Supplemental Information Request Responses #1

Benga Mining Limited
Grassy Mountain Coal Project
CCA Applications No. 1844520 and 1902073
EPEA Application No. 001-403427
WA Applications No. 001-00403428, 001-00403429, 001-00403430 and 001-00403431
PLA Applications No. MSL160757, MSL160758, LOC160841, LOC160842 and LOC970943

February 2018

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A. ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

A.1 GENERAL:

A.1.1. Public Engagement and Aboriginal Consultation

1. Volume 2, Section H, Page H-38 to H 197

Throughout Section H, Benga includes the "pertinent mitigation measures proposed"…and states that "Additional measures are recommended to avoid or minimize potential effects to"…Aboriginal physical and cultural heritage, availability of [trails and travelways, plant gathering areas, fishing areas and hunting areas]".

Benga also includes "Proposed mitigation measures identified in CR (Consultant Report) #8, Section 4.6.4".

a) For each mitigation measure and recommendation to avoid or minimize potential effects identified in the EIA report, clarify whether these were provided by Benga or the First Nation. If they were provided by the First Nation, indicate which one.

Response:

The following mitigative measures have been proposed by Benga and subsequently discussed with the Aboriginal Groups.

The pertinent mitigation measures proposed include:

- a minimum of six wildlife crossings to be incorporated into the design of the coal conveyor;
- access management within the Project footprint to reduce effects to wildlife; and
- wildlife and wildlife habitat reclamation.

Additional measures are recommended to avoid or minimize potential effects to the availability of hunting areas. These are outlined below:

- develop and implement an Aboriginal Access Management Plan for construction and operation phases of the Project that includes notification of access restrictions during construction as required for safety purposes to allow for planning alternate hunting locations; and
- consultation will include sharing information about construction timing

In the Vegetation assessment (Consultant Report [CR]#8, Section 4.6.4), the following list of mitigation measures for TEK vegetation were also developed by Benga and discussed with the Aboriginal Groups:

- the continuation of on-going consultation with Aboriginal Groups in designing mitigation measures for sustainable management of TEK vegetation;

- the implementation of a re-vegetation program which will aim at the re-establishment of vegetation communities, such as closed conifer forests, mature mixed forests, native upland herbaceous grasslands and treed swamps, common to the pre-disturbed landscape that will support TEK vegetation;
- the implementation of a re-vegetation program that utilizes native vegetation species and does not include agronomic invasive species;
- the provision of opportunities to identify and collect suitable lodgepole pine for TU ceremonies, and
- where practicable, utilize locally collected seed to preserve the legacy of species and of place.

2. Volume 2, Section H.1.2.1 Pre-Panel Phase, Page H-6

Benga states, "…sought feedback from each of the Aboriginal groups and considered suggested approaches to avoid, mitigate, or manage potential effects."

a) Provide a table of the feedback received, including concerns and issues identified, mitigations agreed to and how this information has been incorporated into the EIA report for each Treaty 7 First Nation.

Response:

Concerns and Response tables in the format prescribed by the Alberta Aboriginal Consultation Office have been developed for each of the Treaty 7 First Nations to summarize feedback, concerns and issues and the related response by Benga based on the EIA report and additional commitments as a result of the discussions. These tables have been continuously updated and have been given to the Treaty 7 First Nations. Benga continues to consult with the Treaty 7 First Nations to understand if the responses are adequate or if additional work is required.

Concerns and Response tables for Stoney Nakoda Nation Wesley Band, Stoney Bearspaw Band, Stoney Chiniki Band, Piikani Nation, Kainai Nation, Siksika Nation and Tsuut'ina Nation, updated to February 2018, are provided in Appendix A-1.

3. Volume 2, Section H.1.1.2.2 Panel Phase, Page H-6

Throughout the document Benga indicates that TK/TU information has been incorporated but in this section Benga notes that "…integration of TU information will be made available throughout the panel phase". This statement implies that TU information has yet to be incorporated.

a) Provide the TU information.

Response:

Benga is committed to on-going consultation with affected Aboriginal groups through all phases of the project and will continue to seek and consider input as the project is developed, operated and through restoration. Certain TU Studies were completed prior to filing the EA and were appropriately filed with the EA. Additional work with various Aboriginal groups is on-going and will be considered by Benga as it becomes available. Benga does not consider that these additional studies will result in substantive changes to the project. As new reports become available, and provided that the reports are not confidential to the Aboriginal groups involved, Benga will submit the reports to the Alberta Energy Regulator and the Aboriginal Consultation Office.

4. Volume 2, Section H.1.1.4 TK and TU, Page H-7

Volume 2Section H.1.1.4.3 Incorporating TK and TU, Page H-9

Benga indicates that five Treaty 7 First Nations conducted TK/TU studies in 2014. Benga also indicates that TK/TU studies were submitted by all Treaty 7 Frist Nations.

a) Provide a list of the Treaty 7 First Nations that completed studies in 2014.Response:

Response:

TK/TU studies were completed by the following Treaty 7 First Nations in 2014:

- Piikani Nation;
- Stoney Nakoda Nation, which includes three Treaty 7 First Nations:
  - Stoney Nakoda Nation Wesley Band;
  - Stoney Bearspaw Band; and
  - Stoney Chiniki Band.
- Kainai Nation;
- Siksika Nation; and
- Tsuut'ina Nation.

b) Indicate which Treaty 7 First Nations completed them after 2014 and provide the dates.

Response:

As per the response to SIR 4a, all Treaty 7 First Nations completed the TK/TU studies in 2014. However, additional work has been initiated in cooperation with some of the Treaty 7 Nations and Benga, which is in progress. When these reports become available, they will be submitted by Benga to the Alberta Energy Regulator and Aboriginal Consultation Office.

Additional field studies conducted by Treaty 7 First Nations and Benga post 2014:

- Stoney Nakoda Nation (including Wesley Band, Stoney Bearspaw Band, Stoney Chiniki Band);
- Tsuut'ina Nation; and
- Siksika Nation.

5. Volume 2, Section H.1.1.4 TK and TU, Page H-9

Benga states, that TK/TU "was incorporated into the environmental effects assessment and the assessment of potential effects to Aboriginal groups".

a) Describe the concerns and issues expressed by aboriginal communities and the actions taken to address those concerns and issues, including how Aboriginal community input was incorporated into the project design, EIA development, impact mitigation, monitoring, and reclamation.

Response:

Please refer to the response to SIR 2a and the associated Issues and Concerns tables for the various Treaty 7 First Nations located in Appendix A-1.

6. Volume 2, Section H.2.4 Mitigation Measures, Page H-14

Benga states, "Recommendations for mitigation measures by Aboriginal groups through TK studies and the consultation program are referenced and considered in each part of the assessment. Benga then states that …no Aboriginal group has provided views on the effectiveness of the proposed mitigations measures yet".

a) Provide an explanation for Benga's need to obtain the views of Aboriginal groups on the effectiveness of the proposed mitigation measures.

Response:

Please refer to response SIR 2a.

7. Volume 2, Section H.3.1 Overview, Page H-17

Volume 2, Section H.4.1 Overview, Page H-58

Volume 2, Section H.5.1 Overview, Page H-102

Volume 2, Section H.6.1 Overview, Page H-139

Volume 2, Section H.7.1 Overview, Page H-167

Volume 2, Sections H.3.2.2 TK/TU Studies, Page H-26,

Volume 2, Section H.3.4.4 Effects on Kainai Nation Physical and Cultural Heritage, Page H-44 Volume 2, Section H.4.2.2 TK/TU Studies, Page H-68,

Volume 2, Section H.4.4.4 Effects on Piikani Nation Physical and Cultural Heritage, Page H-88 Volume 2, Section H.5.2.2 TK/TU Studies, Page H-111,

Volume 2, Section H.5.4.4 Effects to Siksika Nation Physical and Cultural Heritage, Page H-126 Volume 2, Section H.6.2.2 TK/TU Studies, Page H-145

Volume 2, Section H.6.4.4 Effects to Aboriginal Physical and Cultural Heritage, Page H-157- 158

Volume 2, Section H.7.2.2 TK/TU Studies, Page H-175

Volume 2, Section H.7.4.4 Effects to Tsuut'ina Nation Aboriginal Physical and Cultural Heritage, Page H-187

Benga indicates that the percentage of the Project footprint that overlaps each First Nation's traditional territory is approximately 0.01%.

a) Discuss how this number was generated and whether it was provided by the respective First Nations.

Response:

Benga notes that the preamble incorrectly states "the percentage of the Project footprint that overlaps each First Nation's traditional territory is approximately 0.01%." The EIA (page H-58) states "the amount of land taken up by the Project footprint as shown in Figure A.1.0-2 would be approximately 15.2 km^2 or <0.01% of … traditional territory." It does not state that the percentage of the Project footprint that overlaps each First Nation's traditional territory is approximately 0.01%.

The traditional territory of each of the Treaty 7 Nations has been taken as the whole of Treaty 7, which Benga calculates to be 106,650 km^2. The Project footprint is 15.2 km^2 or 0.014% of the traditional territory, which can be rounded to 0.01%. The EIA suggests that this area is the traditional land area of each Nation, but it actually represents the total of all traditional lands combined.

Benga states, "Of 32 sites, there are 10 that are overlapping the Project footprint". Benga also indicates that over the course of all phases of the field work and site tours, First Nations technicians and Elders identified and recorded anywhere from 15 to 64 TK/TU sites.

b) Clarify the discrepancies in the number of sites that are overlapping the Project footprint.

Response:

We find the referenced quotation above in Section H.4.4.1.4 on page H-84. The entire reference is as follows:

> *There are 32 recorded archaeological or historic era resources located in the Project area including sites that are valued as cultural heritage sites to Aboriginal groups. Of the 32 sites, there are 10 that are overlapping the Project footprint.*

As can be seen in the reference above, "32" refers to the number of recorded archaeological or historic era resources which is different from TK/TU sites which may or may not have historical or archaeological value.

8. Volume 2, Section H.3.2.1 Consultation Summary, Page H-20-H26, Table H.3.2-1 Volume 2, Section H.4.2.1 Consultation Summary, Page 62-67, Table H.3.2-1 Volume 2, Section H.5.2.1 Consultation Summary, Page H-105-110, Table H.5.2-1 Volume 2, Section H.6.2.1 Consultation Summary, Page H-142-44, Table H.6.2-1 Volume 2, Section H.7.2.1 Consultation Summary, Page H-170-73 Table H.7.2-1

a) Provide an updated table showing activities completed in 2017.

Response:

Please see Appendix A-2 for updated tables of key consultation activity to December 2017.

9. Volume 2, Section H.3.2.2 TK/TU Studies, Page H-26 Volume 2, Section H.4.2.2 TK/TU Studies, Page H-68 Volume 2, Section H.5.2.2 TK/TU Studies, Page H-111 Volume 2, Section H.6.2.2 TK/TU Studies, Page H-145 Volume 2, Section H.7.2.2 TK/TU Studies, Page H-175

Benga indicates that over the course of all phases of the field work, First Nations technicians and Elders identified and recorded TK/TU sites.

a) Describe the concerns identified in relation to those sites and how those concerns were addressed.

Response:

All concerns with respect to TK/TU sites are included in the Issues and Concerns Tables included with the response to SIR 2a.

10. Volume 2, Section H.3.3.2.2 Trapping, Page H-30

Benga states that “Kainai Nation did not provide information about current trapping practices among Kainai members”.

In Section H.3.3.1, Kainai Nation Traditional Use of Lands and Resources, Page H-28 Benga states, “Trapping eagles occurs in March when they migrate back into the area from the South…Other species identified for trapping are muskrat, beaver and mink”.

a) Clarify the discrepancy between the two statements.

Response:

Section H.3.3.1 is entitled “Kainai Nation Traditional Use of Lands and Resources” and is intended to convey in general terms some of the traditional or historical land uses and connection to the land from the perspective of the Kainai Nation. In this section, the references to trapping refer to historical practices. Section H.3.3.2.2 is referring to current uses of the land by Kainai members. In this context no reference to trapping was made.

11. Volume 2, Section H.3.3.2.3 Fishing, Page H-30

Volume 2, Section H.3.3.3 Kainai Nation Health, Page H-31 Volume 2, Section H.3.4.1.2 Fishing, Page H-39

Benga states that “During consultation, Kainai Nation identified species of interest including Westslope, cutthroat trout, rainbow trout, bull trout, suckers, squaw fish, pike, whitefish, and walleye (Kainai, 2016)”. Benga then states “Information provided by Kainai Nation did not identify species or locations in the LSA for fishing”.

a) Provide a list of locations for the species identified.

Response:

The fish species in this list were noted by the Kainai Nation as “species of interest” to the Kainai Nation; however, the Kainai Nation did not specifically identify specific species or locations within the project area. Of the species listed, only bull trout, rainbow trout, cutthroat trout, and Westslope cutthroat trout are present in the LSA, which includes Gold Creek and Blairmore Creek.

12. Volume 2, Section H.3.3.3 Kainai Nation Health, Page H-31

Benga states, “Resources used by Kainai Nation are located within the Project LSA (Kainai Nation, 2015). […] Animal species include Westslope cutthroat trout, rainbow trout, bull trout, suckers, squaw fish, pike, whitefish, and walleye (Kainai Nation, 2015).” Under Section H.3.3.2.3 Fishing, Page H-30 Benga states “Information provided by Kainai Nation did not identify species or locations in the LSA for fishing.”

a) Clarify the discrepancy between these statements.

Response:

Please refer to response SIR 11a.

13. Volume 2, Section H.3.4. Potential Effects and Proposed Mitigations – Kainai Nation, Page H- 34, Table H.3.4-1.

Volume 2, Section H.3.4.1.1 Hunting, Page H-372

Volume 2, Section H.3.4.1.1 Hunting, Page H-38, Table H.3.4-2

Volume 2, Section H.3.4.1.3 Plant Gathering, Page H-40-41, Table H.3.4-3

Volume 2, Section H.3.4. Assessment of Potential Effects and Proposed Mitigations – Piikani Nation, Page H-76, Table H.4.4-1

Volume 2, Section H.4.4.1.3 Plant Gathering, Page H-83, Table H.4.4-3

Volume 2, Section H.4.4.4 Effects on Piikani Nation Physical and Cultural Heritage, Page H-90, Table H.4.4-6

Volume 2, Section H.5.4. Assessment of Potential Effects and Proposed Mitigation Measures, Page H-116-118 Table H.6.4-1

Volume 2, Section H.5.4.1.3 Plant Gathering, Page H-122-123, Table H.5.4-3

Volume 2, Section H.5.4.4 Effects to Siksika Nation Physical and Cultural Heritage, Page H- 126, Table H.5.4-4

Volume 2, Section H.6.4. Potential Effects to Stoney Nakota Nation Current Use of Lands and Resources, Page H-150, Table H.6.4-1.

Volume 2, Section H.7.4 Potential Effects and Proposed Mitigations, Page H-179-81, Table H.7.4-1

Volume 2, Section H.7.4.1.1 Hunting, Page H-182, Table H.7.4-2

Volume 2, Section H.7.4.1.2 Plant Gathering, Page H-184-85, Table H.7.4-3

Benga states, "Project activities and phases that may have potential effects on [First Nations] are identified in Table H.3.4-1."

Table H.6.4-2 and Table H.7.4-4 appear only to provide potential effects identified in 2014.

a) Discuss whether these activities and potential effects were identified by the respective First Nations or by Benga.

Response:

The activities and potential effects identified in the various tables were identified by the respective First Nations in discussion with Benga.

b) Describe how Benga intends to share the table and solicit feedback for consideration and incorporation into the tables.

Response:

During the course of consultation activities between Benga and Aboriginal groups over the past 4 years, a comprehensive table of Concerns and Responses has been developed for each Treaty 7 Nation and have been included in the response to SIR 2a.

These tables also contain responses or additional commitments by Benga to each Nation. Discussion with Treaty 7 First Nations is on-going at present and the tables are being populated with the feedback from those discussions.

c) Provide any other potential effects that were identified since 2014 or confirm that none have been identified.

Response:

Please refer to the Issues and Response tables included with the response to SIR 2a, which document all issues and concerns identified to date.

Benga states, "The input provided by [First Nations] and their proposed mitigation measures to reduce or avoid potential effects are summarized in [the respective Tables]."

Benga also states "The recommendations made by [the First Nation] and proposed mitigation measures to reduce or avoid potential effects are summarized in [the Tables]".

d) Discuss whether there have been other potential effects identified or recommended mitigation measures proposed since 2015.

Response:

Please refer to the response to SIR 13c.

e) Provide the potential effects identified by Siksika Nation.

Response:

Please refer to the response to SIR 13c.

14. Volume 2, Section H.4.4.1.1 Hunting, Page H-79

Volume 2, Section H.5.4.1.1 Hunting, Page H-118

Volume 2, Section H.6.4.1.1 Hunting, Page H-152

Volume 2, Section H.7.4.1.1 Hunting, Page H-18

Benga states, "Potential direct and indirect effect from the Project that were assessed include".

a) Describe the direct and indirect effects that were identified by the First Nations.

Response:

Please refer to response provided in SIR 14b.

b) Discuss how those effects were considered and include any effects identified by Benga.

Response:

The concerns expressed by Treaty 7 Nations regarding hunting effects and the associated responses by Benga are included in the Issues and Response tables (Appendix A-1).

15. Volume 2, Section H.3.5.4 Significance and Summary of Residual Effects Characterization, Page H-50, Table H.7.5-1

Volume 2, Section H.4.5.5 Significance and Summary of Residual Effects Characterization, Page H-96, Table H.7.5-1

Volume 2, Section H.5.5.5 Significance and Summary of Residual Effects Characterization, Page H-131, Table H.5.5-1

Volume 2, Section H.6.5.4 Significance and Summary of Residual Effect Characterization, Page H-162, Table H.6.5-1

Volume 2, Section H.7.5.4 Significance and Summary of Residual Effect Characterization, Page H-192-93, Table H.7.5-1

Benga states, "A summary of residual effects of the Project on [Kainai, Piikani, Siksika, Stoney Nakota and Tsuut'ina Nations] is provided in [the Tables]."

a) Confirm if the First Nations had input into this table.

Response:

The tables of Summary of Residual Effect Characterization were based on an assessment made by Benga. These assessments are being validated through the on-going discussion of Issues and Response Tables with each First Nation. Once these discussions are complete final Issues and Response Tables will be submitted to AER and ACO in the format prescribed by ACO.

16. Volume 2, Section H.3.7 Follow-up and Monitoring, Page H-54

Volume 2, Section H.4.7 Follow-up and Monitoring, Page H-100

Volume 2, Section H.5.7 Follow-up and Monitoring, Page H-136

Volume 2, Section H.6.7 Follow-up and Monitoring, Page H-167

Volume 2, Section H, Page H-197

Benga states, "Monitoring programs will be implemented to verify the effectiveness of mitigation measures."

a) Discuss how First Nations will be involved in the development of these monitoring programs and how their input will be used to verify the effectiveness of the mitigation measures.

Response:

Benga will have an extensive monitoring program involving a wide range of environmental values including air and water quality, fisheries, soils, wildlife and revegetation as part of the Project's overall monitoring requirements. Benga has proposed to finalize these monitoring programs and submit them to the regulatory authorities at the appropriate time prior to construction, operation or reclamation. Benga has committed to an adaptive management philosophy through the life of the project that would see the monitoring plans modified as required as mining progresses to improve performance relative to environmental values.

Benga has committed to working with Aboriginal groups in developing the draft monitoring programs through a series of workshops. Benga has committed to providing Annual Reporting documents to Aboriginal groups highlighting the results from the monitoring programs and seeking any input that would help Benga improve monitoring and the effectiveness of mitigation measures.

17. Volume 2, Section H.3.8 Issues and Concerns, Page H-55, Table H.3.8-1

Volume 2, Section H.4.8 Issues and Concerns, Page H-100, Table H.3.8-1

Volume 2, Section H.5.8 Issues and Concerns, Page 136-137, Table H.5.8-1

Volume 2, Section H.6.8 Issues and Concerns, Page H-167, Table H.6.8-1

Volume 2, Section H.7.8 Issues and Concerns, Page H-197, Table H.7.8-1

The table provides issues or concerns expressed in 2014/2015. The table does not seem inclusive of all issues and concerns raised during consultation 2014-2017.

In the table(s) Benga often references other sections of the EIA report. It is unclear how those sections have addressed the issues or concerns expressed by First Nations.

In the response, Benga states, "An assessment of potential effects to hunting is provided in Section H.3.8 including a description of proposed mitigations".

a) Confirm if the tables are inclusive of all issues and concerns raised during consultation between 2014 – 2017 and if it is not, provide new tables.

Response:

The EIA was submitted in 2016, and as such it was complete with results from consultation available at the time. Since the submission of the application, Benga has continued with their consultation efforts with Treaty 7 First Nations and the Issues and Response tables have been updated accordingly. The Issues and Response tables have been updated to December 2017 and are provided in Appendix A-1. Please refer to the response to SIR 2a where updated Issues and Response tables are provided with information from ongoing consultation.

b) Discuss how input from First Nations was considered and how their issues and concerns have been addressed.

Response:

Please refer to the response to SIR 13b.

18. Volume 2, Section H.4.3.2.1 Hunting, Page H-71

Benga states that "Piikani Nation identified wildlife in the Project area including golden eagles and grouse (Piikani Nation, 2015b). During consultation, Piikani Nation identified locations partially or fully overlapping the LSA – there are eight wildlife sites and four harvest sites that are used for hunting and plant gathering". In Section H.4.4.1.1 Hunting, Page H-79, Benga states, that "Piikani Nation continues to hunt throughout their traditional territory. There are no specific hunting sites identified by Piikani Nation in the Project LSA".

a) Explain the discrepancy between these two statements.

Response:

As indicated in the last sentence of the paragraph in Section H.4.3.2.1, the Piikani Nation have indicated that specific hunting site locations are confidential. The Piikani Nation maintain that there are hunting sites that are overlapping the LSA but have not provided these locations to Benga.

19. Volume 2, Section H.4.3.2.2 Trapping, Page H-71

Benga states, that Hannis explains the reason for this decline.

a) Discuss the source of Hannis.

Response:

The specific statement referenced from Hannis in Section H.4.3.2.2 is not annotated in Hannis' paper. However, on page 37 of the paper Hannis writes as follows regarding his understanding of eagle trapping:

> *"Even though the work of early ethnographers was often heavily biased by Eurocentric perspectives, their work recording oral narratives of the Blackfoot and specifically the Piikani, is valuable and illuminating. George Bird Grinnell's*

Blackfoot Lodge Tales (2003 [1892]), Walter McClintock's Old North Trail (1999 [1910]), James Schultz's Blackfeet and Buffalo (1962[1907]), and John C. Ewer's The Blackfeet (1958), all assert eagle trapping was significant in Blackfoot life….. My understanding of eagle trapping is heavily based on the work of these ethnographers, though Piikani elders have clarified some of the more ambiguous information from the ethnographies. "

20. Volume 2, Section H.4.8 Piikani Issues and Concerns, Page H-101, Table H.4.8-1

Benga states, "Concerns that the Project's reclamation program may not achieve objectives (Piikani Nation 2015b)". Benga's response (same table and page in adjacent column) states that "Piikani Nation will have an opportunity to contribute to the development of the Reclamation Plan, and review and provide comments on Project activities taking place through the decommissioning phase".

a) Provide a timeframe and plan of when and how Benga will consider input from First Nations on the reclamation plan.

Response:

In Section F, the Conservation and Reclamation Plan as filed is a conceptual plan which is in accordance with the TOR Section 3.2.8[A]. Input from the Aboriginal groups through consultation and Traditional Knowledge has already been integrated into the conceptual Conservation and Reclamation Plan for species selection for revegetation plans and for terrain and vegetation planning to support vegetation and wildlife of importance to Aboriginal groups.

As the reclamation process is progressive, it lends itself to adaptive management through the incorporation of the results of the site wide environmental monitoring programs and experiences from earlier reclamation activities.

Aboriginal consultation will be ongoing through the life of the mine during the on-going reclamation and closure process to ensure that:

- end land use objectives are developed in consultation with Aboriginal groups, the public, and regulatory stakeholders, building on the existing consultation process;
- site wide environmental monitoring will be conducted throughout the life of the Project and throughout reclamation to ensure landforms, soil conditions and vegetative communities maintain the appropriate trajectory towards the desired end land uses; and
- Benga anticipates that annual discussions will be held with Aboriginal groups to review monitoring results and to prepare for upcoming reclamation activities. Benga anticipates that these discussions will commence during the design and construction phase and will continue for the life of the project.

b) Provide a discussion of how input will be incorporated into the existing Conservation and Reclamation Plan (Section F) of this EIA report.

Response:

Benga does not anticipate significant changes to the conceptual Conservation and Reclamation Plan filed with the EIA. Please see response to SIR 20a.

21. Volume 2, H.5.3.2.3 Fishing, Page H-114

Benga states, that "The Siksika Interim TUS Assessment and Report (Siksika Nation 2015) did not provide information about current fishing practices among Siksika members nor is information available in the literature".

In section H.5.4.1.2 Fishing, Page H-121 Benga states that "Siksika Nation identified through consultation they have a fishing interest in the Project area and identified species including rainbow trout, pike, whitefish, and bull trout (Siksika Nation 2016)".

a) Provide Siksika Nation's current fishing practices and fishing interest.

Response:

Of the species listed in Section H.5.4.1.2, only rainbow trout and bull trout can be found in the LSA and those primarily are found in Gold Creek and Blairmore Creek. As mentioned in H.5.3.2.3, the Siksika Nation has not provided more precise information regarding current fishing practices along these two creeks.

22. Volume 2, Section H.5.4.1.1 Hunting, Page H-120, Table H.5.4-2

In row 3 of Table H.5.4-2, Siksika Nation identified potential effect of the Project on springs throughout the mine site, In this table, Benga states, "Benga has suggested a suite of mitigation measures in this EIA that have been shared with Siksika. Benga welcomes input from Siksika on the mitigation measures. Benga will work with Siksika to get input into the design of the reclamation of the site through consultation on the Conservation and Reclamation plan."

a) Provide a discussion of how the potential effect was addressed.

Response:

Specifically, the potential effect identified by Siksika is as follows:

> *"The springs appearing at elevation throughout the mine site property seem likely to be destroyed by the project. If this is the case, it must be done in such a way that no industrial sediment or other downstream effects are allowed to effect the Blairmore or Gold Creeks or the Crowsnest River because those effects could cause serious harm to the animals that rely on that spring water to live (Siksika Nation 2015)."*

Benga agrees that natural run-off from the mine site, whether from springs fed by groundwater sources or from surface water, needs to be controlled and managed to ensure that water quality in Gold Creek and Blairmore Creek meets applicable regulatory guidelines and thresholds to maintain the aquatic environment. Mitigative measures mentioned in the EIA in Section E.5.5 include segregation of mine-affected water, collection of all water on site in ponds for testing prior to release into the environment, and treatment of mine-affected water to meet quality guidelines.

b) Provide an explanation of why Siksika Nation's input has not yet been incorporated into the design of the reclamation of the site.

Response:

Benga understands the Siksika Nation concern to be related primarily to management of water quality during the construction and mining phases rather than a reclamation issue. Further guidance will be sought from Siksika Nation to confirm this understanding through the on-going discussions of concern and response tables mentioned in response to SIR 13b.

c) Provide any other potential effects or recommended mitigation measures identified since 2015.

Response:

Please refer to the response to SIR 2a.

23. Volume 2, Section H.5.4.1.3 Plant Gathering, Page H-122

Benga states, "Siksika Nation did not identify specific species for harvesting". Then Benga states, "Section E.8.3 addresses potential effects on key species and habitat including the species identified by Siksika Nation. A summary of species identified by Siksika Nation for the Project..."

a) Discuss Siksika Nation's input into the identification of specific species for harvesting.

Response:

As noted in Section E, Section E.8.3, no species were identified by Siksika Nation. Siksika has since conducted a follow-up site visit and is expected to file an additional TK/TU report with the AER in the coming months. If specific species for harvesting are included in this future report, Benga will take the steps necessary to ensure Siksika Nation has an opportunity to participate in the harvesting.

24. Volume 2, Section H.5.5.1.1 Hunting, Page H-127

Volume 2, Section H.5.5.1.2 Fishing, Page H-128

Benga states, "The characterization of residual effects to hunting includes consideration of residual effects described in Section E.9 and Section E.10, and input provided by Siksika Nation".

a) Discuss how Siksika Nation input was incorporated into these sections.

Response:

Siksika input was with respect to the species of fish that are traditionally harvested by the Siksika. After considering this input, the concluding paragraph Section H.5.5.1.2 states:

> *"The Project is not expected to have measurable effects on the long term abundance, distribution, and sustainability of species potentially fished by Siksika Nation. With the implementation of mitigation measures including access management planning and ongoing consultation, the Project is not expected to affect current access patterns."*

25. Volume 2, Section H.5.5.1.3 Plant Gathering, Page H-129

Benga states, "The Project is not expected to have measurable effects on the long term abundance, distribution, and sustainability of species used for plant gathering by Siksika Nation." In Section H.5.4.1.3 Plant Gathering, Page H-122, Benga stated that "Siksika Nation did not identify specific species for harvesting."

a) Discuss the conclusions drawn by Benga on the measurable effects on long rem abundance, distribution and sustainability of species used for plant gathering by Siksika First Nation, in the absence of Siksika Nation identifying specific species for harvesting.

Response:

The list of plant species traditionally used by Siksika members is given in Section H.5.3.2.4 Plant Gathering. Although Siksika Nation did not identify which of these species were present at the site, Benga was able to cross reference the Siksika Nation list with its field studies to arrive at this conclusion.

26. Volume 2, Section H.6.3.1 Traditional Use of Lands and Resources, Page H-146 and 147

Benga states, "…the Stoney Nakota Nation consultation team did not mention traditional trapping of furbearers during the TK/TU program". In Section H.6.3.2.2 Trapping, Page H-148, Benga states, "Stoney Nakota Nation provided a final TU study that identifies black bear, coyote, lynx, squirrel, beaver, mink and marten as species that are of interest for trapping."

Benga states, "There was no discussion about traditional harvest and/or use of plant species during the TK/TU program."

In Section H.6.3.2 Plant Gathering, Page H-148, Benga states, "During the Stoney Nakota Nation site tour, Stoney field crew identified many plant species that remain central to Stoney Nakota ceremony, healing practices, and spirituality".

a) Clarify the discrepancy between these statements.

Response:

In both cases, the Stoney Nakoda Nation identified plant species and wildlife species that are of interest. However, the TK/TU study did not reference traditional harvesting activities practiced in the area of the project related to these species.

27. Volume 2, Section H.6.3.2.3 Fishing, Page H-148

Benga states, "Stoney Nakota Nation identified species of interest through consultation including white fish and trout…."

a) Provide justification for omitting species of interest for fishing identified by Stoney Nation in Volume 5, CR #5 Aquatic Ecology, Section 3.1.1 Fish and Habitat, Table 3.2 Summary of Information on aquatic ecology from Treaty 7 First Nations, Page 22.

Response:

The identification of species of interest mentioned in Section H.6.3.2.3 was not specific to the project area as was the case with the other First Nation information included in CR#5 Table 3.2. Therefore, it was not included.

28. Volume 2, Section H.6.3.2.3 Fishing, Page H-148

Benga states, "Further information about current Stoney fishing, including species, locations and timing, provided by Stoney Nakota Nation will be considered in the Application."

a) Provide information on current Stoney fishing, including species, locations and timing. Include in the response, how this information is considered in the application.

Response:

Additional information on current Stoney Nakoda Nation fishing practices is expected in a pending report from the Stoney Nakoda Nation. Unfortunately, field work for the report could not be concluded in summer 2017 due to wildfires and will be resumed in summer 2018. When the report is completed and submitted to Benga, the information will be considered.

29. Volume 2, Section H.6.3.3 Aboriginal Health, Page H-148

Benga states, "Plant species where not identified by Stoney Nakota Nation." In Section H.6.3.2 Plant Gathering, Page 148, a list of identified plant species is provided.

a) Clarify the discrepancy in these statements.

Response:

The sentence in Section H.6.3.3 refers to plant species that are currently harvested by the Stoney Nakoda Nation members from the LSA and used for health purposes. According to the information received, the Stoney Nakoda Nation does not currently harvest plants from the LSA notwithstanding that those species are present.

30. Volume 2, Section H.6.4.1.2 Fishing, Page H-154

Benga refers to Section E.6.5 and Section E.10.5 on cumulative effects.

a) Provide a discussion on how these cumulative effects mitigations address Stoney Nakota Nation's concerns.

Response:

Sections E.6.5 and E.10.5 properly refer to the summary sections of the respective chapters. The sections discussing cumulative effects are E.6.4 and E.10.4 respectively. It should be noted that since the EIA was written, Section E.6.5 has been replaced in its entirety and can be found in Addendum 1 (Jan 2017).

31. Volume 2, Section H.6.4.4 Effects to Aboriginal Physical and Cultural Heritage, Page H-157, Table H.6.4-2

Volume 2, Section H.7.4.4 Effects to Tsuut'ina Aboriginal Physical and Cultural Heritage, Page H-188, Table H.7.4-4

Tsuut'ina Nation recommended a 100m buffer be placed around sacred sites.

a) Dicuss how this recommendation was considered in the mitigation measures.

Response:

The Tsuut'ina Nation traditional knowledge (TK)/ Traditional Use (TU) Study did not identify the location of any sacred sites. Benga will continue to work with Tsuut'ina Nation to identify the location of sacred sites and discuss ways to mitigate potential effects including protective measures like fences and buffer zones where appropriate.

32. Volume 2, Section H.7.3.1.2 Fishing, Page H-176

Volume 2, Section H.7.3.1.4 Plant Gathering, Page H-177

Benga states, "During ground truthing activities Tsuut'ina field crew observed three different kinds of trout." Benga also states, "During ground truthing, Tsuut'ina field crew identified the following important plant species near the proposed Project"… and "An abundance of traditional and medicinal plants was documented in and around the proposed Project".

a) Confirm if Tsuut'ina Nation provided potential adverse impacts the project may have on their ability to fish those three trout species and gather those important plant species and provide mitigation measures. If so, provide mitigation measures for the impacts identified.

Response:

The following concerns and responses concerning mitigation have been extracted from the Issues and Response Tables included with the response to SIR 2a.

Table SIR 32-1 Tsuut'ina Nation Concerns and Responses extracted from Appendix A-1.

Document or Meeting Reference	Specific Concern Expressed	Proponent Response on Effort to Avoid or Mitigate Concern
Minutes from April 23, 2014 Meeting between Tsuut'ina Nation, Arbutus Consulting, Thorpe Consulting Services, Dialectic Research.	Traditional Use (TU) sites must be logged so that they are protected and ceremonial and medicinal plants are harvested before being destroyed. Tsuut'ina Nation expressed interest in harvesting lodge pole pine during the Spring on a regular and ongoing basis with financial support for doing so provided by Benga.	Benga has committed to allow First Nations including Tsuut'ina, access to the site prior to or during clearing operations to enable them to harvest Lodgepole pine for cultural purposes (*e.g.* teepee poles). Benga has expressed to Tsuut'ina Nation an interest in obtaining their input into the development of environmental management plans.
July 2015 Grassy Mountain Coal Project Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area.	The Project will limit Tsuut'ina Nation in their ability to hunt and practice traditional ways on the site.	The results of the Environmental Impact Assessment (EIA) were submitted in August 2016. The assessment of potential effects to wildlife is considered in Sec E.9.3. The ability to continue hunting practices is included in the assessment of potential effects to Tsuut'ina Nation in Section H. Many of the project effects associated with habitat loss and wildlife movement will be minimized through the implementation of the Project's reclamation plan. As seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year.
July 2015 Grassy Mountain Coal Project Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area.	The Project will limit access to plants, and potentially damage plant health.	Benga will continue to work with Tsuut'ina Nation to identify other species of importance for harvesting in advance of construction activities in the Aboriginal Access Management Plan.
Minutes from April 6 2016 Meeting between Tsuut'ina Nation, Benga and CEAA.	Tsuut'ina Nation is concerned about losing access and the ability to hunt and gather on the land designated to them in their Treaty rights.	Benga provided a conceptual Access Management Plan in the August 2016 update to the Environmental Impact Assessment (EIA). Due to site safety reasons access will be restricted within the Project Permit boundary during construction and operations. This will be enforced by mine operations managers and personnel during the construction and operations phase. Information provided in the Traditional Use Study, including information about wildlife, is considered in the Environmental Impact Assessment (EIA) under potential effects to wildlife and potential effects to hunting.

33. Volume 2, Section H.7.3.4 Aboriginal Physical and Cultural Heritage, Page H-178

Benga states, "During ground truthing, Tsuut'ina field crew recorded several rock cairns." In Section

H.7.2.2 TK/TU Studies, Page H-175 Benga states, "Over the course of all phases of the field work Tsuut'ina Nation technicians and Elders identified and recorded 64 TK/TU sites."

a) Identify any other sites discussed aside from rock cairns.

Response:

The complete list and discussion of sites found can be found in the report entitled "Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area" which is included in Volume 3, Appendix 7c.

34. Volume 2, Section H.7.4.1 Potential Effect to Tsuut'ina Nation Current Use of Land and Resources for Traditional Purpose, Page H-181

Fishing has not been included under this section but is included in Section H.7.3.1.2 Fishing, Page H- 176.

a) Discuss how potential effects to fishing was considered in this section.

Response:

As mentioned in Section H.7.3 on Page H-176,

> *"During the ground-truthing program, the Tsuut'ina Nation Consultation Team did not provide information about traditional fishing practices (Tsuut'ina Nation 2015). Secondary sources note that Tsuut'ina Nation engaged in fishing activities but not as much as hunting and that fish were generally not eaten (Dempsey 2001). There is no mention of fishing in Crowsnest Pass near the Project."*

Consequently, fishing was not considered as an area of potential effect to Tsuut'ina Nation.

35. Volume 3 – Appendix 7 Aboriginal Consultation Records and TK Reports

Volume 3 – Appendix 7B Aboriginal Consultation Records

The consultation records for the Treaty 7 First Nations are not the same as those provided to the ACO.

a) Clarify this discrepancy and update the consultation records to include 2016 and beyond.

Response:

The consultation records in the EIA are meant to address the requirements from ACO as well as CEAA, and are different from those that are specific to the ACO requirements. The ACO is currently working to review the consultation records, and once approved by the ACO and reviewed by the First Nations, these will be submitted in a supplemental filing.

36. Volume 3 – Appendix 7A Treaty 7 First Nation Consultation Plan

The First Nations consultation plan attached to the EIA report is not the First Nations consultation plan approved by the ACO.

a) Identify the difference between the ACO approved First Nation consultation plan and the revised First Nation consultation plan attached to the EIA report.

Response:

The ACO approved First Nation consultation plan is being followed as approved. The plan that was enclosed in the Application included requirements for the federal process as well as the provincial process and has a broader mandate to encompass both processes.

37. Volume 3 – Appendix 7C(i) Kainai Nation

Volume 3 – Appendix 7C(iii) Siksika Nation

Volume 3 – Appendix 7C(iv) Stoney Nakota Nation

Volume 3 – Appendix 7C(v) Tsuut'ina Nation

As per TOR 6 [A] a. a map and description of traditional and current land and water resource use areas, including areas of fishing, hunting, trapping, and nutritional, medicinal, or cultural plant harvesting by affected aboriginal peoples (if the aboriginal community or group is willing to have these locations disclosed) was to be included.

As per TOR 6 [A] b. a map of vision quest sites, cabin sites, spiritual sites, graves, and other traditional use sites considered historic resources under the Historical Resources Act (if the aboriginal community or group is willing to have these locations disclosed), as well as traditional trails and resource activity patterns was to be included.

a) Confirm whether the aboriginal community or group is willing to have these locations disclosed.

Response:

The information included with the EIA represents the information that each Aboriginal group was willing to disclose to the public. This does not include specific locations of the reported sites.

b) Provide a map with the information provided in the TK report.

Response:

See response SIR 37b.

38. Volume 3 – Appendix 7C(i) Kainai Nation

Volume 3 – Appendix 7C(iii) Siksika Nation

Volume 3 – Appendix 7C(iv) Stoney Nakota Nation

Volume 3 – Appendix 7C(v) Tsuut'ina Nation

It is unclear how the TK and TU information was incorporated into the project design and development, technical components of the EIA, the conservation and reclamation plan and monitoring and mitigation plan.

a) Provide a table of the TK/TU information that was incorporated and where, for each of the Treaty 7 First Nations.

Response:

These tables are included in the EIA for the Treaty 7 First Nations in the following sections:

- Kainai Nation Section H.3.4, Table H.3.4-1
- Piikani Nation Section H.4.4, Table H.4.4-1
- Siksika Nation Section H.5.4, Table H.5.4-1
- Stoney Nakoda Nation Section H.6.4, Table H.6.4-1
- Tsuut'ina Nation Section H.7.4, Table H.7.4-1

b) Identify the TK/TU information that was identified with justification as to why.

Response:

A discussion of the specific TK/TU information included in the assessments in included the text that accompanies each of the tables mentioned above.

39. Volume 5 – Consultant Report #6 Aquatic Resources

Volume 5, CR #5 Aquatic Ecology, Section 2.1, Selection of Value Components, Page 10

Benga lists fish species identified as important traditional resources as one of the criteria for selecting Value Component (VC) species.

a) Identify any VC species selected as important traditional resources by Aboriginal groups.

Response:

Information gathered during traditional knowledge and traditional land use surveys with members of Treaty 7 Nations conducted as part of Project preparation (Kanai Nation 2015, Piikani Nation 2015, Tsuut'ina Nation 2015, Siksika Nation 2015, Appendix 7c) suggest no particular fish species are more important for traditional uses than others and therefore all fish species found in the LSA and RSA are denoted as traditional use species.

b) Identify and provide justification for any species selected as important traditional resources by Aboriginal groups that were not selected as a VC species.

Response:

Since it is not possible to address every species or issue of concern, VCs are selected to represent a similar species. For the purposes of the EIA and CR#6, westslope cutthroat trout was selected as being representative of all species found in the study area. The list of all VCs was provided to each of the Treaty 7 Nations prior to drafting the final EIA for their input.

40. Volume 5, CR #5 Aquatic Ecology, Section 6.0, Potential Monitoring, Page 60

Benga indicated that monitoring plans for the Project will be finalized at the end of 2016.

a) Discuss how Treaty 7 First Nations were included in the development of the monitoring plans. Include in the response, a discussion of how Benga considered the Treaty 7 First Nations' input in the development of the plans.

Response:

Development of the Aquatic Resource Monitoring Plan has been delayed due to commensurate delays in the regulatory process to date. The Monitoring Plan will be developed in parallel with regulatory approvals and workshops will be held with Treaty 7 First Nations during the development cycle to gather their input.

41. Volume 5 – Consultant Report #8 Vegetation and Wetlands

Volume 5, CR #8 Vegetation and Wetlands, Section 1.4.6 TK VC Vegetation Resources, Page 15

This section speaks to TK VC plant species traditionally used. In the TOR 4.6.1 [A] d current use is to also be included.

a) Discuss whether "traditionally used" includes current use. Provide an updated section to include current use.

Response:

As mentioned in the last sentence of Section 1.4.6, *"TEK data are derived from historical and current uses of vegetation as identified by the Treaty 7 First Nations groups."* As this Section already considers current use, no update is required.

42. Volume 5, CR #8 Vegetation and Wetlands, Section 4.6.4.1 Mitigation, Page 168

Benga provides a list of mitigation measures for TK vegetation.

a) Confirm whether the mitigations listed in this section were developed solely by Benga or if they are inclusive of Treaty 7 First Nation mitigation recommendations.

Response:

The mitigations included in the vegetation assessment (CR# 8) were developed by Benga; however, as part of the continuing consultation with all Aboriginal groups, the associated mitigations and future monitoring plans are discussed as part of the on-going consultation.

This Aboriginal group consultation will be ongoing through the life of the mine, and especially during the on-going reclamation and closure process to ensure that:

- end land use objectives are developed in consultation with Aboriginal Groups, the public, and regulatory stakeholders, building on the existing consultation process;
- site wide environmental monitoring will be conducted throughout the life of the Project and throughout reclamation to ensure landforms, soil conditions and vegetative communities maintain the appropriate trajectory towards the desired end land uses; and
- Benga anticipates that annual discussions will be held with First Nations to review monitoring results and to prepare for upcoming reclamation activities. Benga anticipates that these discussions will commence during the design and construction phase and will continue for the life of the project.

b) If it is inclusive, identify the mitigations that were recommended, how were they considered, and which ones were incorporated.

Response:

See above response to SIR 42a.

43. Volume 5, CR #8 Vegetation and Wetlands, Section 4.6.5 Impact Rating, Page 169-70

Benga states, “The following assessment of the TK vegetation VC has been completed with consideration of effective mitigation being applied”.

a) Discuss whether the assessment considered Treaty 7 First Nations input and how was it incorporated.

Response:

Treaty 7 Nation input was not available at the time of writing. Benga has received concerns and provided responses to Treaty 7 Nations regarding mitigation proposed. These discussions are on-going. Benga expects Treaty 7 Nation input to be important for final design of reclamation plans as indicated in the response to SIR42a.

44. Volume 5, CR #8 Vegetation and Wetlands, Section 5.2 Summary of Mitigation and Monitoring Measures, Page 235

Benga states, "…consult with and involve First Nations People in designing mitigation measures for sustainable management of TEK vegetation."

a) Confirm whether Benga has engaged the Treaty 7 First Nations in designing mitigation measures.

Response:

Please refer to the response to SIR42a.

45. Volume 6 – Consultant Report #9 Wildlife

Volume 6, CR # 9 Wildlife, Section 7.1.5, Mortality Risk, Page 334

As per TOR 4.7.2 [C] Benga is required to comment on the availability of species for traditional use considering vehicle-wildlife collision, increased non-aboriginal hunting pressures, and other project related implications.

a) Provide this information as per TOR 4.7.2[C].

Response:

The information requested can be found in the Wildlife assessment report (Consultant Report #9, Section 5.6).

46. Volume 7 – Consultant Report #11 Socio-Economic Assessment

Volume 7, CR #11 Socio-Economic Impact Assessment, Section 9.4, Mitigations for Potential Impacts to Aboriginal Groups, Page 52.

Benga states that they recognize "…the effects of resource development on traditional land use and culture" and that they "…will carry out the following actions to enhance the positive and minimize the adverse effects of its project".

b) Identify which of the listed actions are proposed mitigations recommended by the Treaty 7 First Nations.

Response:

Similar to the response provided in SIR 42a, the mitigations included in the Socio-economic assessment (CR# 10) were developed by Benga; however, as part of the continuing consultation with all Aboriginal groups, the associated socioeconomic impacts are discussed as part of the on-going consultation.

c) If none of the actions are from the Treaty 7 First Nations, provide a discussion of why these recommendations have not been included.

Response:

Please refer to the response to SIR 46b.

A.1.2. Noise

47. Volume 1, Section 2.5.1, Page E-38

Volume 4, Consultant Report #2a, Section 5.4.1. Rock Disposal Area Sequencing Noise Mitigation, Page 28

Benga states, "As the Mining years progress, the elevation of the south disposal area will increase and the activity will move closer to the two residential receptor locations to the east of the Mine Pit Boundary. For these two receptors, the dominant Project noise sources will be the haul trucks accessing the south disposal area as well as the dozers operating on the disposal area. In order to achieve noise levels below the Permissible Sound Levels for these two residential receptor locations, there are two recommended operational noise mitigation measures." The noise impact assessment doesn't provide noise level quantification at the two receptors from the operation of haul trucks and the dozers in the disposal area.

a) Provide modeling calculation results for the worst case scenario at the two receptors due to the rock disposal operation in this area, and verify with modeling results that the recommended noise mitigation measures will be effective to reduce the noise levels at the receptors to be within the permissible sound levels.

Response:

The results provided in Table 5.1 1 (Consultant Report #2a, Section 5.1) represent the worst case scenario for the two residential receptors (Res-301, Res-302). Within the model, all of the equipment operating in the South Disposal area has been lumped together at the far east-end (closest to the residents). The modelling results include the first noise mitigation recommendation listed in the noise report (*i.e., "Where feasible, route the haul trucks (conveying waste rock and coal) along the western slope of the south disposal area such that the south disposal area itself provides noise shielding between the operating equipment and the residential receptors to the east"*). Thus, the noise modelling results indicate that the recommended noise mitigation will result in noise levels that are within the Directive 038 PSLs at the receptors.

There may be times when this is not feasible and the second noise mitigation option may be required (*i.e., "Construct the waste rock piles such that the eastern-most areas are built-up during the day time and then the night-time waste rock activities are further to the west and at lower elevations, using the eastern-most piles as a natural noise barrier"*). The extent of the potential rock piles is not known at this time and would require site-specific sound level measurements and updated noise modelling as the mine progresses and more detailed operational information is available.

As the mine progresses and more detailed operational information is available, there may be other noise mitigation options available related to the location of equipment, operational times of specific equipment, and taking advantage of natural shielding that may be in place as the mine is constructed but has not necessarily been included in the noise model. Benga commits to reviewing the noise levels for these receptors and determining the noise mitigation methods that provide noise levels below the Directive 038 PSLs in the best interests of the mine operations.

48. Volume 4, Consultant Report #2a, Section 5.4.2. Blasting Noise and Vibration Mitigation, Page 28

Benga states, "A portion of the mining operations will involve use of explosive charges to loosen the raw materials. The noise and vibration levels associated with blasting can have a potential impact on nearby residents and can cause sensory disturbance to wildlife. There are no specific noise or vibration level limits for blasting in the AER Directive 038, nor are there any specific other provincial or federal criteria." The noise impact assessment doesn't quantify the maximum sound level, Lmax, at the receptors during a typical blasting event. Residences and a hospital are among the receptors.

a) Provide modeling results of Lmax at the sensitive receptor locations. If the blasting noise is expected to be noticeable, elaborate Benga's scheme on notifying the sensitive receptors upon loud blasting events.

Response:

Noise from blasting can vary significantly due to the size of the charges, the depth of the charges, the location of the charges, the weather conditions, the topographical information, and numerous other factors. There is no method of accurately predicting the Lmax noise levels that will result from the blasting operations until blasting actually starts and on-site sound level measurements can be conducted. Even data from on-site blasting is still only minimally useful in future blast noise modeling because the variables change for each blast.

As provided in the noise assessment, the following blasting procedures will be adhered to in order to minimize potential noise and vibration impacts associated with blasting:

- blasting will occur only on weekdays during typical day-time hours;
- minimal blasting during cloud cover; and
- blasting will be limited to smaller more localized blasts, which reduces the amount of explosives used at any one time.

A.1.3. Socioeconomic

49. Volume 1, Section E.11.3.6 – Municipal Infrastructure and Services Effects Assessment, Page E- 228

Volume 1, Section E.11.4.4 - Municipal Infrastructure and Services, Page E-231

Benga states, that for waste management, "the Project will make use of the regional waste transfer station operated by Crowsnest Pass."

Benga also states that "the additional demand for municipal infrastructure requirements driven by the population increase estimated under the application case assumptions will exceed the current and planned levels of municipal infrastructure in Crowsnest Pass but not in Sparwood." Later in E.11.4.4, Benga states, "there is no net in-migration to the region anticipated as a result of the projects currently disclosed in the Planned Development Case and therefore, no additional municipal infrastructure is anticipated."

Clarity between the two referenced sections is required as one section indicates that the current levels of planned infrastructure are exceeded yet another section indicates that no additional municipal infrastructure is required.

a) Provide details on the anticipated use of the regional waste transfer station.

Response:

Use of the regional waste transfer station will be limited to domestic type trash generated on site. This could include office trash consisting of paper, food scraps, and general office consumables. All offices on site will be established with recycling bins to facilitate waste sorting and recycling. We would anticipate that the disposal and recycling service would be contracted out to a local reputable and accredited company. Services covering the disposal of toxic wastes, for example, batteries, printer cartridges, electronic components, *etc*. will be managed through specialized disposal companies.

All waste of an industrial nature will be sent to specialized disposal and recycling facilities, not likely to be located within the Crowsnest Pass region (see response SIR 75)

b) Provide further information on potential project use of Municipal waste infrastructure (i.e. landfills).

Response:

See response SIR 49a

c) Provide details on how the exceedance of municipal infrastructure capacity in the Crowsnest Pass may be addressed and how the statements in E.11.3.6 and E.11.4.4 regarding municipal infrastructure are reconciled.

Response:

The first statement (Section E.11.3.6) notes that population increases estimated under application case assumptions will exceed the current and planned levels of municipal infrastructure in Crowsnest Pass. The second statement (Section E.11.4.4) is meant to explain that additional projects considered in the PDC (beyond those already considered in the application) are not expected to generate additional permanent operations jobs in the area. Therefore, no additional population growth (and no additional municipal infrastructure) is anticipated under PDC assumptions beyond what is already estimated under application case assumptions.

Providing municipal infrastructure and services is the responsibility of municipal governments in the region, whether through their own departments or arms-length bodies and agencies. As evidenced in Volume 7, Consultant Report #11, Section 8.3.2., municipal representatives in Crowsnest Pass are well aware of capacity constraints surrounding municipal infrastructure and services and are working to address these constraints. As an example, the Municipality of Crowsnest Pass was recently able to secure nearly $8 million in provincial funding to support upgrades to its wastewater treatment facility (GOA 2016).

Reference:

GOA (Government of Alberta). 2016. Alberta invests more than $7.8 million in Crowsnest Pass water project. June 29, 2016.

50. Volume 7, Consultant Report #11

Benga published the EIA report for the Grassy Mountain Coal Project in August 2016. The Socio- Economic Impact Assessment was published in July 2016.

a) Provide updates to the Socio-Economic Impact Assessment that have occurred in the last 18 months, including (but not limited to) any updates to:

i. The planned development scenario (last assessed February 1, 2016); and

Response:

Table SIR 50-1 provides an update to the population estimates in Consultants Report #11, Section 5. These updated estimates reflect updated population counts for communities in the RSA, as reflected in the 2016 Federal Census.

Table SIR 50-1 Updated Population Estimates

Geography	2016	2021 Base Case	2021 Application Case
Alberta Portion of the RSA	5,680	5,470	6,130
B.C. Portion of the RSA	3,780	3,750	4,180
Total RSA	**9,460**	**9,220**	**10,310**

Note:
A PDC population estimate was not provided as the population effect of additional projects considered in the PDC is expected to be limited.

Taking into consideration updated socio-economic information, the population in the RSA is expected to:

- decline by an average annual rate of 0.5% between 2016 and 2021 under Base Case Assumptions; and
- increase at an average annual rate of 1.7% between 2016 and 2021 under Application Case Assumptions (*i.e.* including the Project)

The direction and magnitude of these population effects are generally in line with those provided in the filed application.

ii. Negotiations with and agreements with Indigenous groups, Municipalities, Industrial Operators (Teck), etc. as referenced in mitigations and commitments throughout the EIA report, including the status of Impact Benefits Agreement negotiations with potentially affected Indigenous groups.

Response:

Benga is not at liberty to comment on the status of negotiations or agreements with third parties including with Indigenous groups, as those negotiations and agreements, if any, are confidential between the parties involved.

51. Volume 1, p. 611, Figure D.2.4-2 Volume 1, p. 848

The Socio-Economic Regional Study Area is referenced frequently within the Socio-Economic sections of the EIA report. However, Figure D.2.4-2: Project Regional Study Areas does not illustrate the Socio-Economic RSA boundaries. Later on, Benga states, "much of these employment effects will happen outside of the RSA due to the low population density and limited services within the study area."

a) Provide an updated Figure D.2.4-2: Project Regional Study Areas to show the Socio-Economic RSA boundaries.

Response:

Please refer to Figure 51-1 as an update to Figure D.2.4-2 to show the Socio-Economic RSA boundaries.

b) Provide justification for the spatial boundaries of the Socio-Economic RSA.

Response:

As identified in Volume 7, Consultants Report #11, Section 2.1.4.2, the Project is fully located within the province of Alberta in the M.D. of Ranchland and the S.M. of Crowsnest Pass. However, the Town of Sparwood, located 40 km to the west of the Project in the province of British Columbia (B.C.), acts as a service centre to several mines in southeastern B.C. and will likely also serve the Project. The RSA therefore consists of two unique parts:

- the Alberta portion which includes Ranchland and Crowsnest Pass; and
- the B.C. portion which includes only the Town of Sparwood and the portion of Highway 3 connecting the Project to the Town.

The boundaries of the RSA have been defined based on the following considerations:

- the existing trade patterns and traffic flows in the region;
- the existing distribution of service providers and infrastructure in the region;
- Benga's hiring and materials procurement plan for the construction of the Project;
- the experience of other industrial projects in the region;
- land use concerns related to lands nearby the Project; and
- the availability of statistical data to adequately measure the impacts of the Project.

The SEIA focuses on the impact to the services in the communities of Crowsnest Pass due to their proximity to the Project and Sparwood as the nearest service centre for the mining industry. The socio-economic effects of the Project will not be uniformly distributed across the RSA and the effects assessment for different VCs is focused on different communities as appropriate.

c) Discuss the implications of the findings that "much of these employment effects will happen outside of the RSA due to the low population density and limited services within the study area."

   i. Identify where Benga anticipates the employment effects will occur, if not within the RSA.

Response:

The statement that *much of these employment effects will happen outside the RSA* (Volume 1, pg. E-213) is in reference to the total employment effects of the Project. Namely:

- Direct employment: On and off-site employment directly related to the construction and operation of the Project (see Volume 7, Consultant Report #11, Sections 4.5);
- Indirect employment: Employment generated among Project suppliers (*e.g.* materials, equipment); and
- Induced employment: Employment generated in the general economy as direct and indirect workers spend their income on goods and services, hence creating employment in consumer goods and service sectors.

These employment effects will be spread across the RSA and beyond. For example:

- Direct employment: The construction workforce will be largely comprised of mobile workers, as is typical with large industrial projects. These workers will likely be sourced from various communities throughout Alberta and elsewhere in Western Canada. Construction engineering-related employment will accrue to firms outside the RSA, mostly in Edmonton and Calgary. As for operations, many direct workers are expected to either be sourced locally or, if sourced from outside the region, migrate to the RSA and become permanent residents.
- Indirect employment: The project is expected to largely make use of suppliers from across both Alberta and British Columbia. This is illustrated in Volume 7, Consultant Report #1a, Tables 4.1 and 4.2 where roughly 55% of project construction expenditures and 51% of project operations expenditures are expected to accrue to firms and suppliers in British Columbia and Alberta. These suppliers include fabrication shops, machine shops, and equipment suppliers. Many of these types of firms are located in or near urban centres (*e.g.* Edmonton, Calgary, and Lethbridge).
- Induced employment. It is expected that a substantive portion of the income of both direct and indirect workers, which in turn drives induced employment, will be spent in or near communities in which direct and indirect workers reside.

ii. Discuss the implication of the communities within the RSA not benefitting from the employment effects.

Response:

The fact that a majority of Project's total employment effects are expected to occur outside the RSA is a reflection of existing limitations with locally available labour and businesses. For example:

- limited number of appropriately skilled workers, and
- limited number of engineering firms, fabrication and machine shops, and equipment suppliers with adequate capacity and expertise.

Communities within the RSA will still benefit from employment effects of the Project, most evidently through:

- direct operations-related employment of nearly 385 individuals;
- indirect employment resulting from Benga's commitment to support local employment and procurement, where possible, during both construction and operations (see Volume 7, Consultant Report #11, Section 4.2.3); and
- induced employment created by direct and indirect workers in the RSA spending their income on goods and services in the region.

52. Volume 1, Sec. A.6.6, p. 48 Volume 7, Sec 4.5.1, p. 122

Benga states, "pending regulatory approval the project is scheduled to begin site construction in mid- 2017." The schedule provided in the EIA report is outdated and requires updating provided the timelines have changed.

a) Provide an updated detailed schedule for mine construction and operation, considering the updated application and construction schedule.

Response:

As indicated in Volume 7, Consultant Report#11, Section 1.1:

Actual timing of construction and operations will depend on the timing of regulatory approvals and market conditions. For the purpose of this assessment, the following schedule has been assumed:

- *construction of the Project starting in Q1 2018 and ending in Q3 2019; and*
- *operations start-up in Q3 2019.*

If approved, the Project will operate for approximately 23 years following completion of construction.

The schedule provided is illustrative and continues to be appropriate for the project if taken in that context. As the timing of regulatory approvals are not known, a more definitive schedule is not possible at this time.

b) Update Figure 4.1 (Volume 7, Sec 4.5.1, p. 122) illustrating peak workforce activity periods for both construction and operations.

Response:

Further to response SIR 52a, no update is required.

53. EIA TOR 3.2.3 [A]
V. 7, CR. 11, p. 114
V. 7, CR. 11, p. 146

EIA TOR 3.2.3 [A] Regional and Cooperative Efforts: "Discuss the proponent's involvement in regional and cooperative efforts to address environmental and socioeconomic issues associated with regional development."

Benga states that "the primary employer in the region is Teck Coal Ltd., which operates five mines in the region and directly employs 800 workers who live in Sparwood… Regarding cooperative efforts with other industrial operators in the region, Benga is engaged in active discussions with Teck, a major employer in the region, regarding issues of common interest. Benga is committed to continuing its discussions with Teck and others in the region up to and during project construction and operation. Any agreements or memorandums of understanding between the two parties will be drafted and ratified prior to Project construction." Given the socio-economic impacts will occur across provincial jurisdictions, additional information on the coordination of impacts and mitigations between Teck and Benga are required.

a) Provide a summary of the "issues of common interest" that have been the focus of discussions with Teck.

i. Discuss the extent to which Municipal governments in the BC portion of the RSA and British Columbia Provincial government have been involved in these discussions regarding coordination.

Response:

No substantive discussions have taken place with B.C. Municipalities or the B.C. Government to date.

ii. Provide any socio-economic commitments and mitigations Benga has proposed to address socio-economic impacts experienced in British Columbia.

Response:

No commitments have been made to date.

b) Provide a timeline of the lifespan of the existing five Teck mines.

Response:

Benga is not able to comment on the operations of another company; however, based on publicly-available information, Table SIR 53-1 provides an estimated timeline of the lifespan of the five Teck coal mines in the Elk Valley of B.C.

Table SIR 53-1 Estimated Lifespan of Teck Elk Valley Mines

Teck Mine	Current Annual Mine Production (tonnes)	Estimated Mine Life (Based on proven and probable reserves to support planned production rates)
Elkview	7.0 million	Approximately 40 years.
Coal Mountain	2.7 million	Mining operations concluded in the fourth quarter of 2017.
Fording River	8.5 million	Approximately 50 years.
Greenhills	5.2 million	Approximately 35-40 years.
Line Creek	3.5 million	Approximately 20-25 years.

Source: Teck (2016). Teck Operations. Accessed January 2018 at: https://www.teck.com/operations/

54. Volume 7, Section 1.3, page 104 Volume 7, Section 8.3.2, page 149

Volume 7, Section 7.2.2, Table 7.1, page 141

Benga states, "The effects on regional services and infrastructure will largely be in line with population effects, falling primarily on Crowsnest Pass and Sparwood." Benga also identifies that "The additional demand for municipal infrastructure requirements driven by the population increase estimated under the Application Case assumptions will exceed the current and planned levels of municipal infrastructure in Crowsnest Pass."

In Table 7.1 of the Socio-economic Impact Assessment, Benga's assessment of Social Services Issues is incomplete "Pending discussions with Crowsnest Pass representatives." Given the significance of the social impacts in Crowsnest Pass and concerns with distribution of municipal tax revenue, a full examination of the socio-economic impacts on Crowsnest pass is required. Furthermore, provided that current demographics favor seniors, an assessment of capacity for childcare and education in the community must be provided.

a) Provide an updated summary of Social Service Issues in Crowsnest Pass based on consultation with representatives and service providers.

Response:

The Family and Community Support Services (FCSS) office located in Blairmore provides social services to Crowsnest Pass. FCSS funds several programs in the region, including

- the Boys and Girls Club;

- Kids Kollege;
- Parent Link and Student Support Services;
- Crowsnest Pass Literacy Foundation
- Ranchland Victim Services
- Early Childhood Development Coalition;
- Compassionate Friends;
- Crowsnest Forest Kids and
- 40 Developmental Assets – a program focused on helping young people develop in a way that allows them to be more likely to succeed in school, show leadership, and take care of their health.

FCSS also directly offers programs including Meals on Wheels, and a variety of activities for youth, seniors and volunteers.

FCSS is currently in the process of drafting a Social Needs Assessment (SNA), which will provide a basis for strategic planning for future use of FCSS programming and resources. The needs assessment is examining the extent to which social needs are being met and where gaps in service may exist. Although the SNA is not complete, discussions with a representative of FCSS indicated:

- there is an abundance of programming directed at children under the age of six, but limited programming targeted at youth and seniors;
- specific gaps in service include:
    - a need for a communal indoor recreation space with regular operating hours for youth and more seniors-specific programming; and
    - a lack of programming directed specifically at supporting those in need of affordable housing.

Additionally, FCSS identified the following challenges with the delivery of existing services:

- The broad geography of the Crowsnest Pass can be a challenge when clients must travel from one community to another to access specific programs.
- There is a lack of coordination between programs in communities (*i.e.*: the senior's centres in Coleman and Bellevue), which can lead to challenges in accessing selected services, particularly for those individuals who don't drive or have difficulties travelling (Lewis, *pers. comm.*).

References:

K. Lewis. Programmer, Family and Community Support Services in Blairmore. Interview on January 30, 2018.

b) Provide baseline assessment of childcare and (Elementary to High) school capacity in Crowsnest Pass.

Response:

Regulated (*i.e.* provincially licensed) childcare in Alberta is provided by a mixture of:

- day care centres, which are facility-based programs that serve infants, toddlers, and pre-school aged children;
- group family child care programs, which offer care in a private residence to children of all ages;
- Out-of-School care programs that offer before and after school care to school-aged children; and
- family day homes, which offer care in a private residence to children of all ages

The manner in which families choose to use regulated childcare varies. Some families choose to enroll their children in full-time care and therefore, their children occupy regulated childcare spaces on a full-time basis (i.e. one licensed space serves one child). Others choose to use care on a part-time basis and may share a single licensed space with one or more other families (*i.e.* one licensed space serves more than one child). Additionally, parents may rely on unregulated care (i.e. family members, neighbours, friends), or make modified work arrangements in order to provide care to their children. Conversely, parents may choose to enroll their children in childcare programs for socialization or education purposes despite there being familial or other care available. In sum, the demand for childcare is dynamic and difficult to quantify.

Regulated childcare in the Crowsnest Pass is offered by day care centres located in Blairmore and Coleman. Discussion with providers in the region indicate that there are a total of 63 regulated childcare spaces are available in the Crowsnest Pass. Some operators report having a waiting list but note that the waiting time is typically short, and others indicate that additional regulated childcare is not required in the community.

The Crowsnest Pass is served by the Livingstone Range School Division No. 68 which operates three schools in the community:

- Horace Allen School, located in Coleman, offering education to kindergarten to grade 3;
- Isabelle Sellon School, located in Blairmore, offering education to grades 4 to 6; and
- Crowsnest Consolidated High School, located in Coleman, offering education to grades 7 to 12.

Enrollment in all three schools combined has varied over the past five school years, with the lowest enrolment count of approximately 600 occurring in the 2012/13 school year and the highest count of 680 occurring in 2015/16. Enrolment during the 2016/17 school year was approximately 645 students.

In the 2016/17 school year, the schools reported a combined enrolment count of 645. Specifically:

- 215 students in the Horace Allen School, below the school's maximum capacity of approximately 280;
- 143 students in the Isabelle Sellon School; below the school's maximum capacity of 264; and
- 278 students in the Crowsnest Consolidated High School, below the school's maximum capacity of 682.

References

Alberta Education. 2018. School and Authority Enrolment Data. Accessed January 2018 at https://education.alberta.ca/alberta-education/student-population/everyone/school-authority-enrolment-data/

S. Bole. Owner, Little Mountaineers Learning Center. Interview on February 6, 2018.

E. Garner. Administrator. Horace Allen School. Interview Feb 28, 2018.

K. Lewis. Programmer, Family and Community Support Services in Blairmore. Interview on January 30, 2018.

C. McKie, Principal, Crowsnest Consolidated High School. Interview on February 12, 2018.

D. Parkins, Donna's ABC Daycare. Interview on February 12, 2018.

A. Stafford, Isabelle Sellon School. Interview on February 12, 2018.

i. Provide an assessment of the increased demand for childcare and school based on projected population effects.

Response:

Alberta Human Services typically contemplates regulated childcare spaces for unique groups of children, those under six years old and those aged 6 to 12 years. These categorizations reflect the unique needs of each group (*i.e.* school aged children (6 to 12) may require care only before and/or after school whereas those under 6 may require day-long care.

In 2016, the number of school aged children in the Crowsnest Pass was:

- 275 children under the age of 6; and
- 325 children between 6 and 12.

The total of 600 children were served by 63 regulated child care spaces – a ratio of 9.5 children per space.

Under the population effects for the application and planned development cases (as updated in response to SIR 50) by 2021, Crowsnest Pass is expected to house approximately 85 additional children under the age of 12. Accordingly, an additional 9 regulated child care spaces will be required if the ratio of 9.5 children per space is maintained.

With respect to education: the population effects for the application case and planned development cases, as updated in response to SIR 50, by 2021, Crowsnest Pass is expected to house approximately 105 additional children between ages 5 and 18, each of which will likely require a space in one of the three schools identified in the response to (b). If the in-migrating school-aged population is heavily weighted towards the kindergarten to grade 3 cohorts, capacity issues could begin to materialize at the Horace Allen School which could lead to class sizes being larger than the preferred number of students or the need to bring portables onto the school site.

55. Vol. 1, Sec. A.10.10, p. 111

Vol. 1, Sec. A.10.10, p. 112

Vol. 2, Sec. H.4.4.1.1, p. 450

Benga states, "the proposed Project is situated on both Crown and freehold land. A majority of the land to be developed is owned by Benga." Benga also states, "It is predicted that the impact of the Project on the access to hunting and trapping areas will be not significant as a majority of the land to be developed is privately owned. All existing trails and access points through the proposed Project will eventually be closed. Alternate access will be available as required."

Benga states that they "will continue to consult with Piikani Nation, including discussion of options to facilitate access for land use activities where they may be affected by the Project. The potential effects described in these sections could result in a change in use or access to trails and travel ways or disturbance to features associated with trails and travel ways."

a) Provide a map showing:

i. Existing trail and access routes throughout the project footprint used for recreational purposes and traditional land use.

Response:

Existing trails and access routes are illustrated in the Land Use report, Volume 7, Consultant Report (CR#10) Figure 5.1-1.

ii. Traditional trails throughout the project footprint that were developed through the Traditional Land Use studies (where Benga has permission to share these maps).

Response:

Benga has not been provided maps showing traditional trails as part of the TLU studies. This information was deemed sensitive by the First Nations.

b) Provide a map of points of current and planned access control.

Response:

Benga is planning to restrict access to the active mining area which will include access control on the main road into the site and signage or fencing around the perimeter of the active area to limit access for safety reasons. An Access Management Plan is being developed and will be finalized after discussion with First Nations during the first half of 2018 which will include final access control points and procedures.

i. Provide examples of the signage to be used for identifying areas that are not open for public use.

Response:

Benga will develop appropriate signage in conjunction with the Access Control Plan.

c) It is unclear if access points and trails through the proposed project will be closed completely, or if Access Management Plan will allow for access to Indigenous and Recreational Land Users. Clarify Benga's position on access to traditional lands and waters in the Project Area during all stages of the Project broken down by pre-construction, construction, operation, decommissioning and post-reclamation.

Response:

Benga considers that the priority for access management must be to ensure the safety of Benga employees and contractors, and the public. Benga intends to post signs and install fencing and gates as appropriate to ensure that the public does not access areas where work is on-going. In general, this will mean restricted access to areas within the Mine Permit Boundary that are to the west of Gold Creek and to the east of Blairmore Creek. Access to the creeks themselves should not be restricted. Access on trails around the north area of the Mine Permit Boundary will be allowed on designated trails only.

Special access for aboriginal groups to areas not yet disturbed and to areas that have been reclaimed through progressive reclamation shall be permitted on a limited basis for traditional activities that do not interfere with the mining activity or otherwise create a safety risk. This special access will be administered by appointment and perhaps including an accompanying Benga employee to ensure visitor safety.

Details including signage, fencing, trail designation, permission to use firearms, and access protocol for special access will be worked out in consultation with First Nation in 2018.

56. Vol. 2, Sec. H.4.4.1.1, p. 450

Benga states, "To manage potential effects associated with public access to the Project site; Benga adopted a policy that will be used to guide access by authorized users only. Access control will be based on the level of risk to public safety and the need to protect Project infrastructure."

Benga states, "Access will be managed in accordance with the existing management objectives of the mine, where these are defined, and with input from regulatory agencies."

a) Provide the "policy" and "existing management objectives" referenced above.

Response:

The policy and management objectives are more described in the response to SIR 55c.

57. Vol 3, Appendix 7d: Sec. 2.4, p.791

Benga states, "sensitive features (e.g., species of management concern, important habitat features) to be flagged or fenced ahead of clearing, where feasible."

a) Provide a list of sensitive features.

Response:

To date, exact locations of sensitive features have not been disclosed by any of the First Nations that conducted TLU Studies due to their sensitivity. Certain First Nations have agreed to provide this information on a confidential basis to Benga and assistance with mapping is being provided. Once specific locations are identified, Benga will work with the respective First Nations to determine whether it is possible to protect the feature and if so what protection is most appropriate. If it is not possible to protect the feature, alternate mitigative measures will be agreed.

b) Discuss if and how traditional knowledge and input from Indigenous communities were used in determining this list.

Response:

See response SIR 57a.

58. Vol 3, Appendix 7d: Sec. 2.4, p.791

Volume 7, Appendix 7d(i), p. 785

Benga commits that a "post-construction monitoring program will be developed to report on the effectiveness of this [Access Management] Plan. This program will focus on mitigation such as access controls, reclamation, and revegetation." Benga provides a general direction regarding access management planning through an Aboriginal Access Management Plan Framework (See v. 7d(i), p. 785), though more details are required regarding both the Aboriginal Access Management Plan Framework and post-construction monitoring program.

a) List the metrics and indicators Benga will use to assess the effectiveness of the Access Management Plan.

Response:

The Access Management Plan has three primary objectives: 1) safety and protection of the mine infrastructure and 2) facilitation of access to adjacent lands for traditional uses and recreational activities, and 3) facilitation of special aboriginal access to areas not yet mined or areas reclaimed through progressive reclamation for traditional activities. Success of the program will be measured using the following metrics:

- Cameras on the main trails – Benga will mount motion activated cameras along the major trails to monitor the type and frequency of traffic through the site.
- Ongoing consultation with First Nations – Any concerns with access from Benga or the First Nations will be discussed on an event basis or at regular update meetings.
- Safety events – Benga will investigate any safety events or apparent close calls to determine root cause and to implement preventative measures.
- Input from the community – Benga will maintain contact with key organizations in the community, including the municipality, in order to identify access issues as they arise.

59. Volume 7, Section 5.4.6, page 60

Volume 7, Section 5.4.6, page 64

Benga states, “Once mining areas are no longer required, they will be reclaimed to a land use equivalent to what existed prior to development of the Project. This includes areas for both timber production and grazing.” Later, Benga states, that “in addition, at the completion of mining, the area will be reclaimed to a land use equivalent to what existed prior to development, including recreational use.”

a) Confirm whether reclaiming to “land use equivalent” includes traditional land use and an end land-use goal.

Response:

Yes, traditional land use is an end land-use goal.

b) Provide evidence or experience Benga has in reclaiming coal mining landscapes for traditional plant species.

Response:

Benga intends to access expertise that exists in Alberta and Canada where many mine landscapes have been reclaimed. Benga also intends to consult extensively with First Nations on reclamation plans as they are developed and refined throughout the life of the project.

60. Vol. 3, Sec. 03a, p. 668

Benga states, "Riversdale has committed verbally to developing the project with great regard to Blackfoot rights, interests and heritage sites, and to remediate the site once the mine is exhausted to a state as good or better than it was before the mine project was opened, in effect taking responsibility for remediation work that should have been done by previous owners."

a) Confirm what is meant by this statement, and provide whether Benga has made this commitment and what the commitment entails.

Response:

Benga has consulted extensively with First Nations to date and has committed in writing (refer to issues and response tables for specific commitments) to:

- develop an access management plan that provides maximum access to the crown land around the perimeter of the mine permit boundary;
- facilitate access, where safe to do so, to areas within the mine permit boundary that are not being actively mined or which have been reclaimed for the purposes of traditional activities;
- involving and consulting with First Nations on reclamation plans as the mine progresses including creating landscapes and vegetation that are conducive to traditional uses;
- communicating regularly with First Nations regarding mine progress and results of monitoring programs; and
- protection of sensitive sites if possible or other appropriate mitigation measures as determined through discussion with First Nations.

With regard to the final statement, it is well documented that there have been historical mining activities at the site which were never properly remediated. As a result, extensive areas are currently in a degraded state in terms of land capability. Once the Grassy Mountain Project is complete and reclaimed, 100% of the site will be returned to a productive state.

61. EIA FTOR 6 [B]

The EIA FTOR 6 [B] requires that Benga "Describe how traditional ecological knowledge and traditional land use information was incorporated into the project design and development, technical components of the EIA, the conservation and reclamation plan, and monitoring and mitigation plans."

a) Confirm whether traditional knowledge from previous studies, such as the Old Man River Dam and the Weasel Valley Water Use Study were considered in the assessment. If so, discuss.

Response:

Benga did not directly use traditional knowledge from the previous studies mentioned above except insofar as one of the First Nations, that performed a TLU study, may have benefitted from the previous experience working on these projects.

62. Vol. 7, CR 11, Sec. 10.4, p. 158

Benga states, "Benga and its contractors will use buses and multi-passenger vans to transport personnel to site in order to reduce the total number of vehicles traveling on local roads. Benga will also endeavor to schedule construction deliveries during off-peak hours."

a) Confirm whether transportation to the Grassy Mountain project will be based solely from Sparwood and Blairmore, or if there will be transportation available from other nearby communities (Fort McLeod, Pincher Creek, and Brocket, etc.).

Response:

At this time, Benga is only contemplating bus transportation from Blairmore and will endeavour to arrange for pick up at a convenient parking location so that workers can drive to Blairmore and then take a bus to the work site. Benga will consider adding additional buses, or promoting car pooling, from other centers based on actual employee demographics and after consultation with Piikani First Nation at Brocket.

63. 15. Vol. 1, Sec. A.11.11, p. 159

Vol. 1, Sec. A.7.11, p. 86

Benga states that they will "house construction workers in a temporary camp, which has the ancillary effect of reducing the resident population effect of the Project and the anticipated demand for housing." Benga commits that "A semi-permanent base camp of 228 people will be assembled, which can be expanded during peak periods. Available hotels/motels in Blairmore, Coleman, and Bellevue will also be utilized for short term ramp-ups in construction activity." Additional information is needed regarding the temporary accommodations in order to understand how it will mitigate pressure of socio-economic effects.

a) Provide additional details for "base camp"/"temporary camp".

   i. Define semi-permanent base camp.

Response:

The semi-permanent base camp referenced in Volume 1, Section C.6.17 is the same as the temporary construction camp referenced in numerous other sections of the application. As noted in the socio-economic assessment (Volume 7, Consultant Report #11, Section 6.4), the camp is expected to house workers during the project's roughly two-year construction phase but may be used to house some of the operations workforce until adequate housing in the region is available.

ii. Provide a list of services that will be available to workers at base camp, such as recreation, health and emergency services, etc.

Response:

Camp-related amenities and services are expected include:

- basic recreational and entertainment facilities and equipment, including an onsite fitness facility (with weights and aerobic fitness equipment), common dining hall, televisions, and wireless internet;
- onsite 24/7 camp security; and
- first aid and/or basic medical facilities and personnel.

Final decisions on camp-related amenities and services will be made during later stages of Project planning.

In addition, Benga commits to working with responsible agencies in order to develop cooperative protocols for dealing with camp worker access to health services and facilitating ways in which camp security can work with local police.

iii. Provide rationale for why a semi-permanent base-camp was chosen to address workforce accommodations during construction.

Response:

As noted in response to SIR 63a(i), the semi-permanent base camp referenced in Volume 1, Section C.6.17 is the same as the temporary construction camp referenced in numerous other sections of the application. First and foremost, the temporary work camp is a mitigation strategy for short-term accommodation effects. As compared to the alternative of Living-Out Allowances (LOA) for construction workers, the temporary work camps avoid the potential for inflationary pressure on hotel and rental accommodation by expanding quickly the accommodation supply in the region thus avoiding or minimizing accommodation price inflation related to a supply squeeze.

Along with minimizing the impacts on accommodation in the region, camps serve to limit other potential socio-economic impacts on a community. Specifically, they reduce the need for construction workers to visit local communities, thereby limiting impacts on regional infrastructure and services (*e.g.* recreation, health, and emergency services) and limiting the potential for any social-related impacts (*e.g.* residents' concerns with the presence of temporary construction workers). The use of a temporary work camp also makes issues related to the influx of temporary residents more amenable to management and mitigation.

Benga recognizes that accommodation in a camp potentially diminishes the economic benefit to the local restaurant and hotel industry. In order to seek a balance, Benga will continue to coordinate with local municipalities to optimize the number of workers staying in the camp versus the number of workers that use local hotels and restaurants.

iv. Provide justification and rationale for basecamp accommodating 228 people. Confirm if there will be any overflow, and how this will be accommodated (i.e. explain how base –camp can be "expanded".

Response:

For the overflow a LOA will be provided as this will be for short periods and should not impact inflationary pressures on hotels and rental accommodation. If necessary, to manage these short-term peaks, Benga will consider bussing workers to and from larger markets.

b) Confirm whether personal vehicles be allowed at camp.

Response:

Private vehicles will not be allowed at camp sites, only Benga and contractor light duty vehicles, and busses.

64. Vol. 7, CR #11, Sec. 6.4 p. 136

Benga. States, "Although operations workers are assumed to migrate to the region and become permanent residents, the temporary camp may be used to house some of the operations workforce until adequate housing in the region is available." This is a significant assumption and presents the option that the semi-permanent base camp could remain an accommodation option throughout operations. Given housing is limited in Crowsnest Pass, this may be a likely outcome.

a) Discuss fiscal, social, and infrastructure implications if operations' workforce relies on temporary accommodations instead of relocating to the region.

Response:

Table SIR 64-1 identifies the implications to each socio-economic valued component (VC) of accommodating the operations workforce in a camp as compared to residing with their families in the region.

Although the construction camp could be used, if needed, on a temporary basis during operations until adequate housing in the region is available, Benga remains committed to having its operations workforce reside in the region. Benga is committed to working with local governments to facilitate the timely development of residential land and dwellings, such as those identified in Sparwood, by means of ongoing discussions regarding Project timelines and execution strategies (see Consultants Report #11, Section 6.3.2). Benga will consider adopting additional policies and incentives to phase out the camp as soon as possible after operations begin.

Table SIR 64-1 Socio-Economic Effects of Accommodating Operations Workers in Camp as Compared to Residing in the Region

Socio-Economic Area	Effects Related to Use of an Operations Camp
Employment	• Project-related employment of residents in the RSA will likely be reduced and instead realized by residents in other parts of Alberta and B.C. Although an operations camp does not exclude operations workers from living in the region, it facilitates the opportunity for these workers and their families to permanently reside elsewhere. • Induced employment effects (*i.e.* employment created by spending of operations workers and their families) will be reduced in the RSA and will increase in other Alberta and B.C. communities where workers and their families reside. • Employment opportunities will be created to support camp operations (*e.g.* catering, housekeeping services, logistics). The ability of workers and businesses in the RSA to realize these opportunities will depend on the capacity and capability of local businesses and workers to address these service needs. • With fewer operations workers residing in the region, there will be fewer spouses and other family members also residing in the region, thereby decreasing the labour pool on which local businesses and service providers can draw (*e.g.* health professionals, teachers, public servants, salespersons, *etc.*)
Personal and Business Income	• Spending by operations workers and their families will be reduced in the RSA and increased in other parts of Alberta and B.C. • Project-related expenditures will increase slightly in order to support camp operations (*e.g.* catering, housekeeping services, security, administration). The ability of local businesses in the RSA to realize benefits from these increased Project-related expenditures will depend on the capacity and capability of local businesses to address these service needs.
Government Revenue	• In the RSA, municipal expenditures (*i.e.* cost of providing services to residents) and municipal revenues (*i.e.* property taxes) will both be reduced as a result of fewer new households associated with operations workers and their families relocating to the region. Also, the presence of a camp may contribute to the assessment base of the municipality, thereby adding to tax revenues.
Population	• The population effect of the Project on the RSA will be reduced as fewer operations workers and their families are expected to reside in the region.

Table SIR 64-1 Socio-Economic Effects of Accommodating Operations Workers in Camp as Compared to Residing in the Region

Socio-Economic Area	Effects Related to Use of an Operations Camp
Regional Infrastructure and Services	• Demands placed on regional infrastructure and services will be reduced in line with reduced population. While a number of service providers indicated they are well position for growth, concerns with growth were raised in relation to some infrastructure and services, including housing, and municipal sewage and water services. The reduction in the population effect on the RSA resulting from an operations camp could partially, or wholly, alleviate some of these concerns. • With fewer operations workers residing in the region, there will be fewer spouses and other family members also residing in the region, thereby decreasing the labour pool and volunteer base on which local service providers can draw (*e.g.* health, social, emergency services). • Recognizing that growth in a community can help increase or revitalize the breadth and nature of infrastructure and services available to local residents, a reduction in population associated with an operations camp could dampen this effect.
Traditional Land Use	• An operations camp is expected to reduce the effect on traditional land use associated with the population effect of the Project. With fewer permanent residents in the region, it's expected there would be fewer regional residents engaging in outdoor recreation activities (*e.g.* hunting, fishing). In addition, the presence of an operations camp could make the effects on TLU associated with the operations workforce more amenable to management and mitigation (*e.g.* limiting opportunities for workers to engage in outdoor recreational activities while in the region).

65. Vol. 1, Sec. A.7.11, p. 86

Volume 7, Section 4.5.1, Figure 4.1, page 122

Benga commits that "A semi-permanent base camp of 228 people will be assembled, which can be expanded during peak periods. Available hotels/motels in Blairmore, Coleman, and Bellevue will also be utilized for short term ramp-ups in construction activity." Based on Figure 4.1, the construction peaks over the summer tourism season. Recognizing the significance of the tourism economy and extra demands on accommodation during tourism season, construction workforce and contractors may displace tourists from hotel and motel accommodations.

a) As part of the baseline assessment, provide the total capacity of hotel and motel rooms available in the RSA.

i. Discuss the vacancy rates of the hotels and motels in the RSA during the "tourist season".

Response:

The estimated number of hotel and motel rooms in the RSA is provided in Table SIR 65-1.

Table SIR 65-1 Hotel and Motel Supply in Crowsnest Pass

Name	Type	Location	Number of Rooms
Best Canadian Motor Inn	Hotel/Motel	Coleman	25
Highwood Motel	Hotel/Motel	Blairmore	31
The Kanata Inns	Hotel/Motel	Blairmore	48
Paddock Inn	Hotel/Motel	Coleman	18
Historic Cosmopolitan Hotel	Hotel/Motel	Blairmore	15
Causeway Bay Hotel	Hotel/Motel	Sparwood	83
Valley Motel	Hotel/Motel	Sparwood	29
Total			249

Generally speaking, the tourist season runs from late May to early September. During this timeframe, the vacancy rate can fluctuate on any given day, but is generally higher on weekends and during the peak summer months of July and August. Hotel and motel representatives in the Crowsnest Pass indicate that capacity is relatively limited during July and August, with vacancy rates generally around 0% to 10%.

In comparison, hotels and motels in Sparwood are generally busy all year long. Hotel and motel representatives in Sparwood indicate that vacancy rates are generally between 0% and 15% all year.

ii. Describe any other potential demand on hotel and motels during the peaks in construction either from tourist events or other sectors.

Response:

Much of the demand for hotel and motel accommodation in Crowsnest Pass in the summer months come from highway traffic (*i.e.* people passing through the region, either for work or vacation), as well as tourism in the region itself. Notable annual events in the area include the Sinister 7 Ultramarathon (July 6 to 8, 2018) and the Kananaskis Pro Rodeo (April 27 to 29, 2018). The hotels and motels in Crowsnest Pass are usually full for these two annual events.

Demand for hotel and motel accommodation in Sparwood is largely due to tourists in the region engaging in outdoor activities. For example, mountain biking and hiking in the summer months, hunting in the fall and snowmobiling in the winter months. Notable annual events include the

Sinister 7 Ultramarathon (July 6 to 8, 2018), where vacancy rates at hotels and motels in the area are closer to 0%.

References:

Best Canadian Motor Inn. Personal communication. February 5, 2018.

Highwood Motel. Personal communication. February 5, 2018.

The Kanata Inns. Personal communication. February 5, 2018.

Paddock Inn. Personal communication. February 5, 2018.

Historic Cosmopolitan Hotel. Personal communication. February 5, 2018.

66. EIA FTOR 8.1 [B] b.

EIA FTOR 8.2 [B]

Volume 7, Section 4.2.3, page 118

EIA FTOR 8.1 [B] b requires Benga to provide "policies and programs regarding the use of local, regional, and Alberta goods and services". EIA FTOR 8.2 [B] requires Benga to "Discuss plans to work with aboriginal communities and groups, local residents, and businesses regarding employment, training, and other economic development opportunities arising from the project."

Benga states, "has policies in place to hire locally first and to use Alberta-based contractors as often as possible subject to labour availability, cost, and quality considerations. Engagement of the local labour force will be coordinated from Benga's Blairmore office location." Furthermore, Benga acknowledges that "as of filing, Benga are in advanced discussions regarding a benefits agreement with the Piikani First Nation, the closest First Nation to the project. The agreement includes provisions to support preferential hiring and contracting, as well as training, of Piikani First Nation members."

a) Provide policies referenced above regarding hiring locally first and using Alberta-based contractors.

Response:

The commitments or policies are published on the Riversdale Resources web site at the following address: http://www.rivresources.com/irm/content/our-commitments.aspx?RID=250

Detailed employment and procurement procedures to give strength to these policies are being developed during 2018 in anticipation of a construction start in 2019.

b) Identify types of positions available for construction and operation.

Response:

Benga anticipates approximately 400 positions will be generated by the Project once in Operations. There will be more positions available during the two-year construction period. The types of positions available will including the following:

Mining Engineer	Catering and laundry	Administrative Assistant
Geologists	Human Resources	Drillers
Truck Drivers	First Aid and Safety	Blast Hole Engineer
Heavy Equipment Operators	Environmental Engineers	Information Technology
Hydrologists	Community liaison	Accounting and Payroll
Hydrogeologists	Electricians	Business Analyst
Maintenance staff	Procurement Manager	Mine Planner
Mining Engineer	Hydrologists	Process Engineer
Geologists	Marketing Manager	Welder
Truck Drivers	Public Relations and legal	Logistics Manager
Heavy Equipment Operators	Geo-technical Engineers	Training Coordinator
Laboratory Technicians	Stores Manager	Surveyor

i. Of these positions, identify the percentage that will require 1) high school diploma or, 2) trade certification, and/or 3) Union membership.

Response:

The majority of the positions at the site will require a high school diploma and trade certification or post high school training as an equipment operator for example. Some of this training can be on-the-job training for prospective candidates.

c) Identify constraints experienced by Treaty 7 Aboriginal communities and businesses to employment and contracting opportunities provided by Benga.

Response:

A very positive aspect of the Project with respect to Aboriginal involvement is that the project expects to employ nearly 400 people for more than 20 years. That means that, contrary to relatively brief construction projects, there is time to work with the aboriginal communities to systematically build capacity, train candidates and provide that all-important first work experience. Benga will be monitoring the participation of the aboriginal community within the Project workforce and will be working with First Nations to improve participation over the life of the Project.

ii. Describe any programming or strategies Benga is providing to alleviate these constraints.

Response:

See response SIR 66c.

67. Volume 1, Section E.11.7, page 858

Property taxes to both Ranchland ($990,000 annually) and Crowsnest Pass ($490,000 annually). Using an 8% discount rate, the present value of the municipal taxes over the life of the project is calculated to be $11.2 million ($2015). The Ranchland council has acknowledged that much of the impacts of the Project will accrue to Crowsnest Pass and has indicated they would be open to negotiating a revenue-sharing agreement once the Project commences (RL 2013).

a) Provide updates on the negotiation of a revenue sharing agreement between Crowsnest Pass and Ranchland.

Response:

Since Benga is not a party to any discussions between Ranchlands and Crowsnest Pass, Benga cannot comment on this subject.

68. Volume 1, Section E.11.7, page 858

Benga states, "The Project will also contribute an estimated $140 million (NPV 2015) and $210 million (NPV 2015) to provincial and federal corporate income taxes respectively as well as approximately $195 million (NPV 2015) in provincial royalties over the 23-year operating life of the project, assuming a $140/tonne average real price of coal."

a) Provide justification for using $140/tonne average real price of coal to forecast provincial royalty payments.

Response:

Like all commodities, the price of metallurgical or coking coal is cyclical and varies significantly with supply and demand pressures. Since 2013, the world price for metallurgical coal has fluctuated between a low of $80 USD/tonne in 2015 – 2016 to recent highs driven by supply shortfalls in excess of $300/tonne. Based on market knowledge and experience, Benga considers that $140/tonne is a reasonable long-term price for planning purposes.

b) Provide alterative royalty forecasts using both high and low price scenarios, with the low scenario reflecting Benga's breakeven price.

Response:

Benga considers its breakeven price to be commercially sensitive information. To be responsive, Benga has provided alternative royalty forecasts using $100 USD/tonne and $200 USD/tonne respectively and applying the same financial methodology used in the application.

69. Volume 1, Section A.2.7 Page 29

Benga states that the "Development of the Project will provide the following benefits…receipt of revenue in the form of …licence fees.

a) Quantify the license fees paid by Benga (NPV 2015) over the life of the project.

Response:

Benga does not have an estimate of license fees that will be paid to various governments over the life of the project; however, Benga estimates that such payments will be small compared to royalties and taxes.

70. EIA FTOR 8.2 [A] a. iv-v.

EIA FTOR 8.2 [A] a. iv-v requires the proponent "describe the socioeconomic impacts of project construction and operation, including impacts on recreational activities,… hunting, fishing, trapping, and gathering." The EIA report did not discuss impacts on the angling or tourist economy- which based on SOCs, a substantial component of the Crowsnest Pass Economy.

a) Provide the number of outfitting businesses currently using the Crowsnest River as a client destination.

Response:

The Crowsnest River runs through the Municipality of Crowsnest Pass and the Municipal District of Pincher Creek. This river is considered a world-class destination for fly fishing. Of the 45 fishing guides or lodges across the province, there are four which are located in these municipalities (Table SIR 70.1; Alberta Fishing Guide 2017).

Table SIR 70-1 Fishing Guides and Lodges in the Crowsnest Pass and M.D. of Pincher Creek

Name	Guide	Fish	Municipality
Alberta Fly Fishing Adventures	Fly Fishing, Drift Boat, Walk & Wade	Brown Trout, Bull Trout, Cutthroat Trout, Rainbow Trout	Crowsnest Pass
The Crowsnest Angler	Fly Fishing, Fly Casting (Instruction), Drift Boat, Walk & Wade	Brown Trout, Cutthroat Trout, Rainbow Trout	Crowsnest Pass
Trout Wrangler Lodge	Fly Fishing, Fishing Lodge	Brown Trout, Cutthroat Trout, Rainbow Trout	Crowsnest Pass
Bowcrow Fishing Adventures	Fly Fishing, Drift Boat, Walk & Wade	Brook Trout, Brown Trout, Bull Trout, Cutthroat Trout, Rainbow Trout	M.D. of Pincher Creek

Source: Alberta Fishing Guide 2017.

References

Alberta Fishing Guide. 2017. AlbertaFishingGuide.com. Accessed January 2018 at http://www.albertafishingguide.com/

b) Discuss the economic implications of the mine development on Fly Fishing Outfitters, such as willingness to pay for experience, aesthetic and sensory impacts, and impacts to fish abundance and health.

Response:

If the construction and operation of the mine proceeds as planned, and there are no malfunctions or unintended discharges into the Crowsnest River, then adverse impacts to either the water quality or access to the local rivers and streams are not anticipated. The Project is therefore not anticipated to have an adverse impact on the experience of Fly Fishing Outfitters in the region, including aesthetics, sensory considerations, and fish abundance and health.

If a malfunction or unintended discharge into one of the surrounding streams or rivers occurs, then temporary adverse impacts to Fly Fishing Outfitters could occur. Determining the economic impact of potential adverse impacts is accomplished by determining the willingness to pay for Fly Fishing Outfitting by anglers. Although the authors are unaware of studies which calculate the willingness to pay for Fly Fishing Outfitting specifically in the Crowsnest River, there are various academic studies that have calculated the value of, or willingness to pay for, recreational fishing, including the experience of fishing. Values are presented on either a per fishing trip or per fish basis and range between ($2,016 CAD):

- $3.27 to $877.33 per fishing trip day; or
- $0.86 to $314.00 per fish.

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71. Volume 1, Section A.11.11.1, page 162

Benga states, "Socio-economic monitoring will occur in the RSA, which includes M.D. of Ranchland, the S.M. of Crowsnest Pass, Town of Sparwood, and the portion of Highway 3 connecting the Project to Sparwood. Monitoring will be conducted according to provincial/federal standards and regulations and all approval conditions."

a) Identify the "provincial (Alberta and BC)/federal standards and regulations" Benga is committing to for monitoring for socio-economic impacts.

Response:

The statement quoted in the question does not appear in the filed application. Benga is not aware of any specific provincial or federal standards and regulations for socio-economic monitoring but does note that the general statement that "*monitoring will be conducted according to provincial/federal standards and regulations and all approval conditions*" is applicable to all Benga's monitoring initiatives, environmental and otherwise.

b) Discuss if and how the monitoring programs will assess any Project impacts and measure the effectiveness of mitigation plans;

Response:

Benga anticipates that it will gather selected socio-economic information on its Project and report on this information as part of its ongoing engagement with stakeholders. The nature and extent of this monitoring will be established in discussion with stakeholders. For example, Benga will discuss with stakeholders the potential information to be collected (*e.g.* jobs, local spending, social investments, housing demands), along with appropriate data collection methods and processes to allow for accurate data collection and reporting. Information gathered relating to Project-specific activities will be disseminated to interested stakeholders and the general public through a number of ongoing consultation activities (*e.g.* meetings, open houses, newsletters, website). The aim of socio-economic monitoring will be to strengthen Benga's relationship with communities near its operations and provide decision makers with the information necessary to develop informed plans for addressing any socio-economic impacts that may arise.

Along with Benga's commitment to socio-economic monitoring of its Project activities, it is worth noting that a broad range of socio-economic monitoring already occurs in the region. For example, government departments, public agencies and private-sector companies that provide infrastructure and services already monitor ongoing demand for services as part of their normal operation (*e.g.* school boards, public health providers, municipalities).

c) Confirm whether the socio-economic monitoring will be performed in conjunction with all stakeholders.

Response:

As noted in response SIR 71b, Benga's socio-economic monitoring will be performed in conjunction with its ongoing stakeholder engagement activities.

72. Final Terms of Reference for Environmental Impact Assessment Report (March 19, 2015) Concordance table (Ver. 2, p. 669)

The Final Terms of Reference for Environmental Impact Assessment Report requires that Benga provide "an analysis of the need for the project and consideration of alternatives to the proposed activity, including not proceeding with the proposed activity (3.2.1.b)" and that Benga "describe existing access control measures (4.10 [D])". These are excluded from concordance table (V. 2, p. 669) and not discussed in the EIA report.

a) Include a reference to the relevant section in the concordance table.

Response:

See response SIR 72b.

b) Provide this information or indicate where in the EIA report it can be found.

Response:

Project need is discussed in Volume 1, Section A.2.7 and an assessment of alternative means is provided in Volume 1, Section A.7.

If Benga does not proceed with the proposed Project, the local and regional population would not receive the economic benefits that the Project would bring to the area, including economic development, employment opportunities and community benefits. In addition, the proposed Project is located on a disturbed site from past mining activities that has not been reclaimed. At the conclusion of the Project's mine life, the site will be rehabilitated to a better state than it currently is today. However, if the proposed Project was not to proceed, the site would remain disturbed.

Information regarding access is provided in the Consultant Report #10, Section 4.8. At this time, there are no existing access control measures.

A.1.4 Waste Management

73. Volume 1, Section C.2.8.3 – Laboratory, Page C-68 (Adobe PDF Page 399/1028)

Benga states, "The lab layout consists of a small office area used for management of samples and collating test work data, a building suitable for receiving collected plant sample in drums, and a small laydown yard." The discussion on the laboratory does not provide details on the type of chemicals planned and plans for containment. Understanding the types of chemicals to be used and the means of storage is beneficial in assessing potential environmental impacts.

a) Provide details on the types of chemicals and wastes that are anticipated for use and storage at the laboratory.

Response:

The laboratory analysis will only be for production sampling and consist of crushing, drying and filtering samples for ash and moisture testing. To undertake this work the consumables used are paper filter cloths, water, compressed air and natural gas. Unlike commercial laboratories no organic liquids will be present in the lab for testing.

b) Provide details on the type of containment proposed for chemicals and waste streams.

Response:

Once the coal is analyzed it will be returned to the product stockpile. Filter cloths will be disposed on in standard waste bins.

74. Volume 1, Section C.5.3.5 – Metals Treatment Plant, Page C-94

Benga states, that for metals treatment, "direct discharge of this water may cause constituent concentrations in the receiving creeks to exceed provincial and federal guidelines. Monitoring of the discharge will confirm if water treatment is required and the timing of such treatment."

Benga also states, that if a water treatment process is employed, "the proposed method for removal of metals and nitrite is conventional lime treatment, also known as a high density sludge (HDS) process."

Understanding contingency plans, in the event that concentrations exceed guidelines would improve understanding of potential downstream impacts. If metals treatment plant employing an HDS process is to be employed, knowledge of the waste streams is required to determine any impacts on the environment.

a) Discuss plans that Benga would employ in the event that elevated metals concentration are found prior to installation of the proposed water treatment equipment (conventional lime treatment).

Response:

A description of discharge water treatment is provided in Appendix 10C (Water Quality Management), Section 3.4.

As described in this section, the water quality model results for the Project indicated that effluent pumped from managed saturated backfills may contain elevated concentrations of cadmium, cobalt, iron, manganese, nickel, zinc, and nitrite. The requirement for treatment of water pumped from the saturated backfill zones are uncertain. At a minimum, aeration or oxidation followed by settling of solids would likely be required to remove constituents such as ferrous iron or nitrite. Such a treatment process could be constructed and operated semi-passively by allowing outflow from the saturated zones to cascade over a rockfall into a pond. However, it is also possible that active treatment for dissolved metals will be required as discussed below. Monitoring and test-work carried out to evaluate operating parameters for the managed saturated backfills is expected to reveal the type and extent of discharge treatment required.

b) Provide details on the anticipated waste streams from the HDS process and how these waste streams would be handled.

Response:

A description of discharge water treatment is provided in Appendix 10C (Water Quality Management), Section 4.4.

HDS plants are common and do not require specialized equipment or construction methods. HDS plants can typically be designed, constructed and commissioned within 24 months but could be fast-tracked in as little as 12 months depending on the equipment selection. The test-work completed for the managed saturated backfills is expected to reveal whether, or to what extent discharge water treatment is required. Therefore, assuming that test-work commences as soon as a decision is made to proceed with the Project, ample time should be available to implement discharge water treatment.

75. Volume 1, Section C.7.8 – Waste Management, Page C-144

Volume 1, A.10.5 – Surface Water Quality, Page A-80

Volume 1, A.11.9.1 - Wildlife Mitigations, Page A-129

Volume 1, C.6.9 – Uncovered Storage, Page C-116

Volume 1, C.7.6 – Environmental Protection Program, Page C-131

Volume 1, C.7.8 – Waste Management, Page C-144

Volume 1, E.3.3.3 – Effects of Surface Facilities on Groundwater Quality, Page E-63

Volume 1, E.9.5.1.5 – Mortality Risk, Page E-197

Volume 4, 5.1 – Overview of the Mine Activities and Impact Issues, Page 36

Benga states, for waste management activities, "Benga will investigate and evaluate required waste disposal activities."

Benga further indicates that "a detailed Waste Management Plan will be developed and implemented prior to construction and operational activities to minimize the attraction of wildlife".

A commitment is also made whereby "waste generated on site will be stored and disposed of in accordance with regulatory requirements".

The details on waste management facilities (i.e. use of a landfill, offsite disposal, temporary storage locations) are not provided. The details requested in Section 3.2.7 [B] and 3.2.7 [C] of "Final Terms of Reference" concerning characterization of waste, quantities of waste and specific substance generated was not provided in the application. Details on the waste storage facilities and plans for storage of waste have not been provided.

a) Provide details on what will be investigated (i.e. scope of the investigation).

Response:

As part of operational readiness preparation, Benga will develop and implement a comprehensive Waste Management Plan prior to commencing construction and operations. All contractors and employees working on site will receive training in the application of the plan and it will be a condition of employment that the plan is to be complied with.

Prior to developing the plan Benga will consult with equipment and service providers to gain an understanding of the options available for waste reduction and the facilities available for waste disposal. The scope will cover but not necessarily restricted to:

- Earthmoving and Mining Equipment - engine and transmission oils; hydraulic oils and filters; greases and lubricants; mechanical wear parts, tynes, blades, bucket teeth and lips, drill bits, pipes, and tires. Earthmoving and Mining equipment suppliers will be asked to provide details on the options available for reducing, for example oil consumption, through product improvement, and monitoring and sampling.

Mechanical parts will be inspected visually and ultrasonically to determine if the part can be repaired or rebuilt rather than replaced. The major equipment suppliers have facilities in Alberta that can provide these services.

- Coal Processing Equipment- routine wear parts such as filter liners, screen decks, centrifuge baskets, cyclone liners and spigots, pump parts, pipe liners, and crusher and sizer wear, parts will all be reviewed and selected based on expected life, ability to be recycled and cost.
- Office and Workshops – service and contractor providers will be consulted to identify the latest technology and systems available for waste minimization in these areas. This will cover minimization of waste generation, collection, storage and disposal/recycling *e.g.* paper and cardboard, printer consumables, plastics, glass, metals, wood and electrical/electronic components.
- Buildings – architects and contractors will be consulted to draw on the latest technology to minimize heating, cooling and lighting for buildings while adopting a low emission footprint.
- Waste Management Services – a number of existing services in Alberta can help with waste management and provide interesting alternatives for recycling and re-use of waste materials. For example, Alberta Used Oil Management Association works with companies like Benga to recycle and process used motor oil and filters in an environmentally sound manner. Another example is The Alberta Recycling Management Authority which will recycle used tires into useful products. Benga will investigate these and other service providers to maximize recycling opportunities.

b) Discuss on-site infrastructure to be provided with respect to waste management, storage and disposal. Include details on waste storage facilities for:

i. Hazardous waste.

Response:

On site infrastructure for waste management will consist of:

- Provision of appropriate colour coded receptacles and storage areas for routine waste classified by its recycling potential. These will be secured to avoid cross contamination and in the event of outdoor storage to avoid attracting wildlife.
- The Mine Industrial Area (including mine offices, workshops and coal processing facilities) will be serviced by a packaged sewerage treatment plant conforming with ANSI/NSF 40 Standard with a Class 1 treatment capability.
- Liquid industrial waste such as oils, greases and other fluids and chemicals will be captured in storage tanks separated by the nature of the fluid. Private third party contractors licensed to transport and dispose of these fluids will be employed to ensure safe and compliant disposal. These storage tanks will be clearly labeled and positioned for efficient capture of the liquid and protected from damage. Appropriate clean up kits will be provided close by the storage tanks in the event of a spill.

- Separate storage facilities will be provided for non-liquid waste, which has been in contact with liquids; for example: used engine and transmission filters, worn or damaged hoses and pipes and fittings, *etc*.
- The workshop and service bay floors and coal processing floor will be equipped with washdown facilities that provides for contaminants such as oils and chemicals to be captured and drained to a central sump for collection and offsite compliant disposal.
- Mechanical, hydraulic and electrical parts that have reached the end of their useful service life will be separated based on their potential for recycling and stored for collection by equipment suppliers and third-party contractors for offsite recycling or disposal. It is anticipated that the majority of engine, electrical motor and transmission overhauls will be done on an exchange basis with the work carried out off-site in the regional workshops operated by the equipment manufacturers and their specialized service providers.
- Tires that have reached the end of their useful storage life will be stored is designated areas awaiting collection and recycling/disposal at a compliant off-site location. Some tires of an appropriate size may be retained on site for other uses such as providing safety barriers, lane separation, *etc*.

ii. Non-hazardous waste.

c) Provide details on the types of waste generated and their anticipated volumes.

Response:

Table SIR 75-1 is an estimate of the types and quantities of waste based on experience at other mine sites of a similar nature and scaled according to the equipment and workers expected to be on site.

Table SIR 75-1 Estimate of Types and Quantities of Waste for the Grassy Mountain Project

Waste Type	Management Method	Quantity per year
Oily sludge, absorbent, degreaser, grease, oily rags, oil filters	Collected on-site then transported off-site by a licensed regulated waste transporter, to a licensed facility for recycling or treatment and disposal.	Oil sludge 10,000 litres; Grease 43,500 litres; Oil Filters 30 tonnes
Waste oil containers	Drained on-site. Drums will be transported off-site by waste contractor for off-site reuse, recycling or regulated disposal.	1,000,000 litres
Scrap metal, drums	Segregation and collection on-site. Transportation off-site by a waste contractor for off-site recycling.	100 tonnes
General wastes including putrescible and organic (food waste), some plastics and paper not suitable for recycling	Collection on-site and storage in segregated area. Transportation off-site to local landfill.	4,000 m^3 150 tonnes

Table SIR 75-1 Estimate of Types and Quantities of Waste for the Grassy Mountain Project

Waste Type	Management Method	Quantity per year
Recyclable waste including paper and cardboard, plastics, and glass	Segregation and collection on-site. Transportation by a waste contractor for off-site recycling.	2,000 m^3 30 tonnes
Hazardous waste- paints and resins	Collected on-site and stored in a segregated area. Then transported off-site by a licensed regulated waste transporter, to a licensed facility for treatment and disposal.	<2 tonnes
Tires	Light vehicle tyres will be transported off-site by a licensed regulated waste transporter to a licensed facility for recycling. Mine truck tyres will be buried on-site,	50
Vehicle batteries	Collected on-site in a segregated area. Then transported off-site by a licensed regulated waste transporter to a licensed facility for recycling.	3 tonnes
Regulated waste- sewage waste and residues (sewage sludge)	Wastes will be transported and disposed of by licensed contractor at a licensed facility.	10 ML

d) Provide details on proposed recycling programs and storage facilities for material to be recycled.

Response:

The proposed recycling programs and storage facilities for the material to be recycled will include:

- colour Coded receptacles for domestic waste generated in the offices, with recycling and disposal contracted out to accredited service providers;
- a licensed company for off-site disposal will collect sewerage sludge from the packaged wastewater treatment plant for disposal in a regulated disposal facility;
- tanks will be provided for the capture and storage of liquid waste such as oils, greases and other fluids and chemicals will be captured in storage tanks separated by the nature of the fluid. Private third-party contractors licensed to transport and dispose of these fluids will be employed to ensure safe and compliant disposal;
- separate containers will be provided for non-liquid waste, which has been in contact with liquids; for example: used engine and transmission filters, worn or damaged hoses and pipes and fittings, *etc.*;

- floors will be drained to sumps within the workshop, service bay and coal processing areas to facilitate the capture of liquid waste. Liquid waste with these sumps will be pumped to storage tanks awaiting off-site recycling/disposal;
- mechanical, hydraulic and electrical parts that have reached the end of their useful service life will be sorted and stored in containers awaiting collection by equipment suppliers and third-party contractors for offsite recycling or disposal;
- tires will be temporarily stored on site and sorted according to size and potential for recycling/retreading. This service will be contracted out for off-site recycling/disposal; and
- other industrial type waste for example, wooden pallets, plastics, iron, *etc.* will be stored in a designated area awaiting recycling/disposal.

e) Provide information on proposed infrastructure to handle waste including the size and location of any landfill(s) for the Project.

Response:

The proposed infrastructure to handle on-site waste has been described in sections a, b, c, and d above. It is not proposed to operate an on-site landfill for the Project, given the limited land available, and that the in-pit overburden dumps will be operated as saturated backfills for selenium management. As the project is located within 200 km of major urban centers, there are a number of alternative available for off-site disposal of waste in regulated and compliant facilities.

A.2. AIR

A.2.1 Emissions management

76. Volume 1, E.1.3.4 – Greenhouse Gas, Page E-22

Benga provides details on fugitive methane emissions and makes reference to a consultant's report for the calculation methodology (CR#1a, Appendix A, Section A8.0).

Section A8.2 of the consultant's report states, "Fugitive methane emissions from surface coal mining were estimated using emission factors provided by the Intergovernmental Panel on Climate Change (IPCC 2006). The IPCC provides a range of emission factors that depend on the overburden depth of the mine. In the absence of overburden information, or country-specific emission factors, the IPCC considers it good practice to use the average emission factors of 1.2 m3 CH4 /t coal production for surface mining and 0.1 m3 CH4 /t coal production for post-mining (for an overall emission factor of 1.3 m3/t).

Using the IPCC recommended methane density of 0.67 x 10-6 kg/m3; the resulting emission factor is calculated to be 0.87 t CH4/ kt of coal production. The estimated GHG emissions from fugitive methane are 70 kt CO2e per year for Year 19 based on 3,840 kt annual coal production."

The IPCC density reported appears to be in error; when the volume referenced is consulted, the density is 666.6 g/m3 or 0.67 kg/m3 (http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/ch1ref8.pdf, page 1.124) and not 0.67 x 10-6 kg/m3. The calculation was checked and the final value of 0.87 t CH4/kt of coal production is correct even though the density value for methane is incorrect in the text. The value in the text is the correct value for methane density if the units are Gg/m3 (http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_4_Ch4_Fugitive_Emissions.pdf)

a) Confirm the basis of the calculation addressing the commentary provided above.

Response:

There is a typographical error in the units of density in the text. The density should have been 0.67 x 10-6 Gg/m^3, which is equivalent to 0.67 kg/m^3.

77. Volume 4, CR1a, Appendix A, Section A5.1, Page A-22

Benga has conducted the air assessment based on Final Tier 4 emission standards for all mine fleet equipment.

a) Explain how Benga will ensure the mine fleet equipment used for this project will meet federal Off-Road Compression-Ignition Engine Emission Regulations Tier 4 requirements, especially ones with large engines, if Tier 4 compliant equipment is not commercially available when construction commences.

Response:

Table SIR 77-1, taken from an Environment Canada website (last updated August 2017), provides dates by which all vehicles imported into Canada must meet the new emission standards (Tier 4 for heavy duty off road vehicles). Benga has committed to using new vehicles on the Grassy Mountain mine, and this table indicates that only engines with the new (Tier 4) standards may be imported as of the end of 2017. Smaller vehicles with Tier 3 engines could be legally imported to the end of 2018.

Benga will continue to monitor the availability of its preferred equipment and will decide to purchase in due course. In any event, it is expected that Tier 4 standards will be met.

Table SIR 77-1 General Availability Transition Engine Time Frames[3]

Power (kW)	Emission standard	End of general availability provisions[1]
kW < 19	Tier 2	December 31, 2014
19 ≤ kW < 37	Tier 2	December 31, 2014
37 ≤ kW < 56	Tier 2	December 31, 2014
56 ≤ kW < 75	Tier 3	December 31, 2018
75 ≤ kW < 130	Tier 3	December 31, 2018

Table SIR 77-1 General Availability Transition Engine Time Frames[3]		
Power (kW)	**Emission standard**	**End of general availability provisions[1]**
$130 \leq kW \leq 560$	Tier 3	December 31, 2017
kW > 560[2]	Tier 2	December 31, 2017

1 There are also "delayed" availability provisions where engines may meet Interim Tier 4 standards (follow links in information source).

2 For this power category, engines may continue to meet Tier 1 emission standards until December 31, 2012.

3 information source: https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/import-manufacture-off-road-diesel-engines.html

78. Volume 4, CR1a, Appendix A, Section A5.1, Table A5-1, Page A-23

Benga provides the exhaust emission factors used in the air assessment in Table A5-1, where engines with a rating greater than 560 kW have a NOx emission factor of 2.39 g/hp-h. The federal Off-Road Compression-Ignition Engine Emission Regulations specifies a Tier 4 NOx emission standard of 3.5 g/kW-h (approximately 2.61 g/hp-h) for engines with a power rating greater than 560 kW.

a) Provide justification to the conservativeness of using lower emission factor in the air assessment.

Response:

The federal Off-Road Compression-Ignition Engine Emission Regulations established, under the authority of the *Canadian Environmental Protection Act* (1999), Canadian vehicle emission standards and test procedures. These standards and procedures are aligned with those of the United States Environmental Protection Agency (US EPA) *Code of Federal Regulations for off-road diesel engines*.

To assist in the creation of accurate nonroad emission inventories, the US EPA has developed a nonroad emissions model, which includes more than 80 basic and 260 specific types of nonroad equipment, and further stratifies equipment types by horsepower rating. The NONROAD2008a model reflects all of US EPA's final nonroad engine emission standards to date and is recommended by US EPA to be used in analyses to meet any regulatory requirements that call for the development of new nonroad inventories. Data files for NONROAD2008a model can be downloaded at: https://www.epa.gov/moves/nonroad-model-nonroad-engines-equipment-and-vehicles#2008a

The diesel combustion emission factors for NOx used in this assessment were taken from the US EPA NONROAD2008 Engine Model results, in which NOx emission factor for engines with a rating greater than 560 kW was 2.39 g/hp-h.

A.3. WATER

A.3.1. WATER MANAGEMENT

79. Volume 1, Section C.5.1.1 – Water Volume Required, Page C-2 (of October 2017 Errata document)

Volume 1, Section C.6.12 – Potable Water, Page C-116

Benga states, "a water well will be drilled in the vicinity of the office to supply water." Details on the licensing of this well and the potential means for treating the water to ensure that potable water standards are met are not discussed.

a) Provide clarification that this well is to supply potable water.

Response:

Yes, this well would be intended to supply potable water.

b) If the well is for potable water, provide additional details on how water will be treated to reach acceptable potable water standards.

Response:

Water treatment details will be developed with the detail engineering and after further investigation of water source and quality. The water treatment facility will comply with *Alberta Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems*.

80. Addendum 2, Appendix 1D, Section 4, Page 15-25

Benga summarizes basic design parameters of the sediment control ponds in this section but does not include details of the engineering design approach used.

a) Provide the design storm duration, the rainfall intensity distribution, and the rainfall-runoff method used to design each sedimentation pond.

Response:

Benga conducted a hydrological analysis to evaluate the Inflow Design Flood (IDF) and required storage volumes for each storage pond at Grassy Mountain. Components of the water management system of the Project include diversion channels, collection ditches, surge ponds and sedimentation ponds. The Sedimentation Ponds, including the West Sedimentation Pond, the East Sedimentation Pond and the NE Sedimentation Pond have been designed to release water directly to the environment after removing suspended sediment.

Sedimentation ponds were sized to reduce total suspended sediment (TSS). Reduction of TSS is accomplished by gravity settlement with or without the aid of flocculent. Benga has based the dam volume analysis to accommodate a flow equal to the 10-year 24-hour storm event runoff. It was determined that the summer flow conditions is the most critical condition in terms of the magnitude of peak flows and maximum total volume.

Based on this the IDF for each dam was calculated based on the dam catchment area as measured from LIDAR mapping (Table SIR 80-1).

Table SIR 80-1 Inflow Design Flood for Project Sedimentation Ponds

Sediment Pond	Overall Classification	Inflow Design Flood Criteria as per CDA	IDF (m^3/s)	Volume Design Criteria	Min, Design Volume (m^3)	Available Volume (m^3)*
West	Significant	500-yr	3.2	10-yr	54,700	137,346
East	Very High	2/3 between 1,000-yr and PMF	11	10-yr	14,400	169,108
Northeast	Very High	2/3 between 1,000-yr and PMF	35.5	10-yr	46,300	164,673

*Available volume based on footprint

b) Provide the engineering design used to determine the minimum pond volume and surface area required to control sediment for each sediment control pond.

Response:

See response SIR 80a.

A.3.2. HYDROGEOLOGY

81. Volume 1, Section E.3.5.1, Page E-64

Volume 1, Section E.3.5.2.2 Page E-66

Benga states, “Pit dewatering is necessary for the mine operations, therefore drawdown of groundwater in the bedrock units will occur during the Project, but effects to bedrock aquifers are predicted to be localized so that no mitigation measures are required. No impacts are predicted at the water wells, therefore no mitigation is proposed,” as a discussion of the mitigation measures. In describing its approach to the Groundwater Monitoring Program, Benga includes hydraulic heads measured below the threshold near the pit as a condition to initiate a groundwater response plan, which includes the following mitigation measure in respect to the privately owned water wells. “In the unlikely event of a decrease in hydraulic head in privately owned water wells that impedes use of this water supply, mitigation could include either drilling a new well, or connecting the affected user(s) to the municipal water network.” Benga states, that “pit dewatering is conducted by directing all water to containment sumps established within the active benches of the pit and using pumps to transfer the water to a settling pond for treatment and release.”

a) Clarify how Benga will investigate the potential for impact to the privately owned water wells if the drawdowns in the bedrock units associated with the project activities exceed the modelled predictions within the LSA.

Response:

A water well, field verified, survey was conducted by Benga to collect baseline data on the privately-owned water wells closest to the pit and potential dewatering impact. Within the LSA, a total of 47 water wells and one spring were identified. Of the 48 records, 6 water wells and 2 springs were surveyed. Water wells were sampled for routine parameters and the results were provided to the respective landowners.

Data collected during the field verified survey may be used to investigate the potential for impact to the privately owned water wells during operation, if the drawdowns in the bedrock units associated with the project activities exceed the modelled predictions within the LSA.

Benga will install monitoring wells as part of the groundwater monitoring program, as presented in Section E.3.5.2.1. Some of the monitoring wells will be specifically used to evaluate water level changes associated with pit dewatering. Water level data collected at these monitoring wells will be compared to thresholds based on the modelled predictions. Should the monitoring detect drawdown in the bedrock units that exceed the defined threshold(s), the change(s) would be verified prior to initiating the response plan, as described in Sections E.3.5.2.1 and E.3.5.2.2. Investigation methods deemed appropriate at the time, such as, but not limited to:

- drilling additional monitoring wells further downgradient of the pit and closer to the water wells to assess how far the pit dewatering effects are measurable; and
- offering a follow up water survey to the landowners who previously responded in October 2014, to compare water levels and ensure drawdowns observed near the pit exceeding modelling predictions are not negatively impacting the landowners.

b) Discuss what water treatment techniques will be employed should groundwater associated with pit dewatering not meet discharge quality requirements.

Response:

Groundwater associated with pit dewatering is not expected to require any quality treatment (selenium attenuation), as stated in Section 5.1 of CR#3. Groundwater associated with pit dewatering will, however, be collected into a sedimentation pond prior to being released to the environment. Water stored within the sedimentation ponds will be monitored and treated within the water management plan (Section C.5.), as needed, and will only be discharged when water quality meets the guidelines.

82. Volume 3, Appendix 10C, Section 3.2, page 10 Volume 4, Section 5.4.2.1, Page 48 Volume 4, Section 5.1, Page 35

Benga states, "The water quality model conservatively estimated that a combined load capture and attenuation rate that results in an overall reduction of loadings by 95% is required to minimize the potential for downstream water quality effects. The details of the measures to achieve this target will be refined through engineering design and investigations," and further, on Page 1061, Benga states, "capture of seepage is expected to be necessary for many years after the end of operation."

In Volume IV, on page 561, Benga states, "Based on historic precedent and sampling from the site, the potential effects of mining in respect to groundwater quality are expected to dissipate with time and are hardly measureable in the environment approximately 50 years after the last mining activities."

Finally, in its description of the project reclamation, Benga states, that "the final 32 ha (will be) reclaimed at completion of the water treatment and selenium management program." (Volume IV, page 549).

a) Provide a conceptual design of the seepage capture system and its minimal operational goals.

    i. Identify access of feasibility of the system and costs to operate it to achieve the load reduction and for the time period that is sufficient to achieve goals outlined above; and

Response:

A conceptual design of seepage capture systems for the Grassy Project was developed during the preparation of the Environment Impact Assessment. Appendix A-3 provides details of the conceptual design considerations.

i. Cost estimates for the seepage interception systems are included in Appendix A-3.

    ii. Discuss how it will be determined that the water treatment and selenium management program is completed and the final 32 ha can be reclaimed.

Response:

The ongoing groundwater and surface water monitoring programs will produce the water quality and flow data required to determine the performance of the water treatment and selenium management measures.

b) Discuss if the hydrogeological characterization of the site to date provided data that may indicate that the proposed seepage interception system design may be inefficient and discuss if the alternative engineering solutions are available to protect downstream water quality

Response:

The hydrogeological characterization has to date, not revealed data that suggests that the proposed mitigation methods are not feasible. In any event, upon the mines approval, a detailed site investigation, including a hydrogeological drilling and monitoring program will be completed in conjunction with detailed design of the seepage interceptions systems. The final design of the system will accommodate the characterization of the groundwater flow regime established during the detailed investigations.

A.3.3. HYDROLOGY

83. Volume 4, Consultants Report 4, Section 3.5, Page 21

Benga briefly describes a procedure for estimating a 72-year daily flow time series for local gauging stations BL-01, BL-03, CR-01, and GC-01 based on observed relationships between flows at these gauging stations and the Crowsnest River at Frank Water Survey of Canada hydrometric station.

a) Provide:

i. The derived relationships between flows at local gauging stations BL-01, BL-03, CR-01, and GC-01; and,

Response:

The derived relationships between flows at the listed gauging stations are detailed in spreadsheet ***FlowRelations_v2_FS_VM.xlsx*** (Appendix A-4). The spreadsheet also presents the methodology and information used in the baseline hydrology report. The information was divided in 5 tabs:

1) Gauge Flows: the actual flows from the local gauges BL-01, BL-02, BL-03, CR-01 and GC-1. These flows were estimated based on the available rating curves at that time. This table includes records from 9/19/2013 to 11/30/2014.

2) Gauge Unit Flow: This tab divides the local gauges by the unit area and calculate the average flow per month and then relates the monthly average flows from regional station 05AA008 to the local gauge stations.

   During preparation of this supplemental information requests, a minor error (typo) was discovered in the spreadsheet concerning the relationship between GC-01 and 05AA008. Correction of the error did not affect the direction or magnitude of the relationships. Figure 83-1 shows in red line the regression used in the baseline hydrology report and in blue the corrected relationship. The use of one of other line is within the uncertainty and limited information for the local gauge GC-01. For consistency, it is recommended that the relationship documented in the baseline hydrology report remain as-is as the correction to the spreadsheet is so minor, it does not warrant issuing a revised report.

3) Patching Synthesis: This tab includes the regional information used and the patching process logic.
4) Daily Patched Flow: A compilation of the daily patched flow for the regional station is included. The information is in m3/s.
5) Local Gauge: The information from Tab 2) with the relationships between local gauges and the regional gauge station 05AA008 is used. The overall results include the daily flows for every local gauge for 72 yrs.

ii. The local gauging station data used to derive these relationships.

Response:

See response SIR 83a.

b) Demonstrate how the local gauging station data was used to generate these relationships.

Response:

See response SIR 83a.

c) Provide the generated 72-year daily flow time series for local gauging stations BL-01, BL-03, CR-01, and GC-01.

Response:

See response SIR 83a.

84. Volume 4, Consultants Report 4, Section 3.5, Pages 20-22

Volume 4, Consultants Report 4, Section 3.6, Table 12, Page 23

Volume 4, Consultants Report 4, Section 5.2, Pages 28-30

Volume 3, Appendix 10B, Water and Load Balance Model Report, Section 8.2, Pages 48-56

Addendum 1, Appendix A3, Section 4.1.2.3, Page 37

Addendum 1, Appendix A3, Section 4, Pages 26-94

Benga estimates the project site Mean Annual Runoff depth (MAR) to be 323 mm based on the project site longitude and a regional analysis relationship between runoff and longitude. This value is then used to estimate the undisturbed runoff coefficient to be 0.51 (equal to 323 mm divided by 628 mm mean annual precipitation). In the Instream Flow Assessment Report the mean annual discharge in Blairmore Creek 2 km upstream of the confluence with Crowsnest River is estimated to be 0.235 m3/s, where Blairmore Creek drains 48.1 km2. This translates to a Mean Annual Runoff depth of 154 mm. Field data (observed hydrographs, site photographs, etc.) strongly suggest that a disproportionate amount of surface runoff in Gold Creek comes from tributaries not related to the project site (most notably Caudron Creek). The estimated hydrology of Blairmore Creek is therefore likely to be a more accurate representation of the current hydrologic state of the project site than Gold Creek or the regional analysis based on longitude.

Also, the base flow values presented in Table 12 and Table 17 are not consistent with each other. For example, the values in Table 12 imply an average annual base flow rate of 168 L/s in Gold Creek at the mouth while Table 17 presents a value of 543 L/s at the same location. It is not clear from the report which of these approaches was used in the subsequent analysis of changes in stream flows due to the project.

The Load Balance model yield estimates were based on an undisturbed and reclaimed yield (runoff) coefficient that was derived from the longitude based local mean annual runoff value of 323 mm.

This hydrology analysis was also used in the Instream Flow Assessment Report.

a) Describe how the two base flow estimation methods summarized in Tables 12 and 17 were used to evaluate changes to Blairmore Creek and Gold Creek base flows and stream flows.

Response:

The hydrology assessment estimated an average watershed yield of 323 mm. The yield includes surface runoff and shallow groundwater that flows from the site. The flow estimates used in the Instream Flow Assessment report is not total yield but channel flow, which corresponds to the total amount of water that can be measured flowing in the creeks.

b) Reassess the streamflow changes in Section 5.2 of Consultants Report 4 using a runoff coefficient for undisturbed and reclaimed areas based on the mean annual discharge of Blairmore Creek.

i. Update Table 19 and Figures 41, and 43 to 48 accordingly.

Response:

On review of the Hydrology Consultant Report (CR#4), Table 12, during the development of this supplemental information request, it was noted to have an error. The numbers associated to the watershed areas were overwritten by mistake. The corrected table is as presented in the Groundwater Numerical Model (Consultant Report #3, Appendix C, Table 2-3), and presented here for reference as Table SIR 84-1. These values are compatible with Table 17 from the Baseline Hydrology report (CR#4).

Table SIR 84-1 Monthly Unit Base Flow Estimates (from Hydrogeology CR#3, Appendix C, Table 2-3).

Location	Base Flow [l/s/km²]											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Blairmore Creek at BL-02 gauging station	2.0	1.8	1.9	2.9	10.9	18.5	7.8	4.5	3.8	3.5	3.2	2.5
Gold Creek at GC-01 gauging station	5.5	5.4	5.5	6.4	14.3	21.7	11.3	8.0	7.3	7.1	6.8	6.0
Crowsnest River at CR-01 (Frank)	2.8	2.7	2.7	3.3	6.9	13.2	9.1	6.2	5.1	4.3	3.4	3.0

The values in CR#4, Table 12 were not used in the analysis as the error was only made in the table included in the report. The analysis was therefore based on correct values. The baseflow table used in the report is presented for reference below as Table SIR 84-2 and discussed in detail in the Groundwater Numerical Model (Consultant Report #3, Appendix C, Table D-1)which is also explain in CR#4, Table 17.

Table SIR 84-1 Average Monthly Base Flow [m³/s] (from CR#3, Appendix C, Table D-1)

Station	Total Area [km²]	Average Monthly Base Flow [m³/s]											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
BL-02	24.23	0.0483	0.0446	0.0467	0.0706	0.2649	0.4493	0.1902	0.1094	0.0917	0.0858	0.0784	0.0597
BL-03	15.35	0.0345	0.0319	0.0334	0.0504	0.1892	0.3209	0.1358	0.0781	0.0655	0.0613	0.0560	0.0426
BC-01	49.80	0.0628	0.0581	0.0608	0.0919	0.3446	0.5846	0.2474	0.1423	0.1194	0.1117	0.1020	0.0777
BC-02	47.80	0.0630	0.0583	0.0610	0.0922	0.3458	0.5866	0.2483	0.1428	0.1198	0.1121	0.1024	0.0779
BC-03	40.53	0.0618	0.0572	0.0598	0.0905	0.3394	0.5758	0.2437	0.1402	0.1176	0.1100	0.1005	0.0765
BC-04	35.42	0.0592	0.0548	0.0573	0.0867	0.3250	0.5513	0.2334	0.1342	0.1126	0.1053	0.0962	0.0733
BC-05	32.65	0.0572	0.0529	0.0553	0.0837	0.3138	0.5323	0.2253	0.1296	0.1087	0.1017	0.0929	0.0707
BC-06	24.03	0.0480	0.0444	0.0464	0.0702	0.2634	0.4468	0.1891	0.1088	0.0912	0.0854	0.0780	0.0594
BC-07	20.57	0.0431	0.0399	0.0417	0.0631	0.2367	0.4015	0.1699	0.0978	0.0820	0.0767	0.0701	0.0533
BC-08	20.56	0.0431	0.0399	0.0417	0.0631	0.2366	0.4013	0.1699	0.0977	0.0819	0.0767	0.0700	0.0533
BC-09	20.39	0.0428	0.0396	0.0415	0.0627	0.2352	0.3989	0.1688	0.0971	0.0815	0.0762	0.0696	0.0530
BC-10	19.42	0.0413	0.0383	0.0400	0.0605	0.2269	0.3850	0.1629	0.0937	0.0786	0.0735	0.0672	0.0512
BC-11	18.85	0.0404	0.0374	0.0391	0.0592	0.2220	0.3766	0.1594	0.0917	0.0769	0.0719	0.0657	0.0500
BC-12	15.61	0.0349	0.0323	0.0338	0.0511	0.1917	0.3252	0.1377	0.0792	0.0664	0.0621	0.0568	0.0432
BC-13	15.30	0.0344	0.0318	0.0333	0.0503	0.1886	0.3200	0.1354	0.0779	0.0653	0.0611	0.0558	0.0425
BC-14	14.08	0.0321	0.0297	0.0311	0.0470	0.1763	0.2990	0.1266	0.0728	0.0611	0.0571	0.0522	0.0397
BCT02-01	4.96	0.0126	0.0117	0.0122	0.0185	0.0692	0.1175	0.0497	0.0286	0.0240	0.0224	0.0205	0.0156
BCT04-01	8.24	0.0202	0.0187	0.0195	0.0295	0.1108	0.1879	0.0795	0.0457	0.0384	0.0359	0.0328	0.0250
BCT05-01	0.81	0.0021	0.0020	0.0021	0.0031	0.0118	0.0200	0.0084	0.0049	0.0041	0.0038	0.0035	0.0027
BCT06-01	0.89	0.0024	0.0022	0.0023	0.0035	0.0130	0.0220	0.0093	0.0054	0.0045	0.0042	0.0038	0.0029
BCT07-01	3.23	0.0084	0.0078	0.0081	0.0123	0.0460	0.0780	0.0330	0.0190	0.0159	0.0149	0.0136	0.0104
BCT08-01	1.01	0.0027	0.0025	0.0026	0.0039	0.0147	0.0249	0.0105	0.0061	0.0051	0.0048	0.0043	0.0033
GC-01	63.09	0.3500	0.3408	0.3460	0.4069	0.9014	1.3709	0.7112	0.5056	0.4607	0.4456	0.4267	0.3791
GC-02	36.09	0.2002	0.1949	0.1979	0.2327	0.5156	0.7841	0.4068	0.2892	0.2635	0.2549	0.2441	0.2168
GC-03	32.93	0.1827	0.1779	0.1806	0.2124	0.4705	0.7156	0.3713	0.2639	0.2405	0.2326	0.2227	0.1979
GC-04	32.42	0.1798	0.1751	0.1778	0.2091	0.4632	0.7045	0.3655	0.2598	0.2367	0.2290	0.2193	0.1948
GC-05	30.84	0.1711	0.1666	0.1692	0.1989	0.4407	0.6702	0.3477	0.2472	0.2252	0.2179	0.2086	0.1853
GC-06	29.29	0.1625	0.1582	0.1606	0.1889	0.4185	0.6365	0.3302	0.2347	0.2139	0.2069	0.1981	0.1760
GC-07	17.32	0.0961	0.0936	0.0950	0.1117	0.2475	0.3764	0.1953	0.1388	0.1265	0.1224	0.1172	0.1041
GC-08	16.48	0.0914	0.0890	0.0904	0.1063	0.2354	0.3581	0.1858	0.1321	0.1203	0.1164	0.1115	0.0990
GC-09	15.12	0.0839	0.0817	0.0829	0.0975	0.2160	0.3286	0.1705	0.1212	0.1104	0.1068	0.1023	0.0909
GC-10	14.20	0.0788	0.0767	0.0779	0.0916	0.2029	0.3086	0.1601	0.1138	0.1037	0.1003	0.0961	0.0853
GC-11	13.69	0.0759	0.0739	0.0751	0.0883	0.1955	0.2974	0.1543	0.1097	0.0999	0.0967	0.0926	0.0822
GC-12	12.52	0.0694	0.0676	0.0687	0.0807	0.1789	0.2720	0.1411	0.1003	0.0914	0.0884	0.0847	0.0752
GC-13	3.92	0.0217	0.0211	0.0215	0.0253	0.0559	0.0851	0.0441	0.0314	0.0286	0.0277	0.0265	0.0235
GC-14	2.45	0.0136	0.0132	0.0134	0.0158	0.0350	0.0532	0.0276	0.0196	0.0179	0.0173	0.0166	0.0147
GCT06-01	2.79	0.0155	0.0151	0.0153	0.0180	0.0398	0.0606	0.0314	0.0223	0.0204	0.0197	0.0189	0.0167
GCT08-01	0.75	0.0041	0.0040	0.0041	0.0048	0.0107	0.0162	0.0084	0.0060	0.0055	0.0053	0.0051	0.0045
GCT09-01	0.75	0.0041	0.0040	0.0041	0.0048	0.0107	0.0162	0.0084	0.0060	0.0055	0.0053	0.0051	0.0045
GCT10-01	0.85	0.0047	0.0046	0.0047	0.0055	0.0121	0.0184	0.0096	0.0068	0.0062	0.0060	0.0057	0.0051
GCT011-01	1.10	0.0061	0.0059	0.0060	0.0071	0.0157	0.0238	0.0124	0.0088	0.0080	0.0077	0.0074	0.0066
GCT014-01	1.45	0.0081	0.0079	0.0080	0.0094	0.0208	0.0316	0.0164	0.0117	0.0106	0.0103	0.0098	0.0087

ii. Provide in table form all the monthly flows used to generate Figures 41, and 43 to 48 including the following flow components at each location:

A) Stream base flow

B) Stream surface runoff (i.e., non-base flow stream flow)

C) Project release rate

D) Change in base flow due to project

E) Change in surface runoff due to project

Response:

See response SIR 84b.

c) Reassess the project impacts on fish habitat in Gold Creek and Blairmore Creek based on the updated project impacts on stream flows.

Response:

As discussed in SIR 84a and b, the approaches used and differences in flow estimates in the Baseline Hydrology and Instream Flow Assessment Report are compatible and consistent with the stated definitions in each case. Baseline Hydrology is accounting the complete watershed yield, which was used as input to the water balance. The yield estimate included surface water and shallow groundwater component. The Instream Flow Assessment considered only channel flow, which is relevant for assessment of fish habitat compensation. Accordingly, a reassessment of project affects on fish habitat is not warranted.

d) Provide the Gold Creek and Blairmore Creek flows and release volumes used in the Load Balance Model to calculate instream concentrations of water quality parameters.

Response:

Not applicable; see response SIR 84c.

e) Present the results of sensitivity tests of the Load Balance Model in the same manner presented in Section 8.2 of the Load Balance Model report for a range of potential runoff coefficients for undisturbed and reclaimed areas, specifically:

i. The 0.51 value used in the report

Response:

Not applicable; see response SIR 84c.

ii. A value based on the runoff coefficient derived from runoff and precipitation data in the Blairmore Creek watershed (that is, the value derived above).

Response:

Not applicable; see response SIR 84c.

A.3.4. SURFACE WATER QUALITY

85. Volume 1, Section C.5.3.3 – Capture and Release (Sedimentation Ponds), Page C-92

Volume 1, Section C.5.4 – Water Balance and Management, Page C-95

Benga states, "the source of the water directed to the sedimentation ponds will be from surface runoff and groundwater interception from the pit and will not be exposed to selenium enrichment, so they do not require selenium management efforts." Benga also indicates that "if the quality does not meet the release criteria it can be directed towards the saturated backfill zones as needed."

Regarding overburden, Benga states, that "the results of the long term kinetic testing reveal that selenium leaching can be expected from the overburden rock found at Grassy Mountain. Anassumption has been made that the selenium can be expected to materialize approximately one year after rock placement."

It is unclear if consideration was made for the potential for groundwater to contain selenium at a level that would require treatment or not. Understanding what approaches would be taken should selenium be detected would assist in understanding potential impacts. Further understanding of the configuration proposed to ensure that selenium is not release to the environment would also be beneficial in understanding potential downstream impacts.

a) Confirm that selenium enrichment is only anticipated from water exposed to waste rock.

Response:

Yes, selenium enrichment is only anticipated for water in contact with waste rock, and to a much lesser extent water in contact with pit high-walls.

b) Discuss contingency plans should selenium enrichment be found in groundwater interception from the pit.

Response:

As per the response to SIR85a, it is highly unlikely that groundwater intercepted in the mine and routed to a sedimentation pond would be subject to selenium enrichment. Should this occur, an investigation would be made to identify the source of the selenium and to the extent possible isolate that water from non-affected water. Selenium enriched ground water would be directed to the saturated backfill zones for selenium attenuation.

c) Confirm that the sedimentation pond configuration is such that all sedimentation ponds (and other water collection points) could have their flow directed to the saturated backfill zones discussed.

Response:

Yes, all sedimentation ponds can, if deemed necessary, have their flow directed to the saturated backfill zones *via* pumping. This is only intended to be a contingency mitigation option, and is not expected to be required on a regular basis.

d) Confirm that the overburden rock will be placed in such a fashion (designated dump areas) so that any selenium would be treated in the saturated backfill zones.

Response:

Yes, as per the Project's Water Management Plan (and selenium management plan), any material with a potential for leaching selenium will be placed within designated waste rock areas so that contact water can be appropriately captured, collected, and treated.

86. Volume 1, Section A.6.4

As part of Benga's mitigations for addressing elevated selenium concentrations as a result of leaching through waste rock, a number of strategies are listed. This includes consideration of a water quality treatment plant which is not planned at this time although it was considered technically and economically feasible (Section A.7.6.3, pdf page 77). Instead, Benga is proposing the use of a semi- passive treatment using saturated backfills with a carbon source (methanol) injected to enhance anoxic conditions needed to reduce selenium as well as remove excess nitrate and nitrite (Volume 3, Appendix 10C). Volume 3, Appendix 10C, Section 3.3.2 (pdf page 2174) provides an overview of case studies where pit lakes and backfilled pits resulted in the reduction of selenium or creation of anoxic reducing conditions. However the case studies presented are not strictly analogous to the system proposed for this project. While conceptually this system will work to remove selenium and nitrate/nitrite, it remains unproven and therefore carries associated risks should it not function as intended. Additional mitigation measures may need to be implemented to remove excess selenium should target selenium concentrations not be achieved.

a) Discuss, with appropriate justification, whether the construction and operation of an active treatment plant to remove excess selenium would be feasible for this project should the conceptual saturated zone treatment system fail to achieve adequate treatment targets (selenium removal) for seepage water.

Response:

Benga is confident that the active management of saturated backfill zones, as the primary active treatment process, will ensure water quality guidelines for selenium are met. For this reason, a water treatment plant for attenuating selenium is not proposed as part of the Project.

The construction and operation of a water treatment plant, as an additional mitigation measure for the management of selenium, would be technically feasible.

For the Project, a treatment plant capacity required to treat a volume of 4.5 Mm^3 would depend on the operating season and discharge strategy. Assuming that a water treatment plant can operate at nominal treatment capacity for an equivalent of 8 months per year, the required treatment capacities range between 11,000 m^3/day and 20,000 m^3/day. The largest operating selenium treatment plant in Canada is Teck's West Line Creek Active Water Treatment Facility located at the Line Creek Operations in the Elk Valley in British Columbia. The design capacity of that plant is reported to be 7,500 m^3/day. The initial implementation plan for the Elk Valley Water Quality Plan calls for construction of two additional plants in the Elk Valley, one at Fording River with a capacity of 20,000 m^3/day and one at the Elkview Operations with a projected capacity of 30,000 m^3/day (see: https://www.teck.com/media/2015-Water-elk_valley_water_quality_plan_T3.2.3.2.pdf page XV). The capacity of an active water treatment plant for the Grassy Project would therefore be in the range of plants already operating or proposed for other coal mines in the region.

b) Provide a detailed timeline on what would trigger the decision to build an active treatment plant for selenium removal, how long planning and construction would take, and when an operational plant would be functioning.

Response:

Benga has proposed a very conservative selenium attenuation system that consists of a saturated backfill zone in the mine pit based on well understood biological and chemical processes. The applications of the same technology for selenium attenuation in water treatment plants and gravel bed reactors provide the desired attenuation in less than one day. Benga's barrel testing, using site materials, provided satisfactory results in several days. In order to ensure adequate residence time for the saturated backfill zones, Benga has allowed for residence times of up to one year or more than 50 times the theoretically achievable residence time.

Implicit in the design proposed by Benga is the capture of substantially all water that is in contact with waste rock and therefore subject to selenium enrichment. This factor alone is a major advantage in the treatment of selenium over older mines where the capture of selenium enriched water was not built into the original mine plan.

The saturated zones will be engineered and actively managed to understand and control the attenuation process and achieve the desired results. Provision will be made for injection of carbon, most likely methanol, to create and control the necessary anoxic conditions that drive attenuation. Multiple sample points will be monitored to measure oxygen content, selenium and nitrate concentrations and possibly the background biological activity. Multiple dewatering points and dewatering elevations will be possible to optimize flow through the zone.

Should the performance of the saturated zone not provide the anticipated results in terms of effluent selenium concentrations, the first action to be taken would be to use the information derived from the extensive data available to better understand the root cause of the failure. Adjustments to retention time, water recirculation, carbon additions, withdrawal points and other variables would be made to resolve the issue and achieve the necessary selenium concentrations.

In terms of other contingency plans, there are a number of options that would be considered including:

- additional measures to minimize the quantity of water that comes in contact with waste rock through redesign and partial covering of the waste rock dumps;
- addition of secondary gravel bed treatment systems similar to those that have been installed in other coal mines;
- installation of secondary RO or nano-filtration systems for a portion of the effluent stream; and
- installation of a separate water treatment plant for selenium as per part a) of this response.

It the conclusion after analysis is to install a water treatment plant to remove selenium, it is likely that design, procurement, construction and commissioning, would take 3 years.

c) Provide details on how water with selenium concentrations not meeting targets would be handled while waiting for an active treatment plant to be constructed and become operational.

Response:

If through monitoring of the selenium management backfill zones, results indicate that a selenium guideline target is not being met, an analysis of the system would be conducted to determine the cause. Adjustments to methanol injection, retention time, and other variables would be made to bring the performance into conformity. If a substandard result persists, it is likely that the deviation from acceptable results would happen gradually over a period to time during which recirculation of water that does not meet guidelines can be effective. Finally, secondary treatment using gravel bed systems would be relatively simple and quick to install as an interim measure while a full treatment plant was being constructed.

d) If an active treatment plant for the removal of selenium is not being considered as a mitigation measure, provide details on other selenium management strategies that would be implemented if the saturated fill zones prove to be less effective than predicted and do not meet treatment targets.

Response:

See response SIR 86c.

e) Discuss the consequences to aquatic biota, specifically periphton, benthic invertebrates and fish, if the operation of the saturated treatment zones does not achieve the predicted water quality parameters of mine affected water before being discharged to the natural environment.

Response:

Benga recognize the importance of managing selenium (as well as other constituents) for the Project. The intent of the Project's Water Management Plan, and as it specifically relates to the management of selenium, is to ensure that selenium enriched water is captured, collected and treated appropriately. As part of the planning and development of the Water Management Plan, and as part of the Water Quality assessment, Benga assessed the potential effects of selenium on the receiving environment. The Water Quality assessment (Consultant Report #4) Appendix 1a provides an evaluation of selenium uptake in waters by primary producers associated with the Grassy Mountain Coal Project. The report provides an evaluation of the estimated site-specific uptake rate of selenium on two algae and a vascular plant under conditions that are anticipated to occur at the site. The results of this assessment were used to assess the selenium tolerances of periphyton in the downstream receiving environment, and to support in the development of a site-specific selenium threshold.

As stated in response SIR 86c, if selenium guideline targets are not being met, an analysis of the system would be conducted to determine the cause. As selenium is not deemed to have an effect on primary producers, lower trophic level species, or fish at an acute level (risk being more a chronic exposure), Benga would implement one or all of the additional mitigations measures for selenium management to ensure selenium targets are met in the short-term.

f) Provide additional details on the water treatment plant, including:

i. Provide details on what operational water quality results would result in the addition of a water treatment plant.

Response:

A number of factors would be considered when evaluating whether an active water treatment plant is warranted, including the frequency and reasons for any performance failures. All known and proven processes for removing selenium and nitrate from water would be considered though this process.

ii. What processes would be employed in a water treatment plant, if one is provided.

Response:

See response 86 f(i).

g) Discuss how operations will be conducted to ensure that the water is maintained in anoxic conditions.

Response:

Maintaining anoxic conditions in the actively managed/engineered saturated backfill zones will simply be a matter of adding enough electro donor (*i.e.* organic carbon source such as methanol) to the influent water. Dissolved oxygen is relatively quickly consumed in the presence of degradable carbon and other required nutrients. Anaerobic conditions develop relatively quickly even in open water where atmospheric oxygen can freely diffuse into solution, as exemplified by eutrophication of lakes that receive excess nutrients. The backfilled waste rock capping the saturated backfill zones serve as an additional barrier for transfer of oxygen to the water contained in the saturated zone. The headspace within waste rock dumps are often depleted in oxygen due to mineral weathering alone. The active addition of a carbon source can increase the oxygen depletion rates by orders of magnitude

87. Volume 1, Section A.11.5.1

Benga states, that surface runoff "from mining areas, haul roads, overburden disposal areas and any other disturbed areas as well as groundwater runoff from the pit will be collected and directed to settling ponds for treatment" and that once the total suspended solids (TSS) have settled, water would be released to either Blairmore or Gold Creek. Section A.11.5.1 (pdf page 135) states that any parameters not meeting discharge limits would be held within the pond for further treatment with additional settling time or flocculant dosing. This addresses TSS only and not necessarily other dissolved parameters which may be elevated and not suitable for treatment by enhanced holding time or flocculant dosing. If water treated through the saturated zones is passed through the sedimentation ponds, this increases the risk of presence of parameters not amendable to treatment through holding time and flocculation. In addition, the presence of shallow fractured bedrock under the site and use of unlined sedimentation ponds increases the risk of surface/groundwater interactions in the sedimentation ponds especially when extending holding times.

a) Provide details on additional mitigation measures to be implemented should there be exceedances of discharge limits within the sedimentation ponds for parameters not amenable to treatment via increased holding time or application of flocculants prior to discharging these mine affected waters to the receiving environment.

Response:

The operation of the sedimentation ponds, including compliance monitoring, would follow standard industry water quality practices, and as indicated in approval Terms and Conditions. During the early phase of mine development, the ponds would only receive runoff from surface disturbance related to early construction and overburden stripping. During this phase, the influent to the ponds will resemble runoff from any other construction site, at which TSS is the primary parameter of concern. Over time, as the mine development expands concentrations of constituents may increase. Such concentration increases generally occur gradually over the months or years. This is particularly true for ponds that collect groundwater seepage. The monitoring and reliance on water quality trends are standard procedures for operating sedimentation ponds. If monitoring results show that the pond discharge approaches or have exceeded effluent quality limits, the water would be pumped to one of the open pits or saturated zones and would be managed as contact water. Typically, increasing trends in parameter concentrations for settling ponds allow ample time to install and commission permanent pump-back systems.

b) Confirm whether there is sufficient capacity within the sedimentation ponds to withhold water until such time that confirmatory water quality results are available from the lab to ensure water not meeting limits is not released to the receiving environment.

Response:

As described in SIR 87a, the intention is not to continuously hold water in sedimentation ponds until lab results that demonstrate compliance are in. Rather, discharge decisions will be made on real-time field measurements such as turbidity and water quality trends over time based on continuous water quality monitoring.

c) Provide an analysis on the risk to aquatic biota should water within the ponds, which does not meet regulatory discharge limits, need to be released during an unforeseen event.

Response:

A failure to meet water quality standards for effluent from the water management ponds and subsequent effects to the downstream aquatic environment is not an acceptable outcome for Benga and will not be tolerated. Benga intends to develop and closely follow standard operating procedures that govern the operation of all ponds and effluent from the mine site.

d) Provide details on additional protective measures to be included in the pond construction shown on Figure C.5.5-1 (Volume 1, pdf page 579) to minimize the impact of the sedimentation ponds on groundwater.

Response:

During detailed design, the potential for pond water to effect groundwater will be evaluated. If effects are possible or likely, the ponds can be appropriately lined.

88. Volume 1, Section C.8.3.3 – Leaching of Explosive Residuals, Page C-153

Benga states, that, "for the purpose of this project, an assumption that up to 95% of the influent nitrate loading could be removed from water routed through a saturated backfill with more than one year residence time."

The basis for this assumption is not provided; further details on the basis would assist in determining potential impacts on water quality.

a) Provide details on the basis for this assumption.

Response:

Discussion on the potential for attenuation of nitrogen explosives residuals and selenium in saturated rock fills was provided in Appendix 10B, Section 3.3.3 of the 2015 Grassy Mountain Coal Project Water Quality Prediction Model report.

Work by Bianchin *et al* (2013) and SRK (2012) (both referenced in Appendix 10B) have shown that very high levels of attenuation of selenium (exceeding 99%) can be achieved in sub-oxic saturated rock fills without intervention. It was assumed that nitrate can also be attenuated to a similar degree because the rest potential for denitrification of nitrate to nitrate is about the same as selenate to selenite. However, as acknowledged in the application, additional labile carbon may need to be added if natural organic carbon does yield sufficient electrons to allow both reactions to proceed.

89. Volume 1, Section E.3.3.2 – Effects of Mine Waste Rock on Groundwater Quality, Page E-60

Volume 3, Appendix 10 – Geochemistry Reports – Executive Summary, Page ii

Volume 3, Appendix 10 – Geochemistry Reports – Section 6.3 – Selection of Preferred Approach and Assessment, Page 40

Benga states, for selenium, "saturated zones will be created by backfilling the mining pits. Residence time will be targeted to exceed one year."

Benga further states, for selenium, "most basal leakage from the waste rock dumps would reside in the groundwater system for a duration that substantially exceeds the critical residence time to attenuate any selenium."

A report prepared for Benga states that, "in addition, selenium can be attenuated in low oxygen conditions which develop in backfill conditions provided that sufficient reaction time exists for conversions to occur to less mobile forms."

This report also states that "there are currently no data to indicate when a residence time would be too short to result in effective selenium removal."

Attenuating selenium is a key component of ensuring that water quality is met. Further details on the basis for residence time and how Benga will ensure that residence time is met is required to assess the efficacy of the proposed treatment process.

a) Confirm what the critical residence time is for the attenuation of selenium.

Response:

The biological reduction process that occurs naturally within coal waste rock dumps is the same process that is used in active biological water treatment plants where a residence time of less than 12 hours can achieve near-complete removal. Gravel reactors installed at coal mines sites in the United States achieve satisfactory removal of selenium using retention times as low as 24 hours. Gravel reactors are much smaller than saturated backfills but operate in an identical fashion as the saturated backfills proposed for the Grassy Project. Based on these two examples, critical residence time is in the order of one day under optimum conditions.

b) Provide details on what is meant by sufficient reaction time.

Response:

Benga are proposing to engineer and actively manage the Project's saturated backfill zones. The addition of organic carbon, and the active monitoring of system parameters such as oxygen levels at various points in the zones, will enable an increase in the selenium and nitrate reduction by orders of magnitude over a passive system and could theoretically approach the one day of the active biological water treatment plant or the gravel reactors.

On-site barrel testing conducted by Benga demonstrated near-complete selenium removal with residence times of 2 to 3 weeks. Because there are uncertainties associated with the performance of an in-situ, actively managed process, Benga has assumed a very conservative residence time of many months to one year to ensure maximum attenuation. However, if optimized appropriately, residence times of a few days should be sufficient.

c) Discuss how Benga will ensure that adequate residence time is attained.

Response:

As discussed in SIR 89b, applications of the same technology for selenium attenuation in water treatment plants and gravel bed reactors provide the desired attenuation in the order of one day. Benga's barrel testing using site materials provided results in several days. In order to ensure adequate residence time for the saturated backfill zones, Benga has allowed for residence times of up to one year or more than 50 times the theoretically achievable residence time.

90. Volume 1, Section C.5.3.4.1

An overview of the surge ponds is provided with the statement that the surge ponds will accept seepage water from the external rock disposal areas. The surge ponds would not release water to the environment, but rather water would be pumped to the saturated fill zones for treatment of elevated selenium concentrations. The list of surge ponds does not include the southwest pond shown on Figures C.5.3-1 to C.5.3-5. Southwest surge pond is described as being located in Blairmore Creek watershed with water captured here being pumped to the west sedimentation pond (Volume 3, Appendix 10B, Section 2.4.1, pdf page 1974 and Figure C.5.3-2, pdf page 572).

a) Provide details on what water the southwest surge pond would be capturing, specifically identifying whether the pond will be collecting any seepage from the waste rock disposal areas.

Response:

The Southwest Surge Pond is intended to receive runoff from the undisturbed hillside and some pit wall runoff from the pit located on the hill-side above the pond. This surge pond is not intended to receive runoff or seepage from waste rock storage areas.

b) Provide justification for not redirecting the water collected in the southwest surge pond to the saturated fill zone areas for further treatment as is the case with the other surge ponds.

Response:

The geochemical source terms indicate that pit wall runoff will be of acceptable quality to discharge to the receiving environment without treatment other than TSS removal. If water quality testing indicates unacceptable selenium concentrations, as with other sedimentation ponds, this water could be redirected to the saturated backfill for additional treatment.

91. Volume 1, Section C.5.4

Benga states, "all three disposal area surge ponds (NWSP, RWP, SESP) will remain in service after closure as it has been assumed that selenium will continue to leach out of the rock for a time period that extends beyond completion of reclamation. These three ponds will continue to pump water into the saturated zones until selenium levels reach acceptable limits." It is not stated what acceptable limits are expected to be or when this will occur.

a) Provide details on what is considered acceptable selenium limits for the surge ponds and when it is expected that these limits will be achieved and the saturated zone treatment is no longer required.

Response:

Acceptable limits refer to concentrations that would not cause receiving water objectives to be exceeded. Discharge of water from surge ponds must not cause exceedances of in-stream water quality objectives or standards. The pumping of water from the surge ponds to the actively managed saturated backfill zones is expected to extend beyond the end of mining, and through the Closure phase. A timeline on when the acceptable limit is obtained will depend on the concentration of selenium in the receiving environment.

b) Confirm whether ongoing injection of a carbon source will be required after closure to ensure anoxic conditions are maintained within the saturated zones.

Response:

For planning purposes, it is assumed that carbon injection would be required after closure to maintain anoxic conditions; however, the rate of injection is expected to be lower in the closure period. The process of reducing nitrate in the mine water during active operation is expected to consume a majority of the electron donor (carbon source) added to the saturated zones. Once the use of explosives ceases at the end of the operating phase, the demand for electron donor is expected to drop, possibly to the point where organic carbon released from the waste rock is sufficient to maintain anaerobic conditions, as has been observed at historical saturated backfills at other mines.

c) Describe all active management actions that will be required to ensure the saturated zones are functioning as proposed once operations have ceased.

Response:

The active management actions required once operations have ended are the same as the actions required during operation. These include monitoring of redox conditions and water quality in the saturated zones and pacing of carbon source injection, and possibly nutrient injection, based on the monitoring results.

d) Confirm whether the southwest surge pond will remain in service after closure or be reclaimed with other ponds and water management features.

Response:

The southwest surge pond will not receive runoff from the pit wall after the end of operation but only runoff from the hillside. Once the hillside has been fully reclaimed and vegetated the southwest surge pond will be decommissioned as indicated in Section F – Conservation and Reclamation Plan, Section F.4.5 and Figures F.3.6-6 to F.3.6-8.

92. Volume 1, Section C.5.5.1

Benga states, "if quality doesn't meet release criteria, sedimentation pond water can be directed towards the saturated backfill zones as needed". Details on how this will be done and required time are required.

a) Provide details on how water which does not meet release criteria in the sedimentation ponds would be directed to the saturated fill zones.

Response:

Water that does not meet release criteria will be pumped to the saturated zones. SIR 87 includes additional information in the operation and management of effluent from sedimentation ponds.

b) Provide details on expected length of time to implement this mitigation measure (diversion to saturated zones) and whether water can be retained within the sediment ponds until such time that it can be diverted to the saturated fill zones.

Response:

Operational Phase pumps and piping will be on site, installed and commissioned as needed to implement this Water Management Plan mitigation. Design, procurement and construction of permanent pumping stations likely take 4 to 6 months to complete depending on equipment lead time. If during operations, Benga's water quality monitoring and risk management deems it necessary, a mobile diesel pump can be procured and kept on site, which would allow a response to be mobilized within a day or two. However, such a measure is typically not necessary for responsible management of sedimentation ponds, except in exceptional circumstances.

93. Volume 1, Section C.8.3.1

A number of source control measures for mitigating selenium leaching from waste rock are identified in this section. With respect to relative effectiveness, only the saturated fill zones option was considered in this section and elsewhere (Volume 3, Appendix 10A, Section 6.2, pdf page 1794).

Diversion of contact water around waste rock piles and/or covers on wastes was not considered further. As well, the source controls listed do not include segregation of waste rock with high selenium leaching potential from waste rock with low leaching potential as has been done at other coal mines in Alberta. Waste rock selenium concentrations range from <0.1 to 4.8 mg/kg (Volume 1, Section C.8.2.1.1, pdf page 479) indicating the potential to pursue segregation as a source control.

a) Confirm whether diversion of contact water around waste rock piles and/or through covers on waste will be implemented as part of selenium source management activities.

Response:

Diversion of water and construction of waste rock covers were evaluated during the conceptual design of the project. The northwest and south waste rock areas are located at the headwaters of the catchments which means there is essentially no water upstream of the waste rock to be diverted around the areas.

The cost and feasibility of waste rock covers were also evaluated. Low-permeability covers such as bitumen covers would significantly reduce the potential for selenium to leach into mine water. However, it was considered preferable to maximize the waste rock slopes to reduce the mine footprint and the resulting waste rock areas are too steep to allow for construction of such covers. In order to implement a low permeability cover solution, additional mine footprint would be required. Options for covering the flatter sections of the water rock areas was also completed; however, the effect of such covers would be limited due to the relatively small percentage of waste rock that would be covered.

b) Confirm whether segregation of waste rock with high selenium leaching potential is a source control activity being implemented as part of the proposed project.

Response:

Segregation of waste rock with higher selenium leaching potential was considered as a source control activity but was rejected. The premise for segregating rock based on its selenium concentration is that there is a strong correlation between selenium concentration in the rock and selenium concentration in contact waters, and variability in selenium concentrations occur at a scale that is amenable to operational-scale management.

Actual variation in selenium concentrations in the rock vary over a range of about 2 mg/kg with typical concentrations being near 1 mg/kg. Slight selenium enrichment was apparent for the Mutz Formation compared to the other formations. Segregation based on selenium content can at best be expected to yield a factor of two difference in release rates. Humidity cells showed a weak correlation between selenium content and selenium release rates thereby further reducing the benefit of segregation.

In summary, no benefit from segregation based on selenium content is expected to be observed.

c) Provide details on any other source control measures or selenium control measures aside from use of saturated fill zones being considered for use during project operations.

Response:

General methods for controlling selenium loadings at the source include:

- limit or prevent oxidation of the waste rock minerals (*i.e.* inundation in water); and
- limit or eliminate infiltration through the waste rock (*i.e.* low-permeable covers).

The saturated zones in the mine-out open pits do not have sufficient capacity to store all the waste rock produced during production; therefore, inundation is not a viable source control method. The installation of low-permeability covers was evaluated but rejected due to the slope angles of the waste rock areas as discussed in SIR 93a. As such, pure source control methods are not feasible for the Grassy Mountain Project; however, options for creating "anoxic barriers" at the base of the waste rock dumps have been discussed and will continue to be explored during detailed design. These barriers would be permeable zones enriched with organic material. As waste rock seepage passes through these zones, anaerobic conditions would develop and nitrate and selenium would be come attenuated. The concept is similar to permeable reactive barriers, which are often used for remediation of contaminated groundwater. However, rather than intercepting groundwater flow along a horizontal flow path, the anoxic barrier would intercept seepage as it flows downward within the waste rock mass toward the base of the dump. Geotechnical implications of such a design must be carefully considered to ensure that such an anoxic barrier would not cause instabilities. This concept was not presented as part of the Environmental Impact Assessment, but is being considered as an adaptive management, continuous refinement of the Selenium Management Plan.

d) If saturated fill zones is the only selenium management strategy being implemented, provide justification for not including other control measures.

Response:

The discussion on covers in section SIR 93a and the discussion on feasibility of inundating waste rock in SIR 93c as well as the potential for construction of basal anaerobic barriers sums up the rationale for selecting actively managed and engineered saturated backfill zones as the primary selenium and nitrate mitigation measure.

94. Volume 1, Figures C.5.3-1 to C.5.3-5

These figures provide an overview of the water management system being proposed for the project, and include flow pathways from the surge ponds, to the saturated fill zones, and then to the metals treatment plant, but with no further flow paths after the metals treatment plant. Section C.5.4 (pdf page 428) states that water that passes through the southern-most saturated zone (SZ1465) would be pumped into either Blairmore or Gold Creek. However, this contradicts water quality modeling which states water is discharged to Blairmore Creek and that the only water reporting to Gold Creek would be from surface runoff via sedimentation ponds and end pit lake outflow (Appendix 10B, Section 7.1, pdf pages 2004 and 2007). Clarification on flow pathways for treated water is required.

a) Confirm whether water which has passed through the saturated zone fills and the metals treatment plant would be discharged to Blairmore Creek only (as per Volume 3, Appendix 10B), or to both Blairmore and Gold Creek (as per Volume 3, Section C.5.4).

Response:

Water from the treatment plant would only be discharged to Blairmore Creek, not to Gold Creek. The statement in Volume 3, Section C.5.4 is incorrect.

b) If water which has passed through the saturated zone fills and treatment plant is to be discharged to Gold Creek, provide the following:

   i. Updated modeling conducted in Appendix 10B to reflect this change.

Response:

As per response SIR94a, water from the saturated zone is not to be discharged to Gold Creek; subsequently, the requested additional analysis is not required.

   ii. An analysis on the risk to all life stages of aquatic biota inhabiting Gold Creek resulting from the release of water which has passed through the saturated zones and treatment plant.

Response:

See response SIR 94b(i).

c) Confirm the discharge pathways and discharge locations to Blairmore and/or Gold Creek and update Figures C.5.3-1 to C.5.3-5 to include the discharge pathway(s) for treated water from the metals treatment plant clearly indicating where water would be discharged to Blairmore and/or Gold Creek.

Response:

The proposed discharge locations for treated water for the Project is shown on Figure 94-1.

d) If treated water is to be discharged to multiple nodes on Blairmore and/or Gold Creek, provide the following:

   i. A summary of percentage of treated volumes to be reported to each location.

Response:

The Project will include pumps and piping to allow treated water from the saturated backfill zone and metals treatment plant to be moved to various points along Blairmore Creek as required. The distribution of water between the nodes can be modified based on experience as the operation progresses. For the purposes of the IFA, the assumed flow distribution is as follows:

- Location BC07: 53% of the total flow;
- Location BL02: 7% of the total flow; and ADD BULLETS
- Location BC03: 40% of the total flow.

No update to flow analysis or IFA is necessary as these studies have all assumed the appropriate discharges into Blairmore Creek.

ii. An updated analysis on the changes to hydrology, fluvial geomorphology, the Instream Flow Assessment and the changes to available fish habitat for each established bioperiod as a result of releasing treated water to multiple nodes along Blairmore and/or Gold Creeks.

Response:

See response SIR 94d(i).

95. Volume 3, Appendix 10 – Geochemistry Reports – Section 5.4.1 – Selection of Management Approaches, Page 32

Volume 1, Section C.8.3.2 – Acid Rock Drainage Management, Page C-152

The report prepared for Benga states, that for the blending of rocks to offset acid generation potential, "implementation of blending requires a site specific approach and in some circumstances cannot be implemented." This report further states that, "underwater disposal is technologically most reliable and also addresses leaching of elements that do not require acidic conditions to be mobilized, which blending will not achieve."

The proposed means of addressing acid rock drainage by Benga is "blending to produce an overall non-PAG waste rock mixture".

Details on how a rock blending program would be managed to ensure that acid generation potential is minimized are not provided.

a) Provide details on how Benga will ensure that a site specific approach is viable and can be successfully implemented to control acid generation potential.

Response:

Volume 3, Appendix 10A – Geochemistry Characterization Report, provided design guidance for blending including target NP/AP for waste blends, optimization of the blending approach for different formations and recommended waste rock lift heights to encourage waste rock dump blending by end-dumping. This guidance is an input to final waste rock dump design and short- and long-range waste scheduling. Development of detailed designs and waste schedules is expected to be a continuous activity through economic evaluation of the project, start-up and operations.

96. Volume 3, Appendix 10 – Geochemistry Reports – Section 2.5 – Applied Mitigations, page 8

Volume 1, Section A.6.4 – Surface Water Management, Page A-25

The report prepared for Benga states, that "ARD (acid rock drainage) related metals in the SZs discharge would remain problematic to downstream water quality without additional treatment. As a result, a Water Treatment Plant (WTP) was included as a mitigation measure in the current model."

Earlier portions of documentation (A.6.4.) state that "a water quality treatment plant could be constructed but is not planned at this time".

Clarity on whether a water treatment plant is included in the base plan for development is required.

a) Confirm that a water treatment plant, for removal of ARD related metals, is included in the base facilities design.

Response:

Results of the Project's water quality model, which used conservative assumptions, indicated that there is a potential for some metal concentrations to be elevated. However, it is far from certain that metal concentrations in the mine water will warrant implementation of a metals treatment plant at the start of the mining operations. Therefore, Benga have proposed to include metals water treatment as a contingency measure to be implemented if and when monitoring results indicate that treatment may be required in the future.

97. Volume 3, Appendix 10B, Section 2.4.1

An overview of all of the sedimentation and surge ponds is provided. Both the east and northeast sedimentation ponds will discharge water to Gold Creek, however it's noted that if water does not meet release limits, it will be redirected to the saturated zones. All saturated zone water eventually is released to Blairmore Creek via the water management system.

a) Describe predicted impacts to hydrology as a result of diverting water from Gold Creek to Blairmore Creek and describe how this may alter the habitat availability assessment for each bioperiod within each affected reach.

Response:

The Instream Flow Assessment (Aquatic Ecology Consultant Report #6, Appendix A3) takes into account predicted reductions (changes) in hydrology (flow) based on predicted node values at a sub-catchment level in each of Gold and Blairmore creeks that were provided through the Water and Load Balance Model (Appendix 10B).

b) Provide an outline of proposed mitigation measures to address reduced water flows to Gold Creek in cases where water is diverted from the Gold Creek sedimentation ponds to the saturated zones.

Response:

The Project's Water Management Plan (WMP) will identify specific mitigation measures and critical areas in Gold Creek aimed to augment predicted flow reductions, as required. Several hydrometric stations are currently established in Gold Creek that continue to monitor baseline flows to enhance our understanding around natural variability. It is anticipated that if any flow augmentation is required, it will focus on Gold Creek mainstem above the Caudron Creek confluence where flows are considerably lower given Caudron Creek's contribution.

As previously mentioned, the ability to pump water between sedimentation ponds is not part of the initial project design but could be implemented within a few months if required to augment flows in Gold Creek in cases where water needs to be repeatedly diverted from Gold Creek ponds to the saturated zones.

98. Volume 3, Appendix 10B, Section 2.5.1

To meet instream water quality objectives, a cap was applied to the saturated zone attenuation. This cap limited effluent concentration from the saturated fill zone to a maximum of 0.015mg/L for selenium. For starting selenium concentrations of 1.5mg/L or lower, this assumes a 99% or lower treatment efficiency. For concentrations above 1.5mg/L, this would assume a >99% treatment efficiency of the saturated zone.

a) Provide justification for setting the cap for effluent concentration at 0.015mg/L.

Response:

The justification for setting a cap of 0.015 mg/L selenium is that this level of ormance can be reliably achieved in in-situ anaerobic treatment. Addition of molasses and methanol to the Sweetwater Pit Lake in Wyoming reduced selenium concentration from approximately 0.450 mg/L to less than 0.007 mg/L. This performance was achieved in open water. The growth of the anaerobic bacteria that facilitate reduction of selenium and nitrate is facilitated by a media to which they can attach. Active water treatment plants use sand or granular activated carbon, which has a large surface area. In addition, a solid growth media such as waste rock also serves as a filter and adsorption media for species such as selenite that have an affinity for attaching to mineral surfaces. In other words, the performance demonstrated in the Sweetwater Pit occurred under non-ideal conditions because the advantages of the backfilled waste rock media were absent. Active water treatment plants can be designed to achieve 0.015 mg/L at residence times that are orders of magnitude lower then in the proposed backfills.

b) To achieve modeled predictions or better, provide an overview of additional mitigation measures to be implemented should effluent selenium concentrations be greater than 0.015mg/L during project operations.

Response:

See response SIR 86b.

99. Volume 3, Appendix 10B, Section 2.5.3

The water quality model distributes water from the metals wastewater treatment plant proportionally to the three nodes on Blairmore Creek (BC07, BL02, BL03) in an effort to return contact water to nodes where it was collected. This provides an estimate of predicted concentrations within the receiving environment, but does not provide information on predicted water quality and discharge points. Information on the location of the planned discharge points of water treated through the saturated zones and metals treatment plant is not included in the application (see SIR above with the following reference:. Volume 1, Figures C.5.3-1 to C.5.3-5 (pdf page 571), regarding figures providing an overview of the water management system being proposed for the project).

a) Indicate where the intended return point(s) for water from the metals treatment plant is located.

Response:

The proposed discharge locations were indicated in Appendix 10B, Figure 2-2 and are also indicated in a new map references in SIR 94c, Figure 94-1.

b) Confirm whether modeled concentrations of parameters in the WTP would be the same as predicted concentrations of parameters at the discharge point(s) to Blairmore Creek. If this is the case, update modeling for the WTP to include all parameters modeled for Blairmore and Gold Creeks. If this is not the case, update water quality modeling to include predicted concentrations of all water quality parameters modeled at the discharge point(s) to Blairmore Creek.

Response:

The modelled concentrations of parameters in the WTP effluent was the same as in the discharge that was mixed with the creek water in the model. The predicted parameters concentrations in Blairmore Creek assumed that the treated effluent had been completely mixed. Thus, the prediction does not apply to the mixing zone. All parameters were included in the water treatment plant model. Parameters that are unaffected (or assumed to be unaffected by treatment), such as potassium, were assumed to have the same concentration in the effluent as in the influent. All water quality parameters were discharged from the plant to the creek in the model.

c) If discharge from the metals treatment plant is going to a single location on Blairmore Creek, discuss whether increased loadings are expected to have effects on the receiving environment and whether concentrations predicted by the model across three nodes would still apply to a single discharge point.

Response:

The proposed discharge strategy is to discharge to three locations along Blairmore Creek (Figure 94-1). A single discharge point is not proposed.

d) If a single discharge point is proposed after incorporating the water treatment plant, provide an updated analysis of how this single point of discharge will change the hydrology, fluvial geomorphology, IFA and available habitat assessments for each specified bioperiod.

Response:

As per response SIR 99c, the proposed discharge strategy is to discharge to three locations along Blairmore Creek (Figure 94-1).

100. Volume 3, Appendix 10B, Section 3.2

The model was run for three scenarios including a base case and worst case scenario for water quality. The base case is described as a "generally conservative assumption combined with average hydrological conditions and base case source terms." while the worst case scenario is using upper limit source terms with average hydrological conditions. Source terms are listed in Appendix C (pdf page 2044). For the background surface and groundwater source terms average and 95th percentiles are listed. Section 3.2.2 states that these are based on the average and 95th percentile values of available monitoring data and references SRK (2016). It is not clear from the references in the application (pdf page 2028) which of the 2016 SRK reports this is referring to. Sections 5.1 and 5.2 (pdf page 1996) do provide some additional information on derivation of source terms for surface and groundwater, however additional details are required.

a) Provide a table which includes all sample sites and concentrations of modeled parameters for each sampling date. Highlight any data which was screened out in the calculation of source terms and provide rationale for doing so.

Response:

Table SIR 100-1 (Appendix A-5) shows the background water quality data that was used to calculate the mean and 95th percentile concentrations that was used in the water and load balance model.

b) For surface water quality, only data from BC01 and GC01 were included in developing source terms. Provide justification for not including surface water quality data collected from other stations on Blairmore and Gold Creeks and their associated tributaries.

Response:

BC01 and GC01 are the sampling stations furthest downstream on the two creeks. Therefore, the water quality measured at these two stations integrates all upstream contributions and were therefore assumed to be more representative of the central tendency of background water quality in the Creeks.

101. Volume 3, Appendix 10B, Section 5.1

Background water quality data consisted of 12 samples collected from BC-01 and GC-01 from May 2013 to May 2016. As stated, the model reflects a "limitation of containing a short data record with few samples that may not reflect the complete range of concentrations in the area.". A similar statement is provided for groundwater (Section 5.2).

a) Given the short record of data and relatively few samples on which the model is based on, discuss the confidence in modeled predictions to reflect actual conditions in the future.

Response:

Background concentrations are used as input to the model to represent existing water quality. Loadings originating from the mine activities are added to the assumed background concentrations and the result is the predicted water quality. The predictive value of the model is the estimate of loadings originating from the mine site. The background concentration that those loadings get added to are assumed concentrations, not predictions.

Water quality predictions are produced for a range of assumed background concentrations. For example, a model scenario could look at results of a model run that assumes average background concentrations. The prediction of such a model scenario would then only be representative of times when the background concentrations in the creeks happen to be close to average. Another model scenario might look at results of a model that assumes 10th percentile (*i.e.* low) background concentrations or 90th percentile (high) background concentrations. Such model scenarios would then only be representative of situations when background concentrations happen to be low or high.

The confidence of the model predictions, as in the confidence in the estimates of loadings that originate at the site and report to the downstream environment are relatively independent of the assumed background concentrations. However, the confidence that the measured range of background concentrations, and hence the range of background concentrations assumed in the model, is representative of the full range of background concentrations that will be measured over the life of the mine is low. That said, even though relatively few background samples are available, the likelihood that the concentrations measured is representative of the central tendency of the background concentrations is relatively high. In other words, the extreme range of background concentrations are unlikely to be represented by the available data set but the central tendency of the background concentrations that will characterize water in the creeks most of the time is likely representative.

b) Provide an overview of planned model updates as additional water quality is collected.

Response:

Changes to assumed background concentrations do not require a model update per se; only a recalculation of the model results. For example, water from the mine may cause concentrations of some parameter to increase from a background concentration of 100 mg/L to 110 mg/L – an increase of 10 mg/L. If additional monitoring data indicate that 120 mg/L is a more representative background concentration over time then the predicted concentration simply becomes 120 mg/L + 10 mg/L = 130 mg/L.

It is important to note that water quality model predictions are conservative. Complex interactions between water, vegetation, soil, minerals as well as complex aquatic chemistry are difficult to represent in a relatively simple mass-balance model. Therefore, model inputs and assumptions tend to be conservative to make allowances for uncertainties. Because the model assumptions generally are conservative, the assumed background concentrations ought to be representative of the general water quality in the receiving environment as opposed to extreme concentrations that occur rarely or sporadically.

102. Volume 3, Appendix 10B, Section 7.1

Concentrations of sulphate, selenium and some metals in Blairmore Creek are predicted to remain elevated after closure.

c) Discuss why parameters are predicted to remain at an elevated steady stated concentration after reclamation and presumably leaching of waste rock has been exhausted or reclamation creates cover preventing further leaching activities.

Response:

Leaching of waste rock and exhaustion of mineral weathering products is a process that can take decades. Certain parameters, such as ammonia and nitrate that primarily originate from residual explosives used during mining, are expected to dissipate within a few years after the end of mining activities; however, loadings associated with waste rock are expected to continue in the closure period.

The type of waste rock cover that can be constructed for the Project will reduce infiltration through the waste rock material, but will not stop infiltration. Infiltration rates into uncovered waste rock areas can be as high as 40% to 65% of mean annual precipitation. Once a cover has been placed, infiltration may be reduced to as low as 20% of mean annual precipitation, which is an infiltration rate that is similar to undisturbed ground. The only way to eliminate, or nearly eliminate, infiltration is to construct a low permeability cover that uses a synthetic (*i.e.* plastic or bitumen) liner. However, such covers can only be constructed on relatively flat slopes are not feasible for the hill-side waste rock dumps for the Project.

d) Provide details on long-term management of elevated parameters once mining activities (operations phase) have ceased specifically identifying whether proposed management strategies are considered passive, semi-passive or active.

Response:

The proposed management methods are considered to be active. Long-term management of elevated parameters is the same in the closure period as in the operational period. Even though management of the saturated zones and water collection systems likely can be staffed by only a hand-full of operators, the site will require presence of personnel to monitor collection and treatment performance and to adjust and repair any of the equipment of infrastructure needed after closure.

e) Provide an analysis of how these elevated concentrations of sulphate, selenium and other metals may impact all life stages of aquatic biota within Blairmore Creek over the closure period until levels return to background concentrations.

Response:

Details concerning potential effect on aquatic biota was evaluated in the aquatics effects assessment (Addendum 1, Aquatic Ecology Consultant Report #6).

103. Volume 3, Appendix 10B, Section 8.2.1

Sensitivity analysis shows predicted selenium concentrations are very sensitive to capture efficiency. If capture efficiency decreases from 95% to 80%, this results in twofold increase in concentration at closure (Figure 8-1, pdf page 2019). It is acknowledged that this highlights need for mitigation to work (capture and treatment) to achieve compliance.

f) Discuss additional mitigation measures to be implemented if it is determined that capture efficiencies are less than the targeted 95%.

Response:

The water and load balance model conservatively estimated that up to 95% of selenium loadings from the ex-pit waste rock dumps would be captured in order to protect downstream water quality. The model assumed rather conservative (*i.e.* high) estimates of selenium concentrations in waste rock seepage and also assumed that no attenuation of selenium would occur along the flow path. Taken together, these two conservative assumptions will offset capture efficiencies lower than the 95% assumed.

If capture efficiencies are unacceptably low, seepage from waste rock areas can be captured by installing lines of groundwater interception wells across the groundwater or seepage flow path. Interception trenches or slurry walls can be installed to facilitate collection or act as barriers for waste rock seepage flows, as an alternative mitigation. The most suitable methods for intercepting seepage will be determined based on a field assessment, which includes a drilling program. The design of such interception systems typically defines several stages of implementation. A primary line of interception wells will first be installed along with monitoring wells downstream to evaluate the performance of the interception wells. If monitoring results indicates that additional wells are required, a second set of wells would l be installed downstream of the first set of wells. Another mitigation option involves the introduction of a dilute solution of organic carbon such as methanol into the groundwater seepage to promote in-situ attenuation of selenium and nitrate. This method has been used for decades to mitigate nitrate plumes in groundwater caused by agricultural activities. However, the groundwater flow regime must be characterized carefully before such a method is used.

104. Volume 3, Appendix 10B, Section 8.2.2

Sensitivity analysis for selenium treatment efficiency shows an increase from 0.01mg/L at 99% attenuation to 0.22mg/L at 90% attenuation. It is noted that to achieve desired treatment, effective mitigation and management of the saturated zones is required.

a) Aside from injection of carbon sources and water management strategies included within the application, discuss any other mitigation and management options considered if the proposed management strategies for the saturated zones provide less than 99% attenuation of selenium.

Response:

A range of options can be considered for improving selenium treatment performance. One of the most important aspects of the proposed selenium management approach is that a large portion of the mine waste rock will be captured and stored in the relatively large saturated zones. Once captured, a number of treatment methods can be used to achieve the effluent concentration required to protect downstream water quality. These are more fully discussed in SIR 86(b).

105. Volume 3, Appendix 10B, Appendix D

An increase in phosphorus concentrations at all modeled nodes is predicted, but not discussed within the results or elsewhere in the application. Increased phosphorus concentrations in combination with increased nitrogen concentrations have the potential to increase primary production which may have adverse effects on other biota.

a) Provide a discussion of potential impacts to Blairmore Creek as a result of predicted increases in phosphorus concentrations and strategies to be implemented to minimize adverse impacts to the receiving environment.

Response:

Blairmore Creek is classified as an "oligotrophic stream" based on total phosphorus (TP) trigger ranges for Canadian rivers in Environment Canada (2004) and CCME (2004).

Baseline median TP concentrations in Blairmore Creek range from 5 to 11 µg/L, depending on seasons (water quality assessment, CR#5, Table 8). A maximum TP concentration during operations and post-closure in Blairmore Creek is predicted to be approximately 13 µg/L (Volume 7, Appendix 10C). Therefore, Blairmore Creek would remain within the "oligotrophic" range of stream classification according to a TP trigger value of >25 µg/L for the next trophic status (mesotrophic). Nevertheless, increases in TP concentration in Blairmore Creek due to Project activities could potentially lead to minor changes (*i.e.*, increase) in primary productivity, and hence slightly elevated concentrations of organic carbon. The increased availability of organic material could increase dissolved oxygen demand, thus altering dissolved oxygen requirements for fish inhabiting Blairmore Creek. However, Blairmore Creek is a well-oxygenated watercourse maintaining higher baseline dissolved oxygen concentrations ranging from 8 to 18 mg/L throughout the year (CR#5, Table 8). Thus, any potential eutrophication effects due to slightly higher TP concentration are not anticipated to result in Blairmore Creek.

b) Provide an analysis of how increases in phosphorous and nitrogen may impact all life stage of aquatic biota in Blairmore Creek and the habitat suitability for benthic invertebrates and resident fish species. Include a discussion on potential changes to habitat suitability for salmonids.

Response:

See response SIR 105a.

106. CR6 Addendum, Section 4.2.2.2

Benga indicates that density of macroinvertebrates in Gold and Blairmore Creek are not expected to change significantly from baseline values or change in productivity as a result of loss of upstream tributaries through development. It is not clear how this assumption will be confirmed or mitigation strategies to be implemented if there are impacts to the macroinvertebrate community.

a) Provide details on how this expected outcome will be confirmed.

Response:

Consultant Report #6 (CR#6), Section 4.2.2.2 predicts riparian habitat losses that will occur as a result of the Project will affect tributary macroinvertebrate communities and may alter the biomass of invertebrate drift in localized areas of both Gold and Blairmore creeks. However, the contribution of the affected areas relative to the total invertebrate biomass within each mainstem watercourse is small in comparison to the total invertebrate supply or biomass supplied from all reaches and/or other tributaries based on drainage area. This expected outcome will be confirmed through an aquatic monitoring program, which will aim to validate predictions made during the effects assessment. Methodology will aim to either replicate invertebrate drift surveys (as described in CR#6 Appendix A1 Section 3.2.1.2) or consider adopting a bioenergetic monitoring program. Bioenergetic habitat models are mechanistic (process-based) and offer an alternative to correlative habitat suitability models for drift-feeding fish and have the potential to predict habitat-specific growth rates based on swimming costs and energy intake. Bioenergetics can be a useful application for this system since westslope cutthroat trout are predominantly drift-feeders thus bioenergetics can provide a direct measure of changes in fish habitat productivity through the calculation of net energy intake (NEI) rates.

b) Outline mitigation measures to be implemented if significant impacts to density or structure of macroinvertebrate communities is observed within Blairmore or Gold Creek as a result of project activities.

Response:

Detailed design of the Project will aim to minimize the disturbance to riparian vegetation in the LSA and the final amount of habitat disturbance will be confirmed during the permit phase (*Fisheries Act*, *Species at Risk Act*). The Habitat Offsetting Plan will already account for any uncertainty associated with effect predictions noted in CR #6. If monitoring results detect notable effects to westslope cutthroat trout associated with changes in density or structure of macroinvertebrate communities (within Blairmore or Gold creeks), the proposed Habitat Offsetting Plan will be further adjusted to counterbalance the additional residual effect.

c) Provide an analysis of how potential changes to macroinvertebrate density or community structure may impact fish habitat productivity and fish health, acknowledging macroinvertebrates are the main food source for fish found within the LSA.

Response:

CR#6, Section 4.2.2.2 provides an analysis of how potential changes to macroinvertebrate density or community structure may affect fish habitat productivity and fish health, duly acknowledging that macroinvertebrates (in particular drift) are the main food source for westslope cutthroat trout within the LSA. Further assessment of the macroinvertebrates density and community structure in the LSA is provided in CR #6 Appendix A1 Section 3.2.1 and Section 4.2.1.

d) Explain how changes in macroinvertebrate density and community structure might impact the recovery plan for WSCT, and what mitigation and monitoring measures will be implemented to ensure compliance with the WSCT recovery plan.

Response:

In the Alberta's Westslope Cutthroat Recovery Plan 2012-2017 (2013), the recovery goal states:

> *"Protect and maintain the existing ≥ 0.99 pure populations (currently believed to be approximately 51) at self-sustaining levels, and re-establish additional pure populations to self-sustaining levels, within the species' original distribution in Alberta." (p.4)*

Changes in macroinvertebrate density and community structure could affect the recovery plan through changes in westslope cutthroat trout food supply. However, the residual effect is predicted to be unlikely, as described in CR#6 Section 4.2.2.2. To confirm the effect prediction, an aquatic monitoring plan will be developed to validate the findings. Riparian habitat is linked to macroinvertebrate density and community structure. As stated in response SIR106b, the Project will aim to minimize the disturbance to riparian vegetation in the LSA during Detailed design. If monitoring results detect measurable changes to westslope cutthroat trout associated with changes in density and/or structure of macroinvertebrate communities, the project Habitat Offsetting Plan will incorporate measures to counterbalance the residual effect, including an accounting for uncertainty associated with effect predictions.

The Preliminary Habitat Offsetting Plan (CR#6, Appendix A4) was developed with a primary focus on the Alberta Westslope Cutthroat Trout Recovery Team's (2013) Management and Regulation approach to protect the westslope cutthroat trout and its habitat through implementation of the following strategy:

> *"**MR5. Recover populations within historical range**: Based on the results of the feasibility studies, recover populations of diverse life-history strategies within historical range. This would include both re-establishing populations of diverse life-history strategies, as well as increasing current population levels, distribution and connectivity." (p.39)*

In addition to implementing actions under the MR5 strategy, ongoing data collection and scientific research have, and will continue to, contribute to the knowledge gaps and research needs identified in the Recovery Plan.

107. CR6 Addendum, Section 4.2.2.5

Potential for calcite precipitation to develop in Gold and Blairmore Creeks exist as a result of increased calcium carbonate concentration from waste dumps. Aside from the identification that calcite precipitation may occur in these creeks, no further assessment is provided here or in Appendix A of Appendix 10B.

a) Discuss the areal extent of streams sensitive to potential calcite precipitation.

Response:

As noted in Consultant Report #6 (CR#6), Section 4.2.2.5, baseline assessments did not detect any calcite precipitation and the potential for calcite formation to affect fish and fish habitat was considered low. The proposed (and required) capture and treatment of waste rock contact water makes it very unlikely that calcite deposition will occur at all in the creek channels. Localized calcite deposition could occur around groundwater or seepage discharge locations on hill-sides upstream of the creek channels. However, the Water Management Plan (WMP) will include monitoring to confirm these predictions, targeting high value habitats (*e.g.*, spawning habitat) in Blairmore Creek (identified in Consultant Report #6, Appendix A1, Figure 4.11).

b) Provide details of how calcite precipitation will be prevented from occurring in Gold and Blairmore Creek, given there was no evidence of calcite precipitation in baseline habitat assessments of these creeks.

Response:

Contact water from site will be managed to meet receiving environment selenium guidelines. To achieve this, the majority of contact water from waste rock areas must be captured and treated before it is released to Blairmore Creek. Early in the mine life, when mine water constituent concentrations are expected to be relatively low, as much as 12% of the flow in Blairmore Creek may originate from the mine site. As the mine is developed, and through the closure and post-closure period, less than 2% of the flow in Blairmore Creek is expected to originate from the mine. For Gold Creek, the expected proportion of water originating from site is less than 2% for the life of the mine.

The contact water collection efficiency required to mitigate selenium concentrations in the creeks downstream of the project will also mitigate calcite formation because the relatively high background-water to contact water ratios results in creek water that is well below calcium carbonate saturation.

As part of the overall Water Quality Monitoring and Selenium Management Plans, calcite precipitation will also be closely monitored. Monitoring would aim to document: (1) the extent and degree of calcite deposition, analyzing over time to determine trends; (2) assess calcite-specific aquatic ecological concerns (*i.e.* critical westslope cutthroat trout habitat); and (3) assist in determining when and where calcite mitigation is required (where applicable).

c) Provide an analysis of how calcite precipitation may impact habitat suitability in Gold and Blairmore Creeks, as well as habitat productivity and how calcite precipitation may impact the WSCT recovery plan.

Response:

As described in CR#6, Section 4.2.2.5, the formation of calcite precipitation on spawning substrates could potentially limit the quantity and functionality (quality) of spawning gravels, resulting in changes in reproductive ability/success. However, as described in part b, impacts from calcite precipitation are not expected for the Project. As part of the Water Quality Monitoring program, calcite precipitation will also be monitored in both Blairmore and Gold creeks. Should calcite precipitation be observed, Benga would undertake an appropriate mitigation strategy, if warranted.

108. Volume 5, CR5, Section 2.2.2

Benga proposes using a selenium objective relative to sulphate concentrations as sulphate provides an ameliorating effect in the uptake of selenium into periphyton and subsequently higher biota.

Procedures for the development of a site-specific selenium objective are outlined in Appendix A1, which is based on sulphate concentrations and transfer rates into two algae species and one plant species. While it has been demonstrated that sulphate is a potential modifying factor, there are several limitations with respect to this application:

The selenium objective derived is based on modeled sulphate concentrations in the receiving creeks as a result of mining activities. In essence, to meet potential selenium objectives, Benga would be required to elevate sulphate within the receiving environment. As elevated sulphate concentrations may pose its own risks to the environment requiring mitigation, this approach cannot be accepted. Utilizing the formula proposed by Benga for determining a selenium objective (Se(mg/L) = 0.000594 * sulphate(mg/L)0.46) and the median concentrations of sulphate in Blairmore Creek water from Table 8 (pdf page 44) for different seasons would result in a selenium objective ranging from 0.001 to 0.002mg/L.

- Appendix A1, Section 4.0, pdf page 123 – notes that the lab study is limited as it is based on a limited number of species (2 algae, 1 plant) and with a lack of seasonal fluctuations (based on a single water quality sample collected from BC-W01). In addition, figures show that the relationship (as r2 value) between enrichment function and sulphate concentrations while as 0.7- 0.8, indicating some uncertainty in the predictions.
- Selenium concentrations in algae (periphyton) show a large amount of variation amongst sites within both Blairmore and Gold Creeks (pdf page 57) but are much higher than what was typically observed under similar conditions (selenium and sulphate concentrations) in the lab (pdf page 117 and 121) indicating uncertainty in relating lab conditions to field conditions. Pdf page 180 of CR6 addendum summarized selenium content in fish, which are currently below the 4ug/g

B.C. limit (maximum 2.78mg/kg in Gold Creek) but suggest that increases in water selenium concentrations could result in adverse impacts to fisheries populations in these streams. Given the uncertainty in relating lab to field conditions, and the sensitivity of the WSCT population in the receiving streams, a conservative approach is warranted.

For the reasons listed above, the proposed site specific selenium objective based on sulphate concentrations is not accepted at this time. Assessments of selenium impacts and environmental risk should therefore be conducted utilizing appropriate published guidelines. Note that this precludes the use of US EPA guidelines which are based on a food web-based approach developed primarily in warmer waters and the DeForest et al. (2017) paper which utilizes a fish egg selenium guideline of 20 ug/g dry weight and excluded the more sensitive white sturgeon data (15.6ug/g). As Alberta Environment and Parks (AEP) is currently updating provincial guidelines for selenium to reflect those adopted by B.C., a water quality guideline of 2ug/L is considered acceptable.

a) For Table 7 (pdf page 40) and any other tables utilizing the site-specific selenium objective update regulatory guidelines for selenium to 2ug/L.

Response:

A site-specific water quality objective for selenium was proposed for this Project rather than using the published water quality guidelines for Alberta or British Columbia to reflect significant advancement in the scientific understanding of the aquatic toxicology of selenium since these guidelines were produced (*e.g.*, USEPEA 2016; DeForest *et al.* 2017). This science has been used to propose a protective site-specific water quality objective for selenium in lower Blairmore Creek, but more broadly and importantly, this science indicates a defensible, science-based safe concentration threshold for selenium in this creek that can be used for effects assessment, regardless of regulatory guidelines.

The U.S. Environmental Protection Agency (USEPA) has been most active in developing and refining aquatic toxicity criteria for selenium. A 1999 chronic criterion of 5 µg/L in the water column was updated in 2004 to focus on fish-tissue concentrations rather than water-column concentrations. Recognizing the relationship between sulphate and selenium toxicity, the 1999 USEPA acute selenium (selenite) criterion for water included an adjustment for sulphate concentrations (selenium has very low acute toxicity: at a sulphate concentration of 100 mg/L, this acute criterion was 417 µg/L). Recently in 2016, two new chronic water-column criteria were finalized by USEPA—one for flowing waters of 3.1 µg/L, and one for standing waters of 1.5 µg/L—reflecting different chemical speciation, potential for biotic uptake, and risk of chronic aquatic effects between these two types of environments. Although USEPA (2016) recognized the significant effects of sulphate in ameliorating chronic aquatic effects of selenium, the lack of paired sulphate-selenium data in many historical studies supporting the chronic criterion did not allow the formal incorporation of this relationship into the new criterion ("inclusion of a sulfate relationship was not feasible on a national basis at this time, for lack of sulfate [sic] data at many sites in the database"). Therefore, the current USEPA national criteria were developed to be protective in low-sulphate waters.

DeForest *et al.* (2017) recently published a methodology for deriving sulphate-based waterborne Se guidelines for lotic (selenate-dominated) streams, which aligns closely with that used to develop the proposed site-specific objective for this Project. This type of objective is appropriate for the LSA of this Project as proposed, given Gold Creek and Blairmore Creek are well-oxygenated watercourses throughout the year (at least 9 mg/L dissolved oxygen). The presence of sulphate affects uptake of selenium into the tissues of primary producers (typically periphytic algae in lotic systems), while accumulation of selenium in organisms at higher trophic levels (*i.e.*, benthic invertebrates and fish) occurs through food-chain transfer from algae to these higher trophic levels and is substantially unaffected by ambient sulphate concentrations. Given uptake of selenium into algae is the rate-limiting step affecting selenium accumulation throughout the aquatic ecosystem, understanding how site-specific conditions (*i.e.*, local water quality, including sulphate concentrations) affect uptake of selenium into algae provides a foundation for determining safe thresholds for ambient selenium concentrations for local aquatic biota.

DeForest *et al.* (2017) modelled selenate bioconcentration in particulates as a function of waterborne selenate and sulphate concentrations. Waterborne selenate and sulphate along with particulate selenium data collected from both lab and field studies were used. Particulate selenium concentrations were then used to predict selenium concentrations in invertebrates and fish eggs using quantile regression models, yielding the following recommended chronic waterborne guideline:

Waterborne Se Screening Guideline (µg/L) =

$$EXP[2.446*\ln(\text{fish egg Se guideline})-10.67+1.389*\ln(SO_4)]$$

Using a safe-concentration threshold of Se in fish eggs of 20 µg/g dw, representing the 5th percentile of a species sensitivity distribution (SSD) of predominantly fish egg Se EC10s for reproductive effects (DeForest 2012), the above equation was simplified as follows:

Waterborne Se Screening Guideline (µg/L) =

$$EXP[1.389*\ln(SO4)-3.342]$$

The lower bound of this sulphate-dependent model was capped at a sulphate concentration of 43 mg/L, which is the sulphate concentration that results in a guideline of 6.5 µg/L (equivalent to a lotic guideline) (Table SIR 108-1). The lotic Se screening guideline of 6.5 µg/L was based, in part, on the observed relationship between waterborne and particulate Se in a variety of lotic systems.

Relative to this DeForest *et al.* (2017) recommended screening guideline, the site-specific objective proposed for this Project was more conservative at all sulphate concentrations (see Table 1 for relative comparison):

Site-specific Se objective =

$$0.594*SO40.46$$

It should be noted that this proposed site-specific selenium objective for this Project was revised in response to the specific information request from Environment Canada (ECCC) during the first EIA submission (received as SIR #13: Water Quality-Selenium on March 21, 2016). ECCC acknowledged the appropriateness of this approach but suggested including testing results for at least one more algal species, to provide additional confidence in the proposed site-specific objective. Therefore, in addition to results of tests using Pseudokirchneriella subcapitata (alga) and Lemna minor (duckweed) used to develop the original site-specific objective, tests were conducted in 2016 using a third algal species, Scenedesmus acutus. Results for this third species were very similar to those for the first two; and a slightly revised site-specific objective (above) was presented in the second EIA submission.

Table SIR 108-1 Relative comparison of water-borne selenium guidelines between proposed Grassy site-specific objective and DeForest *et al.* 2017 using same sulphate concentration

Sulphate Concentrations (mg/L)	Grassy Site-Specific Se Value (µg/L)	DeForest *et al.* 2017 Se Value (µg/L)
43	3.35	6.5
75	4.33	14
100	4.94	21
150	5.95	37
200	6.80	56
300	8.19	98
400	9.30	145
500	10.36	198
600	11.26	256
700	12.10	317
800	12.86	381

In response to specific information requests:

a) Seasonal summaries of baseline selenium concentrations (along with relevant water quality variables including dissolved oxygen, hardness, and sulphate) in Crowsnest River, Blairmore Creek and Gold Creek are presented in Table SIR 108-2. The predicted selenium concentrations resulting from Project activities are presented in Figure 108-1 for the LSA and Figure 108-2 for the RSA. As suggested, the selenium concentrations were screened against the AEP/BCMOE selenium guideline of 2µg/L and a summary of exceedances are presented in Table SIR 108-3.

b) Baseline concentrations of total selenium measured in Blairmore Creek and the Crowsnest River were below Alberta/British Columbia Guideline of 2 µg/L. However, selenium concentrations at Gold Creek were higher than this guideline value in four (one in summer and three in winter) of 15 samples (Table SIR 108-3). Selenium concentrations modelled in Blairmore Creek nodes during all mine phases were higher than Alberta/British Columbia water quality guideline (approximately 80% exceedances). In contrast, at the Crowsnest River and Gold Creek nodes, predicted selenium concentrations were below this water quality guideline for selenium.

Table SIR108-2 Summary of selected baseline water quality variables in the RSA (Crowsnest River) and LSA (Blairmore Creek and Gold Creek) in the Grassy Mountain mine site.

Variables	Units	Regulatory Guidelines	Spring				Summer				Fall				Winter			
			N	Med	Min	Max	N	Med	Min	Max	N	Med	Min	Max	N	Med	Min	Max
Crowsnest River																		
Dissolved Oxygen (meter)	mg/L	>5-6.5	29	12.26	10.21	14.5	54	10.26	8.78	13.6	34	10.81	8.76	13.09	47	12.5	9.53	14.46
Total Hardness (as $CaCO_3$)	mg/L	-	42	190	146	238	58	174	140	218	70	198	131	236	67	223	164	253
Sulphate	mg/L	309	53	46	21	77	82	33	19	54	91	45	10	67	93	59	10	82
Total Selenium	mg/L	0.002	2	0.00025	<0.0002	0.0003	8	0.00055	0.0003	0.0016	8	0.00035	<0.0002	0.0018	1	<0.0002	<0.0002	<0.0002
Dissolved Selenium	mg/L	0.002	1	0.0002	0.0002	0.0002	1	0.0003	0.0003	0.0003	3	<0.0002	<0.0002	0.0004	0	-	-	-
Blairmore Creek																		
Dissolved Oxygen	mg/L	>5.0-6.5	11	12.4	9.0	16.09	17	9.2	7.6	12.64	5	10.40	9.5	18.72	4	10.5	9.5	11.7
Total Hardness (as $CaCO_3$)	mg/L	-	5	122	95	225	11	161	44	190	4	185	123	200	5	180	73	216
Sulphate	mg/L	309	5	8.3	4.6	9.8	11	13.7	4.53	24.5	4	14.2	7.4	22.0	5	18	5.56	19.6
Total Selenium	mg/L	0.002	5	0.00042	0.00026	0.00062	10	0.00045	0.0003	0.00115	3	0.00043	0.00028	0.00048	4	0.00072	0.00047	0.00091
Dissolved Selenium	mg/L	0.002	0	0.00052	0.0004	0.00083	9	0.0005	0.00042	0.00127	4	0.000685	0.00064	0.00076	3	0.000797	0.000491	0.000798
Gold Creek																		
Dissolved Oxygen	mg/L	>5.0-6.5	6	13.26	8.1	14.39	12	12.3	8.4	13.65	3	18.34	9.7	20.32	5	11.2	8.6	11.4
Total Hardness (as $CaCO_3$)	mg/L	-	1	175	175	175	9	131	30	180	2	174	168	180	6	184	78	307
Sulphate	mg/L	309	1	25.8	25.8	25.8	9	13.7	1.96	28.5	2	22.3	21.6	23	6	26.55	17	53.5
Total Selenium	mg/L	0.002	1	0.00093	0.00093	0.00093	8	0.0007	0.000389	0.00758	1	0.00112	0.00112	0.00112	5	0.00289	0.00089	0.00904
Dissolved Selenium	mg/L	0.002	1	0.0011	0.0011	0.0011	9	0.00066	0.000376	0.00753	2	0.0007	0.00064	0.00076	5	0.0031	0.00105	0.00967

Table SIR 108-3 Exceedances of Alberta/British Columbia selenium guideline in baseline and predicted concentrations the LSA and RSA.			
Stations	**Total Samples**	**# Samples Exceedances**	**% Exceedances**
Baseline Concentrations			
Blairmore Creek	22	0	0
Gold Creek	15	4	27
Crowsnest River	19	0	0
Predicted Concentrations			
BC01	83	66	80
BC03	83	67	81
BL02	83	65	78
BC07	83	66	80
CRR01	83	0	0
CRR02	83	0	0

b) Update all assessments of potential effects and conclusions to reflect use of the 2ug/L selenium guideline for surface waters.

Response:

See response SIR 108a.

109. Volume 5, CR 5, Section 4.1.1.3

Benga proposes using a sulphate guideline of 725mg/L based on Elphick et al. (2011). This paper was included within the B.C. technical appendix “Ambient Water Quality Guidelines for Sulphate” (Meays and Nordin 2013) along with additional studies on sulphate toxicity on rainbow trout. An averaging technique was utilized for the methods to derive the hardness dependent guideline. As the

B.C. guideline incorporates and builds on the Elphick et al. (2011) study it is unclear why Benga chose to extract results from this study only. Further, Meays and Nordin (2013) identified shortcomings of the Elphick et al. (2011) paper including their inability to develop a sulphate toxicity/water hardness relationship that applied across species and endpoints, and issues with higher hardness creating issues (osmotic stress) with test species. The most sensitive species (C. dubia) is not analogous to Westslope cutthroat trout, and given their status, it is not appropriate to extrapolate data from other species to this species, but rather take the approach of utilizing model averaging of multiple species as was done in the development of the B.C. guidelines for sulphate which are considered more robust than the single study by Elphick et al..

In addition to the above, Benga states, that predicted high hardness necessitates the development of a site specific sulphate guideline. While predicted hardness in Blairmore Creek is expected to increase to ~350mg/L (Section 4.1.1.4 pdf page 83) this may also lead to calcite precipitation which may require mitigation (see Volume 3, Appendix 10B, Appendix A, pdf page 2030) and cannot be used as justification for increasing sulphate guidelines. The maximum sulphate guideline is 429mg/L at 250mg/L hardness. Table 8 (pdf page 44) for Blairmore Creek indicates median concentrations are below 200mg/L with a maximum concentration in spring (225mg/L) and winter (216mg/L), all below the maximum sulphate hardness value. Table 9 (pdf page 48) for Gold Creek indicates median concentrations for hardness is below 200mg/L throughout the year with a maximum above 300mg/L for winter only (307mg/L). Table A3.1 and A3.2 (Appendix A.3, pdf page 147) confirm that the elevated hardness values above 250mg/L occur infrequently based individual sampling dates.

Justification for use of the site specific objective as proposed is therefore not warranted. The appropriate sulphate guideline should be based on the B.C. guideline for sulphate (which has previously been adopted for use in Alberta) at hardness ranges specified in the guideline table at the moderately hard to hard or very hard sulphate guidelines (309 and 429mg/L respectively).

a) Replace the 725mg/L sulphate guideline in all tables and figures with either the moderately hard or very hard sulphate guideline (309 or 429 mg/L).

Response:

A site-specific guideline for sulphate in lower Blairmore Creek was proposed for this Project for the following reasons:

- Development of a site-specific assessment for sulphate is recommended by BCMOE in case the hardness level is greater than 250 mg/L. Indeed, baseline hardness levels in Gold Creek (max recorded 307 mg/L $CaCO_3$) and Crowsnest River (max recorded 253 mg/L $CaCO_3$) exceeded this level in winter. Although baseline hardness levels were lower than 250 mg/L (max recorded 225 mg/L $CaCO_3$) in Blairmore Creek, predicted hardness in Blairmore Creek downstream of the Project discharge were always greater than 300 mg/L (range 367 to 471 mg/L $CaCO_3$ depending on mine phases and station nodes).
- A sulphate guideline of 725mg/L developed by Elphick *et al.* (2011) has been proposed for this Project as the range of hardness levels used in this study matches the similar hardness levels in this Project. It is noted that British Columbia sulphate guideline incorporates and builds on the Elphick *et al.* (2011) study along with other literatures but does not provide the guideline values beyond 250 mg/L hardness level, rather recommends to develop site specific guideline based on elevated hardness levels. However, it is acknowledged that the test species (C. dubia) used in this study is more sensitive than fish species and not analogous to Westslope cutthroat trout. Therefore, using a more sensitive species like C. dubia was more conservative in developing site-specific water quality objective.

The science used to support this proposed site-specific objective indicates a defensible, science-based safe concentration threshold for sulphate in this creek that can be used for effects assessment, regardless of regulatory guidelines.

Predicted sulphate concentrations were screened with Alberta/British Columbia guideline of 429 mg/L only, based on a maximum hardness level of 250 mg/L. Figure 109-1 presents the revised figures for different nodes of Blairmore Creek. Table SIR 109-1 summarizes the seasonal guideline exceedances of sulphate in different mine phases.

Table SIR109-1 Seasonal exceedances of sulphate guideline and recommended effect threshold in Blairmore Creek over time.

Nodes	Mine Phase															
	Pre-mining				Operations				Closure				Post-closure			
	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W	Sp	Su	F	W
Blairmore Upper (BL03)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blairmore Mid (BC07)	-	-	-	-	√	√	√	√	√	√	√	√	√	√	√	√
Blairmore Mid (BL02)	-	-	-	-	√	√	√	√	√	√	√	√	√	√	√	√
Blairmore Lower (BC03)	-	-	-	-	√	√	√	√	√	√	√	√	√	√	√	√
Blairmore Lower (BC01)	-	-	-	-	√	√	√	√	√	√	√	√	√	√	√	√

Sp = Spring; Su = Summer; F= Fall; W= Winter;
√ = Exceeds published AB guideline; - = no exceedance.

b) Update all assessments and conclusions for project effects to reflect the lower sulphate guidelines.

Response:

Sulphate concentrations in Blairmore Creek are predicted to increase steadily over mine life to above the maximum published Alberta guideline of 429 mg/L (at 250 mg/L hardness) at all modelled locations (Figure 109-1) downstream of the West Sedimentation Pond release (*i.e.*, from BC-07 downstream). Sulphate is predicted to remain below the Alberta guideline during mine life until the mid-to-late 2030s, when it is predicted to exceed this guideline in all seasons until mine closure, after which time concentrations are predicted to decline to a stable, long-term average, which would still remain consistently above this guideline at all modelled locations downstream of the West Sedimentation Pond water release (Table SIR 109-1). Given sulphate concentrations are expected to exceed the published Alberta guideline of 429 mg/L late in mine life (*i.e.*, by the mid-2030s), development of a site-specific sulphate objective reflective of predicted hardness (*i.e.*, >300 mg/L) and ionic composition of Blairmore Creek at this future time is recommended for Blairmore Creek, using site waters for test dilution to reflect the specific ionic composition of Blairmore Creek waters.

c) Given the increased potential for calcite precipitation as a result of modeled increases in hardness, provide the mitigations that will be incorporated to prevent calcite precipitation in fish bearing waters to comply with the WSCT recovery plan.

Response:

In a recent study, Bogart *et al.* (2016) investigated calcite precipitation associated with rapid and extreme shifts in water hardness (38 to 600 mg/L as $CaCO_3$) and alkalinity (30 to 420 mg/L as $CaCO_3$) and toxicity to Daphnia magna on a laboratory scale. Within these hardness and alkalinity ranges, only at the combined highest concentrations was any calcite precipitation in the water column observed. Predicted concentrations of hardness in Blairmore Creek ranged from 367 to 471 mg/L, below the 600 mg/L effect level observed in Bogart *et al.*

Calcite precipitation will be closely monitored in Blairmore Creek during the Project phases and if warranted (see response SIR 107), an appropriate mitigation strategy will be undertaken.

References

Bogart S.J., S. Woodman, D. Steinkey, C. Meays, G.G. Pyle. 2016. Rapid changes in water hardness and alkalinity: Calcite formation is lethal to Daphnia magna. Science of The Total Environment. 2016:559:182-191.

Elphick, J.R., M. Davies, G. Gilron, E. C. Canaria, B. Lo and H. C. Bailey. 2011. An aquatic toxicological evaluation of sulfate: The case for considering hardness as a modifying factor in setting water quality guidelines. Environ. Toxicol. Chem. 30(1):247-53.

Meays, C., R. Norden. 2013. Ambient water quality guidelines for sulphate - technical appendix. British Columbia Ministry of Environment. Water Protection and Sustainability Branch. Environmental Sustainability and Strategic Policy Division.

Ketola, H.G., D. Longacre, A. Greulich, L. Phetterplace, and R. Lashomb. 1988. High calcium concentration in water increases mortality of salmon and trout eggs. Prog. Fish. Cult. 50(3):129–135.

110. Volume 5, CR 5, Section 4.1.1.3

Benga predicts a steady increase in sulphate concentrations over the project life in Blairmore Creek associated with mining activities. Background sulphate concentrations in Blairmore Creek are below 25mg/L (Table 8, pdf page 44) while predicted concentrations range from 400 to over 700mg/L at the end of operational mine life (Figure 6, pdf page 78). Aside from direct toxicity effects, increases in sulphate concentrations are associated with increases in sediment phosphorus release and mercury methylation (Meays and Nordin, 2013).

a) Describe mitigation measures to be implemented to reduce sulphate concentrations in the receiving environment as a result of mining activities.

Response:

The Alberta sulphate guideline follows the recently derived BC guideline, which proposes sulphate thresholds across classes of water hardness from 0 to 250 mg/L, with a hardness-dependent sulphate guideline value of 429 mg/L for waters with a maximum hardness level of 250 mg/L. For waters with hardness above 250 mg/L, the BC guideline acknowledges this higher hardness can be further protective of higher sulphate concentrations but recommends derivation of a site-specific threshold for sulphate in these waters rather than providing a prescriptive value. In Blairmore Creek, predicted hardness levels may exceed 300 mg/L, and dissolved hardness in mine discharges will further reduce the influence of sulphate on aquatic life downstream of discharge. Therefore, a site-specific sulphate threshold that considers this higher hardness has been developed and recommended. As an engineering approach to reducing potential effects of sulphate on the receiving environment, control release of water from sedimentation ponds based on sulphate concentrations especially release of water during high flow seasons may be an option.

b) Describe proposed monitoring activities and research to better understand potential impacts of increased sulphate concentrations within the receiving environment.

Response:

Water quality compliance monitoring will be an integral component of the Project operations. Water in sedimentation/release ponds will be tested before release to the surrounding environment to verify these release waters meet water quality standards to be defined under the EPEA approval for the Project. In addition to routine effluent monitoring that will be required under the mine's EPEA Approval, an ambient water quality monitoring program will be implemented in natural watercourses both upstream and downstream of the Project to assess any changes in water quality due to treated water release into the receiving environment, with monitoring occurring at a sufficient frequency to capture expected variability in background seasonal water quality and treated water discharge quality.

Reference locations will be incorporated into the monitoring design, including locations in the mainstems and tributaries of Blairmore and Gold creeks and Crowsnest River upstream of Project influences, as well as potentially reference locations in other similar, nearby creeks flowing to the Crowsnest River or other similar drainages. Special attention should be given the water quality variables of potential concerns including sulphate, hardness, selenium, phosphorus, and mercury. These variables will be monitored at key locations across the mine site, including in mine water-management infrastructure (*e.g.*, sedimentation ponds, surge ponds, saturated backfill zones) and in Blairmore Creek, Gold Creek and the Crowsnest River upstream and downstream of mine influences.

c) Provide an analysis of the short and long term impacts to all life stages of aquatic biota exposed to the predicted elevated levels of sulphate, how these elevated levels may impact fish health resulting from increased methyl mercury concentrations, and how sediment phosphorous release may alter habitat suitability for WSCT.

Response:

Recent studies show that the elevated concentrations of sulphate promote sulphate reduction, phosphorus release and mercury methylation in sediments where reducing conditions exist. However, neither sediment phosphorus release nor mercury methylation are anticipated in the project area for the following reasons:

- Both the processes are related to depositional areas of the waterbody and suboxic conditions, which are uncommon in the LSA and RSA of the Project.
- There are very few depositional areas in the lower Blairmore Creek receiving environment where suboxic conditions are likely to develop.
- From baseline water quality surveys, dissolved oxygen concentrations remain high (*i.e.*, >9 mg/L) throughout the year in both the LSA and RSA, which would limit anaerobic decomposition at the water-sediment interface.

A.3.5. Fisheries

111. Volume 1, Section A.5.2.2 – Fisheries Act, Page A-19

Regarding the Fisheries Act, Benga states, "Benga is NOT seeking approvals at this time, but information in this application supports the assessment and ultimate approval for these activities. Additional field work and data analysis is planned over the next few months and Benga plans to file the Section 35(2) application in Q1, 2017." The status of the assessment and activities completed in Q1, 2017 is not reflected in the Project Introduction documentation. An understanding of the results of this work is important in assessing potential impacts with respect to the Fisheries Act.

d) Provide details on the status of assessment and approval activities for Fisheries Act aspects.

Response:

The addendum to Consultant Report #6 (January 31, 2017) predicted residual effects on westslope cutthroat trout that will require authorization under Section 35(2) of the *Fisheries Act* and/or approval under the *Species at Risk Act* (*SARA*). A Preliminary Habitat Offsetting Plan (Consultant Report #6, Appendix A4) was developed to provide a framework for counterbalancing residual effects on, and increasing productivity of, westslope cutthroat trout following the information requirements set out in the Application for Authorization under Paragraph 35(2) of the *Fisheries Act Regulations* as well as the *SARA*. The next phase of the Habitat Offsetting Plan is being developed in consultation with Fisheries and Oceans Canada (DFO). Key objectives from *Alberta's Westslope Cutthroat Recovery Plan 2012-2017* (2013) as well as the *Species at Risk Act Recovery Strategy for Westslope Cutthroat Trout Alberta Populations* (2014) are key to the Plan's development. A detailed Habitat Offsetting Plan will ultimately be issued during the permitting phase (*Fisheries Act, SARA*); however, the objective is to maintain open communication with DFO as Offset components are designed in reasonable detail and receive feedback from DFO prior to the Panel hearing.

112. Consultant Report #6 – Aquatic Ecology Addendum, Section 4.2.3.1, Page 61

The proponent discusses the commitment to maintain riparian habitat through the establishment of riparian buffer zones, which were based on consultation of Stepping Back from the Water: A Beneficial Management Practices Guide for New Development Near Water Bodies in Alberta's Settled Region (AESRD 2012).

The current standards for establishing appropriate buffers around watercourses and waterbodies are described in the Master Schedule of Standards and Conditions (AEP, June 28, 2017).

e) Confirm that the mine will be developed following the current standards outlined in the Master Schedule of Standards and Conditions.

Response:

Although the Master Schedule of Standards and Conditions (MSSC; AEP 2017) was published six months post-submission of the Aquatic Effects Assessment addendum (Consultant Report #6), the majority of watercourses that will interact with the Project applied riparian setbacks more conservative than those listed in the MSSC. In Consultant Report #6 Section 4.2.3.1, riparian buffers adjacent to Gold Creek and Blairmore Creek mainstems were set at 50 meters, which is greater than the riparian setbacks identified in condition 1173-AS (small permanent watercourses shall have a setback of at least 45 meters from top of the break). Most tributaries to Blairmore and Gold creeks are non-fish bearing and ephemeral in nature; a 20-meter riparian setback was applied in Consultant Report #6, which is also greater than the riparian setbacks identified under condition 1172-AS (the disposition holder shall not construct activities within 15 meters of temporary wetlands or ephemeral watercourses). A small number of tributaries characterized as intermittent or semi-permanent were assigned 30-meter riparian buffers (fish bearing) and 20-meter (non-fish bearing).

A.4. TERRESTRIAL

A.4.1. Conservation and Reclamation

113. Section F.2.1.6, Page F-30

Whitebark Pine (Pinus albicaulis) is legally listed in Canada as Endangered under Schedule 1 of the Species at Risk Act (SARA). White bark pine was found in pure and mixed stands as scattered trees and in dense stands across the local study area including in areas that are difficult for tree harvest. The project will remove 21, 000 whitebark pine trees, a number that represents those trees that could be counted through aerial surveys or field surveys.

Benga states, "all whitebark pine will be salvaged as well…"

a) Describe a method that Benga will use to salvage individual whitebark pine that is found scattered among rock outcrops as part of timber salvage operations.

Response:

From a conservation and reclamation perspective, where salvage or a transplanting mitigation is not feasible, the primary value of individual whitebark pine (WBP) is in the collection of mature cones for seed ahead of clearing (as outlined in CR#8, Section 4.2.6.3).

Collection of WBP cones occurs over more than one growing season, requires cone protection from seed predators, and qualified professionals with specific training to safely access the trees. To achieve this, Benga will engage qualified professional contractors to undertake the safe collection of WBP cones. For safety reasons no special attempt to salvage trees on steep and or unstable terrain will be undertaken.

b) Whitebark pine thrives on south facing slopes at elevations ranging from valleys to ridges with most successful stands at higher elevations within the montane and subalpine sub regions of Alberta. The reclamation plan indicates that whitebark and limber pine reclamation will be planted within reclamation areas with slopes that range from 1-5 %.

   i) Provide the rationale employed to conclude that white pine will successfully establish and thrive at these lower elevations.

Response:

The natural limiting factors for WBP establishment is competition and seed cash sites for the Clark's Nutcrackers that are the primary seed dispersers. No physiological impediment to growth due to lower elevations have been reported. In the study area, WBP does occur at lower elevations and this has been described in the C5 Forest management unit with specific protections put in place for forest harvesting operations. As described in draft federal WBP recovery strategy (Environment and Climate Change Canada 2017) elevation is highly variable, with WBP observed growing as low as 765 m. For the Project, WBP will be established at elevations ranging at 1,500 m to 1,850 m.

   ii) Describe why Benga has not made an effort to avoid the disturbance of and loss pine located in the area of the ultimate rock disposal area (see Figure F.3.2-1).

Response:

During the mine plan development for this Project, efforts were made to minimize the overall project disturbance, as best possible. The current configuration of the Project footprint has placed a strong emphasis on watershed protection by avoiding riparian zones and watercourses to the best extent possible. Compared to early versions of the mine plan, the mine phasing and external waste rock disposal areas (*i.e.*, the north and south waste rock disposal areas) was designed to reduce the size of the north rock disposal area and to minimize disturbance of the Blairmore Creek and Gold Creek watersheds. In regard to WBP populations, where possible, the mine development was designed to avoid the removal of trees if possible; however, based on the layout of the associated coal seams and required mine bench configuration to access the coal, complete avoidance of some WBP stands and/or individuals can not be incorporated into the mine plan.

iii) Describe how climate change may affect anticipated reclamation outcomes for rough fescue communities, whitebark pine, limber pine and vegetation species important for traditional use.

Response:

In the applications Air Quality Consultant Report (CR#1a), Table 5.14-1 (copied below) provided an abbreviated summary of climate parameters based on future high and low carbon predictions. The amount of change estimated is not beyond the range of tolerance for critical life history traits for most species present in the Montane and Subalpine regions of Alberta and is within the range of occurrence for the plant communities that are the target of the Projects reclamation plan.

Table 5.14-1 Projected Climate Parameters near Pincher Greek based on the Average of 12 GCMs (PCC 2016)

Parameter	Baseline Value (1961 – 1990)	High Carbon Prediction, 2050s	Low Carbon Prediction, 2050s
Number of Days above 30 °C	7.6	17.2	15.2
Number of Days below -30 °C	3.0	0.6	0.9
Precipitation (mm)	474.7	487.0	489.2
Total Winter	76.6	79.4	82.2
Total Spring	134.8	151.3	150.8
Total Summer	175.4	164.1	165.5
Total Fall	87.9	92.2	90.7
Frost Free Days	114.3	133.2	129.9

Species response to climate change will not be uniform with some benefitting, some potentially impacted, and others reduced in number or abundance. The reduction in a number or abundance of individual species within their communities may also occur indirectly; as changes to climate can result in changes in relative competitiveness of species within communities. For WBP and Limber pine, it is expected that across their range more habitat will become available at higher elevations as habitat at lower elevations becomes less suitable (Hamann and Wang 2006) due to expansion of lower elevation communities (*i.e.*, competition). The process of habitat shifting will occur slowly and long after the Project has been reclaimed.

Reclamation outcomes are driven by both opportunity (*e.g.*, suitable soil volume, nutrient and moisture conditions, propagules) and stochastic (*e.g.*, drought, fire, disease) conditions. Reclamation plans are typically updated every five years to reflect new, site specific knowledge and prediction of the opportunities that will be present at the time of execution. The amount of time from disturbance (mine advancement) to reclamation is too short for significantly altering reclamation plans as the target plant communities identified today will not change over such a short period. In ecological terms, the time from the initial project disturbance to reclamation is within one rotation (renewal to maturity) for the lodgepole pine forests that are the dominant plant community. In addition, species such as WBP are slow maturing and long lived (500 years or more), such that once established they will effectively resist change due to climate if the climate remains within the tolerable range for the species, and stochastic factors do not occur that are beyond the individual's ability to endure. Thus, the expected direct impact on individual species due to changes in climate parameters would be negligible.

As it relates to indirect effects, the most likely impact on both individual plant species and on reclaimed plant communities may be caused by change in the fire regime (Flannigan *et al.* 2005). Though fire is largely a stochastic process, the modelled changes in climate parameters are expected to increase the area burned each year and in many cases the frequency of fire as well. Where fire adapted species dominate, such as the pine forests in the Project area, it is expected that changes in the fire regime may act to maintain much of the forested areas in younger age classes with less area reaching old age. Because both Limber pine and WBP are not well adapted to fire and are slow to mature compared to other pine species, the indirect effect of climate change on the fire regime may over time reduce their numbers – particularly where they occur in mixed species stands. The total absence of fire is also a threat to limber pine and WBP as suitable regeneration space is not opened and competition prevents establishment from seed (Alberta Whitebark and Limber Pine Recovery Team 2014a, 2014b, ECCC 2017).

The draft federal recovery strategy for WBP (ECCC 2017) describes the effects of climate as follows:

> *"Climatically suitable habitat for Whitebark Pine is projected to shift under climate change scenarios, with negligible predicted net change in climatically suitable habitat as habitat lost is replaced by new habitat at higher elevations and higher latitudes (Hamann and Wang 2006). However, the ability of Whitebark Pine to respond to climate change through species migration or in-situ genotypic adaptation will lag behind the rate at which the climate is anticipated to change, owing to its requirement for suitable microsites for establishment, and slow growth rate to maturity. Recovery needs of Whitebark Pine will require that potentially suitable habitat for growth is identified within predicted suitable climate envelopes, to facilitate assisted migration trials or operational migration plantings where appropriate. All restoration activities must address how natural or planted Whitebark Pine will survive under the constant threat of White Pine Blister Rust."*

Rough fescue has a complex response to fire and may be reduced where fire is excluded allowing fuel to build up resulting in increased fire severity and the spread of competing woody species (Fleenor 2011, Bailey and Anderson 1978). Rough fescue is tolerant of fire during the dormant season and an alteration of the fire regime due to climate change will favor the open forest grassland communities where rough fescue is found. However, fire may not result in an increase in in rough fescue if the occurrence of fire during the growing season increases.

For species listed as important for traditional use, abundance post reclamation is dependant on successful establishment of the communities in which they occur. Again, a change in climatic parameters due to climate change is not anticipated to result in wholesale changes in plant communities, particularly since the natural communities already present are driven largely by terrain (slope and aspect) and occur across naturally steep gradients in local and micro climate. As described for WBP, Limber pine and rough fescue it is the anticipated indirect effect of climate change on the fire regime that may have the largest impact on individual species abundance. Since there is no suit of exotic replacement species waiting to invade, the effects of climate change will be manifest as changes in relative species abundance within communities, and over time as changes in relative abundance of communities across the landscape.

iv) Describe how climate change may affect anticipated reclamation success of reclaimed wetlands in the project area.

Response:

The predicted changes in the amount of precipitation are provided in Table 5.14-1 (copied above). The total amount of precipitation is expected to increase with more precipitation in the spring and less in the summer. Less precipitation in the summer may lead to increased moisture loss late in the season and stress on wetland communities. The reclaimed wetlands planned for the Project are in low receiving landscape positions and intended as treed wetlands (initial target is swamp). Once established swamps are the least sensitive to reduced water levels during late summer. Swamps are typically flooded in the spring and without surface water for significant periods during the growing season (ESRD 2015). Tree growth within swamps is generally improved when the rooting zone is not saturated during the summer.

References:

Alberta Environment and Sustainable Resource Development (ESRD). 2015. Alberta Wetland Classification System. Water Policy Branch, Policy and Planning Division, Edmonton, AB.

Alberta Whitebark and Limber Pine Recovery Team. 2014a. Alberta Whitebark Pine Recovery Plan 2013-2018. Alberta Environment and Sustainable Resource Development. Alberta Species at Risk Recovery Plan No. 35. Edmonton, Alberta. 61 pp.

Alberta Whitebark and Limber Pine Recovery Team. 2014b. Alberta Limber Pine Recovery Plan 2014-2019. Alberta Environment and Sustainable Resource Development. Alberta Species at Risk Recovery Plan No. 35. Edmonton, Alberta. 61 pp.

Bailey, A.W., and Murray L. Anderson. 1978. Prescribed Burning of a Festuca-Stipa Grassland. Journal of Range Management 31(6) 446-449.

Environment and Climate Change Canada (ECCC). 2017. Recovery Strategy for the Whitebark Pine (Pinus albicaulis) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. viii + 54 pp.

Fleenor, R.A. 2011. Plant Guide for mountain rough fescue (Festuca campestris). USDA-Natural Resources Conservation Service, Spokane, WA 99201

Future area burned in Canada. 2005. Flannigan, M.D.; Logan, K.A.; Amiro, B.D.; Skinner, W.R.; Stocks, B.J. Climatic Change 72(1-2): 1-16.

Hamann, A. and T. Wang. 2006. Potential effects of climate change on ecosystem and tree species distribution in British Columbia. Ecology 87: 2773-2786.

114. Section F.3.2.4 Page F60, Appendix A PDF Page 1014, Figure F.3.6-8

Benga has outlined small areas which will be targeted for establishment of foothills rough fescue communities but does not indicate how large each unit is and what the criteria will be for establishing these communities.

Benga lists direct placement as a preferred method of re-stablishing foothills rough fescue communities in the reclaimed landscape. However section F.3.2.4, also states that the foothills rough fescue dominant grasslands are expected to be disturbed early in the mine development from Year 1 through to Year 5. During that time reclamation will occur in the south waste rock disposal area.

a) Provide a rationale for determining where rough fescue populations will be established.

Response:

The rationale for the determination of where rough fescue populations will be established as shown Section F, on Figures F.3.6.4, F.3.6.7 and F.3.6.8, is based on a variety of factors. The primary rational for the location of rough fescue communities is based on observations during the field assessments for the EIA of the occurrence of dominant rough fescue communities and areas where it occurred as a subdominant species in open and closed forest. It is also based on factors such as topography, aspect, and moisture conditions, and the targeted trajectory of the expected ecosites in Section F, Table F.3.6-2. Opportunities that may arise during reclamation on valley bottoms and dry level and south facing mid-slopes that may support populations of rough fescue would also be a consideration.

Specific opportunities to align the disturbance of the foothills rough fescue dominated communities with the availability of areas scheduled to be reclaimed will be pursued and considered before all other mitigation.

b) Discuss how Benga plans to employ direct placement practices to encourage rough fescue establishment when later year soil salvage operations will occur in areas devoid of rough fescue communities.

Response:

As stated in Section F, Section F.3.6.3.2, Benga will identify opportunities for direct placement of salvaged reclamation material. The scheduling of direct placement opportunities is limited to having recontoured lands available in proximity to reclamation material salvage areas. Direct placement practices to encourage rough fescue would be limited to dry, south-facing mid slopes in reclaimed areas where rough fescue communities have been established and there is a rough fescue seed bank in the stored topsoil piles. As indicated in Section F.3.2.4, areas where direct placement is targeted will be further supported by other seeding and maintenance techniques to ensure soil stability and vegetation establishment of the desired communities is achieved.

Areas devoid of rough fescue communities will be reclaimed as close as possible to the target ecosite; however, as indicated in Section F.3.2.4 direct placement of salvaged reclamation material will be prioritized, when opportunities exist, to promote foothills rough fescue and native grassland establishment. The viability of establishing rough fescue in these devoid areas will be determined based on the evaluation of reclaimed moisture conditions, topographic position, aspect and expected ecosite. Establishment measures such as seeding of rough fescue in the seed mixes in Table F.3.6.3 or planting of rough fescue plugs in these devoid areas will also be considered.

115. Section F.3.6.2 Page F-69

Benga states, "The surge and sediment ponds will be developed into treed wetlands.

a) Provide a conceptual design for the wetlands including the expected class, area and depth of each wetland unit.

Response:

The surge and sediment ponds will have the berms in the respective ponds removed once water levels have been tested for water quality and meet all regulatory requirements. Maintenance of water levels are described in Section F.4.4.3 on page F-91. Wet areas that will remain after the berms have been removed will be seeded to the treed wetland mix (seed mix #5) described in Table F.3.6.3 on page F-76. White clover will not be included in the mix and will be replaced by an additional 5% cover of fowl bluegrass. Woody species such as black spruce, white spruce and willow will also be planted along the perimeter of the open water areas in the reclaimed pits. Open water areas that remain will be seeded with emergent vegetation such as water sedge, small-bottle sedge, and awned sedge. The topsoil replacement plan for surge and sediment ponds is described in Section F.3.6.2, page F-65.

b) Provide Benga's plans for ensuring that water quality in reclaimed wetlands meet acceptable water quality standards.

Response:

Water collected in surge ponds will be treated as described in Section F.4.4.1. Section F.3.6.2 on page F-65 states that "the surge ponds and end pit lake that will remain as part of the final reclamation landscape will have mineral soil placed around the perimeter and the surge and sediment ponds will be developed into treed wetlands". The vegetation that establishes will help trap sediments carried by surface water flow into the newly created treed wetlands. Section F.2.2 on page F-35 states that "the remaining areas will have final surface reclamation completed once the surge ponds have measured selenium levels that are within allowable discharge limits and can be released to the environment without further treatment. Once no longer needed the surge ponds will be removed and reclaimed". No water quality issues are anticipated.

The initial wetland type for the reclaimed treed wetlands will be treed swamp because they will be established on mineral soil. At reclamation, the berms and earthworks for the ponds will be removed or reduced to a permanently stable level. The final water depth of the wetlands within the pond boundaries is expected to be at or near the ground surface supporting swamp and fen tree species. Where it existed prior to pond construction, the channel will also be restored through the pond areas. Restoration of the drainage channel to fit with surrounding terrain may also result in some minor inclusion of fringe marsh and riparian wetland communities. The expected area of treed wetlands is provided in Section F, Table F.4.3-1 page F89.

116. Section F.3.6.3, Table F.3.6-1, Page F-71

Benga's reclamation plan includes a commitment to reclaim legacy disturbance from previous mining operations. This includes all anthropogenic cover classes found within the Project footprint. Table F.3.6-1 indicates that all previous anthropogenic types will be reclaimed to anthropogenic classes.

a) Discuss Benga's plans for reclaiming linear features (e.g. CL, AIH) and non-linear (e.g. CC, CO) features that will not be left on the landscape.

Response:

Existing linear features within the proposed pit boundaries or rock disposal areas will be incorporated into the larger reclamation activities including final contouring and soil placement. Thus, these existing linear features will be completely removed from the landscape after reclamation.

Where roads and other linear disturbance features are outside the pit and rock disposal areas reclamation will include:

- removal of fill and any haul road culverts;
- restoration of stable, non-erosive surface with final grading and contour matching to ensure restoration of natural surface drainage, wherever possible;
- soil placement with initial target of 0.2 m average depth (note: roads are included in Project reclamation material balance); and
- revegetation to a vegetation community consistent with adjacent undisturbed lands.

As described in Section F (Section F.3.6.3.3), natural recovery is a viable means of reclaiming linear features where they are within 25 m of a desired plant community. This is particularly appropriate for linear disturbances where the vegetation was cleared but the soil left in place (*e.g.*, overhead power line corridors). Under these circumstances natural regeneration would be monitored. Based on results of monitoring, planting and control of competing vegetation to support natural regeneration will be undertaken if required.

b) Assign a reclaimed ecological class other than anthropogenic to pre-mine anthropogenic features that will be reclaimed.

Response:

As mentioned in SIR 116a of this supplemental information question, the existing anthropogenic disturbances that are within the pit or rock disposal areas will be completely removed from the landscape during operation of the mine. In Section F, Figures F3.6-1 to 3.6-7 show the progression of reclamation and the final reclamation units for all disturbed areas including pre-mine anthropogenic areas. Table F.3.6-1 (copied below), provides a correlation of pre-mining ecosite phases to the assigned reclaimed ecological units.

Table F.3.6-1 Correlation of Pre-Mining Ecosite Phases to Reclaimed Ecological Units

Pre-Mine Ecosite Phase	Reclaimed Ecological Unit
Montane:, b1, c1, c2, d2, d3, e1, e3	Closed Conifer Forest
Subalpine: a1, b1, e1, e2, e3, e4, f1, f2, h1	
HG, SO[1], SC[1]	Grassland Open Forest
Montane: a1[1]	
Subalpine: d1	
Montane: b2, b3, c3, c4, d1, e2, f1, g1, g2	Mixed Forest
FONG/MONG[1], FONS[1], FTNN[1] & STNN[1]	Treed Wetland
Subalpine: g1[1], h2[1]	
NWF, NWL, NWR (WONN) [1]	Open Water
NMR	Barren Land
AIH, AII[1], AIM, ASC, CC, CIP, CIW, CL, CO, CP	Various; reclaimed ecological units consistent with adjacent units or larger reclaimed units at time of reclamation. (Figures F3.6-2 to F3.6-7)

[1] Ecosite Phase or AVI Unit mapped outside of the Project Footprint but within the terrestrial LSA

117. Table F.3.6-3 Page F-77

Table F.3.6-3 provides proposed conceptual seed mixes and seeding rates for the Project.

a) Seed mix #4 includes slough grass and is targeted for mixed forest stands. Slough grass (Beckmannia syzigachne) is a saline tolerant species that thrives in wet environments such as marshes and sloughs.

   i) Justify the inclusion of slough grass in seed mixes targeted for mixed forests or update the table of seed mixes to exclude slough grass.

Response:

For the development of the Project's C&R Plan, Benga contacted AEP representatives for input into the proposed seed mixes and to confirm AEP seed mix expectations. The AEP indicated that the expectation is that Operating Ground Rules for the C5 FMU (ASRD 2012) be followed, and that final specific seed mixes be discussed prior to seeding". This expectation was presented in Section F, Section F.3.6.3, Page F-76.

The mixed forest ecological unit is identified in Section F, Table F.3.6-1 as including the e2 (shrubby wet meadow), g1 (graminoid fen) and g2 (shrubby fen) ecosites. Sloughgrass would be appropriate for use on those sites but would not be planted on montane, b2, b3, c3, c4 and d1 ecosites. The *Native Plant Revegetation Guidelines for Alberta* (2001) suggests using tufted hairgrass on moister sites in the subalpine and montane natural regions; therefore, conceptual seed mix #4 will be updated to exclude the 5% sloughgrass and replace it with 5% tufted hair grass (see revised table below).

Table F.3.6-3 provides the revised conceptual seed mixes and seeding rates proposed for the Project.

Table F.3.6-3 Revised Conceptual Seed Mixes

	% by wt
1a. Direct placement monoculture (15-35 kg/ha, no fertilizer)	
Foothills rough fescue	60
Annual ryegrass	40
	100
1b. Direct placement (50 kg/ha, no fertilizer)	
Annual ryegrass	65
Tufted hairgrass	8
Slender wheatgrass	25
Ticklegrass	2
	100
2. Grassland, Open Forest (60-70 kg/ha)	
Foothills rough fescue	15
American vetch	5
Awned slender wheatgrass	10
Annual ryegrass	40
Mountain brome	10
Junegrass	10
Richardson needlegrass	5
Columbia needlegrass	5
	100
3. Closed Conifer Forest (60-70 kg/ha)	
Foothills rough fescue	10
Fringed brome	10
Tufted hairgrass	15
Awned slender wheatgrass	15
American vetch	5

Table F.3.6-3 Revised Conceptual Seed Mixes	
Annual ryegrass	40
Ticklegrass	5
	100
4. Mixed Forest (60-70 kg/ha)	
Foothills rough fescue	10
Fringed brome	5
Tufted hairgrass	5
Awned slender wheatgrass	10
American sweet vetch	2
American vetch	3
Annual ryegrass	40
Ticklegrass	5
Fowl bluegrass	5
Tufted hairgrass	5
Streambank wheatgrass	10
	100
5. Treed Wetland (60-70 kg/ha)	
Streambank wheatgrass	10
Tufted hairgrass	20
Fowl bluegrass	25
Annual ryegrass	45
	100

b) Seed mix # 5 includes white clover (Trifolium repens). White clover is a native of Europe and Asia and is not native to Alberta.

ii) Update Table F.3.6-3 to remove white clover from the proposed seed mix for treed wetlands.

Response:

White clover will be removed from the conceptual seed mix #5 for treed wetlands. The 5% of white clover that is removed will be added the amount of fowl bluegrass (refer to revised table provided in response SIR117a).

118. Section F.4.5.7, Table F.4.5-1, Page F-97

Benga presented a table indicating the conceptual characteristics of the end pit lake in the closure landscape. Benga also stated that a portion of the end pit lake will be contoured to provide wetland area.

a) Provide the maximum and average depth of the littoral zone.

Response:

Table F.4.5-1 (copied below) identifies the Littoral Zone (ha) to comprise 10% of the end pit lake and be equivalent to 1.8 ha in surficial area. The littoral zone would be at a maximum of 3 m. The average depth and width across the littoral zone will vary depending on contouring along lake edge.

Table F.4.5-1 Lake Characteristics

Water level (m)	1,700
Lake Surface Area (ha)	18.4
Maximum Depth (m)	105
Average Depth (m)	36
Lake Volume (x 1,000 m^3)	6,500
Littoral Zone (ha)	1.8
Littoral Zone (%)	10.0
Drainage Area including lake (km^2)	1,032
Mean Annual Outflow (mm/yr)[1]	738

[1.] No surface outlet, discharge will flow subsurface through saturated backfill zones for treatment and Se removal.

b) Provide a list of vegetation species that will be used for revegetation of the littoral zone.

Response:

Based on a study (Hatfield 2014) of similar end pit lakes (EPLs), Benga propose to allow the littoral zone to establish through natural generation. Hatfield (2014) found through abundance and composition (taxonomic richness) macrophyte and bathymetry surveys on nine existing EPLs in the Upper Foothills Natural Subregion that macrophyte colonization begin in shallow areas (0 - 1.5 m). It was observed that after five years macrophyte growth only occurs in areas greater than 1.5 m. Biovolume of macrophytes generally increases with age, with colonization of macrophytes being greater in shallow areas of the lake then moving deeper more gradually.

Hatfield (2014) found that taxonomic richness of macrophyte communities in EPLs in the Upper Foothills Natural Subregion increases significantly with the age of the EPLs. In the study, the youngest EPL (Pit 122 – 4 years) had no vegetation growth, suggesting EPLs require a minimum of 4-5 years to begin developing macrophyte communities. It was observed that an increase in taxonomic richness of macrophyte communities occurred with age at greater depths. The highest taxonomic richness and the greatest increase in macophyte establishment for both biovolume and taxonomic richness occurred after 10 years (Hatfield 2014).

Based on this study, vegetation establishment in the shallow portions of the EPL should occur along the fringe of the EPL five years after the lake elevation achieves a sustainable water elevation. Through adaptive management, if after five years the establishment of macrophyte communities has not occurred, the conservation and reclamation plan will be re-evaluated to assist in the development of vegetative communities in the EPL. Hatfield (2014) recommended that if manual planting is undertaken in should occur in shallow sheltered areas of the EPLs.

Reference

Hatfield Consultants (Hatfield). 2014. Marcophyte and Bathymetry Surveys in End-Pit Lakes in the Coal Valley Mine Area. Prepared for Coal Valley Resources Inc.

119. Appendix A, Figure F.3.6-8

Benga has presented a closure landscape map that contains broad ecological units used to map the regional study area (RSA). The regional study area was mapped and described at a spatial scale not representative of how the project would directly and indirectly affect upland, riparian and wetland vegetation communities resulting from the project. No field verification occurred for the RSA. The project footprint and LSA were mapped at the ecosite phase level, a spatial scale that more accurately represents the ecological communities of the surrounding vegetation communities. This scale also would more accurately describe equivalent land capability at closure.

a) Provide a conceptual closure landscape map that includes ecosite phases and wetland types as described at baseline.

Response:

Section 3.2.8 [B] of the Terms of Reference for Environmental Impact Assessment Report, Benga Mining Limited, Grassy Mountain Coal Project (AER 2015) requires that a map of the predicted ecological land classification for the post-reclamation landscape be provided. The appropriate level of detail for reclaimed ecological land classification is not ecosite phased due to the significant amount of overlap between ecosites (*e.g.*, montane c, d, and e, all can occur on mesic and rich sites with pine aspen and spruce as dominant canopy species) and ecosite phases (*e.g.*, e1, e2, e3 all occur on the same range of site moisture and nutrient conditions differing primarily in relative abundance of species). Providing a predicted ecosite phase map for a reclaimed landscape would not be appropriate. Table F3.6-1 shows the ecosite phases associated with each reclaimed ecological unit.

A.4.2. TERRAIN AND SOILS

120. Section C.7.6.10, Page C-135

Historic activities have occurred on 372.6 ha of the Project area. Benga indicates "The coal and any related debris from previous workings (timbers, rail etc.) will be separated prior to being processed. Typically, this material is treated as overburden and will be disposed of in ex-pit rock disposal areas." Benga does not discuss other types of impacts (contamination) that may be encountered during their Project operations. Depending on the type of material encountered, disposal in the ex-pit rock disposal areas may not be appropriate.

a) List potential sources of contamination from historic activities.

Response:

Upon investigation of historic activities sites no contamination was found. On behalf of Benga, SRK Consulting (Canada) Inc. were contracted to conduct a geochemical characterization of mine wastes for the Project including legacy (existing) waste rock and waste products from historic activities (Appendix 10A).

Results of the assessment found that no contaminations were found nether in waste rocks from historical activities nor in water from seeps drained from legacy waste dumps. No significant differences between historical activities waste rock and in-situ overburden material were found. This material will be treated as overburden and will be disposed of in ex-pit rock disposal areas.

b) Provide a summary of any known contamination from historic activities.

Response:

See response SIR 120a.

c) Describe the process Benga will employ to assess locations of historic activity for potential contamination.

Response:

See response SIR 120a.

121. Section F.2.1.5, Page F-25 CR#7, Section 3.3.5, Page 27 CR#7, Table 3.3-4, Page 27 CR#7, Table 4.1-1, Page 33 CR#7, Section 4.1, Page 31 CR#7, Table 4.1-2, Page 39 CR#7, Figure 2.1-3

Benga states, "Approximately 3.3 million m3 of reclamation material is available to be salvaged which will facilitate an average reclamation material placement depth of 20 cm on reclaimed lands." A total of 4.0 million m3 of reclamation material on the Project area was calculated using the extent of soil map units in Table 3.3-4 and the average depth of upland surface soil provided in Table 4.1-1.

Based on these calculations an estimated 700,000 m3 of reclamation material will not be salvaged. Figure 2.1-3 illustrates areas where soil salvage will not occur due to steep slopes. Reclamation suitability ratings are provided in Table 4.1-2 and there are soil models that have one or more soil horizons rated as unsuitable. It is unclear if the volume of reclamation material available for salvage calculations includes the soil models with unsuitable reclamation suitability ratings

Benga calculated a surplus for their reclamation material balance. However, during operations there are often unplanned events that result in a loss in available reclamation material (i.e. slope wall instability and inability to salvage reclamation material due to safety concerns,).

a) Provide an update to Table 3.3-4, for the LSA, to include: the estimated upland surface soil available for each soil map unit, and the area available for salvage (removing areas with steep slopes or other restrictions).

Response:

The estimated upland surface soil available for each soil map unit, and the area available for salvage are provided in Table SIR 121-1.

Table SIR 121-1 Soil Map Unit Areas and Salvageable Soil Volumes

Soil Map Unit (SMU)	Area (ha)	Soil Stripping Area (ha)	Salvageable Deep Organics Volume (m^3)	Salvageable Upland Surface Soil Volume (m^3)	Total Salvageable Reclamation Material (m^3)
CON5/FGt (3-4)	1.7	1.7	0	4,127	4,127
DNL1/Ol (1-2)	15.8	15.8	315,216	0	315,216
FVCP16/Cw/Ri (7-8)	36.0	27.6	0	69,083	69,083
FVCP16/Cw/Ri (8-9)	22.7	1.8	0	3,503	3,503
FVCP4/Cw/Ri (5-6)	14.6	14.5	0	21,736	21,736
FVCP4/Cw/Ri (6-7)	214.9	208.4	0	520,995	520,995
FVCP4/Cw/Ri (7-8)	24.6	15.8	0	71,012	71,012
FVCP4/Cw/Ri (8-9)	75.7	22.5	0	90,022	90,022
FVHE4/Cw/Ri (7-8)	0.3	0.2	0	567	567
FVNK16/Cw/Ri (6-7)	24.1	23.3	0	46,639	46,639
FVRD5/Cw/Ri (6-7)	32.0	31.4	0	47,091	47,091
FVRD5/Cw/Ri (7-8)	311.8	171.9	0	515,849	515,849
FVX4/Cb/Ri (7-8)	32.1	28.7	0	100,458	100,458
FVX4/Cw/Rh (5-7)	33.8	32.5	0	97,564	97,564
FVXfi11/Cw/Ri (6-7)	31.3	28.9	0	130,090	130,090
FVXfi11/Cw/Ri (7-8)	122.6	97.7	0	390,793	390,793
HDFR18/Fl (1-3)	3.5	3.5	0	6,923	6,923
HDTB18/Fi (3-4)	22.8	22.8	0	68,283	68,283
HDTB18/Ft (3-4)	4.2	3.6	0	5,379	5,379
MTF20/Ol (1-2)	3.1	3.0	14,831	0	14,831
NKRD1/Ui (7-9)	2.5	1.3	0	1,879	1,879
NS/Cw/Ri (7-8)	27.8	17.0	0	0	0
NS/Cw/Ri (8-9)	6.1	0.7	0	0	0
SPgrWL1/Mb/Ri (4-5)	6.9	6.9	0	27,726	27,726
SPgrWL1/Mb/Ri (5-6)	15.7	15.1	0	60,486	60,486
SPgrWL1/Mw/Ri (5-6)	3.6	3.5	0	14,152	14,152
SPgrWL1/Mw/Ri (5-7)	31.4	28.4	0	113,630	113,630
SPLT4/Mw/Ri (6-7)	2.4	2.4	0	8,422	8,422
SPR1/Mb/Ri (5-6)	55.0	46.9	0	234,424	234,424

Table SIR 121-1 Soil Map Unit Areas and Salvageable Soil Volumes

Soil Map Unit (SMU)	Area (ha)	Soil Stripping Area (ha)	Salvageable Deep Organics Volume (m^3)	Salvageable Upland Surface Soil Volume (m^3)	Total Salvageable Reclamation Material (m^3)
SPR1/Mb/Ri (6-7)	16.1	16.1	0	80,449	80,449
SPR1/Mw/Rh (4-6)	1.7	1.7	0	8,336	8,336
SPRgr1/Mb/Ri (5-6)	21.4	0	0	0	0
SPRgr1/Mw/Rh (6-8)	8.6	1.2	0	4,612	4,612
SPRgr1/Mw/Ri (6-7)	47.5	47.4	0	236,853	236,853
SPRgr1/Mw/Ri (7-8)	6.1	5.8	0	23,042	23,042
TUCD1/Mv/Ri (6-7)	3.8	3.7	0	12,996	12,996
TUCD1/Mv/Ri (7-8)	0.6	0.6	0	2,538	2,538
ZDL	235.9	0	0	0	0
ZWA	0.1	0	0	0	0
Totals[1]	1,520.7	1,102.0	330,047	3,019,660	3,349,707

[1] Due to rounding of values, totals may not equal the sum of the individual values presented in the table.

b) Discuss potential events that could lead to loss of reclamation material and how Benga plans to prevent each type of event.

Response:

Potential events that could lead to loss of reclamation material are discussed in the soils assessment, CR#7, Section 7.1.1. Mitigation measures showing how Benga plans to prevent negative events are provided in CR#7, Section 7.1.3.

122. Section F.4.4.1, Page F-91

Section F, Appendix A, Figure F.1.2-1 CR#7, Section 2.1.1, Page 6

CR#7, Table 2.1-1, Page 6

The surface disturbance for the reclamation material stockpile is 38% of the Project disturbance as provided in Table 2.1-1. Haul distance, logistics and quality of reclamation material are at risk by having only one stockpile location.

Benga does not provide sufficient information on how access to the reclamation material stockpile will be maintained and risks considering the proximity to the coal handling processing plant.

Based on the figures provided, it appears there will only be one reclamation material stockpile for the Project. It is not apparent if there will be segregation of reclamation material within the stockpile area. It is not clear if suitable overburden will be selectively salvaged and stored in the reclamation material stockpile footprint.

a) Discuss if the reclamation material stockpile will have designated areas for different material type (mineral, organic, suitable overburden).

Response:

Reclamation material stockpile will consist of upland surface soil with small amount of deep organic material. The entire Project have only approximately 330,047 m^3 of the deep organic material. This material will be stored together with upland surface soil.

As indicated in Section F, Section F.3.5 of the Conservation and Reclamation Plan, the in situ overburden has been analyzed for reclamation suitability and most of the samples have been rated as suitable for reclamation. Overburden material will not be separately salvaged. All overburden material will be sampled prior to reclamation material placement to determine the suitability of the material and unsuitable material will be covered by at least 1 m of suitable material prior to replacement.

b) If the reclamation material is stored in one common stockpile, discuss the risks to reclamation material quality from having it located in one stockpile and how the risks will be monitored, minimized and mitigated.

Response:

As indicated in Section F, Section F.1.2 of the Conservation and Reclamation Plan, the development and reclamation of the mine project will be phased over time and will allow for implementation of a progressive reclamation program.

Benga will put temporary soil stockpiles, on previously mined-backfilled areas, where practical to prevent long distance hauling. The temporary soil stockpiles will be constructed as follows:

- soil will be stockpiled separately from overburden and other materials;
- stockpile foundations will be stable;
- stockpiles will be stabilized to control water and wind erosion;
- stockpiles will be constructed out of the way of surface water flow;
- stockpiles will be accessible and retrievable; and
- all stockpiles will include signage that indicates the type of reclamation material.

As indicated in Section F.3.6 of the Conservation and Reclamation Plan, as mining operations on certain areas of the mine are finalized, the areas will be graded and contoured in preparation for reclamation material placement as part of final reclamation plan. Reclamation material will be sourced from active mining areas if direct placement opportunities exist or will be hauled from stockpile locations on the mine. As part of the progressive reclamation program, direct placement of salvaged reclamation material will be prioritized for recontoured areas of the completed mining area as they become available for reclamation and as areas of new development have reclamation material salvage operations conducted.

The reclamation program will result in the formation of a mosaic of reclaimed areas with multiple end land uses across the mine site. This process allows for the earliest reclamation possible, thereby reducing erosion and increasing the opportunities for direct placement of reclamation material and storing less in stockpiles.

c) Discuss the risk to the reclamation material from having the stockpile area located next to the coal handling processing plant and infrastructure area and methods for maintaining access.

Response:

Stockpiles were placed in strategic location in order to be accessible and retrievable through the life of the project via planned haul roads. The coal processing plant modules will be contained within an enclosed area and all coal material handling will be *via* covered conveyors. Benga has introduced mitigative measures to reduce emissions from infrastructure provided in the Air Quality assessment (CR#1, Section 6.6). Upon implementation of mitigative measures risk of degradation of reclamation material stored in the stockpile area will be minimal.

123. Section F.4.4.1, Page F-91 CR#7, Section 2.1.1, Page 6

Benga is proposing to conduct one lift for soil salvage (A horizons (if any, includes surface litter layer) and part or all of the B horizon). Salvaging the reclamation material in one-lift, as well as having only one reclamation material stockpile, will reduce the variability among reclaimed soil profiles.

Benga states, the blending of the A horizons and B horizons may be beneficial to soil quality in some instances depending on layer textures and nutrient levels. However, the nutrient analytical data is not comprehensive. Benga also states the salvage of the A horizons and B horizons will improve water holding capacity in higher elevations due to incorporation of finer material and organic debris into sandy soil. Benga does not discuss if the loss of soil texture diversity will impact the ability to reclaim to certain ecosites at the time of reclamation.

a) Based on the limited nutrient analytical data, provide a discussion on the dilution of nutrients and organic material with the proposed one-lift salvage of reclamation material.

Response:

The main goal for the reclamation program is to achieve land capability equivalent or higher than pre-disturbance conditions. In CR#7, Section 4.5.2 predicted post reclamation land capability ratings are discussed. One of the assumption made for the calculation of post reclamation ratings is forest litter (LFH), A and B horizons would be salvaged in one lift and blended to be used as a reclamation material. All SMUs contain the same or higher final capability ratings for reclaimed landscapes than compared to pre-disturbance conditions.

Section F, Table F.2.1-1 provides a comparison of reclamation suitability ratings of A and B horizons as well as blended together. All soils have similar reclamation suitability ratings for A horizons and blended A and B horizons.

b) Discuss how a consistent soil placement prescription (20 cm) of uniform texture across the reclaimed terrestrial area will create the diverse conditions for establishing a variety of ecosites.

Response:

Benga proposed average reclamation material replacement depth of 20 cm on reclaimed lands. Actual soil placement depth may not be a uniformed 20 cm and may vary. During salvage, storing and placement reclamation material of different texture will not be thoroughly blended and uniformed. It is expected that reclaimed landscapes will not be perfectly uniform; subsequently, diverse conditions will exist.

As indicated in Section F, Section F1.2 of the Conservation and Reclamation Plan, the development and reclamation of the mine project will be phased over time and will allow for implementation of a progressive reclamation program. As discussed in response SIR 121b, Benga will also utilize temporary soil stockpiles where practical; consequently, it is expected that reclamation material will not be uniform.

To enhance diverse conditions, direct placement of the reclamation material will be utilized for reclamation as mining operations on certain areas of the mine are finalized. Reclamation material will be sourced from active mining areas if direct placement opportunities exist, as stated in Section F3.6 of the Conservation and Reclamation Plan (Section F).

The potential effect to soil biodiversity and resulting ecological integrity of vegetation communities is discussed in the vegetation assessment (CR#7, Section 7.2). Soil diversity and ecological integrity may be decreased as a result of development but appropriate reclamation will allow for increased reclaimed soil profile diversity in the reclaimed landscapes. Over time, as reclaimed soil profiles develop, it is expected that soil and landscape biodiversity will increase as reclaimed profiles develop relative to landscape position, aspect, and slope.

124. Section F, Appendix A, Figures F.2.1-5, F.2.1-6 and F.4.1-6

CR#7, Section 4.5.2, Page 61

CR#7, Table 4.5-5, Page 62

Benga provided estimated reclaimed capability class for soil map units disturbed in the LSA (Table 4.5-5). Providing reclaimed capability class for soil map units implies they are salvaging and stockpiling soil from the map units separately, which does not correspond to the understanding of soil handling operations from the application. The decrease in reclaimed land capability variability is not surprising considering the loss of diversity in soil texture, reclaimed soil profiles and landscape topography (Figure F.4.1-6).

Figure 2.1-6 shows the soils LSA reclaimed land capability but does not show the land capability of the surrounding land. The figure would be more useful if it included the land capability of adjacent land (as in Figure 2.1-5) to show integration of the reclaimed landscape.

a) Elaborate on the soil salvage and stockpiling operations with respect to segregation of reclamation material based on soil map units.

Response:

The main limitations in terms of forest soil capability to soils within the Project include restriction of rooting zone by bedrock (subclass R), exposure (subclass U) and excess soil moisture (subclass W). Soil map units within the Project have no limitations that are related to salvageable material characteristics. They are mosaic in nature, and segregation of reclamation material based on soil map units is not practical. However, as discussed in responses SIR 121b and SIR 122b, progressive reclamation and direct placement will allow segregation of material within the Project to some extent.

b) Recalculate the estimated reclaimed capability class to reflect the soil salvage and stockpiling activities as discussed in (a).

Response:

Please see response SIR 124a.

c) Provide an updated Figure F.2.1-6 that includes the land capability of the RSA as well as the reclaimed soils LSA.

Response:

Figure 124-1 displays final land capabilities of landscapes within the LSA, as well as baseline ratings for surrounding land outside the Project footprint within the RSA.

d) Discuss the integration of the reclaimed landscape with the surrounding land outside the Project footprint and how Benga will ensure a natural appearance in the transition, especially with the reduced topographical diversity.

Response:

The natural variability and complexity of the existing terrain within the Project will not be duplicated by creation of re-contoured landscapes. The reclaimed landscape will be more homogenous than current conditions. However, the reclaimed landscapes will contain characteristics similar to the existing upland terrain. Similar aspects and slope lengths will exist and will include ridges, benches (plateaus) separated by terraces, valleys, and steep single slope inclines. A variety of wetland complexes will also be created during the reclamation of the Project. It is expected that the creation of a range of terrain types, during contouring and reclamation will provide a reclaimed terrain that will tie into adjacent undisturbed lands, provide suitable landscapes for the development of a range of reclaimed soil types and functioning vegetation communities.

Integration of the reclaimed landscapes with the surrounding land will be implemented through appropriate re-contouring of reclaimed landscapes to create topography and surface forms that provide appropriate surface drainage, blend with the adjacent undisturbed terrain (*i.e.*, drainage, aspect), remain stable, provide suitable habitat for the formation of diverse reclaimed soil and vegetation patterns in the reclaimed landscape, and meet the desired end land use objectives.

125. CR#7, Table 3.3-4, Page 27 CR#7, Section 7.2.4, Page 98

In the PDC case, residual environmental effects on soil diversity and ecological integrity are predicted to not be significant and partially reversible. Assumption for partially reversible is that soil placement will create soil landscape patterns appropriate for the desired end land uses.

Soil map units FVCP16/Cw/Ri(8-9); FVRD5/Cw/Ri(6-7); FVX4/Cw/Rh(5-7) are contained in the LSA, thus when the soils are disturbed, the soil map unit will be removed from the RSA. Benga did not mention the loss of soil map units and the impact on soil diversity for the LSA and RSA. The loss of soil map units may be of consequence if the soil map units are associated with any rare vegetation or vegetation communities.

a) Reevaluate the Project effects on soil diversity within the LSA and the RSA, considering soil map units will be removed from the LSA and only partially reversible.

Response:

After mining and reclamation of Project infrastructure there will be a permanent loss of organic landforms and the extreme slopes in the upland terrain will be reduced to a maximum slope angle of 23°. Permanent lost is expected for organic soil map units (MTF20 and DNL1) only. They cover approximately 18.9 ha or 1.2% of the LSA and 0.4% of the RSA.

Soils developed on extreme slopes with slope angle higher than 23° (that is approximately corresponds to slope class 8 and higher) are not unique for extreme slopes and are common for slopes less than 23°.

Soil diversity and ecological integrity may be decreased as a result of development but appropriate reclamation will allow for increased reclaimed soil profile diversity in the reclaimed landscapes. Upon implementation of mitigations outlined in the soils assessment, CR#7, Section 7.2.3, no change in soil diversity with respect to soil types and landscape patterns is expected from a regional perspective, and the Project is not expected to have a significant impact.

b) Provide an evaluation of the soil map units that will be removed by the Project and the overlap with known rare vegetation in the LSA.

Response:

After mining and reclamation of Project infrastructure there will be a permanent loss of organic landforms and the extreme slopes in the upland terrain will be reduced to a maximum slope angle of 23°. As indicated in the vegetation assessment, CR#8, Table 3.2-1, there were no rare plants found within the Project development with habitat conditions associated exclusively with organic landscapes or extreme slopes.

126. CR#7, Section 4.3.2, Page 50 CR#7, Table 4.3-2, Page 50 CR#7, Section 7.1.1.2, Page 87 CR#7, Section 7.1.1.2.2, Page 88 CR#7, Section 7.1.3.1, Page 90 CR#7, Section 7.1.3.2, Page 91 CR#7, Table 7.5-1, Page 110

Benga indicates that for bare soil, "Soil units in the Project would generally be at moderate to high risk of wind erosion." The time gap between vegetation removal and soil salvage will be of consequence for erosion by wind.

Benga discusses potential for soil erosion during reclamation "Within the LSA, approximately 42.1% (640.5 ha) of the area has a high risk of wind erosion and 77.9% (1,185.0 ha) of the area has a severe risk of water erosion (assuming no mitigation) prior to vegetation establishment." Soil erosion control measures will be implemented to minimize loss of soil materials. Proposed mitigation for loss of material includes suspension of soil handling activities under wet or windy conditions when the degradation of soil quality is a potential.

Benga discusses the wind erosion risk, however, they do not relate the risk to the Project location (in the Crowsnest Pass) and the operational challenges due to high winds/erosion risk. The impact rating is not significant despite being irreversible (Table 7.5-1).

a) Considering the Project location and the high risk of many soils in the LSA, justify the impact rating of not significant for impact on soil quality.

Response:

The potential for impacts resulting from soil erosion on soil quality do exists throughout the life of the Project; however, appropriate mitigation measures are able to minimize and mitigate risk of erosion and associated degradation of soil quality. In order to demonstrate that, calculation of soil loss due to erosion for soils within the Project with no mitigations and with mitigation implemented we made, and results are presented in CR#7, Table 4.3-1.

The potential impacts from legacy activities have been substantial in the form of erosion and sedimentation and continue to this day. It is Benga's intention during mining operations and at closure, to include all the legacy Grassy Mountain mining areas in the mitigation measures planned for the entire Project. This will result in an overall net positive improvement in the current conditions.

With appropriate revegetation and erosion control activities during the Project, implementation of direct placement and progressive reclamation it is expected that the soil loss due to erosion will be minimal and have a low effect on the soil resource.

b) Discuss how Benga will plan construction activities to ensure minimal time bare soil is exposed prior to salvage.

Response:

Benga plans the following activities to minimize or eliminate exposure of bare soils:

- minimize the overall disturbance footprint through the mine planning process. There may be opportunities to reduce the mine disturbance area through an adaptive management program;
- maximize the direct placement of salvaged soil to maximize the potential for quick vegetation establishment;
- maximize progressive reclamation to create suitable conditions for quick vegetation establishment;
- in areas where there will be minimal soil disturbance, such as powerline rights of way, the remaining vegetation may be mulched after the merchantable timber has been removed;
- stockpiles will be seeded with a non-invasive and weed free seed mix that establishes quickly;
- in moderate to high erosion risk areas around watersheds, a grass-legume cover is established immediately after soil placement to control erosion;
- erosion control materials (mats, netting, mulches, straw) will be used to reduce soil surface exposure, as required;
- reclaimed landscapes will be reseeded with a quick establishing; non-invasive cover crop;
- monitoring of stockpiled soils and reclaimed areas to ensure erosion is minimized; and
- based on monitoring results of reclaimed landscapes, adaptive management will be incorporated by Benga in order to allow for continual improvement of erosion control processes.

These mitigation and monitoring measures are detailed throughout the C&R Plan.

c) Discuss proposed criteria for suspension of soil handling activities.

Response:

Benga plans to suspend soil handling if adverse weather or ground conditions cause or may cause adverse effects on soil quality. If soil conditions become wet or frozen and will result in the mixing, loss or degradation of reclamation material, soil salvaging will be suspended during that period of time. Soil handling activities will also be assessed in dry windy conditions when excessive dust is being generated. Soil handling activities will be supervised by experienced professionals to assess conditions when the degradation of soil quality is a potential.

A.4.3. VEGETATION

127. Section F.1.9, Page F-17

Benga states, "Vegetation species identified during the Aboriginal Consultation process including TEK species (vascular and non-vascular) observed in the vegetation LSA during vegetation field surveys are provided in Table F.1.9-1. Additional species identified by Aboriginal groups outside of the systematic vegetation field surveys, are also provided in Table F.3.6-3."

Table F.3.6-3 does not show vegetation species. The table contains a ranking of TEK plant potential for the local study area (LSA).

a) Provide an updated Table F.3.6-3 to accurately depict species identified by Aboriginal groups outside of the systematic surveys.

Response:

All vegetation species identified during the Aboriginal Consultation process, including those in and outside the systematic vegetation field surveys, are provided in the Vegetation Consultant Report (CR#8), Table 3.6-1.

b) Provide a list of the species identified outside the systematic surveys.

Response:

See response SIR 127a.

128. Section F.2.1.6, Page F-30

Benga states, that species in high and very high TEK potential ecosite phases that will be impacted by the project include lodge pole pine, prickly rose, ground juniper, willow, aspen, balsam poplar, Saskatoon, thimbleberry, bearberry and dwarf birch. Benga further states that these species will be incorporated into the revegetation planning for the project.

a) Explain Benga's plan to incorporate the species above with high traditional use potential into reclamation planning.

Response:

See response SIR 128b.

b) Discuss the ecosite phases where the species are common and how Benga plans to enhance reclamation outcomes for those ecosite phases.

Response:

Within the Vegetation Consultation Report (CR#8), the ecosite phases where the TEK species are common are summarized in Table 3.6-2, as copied below. Three ecosite phases in the Montane Natural Subregion (c1, c4, and g1) and two ecosites phase in the Subalpine Natural Subregion (e1 and d1) were deemed to have high or very high TEK vegetation potential.

Table 3.6-2 Baseline Traditional Ecological Knowledge Vegetation Potential Within the Local Study Area

Ecosite Phase/AVI Code	Ecosite Phase Descriptions	Number of TEK Species Found in LSA	TEK Vegetation Ranking Results	
			Potential Ranking	Total Area in LSA (ha)
Montane				
a1	limber pine/juniper Fd-Pf	10	Low	52.5
b1	bearberry Pl	21	Moderate	221.9
b2	bearberry Aw	NA	Moderate	22.5
b3	bearberry Aw-Sw-Pl	NA	Moderate	33.8
c1	Canada buffalo-berry/hairy wild rye Fd	25	High	150.7
c2	Canada buffalo-berry/hairy wild rye Pl	18	Moderate	135.8
c3	Canada buffalo-berry/hairy wild rye Aw	23	Moderate	22.9
c4	Canada buffalo-berry/hairy wild rye Aw-Sw-Pl-Fd	38	High	173.9
d1	creeping mahonia – white meadowsweet Fd	15	Moderate	89.0
d2	creeping mahonia – white meadowsweet Pl	13	Moderate	593.5
d3	creeping mahonia – white meadowsweet Sw	NA	Moderate	25.7
e1	thimbleberry/pine grass Pl	19	Moderate	289.0
e2	thimbleberry/pine grass Aw	NA	Moderate	71.7
e3	thimbleberry/pine grass Se	NA	Moderate	78.2
f1	*balsam poplar Pb*	NA	Moderate	16.8
g1	horsetail Sw-Pb	29	High	49.7
g2	horsetail Sw	8	Low	35.5
Subalpine				
a1	lichen Pl	20	Moderate	11.5
b1	bearberry/hairy wild rye Pl bearberry/hairy wild rye Pl	16	Moderate	163.4
d1	*spruce/heather Se*	NA	High	0.8
e1	false azalea – grouse-berry Pl	53	Very High	998.6
e2	*false azalea – grouse-berry Pw*	NA	Low	3.4
e3	false azalea – grouse-berry Se	6	Low	212.6
e4	*false azalea – grouse-berry Fa*	NA	Low	19.9
f1	thimbleberry Pl	22	Moderate	107.2
f2	thimbleberry Fa-Se	NA	Moderate	47.6
h1	horsetail Se	2	Very Low	34.7

NA – not applicable (ecosite phase not surveyed).

[1] Ecosite phases are from Archibald *et al.* 1996 .

Note: Ecosite phases shown in *italics* are of limited distribution.

An excerpt from Section F, Section F 3.6.3 of the Project's Conservation and Reclamation Plan states:

> *"Benga has identified six ecological units occurring over the mine site, based on ecosite phases present in the Montane and Subalpine Natural Subregions (Table F.3.6-1). Many of the ecological units can be further broken down, based primarily on moisture (dry versus moist). Archibald's et al. (1996) ecosites do not conform exactly to the ecological units, for example, ecosite "c" can be broken into open coniferous, deciduous, and mixedwood ecological units. The ecological units do conform to ecosite phases. Additional ecosite phases for grassland and shrubland have come from Willoughby (2007)."*

The four ecosite phases that have been identified as having high or very high TEK vegetation potential are classified under the closed conifer forest (Montane c1, and Subalpine e1) and mixed forest (Montane c4 and g1) Reclaimed Ecological Units from Section F, Table F.3.6-1 (copied below).

Table F.3.6-1 Correlation of Pre-Mining Ecosite Phases to Reclaimed Ecological Units

Pre-Mine Ecosite Phase	Reclaimed Ecological Unit
Montane: b1, c1, c2, d2, d3, e1, e3	Closed Conifer Forest
Subalpine: a1, b1, e1, e2, e3, e4, f1, f2, h1	
HG, SO[1], SC[1]	Grassland Open Forest
Montane: a1[1]	
Subalpine: d1	
Montane: b2, b3, c3, c4, d1, e2, f1, g1, g2	Mixed Forest
FONG/MONG[1], FONS[1], FTNN[1] & STNN[1]	Treed Wetland
Subalpine: g1[1], h2[1]	
NWF, NWL, NWR (WONN) [1]	Open Water
NMR	Barren Land
AIH, AII[1], AIM, ASC, CC, CIP, CIW, CL, CO, CP	Anthropogenic

[1] Ecosite Phase or AVI Unit mapped outside of the Project Footprint but within the terrestrial LSA

Species identifies in the TEK can be found in multiple ecosite phases, not only in the ones listed as high or very high potential. The conservation and reclamation plan focuses on ecological units rather than ecosite phases. The reclamation plan focuses on slope, aspect, and moisture in determining the trajectory setting for reclaimed ecological communities. From that basis specific plant species can be identified that can be used for revegetation of each of the reclaimed ecological communities. Section F, Table F3.6-2 summarizes the specific plants that will be encouraged, and established through planting and natural recovery. Lodgepole pine, prickly rose, ground juniper, willow, aspen, balsam poplar, Saskatoon, thimbleberry, bearberry, and dwarf birch are all identified in Section F, Table F3.6-2 (copied below) as species that will be encouraged, and/or assessed in establishment through planting.

Table F.3.6-2 Target Species of Reclaimed Ecological Communities

Reclaimed Ecological Unit	Climactic Zone		Ecosite Expected (Montane)	Trajectory Setting	
	Topographic Position	Aspect		Naturally Occurring Plant Species to be Encouraged	Species to be Established – planting and natural recovery
CONIFEROUS, CLOSED FOREST					
dry	level, crest, upper to mid-slope	level, north, east, south	d	Shrubs: snowberry, creeping mahonia, white meadowsweet	Trees: lodgepole pine, white spruce Shrubs: green alder, prickly rose Forbs and Grasses: seed mix 1, 2
moist	midslope	all aspects	e	Shrubs: snowberry, Saskatoon, thimbleberry Forbs and Grasses: hairy wild rye, pine grass	Trees: lodgepole pine, white spruce Shrubs: prickly rose Forbs and Grasses: seed mix 3
GRASSLAND, OPEN FOREST					
dry	midslope	level and south	b	Shrubs: Canada buffalo-berry, bearberry Forbs and Grasses: hairy wild rye	Trees: lodgepole pine Shrubs: prickly rose, ground juniper Forbs and Grasses: seed mix 1, 2
moist	midslope	west	c	Shrubs: Canada buffalo-berry Forbs and Grasses: hairy wild rye, rough fescue	Trees: white spruce, lodgepole pine Shrubs: willow, prickly rose Forbs and Grasses: seed mix 3
MIXEDWOOD FOREST					
moist	mid- to lower-slope	south, east north	e + c	Shrubs: Canada buffalo berry, snowberry, Saskatoon, thimbleberry Forbs and Grasses: hairy wild rye, pine grass	Trees: aspen, balsam poplar, white spruce, lodgepole pine Shrubs: willow, prickly rose Forbs and Grasses: seed mix 3
TREED WETLAND					
moist	depression to level	level	h (Subalpine)	Trees: Engelmann spruce, dwarf birch	Trees: white spruce Shrubs: prickly rose Forbs and grasses: seed mix 4

In addition, from Section F, Section F3.6.3.2:

> *"Benga will undertake further consultation with the Aboriginal groups to initiate research and development to determine the potential efficacy of the use of the identified native plant species in the reclamation program. Revegetation targets will aim to include native vegetation species and establish communities that support TEK vegetation."*

Through Benga's adaptive management strategy, Benga can incorporate input from public engagement and aboriginal consultation programs, along with data from monitoring or reclamation and revegetation performance to modify their plans to continual to enhance the revegetation process.

c) Dwarf birch (*Betula pumila*) is not listed among the species that were found in the Local study area during vegetation surveys. Dwarf birch also thrives in organic wetlands and occasionally in shrubby or treed swamps. Discuss how Benga plans to introduce the species to the reclaimed landscape where it is not commonly found.

Response:

As described in response 128b, Benga will utilise adaptive management and consultation with aboriginal groups. Where wet conditions are present within the reclaimed areas, such as ponds, it may be possible to establish dwarf birch by planting, transplanting or seeding. Opportunity to establish dwarf birch may be limited by regulated seed zones and limits on transport distance and elevation changes for woody vegetation. These opportunities and limitations will form part of the ongoing consultations.

129. Consultant Report #8 Section 4.2, Page 130

Benga states, "Almost all of the field observations of whitebark pine occurred within the mine portion and north disposal area of the Footprint." Benga further reported occurrences of limber pine within the Project Footprint with one occurrence in the ultimate rock disposal extent and three in the ultimate pit extent". A total 21, 000 individuals of whitebark pine and nearly 1,000 limber pine trees were either growing in mixed stands or scattered at higher elevations.

Both white bark pine and limber pine are listed on the SARA list as endangered. While recovery plans exist for restoration of both species, their success has not been widely documented. Benga has assigned a no significance rating (after mitigation) to the effect of the project on rare plants including at risk species (SARA).

a) Provide justification for assigning a no significance rating to the impact to rare plants which includes limber pine and whitebark pine populations when existing literature indicates that due to the risk of failure to reclaim due to disease, pine populations within the project footprint may not be as successful as implied.

Response:

The estimate of 21,000 whitebark pine (WBP) trees within the footprint is intentionally conservative and includes estimates of juvenile trees and seedlings. Benga is committed to planting three times the number of trees removed from mining and to support establishment of disease resistant trees wherever possible as this is the key component of recovery. Tree plantation success will be assured by application of adaptive management, active participation/engagement with recovery plans and groups, and use of best management practices as they evolve over time.

Justification includes the high blister rust infection rate within the study area (mortality is occurring), the estimated 28.9 million WBP mature stems in Alberta and 44.4 million limber pine in Canada, and expected population decline from blister rust, mountain pine beetle, fire exclusion and climate change of 66% for WBP and 78% for limber pine over next 100 years. Loss of 21,000 trees from an area of high infection with subsequent mitigation that includes establishing 60,000 trees over a relatively short 30-year period of time (well within one natural disturbance rotation) is deemed to be not a significant impact. More assessment details and summary can be found in reply to part b of the question.

b) Provide the thresholds and scales used to determine the environmental significance of the Project's effects on other vegetation and wetlands VECs.

Response:

The following VC's were identified for the Project (CR#8, Section 2.4.2). A brief summary of assessment methods is provided in Table SIR 129-1. This is not an exhaustive list but was used to support project environmental effects assessments including ability to recover, magnitude, project contributions, confidence rating, and significance.

Table SIR 129-1 Vegetation Valued Components, Indicators and Decision Methods

VC	Key Indicator	Rationale for Indicator	Methods/Criteria/Thresholds/Residual
Vegetation Communities	Ecosite phases Communities of limited distribution	Baseline vegetation conditions are used for determining potential impacts to critical wildlife habitat, and other ecosystem components; and they are important for determining conservation and re-vegetation goals following Project closure.	Methods: • Mapping Criteria: • quantitative Threshold(s) used: • Yes. Loss of community • Yes. Natural disturbance (Fire) Residual effects if: • Unable to restore/reclaim • 100% loss in LSA or RSA • Reclaimed landscape will no longer support.

Table SIR 129-1 Vegetation Valued Components, Indicators and Decision Methods

VC	Key Indicator	Rationale for Indicator	Methods/Criteria/Thresholds/Residual
Rare Plants	*SARA*/COSEWIC listed species (*e.g.*, whitebark pine, limber pine) and all vegetation species included in Federal and/or Provincial Tracking Lists	A vegetation species is considered rare if it is uncommon or scarce. Rare species are generally considered threatened because of the inability for their small population size to recover from stochastic events. Rare plants contribute to biodiversity, may possess medicinal uses, are legally protected, and may be of spiritual or traditional value.	Methods: • Field investigation • Mapping • Records Criteria: • Quantitative • Qualitative (recovery plans for Whitebark pine, Limber pine) Threshold(s) used: • Yes. Removals relative to populations size. • Management objectives for listed species with recovery plans. Residual effects if: • 100% removal of potential from LSA • 100% loss historically known populations (LSA or RSA) • Reclaimed landscape will not support
Rangeland Resources	Fescue community grasslands	Rangelands are a source of water, wildlife, and forage for wildlife and livestock, and are important contributors of landscape-level biodiversity.	Methods: • Field investigation • Mapping • Records Criteria: • Quantitative • Qualitative (health, functions) Threshold(s) used: • Yes. Loss of community • Yes. Reduced area. Residual effects if: • 100% loss (LSA or RSA)) • Reduced abundance (LSA) • Unable to restore/reclaim • Reclaimed landscape will not support

Table SIR 129-1 Vegetation Valued Components, Indicators and Decision Methods

VC	Key Indicator	Rationale for Indicator	Methods/Criteria/Thresholds/Residual
Forest Resources	Timber productivity	Forests are a valuable resource because they help maintain air quality, store atmospheric carbon, provide habitat for wildlife, keep soil in place, filter and regulate water supplies, support recreational activities, and house valuable resources such as timber, fuel, and traditional medicinal, food and other use vegetation.	Methods: • Field investigation • Mapping • Records • Volume calculations Criteria: • Quantitative Threshold(s) used: • Yes. Loss of timber • Yes. Loss of productivity • Yes. Historical harvest Residual effects if: • Permanent reduction in growing stock (LSA) • Unable to restore/reclaim • Reclaimed landscape will not support sustainable resource use
Old Growth Forests	Age of a forest stand	Old growth forests have a complex structure which provides a large variety of habitat types for use by species with specialized requirements. These forests have the highest diversity of species, relative to other age classes, with representation of many rare species having their greatest abundance in old-growth stands. Vegetation species that require a long time for colonization and growth, such as lichens, are often only found in old-growth forest stands. Accumulation of large decaying wood, characteristic of old-growth stands, supports unique groups of wood-decomposing species, as well as shelter and food for many other species.	Methods: • Field investigation • Mapping • Records Criteria: • Quantitative Threshold(s) used: • Yes. Loss of age class • Yes. Historical harvest regime • Yes. Wildfire regime Residual effects if: • 100% removal (LSA or RSA) • Reclaimed landscape will not support return of old growth forest

Table SIR 129-1 Vegetation Valued Components, Indicators and Decision Methods

VC	Key Indicator	Rationale for Indicator	Methods/Criteria/Thresholds/Residual
Traditionally Used Species (TEK Vegetation)	Occurrence & distribution of vegetation valued by Aboriginal groups	Vegetation used by Aboriginal Groups for country foods, medicine, technology and other uses are valued and should be managed sustainably for future generations (UN 2008:11). The baseline abundance and distribution of TEK vegetation will serve as a benchmark for the sustainable management of TEK vegetation.	Methods: • Consultation with stakeholders (Treaty 7 First Nations) • Species of concern provided by Treaty 7 FN groups • Site visit • Records • Comparison with field survey and vegetation mapping • Predictive mapping Criteria: • Quantitative • Qualitative Threshold(s) used: • Yes. Loss of age class • Yes. Historical harvest regime • Yes. Wildfire regime Residual effects if: • 100% removal (LSA or RSA) • Permanent loss of TEK potential • Reclaimed landscape will not support TEK harvest
Wetlands	Obligate and facultative vegetation	Wetlands are highly valued and beneficial by virtue of their diverse functions that include water filtration; flood attenuation; wildlife habitat; moderating climates; storing nutrients and carbon; providing recreational and educational opportunities; and providing a source for subsistence and medicinal vegetation.	Methods: • Mapping Criteria: • Quantitative • Qualitative Threshold(s) used: • Yes. Loss of community type • Yes. Reduction of area Residual effects if: • Permanent reduction of wetland area • Unable to restore/reclaim

Table SIR 129-1 Vegetation Valued Components, Indicators and Decision Methods

VC	Key Indicator	Rationale for Indicator	Methods/Criteria/Thresholds/Residual
Biodiversity	Measures of abundance, distribution and variation in vegetation species and communities	Biodiversity is the degree of variation in biological species in a given area, and is a measure of the health of an ecosystem. Greater biodiversity implies greater health, and the reduction of biodiversity can adversely impact ecosystem integrity (composition, structure and functioning) and re-vegetation success.	Methods: • Mapping • Richness, relative abundance, diversity index • Predictive mapping (biodiversity potential) Criteria: • Quantitative • Qualitative (predictive mapping) Threshold(s) used: • Yes. Loss of species. • Yes. Loss of community type. • Yes. Natural disturbance (Fire) • Yes. Regional management objectives Residual effects if: • Permanent loss of species or community level diversity • Permanent loss of high biodiversity potential communities • Unable to restore/reclaim potential for return of high diversity communities
Habitat Fragmentation	Measure of all landscape areas that are divided by human disturbance	Forest fragmentation is one of the greatest threats to the biodiversity of forests. Fragmented areas are less likely to support viable populations (especially of large vertebrates) due to edge effects that alter conditions, including increases in some species and decreases in others. The effect of fragmentation on the vegetation and wildlife of a forest depends on a) the size of the patch, and b) its degree of isolation.	Methods: • Mapping • Predictive mapping • Fragmentation statistics Criteria: • Quantitative • Qualitative (relative to historical management and current regional forest management objectives) Threshold(s) used: • Yes. Regional management objectives • Yes. Natural disturbance regime (Fire) Residual effects if: • Permanent increase in fragmentation • Fragmentation exceeds regional management objectives • Unable to restore/reclaim contiguous patches (LSA) • Unable to restore landscape connectivity (LSA)

Assessment Context (Terrain)

Due to the nature of the project it is assumed that there are no partial or gradations in effects on vegetation. The assessment made a conservative assumption that vegetation for all areas shown within the project footprint, would be removed. This includes access roads and rail lines.

The Project is located in the Rocky Mountain Natural Region, which is characterized by highly variable topography, geology, and vegetation. The Project crosses both Montane and Subalpine subregions (CR 8).

> **Montane Natural Subregion** – Characterized by a pattern of open forests and grasslands, with modal sites having forested stands of Douglas fir, lodgepole pine, white spruce, aspen, or mixtures of all. The Montane Subregion occurs at lower elevations than the Subalpine Subregion and has warmer and drier climatic conditions as a result. Limber pine may be present, but is commonly restricted to dry, exposed ridge tops. Abrupt changes in vegetation can occur over very short distances due to high variability in microclimates from differing aspects, slope positions, and wind exposure (Natural Regions Committee 2006).
>
> Chernozoic soils tend to develop beneath grasslands under warmer and drier conditions, while Luvisols form under coniferous stands in moister, cooler areas with accumulations of litter.
>
> **Subalpine Natural Subregion** – Occurs at high elevations on strongly rolling ridges and lower slopes of mountains, often with bedrock near the surface (Archibald *et al.* 1996). A broad range of vegetation species are characteristic of on mesic sites due to significant variations in elevation. Vegetation communities at lower elevations are characterized by closed canopy forests of lodgepole pine, Engelmann spruce, and subalpine fir. Whitebark pine is found at higher elevations where the forest canopy is generally more open (Archibald *et al.* 1996).
>
> This Natural Subregion is characterized by Brunisolic and Luvisolic soils. Litter layers tend to be thin and acidic as a result of high moisture regimes and coniferous forest cover (Natural Regions Committee 2006).

The effect of the terrain on the distribution of vegetation and on the assessment of project effects is strong. Vegetation changes are dramatic and generally driven by slope steepness, slope position, and aspect. Soils generally vary according to the same factors with poor soil development and depth except for lower slope positions and valley bottoms. The strong effect of terrain also results in the landscape appearing highly fragmented as it is characterised by often thin and small patches of forest or grasslands oriented along slopes. Where the terrain is more subdued lodgepole pine forest dominates.

Indirect effects to vegetation (and wetlands) is generally assessed by the potential of disturbance in one location to alter the moisture regime of adjacent undisturbed areas. Altering the surface and near surface moisture conditions has the greatest potential to extend Project effects well beyond the disturbance footprint compared to other indirect effects of disturbance. However, in areas of steep terrain and abrupt changes in community, indirect effects of vegetation clearing (including soil salvage) will occur almost exclusively downslope and will not cross valleys (opposite valley slopes are hydrologically isolated from one another). The effects of soil stability and introduction of invasive species increase in importance when assessing indirect effects of projects on steep terrain.

The assumption of complete removal of all vegetation within the footprint (maximum disturbance scenario), and the effect of the steep terrain in limiting indirect effects to vegetation and wetlands, simplifies the assessment of residual effects. Residual effects are assessed after reclamation thus any VC that cannot be reclaimed and will not return over time will be considered residual. Residual effects also include the 100% removal of a VC or VC key indicator from the LSA or RSA if that indicator will not return to the landscape over time or the length of time to return is considered to be excessive. The timeline for natural disturbance and renewal is mediated by wildfire. The fire cycle for the region will be used as a threshold for acceptable magnitude and duration of project effects.

Assessment Context (Natural Thresholds and Management Thresholds)

Few natural thresholds are available for use in the assessment. Natural threshold used include the presence of soil and the ability of soil to support reclamation of forest and grassland communities. This threshold is provided by the soils and terrain assessment (CR#7) and summarized in the Project C&R plan (Section F). Soil threshold is both quantitative and qualitative.

Another available natural threshold is historical and current fire regime. A detailed fire history and fire modeling has been done for the region (C5 and R11 Forest Management Units).

- The recent (1961-2003) fire regime indicates that 0.25% of C5 management region burned every year (fire cycle of 402 years). This is biased by fire suppression.
- Montane subregion is the most susceptible to fires (66.7% of fires)
- Historical fire regime (1900-1950) indicates that some valleys have fire intervals of less than 30 years (29-100 year fire interval range).
- The (1930-1950) fire cycle was 85 years (1.18% of forested area burned per year).
- Approximately 25% of forest stands in the Montane and 35% in the Subalpine are in the 30 year age class or less.
- 34% of forest stands in the Montane and 41% in the Subalpine are in the 100 year age class or greater.
- Mean fire size has been greatly reduced by active fire suppression.
- From 1961 to 2002, four fires were > 1,000 ha in size burning 2,868 ha.
- From 1961 to 2002, 742 fires were < 11 ha in size burning 216 ha
- When all data was modelled for 1,000 years, 30% of fires in Subalpine and 35% in Montane were 1-100 ha in size.

- When all data was modelled for 1,000 years, average fire size was 1,670 ha (Std. Dev. 3,205) in Subalpine and 985 ha (Std. Dev 1,894) in Montane.
- When all data was modelled for 1,000 years, average fire cycle was 116 years (Std. Dev. 23) in Subalpine and 92 years (Std. Dev 16) in Montane.
- Approximately 50% of fires are larger than forest harvest blocks.

The landscape is moderately to highly fragmented from historical and current human use. As described in the regional management plan (C5 Forest Management Plan 2006-2026) having a distribution of patch sizes is beneficial with respect to maintaining diversity. This has been identified as a forest harvest goal and is reflected in the planned (future) spatial harvest sequence. However, social constraints limit the active creation of large forest patches with forest harvesting (C5 Forest Management Plan 2006-2026). Forest harvesting using the current harvest size distribution and the continued active fire control in the region will result in an increase in forest fragmentation over time.

Whitebark pine (WBP) and Limber pine (LP) recovery plans provide management thresholds useful in determining project effects. Provincial 2013-2018 recovery strategy has been prepared for WBP and a 2014-2019 strategy prepared for LP (Alberta Whitebark and Limber Pine Recovery Team 2014a, b). These plans are to inform the federal plans that are in draft and have not been released. Additional pine management plans are contained in regional forest management plans (C5 and R11 Forest Management Units). Relevant information contained in the Provincial management plans that can be used as a natural threshold or to infer a reasonable natural threshold includes:

- White Pine Blister Rust is the most critical threat to WBP and LP.
- Threats to WBP and LP populations do to removal of trees or alteration/loss of habitat are indirect by loss of potentially rust resistant trees.
- Estimated 28.9 million WBP mature stems in Alberta.
- Estimated 44.4 million LP in Canada.
- Whitebark pine population decline from blister rust, mountain pine beetle, fire exclusion and climate change. A 78% population decline predicted over next 100 years based on current infection and insect rates.
- Limber pine population decline from blister rust, mountain pine beetle, fire exclusion and climate change. A 66% population decline predicted over next 100 years.
- Suppression of fire is an important factor where WBP and LP are competing with spruce and fir tree species. At higher elevations where competition is not intense fire suppression is less important historically, and for management.
- Natural seed dispersal of WBP is in decline. WBP depends on Clarks nutcracker for dispersal. Clarks nutcracker is also in decline.
- Timber companies operating in the C5 Forest Management Unit must follow the Spray Lakes Sawmills and C05 Operating Ground Rules (May 2012). WBP and LP can only be destroyed when unavoidable, and written approval from ESRD is required.

- Whitebark pine does not produce seed until 30-50 years of age.
- Limber pine matures at about age 50 years and does not produce a good seed crop until 60-80 years old.
- Losses of mature WBP and LP seed producing trees should be minimized.
- Introduce rust resistant strains. This is the most critical factor for long term recovery of both WBP and LP.
- Identification of rust resistant tress is not well developed for LP and may take a decade or more. Identification of resistant trees to supply seed for short term use is recommended.

Impact Assessment Criteria

The level of an environmental effect was determined after considering mitigation. Residual effects were considered those effects that may occur after mitigation (*i.e.*, project impacts that extend beyond the life of the project and not interim project impacts). Criteria used to assess the potential effects of the Project on vegetation and wetland resources included: geographic extent, duration, frequency, permanence, magnitude, direction, and level of confidence (Noble 2009). Table SIR 129-2 provides a brief summary of key criteria used for the evaluation of significance.

Assessment context, thresholds and disturbance regimes are described above and in CR#8. Baseline area and number of plant communities (ecosite phases, habitat types) are provided in CR#8, Section 3.1. Species of concern, rare plant abundance and distributions, traditional use species, rangeland, old growth and wetlands are provided in CR#8 Sections 3.2 to 3.7. Biodiversity metrics including distribution and abundance of forested and non-forested community patches are provided in CR#8 Section 3.8. Summary of project effects and impact assessment discussion for each VC is in CR#8, Section 4.

Table SIR 129-2 Evaluation Criteria for Assessing the Environmental Effects of the Project

Criteria	Criteria Definition	
Geographic Extent	Local	Effects occurring mainly within or close proximity to the proposed development area. Within Project local study area (LSA)
	Regional	Effects extending outside of the Project boundary to regional surroundings. Within Project regional study area (RSA)
	Provincial	Effects extending outside of regional surroundings, but within provincial boundary
	National	Effects extending outside of the provincial surroundings, but within national boundary
	Global	Effects extending outside of national boundary
Duration	Short	Effects occurring within development phase
	Long	Effects occurring after development and during operation of facility
	Extended	Effects occurring after facility closes but diminishing with time

Table SIR 129-2 Evaluation Criteria for Assessing the Environmental Effects of the Project		
Criteria	**Criteria Definition**	
	Residual	Effects persisting after facility closed for a long period of time
Frequency	Continuous	Effects occurring continually over assessment periods
	Isolated	Effects confined to a specified period (*e.g.,* construction)
	Periodic	Effects occurring intermittently but repeatedly over assessment period (*e.g.,* routine maintenance activities)
	Occasional	Effects occurring intermittently and sporadically over assessment period
Ability for Recovery (Reversibility)	Reversible in Short-Term	Effects which are reversible and diminish upon cessation of activities
	Reversible in Long-Term	Effects which remain after cessation of activities but diminish with time
	Irreversible	Effects which are not reversible and do not diminish upon cessation of activities and do not diminish with time.
Magnitude	Nil	No change from background conditions anticipated after mitigation. Background includes natural fire regime, insect and disease.
	Low	Disturbance predicted to be somewhat above typical background conditions, but well within established or accepted protective standards and normal socio-economic fluctuations, or to cause no detectable change in ecological, social, or economic parameters. Assessment includes current (managed) fire regime, insect and diseases; current management planning and sustainable management (harvesting) impacts and ability of soil (salvaged and replaced) and terrain to support VC.
	Moderate	Disturbance predicted to be considerably above background conditions but within scientific and socio-economic effects thresholds, or to cause a detectable change in ecological, social, or economic parameters within range of natural variability. Assessment includes natural and managed fire regime, insects and disease, and planned management impacts. Disturbance does not exceed historical range for total area of disturbance, size of disturbance and alteration of age class, habitat type and patch size or distribution. Terrain and soil (salvaged and replaced) productivity loss and or unable to support natural range of VC occurrence or extent
	High	Disturbance predicted to exceed established criteria or scientific and socio-economic effects thresholds associated with potential adverse effect, or to cause a detectable change in ecological, social, or economic parameters beyond the range of natural variability. Disturbance is greater than historical or predicted natural and managed disturbance regimes, and or sustainable management plans/practices. Greater than one standard deviation of known thresholds (one standard deviation used due to high natural variability in study area)

Table SIR 129-2 Evaluation Criteria for Assessing the Environmental Effects of the Project

Criteria	Criteria Definition	
Project Contribution (ecological/social context)	Neutral	No net benefit or loss to the resource, communities, region, or province. Assessed relative to historical and planned disturbance, impacts on sustainability of the VC or reduction or loss including species of concern, and forest and non-forest patch size and distribution.
	Positive	Net benefit to the resource, community, region, or province. Assessed relative to historical disturbance and desired regional and local management outcomes for VC. Includes reversal of past losses, increased long term sustainability, and increased presence of VC (above background).
	Negative	Net loss to the resource, community, region, or province Assessed relative to permanent decline in VC function, value or ability to support traditional use or sustainable harvest/use
Confidence Rating	Low	Based on incomplete understanding of cause-effect relationships and incomplete data pertinent to study area
	Moderate	Based on good understanding of cause-effect relationships using data from elsewhere or incompletely understood cause-effect relationship using data pertinent to study area.
	High	Based on good understanding of cause-effect relationships and data pertinent to study
Probability of Occurrence	Low	Unlikely
	Moderate	Possible or probable
	High	Certain
Significance	Insignificant (not significant)	Effects are predicted to be within the range of natural variability and below guideline or threshold levels. Thresholds include natural and managed fire regime, forest and regional management plans including forest age class distribution, and forest and non-forest patch size and distribution
	Significant	Effects of the Project are predicted to cause irreversible changes to the sustainability or integrity of a population or resource

c) While it is convenient and usual practice to determine environmental consequences of project impacts after mitigation, assigning significance prior to mitigation provides a clearer picture of project impacts. Successful reclamation outcomes for whitebark and limber pine are not proven.

i) Provide an analysis of the environmental consequences for each of the following valued ecosystem components, prior to the implementation of any mitigation measures:

   A) Rare plants

Response:

As requested, Table SIR 129-3 summarises the project effects without mitigation. In this case, without mitigation would be disturbance/removal without reclamation. For the impact criteria Ability to Recover, it is assumed natural recovery processes without any soil replacement. Though technically all project effects are reversible over the long term, the processes of natural succession including soil building on newly exposed rock surfaces extends beyond any reasonable human management time-scale. The evaluation criteria Ability to Recover has therefore been assessed as irreversible without mitigation.

The Vegetation assessment (CR#8), Table 4.1-1 provides the project impact without mitigation on communities of limited distribution within the LSA. One ecosite phase (d1) is removed from the LSA and others such as e2, e4 and f1 are substantially reduced as a percentage and in absolute area. This loss is a residual effect and without mitigation there is little chance of reversal and thus it is considered significant based on our decision criteria.

All of the rare plants that occurred within the project footprint are considered to be globally secure and also found outside the footprint. Even without mitigation the Project is not expected to have a significant effect on rare plants other than WBP. The direct removal of WBP and loss of habitat that would occur without mitigation are not significant factors (see response SIR 129a and SIR 129b). The potential loss of genetic diversity and of disease resistant trees would be significant. For this reason, the project effects on WBP without mitigation are considered significant.

Without mitigation the project will have a negative effect on biodiversity at all levels (species, community, landscape) and impacts would be residual. Without mitigation, the loss of species, community and landscape diversity would persist and be significant. However, the existing amount of disturbance from forestry, oil and gas, and historical mines that have not been reclaimed result in the project contribution being small. Also, the total size of the project footprint is within the range of historical natural disturbance from fire (see response to SIR 128b) so the significance would be local and not regional or provincial for species and community diversity. The change in landscape diversity would be considered regional as without mitigation the amount of exposed rock, pits and potentially pit lakes replacing confer forest communities would exceed the typical patch size for such features in the region.

Table SIR 129-3 Summary of Impacts on Vegetation Components without Mitigation for Reduction in Communities, Rare Plants and Biodiversity

VC Potential Impact or Effect	Mitigation / Protection Plan	Type of Impact	Geographical Extent of Impact[1]	Duration of Impact[2]	Frequency of Impact[3]	Ability for Recovery[4]	Magnitude[5]	Project Contribution[6]	Confidence Rating[7]	Probability Occurrence – Ecological Context[8]	Significance
Terrestrial Vegetation/Plant Communities or Ecosite Phases											
Reduction in Plant Community Types & Area	NA	Application	Local	Residual	Continuous	Irreversible	High	Negative	High	High	Significant
		Cumulative	Local	Residual	Continuous	Irreversible	High	Negative	High	High	Significant
Rare Plants, Rare Plant Communities and Rare Plant Potential											
Removal of rare plant potential	NA	Application	Local	Residual	Continuous	Irreversible	High	Negative	High	High	Not significant
Removal of Rare Plants	NA	Application	Local	Residual	Continuous	Irreversible	High	Negative	High	High	Not significant
Removal of whitebark (and limber pine)	NA	Application	Regional	Residual	Continuous	Irreversible	High	Negative	High	High	Significant
Biodiversity											
Reduction in Species Diversity	NA	Application	Local	Residual	Continuous	Irreversible	High	Negative	High	High	Significant
		Cumulative	Local	Residual	Continuous	Irreversible	High	Negative	High	High	Significant
Reduction of Community Diversity	NA	Application	Local	Residual	Continuous	Irreversible	High	Negative	High	High	Significant
		Cumulative	Local	Residual	Continuous	Irreversible	High	Negative	High	High	Not significant

Table SIR 129-3 Summary of Impacts on Vegetation Components without Mitigation for Reduction in Communities, Rare Plants and Biodiversity

VC Potential Impact or Effect	Mitigation / Protection Plan	Type of Impact	Geographical Extent of Impact[1]	Duration of Impact[2]	Frequency of Impact[3]	Ability for Recovery[4]	Magnitude[5]	Project Contribution[6]	Confidence Rating[7]	Probability Occurrence – Ecological Context[8]	Significance
Reduction of Landscape Diversity	NA	Application	Regional	Residual	Continuous	Irreversible	Moderate	Negative	High	High	Not significant
		Cumulative	Regional	Residual	Continuous	Irreversible	Moderate	Negative	High	High	Not significant

[1] Local, Regional, Provincial, National, Global

[2] Short, Long, Extended, Residual

[3] Continuous, Isolated, Periodic, Occasional, Accidental, Seasonal

[4] Reversible in short term, Reversible in long term, Irreversible – rare

[5] No Impact, Low Impact, Moderate Impact, High Impact

[6] Neutral, Positive, Negative

[7] Low, Moderate, High

[8] Low, Medium, High

[9] Significant, Not significant

B) Communities of limited distribution , and

Response:

See response SIR 129a.

C) Biodiversity prior to mitigation/before reclamation.

Response:

See response SIR 129b.

130. Consultant Report #8

a) Discuss the sensitivity to disturbance (including acid deposition), as well as the techniques used to estimate sensitivity to disturbance and reclamation, of each vegetation community.

Response:

Methods for assessing PAI and nitrogen deposition are described in the Vegetation assessment (CR#8, Section 2.3.10) that includes a discussion of sensitive receptors (communities). Additional method details are described in the Air Quality assessment (CR#1) and the Soils and Terrain assessment (CR#7).

The low PAI in baseline, and with the project development scenario, results in no anticipated direct effect on plants and only indirect effects possible due to impacts on the soil. The thresholds for soils were not reached in any assessment scenario; subsequently, no impact on vegetation is expected.

For vegetation communities, the assessment approach is conservative and assumed complete removal of all vegetation present within the Project footprint. Sensitivity to disturbance for each community is thus not required as it is not possible for even the most resistant or resilient community to withstand full removal by mechanical means, in most cases also accompanied by soil salvage.

The establishment of trees, particularly lodgepole pine, on postmining landscape in western Alberta is well understood; examples include TECK Luscar, and Coal Valley Mine that have successfully certified many hectares of pine and spruce forest reclamation. Thus, there is little sensitivity or risk in establishing the target closed and open canopy conditions as described in the C&R plan. The community components most sensitive to disturbance and to reclamation are communities comprised of later successional species and species that do not tolerate competition; specifically, some understory species, whitebark pine, and fescue grassland communities. The establishment of later successional species that are typically found in the understory of forest communities will take time. Reclamation planning for biodiversity and vegetation is described in Section F, Sections F.2.5 and F.2.7, respectively.

Both WBP and fescue grasslands are considered high sensitivity to disturbance and high risk for reclamation and therefore require specific modifications to the typical mine reclamation procedures. Details on the methods to establish WBP and limber pine are in Section F, Section F.3.2.2 and Foothills Rough Fescue in Section F, Section F.3.2.4. Benga is committed to engagement and use of best management practises for the establishment of WBP, limber pine and fescue. Benga is also committed to undertaking maintenance (Section F.3.8) on reclaimed lands and application of adaptive management to reduce the risk to reclamation.

131. Consultant Report #8

a) Discuss from an ecological perspective, the expected timelines for establishment and recovery of vegetation communities and the expected differences in the resulting vegetative community structures.

Response:

The structure of communities is closely tied to age, composition and disturbance. Forested communities that are old may develop increasing amounts of dead standing trees, secondary canopy layers, shrub and herb layers, and patches as canopy openings develop. This increase in structure over time will not be found on forested sites that are maintained at an edaphic climax, or open forest or grassland communities that are maintained by fire. Reclaimed communities will have little structure and resemble natural communities present after severe fire or those establishing on large soil slumps or scree slopes. Structure will slowly return to reclaimed communities over time and with the return of natural disturbance regimes.

Stand structure, succession and the role of fire in the mountains has long been understood. With the exception of predictive model refinements, little has changed since Day (1972) described structure and succession in the mountain forests of southern Alberta. Consistent with the stand level descriptions of Day (1972), the ecosite guide for southwestern Alberta (Archibald *et al.* 1996) describes edaphic climax and fire mediated climax conditions for most communities present in the Project area and slow succession where it does occur. The timelines for natural communities' present are primarily impacted by the local fire regime. The best description and modelling of the local fire regime can be found in the C5 forest management planning documents that are summarized below:

- The recent (1961-2003) fire regime indicates that 0.25% of C5 management region burned every year (fire cycle of 402 years). This is biased by fire suppression
- Montane subregion is the most susceptible to fires (66.7% of fires).
- Historical fire regime (1900-1950) indicates that some valleys have fire intervals of less than 30 years (29-100 year fire interval range).
- The (1930-1950) fire cycle was 85 years (1.18% of forested area burned per year).
- Approximately 25% of forest stands in the Montane and 35% in the Subalpine are in the 30 year age class or less.
- 34% of forest stands in the Montane and 41% in the Subalpine are in the 100 year age class or greater.
- Mean fire size has been greatly reduced by active fire suppression.
- From 1961 to 2002, four fires were > 1,000 ha in size burning 26,868 ha.

- From 1961 to 2002, 742 fires were < 11 ha in size burning 216 ha.
- When all data was modeled for 1000 years; 30% of fires in Subalpine and 35% in Montane were 1-100 ha in size.
- When all data was modeled for 1000 years; average fire size was 1,670 ha (Std. Dev. 3,205) in Subalpine and 985 ha (Std. Dev 1,894) in Montane.
- When all data was modeled for 1,000 years; average fire cycle was 116 years (Std. Dev. 23) in Subalpine and 92 years (Std. Dev 16) in Montane.
- Approximately 50% of fires are larger than forest harvest blocks.

Because of the stochastic nature of fire, it is normal that some forest patches will exceed the expected age of approximately 100 years with some areas burning every 30 years or so and some not burning for centuries.

Plant communities will also be more or less resistant to fire due to location (*e.g.*, high elevation rock outcrops with little fuel to spread fire), moisture regime and species composition. Some forested communities will also be resilient to fire where the fuel load, fuel type, and fire season can result in high rates of survival of mature trees and renewal of understory without canopy reinitiation. Open forest communities or grassland communities are typically maintained by fire and succession to increasing tree cover is slow or absent. Exclusion of fire will favor succession toward spruce and fir forested communities where edaphic conditions do not limit the canopy to pine or open grassland. The succession from pine to spruce and fir is slow due the longevity of pine and slow dispersal and initial growth of spruce and fir.

Reference

Day, Robert. 1972. Stand Structure, Succession, and use of Southern Alberta’s Rocky Mountain Forest. Ecology, Vol. 53 No. 3: 472-478.

A.4.4. WILDLIFE

132. Volume 6, Section 1.4.1, Table 1.4-1, pg. 26 – 28

Benga provides a table which lists the Wildlife Legislation, Standards and Guidelines that “pertain to the protection of wildlife and wildlife habitat and are enforced under both federal and provincial legislation.” Currently, Benga references *Federal Recovery Strategies for certain species and Land Use guidelines*; however there is no reference to the *Provincial Recovery Strategy or Land Use Guidelines for Grizzly Bear* and/or other sensitive species listed.

a) Update the table to accurately reflect the current legislation, standards and guidelines in practice for all relevant sensitive species.

Response:

As requested, Benga has provided an update to relevant wildlife legislation, regulation, policy, standards and guidelines. Changes to CR#9 Table 1.4-1 are indicated in bold in Table SIR 132-1.

Table SIR 132-1 Wildlife Legislation, Regulation, Policy, Standards and Guidelines

Name	Type	Jurisdiction	Description
Species at Risk Act (SARA)	Act	Canada	Legal protection for at-risk wildlife species including species of special concern, and endangered, threatened, or extirpated species. Prohibits these species from being harmed or harassed and prohibits the destruction of their nests or dens.
Federal Recovery Strategies	Policy	Canada	Developed for species designated as threatened, endangered, or extirpated under Schedule 1 of SARA. Identifies critical habitat of Schedule 1 species. Currently, there are only three recovery strategies applicable to the Project: • Recovery Strategy for the Common Nighthawk (*Chordeiles minor*) in Canada (Environment Canada 2016b). • Recovery Strategy for the Olive-sided Flycatcher (*Contopus cooperi*) in Canada (Environment Canada 2016a). • Proposed Recovery Strategy for Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-colored Bat (*Perimyotis subflavus*) in Canada (Environment Canada 2015).
Federal Management Plan	Policy	Canada	Proposed Management Plan for the Short-eared Owl (*Asio flammeus*) in Canada (Environment Canada 2016c). **Proposed Management Plan for the Western Toad (*Anaxyrus boreas*) in Canada (Environment and Climate Change Canada 2016).**
Committee on the Status of Endangered Wildlife in Canada (COSEWIC)	-	Canada	Legally assesses and classifies wildlife species according to the framework of SARA. Determines national status of species, subspecies, and populations thought to be at risk.
Migratory Birds Convention Act	Act	Canada	Prohibits killing, harming, or disturbing migratory birds or deposition of harmful substances in areas frequented by migratory birds; also protects their eggs and nests.
Wildlife Act	Act	Alberta	Multiple sections protect wildlife by outlining rules in regards to hunting, taking, trapping, wounding, and/or killing wildlife.
Water Act	Act	Alberta	Ensures that water quality, fish and wildlife habitat, and the rights of license users are not compromised.

Table SIR 132-1 Wildlife Legislation, Regulation, Policy, Standards and Guidelines

Name	Type	Jurisdiction	Description
Provincial Recovery Plans	**Policy**	**Alberta**	**Draft Alberta Grizzly Bear Recovery Plan (Alberta Environment and Parks 2016).**
			Alberta Whitebark Pine Recovery Plan 2014 – 2019 (Alberta Whitebark and Limber Pine Recovery Team 2014a) as it relates to Clark's Nutcracker.
			Alberta Limber Pine Recovery Plan 2014 – 2019 (Alberta Whitebark and Limber Pine Recovery Team 2014b) as it relates to Clark's Nutcracker.
Integrated Standards and Guidelines: Enhanced Approval Process	Guideline	Alberta	Outlines best management practices that industry can follow to avoid, limit, or mitigate negative effects on wildlife and the environment.
Recommended Land Use Guidelines: Key Wildlife and Biodiversity Zones	Guideline	Alberta	Assists industry in minimizing impacts on wildlife in KWBZ that generally provide high-quality wintering habitats for ungulates.
Recommended Land Use Guidelines: Mountain Goat/ Bighorn Sheep Ranges	Guideline	Alberta	Assists industry in minimizing impacts on mountain goats and mountain sheep.
Wildlife Sensitivity Maps	Guideline	Alberta	Identifies specific wildlife key areas that function in ensuring the continued survival of local and regional populations of wildlife or wildlife group.
Sensitive Species Inventory Guidelines	Guideline	Alberta	Pre-disturbance inventory protocols focused on wildlife that are or may be at risk of extirpation, require protection to prevent them from becoming at risk, or other species of management concern.
Wildlife Status Reports	**Status Ranking**	**Canada/ Alberta**	**Developed for various wildlife species believed to be declining in Alberta and Canada. Used to assess the status of individual species and to support federal/ provincial legislation and recovery plans.**

References:

Alberta Environment and Parks. 2016. Draft Alberta Grizzly Bear (Ursus arctos) Recovery Plan. Alberta Environment and Parks, Alberta Species at Risk Recovery Plan No. 38. Edmonton, Alberta, Canada. Available Online: http://aep.alberta.ca/files/GrizzlyBearRecoveryPlanDraft-Jun01-2016.pdf.

Alberta Whitebark and Limber Pine Recovery Team. 2014a. Alberta Whitebark Pine Recovery Plan 2014 – 2019. Alberta Environment and Sustainable Resource Development, Alberta

Species at Risk Recovery Plan No.34. Edmonton, Alberta, Canada. Available Online: http://aep.alberta.ca/fish-wildlife/species-at-risk/species-at-risk-publications-web-resources/plants/documents/SAR-WhitebarkPineRecoveryPlan-Jan-2014.pdf.

Alberta Whitebark and Limber Pine Recovery Team. 2014b. Alberta Limber Pine Recovery Plan 2014 – 2019. Alberta Environment and Sustainable Resource Development, Alberta Species at Risk Recovery Plan No.35. Edmonton, Alberta, Canada. Available Online: http://aep.alberta.ca/fish-wildlife/species-at-risk/species-at-risk-publications-web-resources/plants/documents/SAR-LimberPine-RecoveryPlan-Sep2014.pdf.

Environment and Climate Change Canada. 2016. Management Plan for the Western Toad (Anaxyrus boreas) in Canada [Proposed]. Species at Risk Act Management Plan Series. Environment and Climate Change Canada, Ottawa, Canada. Available Online: http://www.registrelep-sararegistry.gc.ca/virtual_sara/files/plans/mp-western-toad-e-proposed.pdf

133. Volume 6, Section 2.3, Table 2.3-1, pg. 37 Volume 6, Section 2.4.3.2.5, pg. 98

Benga provides Table 2.3-1 Field Surveys Conducted in the Wildlife Local Study Area with survey efforts, time of year, and target species. Volume 1, Section E.9, Pg. E-174, Benga states, “In addition to the VCs, the Project could potentially affect several other special status or highly-valued wildlife species. A set of eight wildlife species were selected as special status species: barn swallow, common nighthawk, short-eared owl, bald eagle, golden eagle, mountain goat, bighorn sheep and wolverine.” Benga also states, “There is suitable habitat for nesting nighthawks in the WLSA, particularly in the patches of recently-harvested forest in the northern section.”

a) Of the eight selected wildlife species considered as special status or highly-valued wildlife species, five were included in the field surveys conducted in the Wildlife Local Study Area (Table 2.3-1). Provide rationale for the exclusion of barn swallow, common nighthawk and mountain goat species from the field survey efforts conducted in the Wildlife Local Study Area.

   i) Discuss the baseline data for these species and provide adequate supporting literature and/or sources used to determine baseline information.

Response:

Although species-specific surveys were not identified for mountain goat, barn swallow, and common nighthawk, Benga does not agree with the suggestion that these species “were excluded from field survey efforts”.

Specific surveys for mountain goat were not conducted because of the absence of suitable habitat in the Wildlife Local Study Area (WLSA). Mountain goats typically remain in or near alpine areas throughout the year although they will winter on south and southwest facing slopes or on wind exposed ridges where snow cover is minimal (AFWD 2003). Nursery herds rarely move more than 400 m from escape terrain which is predominantly characterized by cliffs or extremely steep rocky slopes. The most suitable habitat is characterized by bands of cliffs intersected by rocky ledges and narrow chutes that lead onto talus of vegetated avalanche slopes (AFWD 2003). They rarely move to lower elevations except when accessing salt or mineral licks. Although mountain goats will make seasonal use of other habitats, most researchers have concluded that a primary limiting factor for this species is the availability of steep cliffs that offer effective escape terrain (Poole *et al.* 2009, AFWD 2010). Suitable escape terrain is lacking in the WLSA. In addition, while the mapped range for mountain goat and bighorn sheep includes approximately one-third of the southeast portion of the WLSA (Consultant Report #9 (CR#9) Wildlife, Figure 1.3-1), this area currently supports various land use activities including oil and gas development, forestry, grazing, various seasonal recreational activities, and some rural residences (CR #10), which can affect the behavioral responses of mountain goats (AFWD 2003) and, therefore, potential suitability of this habitat for mountain goat.

Current levels of human disturbance in conjunction with the lack of suitable habitat did not warrant specific mountain goat surveys. However, a number of baseline surveys conducted in the WLSA are useful for evaluating potential seasonal habitat use by mountain goats. An aerial raptor survey conducted on April 27, 2016, prior to leaf out, covered much of the WLSA (CR#9, Figure 2.3-4). Although the mapped mountain goat and bighorn sheep range could not be surveyed because of minimum above-ground and restricted activity period restrictions associated with land use guidelines for mountain goats and bighorn sheep (AFWD 2010) and key wildlife and biodiversity zones (AESRD 2015), respectively (CR#9, Section 2.3.2.2.1). Other surveys, including camera trapping, pellet-group counts, and the winter track survey, covered all the major habitat types in the WLSA. Based on the amount of survey effort conducted during other baseline wildlife surveys between 2014 and 2016, Benga believes it is unlikely that mountain goat would have gone undetected in the WLSA.

Barn swallow and common nighthawk were surveyed as part of the breeding bird survey. Because of similarities in habitat use, the short-eared owl survey provided an additional opportunity to obtain baseline data on common nighthawk. Three common nighthawks (one pair and one individual) were recorded during the 2014 breeding bird survey (CR#9, Figure 2.4-3); however, this species was not detected during the 2016 survey. No barn swallows were detected during the 2014 breeding bird survey and one individual was recorded during the 2016 survey (CR#9, Table 2.4-9). Both species have been recorded along the nearest North American Breeding Bird Survey route, albeit in small numbers. During five surveys conducted between 2008 and 2014 along BBS Route 04-205, 15 barn swallows and one common nighthawk were recorded, indicating that both species are uncommon in the WLSA.

References

Alberta Environment and Sustainable Resource Development (AESRD 2015). Recommended land use guidelines: Key wildlife and biodiversity zones. Government of Alberta, Edmonton, Alberta, Canada. Available Online: http://aep.alberta.ca/fish-wildlife/wildlife-land-use-guidelines/documents/KeyWildlifeBiodiversityZones-Apr08-2015.pdf.

Alberta Fish and Wildlife Division (AFWD). 2003. Management plan for mountain goats in Alberta. Wildlife Management Plan Series No. 7. Alberta Fish and Wildlife Division, Edmonton, Alberta, Canada.

Alberta Fish and Wildlife Division (AFWD). 2010. Recommended land use guidelines for mountain goat and bighorn sheep ranges in Alberta. Alberta Fish and Wildlife Division, Edmonton, Alberta, Canada.

Poole, K.G., K. Stuart-Smith and I.E. Teske. 2009. Wintering strategies by mountain goats in interior mountains. Canadian Journal of Zoology 87: 273-283.

134. Volume 6, Table 2.3-1, pg. 37

Benga provides a table which outlines the survey, timing, *Sensitive Species Inventory Guidelines* (SSIG) and targeted species. As per the SSIG, the essential habitat surveys ensure that habitat features necessary for the suite of the raptor species are protected and buffered when new disturbances are placed on the landscape. This type of survey combines the benefit of nest searches with the additional benefit of identifying important habitat features. Benga states, that, "Each essential habitat feature was assigned a restricted activity buffer."

a) Justify why the target species northern goshawk, golden eagle and bald eagle, which were captured in the aerial survey, were excluded from the "Raptor Essential Nest Habitat Survey."

    i) Discuss the baseline data regarding nest habitat types for these species and provide adequate supporting literature and/or sources to determine the baseline information.

Response:

Although not identified as target species in CR#9 Table 2.3-1, northern goshawk, bald eagle, and golden eagle, along with other forest raptors, were not excluded from the raptor essential habitat nest survey. As indicated in the SSIG (GoA 2013), the primary intent of the boreal and foothills raptor survey protocol, in addition to locating raptor nests, is to identify essential habitat features for various forest nesting raptors and to provide data that can be used to evaluate raptor habitat suitability. The survey protocol includes aerial surveys to supplement the success of on-the-ground essential habitat surveys, and while it is not specifically designed to capture all species of breeding raptors (GoA 2013), the intent is to maximize detection of breeding raptors to the extent possible.

Based on the results of the raptor aerial and essential habitat features surveys and other baseline wildlife surveys, northern goshawk was not detected in the WLSA although potential nest site features such as large trembling aspen and balsam poplar trees in mature closed mixedwood and coniferous forests were present (CR#9, Table 2.4-18, Figure 2.4-8; Schaffer *et al.* 1999). In addition, as indicated in CR#9, Section 2.4.3.2.4.1.1.2, bald eagles typically nest in the vicinity of large water bodies where fish, waterbirds, and other prey are available. With the possible exception of the Crowsnest River, no large waterbodies occur in the WLSA. Golden eagles prefer to nest on ledges on steep cliffs, which also do not occur in the WLSA. While both eagle species have been observed in the area, no nests or suitable nest sites were observed in the

WLSA during the raptor aerial and essential habitat nest surveys or located incidentally during other baseline wildlife surveys.

References

Government of Alberta (GoA). 2013. Sensitive species inventory guidelines. Edmonton, Alberta, Canada. Available online at: http://esrd.alberta.ca/fish-wildlife/wildlifemanagement/ sensitive-species-inventory-guidelines.aspx.

Schaffer, W., B. Beck, J. Beck, R. Bonar, and L. Hunt. 1999. Northern goshawk reproductive habitat: Habitat suitability index model, Version 3. Available Online: https://friresearch.ca/sites/default/files/null/HSP_1999_10_Rpt_NorthernGoshawkReproductiveHabitat.pdf.

135. Volume 6, Section 2.3.1.1.2, pg. 39

Benga states, that the amphibian acoustic and non-acoustic surveys "were conducted May 3-4, 2016 and May 16-18, 2016" for the acoustic and visual survey efforts. As per the *Sensitive Species Inventory Guidelines* (SSIG), the survey efforts for acoustic are at least three times during breeding season and for the visual survey, the survey efforts should be conducted at least twice during the appropriate survey period.

a) Clarify if these dates meet the *Sensitive Species Inventory Guidelines (SSIG)* for surveying efforts for both the acoustic and visual surveys. Provide the dates corresponding to survey efforts, which align with the acoustic surveys completed versus the visual surveys completed based on species and survey period.

Response:

The SSIG recommends that call (acoustic) surveys for amphibians be conducted three times during the breeding season, but it is also noted that the required survey frequency will depend on the purpose of the survey, stating that "for species composition surveys, the number of surveys required may be dictated by what species are found during the first visit to the site. If all expected species are recorded, no further site visits are required" (GoA 2013). The primary goals of the amphibian surveys conducted in the WLSA were to determine whether species of concern occur in the area and to identify important breeding habitats. Accurate population estimates, which are problematical for most amphibian species, were not considered essential for purposes of environmental impact assessment and mitigation planning.

Benga feels that the two 2016 surveys, together with the 2014 survey accomplished these goals. The 2014 survey, which took place from June 2-5, fell within the recommended acoustic survey period for the western toad, a late breeding species (GoA 2013). The 2016 surveys, which took place from May 3-4 and again on May 16-18, fell within the recommended acoustic survey periods for the Columbia spotted frog and the northern leopard frog, two early breeding special status species. Several other factors should also be considered:

- During each of these surveys, survey conditions and weather were suitable, conforming to SSIG guidelines.

- All expected anurans were recorded in the WLSA, with the exception of the northern leopard frog, which has disappeared from much of its former range in central and western Alberta (GoA 2014).
- The surveys included all wetlands and waterbodies that could be identified in the WLSA.

In 2016, two visual surveys were conducted to provide information on occurrence and habitat use of less vocal species (*i.e.*, Columbia spotted frog and northern leopard frog) as well as the long-tailed salamander and tiger salamander, which do not call. Visual surveys were conducted during the same time periods as the 2016 call surveys. SSIG guidelines indicate that visual surveys can be carried out between May and September but point out that May is an optimal time because there is also an opportunity to observe egg masses (GoA 2013). Together, the call surveys and visual surveys resulted in the detection of Columbia spotted frogs at six stations, long-toed salamanders at seven stations, and western toads at three stations.

References

Government of Alberta (GoA). 2013. Sensitive species inventory guidelines. Edmonton, Alberta, Canada. Available online at: http://esrd.alberta.ca/fish-wildlife/wildlifemanagement/ sensitive-species-inventory-guidelines.aspx.

Government of Alberta (GoA). 2014. Species at Risk 2013-2014 Recovery Action Summary: Northern leopard frog. Available Online: http://aep.alberta.ca/fish-wildlife/species-at-risk/species-at-risk-publications-web-resources/amphibians/documents/SAR-NorthernLeopardFrogRecoveryAction-May2014.pdf

136. Volume 6, Section 2.3.2.1, Page 39

Benga states, for the breeding songbird survey, "The placement of points was determined prior to the survey using available aerial imagery and ecosite phase mapping. Survey points were generally placed at least 50-m from habitat edges and from roads and trails." The SSIG Section 10.3.2.3 Local Study Area Investigations states, "If sampling is to be done over a larger area, for instance at a local study area level, regularly spaced point counts along transects across a random stratification of habitat types associated with the study area should be employed. [These should]… be sufficient to inform an appropriate RSF or HSI model."

a) Provide Benga's placement of points for the breeding songbird survey as it relates to the requirements per the SSIG.

   i) Discuss and provide reasoning for the placement of the breeding songbird survey points if different from the SSIG.

Response:

The procedures followed in placement of sample points for the breeding songbird survey comply with the SSIG guidelines. Sampling was stratified on the basis of habitat type with point count stations distributed throughout the WLSA to ensure geographic coverage to the extent possible.

The point count stations were spaced at a minimum of at least 300 m intervals to avoid possible double counting of breeding birds. While the specific location of point count stations within habitats was a random distribution, Benga considered that it was necessary to place the stations at least 50 m from habitat edges to more clearly identify habitat associations for data analysis. Placement of transects was influenced by access, terrain, and safety considerations, as well as the need to sample the range of habitat types that occur in the WLSA. The heterogeneity of habitat types in the WLSA, together with access and safety considerations, did not make a completely random selection of transect locations practical in this case. This approach has been widely used in other environmental impact assessments in Alberta.

137. Volume 6, Section 2.3.3.1.2, pg. 41

Benga states, "While it was not possible to accurately associate individual owls with a specific habitat types, a summary of habitats within 800 m of each owl was determined."

a) Discuss and provide a breakdown of the methodology that Benga used to determine the summary of habitats within 800 m of each owl.

i) Provide the habitat summary per owl observed within the surveys completed.

Response:

GIS mapping was used to determine habitat composition associated with each owl survey station (Figure 137-1), which was used to characterize potential owl habitats sampled in the WLSA (CR#9, Table 2.4-13). Areas of each habitat type that occurred within an 800 m radius of each survey station were then calculated. Dominant habitat associations for the 11 owl survey points were summarized and provided in the wildlife baseline report (CR#9, Table 2.4-13), and a summary of the habitat associations for each owl detected during the surveys is presented Table SIR 137-1. One great gray owl was detected incidentally in 2014 outside of the WLSA while three great-horned owls were identified at two sites in 2015 during the owl survey. As well, one great gray owl was incidentally observed during the 2015 owl survey during travel between survey stations (GMO 8) and two incidental sightings of barred owls were recorded in the WLSA (CR #9, Figure 2.4-4) in 2016 (Table SIR 137-1, Figure 137-1).

Table SIR 137-1 Summary of Habitat Types Associated with Owl Detections in the WLSA.

Species Detected	Location[1]	Habitat Type	Area (ha)[2]	% of Total
Great Gray Owl (One Incidental Observation)	GMO8	Anthropogenic Disturbance	73.7	36.7
		Closed Mixedwood	12.9	6.4
		Grassland	20.8	10.3
		Moderate Mixed Coniferous	47.6	23.7
		Open Pine	28.0	0.6
		Open Mixedwood	1.2	13.9
		Rock Barren	16.8	8.4

Table SIR 137-1 Summary of Habitat Types Associated with Owl Detections in the WLSA.

Species Detected	Location[1]	Habitat Type	Area (ha)[2]	% of Total
Totals			**20.1.0**	**100.0**
Great Horned Owl and Barred Owl (Two Incidental Observations)	GMO9	Anthropogenic Disturbance	53.4	26.6
		Closed Mixedwood	122.8	61.1
		Closed Spruce	5.5	2.7
		Grassland	7.0	3.5
		Open Deciduous	1.0	0.5
		Open Mixedwood	10.2	5.1
		Shrubby Wetland	1.1	0.5
Totals			**201.0**	**100.0**
Great Horned Owl	GMO12	Anthropogenic Disturbance	39.5	19.7
		Closed Mixed Coniferous	2.0	1.0
		Closed Mixedwood	18.5	9.2
		Closed Spruce	6.0	3.0
		Grassland	18.7	9.3
		Open Deciduous	0.6	0.3
		Open Mixed Coniferous	39.2	19.5
		Open Mixedwood	36.4	18.1
		Open Pine	38.8	19.3
		Shrubby Wetland	1.3	0.6
Totals			**201.0**	**100.0**
Great Gray Owl[2]	3	Anthropogenic Disturbance	35.9	59.1
		Closed Mixedwood	0.8	1.3
		Open Mixed Coniferous	6.9	11.4
		Open Mixedwood	3.5	5.8
		Upland Shrub	0.1	0.2
		Waterbody	13.6	22.3
Totals			**60.7**	**100.0**

[1] Owl survey stations are depicted by GM0 prefix on location label.

[2] Reflects only mapped habitats located within the WLSA.

138. Volume 6, Section 2.3.3.4, Pg. 43

Benga states, "Survey stations were selected due to their proximity to suitable habitat and ability to attain an appropriate vantage point from which to survey the habitat to ensure optimum visibility of the landscape. All other habitats adjacent to the surveyed suitable grasslands and clearings and within 400 m of the survey station were also surveyed." The SSIG, Section 6.3.2.2, for non-linear development describes the survey effort required to ensure full coverage of the development site, where the exact number of survey points will depend on the proposed development footprint.

a) Benga does not state that they had followed the SSIG for selection of survey points within Section 2.3.3.4. Clarify whether the SSIG had been followed regarding the survey points for short-eared owls and provide the rationale and strategy for the survey points chosen.

Response:

The procedures used in the short-eared owl survey followed the SSIG guidelines for conducting roadside/point count surveys (CR#9, Section 2.3.3.4.1). All grassland and open habitats were assessed prior to the survey to determine potential suitability for short-eared owls. Thirty-six survey points were selected to provide good representation of each habitat type (CR#9, Table 2.4-14). In total, the 2016 short-eared owl survey covered 1,127.4 ha, representing 20% of the available habitat in the WSLA. Most of the survey points were located within or immediately adjacent to the mine area and along the mine access/conveyor corridor (CR#9, Figure 2.3-6). As recommended in the SSIG guidelines, survey points were selected to provide optimum visibility of the surrounding landscape.

In accordance with SSIG guidelines, each station was surveyed three times during the breeding season. Surveys began 60 minutes prior to sunset and continued until 30 minutes after sunset. Two observers with binoculars counted any owls seen or heard within 400 m of each point during a three minute observation period. Also in accordance with SSIG guidelines, the survey protocol called for a ground search for a nest if a short-eared owl was observed; however, as reported, no owls were observed. Other species observed during the survey were recorded as incidental observations. Benga feels that they have made a reasonable effort to follow SSIG guidelines for this species and that the results of the survey strongly affirm that there is a low likelihood that short-eared owls were present in the proposed development area at the time of the baseline surveys.

139. Volume 6, Section 2.4.3.2.4.1.2.2, Table 2.4-16, Pg. 94

Benga provides a table which outlines the raptor nests detected during the aerial raptor nest and songbird survey in the Wildlife Local Study Area. The table includes the species, nest type, nest status and habitat type.

a) Clarify the definitions of and provide how Benga determined an "active" vs. "inactive" nest status based on the aerial raptor and songbird survey.

i) Discuss how the essential raptor nest habitat survey results advised the nest status as "active" vs. "inactive." Provide justification and supporting literature for the nest status definitions and results.

Response:

As described in CR#9, Section 2.3.3.2.1, raptor nests identified during the aerial survey were classified as "active" if (a) eggs or an incubating adult were present and (b) the nest showed evidence of recent construction and use. If the status and species associated with a nest could not be verified during the aerial survey the nest site was revisited on the ground during the breeding season to confirm species and occupancy as recommended by the SSIG (GoA 2013).

The essential raptor nest survey also followed SSIG. Nest structures identified during the survey were classified as "active" if (a) adults or young were visible or audible in the nest from the ground, (b) an adult was defending the nest site, or (c) fresh sign (feathers, pellets, prey remains) were present at the nest site. As noted in the SSIG guidelines for Boreal and Foothills Raptors (GoA 2013), "a nest can be considered active by the presence of birds or if there is fresh sign apparent". These procedures were also followed if a nest structure was encountered during other baseline wildlife surveys conducted in the WLSA.

References

Government of Alberta (GoA). 2013. Sensitive species inventory guidelines. Edmonton, Alberta, Canada. Available online at: http://esrd.alberta.ca/fish-wildlife/wildlifemanagement/ sensitive-species-inventory-guidelines.aspx.

140. Volume 6, Section 3.2.5.2.1, pg. 177

Benga states, "Rating adjustments factoring the proximity of disturbance features were also incorporated through the use of Zones of Influence (ZOIs), which are areas surrounding disturbances that wildlife may avoid because of sensory disturbance. This allows for an accounting of indirect habitat loss.

Disturbance ZOIs for the Project were based on the operations phase, under the assumption that the construction phase will be short-term."

a) Provide the rationale for each of the specific ZOI per each valued component that was selected in the habitat availability and suitability model. Provide supporting literature and/or sources for the conclusions provided.

Response:

The rationale for the ZOIs established for each wildlife VC, as well as a review of supporting literature, is provided in CR#9, Appendix C. Benga notes however that, although the response of a species to sensory disturbance is clearly a factor that should be considered during habitat suitability modeling, the availability of pertinent scientific literature that can be used to establish disturbance zones is lacking for many wildlife species. In such cases, professional judgement by biologists familiar with the species is used, sometimes relying on research conducted on closely related or comparable species.

141. Volume 6, Section 5.0 Application Case Assessment, Page 238-287

Volume 6, Section 3.2.5.3, pg. 178

Volume 6, Section 3.2.5.4.3, Table 3.2-8 pg. 181

Volume 6, Section 3.2.5.4.4, pg. 181.

Benga discusses the environmental impact assessment using evaluation criteria for each of the Valued Components within Section 5.0 of Volume 6. Examples of statements include, "With mitigation, the effects of the Project on [valued component] abundance in the WLSA are expected to be local in extent, extended in duration, continuous in frequency, reversible in the short term, low in magnitude, and not significant. The project contributions are expected to be negative, the confidence rating of these predictions is moderate, and the probability of occurrence is low. Project development is not expected to after [valued component] abundance in the WRSA."

For the majority of Valued Components, a description of the relationship between the significance rating and the scientific effect threshold is not provided. The EIA report also does not provide a description of the range of natural variability of ecological, social, or economic parameters associated with each of the wildlife VCs identified and does not identify critical threshold levels for significance that would enable a determination of significance.

a) For each of the valued components, the evaluation criterion for assessing the environmental impact on change in movement, change in abundance and change in mortality risk lacks clear rationale to support the conclusions. As such, this lacks transparency of process or the ability of a stakeholder or reviewer to follow the assessment logic from baseline data through to final impact rating.

   i) Provide the qualitative or quantitative analysis for each of valued component species, when using the evaluation criterion for assessing change in movement, change in abundance and change in mortality risk. Include adequate support and/or sources to support conclusions provided.

Response:

To provide additional transparency of process, the following additional information on assessment evaluation criterion is provided.

Assessment Approach

In conducting the wildlife assessment, a systematic approach to effects assessment was used to determine the overall significance of the Project to selected wildlife VCs. This approach was based on the following considerations:

- **Selection of Valued Components** - The wildlife species at risk associated with this Project include olive-sided flycatcher, little brown bat, short-eared owl, and common nighthawk. Similarly, western toad (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] – Special Concern for calling and non-calling populations), barn swallow (COSEWIC – Threatened), and grizzly bear (COSEWIC – Special Concern) are also included. Although not federally-listed species, the list of VCs was expanded to include the great gray owl, Columbia spotted frog, American marten, Canada lynx, elk and moose and high level assessments of several other special status species, including the bald eagle, golden eagle, wolverine, mountain goat and bighorn sheep. This list not only includes species of socio-economic and cultural importance, but constitutes a list of indicators that adequately represent the natural biodiversity of the Project area CR #9, Section 3.2.3).

- **Measurable Parameters and Threshold Criteria** – Where possible, measurable parameters were selected to facilitate the measurement of potential Project-related effects and cumulative effects on wildlife VCs. For the most part, change in habitat availability (both direct and indirect effects) was used to quantitatively assess Project-related landscape changes in the WLSA, WRSA, and GBRSA for all wildlife VCs and special status wildlife. Land clearing during Project construction creates a direct loss of habitat, which for many wildlife species, represents the greatest single effect of the Project. Habitat change (ha and %) can affect wildlife behavior, breeding success, mortality risk, and wildlife abundance. In addition, linear features density (km/km^2) was used as a second measurable parameter to quantitatively assess Project effects on movement, mortality risk, and habitat fragmentation (habitat change) for moose, elk, and grizzly bear where applicable.

  Where possible, threshold criteria were established for each wildlife VC and special status wildlife species based on an extensive review of available literature and largely reflected effects of Project development on changes in habitat availability, movement patterns, and mortality risk (CR #9, Section 3.2.5.4). Changes in wildlife abundance were for the most part assessed qualitatively.
- **Baseline Case Assessment** – A quantitative (field data, based on the measurable parameters used) and/or qualitative (field data, available literature) description of existing (baseline) environmental conditions for each wildlife VC (CR #9, Section 4.0) was conducted which implicitly included those effects that have been caused by past or present projects or activities that have been or are currently being carried out.
- **Application Case Assessment** – A quantitative (field data, based on the measureable parameters used) and/or qualitative (field data, available literature) description of how Project-related effects on wildlife VCs were undertaken (CR #9, Section 5.0). This included descriptions of how an effect may occur or how the Project will interact with each wildlife VC; consideration of proposed wildlife protection, mitigation (including recovery strategies), and reclamation measures to minimize or avoid the effect (CR #9, Section 7.0); and an assessment of the significance of residual effects following mitigation.
- **Planned Development Case** - Past, present or reasonably foreseeable future projects or activities that were or will be carried out in the GBRSA were considered for identifying cumulative environmental effects for all phases of the Project (CR #9, Section 6.0). Although no Project-related residual effects were identified, a cumulative effects assessment on five wildlife VCs was conducted because of their dependence on and sensitivity to loss of mature and old-growth forests in the region.

Using quantitative (field data, based on the measureable parameters used) and/or qualitative (field data, available literature) information, cumulative effects on the five wildlife species were assessed.

- **Determination of Significance** – Where possible, threshold criteria or standards were used to determine the significance of Project-related effects on wildlife VCs and special status wildlife species. The determination of the significance of residual Project effects was then made using the threshold criteria or standards, and/or the measurable parameters identified for each wildlife VEC along with available literature and professional judgement. The significance determination was based on significance criteria for assessing the environmental effects of the Project (CR #9, Table 3.2-4). The determination of the significance of residual cumulative effects was made using the same approach that was used for the Application Case Assessment. In the context of CEAA (2017), the approach used to determine whether an adverse effect was significant for the Project was comparable to the reasoned argumentation and professional judgement methodologies described in the guidance document.

Rationale for Assessment Criteria

Project effects were assessed in accordance with assessment criteria identified in the Terms of Reference. Magnitude refers to the expected size or severity of the potential Project-related effect. The magnitude of potential effects was assessed qualitatively based on key issues of concern for each wildlife Valued Component (VC) that would be affected by Project development including the proportion of habitat affected within the spatial boundaries established for the Project WLSA, WRSA, and GBRSA], natural annual variation, and established threshold criteria or standards, where possible. The qualitative definitions for low, moderate, and high magnitude that were used to guide the determination of magnitude of potential effects were provided in Section D.2.5.3, Table D.2.5-2 of CR #9 but is provided below:

- ***Low***: Disturbance predicted to be somewhat above typical background conditions, but well within established or accepted protective standards and normal socio-economic fluctuations, or to cause no detectable change in ecological, social or economic parameters.
- ***Moderate***: Disturbance predicted to be considerably above background conditions but within scientific and socio-economic effects thresholds, or to cause a detectable change in ecological, social or economic parameters within range of natural variability.
- ***High***: Disturbance predicted to exceed established criteria or scientific and socio-economic effects thresholds associated with potential adverse effect, or to cause a detectable change in ecological, social or economic parameters beyond the range of natural variability.

The Project footprint is located on a landscape that was previously disturbed by historical mining and left unreclaimed. As examples, a portion of the proposed mine footprint was previously mined in the 1950s and 1960s by surface mining. The Grassy Mountain landscape currently has a surface mining trench, with surface waste rock and discarded coal fine piles on either side or within the mined trench. This legacy disturbance was not reclaimed and provides no to poor habitat quality for various wildlife species. Based on this level of unreclaimed disturbance, the area was interpreted as having a High magnitude disturbance, which was used as a benchmark for characterizing magnitude of potential effects of the Project. Potential residual effects were based on any potential effects that may exist once Project mining is complete and all of the proposed mine footprint, including the legacy mining has been reclaimed. The primary intent of the reclamation mitigation is to reclaim the site to a state equal to or better than what existed prior to the legacy mining. Details of this reclamation plan were provided in Volume 1, Section F (Conservation and Reclamation Plan). The residual effects remaining after mitigation and reclamation were characterized based on an effectively and fully reclaimed site. Many examples of successful reclamation at mine sites exist across Alberta and elsewhere in western Canada. The magnitude of residual effects was based on professional judgment (CEAA 2017) using the level definitions provided in CR #9, Section D.2.5.3, Table D.2.5-2.

For potential effects on movement, mortality risk, and abundance, the magnitude of residual effects was rated low for all species assessed as VCs (including little brown myotis, olive-sided flycatcher, western toad, and grizzly bear, as well as great gray owl) (CR #9, Section 5.3.11, Table 5.3-26). Following reclamation, which aims to provide a diversity of natural wildlife habitats representative of the region, it is anticipated that the movement, mortality risk, and abundance of these species will be little changed from general baseline conditions.

The magnitude of potential effects on habitat availability for olive-sided flycatcher and little brown myotis was conservatively characterized as moderate. The rationale for this is that the reclaimed landscape is anticipated to be different from the current landscape; more different than would happen from natural disturbance such as fire. Because reclamation aims to restore the area to natural land cover representative of the area and consisting of suitable habitats for these three species, the magnitude of effects is believed to be lower than high.

The magnitude of potential effects on habitat availability for western toad and grizzly bear was characterized as low, because the reclaimed landscape is anticipated to have more wetland area and primary source habitat that currently exists for these two species, respectively. Benga considers this characterization as conservative since the actual magnitude for western toad and grizzlies may be low (less than) because of the increase of suitable habitat after reclamation.

The overall magnitude of potential effects on barn swallow, common nighthawk, and short-eared owl were characterized as low (CR #9, Section 5.4.9, Table 5.4-1), as a result of the diversity of habitats provided in the reclaimed landscape. Similarly, adverse residual effects on species such as moose, elk, lynx and marten are expected to be low, because, over the long term, the amount of effective habitat for these species in the reclaimed landscape is predicted to be greater than currently exists.

Use of Thresholds

Benga used the conservative threshold of 20% loss of effective habitat at the regional level for significance of effect of habitat loss on wildlife species. Literature reviews support a threshold of 70% to 90% loss (or 10% to 30% regional landscape remaining effective habitat) for extirpation, with acknowledgment that effects on body condition, reproductive potential, and abundance are likely prior to extirpation (CR #9, Section 3.2.5.4.1). Every species will have a unique area-specific threshold for the maintenance of its health, reproductive output, and population size. Although these thresholds are not known for the VCs in general, and the VCs within the region and Project area specifically, Benga believes that the use of 20% loss as a residual effect to determine significance is a conservative threshold at which healthy populations will exist. In addition, other evaluation criteria (CR #9, Section 3.2.4, Table 3.2-4) were considered in determining overall significance, particularly the magnitude, reversibility, and duration of the effect on each wildlife VC.

Within each of the available Recovery Strategies or Management Plans, there are no specific guidance about the nature of or requirements for critical habitats for olive-sided flycatcher, little brown myotis, western toad, and grizzly bear. Consequently, it is not possible to develop Project-specific quantitative thresholds for habitat loss for each of these four species at risk. Therefore, the conservative 20% loss threshold was used. Residual effects for these species were rated not significant because:

- Habitat will be progressively reclaimed throughout the lifespan of the Project, making the loss of olive-sided flycatcher habitat temporary but long-term (CR #9, Section 5.3.3.1). The residual effect is expected to be reduced to well under 20% local habitat loss, and therefore much lower than 20% regionally.
- Since disturbed habitats will be progressively reclaimed throughout the life of the Project, the effects of bat roosting habitat availability will be temporary and reversible (CR #9, Section 5.3.5.1). Although old or mature trees are most likely to provide suitable roosting cavities for bats in habitats adjacent to the Project footprint, Benga will assess the potential for creating roosting sites for bats by constructing and erecting bat houses in habitats adjacent to the Project footprint and in reclaimed areas. The residual effect is expected to be reduced to well under 20% habitat loss locally, and therefore much lower than 20% regionally.
- By Year 27, it is expected that there will be 8.3% less effective habitat available (particularly high-quality habitat) locally for western toad than was present under baseline conditions (CR #9, Section 5.3.2.1). Losses of effective habitat for western toad will be offset by reclamation and mitigation, which includes construction of wetlands. The residual effect is expected to result in a gain in suitable habitat for breeding toads and be very low regionally.
- Habitat will be progressively reclaimed throughout the lifespan of the Project, making the loss of grizzly bear habitat temporary but long-term (CR #9, Section 5.3.8.1). The residual effect is expected to result in a substantial increase in suitable habitat locally, and to be very low regionally.

Residual effects on habitat loss for the remaining wildlife VCs were considered to be not significant for the following reasons:

- Columbia spotted frog - Same conclusion as for western toad;
- Great grey owl - By Year 27, it is anticipated that there will be 12% more suitable habitat available locally than is currently present;
- American marten - Same conclusion as for olive-sided flycatcher;
- Canada lynx: - By Year 27, it is anticipated that there will be a 2.8% loss in effective habitat regionally;
- Moose and elk - By Year 27, it is anticipated that there will be 20% and 60% increases in effective habitat locally, respectively.

The existing landscape is extensively disturbed by previous development and current human activity. Habitat availability for wildlife is expected to increase because the reclamation process will include reclaiming previously unreclaimed landscapes from historical mining activities.

The approach to the wildlife assessment is provided in CR #9, Section 2.0. Table SIR 141-1 provides additional information regarding the evaluation criteria used for the assessment of significance of potential Project impacts on identified wildlife VCs.

Table SIR 141-1 Summary of Valued Components, Key Indicators , Rationale and Decision Methods Used to Support the Wildlife Assessment

VC	Key Indicator	Rationale	Methods/Criteria/Thresholds/Residual
Amphibians			
Columbian Spotted Frog	Occurrence (presence/ absence), habitat use, and distribution	Known to occur in WLSA; indicator of wetland/ aquatic/riparian-dependent species; sensitive to changes in water quality; relies on breeding ponds which are of limited availability and distribution; vulnerable to human disturbance; provincially listed species.	Methods: • Field surveys • Habitat suitability modelling/ mapping Criteria: • Quantitative • Qualitative Threshold(s) used: • Habitat loss Residual effects if: • Breeding ponds/wetland habitats not reclaimed

Table SIR 141-1 Summary of Valued Components, Key Indicators , Rationale and Decision Methods Used to Support the Wildlife Assessment

VC	Key Indicator	Rationale	Methods/Criteria/Thresholds/Residual
Western Toad	Occurrence (presence/ absence), habitat use, and distribution	Known to occur in WLSA; indicator of wetland/ aquatic-dependent species; sensitive to changes in water quality, vulnerable to human disturbance; provincially and federally listed species.	Methods: • Field surveys • Habitat suitability modelling/ mapping Criteria: • Quantitative • Qualitative Threshold(s) used: • Habitat loss Residual effects if: • Breeding ponds/wetland habitats not reclaimed
Birds			
Olive-sided Flycatcher	Relative abundance, habitat use, and distribution	Known to occur in WLSA; indicator of mature coniferous/riparian forests, burned woodlands, and edge habitat bird species; provincially and federally listed species.	Methods: • Field surveys • Habitat suitability modelling/ mapping Criteria: • Quantitative • Qualitative (recovery plan) Threshold(s) used: • Habitat loss • Noise levels Residual effects if: • Coniferous forests not reclaimed
Great Grey Owl	Occurrence (presence/ absence), habitat use, and distribution	Known to occur in WLSA; indicator of mature and old growth forest bird species; vulnerable to habitat loss and forestry practices; cultural importance to First Nations; provincially listed species.	Methods: • Field surveys • Habitat suitability modelling/ mapping Criteria: • Quantitative • Qualitative Threshold(s) used: • Habitat loss Residual effects if: • Forests are not reclaimed

Table SIR 141-1 Summary of Valued Components, Key Indicators , Rationale and Decision Methods Used to Support the Wildlife Assessment

VC	Key Indicator	Rationale	Methods/Criteria/Thresholds/Residual
Mammals			
Little Brown Myotis	Relative abundance, habitat use, and distribution	Known to occur in WLSA; indicator of mature and old growth forest species; federally listed species.	Methods: • Field surveys Criteria: • Quantitative • Qualitative Threshold(s) used: • Habitat loss Residual effects if: • Roosting habitats are not reclaimed
American Marten	Relative abundance, habitat use, and distribution	Known to occur in WLSA; important fur harvest and First Nations traditional use species, vulnerable to habitat fragmentation and human disturbance; indicator of late succession coniferous forest.	Methods: • Field surveys • Habitat suitability modelling/ mapping Criteria: • Quantitative • Qualitative Threshold(s) used: • Habitat loss Residual effects if: • Coniferous forests are not reclaimed
Canada Lynx	Relative abundance, habitat use, and distribution	Known to occur in WLSA; important fur harvest and First Nations traditional use species; vulnerable to habitat fragmentation/ human disturbance; indicator of early succession forest species; provincially listed species.	Methods: • Field surveys • Habitat suitability modelling/ mapping Criteria: • Quantitative • Qualitative Threshold(s) used: • Habitat loss Residual effects if: • Forest habitats are not reclaimed

Table SIR 141-1 Summary of Valued Components, Key Indicators , Rationale and Decision Methods Used to Support the Wildlife Assessment

VC	Key Indicator	Rationale	Methods/Criteria/Thresholds/Residual
Grizzly Bear	Relative abundance, habitat use, and distribution	Known to occur in WLSA; culturally important to First Nations; potentially declining population in the Castle-Livingstone region; susceptible to industrial activities and vulnerable to conflicts with humans; provincially and federally listed species.	Methods: • Field surveys • Resource selection function modelling Criteria: • Quantitative • Qualitative (recovery/ management plans) Threshold(s) used: • Habitat loss • Linear features density Residual effects if: • Grassland habitats are not reclaimed
Moose	Relative abundance, habitat use, and distribution	Known to occur in WLSA; important recreational hunting and traditional use species; culturally important to First Nations important prey for large predators; indicator of riparian and early to mid-successional habitats.	Methods: • Field surveys • Habitat suitability modelling/ mapping Criteria: • Quantitative • Qualitative Threshold(s) used: • Habitat loss • Linear features density Residual effects if: • Winter core habitats are not reclaimed
Elk	Relative abundance, habitat use, and distribution	Known to occur in the WLSA; important recreational hunting species; culturally important to First Nations; important prey for large predators; indicator of grassland/early successional habitats.	Methods: • Field surveys • Habitat suitability modelling/ mapping Criteria: • Quantitative • Qualitative Threshold(s) used: • Habitat loss • Linear features density Residual effects if: • Winter core habitats are not reclaimed

Table SIR 141-1 Summary of Valued Components, Key Indicators , Rationale and Decision Methods Used to Support the Wildlife Assessment

VC	Key Indicator	Rationale	Methods/Criteria/Thresholds/Residual
Wildlife Diversity	Measures of relative abundance, distribution and variation in wildlife species and wildlife habitat	Wildlife diversity reflects the variation in the number of wildlife species in a given area taking into account habitat types/landscape cover classes. It is a measure of ecosystem health with higher diversity ratings indicating healthier wildlife and vegetation communities. Lower diversity ratings indicate that vegetation integrity (composition, structure, and functioning) is affected which can affect wildlife use of reclaimed areas.	Methods: • Field surveys • Habitat mapping Criteria: • Quantitative • Qualitative Threshold(s) used: • Reduced wildlife abundance • Habitat loss Residual effects if: • Permanent loss of wildlife species diversity if habitats not reclaimed

References

Canadian Environmental Assessment Agency (CEAA). 2017. Determining whether a designated Project is likely to cause significant adverse environmental effects under the *Canadian Environmental Assessment Act*, 2012 – Technical Guidance. Draft Version 1, April 2017. Ottawa, Ontario, Canada. Available Online: https://www.ceaa-acee.gc.ca/050/documents/p80054/119238E.pdf.

142. Volume 6, Section 5.3.9.2, pg. 278-280

Volume 6, Figure 5.3-41, pg. 504

Benga states, "A primary concern with respect to Project development is the potential effect on seasonal movements of moose in and around the WLSA. Permeability of the WLSA will be reduced by the Project footprint, particularly by the active mine site, access road, rail loop and the coal conveyor. While moose movements in the WLSA will be affected to some extent by the access road and the rail loop which will be at least partially permeable, the active mine site and the coal conveyor is expected to affect moose movements the most."

Benga provides a figure that indicates the core habitat of moose and elk with the disturbance permeability in the wildlife local study area at Application Year 14 and Year 27. Figure A.1.0-2 overlaying Figure 2.4-25/30 with a full overlay provided in Figures 5.3-41/42 (Vol6. Page.504-505) depicts where the proposed project footprint disturbance could impact moose and elk in the areas of their highest detection frequency and core habitat.

a) Benga recommends mitigation techniques to alleviate the potential effect on seasonal movements of moose and elk; however, partial to full impermeability exists as per the figures and assessment. Provide reasoning and justification for Benga's evaluation of the environmental impact criterion and include appropriate literature and/or sources to support conclusions provided.

Response:

The movement patterns of moose and elk in the region are not well known, but based on research conducted in other areas (*e.g.*, Maier *et al.* 2005), Benga expects that moose in mountainous areas will move to lower elevations during winter in response to increasing snow depths. As discussed in CR#9, Section 5.3.9.2, it is likely that such seasonal movements would occur within corridors of suitable habitat, such as the riparian zones along Blairmore Creek and Gold Creek. The Crowsnest River valley has been provincially designated as a Key Wildlife and Biodiversity Zone, in part because of its suitability as winter range for ungulates. The development of the Grassy Mountain Coal Project will maintain riparian corridors along Blairmore Creek and Gold Creek that are expected to function as effective movement corridors for moose during the period of mine development. Benga acknowledges that the rail loadout facility could provide a further barrier (in addition to Highway 3 and urban development at Blairmore) to the north-south movement of ungulates between the Crowsnest River valley and higher elevation summer ranges to the north during the period of mine operations.

While Benga does not expect mine operations to significantly alter north-south movements of ungulates along Blairmore Creek and Gold Creek, the mine itself could disrupt local movements of ungulates between core habitat patches associated with these drainages. Although the extent of east-west movements are unknown, animals (particularly moose) are more likely to move along riparian zones that cross over heights of land between drainages. The mine itself will remain impermeable to ungulate movements through most of the construction and operation phases but the effects are expected to be relatively short-term and by Year 27, the reclaimed mine and dump areas are expected to support early-successional habitats attractive to both moose and elk.

Although the mine itself represents an impermeable, physical barrier to ungulate movements during the operations phase, the coal conveyor does not. As discussed in CR#9, Section 7.1.4, effects of the conveyor on wildlife movements will be mitigated by installing wildlife crossings (either underpasses or overpasses) at observable or probable ungulate travel routes along the 5.4 km length of the conveyor. This is a proven technology that has been shown to provide effective mitigation for moose, elk, and deer (Greenwood and Dalton 1984, Brusnyk and Westworth 1987, Coal Association of Canada 2003). At the Obed Mountain Coal Mine in west-central Alberta, Brusnyk and Westworth (1987) studied the use of wildlife underpasses installed at key locations along a 13 km coal conveyor leading from the mine site to a rail loadout in the Athabasca River Valley. The study examined changes in wildlife use of the crossings during the initial three year period following construction. Infra-red beams and recorders were used in conjunction with winter and summer (prepared substrate) track counts to determine the crossing success (the proportion of animals that approached the conveyor and successfully used the crossing structure). The authors reported that moose, elk, and deer successfully crossed under the 3 m high elevated sections of conveyor with use of crossings increasing over the 3 year period as animals habituated to the presence of the conveyor. There were also differences in habituation rates between the species. While moose adapted relatively quickly reaching a crossing success rate of 70% by Year 3, elk were less successful achieving 37% by Year 3 with deer reaching 51%. Vehicle traffic along an adjacent access road may have been a primary factor in unsuccessful crossing attempts although it was expected that a proportion of animals that were unsuccessful in their initial attempt to cross beneath the conveyor would have been successful in later attempts.

Deer and elk are also reported to have adapted very well to similar 3 m high underpasses constructed along a coal conveyor at Teck's Line Creek coal project in British Columbia's Elk Valley (Coal Association of Canada 2003). Greenwood and Dalton (1984) also reported that mule deer freely passed under an operating coal conveyor at a mine in Utah wherever a 50 – 90 cm clearance existed. These authors recommended that, although a height of 1 m appears sufficient for smaller ungulates like deer and bighorn sheep, underpass structures should have a minimum clearance of 3 m for moose and elk.

Selection of optimum sites to install wildlife crossings and use of speed controls (including signage and other enforcement) are important for improving crossing success rates. While these previous studies support the conclusion that properly designed wildlife crossings can effectively mitigate the impact of the coal conveyor on wildlife movements, there is also strong evidence that resource roads disrupt wildlife movements to some degree, and it is likely that the corridor containing the coal conveyor and the mine access will disrupt east-west movements of ungulates in the WLSA to some degree. While this is not likely to interfere with seasonal movements between summer and winter ranges, it could affect local movements and resource use (*e.g.*, access to forage). There is a low likelihood, however, that these changes would affect survival and the persistence of moose and elk populations in the area.

On this basis, although the operation of the Grassy Mountain Coal Mine will negatively affect movements of moose and elk in the area, these effects can be mitigated with proper installation of wildlife crossings and phased reclamation. Benga concludes that the residual effects will be regional in extent but of low magnitude, not significant, and fully reversible (CR#9, Table 5.3-26,).

References

Brusnyk, L.M. and D.A. Westworth. 1987. Ungulate monitoring studies in the Obed Marsh thermal coal project area - Final Report. Prepared by D.A. Westworth & Associates Ltd. for Union Oil Company of Canada Ltd., Calgary, Alberta, Canada.

Coal Association of Canada. 2003. Environment – Module 4. Available Online: https://coal.ca/wp-content/uploads/2017/10/module-4-environment.pdf.

Greenwood, C.L. and L.B. Dalton. 1984. Mule deer passage beneath an overland coal conveyer. Great Basin Naturalist 443: 499-504.

Maier, J.A.K., J.M. Ver Hoef, A.D. McGuire, R.T. Bowyer, L. Sapterstein and H.A. Maier.

2005. Distribution and density of moose in relation to landscape characteristics: Effects of scale. Canadian Journal of Forest Research 35: 2233-2243.

b) As per TOR 4.7.2. [A] (a), discuss and assess the impact regarding the hindrance in the seasonal moose and elk movements patterns and distribution for all stages of the project, particularly from east to west as the figures suggest partial to full impermeability, hindering seasonal movements.

Response:

See response SIR 142a.

143. Volume 6, Section 5.5.2, Pg. 303

Benga discusses the environmental effects assessment on migratory birds with regards to habitat fragmentation and connectivity, stating "With mitigation, the effects of Project development on migratory bird movements are predicted to be local in extent, long in duration, continuous in frequency, reversible in the short-term, low in magnitude and not significant." With a similar statement made for the environmental effects on migratory birds regarding abundance.

Benga recommends mitigation techniques that may alleviate potential effects on habitat fragmentation and connectivity and migratory bird abundance.

a) Provide the analysis for the conclusions made in the criterion for the environmental impact on migratory birds and include supporting literature and/or sources for conclusions provided.

Response:

Migratory birds are protected under the federal Migratory Birds Convention Act (MBCA), which recognizes the following groups of birds: waterfowl, cranes, rails, coots, shorebirds, doves, insectivorous birds (excluding blackbirds), grebes, bitterns, herons, gulls, terns, seabirds, and loons. Of the 156 bird species with the potential to occur in the WLSA (CR #9, Appendix D), 116 (74.4%) are protected under the MBCA. Thirty-three of the protected migratory bird species were detected within the WLSA during the songbird survey conducted to support the Wildlife Assessment (Section 2.3.2, CR#9). Of these 33 species, 29 were detected at point count stations and four were detected incidentally. An additional 30 species protected under the MBCA were either detected at point counts located within 1 km of the WLSA, on BBS Route 04-205 (Section 2.4.3.2.1, CR#9), or through a query of the Alberta Fisheries and Wildlife Management Information System (FWMIS) database. The remaining 53 migratory bird species have the potential to occur within the WLSA based on their habitat preferences and geographic range.

The effects of Project development on 10 selected wildlife Valued Components (VCs) were assessed quantitatively using habitat suitability index or resource selection function modelling approaches. One of these species, the olive-sided flycatcher, is protected under the MBCA and the federal *Species at Risk Act* (SARA) while the remaining nine species were either special status species or species of management concern in Alberta. In addition, high-level assessments (which did not include habitat suitability index modelling) were conducted for eight species, two of which are protected by the MBCA and SARA (common nighthawk and barn swallow) and six which were either special status species or species of management concern in Alberta.

As indicated in CR #9, Section 3.2.3, wildlife VCs were selected based on various criteria including ecological, economic, and traditional use importance. The VCs served as indicator species to focus the wildlife assessment in accordance with current practice in Alberta and Canada. Many of the migratory birds present in the WLSA have habitat requirements that overlap those of other wildlife VCs that were selected. For example, the Project effects on habitat availability for the Columbia spotted frog was expected to be similar for shorebirds and other migratory bird species that rely on ponds, streams and wetlands.

However, to further assess the effects of the Project on migratory birds, species that may occur in the WLSA were divided into broader groups based on their preferred habitat type (Table SIR 143-1). Most of the migratory bird groups have habitat requirements that are similar to wildlife species selected as VCs (Table SIR 143-1), although some do not. A high-level assessment of potential Project effects on habitat availability, fragmentation and connectivity, mortality risk and health, and abundance for each group of migratory birds was conducted based on the criteria described in CR #9, Table 3.2-3.

Habitat Availability

The largest effect of Project development on migratory birds will be direct habitat loss, most of which is expected to be temporary as disturbed habitats will be reclaimed progressively during Project operations and following Project closure. Wildlife habitat availability under the Baseline and Application (Years 14 and 27) Cases is summarized in CR #9, Table 5.1-1.

Shorebirds, waterfowl and other wetland-dependent birds (Table SIR 143-1) are expected to be minimally affected by habitat loss since wetlands and waterbodies are scarce in the WLSA. Under the Baseline Case, there are only 17.9 ha (0.3%) of shrubby wetland, 4.8 ha (0.1%) of treed wetland, and 63.9 ha (1.1%) of waterbody habitats in the WLSA. During Year 14 of the Application Case, shrubby wetland and waterbody habitats will be reduced by 72.6% (17.9 to 4.9 ha) and 0.1% (63.9 to 63.8 ha) respectively, while the treed wetland habitat type will remain unaffected by Project development. By Year 27 of the Application Case, the areal extent of shrubby and treed wetland will not have changed from Year 14. However, following post-closure reclamation, the waterbody habitat type will increase by 59.2 ha (92.7%) from the Baseline Case. Thus, by Year 27 of the Application Case, habitat availability for waterfowl is expected to increase while the availability of shrubby wetland habitat will decrease by 13.0 ha (72.6%). Treed wetland habitat is expected to remain unchanged. The abundance of species that prefer wet, shrubby habitats, such as common yellowthroat and Wilson’s warbler, may therefore decrease in the WLSA as they will be displaced to similar, nearby habitats. However, many of the species that prefer wet, shrubby habitats may also occur in upland habitats with thick shrubs as well as in shrubby riparian habitats. Upland habitats with thick shrub cover account for 0.2 ha of the WLSA and will be unaffected by Project development. Project development will also avoid riparian habitats by a minimum of 100 m.

Table SIR 143-1 Migratory Bird Species[1] with the Potential[2] to Occur in the WLSA and Their Habitat Preferences

Migratory Bird Group	Species Included	SARA-Listed Species	Habitat Preferences	VCs With Similar Requirements
Shorebirds and Other Birds Reliant on Marshes or Rivers	American Dipper, Bank Swallow, Common Yellowthroat, Killdeer, Lincoln's Sparrow, Marsh Wren, Northern Waterthrush, Sora, Spotted Sandpiper, Wilson's Snipe, Wilson's Phalarope, Wilson's Warbler	None	Wetlands, ponds, lakeshores, streams. Wet, shrubby area in case of Wilson's Warbler and Common Yellowthroat.	Columbia Spotted Frog, Western Toad
Waterfowl	American Coot, American Wigeon, Barrow's Goldeneye, Blue-winged Teal, Bufflehead, Canada Goose, Common Goldeneye, Common Merganser, Green-winged Teal, Harlequin Duck, Hooded Merganser, Lesser Scaup, Mallard, Northern Shoveler, Northern Pintail, Ring-necked Duck, Redhead, Wood Duck	None	Wetlands, lakes, rivers, streams	Columbia Spotted Frog, Western Toad
Grassland or Open Country Birds	American Goldfinch, American Pipit, Bobolink, Brewer's Sparrow, Clay-colored Sparrow, Common Nighthawk, Eastern Kingbird, Fox Sparrow, Golden-crowned Sparrow, Mountain Bluebird, Mourning Dove, Savannah Sparrow, Tree Swallow, Vesper Sparrow, Western Meadowlark, White-crowned Sparrow	Bobolink, Common Nighthawk	Grasslands. Shrubby habitats at forest edges (Fox, Golden-crowned and White-crowned Sparrow)	Elk Common Nighthawk was assessed as a special status wildlife species in Section 5.4.2, CR#9.
Old-Growth Forest Birds	American Three-toed Woodpecker, Black-backed Woodpecker, Brown Creeper, Evening Grosbeak, Pileated Woodpecker	None	Mature to Old Growth Forests	Great Gray Owl, American Marten
Coniferous-dominant Forest Birds	Boreal Chickadee, Cassin's Finch, Cordilleran Flycatcher, Golden-crowned Kinglet, Hammond's Flycatcher, Mountain Chickadee, Olive-sided Flycatcher, Pine Grosbeak, Purple Finch, Red-breasted Nuthatch, Red Crossbill, Ruby-crowned Kinglet, Townsend's Solitaire, Townsend's Warbler, Varied Thrush, Western Tanager, White-winged Crossbill, Winter Wren, Yellow-rumped Warbler	Olive-sided Flycatcher	Coniferous or Coniferous-dominant Mixedwood Forests	Olive-sided Flycatcher, American Marten, Canada Lynx

Table SIR 143-1 Migratory Bird Species[1] with the Potential[2] to Occur in the WLSA and Their Habitat Preferences

Migratory Bird Group	Species Included	SARA-Listed Species	Habitat Preferences	VCs With Similar Requirements
Deciduous-dominant Forest Birds	Alder Flycatcher, American Redstart, Baltimore Oriole, Black-capped Chickadee, Black-headed Grosbeak, Downy Woodpecker, Gray Catbird, Lazuli Bunting, Least Flycatcher, Ovenbird, Red-eyed Vireo, Red-naped Sapsucker, Veery, Warbling Vireo, White-breasted Nuthatch, Willow Flycatcher, Yellow Warbler	None	Deciduous or Deciduous-dominant Mixedwood Forests. Some species may also breed in thick patches of deciduous shrubs.	Little Brown Myotis, Moose
Forest Generalist Birds	American Robin, Calliope Hummingbird, Cassin's Vireo, Cedar Waxwing, Chipping Sparrow, Common Redpoll, Dark-eyed Junco, Dusky Flycatcher, Hairy Woodpecker, Hermit Thrush, Hoary Redpoll, House Finch, House Wren, MacGillivray's Warbler, Northern Flicker, Northern Rough-winged Swallow, Orange-crowned Warbler, Pacific-slope Flycatcher, Pine Siskin, Rufous Hummingbird, Song Sparrow, Swainson's Thrush, Tennessee Warbler, Violet Green Swallow, Western Wood-pewee		Deciduous, coniferous, or mixedwood forests. Some species may breed or forage in thick shrub patches.	Moose, Little Brown Myotis
Cliffs, Alpine or Other Rocky Habitat Birds	Black Swift, Cliff Swallow, Gray-crowned Rosy Finch, Rock Wren	None	Cliff faces, areas with exposed rock (rock wren), or alpine areas (gray-crowned rosy finch).	None
Anthropogenic Habitat Birds	Barn Swallow, Eastern Phoebe	Barn Swallow	Old Buildings (barn swallow), bridges (eastern phoebe).	None Barn Swallow was assessed as a special status wildlife species in Section 5.4.1, CR#9.

[1] Refers to species that are protected under the *Migratory Birds Convention Act*

[2] Refers to migratory bird species with a high, moderate or confirmed Probability of Occurrence rating in CR #9, Table 2.4-2.

Grassland species (including the mountain bluebird and vesper sparrow, Table 10.1-1) occur in the WLSA but are uncommon because of the relative scarcity of grassland habitat. At Baseline, 5.1% (290.3 ha) of the WLSA is comprised of grassland habitat. In addition, there is a very small amount of upland shrub habitat present in the WLSA (0.2 ha). By Year 14, it is expected that grassland habitat will be reduced by 51.9% (150.7 ha) while upland shrub habitat will remain unchanged. However, by Year 27, grassland habitat is predicted to increase by 20.2% (290.3 to 349.1 ha) through progressive reclamation of the Project footprint. Therefore, while there will be a temporary decrease in habitat availability for grassland-dwelling migratory birds up to Year 14, grassland habitat availability is expected to increase in the WLSA following progressive and post-mine closure reclamation.

Forest-dwelling migratory bird species, particularly those that nest in coniferous and mixedwood forests (see Table 10.1-1), will likely be the most affected by Project development. Coniferous and mixedwood forests cover a large area of the WLSA and species richness and diversity were highest in these habitats (CR #9, Table 2.4-8). By Year 27 of the Application Case, there will be a reduction in the area of coniferous forest (open pine, open mixed coniferous, moderate mixed coniferous, closed spruce, and closed mixed coniferous habitat types) from 2,831.9 ha to 2,107.7 ha (724.2 ha; 25.6%) and a reduction in the area of mixedwood forest (open mixedwood and closed mixedwood habitat types) from 1,282.4 ha to 936.7 ha (345.7 ha; 27%). The area of deciduous forest in the WLSA (79.2 ha) at Baseline will be minimally affected by Project development. By Year 27 of the Application Case, it is expected that deciduous forest will be reduced by 6.3% (3.2 ha).

Some species display a strong preference for mature and old-growth forests. Such species are particularly vulnerable to habitat loss as it can take 100 years or more (CR #9, Appendix C, Section 1.2) for a young forest to display old-growth forest characteristics. Old-growth forests were selected as a vegetation VC (CR #8, Section 4.5) and the effects of Project development on old growth forests are discussed in CR #8, Section 4.5.1. Under the Baseline Case, there are 168.8 ha (3.0%) of old growth forest present in the WLSA, only 4.9% (8.3 ha) of which will be affected by Project development (CR #8, Section 4.5.1, Table 4.5-1). This loss could potentially be offset if mature forests within the WLSA reach the old-growth stage by Year 27 of the Application Case. However, none of the ecosite phases mapped in the WLSA have a high potential to support old-growth forest (CR #8, Section 4.5.2).

A small number of migratory bird species breed in open, rocky habitats, including alpine habitats (Table SIR 141-1). Under the Baseline Case, 48.6 ha (0.9%) of the WLSA is characterized as rock barren habitat, and by Year 14 of the Application Case, it is expected that there will be a loss of 31.8 ha (-65.5%). However, by Year 27, it is predicted that there will be a small increase (0.4%, 0.2 ha) in rock barren habitat in the WLSA with Project development compared to the Baseline Case.

Some species with the potential to occur in the WLSA frequently build their nests on anthropogenic structures such as buildings or bridges (Table SIR 141-1). One of these is the barn swallow, and the effects of the proposed Project on this species are discussed in CR #9, Section 5.4.1. The effects of the proposed Project on other species that tend to build their nests on anthropogenic structures are expected to be similar.

In addition to direct habitat losses, Project development may result in indirect habitat losses from sensory disturbances since some migratory birds may avoid otherwise suitable habitats located close to the Project footprint. The effects of indirect habitat losses on migratory birds are discussed in CR #9, Section 5.5.1. In addition, methods that will be used to mitigate the effects of habitat loss on migratory birds are discussed in CR #9, Section 7.1.3. For example, Benga has committed to developing a Beneficial Management Plan as described by Environment Canada to minimize the effects of Project development on migratory birds and their habitats by identifying site-specific mitigation and monitoring measures.

Overall, the geographic extent of all changes in habitat availability to migratory birds are predicted to be local, as no migratory bird species that occur in the area have breeding territories that exceed the size of the WLSA. The duration of Project effects will vary among species, but are predicted to be extended for forest-dwelling birds, residual for species that rely on old-growth forests, and long for all other species. The frequency of all Project-related effects on habitat availability for forest-dwelling migratory birds will be continuous, moderate in magnitude and reversible in the long-term. The frequency of all Project-related effects on habitat availability for all non-forest-dwelling migratory bird species will be continuous, nil to low in magnitude, and reversible in the short-term. The proposed Project contribution to changes in habitat availability for migratory birds is predicted to be positive for waterfowl, grassland species, and rock/cliff dwelling species and negative for all other species. The confidence rating for these predicted effects is high, the probability of occurrence is high and the predicted significance is insignificant.

Habitat Fragmentation and Connectivity

The effects of Project development on habitat fragmentation and connectivity for migratory birds are discussed in CR #9, Section 5.5.2. With mitigation (CR #9, Section 7.1.4), the effects of Project development on migratory bird movements are predicted to be local in extent, long in duration, continuous in frequency, reversible in the short-term, low in magnitude, and insignificant. The Project contribution to migratory bird movements are predicted to be negative, the confidence rating for this prediction is high, and the probability of effect occurrence is high.

Change in Mortality Risk and Health

The effects of Project development on mortality risk of migratory birds are discussed in CR #9, Section 5.5.3. In addition, changes to the health of waterfowl, shorebirds, and other species that feed on aquatic life could occur if levels of selenium or other heavy metals increase in waterbodies located within the WLSA and downstream. However, this potential concern was assessed in CR #9, Section 5.4.4, where the potential effects of Project development on the bald eagle, a species that may feed heavily on fish, was discussed. Potential effects of selenium on other migratory birds, such as American dippers and spotted sandpipers, were also reviewed in CR #9, Section 5.4.4. Changes in water quality have the potential to affect aquatic birds;

however, a water quality management program has been developed to mitigate this problem (Section C.8 [Geochemistry and Selenium Management] of the Application).

Many of the potential Project-related effects on migratory bird mortality risk will be mitigated (CR #9, Section 7.1.5). The largest mortality risk for migratory birds associated with Project development is the destruction of nests during vegetation clearing. However, this source of mortality will be mitigated by clearing vegetation outside of the breeding season for migratory birds (April 15 to August 31) to the extent possible.

With mitigation (CR #9, Section 7.1.5), the effects of Project development on migratory bird mortality risk and health are predicted to be local in extent, long in duration, isolated in frequency, reversible in the short term, low in magnitude, and insignificant. The Project contribution to migratory bird mortality is predicted to be neutral, the confidence rating for this prediction is high, and the probability of effect occurrence is high.

Abundance

Because of Project effects associated with direct and indirect habitat losses, the abundance of migratory birds within the Project footprint and adjacent habitats will be reduced over the short-term. Migratory birds will largely be displaced to other suitable habitats in the WLSA and surrounding region. With mitigation (CR #9, Section 7.0), the effects of Project development on migratory bird abundance are predicted to be local in extent, long in duration, continuous in frequency, reversible in the long term, low in magnitude, and insignificant. The Project contribution to migratory bird abundance is predicted to be negative, the confidence rating for this prediction is high, and the probability of effect occurrence is high.

The avian species identified as VCs are the olive-sided flycatcher and great gray owl. Great gray owls using habitats within the Project footprint will be displaced to other areas of the WLSA and surrounding area during the life of the Project because of direct and indirect habitat losses, although they may use residual habitats within the Project footprint to some extent. However, great gray owls are very likely to persist elsewhere in the WLSA over the life of the Project. High-quality habitat for great gray owls (which is composed primarily of mature to old-growth forest) will be minimally affected by the Project (CR #9, Table 5.3-4). The area of moderate-quality habitat in the WLSA will increase following Project closure and, overall, the area of effective habitat for great gray owls is expected to increase by 12.2% by Year 27. Thus, although there may be a temporary decrease in the abundance of great gray owls in the WLSA during the lifespan of the Project, sufficient habitat will remain in the WLSA following Project closure to allow for a population recovery.

Olive-sided flycatchers are likely to persist in the WLSA during the lifespan of the Project, although this effect prediction will be verified with the development and implementation of a Beneficial Management Plan for migratory birds and a wildlife monitoring program in consultation with provincial and federal regulators (CR #9, Sections 7.1 and 7.2). At Year 14 of the Application Case, 2,168.3 ha of effective olive-sided flycatcher habitat will remain in the WLSA (CR #9, Table 5.3-3), and olive-sided flycatchers can have home ranges of 10 to 45 ha (Environment Canada 2015). Thus, there should be sufficient habitat available for a population of olive-sided flycatchers (between 48 and 217 individuals based on the area of available habitat in WLSA and home range size estimates) to persist in the WLSA. At Year 27 of the Application Case, 2,272 ha of effective olive-sided flycatcher habitat will remain on the landscape, which will allow for population growth and recovery following mine closure. Reclaimed habitats will eventually mature to the point where they will provide effective breeding habitat for olive-sided flycatchers, although this may take several decades (see CR #9, Section 5.3.3.1).

References

Environment Canada. 2015. Recovery Strategy for Olive-sided Flycatcher (Contopus cooperi) in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa, Ontario, Canada.

144. Volume 6, Section 6.1, Pg. 306-307

Benga provides information regarding baseline, approved and foreseeable projects in the WRSA and GBRSA, which includes various activities associated with coal mining, forestry, oil and gas activities, urban areas, road/rail/utility corridors and recreational areas. Benga states, "The Planned

Development Case (PDC) is also the cumulative effects assessment and includes the potential effects of the Project together with the combined effects of all existing, approved and planned projects at the regional (WRSA, GBRSA) scale."

As per the AER Environmental Assessment Major Deficiency Report, Benga had not addressed the impact of re-locating half of the golf course and clubhouse, even though this is a direct result of the proposed mine development.

a) While it is understood the new golf course design has not been finalized and the impacts to the golf course have been discussed in the EIA report, the direct and cumulative impacts of the golf course re-development are not addressed specific to wildlife. A detailed course design is not required to determine potential impacts from the golf course re-development on wildlife resources, but should consider interactions with Benga's proposed developments (i.e., conveyor and access road).

    i) The golf course has the potential to have impacts on wildlife through various means (mortality, fragmentation, habitat loss, movement, etc.), and as per ToR 4.7.2[A] describe and assess the potential impacts of the project on wildlife populations and wildlife habitats, provide the potential impact of the golf course re-development in the environmental impact analysis as it is a component of the mine proposal under the Planned Development Case.

Response:

The proposed relocation of the golf course was included in the Application Assessment and the Planned Development Case as one component associated with anthropogenic disturbances in the WLSA and the GBRSA (refer to CR #9, Section 1.0, Section 1.2.1, Table 1.2-1, Section 2.35, Section 2.4.1, Section 2.4.3.2.2.2, Table 3.1-1, Table 3.2-6, Section 4.0, Section 6.1, and various Figures). Applicable wildlife mitigation outlined in CR #9, Section 7.0 would apply to the relocated golf course as well.

It is important to note that the primary concern associated with the proposed golf course location is expected to be habitat for wildlife VCs. The relocated golf course is located in a predominantly forested area that was rated as providing effective habitat for moose, elk and forest birds such as the olive-sided flycatcher. However, the area affected is just 38.1 ha representing only 2.5 % of the Project footprint (CR #9, Table 1.2-1), 0.7% of the WLSA, or 0.001% of GBRSA. Furthermore, it was conservatively assumed that all of the 38.1 ha associated with the relocated golf course would be lost but it is likely that the fairways would still be tree-lined similar to the existing golf course which would reduce the amount of habitat affected. Because of the proximity of the site to other major disturbance features (Highway 3, railway, Towns of Blairmore and Coleman), the area is not expected to provide core habitat for sensitive species such as lynx and grizzly bear. While human activity associated with the golf course may reduce the overall permeability of the golf course for wildlife movements, it will not be impermeable and is not expected to significantly disrupt seasonal or dispersal movements of any of the wildlife VCs.

ii) Update each of the Value Components used in the Planned Development Case cumulative effects assessment and include the potential effects of the golf course re-development.

Response:

See response SIR 144a(i).

145. Volume 6, Section 2.4.3.3.4.1.3, pg. 136

Volume 6, Section 5.3.9.2, pg. 278-280

Volume 6, Section 6.3.1, pg. 312

Benga states, “During the wildlife camera program, moose were detected at 18 of the 25 cameras, [and] are [considered] a species of management concern because of their recreational hunting value [and traditional uses].”

Benga states, “A primary concern with respect to Project development is the potential effect on seasonal movements of moose in and around the WLSA. Permeability of the WLSA will be reduced by the Project footprint, particularly by the active mine site, access road, rail loop and the coal conveyor. While moose movements in the WLSA will be affected to some extent by the access road and the rail loop which will be at least partially permeable, the active mine site and the coal conveyor is expected to affect moose movements the most.”

Benga states, “Columbia spotted frog, western toad, great gray owl, moose and elk were screened from further consideration in the cumulative effects assessment. Moose and elk are early to mid- successional species that will likely benefit from mining (post-reclamation) and forestry activities in the region.”

a) Benga provides information regarding the presence of moose in the area, their value for traditional users and habitat needs regarding seasonal movements within the area. Provide further rationale and supporting literature and/or sources to not include moose within the Planned Case Development cumulative effects assessment.

Response:

Although moose are an important species in socio-economic terms (i.e., for sport hunting and traditional resource use), there is no evidence that their population status will be jeopardized by the Project. In terms of their conservation status, moose are listed as "Secure" in Alberta. While recent population survey data are lacking for the region, other indicators suggest that moose remain relatively abundant. Hunter harvest surveys reported for 2016indicate that although Wildlife Management Unit (WMU) 302 received little use with one animal taken and a hunter success rate of 25% during that year, WMU 402 (80%), WMU 400 (92%), and WMU 306 (100%) had some of the highest moose hunter success rates in the province (GoA 2017).

Moose were also judged to have a low vulnerability to regional population decline as a result of the proposed Project. Effective moose habitat is broadly distributed throughout the WRSA (CR#9, Figure 4.4-21) with 47% of the WRSA comprising effective habitat (CR#9, Table 4.4-10). As discussed in CR#9, Section 5.3.9.1, during full mine development (Year 14), the resulting habitat loss is predicted to comprise just 1.4% of the effective moose habitat in the WRSA. By Year 27, reclamation of disturbed lands to early successional communities favoured by moose is expected to increase the amount of effective moose habitat in the WRSA by 2.3%.

Previous studies also suggest that moose exhibit a relatively high tolerance to the types of sensory disturbances typically associated with mining activity. Westworth et al. (1989) studied winter habitat use by moose in the vicinity of a large, open-pit copper mine in north-central British Columbia. These authors reported that moose became conditioned to noise and general activity associated with vehicular traffic, equipment operation and blasting of ore reserves. Using browse surveys and pellet-group counts, they demonstrated that moose made greater use of habitats within 300 m of the mine edge than they did of habitats that were 1,000 m or more from the mine. They attributed these differences to the abundant browse resources in cleared areas around the perimeter of the mine, along with potentially greater security from wolf predation. As discussed in SIR 142, the Project has potential to disrupt the local movements of a small number of moose; however, there is a low likelihood that movement of moose between seasonally important habitats will be significantly affected. For these reasons, Benga has concluded that effects of the Project on moose will be of low magnitude, not significant, and primarily restricted to the WLSA (CR#9, Table 5.3-26). Because residual effects were not identified, moose was not considered a species for which a cumulative effects assessment was warranted.

References

Government of Alberta (GoA). 2017. Big game harvest estimates 2016 – Moose. Available Online: https://mywildalberta.ca/hunting/documents/Moose-2016HunterHarvest-May2017.pdf.

Westworth, D.A., L.M. Brusnyk, J. Roberts and H. Veldhuzien. 1989. Winter habitat use by moose in the vicinity of an open pit mine copper mine in north-central British Columbia. Alces 25: 156 - 166.

146. Volume 6, Section 6.3.2.1, pg. 316 – 326

Benga states, “The cumulative effects on olive-sided flycatcher habitat availability are predicted to be nil in magnitude and neutral, due to the increase in high-quality habitat (i.e. edge effect) that will result from forestry activities. The confidence rating associated with these predications is high, and the changes are predicated to be not significant at the regional level.”

Throughout Section 6.3 Cumulative Effects Assessment, similar statements are made for the chosen Valued Components within their respective sections. As per the Evaluation Criterion for Assessing the Environmental Impact, provided in Table D.2.5-2, various criterion are missing throughout this section.

For the majority of Valued Components, a description of the relationship between the significance rating and the scientific effect threshold is not provided. The EIA also does not provide a description of the range of natural variability of ecological, social, or economic parameters associated with each of the wildlife VCs identified and does not identify critical threshold levels for significance that would enable a determination of significance.

a) Provide the entire appropriate evaluation criterion for assessing the environmental impact throughout Section 6.3 for all the selected Valued Components in the Cumulative Effects Assessment.

   i) Provide clear rationale to support the conclusions of the cumulative effects assessment for the missing evaluation criterion where Benga has concluded that no predicted affects will occur.

Response:

The concerns expressed in SIR 146 are substantially the same as those indicated in the response SIR 141 since this describes the overall approach and rationale that Benga followed for the entire wildlife assessment, including the Planned Development case.

   ii) For instances where Benga choses to not include certain criterion, adequate justification and support is to be provided.

Response:

See response SIR 146 a(i).

147. Volume 6, Section 6.3.5.1 pg. 320-321

Benga states, “Cumulative effects in the WRSA are predicted to result in a net loss of effective winter habitat for Canada lynx. By Year 14, approximately 18% of effective lynx winter habitat will be lost from the WRSA. Most of this loss will be high-quality habitat. Benga adopted a precautionary approach for assessing habitat change, and used a conservative threshold of 20% for valued species at the regional level. The cumulative effects on Canada lynx habitat available are predicated to be regional in extent, extended in duration, continuous, reversible in the long-term, low in magnitude and negative.”

a) Based on Table D.2.5-2, low in magnitude is defined as “Disturbance predicted to be somewhat above typical background conditions, but well within established or accepted protective standards and normal socio-economic fluctuations, or to cause a detectable change in ecological, social or economic parameters.”

   i) Provide adequate justification and supporting literature and/or sources for evaluating the magnitude as “low” for the change in habitat availability, given that approximately 18% of effective, high-quality habitat for Canada lynx will be lost, being one of the closest species to the 20% threshold.

Response:

Cumulative effects of habitat loss on lynx were rated as low because they were below what Benga had suggested was a very conservative estimated ‘threshold’ of 20% habitat loss (CR#9, Section 3.2.5.4.1). At the landscape scale, it is also clear that forest harvesting is the primary factor driving habitat change for this species and it was pointed out that over time, the amount of effective habitat in the WRSA will change in accordance with harvesting rotations and stand age. It is also important to consider how the proposed Project would likely affect lynx habitat in this overall context.

The lynx habitat that will be lost in the Project footprint likely constitutes primarily summer foraging habitat. As noted by Kohler and Aubrey (1994), lynx habitat in mountainous areas of western North America primarily consists of two structurally different stand types – early successional stands that provide suitable habitat for snowshoe hares and other prey species, and late-successional forests that provide suitable denning habitat. For denning, lynx select dense, mature forest containing large woody debris, such as fallen logs, as denning sites and rearing habitat for kittens (Koehler and Aubrey 1894, Koehler and Brittell 1990). These requirements are best satisfied in old-growth forest. As indicated in CR#8 (Vegetation), Figure 3.5-3, little old-growth habitat currently exists within the WLSA and the small stands that do exist tend to occur along valley bottoms, rather than within the mine footprint. Most of the area within the mine footprint is also rated as having low potential for growth of old-growth forest (CR#8, Figure 3.5-2). Koehler (1990) found that in mountainous regions of Washington, lynx used higher elevations in summer but were primarily found at lower elevations in winter.

It should also be noted that home ranges of lynx are relatively large in relation to the 1,520.7 ha Project footprint. Nellis *et al*. (1972) reported an average home range size of 38.4 km^2 for lynx in central Alberta, while Brand *et al.* (1976) reported an average size of 28.0 km^2 in the same study area several years later. While these home range sizes may be representative of lynx in its preferred boreal forest habitat, a study conducted in the southern Canadian Rockies reported much larger home ranges of 389 km^2 for males and 239 km^2 for females (Apps 2000). Apps (2000) attributed the larger home ranges as a response to low prey densities and a patchy distribution of habitat. It is also likely that the area affected by the Project would be along the margins of home ranges rather than in the center, since home ranges of lynx in mountainous areas have been found to correspond to drainages, with home range boundaries occurring along ridges between drainages (Koehler unpublished data cited in Koehler and Aubrey 1994).

Benga also considered the possibility that the presence of the mine could affect habitat availability indirectly, by restricting the ability of lynx to move between patches of desirable habitat on the landscape. While projects such as mines are likely to reduce landscape permeability, they are not likely to create a barrier to movements. As Apps (2013) indicated, lynx are adapted for movement around patchy landscapes and for long-distance dispersal that span large patches of unsuitable habitat. Squires *et al.* (2010) studied movements and resource selection by lynx in an intensively managed landscape in Montana, characterized by a high density (2.6 - 3.2 km/km^2) of resource roads. They "found no evidence that lynx were sensitive to forest roads, including roads used by snowmobiles during winter". Lynx have been reported to be relatively tolerant of human activity, although this behavior may increase their vulnerability to human-caused mortality (Koehler and Aubry 1994).

References

Apps, C. 2000. Space use, diet, demographics and topographic associations of lynx in the southern Canadian Rocky Mountains. Pages 351-371 in C.F. Ruggiero, R.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey and J.R. Squires, editors. Ecology and Conservation of Lynx in the United States. University Press of Colorado, University of Colorado, Boulder, Colorado, USA.

Apps, C. 2013. Assessing cumulative impacts to wide-ranging species across the Peace River Region of northeastern British Columbia. Version 3.0 Yellowstone to Yukon Conservation Initiative, Canmore, Alberta, Canada.

Brand, C.J., L.B Keith and C.A. Fisher. 1976. Lynx responses to changing snowshoe hare densities in central Alberta. Journal of Wildlife Management 40:416-428.

Koehler, G.M. and K.B. Aubry. 1994. Lynx. Chapter 4 in The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx and Wolverine in the Western United States. United States Department of Agriculture, Forest Service, General Technical Report RM-254, Fort Collins, Colorado, USA.

Koehler, G.M. and J.D. Brittell. 1990. Managing spruce-fir habitat for lynx and snowshoe hares. Journal of Forestry 88:10-14.

Nellis, C.H., S.P. Weymore, and L.B. Keith. 1972. Lynx-prey interactions in central Alberta. Journal of Wildlife Management 36:320-329.

Squires, J.R., N.J. Decesare, J.A. Kolby, and L.F. Ruggiero. 2010. Seasonal resource selection of Canada lynx in managed forests of the northern Rocky Mountains. Journal of Wildlife Management 74(8): 1648-1660.

148. Volume 6, Section 7.1.4, pg. 331-332

Benga states, "A minimum of six wildlife crossings (underpasses and overpasses) will be incorporated into the design of the coal conveyor [and] will be strategically placed in locations that will maximize wildlife use." Benga also provides Figure 7.1-1 (pg. 531) in Volume 6, indicating the potential wildlife crossing locations for the proposed coal conveyor route.

Benga does not provide adequate research and literature to showcase the probability of success that the proposed wildlife crossings may have along the coal conveyor belt.

a) As per TOR 9.0 [B] provide rationale, supported by adequate literature and/or sources regarding the proposed wildlife crossings incorporated into the design of the coal conveyor belt.

   i) Include a discussion as to how Benga has decided upon the wildlife crossings, their locations and the amount of crossings for the length of the coal conveyor belt.

Response:

Previous research on the effects of coal conveyors on wildlife movements is discussed in relation to SIR 142. Figure 7.1-1 in CR#9 provides a schematic representation of potential wildlife crossing locations based on a preliminary site reconnaissance conducted along the conveyor corridor and a high-level evaluation of terrain features. As discussed in CR#9, Section 7.1.4, Benga proposes to conduct further pre-disturbance surveys to finalize the optimum location of wildlife crossings. Where terrain or topographic conditions are suitable, natural underpasses may be used. When the topography is not favourable, the conveyor will be raised to a height sufficient to accommodate movements by the largest species. Although the number of crossings has not been finalized, Benga has committed to installing a minimum of six crossings along the 5.4 km long conveyor. Site-specific designs will be developed for each wildlife crossing, taking into account information obtained from previous studies and through consultation with other operators and with the AER.

149. Volume 6, Figure 2.3-9, pg. 390

Benga provides a figure regarding the locations of winter track transects in the wildlife local study area for 2016. Within this figure, the winter track transects provided indicate survey efforts within the central and northern portion of the WLSA.

a) Discuss the reasoning for the locations of the winter track transect and provide justification for the lack of survey efforts in the southern portion of the WLSA.

   i) Clarify how baseline information, including but not limited to wildlife use and presence/absence was determined for the southern portions of the proposed area within the WLSA and then used in the Impact Assessment.

Response:

The reviewer correctly points out that winter track surveys conducted in March 2016 were limited to the central and northern parts of the WLSA. Snow conditions in the south portion of the study area are generally unsuitable for winter tracking. The nine track transects completed, which ranged in length from 1.3 to 5.7 km, were set out to provide broad geographic coverage of the WLSA, while including each of the major habitat types. In practice however, accessibility, terrain, and safety considerations also influenced the placement of transects.

The sporadic nature of suitable snow conditions at lower elevations in the Crowsnest Pass was a primary reason that the baseline study program for mammals focussed on the use of wildlife cameras. The wildlife camera program, which operated continuously from September 2013 until April 2016, provided information on the occurrence and seasonal habitat use of a wide range of mammals, including rare or secretive species such as lynx and wolverine. Over this period, the 27 cameras deployed in the study area provided 17,403 camera days of monitoring data. Almost one-third (eight) of the cameras were placed in the southern portion of the WLSA (CR#9, Figure 2.3-9).

Pellet/scat surveys were conducted in spring 2016 to provide additional data on cumulative winter habitat use and relative abundance for various mammals including ungulates, carnivores and prey species such as snowshoe hare. In total, 420 plots were sampled along 60 transects. The number and distribution of plots sampled was based on the need to obtain statistically meaningful data for each habitat type. Approximately 50% of the transects (32) were placed in the southern half of the WLSA (CR#9, Figure 2.3-10).

While it is acknowledged that snow conditions precluded the completion of winter track surveys in the southern portion of the WLSA, Benga believes that the data obtained from wildlife camera trapping and the pellet count survey was adequate for establishing baseline conditions for mammals and for completing the wildlife impact assessment.

150. Consultant Report 8, Section 3.2.1.1 page. 72; CR #8 Section 4.2.1, page. 130

Benga states, "Whitebark pine and limber pine are two of the few tree species capable of establishing under the harsh and poor conditions of higher elevation steep rocky slopes. These species are important components of high-mountain ecosystems where their large seeds support many species of mammals and birds, including grizzly bear (*Ursus arctos horribilis*) and Clark's nutcracker (*Nucifraga columbiana*)." "The Project will disturb approximately 208.4 ha of whitebark and open grassland areas containing a sparse whitebark pine canopy, for a total of approximately 21,000 whitebark pine trees and less than 1,000 limber pine trees."

As stated in the *Alberta Whitebark Pine Recovery Program* (2013-2018) the Clark's nutcracker is currently listed as *Sensitive in Alberta* (Alberta Sustainable Resource Development 2011) and is protected provincially as a Non-game Animal. Declines in whitebark and limber pine populations in Alberta and other areas of the northern Rocky Mountains may lead to declines in nutcrackers, and possible shifts in distribution. Conservation of whitebark and limber pine in Alberta is important to protect this bird species from decline. Whitebark pine is designated as an Endangered species under both Alberta's *Wildlife Act* and *Schedule 1 of Canada's Species at Risk Act.*

a) Provide a discussion, as per TOR 4.7.1 [A], the species distribution, habitat requirements, key habitat areas, general life history and potential use of habitat in the WLSA for the Clarks nutcracker and relationship with limber/whitebark pine.

Response:

Status - The Clark's nutcracker is currently listed as a Sensitive species in Alberta (GoA 2017). This species has a restricted distribution within Alberta's parks and that its dependency on declining species such as limber pine and whitebark pine make it vulnerable to population declines (GoA 2107). Whitebark pine is listed as "Endangered" in Alberta and British Columbia under SARA Schedule 1 in 2012 (Government of Canada 2015), and limber pine was designated as "Endangered" throughout its range in Alberta and British Columbia by COSEWIC in November 2014. Both species are declining throughout their range due to infestations of white pine blister rust and mountain pine beetle, together with the effects of climate change and fire suppression (Alberta Whitebark and Limber Pine Recovery Team 2014a and 2014b).

A single sighting of Clark's nutcracker was recorded during the wildlife baseline program. None were recorded during the 2014 breeding bird survey, while one bird was observed in mixed coniferous habitat during the 2016 breeding bird survey (CR#9, Table 2.4-9). Despite its relatively large size and visibility, no incidental sightings of Clark's nutcracker were recorded in the WLSA. Only three Clark's nutcrackers were recorded along BBS Route 04-205 during North American Breeding Bird surveys conducted between 2008 and 2014 (CR#9, Table 2.4-6).

Life History and Habitat Requirements – The Clark's nutcracker is found in montane and subalpine forests throughout western North America. While the species has been extensively studied in the United States (Keane et al. 2012), little research has been conducted in Canada. Much of the research that has been conducted focusses on the unique relationship that exists between the Clark's nutcracker and the whitebark pine, its primary food source.

The Clark's nutcracker has been described as a 'keystone' species because of the pivotal role it plays in seed dispersal and forest regeneration for a number of conifer species (Schaming 2015). The whitebark pine, also a keystone species, is an obligate mutualist that germinates almost exclusively from Clark's nutcracker seed caches (Tomback 1978, Tomback 1982, Lorenz and Sullivan 2009, Keane *et al.* 2012, Schaming 2015).

The Clark's nutcracker has unique anatomical adaptations that enable it to harvest the seeds from pine cones and store the seeds in a sublingual pouch prior to depositing them in scattered food caches, typically placed up to 3 cm below ground (Tomback 1978, McCaughey and Tomback 2001). Clark's nutcrackers annually store tens of thousands of seeds in thousands of caches, sometimes dispersing seeds over 30 km (Tomback 1978, Hutchins and Lanner 1982, Lorenz *et al.* 2011). Seed caches are important not only for overwinter survival and breeding but represent the primary food source for feeding young (Mewaldt 1956).

While feeding clearly focusses on whitebark pine stands, the Clark's nutcracker typically nests in mixed coniferous forest (Schaming 2015). Research has shown that breeding success of this species is highly dependent on food availability. Schaming (2015) found that, in two of five years, Clark's nutcrackers in the Yellowstone area exhibited a population-wide failure to breed. The two non-breeding years coincided with low whitebark pine cone crops the previous autumn, along with a higher than normal spring snowpack, which reduced their access to cached whitebark pine seeds. Schaming (2015) suggests that this type of breeding plasticity may be an adaptation of the species to survive in an unpredictable environment (*i.e.*, reducing reproductive efforts during a poor year may increase fitness, reproductive success and survival over their lifetime).

b) As per TOR 4.7.2 [A], provide the impact assessment to Clark's nutcracker population and habitat; including but not limited to habitat availability, habitat effectiveness, abundance, distribution, species resilience and recovery population given that the Project proposes to disturb approximately 21,000 whitebark pine trees and less than 1,000 limber pine trees.

Response:

Environmental Effects - The principal concern with respect to the impact of the Project on the Clark's nutcracker is the predicted loss of habitats containing whitebark pine and limber pine, two important food sources for this species. The Project will disturb approximately 208.4 ha of whitebark pine and open grassland areas containing a sparse whitebark pine canopy, for an estimated total of approximately 21,000 whitebark pine trees and less than 1,000 limber pine trees (CR #8,).

While whitebark and limber pine are the preferred food species for Clark's nutcracker, they will forage on other coniferous species. In the Yellowstone area, for example, Schaming (2015) found that, although Clark's nutcrackers regularly foraged on Douglas fir, the seeds were much less nutritious than whitebark pine (0.06 vs 1.19 kcal/seed; Hutchins and Lanner 1982, Smith 1970 cited in Schaming 2015). This implies that it might be energetically costly to switch to alternate food sources. Benga is not aware of any studies that report the use of lodgepole pine seed by this species but assume, because Clark's nutcrackers are known to use other pine species, including Ponderosa pine, that lodgepole pine represents a secondary food source. Clark's nutcrackers also eat insects, arthropods, carrion and small vertebrates (Tomback 1978). For food specialists, like the Clark's nutcracker, that depend on an episodic food source (mast crops), omnivory may be an important strategy for surviving years in which preferred foods are scarce (Tomback and Linhart 1990). This strategy may also increase the likelihood that a population would survive the loss of a portion of its foraging habitat, as would occur in the case of the Project.

Effects Ratings - The potential effects of the Project on Clark's nutcracker were assessed in terms of the expected loss of open forest habitat containing whitebark pine and limber pine, two key forage species. These effects ratings presume that the planned reclamation program will be largely successful in replacing lost habitat over the long term.

- **Geographic Extent**: Loss of habitats containing whitebark pine and limber pine will be limited to the Project footprint and the WLSA. However, Clark's nutcrackers have been reported foraging over distances that exceed the WLSA, creating the possibility that the effects will be regional in extent.

- **Duration**: The duration of the effects will be extended, as it will take many decades for re-established stands of whitebark pine and limber pine to produce sizeable cone crops.
- **Frequency**: Effects will continue throughout the operational and reclamation phases of the Project.
- **Reversibility**: Effects are expected to be reversible in the long term with the planned mitigation and reclamation program. However, the outlook for this species in Alberta and in the Canadian portion of its range is not clear. As populations of whitebark pine and limber pine continue to decline, downward pressure on Clark's nutcracker populations is expected to occur. The future of this species is likely tied closely to the ability of recovery teams to propagate disease resistant strains of whitebark pine and limber pine.
- **Project Contribution and Magnitude**: At the local (WLSA) scale, adverse effects are initially expected to be of moderate to high magnitude, depending on the ability of Clark's nutcrackers to forage successfully in lodgepole pine and Douglas fir stands at lower elevations. Birds that currently use the proposed Project footprint may have to travel farther to find alternate food sources, which may energetic consequences. Over the long term, (60-80 years following closure) effects may be neutral or of low magnitude. At the regional (WRSA) scale, effects are likely to be of low magnitude.
- **Confidence Rating**: Since the effects of mining are quite well understood, there is high confidence in the predicted losses of whitebark pine and limber pine foraging habitat. Benga has also confirmed that the Clark's nutcracker occurs in the study area, albeit at very low numbers. However, there is some uncertainty about the extent to which Clark's nutcrackers displaced from the mine area will be able to forage successfully in alternate habitats. For this reason, our overall confidence in our impact ratings is considered moderate.
- **Probability of Occurrence**: The probability of occurrence is high given the nature of the Project.
- **Significance**: In terms of the potential effects of the Project on the persistence of this species in southwestern Alberta, the effects are likely to be Not Significant. This rating is partly based on the comparatively small area of whitebark pine and limber pine foraging habitat that will be lost to the Project and the likelihood that much of this habitat will be replaced over the long term through the proposed reclamation program.

c) Discuss mitigation and monitoring measures, as per TOR 9.0 [A] and [B] to avoid, minimize or eliminate the potential impact for all stages of the Project.

Response:

Mitigation and Monitoring - Proposed mitigation strategies for whitebark pine and limber pine are outlined in CR#8, Section 4.2.6.3. Along with minimizing the loss of healthy stands during mine development, the strategy involves harvesting seeds from disease resistant trees prior to mining and planting seedlings on suitable sites during mine reclamation, following procedures recommended by the Alberta Whitebark and Limber Pine Recovery Team (2014a and 2014b).

Benga estimates that the reclaimed area dedicated to these species will be 310 ha (approximately 102 ha greater than estimated losses). The number of seedlings that will be planted is 63,000 and is three times the conservative pre-disturbance number to account for planting and natural mortality, reclamation of historical mine areas, and future losses.

While successful planting of whitebark pine and limber pine on reclaimed sites would mitigate habitat losses for Clark's nutcracker, benefits to the species would be delayed many years into the future. McCaughey and Tomback (2001, cited in Alberta Whitebark and Limber Pine Recovery Team 2014a) report that cone production in whitebark pines does not begin before 25 to 30 years of age and that sizeable cone crops do not appear until 60 to 80 years of age. Accordingly, effective mitigation for the Clark's nutcracker is not expected to occur until 60 to 80 years after planting. If Benga's reclamation team is successful in salvaging seeds from disease resistant trees within the mine area, there is also potential for augmenting the province's seed bank and contributing to the recovery of whitebark pine and limber pine in the region, which could in turn benefit the Clark's nutcracker over the long term. Monitoring use of reclaimed whitebark and limber pine plantings by Clark's nutcracker and other wildlife species will take place as part of Benga's monitoring program for whitebark pine and limber pine.

References

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**151. Consultant Report 8 Addendum Wildlife, Figures 2.1-1 and 4.1- 1, Page 29-30
Consultant Report 8 Addendum Wildlife, Section 2.1, Page 2**

Benga states, "Mist netting and acoustic monitoring of bars were conducted at four locations in the WLSA that were considered to be high roosting or foraging habitats and one location considered to be a good flight corridor along a cutline through forest." Benga has also provided two figures, one indicating the locations of the bat survey stations in the Wildlife Local Study Area (WLSA) in 2016 and another figure indicating habitat suitability for baseline.

a) Based on these two figures, the survey station locations have not been placed in high habitat suitability locations. Explain how Benga determined where to place its survey station locations and include adequate support for the conclusions provided.

Response:

CR#9, Figure 4.1-1 illustrates day roost habitat suitability for little brown myotis only, whereas netting was conducted (at night) when all species bats were foraging or commuting to/from nighttime foraging areas. Day roosting habitat suitability for little brown myotis is different than foraging habitat suitability for little brown myotis and other species. Four of five locations were placed in suitable:

- foraging habitats that were characterized by open water of areas substantial enough to be suitable for foraging for species that forage over water (*e.g.*, little brown myotis, which is a SARA listed species), and were surrounded by vegetation that was suitable for species that are gleaners and/or forage near/over vegetation; and/or
- summer day roosts and maternity roosts consisting of abandoned mine infrastructure.

The remaining location was sited in a corridor appropriate as a flyway corridor for nightly commuting from forested area potentially suitable for day roosts to foraging habitat. The spatial extent of the Project is such that not all open water and old infrastructure shows up on the provided figures.

152. Volume 7, Appendix H, Section 2.2

Benga states, "Since none of the identified COPCs are expected to biomagnify up the food chain and in most cases they are metabolized in higher organisms; exposures are expected to be highest for primary consumers (CCME, 2010; US EPA, 1999)."

Recent research in selenium toxicity and accumulation in aquatic systems have found that selenium concentrations can biomagnify in lentic water systems (BC MOE, 2014) through the surface water to aquatic plants pathway. Several of the wildlife receptors of concern would be expected to inhabit lentic aquatic habitats and consume aquatic plants (e.g., green winged teal, great blue heron, sand hill crane).

The Conceptual Site Model for Wildlife must include consumption of food.

The TRV for selenium for avian receptors must be based on reproductive effects.

a) Identify the criteria used to identify COPCs that biomagnify.

Response:

The selenium soil quality screening value of 1.2 mg/kg dw (as shown in Table H.8 of CR#12 Appendix H) was taken from US EPA Eco-SSL (US EPA 2007). Review of the Eco-SSL TRV for selenium indicates that the origin of the avian receptor TRV was based on a review of 219 suitable papers and is equal to the highest bounded NOAEL lower than that lowest bounded LOAEL for reproduction, as well as growth and survival (US EPA 2007). Therefore, the selenium TRV for protection of avian receptors already included consideration of reproductive effects.

In response to the Canadian Environmental Assessment Agency's (CEAA) additional information request #14 (AIR #14), the screening level wildlife risk assessment (WRA) was expanded to include the following dietary exposure pathways: ingestion of plants and berries and ingestion of fish and prey. Details on reasoning and results of this response have been posted on the Grassy Mountain Coal Documents page on the CEAA web site (http://www.ceaa.gc.ca/050/documents-eng.cfm?evaluation=80101). Specifically, see:

Appendix A14 – WRA. In: Attachment 2: Response to the CEAA's Request for Additional Information (http://www.ceaa.gc.ca/050/documents/p80101/121165E.pdf).

A summary of the results of the additional assessment are follows. The predicted hazard quotients for all contaminants of potential concern (COPCs) for all surrogate wildlife species were below 1.0 (Appendix A14, Table A14-6). These results support the conclusion that release of COPCs by the Project is not predicted to have any adverse impact to wildlife in the Study Area. These results are consistent with results of the human health multimedia risk assessment, which concluded that ingestion of locally grown food sources made a minimal contribution to overall exposure (CR #12 Section 6.3 3 – Chronic Multimedia Exposure and CR#12 Appendix F – Detailed Multimedia Model Results).

The WRA included assessment of all COPCs with the potential to bioaccumulate in plant or animal tissue; these COPCs were issued in August 2016 as part of the Project application (CR #12 Human Health and Wildlife Screening Risk Assessment, Section 5.1.1 – Chemical Inventory). Input vegetation concentrations used to calculate wildlife exposure for the Baseline Case exposure assessment were as reported from the Baseline Monitoring program (CR #12, Appendix G - Baseline Monitoring Program) and were modelled for Project contributions in the Application Case.

Potential wildlife receptors were previously identified in the baseline wildlife survey (CR #9 – Wildlife Assessment, Section 2.0 – Baseline Surveys), including sensitive species (CR #9, Section 2.4.2 – Wildlife Species of Concern, Table 2.4-2). Surrogate mammalian and avian species were selected from those lists for the WRA based on their value to the nearby communities, their dietary composition, and the availability of exposure characteristics, with priority given to species at risk and migratory birds.

For these surrogate species, predicted exposure doses for the applicable COPCs were calculated based on the exposure pathways identified in the original WRA (CR #12 Appendix H – Screening Wildlife Risk Assessment, Table H.3), using equations provided in CR #12, Appendix E – Multimedia Model Equations and Sample Calculations.

b) Describe how receptors inhabiting lentic aquatic habitats will be protected over the life of the project.

Response:

Receptors inhabiting lentic aquatic habitats will not be affected by the project. As discussed in CR #5 - Surface Water Quality, Section 4 – Application Case and Planned Development Case for Surface Water Quality Assessment), no significant Project effects on surface water or groundwater quality are anticipated. Exposure to waterborne chemical of potential concern (COPC) is not an operative exposure pathway for human or wildlife receptors. Additional details describing mitigation measured proposed for the protection of surface and groundwater quality is provided in the response SIR 163a and b.

References

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153. Volume 7, CR#12 (Human Health and Wildlife Screening Assessment), Section 5.2.2 – Multimedia Exposure, Page 23

Volume 4, CR1a (Air Quality Assessment), Section 4.2.2 – Criteria Air Contaminant Emission Summary, Page 34

Volume 1, Section E.1.2.3.11 – Ozone, Page E-13

Volume 4, CR1a (Air Quality Assessment), Section 3.1 – Air Quality, Page 24

A consultant's report prepared by Benga indicates that, "an HHRA baseline sampling program was conducted July 22-31, 2014 and September 5-9, 2014. The Human Health Risk Assessment (HHRA) baseline sampling program included the collection and chemical analysis of vegetation and soil samples." Other investigations by Benga outlined the contribution to particulate matter from diesel combustion and fugitive dust emissions.

The baseline information for air quality used by Benga involved values from stations at Lethbridge and Castlegar. The information provided by Benga discusses relevant exposure pathways (inhalation and ingestion) and the potential for accumulation of contaminants in vegetation. What Benga has reported are estimates, but does not discuss how these predictions will be verified during operations.

a) Provide justification of the adequacy of baseline and background information used to make assessments.

Response:

The baseline soil and vegetation data were used in the HHRA multimedia model to predict potential exposure to the COPC for the Baseline Case. The baseline soil and vegetation data was not used in the Air Quality Baseline Case dust exposure estimate. The baseline sampling program (CR#12, Appendix G) was conducted in 2014. Since 2014, there have been no changes within the assessment area that would have resulted in any changes to baseline concentrations of the COPC considered in the HHRA; therefore, these data are still considered to be representative of the current conditions at the site and are an adequate representation of baseline.

Data collected at the Lethbridge and Castlegar stations were considered representative of background air concentrations in the area. These data were used in the HHRA cumulative inhalation assessment. The data sources for air quality are described in Appendix C to CR#1, Section 2.4. This section notes that the most recent five years of data are typically used to characterize background concentrations. This requirement, and others to which the assessment complies, are found in AESRD (2013).

The section also reviews the rationale for using station data from southern Alberta and B.C. in the air quality assessment and compares this dataset to measurements in other parts of Alberta that are generally downwind of coal mining operations.

In addition, Section 3 of CR#1 presents background concentrations of the gases and particulate modelled at stations considered in the assessment, and justifies why values at a certain stations were used over others available. Section 4.4.1 in CR#1 lists the background concentrations used in the assessment. Note that in the air quality assessment, the baseline concentrations are the sum of modelled baseline emissions plus measured background concentrations.

Reference

Alberta Environment and Sustainable Resources Development (AESRD) 2013. Air Quality Model Guideline. Effective October 1st, 2013. Prepared by Air Policy Section.

b) The soil baseline used 21 samples collected in July and September 2014. Provide justification for the basis for using this extent of sampling to characterize the dust emissions (originating from these soils) that may occur during some phases of this project.

Response:

The soil baseline data was used as input data in the HHRA multimedia assessment. Dust emissions characterized in the Air Quality assessment were not derived from the baseline sampling program data.

In many cases, modellers of dust emissions to not have available soil samples on which to base emission properties. The traditional approach is to rely on more general emission factors such as those found in U.S. EPA AP42 (2011) and to use those factors thought to be most suitable to the current situation.

For example, to determine baseline dust emissions in communities in the study area, emission factors were used as follows:

- The silt loading parameter was the average of the recommended default winter and summer values for roads for AADT categories between 5,000 to 10,000 AADT (Table 13.2.1-2 in AP-42; U.S. EPA 2011).
- The average weight of the vehicle fleet on roads in communities and Highway 3 was assumed to be 8 short tons (7.3 t).

Based on these assumptions, emission factors based on vehicle kilometers travelled (VKTs) were applied to community vehicle road-dust emissions.

References:

U.S. EPA. 2011. Compilation of Air Pollutant Emission Factors: Volume I Stationary Point and

Area Sources. Part 13.2.1 Paved Roads, Fifth Edition (AP-42). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

c) Discuss how the potential contribution of particulate matter from waste rock to dust emissions was quantified.

Response:

Emissions of waste rock are reflected in several activities:

- Removal of waste rock (and overburden) from atop the coal seam. Also, removal of ROM coal which contains waste material. Emissions were based on the volume of material handled, with emission factors from dozing and loading.
- Transport of the removed waste to waste disposal in haul trucks, and ROM coal to the plant site, with emissions generated by vehicle wheel entrainment on unpaved haul roads whose distance was estimated from mine plans. Transport also generates PM from diesel combustion based on engine size and hours of operation.
- Windblown dust from the ROM storage pile at the plant, a portion of which is waste. Emissions were based on wind speed and estimated pile size.
- Separation of coal from coarse refuse at the plant site and transport of the coarse refuse to storage areas or excavated pits. Since separation is a water-based activity, only transport emissions are linked to refuse (waste) disposal.
- Disposal of the pit waste and the coarse plant refuse to storage areas or within excavated pits, including unloading and dozing activities. Emissions are based on the volume of material handled.

Emission estimation approaches and quantities for all activities are shown in Appendix A of CR#1.

d) For baseline air quality measurements, in addition to data collected at Lethbridge and Castlegar, some measurements (dustfall sites and passive samplers) were conducted in the project area in 2016. Provide justification for the limited duration and scope of sampling within the study area.

Response:

Benga began dustfall and passive measurements in spring 2016. At the time of writing the Project Update in 2016, only a few months of lab-analyzed data were available. Measurements have continued to the current time and are summarized below to the end of 2017. Twenty-one months of dustfall observations are currently available at three sites, and twelve months are available at three additional sites. These are summarized in Table SIR 153-1 which indicates that dustfall varies considerably with season with summer 2016 providing the highest measurements at all locations, indicative of a regional source (dry conditions or strong winds) rather than a local source. Alberta residential and industrial guidelines are included in the table.

Dustfall was not modelled as part of the air quality assessment.

Table SIR 153-1 Dustfall Measurement Results, April 2016 to December 2017

Sample Date		DF – 1	DF – 2	DF – 3	DF – 4	DF – 5	DF – 6
		Residence	**Campground**	**Hospital**	**Residence**	**Plant**	**Residence**
mg/100 cm²/30day							
2016	April	3	6	10	33	113	6
	May	20	21	37	53	99	34
	June	722	666	487	517	903	347
	July	504	465	407	717	–	701
	August	27	21	243	35	121	35
	September	53	15	10	33	–	17
	October	34	37	35	53	46	44
	November	30	11	10	39	2	14
	December	4	5	35	35	3	10
2017	January	6	5	6	25	0	6
	February	2	2	2	2	1	5
	March	2	2	12	53	0	2
	April	–	–	–	99	46	8
	May	–	–	–	122	87	24
	June	–	–	–	49	53	42
	July	–	–	–	55	72	25
	August	–	–	–	34	19	20
	September	–	–	–	51	13	23
	October	–	–	–	274	40	50
	November	–	–	–	41	10	16
	December	–	–	–	42	–	30
AAAQG							
Residential		53	53	53	53	53	53
Industrial		158	158	158	158	158	158

– Data not available

Twenty months of passive data at the proposed plant site are also available and summarized in Table SIR 153-2. SO_2 measurements are near the detection limit in all months (winter 2016-2017 data are accumulations over two months), and are well below the 30-day AAAQO of 11 ppb and below the 30-day background level of 1.0 µg/m^3 (about 0.4 ppb) assumed in the EIA (CR#1 Table C5-1). Similarly, the maximum observed 30-day NO_2 concentration of 0.5 ppb (1 µg/m^3) is well below the annual NOx background of 11 µg/m^3 assumed in the EIA.

Table SIR 153-2 Passive Sampling Results at the Proposed Plant Site, April 2016 to November 2017

Sample Date		NO_2	O_3	SO_2
ppb				
2016	April	0.3	37.1	<0.1
	May	0.2	30.3	0.1
	June	0.1	37.1	<0.1
	July	0.2	28.9	<0.1
	August	0.2	24.8	<0.1
	September	<0.1	26.2	0.1
	October	0.1	25.6	0.1
	November	0.2	39.6	<0.1
	December	0.6	30.2	0.2
2017	January			
	February	0.2	32.5	0.2
	March			
	April	<0.1	43.1	<0.1
	May	<0.1	33.5	<0.1
	June	<0.1	32	<0.1
	July	<0.1	38	<0.1
	August	<0.1	32.8	<0.1
	September	0.2	39.3	0.1
	October	0.5	25.4	<0.1
	November	0.3	33.4	<0.1
AAAQG		-	-	11

A.5. HEALTH

154. Volume 4, Consultant Report #1, Section 2.2.1

Benga states, "A scoping exercise identified the following key potential issues for air quality:

- effects on air quality in the region, especially related to dust and particulates;
- effects of air emissions on deposition of acid-forming compounds and nitrogen;
- effects of changes in air quality on human health; and
- production of greenhouse gases (GHGs).

The scoping exercise identified the following chemicals of potential concern for the Project: sulphur dioxide (SO2), nitrogen oxides (NOX), carbon monoxide (CO), ozone (O3), Volatile Organic Carbons (VOC), Polycyclic Aromatic Hydrocarbons (PAH), particulate matter with a mean aerodynamic diameter of 2.5 µm or smaller (PM2.5), with a mean aerodynamic diameter of 10 µm or smaller (PM10), particulate with a mean aerodynamic diameter of about 30 µm or smaller (TSP), and GHGs."

The CCOHS, US EPA, WHO/IARC, NTP and OEHHA have identified adverse health effects ranging from pulmonary inflammation to lung cancer, as a result of inhalation exposure to diesel engine exhaust, particularly diesel particulate matter (DPM). Considering the predominance of diesel fuel combustion associated with the project, DPM would be considered a chemical of potential concern.

a) Provide an estimate of the diesel particulate matter emissions resulting from diesel fuel combustion for all assessment cases, including project only, to allow for evaluation of human health risks from exposure to DPM in the HHRA.

Response:

The diesel particulate matter (DPM) emissions resulting from diesel fuel combustion was estimated for all receptor locations and are provided for acute (two hour maximum) and chronic (annual average) in Table SIR 154-1. A 2-hour duration was predicted for the acute assessment to allow for comparison to Health Canada's 2-hour exposure guideline (Health Canada 2016).

Table SIR 154-1 Diesel Particulate Matter (DPM) Predicted 2-hour Max and Annual Average Air Concentrations.

Receptor	Project		Baseline		Application	
	2-hr Max ($\mu g/m^3$)	Annual ($\mu g/m^3$)	2-hr Max ($\mu g/m^3$)	Annual ($\mu g/m^3$)	2-hr Max ($\mu g/m^3$)	Annual ($\mu g/m^3$)
RSA-MPOI	31.27	1.01	19.34	2.50	31.35	2.51
FL-MPOI	13.57	0.24	2.11	0.15	13.61	0.26
SP-MPOI	7.61	0.20	16.57	2.07	16.61	2.10
R1	1.75	0.01	9.98	0.64	10.00	0.65
R2	1.94	0.02	0.23	0.004	2.00	0.03
R3	1.38	0.01	7.61	0.41	7.63	0.42
R4	1.37	0.01	0.18	0.002	1.54	0.01
R5	1.12	0.01	0.18	0.003	1.21	0.01
R6	1.37	0.01	9.84	1.45	9.88	1.45
R7	0.76	0.01	6.64	0.71	6.68	0.72
R8	1.61	0.03	13.10	2.07	13.20	2.10
R9	7.61	0.11	0.99	0.05	7.77	0.17
R10	4.60	0.20	0.40	0.02	4.88	0.22
R11	5.75	0.07	0.27	0.01	5.85	0.08

Table SIR 154-1 Diesel Particulate Matter (DPM) Predicted 2-hour Max and Annual Average Air Concentrations.

Receptor	Project		Baseline		Application	
	2-hr Max (µg/m³)	Annual (µg/m³)	2-hr Max (µg/m³)	Annual (µg/m³)	2-hr Max (µg/m³)	Annual (µg/m³)
R12	2.08	0.07	0.65	0.03	2.17	0.10
R13	2.37	0.06	0.51	0.02	2.42	0.08
R14	1.40	0.01	16.57	2.07	16.61	2.08

Acute Inhalation Risk Assessment

Health Canada (2016) published a 2-hour non-cancer short-term exposure risk/guidance value of 10 µg/m³ for increased airway resistance and inflammation. This value was based on a review of studies indicating that respiratory endpoints are the most sensitive. Acute HQs were calculated for all receptor locations and are provided in Table SIR 154-2.

Table SIR 154-2 Diesel Particulate Matter (DPM) Acute HQ Results

Receptor	Project	Baseline	Application
RSA-MPOI*	**3.1E+00**	**1.9E+00**	**3.1E+00**
FL-MPOI	**1.4E+00**	2.1E-01	**1.4E+00**
R1	1.8E-01	1.0E+00	1.0E+00
R2	1.9E-01	2.3E-02	2.0E-01
R3	1.4E-01	7.6E-01	7.6E-01
R4	1.4E-01	1.8E-02	1.5E-01
R5	1.1E-01	1.8E-02	1.2E-01
R6	1.4E-01	9.8E-01	9.9E-01
R7	7.6E-02	6.6E-01	6.7E-01
R8	1.6E-01	**1.3E+00**	**1.3E+00**
R9	7.6E-01	9.9E-02	7.8E-01
R10	4.6E-01	4.0E-02	4.9E-01
R11	5.8E-01	2.7E-02	5.9E-01
R12	2.1E-01	6.5E-02	2.2E-01
R13	2.4E-01	5.1E-02	2.4E-01
R14	1.4E-01	**1.7E+00**	**1.7E+00**

*Note: The locations for RSA-MPOI differ based on assessment case and COPC. The RSA-MPOI for Baseline $PM_{2.5}$ is predicted to occur in the townsite of Blairmore, where as the RSA-MPOI for the Project occurs within the Project boundary (See CR#5, Figures 5.4-1 and 5.4-2 respectively).

For acute inhalation exposure to DPM (Table SIR 154-2), HQs were predicted to be greater than 1.0 at the RSA-MPOI, FL-MPOI, R8 and R14 (Blairmore) receptor locations. There were no HQs in excess of 1.0 at any of the other locations. For those locations within the project boundaries (Project and Application RSA-MPOI) and at the Project boundary, (FL-MPOI) the Project emissions were predicted to contribute the majority of the HQ results. Access to areas within the plant boundaries are restricted from the public.

At both R8 and R10 the HQ results are marginally elevated above 1.0 and almost entirely a result of Baseline emissions (predicted maximum DPM concentration from project emissions were 11% (at R8) and 8% (at R10) of the Baseline emission).

Provided that the mine site area is restricted from the public during construction and operation activities, that outside of the mine area contribution of DPM is primarily a result of Baseline emissions and the conservative nature inherent in both the TRV and the air modelling methodology, acute exposure to project related DPM is not considered to pose a risk of adverse human health effects.

Chronic Inhalation TRV

Health Canada (2016) published a non-cancer chronic exposure risk/guidance value of 5 µg/m^3 for respiratory inflammation, histopathological and/or function changes. Chronic HQ results for all receptor locations are provided in Table SIR 154-3.

Table SIR 154-3 Diesel Particulate Matter (DPM) Chronic HQ Results

Receptor	Project	Baseline	Application
RSA-MPOI	2.0E-01	5.0E-01	5.0E-01
FL-MPOI	4.8E-02	3.0E-02	5.2E-02
SP-MPOI	4.0E-02	4.1E-01	4.2E-01
R1	2.0E-03	1.3E-01	1.3E-01
R2	4.0E-03	8.0E-04	6.0E-03
R3	2.0E-03	8.2E-02	8.4E-02
R4	2.0E-03	4.0E-04	2.0E-03
R5	2.0E-03	6.0E-04	2.0E-03
R6	2.0E-03	2.9E-01	2.9E-01
R7	2.0E-03	1.4E-01	1.4E-01
R8	6.0E-03	4.1E-01	4.2E-01
R9	2.2E-02	1.0E-02	3.4E-02
R10	4.0E-02	4.0E-03	4.4E-02
R11	1.4E-02	2.0E-03	1.6E-02

Table SIR 154-3 Diesel Particulate Matter (DPM) Chronic HQ Results			
Receptor	**Project**	**Baseline**	**Application**
R12	1.4E-02	6.0E-03	2.0E-02
R13	1.2E-02	4.0E-03	1.6E-02
R14	2.0E-03	4.1E-01	4.2E-01

For chronic inhalation exposure to DPM (Table SIR 154-3), HQs were predicted to be less than 1.0 at all receptor locations. The results indicate that chronic exposure to project related DPM is not considered to pose a risk of adverse human health effects.

Health Canada (2016) does not provide a carcinogenic TRV for DPM exposure due to an apparent species specificity of the observed effect, very high levels of exposure required to solicit those effects and the role that particle overload have in tumor development. Hence, chronic inhalation exposure was not assessed for carcinogenic potential.

Reference

Health Canada. 2016. Human Health Risk Assessment for Diesel Exhaust. Fuels Assessment Section, Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada.

b) Describe what controls will be put into place to reduce the release of diesel particulate matter from diesel combustion sources related to the Project.

Response:

To meet Tier 4 PM emission standards, engine manufacturers will choose to rely on one of the following controls:

- exhaust filters coated with diesel oxidation catalysts, similar to a catalytic converter;
- high efficiency diesel particulate filters, which physically remove or filters out particulates from the exhaust stream; or
- combination of above controls.

Whether an engine requires only catalytic conversion or both catalytic conversion and diesel particulate filters will depend on the engine design and other emission controls implemented into the engine. For example, engines that rely on heavy exhaust gas recirculation (EGR) to control NO_X emissions may need both diesel oxidation catalysts and diesel particulate filtration to control particulates down to Tier 4 levels since EGR tends to increase the formation of particulates within the combustion cylinders. Benga will make their final selection of vendor and diesel fleet equipment at the completion of the FEED process. The final equipment selection will comply with Tier 4 emission benchmarks and Benga would not add controls beyond that.

As part of its ongoing mine planning, Benga will look for ways to improve efficiency of vehicle operation (minimize haul road distances, reduce haul road slopes, minimize idling, *etc*.) that will reduce overall emissions from Project equipment. Benga will also implement manufacturer recommended vehicle maintenance programs to manage emissions.

155. Volume 2, Consultant Report #1, Section 2.2.2.1

Benga states, "Emissions of VOCs and PAHs from the Project were estimated on the basis of diesel combustion emission factors."

a) Describe the limitations and uncertainty associated with the emission factors selected to represent emission sources for the Project.

Response:

Diesel combustion emission factors for CO, particulates and NOx were estimated using engineering estimates from the U.S. EPA Nonroad model (U.S. EPA website). The alternative is using AP42 emission factors – for example Chapter 3 Sections 3.3 and 3.4 (Gasoline and Diesel Industrial Engines or Large Stationary Diesel and All Stationary Dual-fuel engines). However, the Nonroad model is expected to provide more accurate emission estimates that depend on the size of engine, its age, and equipment mode of operation. The remaining emissions (*e.g.* PAHs, and VOCs) were estimated using AP42 emission factors, since Nonroad model does not have estimates for them.

Frey (2008) overviewed methods for, and examples of, quantification of variability and uncertainty in emission factors. The typical sources of uncertainty in emission factors and inventories include:

- random sampling error, which would be, for example, the basis for estimation of confidence intervals;
- measurement errors due to imperfections in sampling and analytical methods. Measurement errors are typically categorized as systematic and random errors;
- non-representativeness: This source of uncertainty arises when the specific sources that are tested, or the conditions under which the sources are tested, are not representative of the real-world situation that affects emissions for the geographic area and time period of interest. Furthermore, it is possible for a set of data to be representative for one purpose but not for another. For example, some driving or test cycles used for on-road or non-road vehicles would not capture the effect of transients on emissions. The use of non-representative data typically leads to biases in emission estimates;
- averaging time: Emissions data are measured for different averaging times depending on the pollutant. For example, emissions of some gases, such as NOx, SO_2, and others, can be measured at short time resolutions while speciated $PM_{2.5}$ emissions might be based on 24 hour integrated filter-based samples. Many emission inventories (such as used in Project modelling) are developed on an hourly, daily basis, or annual basis. If the time period of the inventory does not match the time period of the measurements, there can be errors of interpolation or extrapolation.

Some uncertainties in current emissions are the result of the complicated nature of mining operations and the easily match the two. Furthermore, for short averaging times, there can be substantial variability. An example of this is the use of driving cycle data to estimate vehicle emissions, given that driving cycles are highly variable from one trip to another on haul roads or for mine pit activity even if average speeds are similar;

- omissions: A typical omission is one in which emission data for mobile sources are available for some pollutants for a particular emission source but not others (*e.g.*, total hydrocarbons but not speciated hydrocarbons, or total $PM_{2.5}$ mass but not speciated $PM_{2.5}$);
- surrogate data, where directly relevant data are not available, but a judgment is made that an analogy can be made for a situation in which data are available. For some of the types of omissions discussed above, one might be able to fill data gaps based on surrogate data. For example, speciated hydrocarbon data are available for stationary engines but not for mobile sources. Such an assumption may introduce biases if the analogy is weak or not appropriate; and
- lack of relevant data: This situation occurs when there are no relevant data and no realistic or meaningful opportunity to use surrogate data. An example of this situation is the use of the dragline equation to represent some material drop activities that don't have precise emission factors. Ignoring these sources could lead to gaps in the inventory, which in turn lead to emission biases.

As noted above, speciated VOC and PAH were based on the U.S. EPA (1996) stationary combustion emission factor database. VOC and PAH emission factors in this document have a rating factor of E = Poor. According to the US EPA (https://www3.epa.gov/ttnchie1/faq/ap42faq.html), the factors are developed from C and D rated test data (average and below average) from a very few number of facilities, and there may be reason to suspect that the facilities tested do not represent a random sample of the industry. There also may be evidence of variability within the source category population.

In November 2016, after completion of modelling for the Grassy Mountain Project Update, the U.S. EPA (2016) released a report providing emission factors of toxics for nonroad vehicles. This report notes that uncertainties in toxics emission factors result from the use of surrogate data (*e.g.* the use of pre2007 on-road emission factors from vehicles equipped with catalysts) applied to Tier 4 nonroad engine emissions, although this would likely affect metal emission estimates most (a considerable source of uncertainty in this approach is that the on-road data were obtained from vehicles with catalysts, but are being applied to nonroad engines without catalyst controls). In addition, it was noted that manufacturers have been able to meet Tier 4 nonroad standards without diesel particulate filters; thus, applying a profile based on 2007 on-road engines introduces uncertainty.

While SIR 155 specifically deals with uncertainty and limitations, it is emphasized that the approach taken in modelling is typically conservative. The emission factors used were based on those currently available in the literature and thought to best represent emissions. The CALPUFF modelling approach is considered to realistically but conservatively estimate ground level concentrations. Modelling provides the highest predictions at any locations using five years of meteorological data. These highest results don't represent the air quality that would typically be experienced.

References

U.S. EPA. 1996. Compilation of Air Pollutant Emission Factors: Volume I Stationary Point and Area Sources. Part 3.4 Large Stationary Diesel And All Stationary Dual-fuel Engines, Fifth Edition (AP-42). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

U.S. EPA. 2016. Speciation Profiles and Toxic Emission Factors for Non-road Engines. EPA-420-R-16-017. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100PUQI.pdf.

156. Volume 7, Consultant Report #12, Section 2.1

Benga states, "Appendix 1, Section 6.1 of the TOR lists the public health related requirements; those relevant to the human health and addressed by the HHRA are as follows:

- Describe aspects of the Project that may have implications for public health or the delivery of regional health services. Determine quantitatively whether there may be implications for public health arising from the Project.
- Document any health concerns raised by stakeholders during consultation on the Project.
- Document any health concerns identified by First Nation communities or groups resulting from impacts of existing development and of the Project, specifically on their traditional lifestyle. Include an Aboriginal receptor type in the assessment."

a) Describe how the project could impact on the delivery of regional health services.

Response:

The potential impact of the Project on social infrastructure, including health service delivery, was assessed in the Socio-Economic Impact Assessment (Consultants Report 11, Section 7). The SEIA predicted that Project-related effects on social infrastructure in the region will largely fall on the town of Blairmore and Sparwood where the majority of population effects are expected to occur. Project-related effects on social infrastructure, including health services, are expected to be not significant. A more fulsome discussion of Project-related effects on social infrastructure, including health services, is provided in Consultants Report 11, Section 7.3.

b) Describe how the health concerns raised by the First Nations and others were taken into consideration in the human health risk assessment.

Response:

The primary health concerns raised during the public and Aboriginal consultation process were potential impact to health through changes in air quality and ecological quality (Consultants Report 12, Section 2.2). This information considered in the problem formulation stage of the

HHRA, in which human receptors were characterized and exposure pathway identified for detailed assessment. The HHRA problem formulation identified exposure to project COPCs through inhalation and ingestion of vegetation and local wild game and fish as important exposure pathways; and Aboriginal and residential receptors types as important human receptors. Thus, the HHRA include assessment of potential health effects associated with air quality and ingestion of local vegetation and wildlife for both the general public and Aboriginal receptors.

c) Describe how the potential health impacts resulting from higher regional traffic volumes and the increased risk of accidental leaks and spills were addressed in the human health risk assessment.

Response:

The HHRA did not assess the potential health impacts resulting from higher regional traffic volumes. These impacts were assessed in the Traffic Impact Assessment (Appendix 8).

The proposed project does not have typical upset scenarios (*e.g.*, as flaring) which would result in an accidental impact on air quality. Therefore, an upset scenario typical of the proposed activity was not required in the HHRA.

157. Volume 7, Consultant Report #12, Table 5.1.4

Table 5.1.4 outlines the exposure pathways included in the HHRA multimedia assessment for the different receptor groups. In section 5.1.4, Exposure Pathway Identification, it is stated "Direct inhalation of air was assumed to be the primary exposure pathway." Inhalation of air is not included in Table 5.1.4.

a) Confirm whether inhalation of air was included in the multimedia exposure assessment. If not, include inhalation of air in the multimedia exposure assessment and update the report or provide adequate justification for not doing so. If yes, provide a revised Table 5.1.4 that includes inhalation of air.

Response:

Inhalation of air was not included in the multimedia exposure assessment; each exposure pathway was evaluated separately. In response to this SIR and SIR 171, the potential cumulative impact *via* inhalation plus multimedia was calculated. Please refer to response SIR 171 for additional details.

b) Confirm whether local residents who are not Aboriginal, but who may consume local vegetation and fish and hunt local game were included in the risk assessment. If not, include a local resident that consumes local vegetation and fish and hunts local game in the risk assessment or provide a rationale for why this receptor was not included. If yes, provide a revised Table 5.1.4 that includes this receptor.

Response:

In the HHRA, local residents who are not aboriginal were assumed to consume local vegetation, fish and wild game. The higher rates of consumption identified for the Aboriginal receptors were conservatively assumed for the residential receptors (Table 5.1.3-2).

158. Volume 7, Consultant Report #12, Section 6.1

Benga states, "For PM10, HQs were predicted greater than 1.0 at the RSA-MPOI, the FL-MPOI, R10 (cabin located within the Mine Permit Boundary), R6 (Coleman), and R8 and R14 (Blairmore). At the locations within the Mine Permit Boundary (The RSA-MPOI, FL-MPOI and R10), Project emissions were predicted to contribute the majority of the HQ results. At R10, PM10 exceedances were only marginally above 1.0 and were similar to those predicted for a person living in Blairmore North and Coleman. However, as Project emissions contributed the majority of the predicted exposures additional assessment of the results was conducted." The additional assessment found that "there is a potential risk of exposure exceeding the safe Toxicity Reference Value (TRV) at the R10 on average only 0.8 days per year over the life of the Project." Since access to the R10 location will be restricted during mine operation, public exposure is not expected.

PM10 exceedances were also predicted for the Blairmore North and Coleman communities. The predicted PM10concentrations at Blairmore North and Coleman were determined to be primarily due to existing road and rail traffic. During construction and operation, the Project will contribute additional traffic in these communities, as outlined in Appendix 8.

a) Explain how the increase in traffic in Blairmore North and Coleman communities will impact exposure of people living in these communities to PM10 and other traffic-related contaminants.

Response:

The Application case in the HHRA assesses the potential risk of adverse health effects associated with current traffic plus traffic predicted to occur due to project activities for all COPC including traffic emissions. The HHRA demonstrated that Project emissions posed no significant risk to human health outside of the Project footprint.

With the exception of PM_{10}, potential exposure to COPC at Blairmore North and Colman were below their respective toxicological risk values (TRVs) and therefore, pose no risk of potential adverse health effects. In response to the initial PM_{10} results at Coleman and Blairemore, a more detailed assessment was conducted to determine whether there was a potential risk for adverse health effects, or whether the risk results were the result of conservative assumptions used in the HHRA. Thus, the inputs of the PM_{10} assessment were reviewed in even greater detail and additional health risk assessment included:

- evaluation of the hazard assumptions made in the HHRA in the derivation of the TRV (Consultant Report #12, Appendix B – Toxicological Evaluations, Section 30.0 – Particulate Matter >10 µm in Diameter), and,
- A time-series assessment of PM10 contribution throughout the year in order to determine the proportion Project PM10 emission predicted to occur (CR #12, Section 6.1- Acute Inhalation, Table 6.1-4, Appendix C – Acute Inhalation Results, Table C4, and Section 6.2 – Chronic Inhalation, Table 6.2-5).

Based on the detailed review of potential PM10 exceedances, the following observations were noted and used to support the conclusion that emissions of PM10 from the Project posed no significant risk to human health outside of the Project footprint:

- The predicted HQs at Coleman and Blairmore did not exceed 1.3 (CR#12, Section 6.1, Table 6.1-4 and Section 6.2, Table 6.2-5) and the same HQ was predicted for the Baseline Case and Application Case indicating the Project contribution to the predicted risk was negligible.
- The time series analysis of the predicted 24 hour maximum concentrations of PM_{10} for everyday of the five years modelled in the air dispersion assessment was completed for the Application Case, a total of four PM_{10} exceedances over five years were predicted (CR #12, Appendix C, Table C4); indicating that there is a potential risk of exposures exceeding the TRV on average only 0.8 days per year.
- The risk results of the $PM_{2.5}$ assessments (acute and chronic) were all below the TRV. Assessment of $PM_{2.5}$ toxicology is a better indicator of potential adverse health effects associated with exposure to particulate matter and. The US EPA (2012) has revoked the annual standard for PM_{10} because available evidence generally did not suggest a link between long-term exposure to current ambient levels of coarse particles and health effects (US EPA 2010). The TRV for PM_{10} is based on associated exposure to $PM_{2.5}$ (WHO, 2005). It is derived as the 99th percentile of the distribution of daily concentrations over a year for $PM_{2.5}$.
- The TRV for PM_{10} (CR #12, Appendix B, Section 30.0) is based on $PM_{2.5}$ toxicity that assumes a $PM_{2.5}$:PM_{10} ratio of 0.5, with a recommendation to adjusting the PM ratio to reflect local conditions when data is available (WHO, 2005). The applied PM ratio of 0.5 is conservative when compared to the current Project, which had a predicted average $PM_{2.5}$:PM_{10} ratio of 0.25 with a maximum value of 0.37 for the Application case.
- The majority of predicted chronic PM_{10} exceedances in Coleman and Blairmore were not related to Project activities. The Project contribution to PM_{10} concentrations ranged from 0.0% to 7.6% in Blairmore and 0.0% to 6.1% in Coleman, with the average Project contribution at Coleman being 1.6%, and Blairmore being 1.5%. As demonstrated by the timeseries assessment, the maximum concentrations were predicted to occur infrequently (only four times over five years).

While predicted concentrations of COC exceed applicable TRVs, these exceedances are either: within the Project boundary, primarily related to existing background conditions, extremely infrequent, or not directly associated with adverse health outcomes based on more relevant measurements of $PM_{2.5}$. As such the existing mitigation measures to limit access of the general public to the Project footprint, where TRV exceedances are predicted to occur, are considered to be sufficient mitigating measures for the protection of the general public.

References

US EPA. 2012. National Ambient Air Quality Standards (NAAQS). Washington, DC: U.S. Environmental Protection Agency, Office of Air and Radiation. Available at:

http://www.epa.gov/air/criteria.html. December 14, 2012. Accessed January 2015.

US EPA. 2010. Quantitative Health Risk Assessment for Particulate Matter. US Environmental Protection Agency, Office of Air and Radiation, Office of Air Quality Planning and Standards, Health and Environmental Impacts Division, Research Triangle Park, NC. June 2010. EPA-452/R-10-005. Available at: http://www.epa.gov/ttn/naaqs/standards/pm/data/PM_RA_FINAL_June_2010.pdfAccessed January 2015.

US EPA. 2008. Integrated Science Assessment for Oxides of Nitrogen - Health Criteria. National Center for Environmental Assessment. EPA/600/R-08/071. Available at: http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=194645. Accessed October 2013.

WHO (World Health Organization) 2005. Air Quality Guidelines. Global Update 2005. Particulate Matter, ozone, nitrogen dioxide and sulfur dioxide. ISBN 92 890 2192 6. World Health Organization, Germany. 2006. Available at: http://www.euro.who.int/en/health-topics/environment-and-health/air-quality/publications/pre2009/air-quality-guidelines.-global-update-2005.-particulate-matter,-ozone,-nitrogen-dioxide-and-sulfur-dioxide. Accessed January 2015.

WHO. 1997. United Nations Environment Programme, International Labour Organisation, World Health Organization, International Programme on Chemical Safety. Environmental Health Criteria 188. Nitrogen Oxides (Second Edition). World Health Organization, Geneva. Available at: http://www.inchem.org/documents/ehc/ehc/ehc188.htm#PartNumber:9. Accessed October 2013.

159. Volume 7, Consultant Report #12, Section 6.2.

Benga states, "No HQs or ILCR quotients greater than 1.0 due to additive toxicity were predicted (Table 6.2-2)."

a) Explain the lack of HQs of greater than 1.0 due to additive toxicity when HQs were greater than 1.0 for NO_2, $PM_{2.5}$ and PM_{10}.

Response:

The response to SIR 170 includes discussion of the chemical groupings assumed for the assessment of potential additive effects. For some groups, the HQs were re-calculated. An explanation of the respiratory irritant group results is also included in SIR 170 response.

160. Volume 7, Consultant Report #12, Table 6.2-3

Predicted NO2-Annual Hazard Quotients at all Receptor Locations. There are two entries for R8 and no entry for R9.

a) Revise Table 6.2-3 so that it is clear which predicted NO2 Annual Hazard Quotient value belongs to R8 and which value belongs to R9.

Response:

The predicted NO_2 Annual Hazard Quotient values are ordered correctly but a typo was present in the table (the second R8 entry should have read R9). The corrected version of the table is provided below (Table SIR 160-1).

Table SIR 160-1 Predicted NO_2-Annual Hazard Quotients at all Receptor Locations

Receptor	Project	Baseline	Application
RSA-MPOI	8.6E-01	4.1E-01	**1.2E+00**
FL-MPOI	3.0E-01	5.0E-01	6.9E-01
R1	9.2E-03	6.2E-01	6.3E-01
R2	1.5E-02	4.1E-01	4.3E-01
R3	7.4E-03	6.2E-01	6.3E-01
R4	4.4E-03	4.1E-01	4.1E-01
R5	7.4E-03	4.1E-01	4.2E-01
R6	7.1E-03	8.9E-01	8.9E-01
R7	6.6E-03	7.2E-01	7.2E-01
R8	3.9E-02	**1.1E+00**	**1.1E+00**
R9	1.1E-01	4.4E-01	5.3E-01
R10	3.3E-01	4.2E-01	7.1E-01
R11	6.9E-02	4.1E-01	4.7E-01
R12	9.8E-02	4.2E-01	5.2E-01
R13	8.5E-02	4.2E-01	5.0E-01
R14	7.8E-03	8.8E-01	8.8E-01

161. Volume 7, Consultant Report #12, Section 2.2

This section, entitled "Assessment Focus Based on Public and Aboriginal Consultation", summarizes the concerns raised by the public and aboriginal groups, including the need for an emergency preparedness plan. The plant and animal species of importance to Treaty 7 First Nations are also listed.

a) Describe how health concerns of the public and Aboriginal groups, including lung problems and various health issues were taken into consideration in the HHRA.

Response:

Health concerns of the public and Aboriginal groups were identified in stakeholder meetings and workshops conducted by Benga throughout the EIA process. During the HHRA process, the Health team directly communicated with the disciplines conducting stakeholder communication in order to ensure that health concerns raised by the stakeholders were considered at the scoping stage (problem formulation) of the HHRA.

Health concerns specifically raised were potential adverse health effects that may be occur with the proposed Project's impact on air and surface water quality. The HHRA identified all operative exposure pathways which would assess the potential impact to air and surface water quality and calculated potential risk of adverse health effects. This included inhalation of COPC released into the air and multimedia exposure to COPC deposited from air on environmental media (soil, surface water, vegetation) and taken up into plants and animals. The HHRA included assessment of these exposure pathways in the detailed multimedia HHRA and included the assessment of potential risk of adverse health effects in the risk characterization (CR#12, Section 5.4).

b) Describe how species of importance to Treaty 7 First Nations were taken into consideration in the HHRA.

Response:

The species of importance identified during consultation with Treaty 7 First Nations (CR#12 Section 2.2). As the specific species identified do not have the adequate receptor characteristics data to model potential tissue concentrations associated with exposure to COPC in the environmental media, surrogate species were identified for the purposes of the HHRA's exposure assessment. The surrogate species were used to estimate potential exposure via consumption of local wildlife. Receptor characteristics were obtained from Environment Canada (2012). Details of the wildlife exposure modelling are provided in CR#12 Appendix E. Additional assessment of potential exposure and health impact to wildlife receptors was conducted in response to these SIRs and is provided in Response SIR 152.

Reference

Environment Canada. 2012. Federal Contaminated Sites Action Plan (FCSAP) Ecological Risk Assessment Guidance Module 3: Standardization of Wildlife Receptor Characteristics. March 2012.

162. Volume 7, Consultant Report #12, Section 3.1.

Benga states, "The available statistical data did not disseminate the data specific to smaller populations within the area (e.g. specific towns or Aboriginal communities). Similar but more recent - data (from 2011-2012) are presented by Statistics Canada (2013); however, due to the reorganization of Alberta's health regions, the data are not directly comparable. Through the reorganization, the former Chinook and Palliser regions have been combined and re-named as the South Zone; consequently, the Project is now defined by the South Zone regional data, as it is situated within the former Chinook region."

a) Explain what is meant by "the available statistical data did not disseminate the data." Include in the response access of data to the proponent.

Response:

The sentence is meant to convey that the data published in the *Report on the Health of Albertans* (AHW 2006) was pertaining to the South Zone as a whole. Similarly, the data published by Statistics Canada (2013) was pertaining to the Chinook region as a whole. Data specific only to only the LSA, to aboriginal communities within the LSA or to specific towns was not available.

b) Explain how the data quoted in this section is relevant to the Aboriginal communities and the small communities of Coleman or Blairmore.

Response:

Please see response SIR 162a.

c) Explain how the size of the health regions considered (Chinook, Palliser and South Zone) and the communities included within these regions compare to the size of the LSA and the communities within the LSA.

Response:

The most current population data available for the Chinook and Palliser Health Regions was from 2011; therefore, population data from 2011 was used for all regions for direct comparison. For the areas where more current population data were available (South Zone, Blairmore and Coleman), the more current data is also provided.

- Area of LSA: 150 km^2;
- Area of the Chinook Health Region: approximately 24,800 km^2 (calculated);
- Area of the Palliser Health Region: approximately 37,400 km^2 (calculated);
- Area of the South Zone: approximately 62,200 km^2 (calculated);
- Area of Blairmore: 2.04 km^2 (Statistics Canada 2016a);
- Area of Coleman: 1.97 km^2 (Statistics Canada 2016b);
- Population in LSA (Crow's Nest Pass): 5,565 in 2011; 5,589 in 2016 (Statistics Canada 2016c);
- Population in Chinook Health Region: 176,566 in 2011 (Government of Alberta 2011);
- Population in Palliser Health Region: 113,100 in 2011 (Government of Alberta 2011);
- Population in South Zone: 289,666 in 2011; 308,113 in 2014 (Government of Alberta 2011, 2014);
- Population in Blairmore: 1,521 in 2011; 1,545 in 2016 (Statistics Canada 2016a); and
- Population in Coleman: 1,366 in 2011; 1,475 in 2016 (Statistics Canada 2016b).

References

Government of Alberta. 2011. Distribution of population covered by former health service location as of March 31, 2011. Accessed at: https://open.alberta.ca/opendata/distribution-of-population-covered-by-alberta-health-services-geographic-zone-service-location.

Accessed on February 1, 2018.

Government of Alberta. 2014. Distribution of population covered by former health service location as of March 31, 2011. Accessed at: https://open.alberta.ca/opendata/distribution-of-population-covered-by-alberta-health-services-geographic-zone-service-location. Accessed on February 1, 2018.

Statistics Canada. 2016a. Census Profile, 2016 Census Blairmore, Alberta. Accessed at: http://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=POPC&Code1=0074&Geo2=PR&Code2=48&Data=Count&SearchText=Blairmore&SearchType=Begins&SearchPR=01&B1=All http://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=POPC&Code1=0074&Geo2=PR&Code2=48&Data=Count&SearchText=Blairmore&SearchType=Begins&SearchPR=01&B1=All. Accessed on February 1, 2018.

Statistics Canada. 2016b. Census Profile, 2016 Census Coleman, Alberta. Accessed at: http://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=POPC&Code1=1543&Geo2=PR&Code2=48&Data=Count&SearchText=Coleman&SearchType=Begins&SearchPR=01&B1=All&GeoLevel=PR&GeoCode=1543&TABID=1. Accessed on February 1, 2018.

Statistics Canada. 2016c. Census Profile, 2016 Census Crowsnest Pass, Alberta. Accessed at: http://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/Page.cfm?Lang=E&Geo1=CSD&Code1=4815007&Geo2=POPC&Code2=0074&Data=Count&SearchText=Blairmore&SearchType=Begins&SearchPR=01&B1=All. Accessed on February 1, 2018.

d) Provide references when citing specific data in the subsections of 3.1.

Response:

Data for the Chinook Region were obtained from AHW (2006). Data for the South Region were obtained from Statistics Canada (2013).

References

AHW (Alberta Health and Wellness). 2006. Report on the Health of Albertans. Accessed at: https://open.alberta.ca/dataset/0778534774

Statistics Canada. 2013. Health Profile, December 2013. Accessed at: http://www12.statcan.gc.ca/health-sante/82-228/Index.cfm?Lang=E

e) Define how significance was determined when comparisons resulted in “significantly higher” response in one region compared to another.

Response:

The phrase "significantly higher" occurs in the following 2 instances within the health status summary (Section 3.1):

- In 2011-2012, similar percentages of the population were considered overweight in the South Zone compared to the Alberta population; however, a significantly higher percentage was classified as obese in the South Zone (23.5%) compared to the Alberta population (18.9%).
- In this instance, the value for obesity in the South Zone was nearly 5% greater compared to the Albertan value and, as such, was deemed to be significant by AHW (AHW 2006).
- The prevalence of treated substance abuse in the Chinook region was significantly higher than the provincial average (1.1 compared to 0.7 per 100 in 2003).

In this instance, the source document (AHW 2006) described the prevalence of treated substance to be significantly higher. The document stated the following: "Five health regions were **significantly above** the provincial average for substance abuse disorder treatment". Of the health regions that were described as being significantly higher than the provincial average, the Chinook region had the highest prevalence of substance abuse disorder treatment. The document did not define how significance was determined.

163. Volume 7, Consultant Report #12, Section 5.1.1 and Section 5.1.2.

Benga states, "The Project was assumed to have no direct effect on water quality, therefore, emission into air were the only Project related chemical source which required detailed exposure risk assessment in the HHRA." and "The HHRA assumed that there will be no changes in surface water quality for the reclaimed landscape as a result of the end pit lake."

According to the Project Description, mine operations will require 558,772 m3 of water per year and a key component of mine development will be surface water management. The Project Description and assumptions in the HHRA are not sufficient to support the conclusion that Project release to groundwater or surface water will not affect human health.

a) Discuss the potential use of groundwater and surface water as drinking water sources within the RSA and LSA and identify any operable human exposure pathways to groundwater and surface water.

Response:

Implementation of the mitigation measures proposed for the Project will prevent potential human exposure to leaching of metals and other contaminants from the raw coal stockpiles via either groundwater or surface water. Therefore, the only operative exposure to chemicals of potential concern (COPC) is from Project activities through emission to air. As per Health Canada HHRA guidance, if there is no operative exposure pathway, there is no potential risk of adverse health impacts and additional risk characterization is not required. As deposition from air is not anticipated to adversely affect groundwater quality, characterization of the potential human health risk via groundwater as a drinking water source was not required. Conversely, as discussed in CR#12 - Section 5.1.4 COPC deposition onto surface water, exposure through ingestion of surface water, contact with surface water while swimming, and ingestion of fish sourced from surface water were included in the multiple media exposure model.

Therefore, the potential use of both groundwater and surface water as drinking water sources within the RSA and LSA were considered. For groundwater, the pathway is inoperative and therefore risk characterization was not required. For surface water, the pathway was included as part of the multiple media exposure model.

b) Provide evidence, based on environmental assessment, that water released from the Project will not affect groundwater and/or surface water quality in the RSA or LSA.

Response:

The mitigation measures proposed to ensure groundwater and surface water are not affected by leachate from the storage areas are summarized below.

The water management strategy for the Project is described in Section C – Project Description, Section C.5 – Water Management. The water management strategy aims to minimize water diverted from streams, maximize the separation of clean and contact water, and pump water with high selenium and nitrate concentrations to saturated zones for attenuation. The planned water management infrastructure is shown in Section C, Figure C.5.3-5.

Water collected in the various mine pit phases will be pumped to sedimentation ponds for treatment and discharge. Water seeping from waste rock (placed in-pit or ex-pit) will either percolate naturally or be actively managed to pass through the saturated zones. A detailed discussion of the Project's water treatment objectives is provided in Section C.5.3 – Water Treatment.

The Project's water management strategy aimed to ensure the majority of the water quality (surface and groundwater) impacts were mitigated through the Projects design. All surface runoff and leachate from the three rock disposal areas will be collected by interceptor ditches and groundwater dewatering wells and sent to surge ponds for temporary storage (northwest surge pond, southeast surge pond, and the raw water pond). The capture efficiency of these features was expected to be 95%. A full description of the seepage minimization and capture process is included in Appendix 10C, Section 3.2, Pages 10-12 and Section 4.2, Pages 19-20.

The hydrogeology and surface water quality assessments have taken these design features in account. Potential impacts and additional mitigations for each are summarized in Section E – Environmental Impact Assessment Summary, Sections E.3 – Hydrogeology, and Section E.5 – Water Quality.

In addition to the aforementioned sections, Benga also provided an additional water quality management report in Appendix 10C. The intent of the water quality management report was to develop mitigation concepts to a level appropriate for environmental effects assessment. Site-specific tests, field investigations, ongoing monitoring, and engineering assessments will be conducted to further refine the required performance of the proposed measures.

c) If impacts to water are predicted and operable human exposure pathways are identified, provide an assessment of the potential adverse effects on human health as a result of changes in water quality.

Response:

Impacts to groundwater were not predicted and an operative human exposure pathway was not identified. Therefore, an assessment of the potential for adverse effect was not required for human exposure to groundwater. The potential for impacts to surface water (as a result of deposition from air emissions) were predicted and were assessed as a part of the multiple-media exposure model (CR#12, Section 6.3 Chronic Multimedia Exposure).

164. Volume 7, Consultant Report #12, Section 5.1.1.

Benga states, "The HHRA evaluated both acute and chronic inhalation health risks for all of the identified Chemicals of Potential Concern (COPC)for which adequate toxicological data was available. A list of the chemicals included in the HHRA is presented in Table 5.1.1-1."

Chromium is listed in Table 5.1.1-1 as Cr II, III and VI, however, the Air Quality Assessment (CR#1) does not appear to differentiate between these chromium species.

a) Explain how inhalation and oral exposures to chromium II, III and VI were determined from total chromium concentrations.

Response:

Two chromium species were assessed as individual COPC in the HHRA, Chromium III (Cr III) and Chromium VI (Cr VI). Details of the TRVs selected for each species are provided in the toxicological profiles (CR#12, Appendix B). Further clarity on the selection process for inhalation and oral exposure to chromium are provided below.

Acute Inhalation

Sufficient toxicological information exists for an acute evaluation of all chromium compounds with the exception of Cr VI). No acute inhalation TRV was available for Cr VI due to a lack of defensible inhalation exposure limits.

The total chromium concentration was directly compared to the Cr III TRV for assessment of acute inhalation exposure.

Chronic Inhalation

Chromium VI compounds are Occupational Safety and Health Administration (OSHA) regulated chemicals and are classified as human carcinogens (Group 1) by the International Agency for Research on Cancer (IARC) and as known human carcinogens (Group K) by the National

Toxicology Program (NTP) (OSU 2010). Therefore, for the purposes of chronic inhalation assessment Cr VI was evaluated separately from all other forms of chromium.

The total chromium concentration was directly compared to the Cr III chronic (non-cancer) respiratory effects TRV developed by the TCEQ (2009) for all forms of chromium except Cr VI.

The total chromium concentration from oil combustion sources was multiplied by 0.05 (5%) as an estimate of Cr(VI) contribution (AB 22588, ARB 1985). The resultant concentration was then compared to Health Canada (2010) TRV for increased incidence of lung cancer.

Oral Exposure

The total chromium concentration was directly compared to the Cr(VI) TRV for gastrointestinal effects from ATSDR (2012). It is noted that this is a highly conservative assumption as Cr(VI) is known to make up only a relatively small proportion of total chromium.

The HQs and ILCRs calculated for Cr III and Cr VI for the RSA-MPOI location are provided in Table SIR 164-1. The HQ and ILCR Quotients for the worst-case RSA-MPOI were all below 1.0 indicating no potential risk of adverse health effects. Potential risk predicted for the remaining receptor locations are lower than the RSA-MPOI.

Cr III and Cr VI were also include in the assessment of multiple chemical assessment. Cr III was included in the acute and chronic respiratory irritant group, Cr VI was included in the lung tumor group, and total chromium (assumed to be Cr VI) was included in the Gastrointestinal Irritant group. Updates to the chemical groupings and revisions of HQs and ILCR Quotients were conducted in response to SIR 170.

Table SIR 164-1 Predicted HHQs and ILCR Quotients for the Cr III and Cr VII at the RSA-MPOI

Parameter	Project	Baseline	Application
Acute Inhalation HQs			
Chromium (III)	2.5E-04	1.8E-04	2.5E-04
Chronic Inhalation HQs			
Chromium (III)	8.3E-03	2.1E-02	2.1E-02
Chronic Inhalation ILCR Quotient			
Chromium (VI)	3.0E-02	-	-
Chronic Multimedia HQs			
Chromium (VI)	1.2E-02	5.6E-03	1.5E-02

REFERENCES

AB 2588 (Ventura County Air Pollution Control District). 2001. AB 2588 Combustion Emission Factors. Accessed at: http://www.aqmd.gov/docs/default-source/permitting/toxics-emission-factors-from-combustion-process-.pdf?sfvrsn=0

ARB (State of California Air Resources Board). 1985. Public Hearing to Consider the Adoption of a Regulatory Amendment Identifying Hexavalent Chromium as a Toxic Air Contaminant. Accessed at: https://oehha.ca.gov/media/downloads/air/document/hexavalent20chromium.pdf

ATSDR (Agency for Toxic Substances and Disease Registry). 2012. Toxicological Profile for Chromium. Accessed at: http://www.atsdr.cdc.gov/toxprofiles/tp7.pdf. Accessed April 2015.

Health Canada. 2010. Federal Contaminated Site Risk Assessment in Canada. Part II: Health Canada Toxicological Reference Values (TRVs) and Chemical Specific Factors Version 2.0. Contaminated Sites Division. Safe Environments Programme. September 2010.

OSU (Ohio State University). 2010. Chemical Hygiene Plan Table 9 Carcinogens Table: OSHA, IARC, NTP, ACGIH. Office of Environmental Health and Safety. Accessed at: http://oh.muq.ac.ir/uploads/125_193_54_liste%20mavade%20saratanza.pdf. Accessed March 2015.

TCEQ (Texas Commission on Environmental Quality). 2009. Chromium. All Compounds Except Hexavalent Chromium. CAS Registry Numbers: Trivalent Chromium (16065-83-1) Elemental Chromium (7440-47-3). Development Support Document. Final, October 2009. Accessed at: http://www.tceq.state.tx.us/assets/public/implementation/tox/dsd/final/october09/chromium3_1606 5-83-1.pdf. Accessed March 2015.

165. Volume 7, Consultant Report #12, Section 5.1.3.

Benga states, "Other than proposed Project related operations, no other industrial activities requiring work camps were identified within the RSA; therefore, a worker receptor type was not required in the HHRA."

a) Workers could be any people engaged in physically demanding work such as farming, building and landscaping, etc. Include in the HHRA an assessment of potential health risk to workers in the area of potential impact, or explain why no workers would be expected in this area.

Response:

Assessment of a worker type receptor was included in the HHRA. Potential exposure and therefore risks for the worker receptor were lower than those predicted for a residential receptor. The risk results of the worker receptor were included in results tables in CR#12, Appendices C, D and F.

b) Include in the HHRA an assessment of potential health risks to visitors to the mine area, as a result of acute inhalation exposures.

Response:

The HHRA include assessment of adult acute exposures. Two sites within the mine boundary were included in the HHRA (R9 and R10). The acute HQs for these locations were all below 1.0, indicating that predicted air concentrations were below the TRV and a potential risk of adverse health effects is not expected. These results can be assumed to be representative of a person visiting the mine.

166. Volume 7, Consultant Report #12, Section 5.1.3.

Benga states, "From the information collected, 13 HHRA receptors were selected (Table 5.1.3-1, Figure A-4). In addition, both the LSA-MPOI and RSA-MPOI were also included in the HHRA as hypothetical worst-case receptor locations, as they represent locations of the highest predicted air concentrations and thus, the highest potential risk of adverse health effects. Thus, a total of 15 HHRA receptor locations were assessed."

a) Explain the basis for the locations of HHRA receptors in the towns of Coleman, Frank, and Blairmore.

Response:

Coleman, Frank and Blairmore were selected as human receptors for the HHRA as they are the closest communities to the Project. The specific locations were selected to represent the centre of the community. As Blairmore is the closest community to the Project, specifically to the proposed rail yard, a second location north of Highway 3 close to the proposed rail loop was also included (R8, Figure A.4).

b) Explain why receptor locations in the towns of Bellevue and Hillcrest were not included in the HHRA, or identify where receptors will be included in these locations.

Response:

The HHRA problem formulation identified over 500 potential human receptor locations (Section 5.1.3, Figure A-2). The communities of Bellevue and Hillcrest were included in that list. All locations including Bellevue and Hillcrest, were considered for the detailed HHRA were selected. It is not necessary to conduct a detailed exposure and risk assessment for all potential locations in the region to determine whether there are risks of potential adverse health effects; receptor locations in closer proximity to the Project were assumed to have greater potential exposures were selected for the detailed HHRA. As Bellevue and Hillcrest are farther from the proposed Project than Coleman, Blairmore and Frank, the potential exposure to COPC and predicted risks can be assumed to be lower. As the potential risk for the three communities assessed indicate that the proposed Project does not pose a risk of adverse health effects, the same conclusion can be applied to the more distant communities.

c) There are several locations in nearby towns where sensitive receptors may spend extended periods of time (i.e., hospitals and senior residences). Explain why these locations were not included or include an evaluation of these receptor locations within the HHRA.

Response:

A number of conservative assumptions are built into HHRA methodology which purposefully over predict potential risks. This guidance was applied for the current HHRA. In the problem formulation step, sensitive receptors were assumed to occur at all the receptor locations for both short (acute) and extended (chronic) periods of time. Receptor locations were selected to represent locations with higher potential exposures. In the HHRA hazard assessment, the TRVs were selected so as to be protective of the most sensitive human receptor. It can be assumed that a person living at any of the receptor locations assessed may be living in a hospital, senior residence, or similar. Thus, the conclusions of the HHRA are representative of these sensitive receptors.

Due to the conservative assumptions applied in the HHRA, it can be concluded that potential risk for other locations within each community will be similar or lower than those predicted for the locations selected to represent Coleman, Blairmore and Frank. Because the potential risk for the community receptor locations assessed in the HHRA indicate that the proposed Project does not pose a risk of adverse health effects, the same conclusion can be applied to the more distant receptor locations.

d) Provide evidence that the assessment of health risks as a result of acute and chronic exposure at the fenceline is not required.

Response:

A fenceline location was included in the HHRA. The FL-MPOI receptor location is representative of the maximum potential exposure at fenceline. The HHRA included the assessment of a receptor at the FL-MPOI for both acute and chronic inhalation, as well as for chronic exposure *via* multimedia. Results for this location were provided in CR#12, Appendices C, D and F.

167. Volume 7, Consultant Report #12, Section 5.1.3, Table 5.1.3-2.

Table 5.1.3-2 includes receptor characteristics for different age groups and a worker receptor.

a) Provide clarification on the exposure characteristics assumed for each of the receptors considered in the HHRA, including a worker in the communities and a visitor to the mine area.

Response:

All receptor characteristics assumed in the HHRA were as per Health Canada guidance (Health Canada 2010) with the exception of Aboriginal receptor traditional food consumption rates (Wein *et al*. 1990). A mine visitor was not specifically selected as a receptor for the HHRA; however, it would share the same characteristics as the adult life stage described in the HHRA. Subsequently, the risk predicted for this receptor would be similar to the acute inhalation results predicted for locations close to the mine (*e.g.*, R9, R10, R11, R12, and R13 as per Figure A-4).

A worker receptor was assumed to be similar to the adult life stage, with the expectation of a greater inhalation rate than the adult life stage and zero local game, fish or produce consumption.

REFERENCES

Health Canada. 2010. Federal Contaminated Sites Risk Assessment in Canada Part I: Guidance on Preliminary Quantitative Human Health Risk Assessment (PQRA). Version 2.0. Contaminated Sites Division. Ottawa. Revised 2012.

Wein, E., J.H. Sabry and F.T Evers. 1990. Food consumption patterns and use of country foods by Native Canadians near Wood Buffalo National Park, Canada. Arctic 44(3): 196-205.

168. Volume 7, Consultant Report #12, Section 5.2.2.

Benga states, "An HHRA baseline sampling program was conducted in July 22-31, 2014 and September 5-9, 2014. The HHRA baseline sampling program included the collection and chemical analysis of vegetation and soil samples. Within the program, efforts were made to collect berries and leaves typically consumed through local harvesting; the results were dependent on the time of year samples were collected and the availability of specific species in the areas sampled. Complete results from the soil and vegetation sampling program are provided in Appendix G (Baseline Sampling Program)."

a) Explain how baseline surface water quality and fish tissue quality was determined for the HHRA.

Response:

Baseline surface water and fish tissue concentrations were not included in the baseline monitoring assessment program. In order to assess the potential exposure to human receptors via water and fish consumption, the HHRA predicted the potential exposure doses in the multimedia model. The multimedia model was based on the formulas provide by the US EPA for environmental media modelling in detailed HHRA (US EPA 2005). Details of the calculations were provided in Appendix E, Equations 7 and 8 for surface water and aquatic organisms respectively.

REFERENCES

US EPA (United States Environmental Protection Agency). 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Sites. Office of Solid Waste and Emergency Response. EPA530-R-05-006.

169. Volume 7, Consultant Report #12, Section 5.3.1, Table 5.3.1-2.

a) Include the toxicity endpoint for lead in this table and provide any necessary updates to chemical grouping based on this endpoint.

Response:

The toxicity endpoint for lead is neurocognitive and neurobehavioral effects in children (US EPA 2008).

Lead was included in the chemical group for a neurological endpoint. Updates to the chemical groupings and revisions of HQs were conducted in response to SIR 170.

Reference

US EPA (United States Environmental Protection Agency). 2008. Federal Register. 73 (219): 66964-67062. Accessed at: http://www.gpo.gov/fdsys/pkg/FR-2008-11-12/html/E8-25654.htm. Accessed May 20, 2015.

170. Volume 7, Consultant Report #12, Section 5.3.2, Table 5.3.2-1.

a) Justify why some chemicals identified as eye irritants following acute inhalation in Table 5.3.1-1 (e.g., acenaphthene) were not included in the acute inhalation eye irritant group in Table 5.3.2-1.

Response:

The correct chemical toxicity endpoint groupings are provided in Table SIR 170-1 below.

Table SIR 170-1 Toxicity Endpoint Groups

Exposure Pathway and Duration	Toxicity Endpoint	COPC
Acute Inhalation	Eye Irritant	Acenaphthene, Acenaphthylene, Anthracene, Fluoranthene, Fluorene, Naphthalene, Phenanthrene, Pyrene, Acetaladehyde, Acrolein, Formaldehyde, Toluene, Xylenes.
	Nasal Irritant	Acetaldehyde, Acrolein, Formaldehyde, Toluene, Cadmium.
	Respiratory Irritant	NO_2, SO_2, Acetaldehyde, Acrolein, Xylenes, Chromium (III), Copper, Vanadium.
	Neurological	Mercury, Toluene, Xylenes.
Chronic Inhalation	Eye Irritant	Formaldehyde, Xylenes.
	Respiratory Irritant	Acrolein, Antimony, Beryllium, Formaldehyde, Chromium (III), Cobalt, Copper, Vanadium.
	Nasal Irritant	Acetaldehyde, Acrolein, Formaldehyde, Naphthalene, Xylenes.
	Neurological	Aluminium, Lead, Manganese, Mercury, Selenium, Toluene, Xylenes.
	Kidney and Liver	Acenaphthene, Acenaphthylene, Anthracene, Fluoranthene, Fluorene, Phenanthrene, Pyrene.
	Nasal Tumors	Napthalene, Acetaldehyde, Formaldehyde.
	Lung Tumours	Benzo[a]pyrene group, Arsenic, Beryllium, Cadmium, Chromium (VI), Nickel.
Chronic Oral	Gastrointestinal Irritant	Beryllium, Total Chromium, Formaldehyde, Copper.
	Liver	Acenaphthene, Acenaphthylene, Fluorene, Aluminum, Antimony, Copper, Selenium.

Table SIR 170-1 Toxicity Endpoint Groups		
Exposure Pathway and Duration	**Toxicity Endpoint**	**COPC**
	Kidney	Barium, Cadmium, Formaldehyde, Fluoranthene, Fluorene, Mercury, Pyrene, Toluene, Uranium.
	Reproductive	Aluminium, Lead, Naphthalene, Nickel, Vanadium, Xylenes
	Gastrointestinal Tumors	Benzo[a]pyrene group.

b) Justify why some chemicals not identified as acute respiratory irritants in Table 5.3.1-1 (e.g., nickel) were included in the acute respiratory irritant group in Table 5.3.2-1.

Response:

See response SIR 170a.

c) Justify why some chemicals identified as chronic respiratory irritants in Table 5.3.1-2 (e.g., acrolein) were not included in the chronic respiratory irritant group in Table 5.3.2-1.

Response:

See response SIR 170a.

d) Justify why a group for kidney and liver effects following chronic inhalation exposure was not considered when several COPCs were considered to cause kidney and liver effects in Table 5.3.1- 2.

Response:

See response SIR 170a.

e) Justify why nickel was not included in the lung tumor group for chronic inhalation, when lung cancer was the toxicity endpoint for nickel listed in Table 5.3.1-2.

Response:

See response SIR 170a.

f) Justify why copper was not included in the gastrointestinal group for chronic oral, when liver and gastrointestinal effects were the toxicity endpoints for copper listed in Table 5.3.1-3.

Response:

See response SIR 170a.

g) Justify why some chemicals capable of liver toxicity following chronic oral exposure listed in Table 5.3.1-3 were not included in the liver toxicity group.

Response:

See response SIR 170a.

h) Justify why Table 5.3.2-1 does not include a group for gastrointestinal tumours following chronic oral exposures (e.g., dibenzo(a,h)anthracene).

Response:

See response SIR 170a.

i) Revise Table 5.3.2-1 and predicted HQ values for mixtures as required, based on comments above.

Response:

The HQs and ILCR were re-calculated using the correct chemical groupings from Table SIR 170-1 and are provided in Tables SIR 170-2, SIR 170-3 and SIR 170-4.

Table SIR 170-2 Predicted Additive HQs by Toxicity Groups – Acute Inhalation

Toxicity Endpoint	RSA-MPOI		
	Project	Baseline	Application
Eye Irritation	1.7E-03	1.9E-03	1.9E-03
Nasal Irritation	1.7E-03	1.8E-03	1.8E-03
Respiratory Irritation	**3.7E+00**	2.0E-01	**3.7E+00**
Neurological	5.6E-05	2.6E-05	5.8E-05

Table SIR 170-3 Predicted Additive HQs and ILCR Quotients by Toxicity Groups – Chronic Inhalation

Toxicity Endpoint	RSA-MPOI		
	Project	Baseline	Application
Eye Irritant (HQ)	1.3E-04	4.7E-04	4.7E-04
Respiratory Irritant (HQ)	9.5E-02	6.5E-02	1.1E-01
Nasal Irritant (HQ)	6.1E-03	2.2E-02	2.3E-02
Neurological (HQ)	1.7E-03	4.4E-03	4.4E-03
Kidney and Liver (HQ)	2.0E-05	7.3E-05	7.4E-05
Nasal Tumors (ILCR Quotient)	6.3E-03	-	-
Lung Tumors (ILCR Quotient)	3.2E-01	-	-

Table SIR 170-4 Predicted Additive Hazard Quotients and ILCR Quotients by Toxicity Groups – Chronic Multimedia

Toxicity Endpoint	RSA-MPOI		
	Project	Baseline	Application
Gastrointestinal (HQs)	2.7E-02	1.2E-02	3.3E-02
Liver (HQs)	1.2E-02	9.0E-03	1.8E-02
Kidney (HQs)	8.4E-01	1.9E-01	7.6E-01
Reproductive (HQs)	1.2E-01	1.1E-01	1.9E-01
Gastrointestinal Tumors (ILCR)	4.6E-02	-	-

Predicted additive HQ results were less than 1.0 for all groups with the exception of the Acute Inhalation Respiratory Irritant group (Table SIR 170-2). This result is consistent with the original findings of the HHRA.

Table SIR 170-4 provided the HQ for all the human receptor locations for the Acute Inhalation Respiratory Irritant group. HQs greater than 1.0 were predicted to occur only at the maximum point of impingement (MPOI) locations (RSA-MPOI and FL-MPOI). The MPOI locations are assuming the most conservative exposure and toxicological parameters apply; they are representative of worst-case exposure scenarios. Due the number of conservative assumption include in the assessment of the MPOI locations, the likelihood that the predicted air concentrations would occur and that a person would happen to be at the MPOI locations for an acute period of time is very low. In addition, as discussed in the HHRA, the RSA-MPOI is predicted to occur close at the edge of the pit boundary within the Project footprint. This area will be restricted to the general public during construction and operation. Finally, the HQ results for other locations also close to the mine were all below 1.0 (R9, R10, R11, R10, R12, and R13) and therefore indicate no potential risk of adverse health effects.

Table SIR 170-5 Predicted Additive Hazard Quotients for Acute Inhalation of Respiratory Irritants

Location	Respiratory Irritants (HQs)		
	Project	Baseline	Application
RSA-MPOI	**3.7E+00**	2.0E-01	**3.7E+00**
FL-MPOI	**1.8E+00**	3.6E-01	**1.8E+00**
R1	3.5E-01	5.0E-01	5.0E-01
R2	4.5E-01	1.9E-01	4.8E-01
R3	3.3E-01	5.2E-01	5.2E-01
R4	2.4E-01	1.8E-01	3.9E-01
R5	3.1E-01	1.9E-01	4.6E-01

Table SIR 170-5 Predicted Additive Hazard Quotients for Acute Inhalation of Respiratory Irritants

Location	Respiratory Irritants (HQs)		
	Project	Baseline	Application
R6	3.2E-01	5.5E-01	5.5E-01
R7	3.0E-01	5.1E-01	5.1E-01
R8	3.4E-01	7.1E-01	7.1E-01
R9	5.2E-01	2.7E-01	5.4E-01
R10	6.5E-01	2.0E-01	6.7E-01
R11	5.8E-01	1.9E-01	6.0E-01
R12	4.5E-01	2.2E-01	4.8E-01
R13	5.5E-01	2.1E-01	5.8E-01
R14	3.1E-01	5.4E-01	5.4E-01

171. Volume 7, Consultant Report #12, Section 6.3.

a) Confirm whether combined inhalation and oral exposures considered in the chronic multiple exposure pathway assessment, where the same critical effect(s) was reported for both pathways (e.g., kidney or liver). If not, provide an assessment of potential risks from combined inhalation and oral exposure pathways or provide an explanation as to why this assessment would not be required.

Response:

Combined inhalation and oral exposures were not considered in the chronic multiple exposure pathway assessment. Upon review, the following critical effect pathways exist for both inhalation and oral exposure: liver, kidney, neurological and lung cancer. A summary of the chemical groupings considered in response SIR 171a is provided in Table SIR 171-1.

Table SIR 171-1 Multi-Media Exposure Groupings for Similar Critical Effect Pathways

Toxicity Endpoint	COPC
Inhalation	
Kidney and Liver	Acenaphthene, Acenaphthylene, Anthracene, Fluoranthene, Fluorene, Phenanthrene, Pyrene.
Neurological	Aluminium, Lead, Manganese, Mercury, Selenium, Toluene, Xylenes.
Lung cancer	Benzo[a]pyrene group, Arsenic, Beryllium, Cadmium, Chromium (VI), Nickel.
Multimedia - Oral	
Liver	Acenaphthene, Acenaphthylene, Fluorene, Aluminum, Antimony, Copper, Selenium.

Table SIR 171-1 Multi-Media Exposure Groupings for Similar Critical Effect Pathways	
Toxicity Endpoint	**COPC**
Kidney	Barium, Cadmium, Formaldehyde, Fluoranthene, Fluorene, Mercury, Pyrene, Toluene, Uranium.
Neurological[1]	Manganese
Lung cancer[1]	Arsenic

[1]*no toxicity endpoint group was developed for neurological or lung cancer effect endpoints via oral exposure as both groups are represented by a single chemical.*

Following the identification of similar critical effect pathways, the potential risk from combined inhalation and oral exposure was assessed (Table SIR 171-2).

Table SIR 171-1 Predicted Additive HQs and ILCR Quotients for Inhalation, Multi-Media and Combined Exposures *via* Similar Critical Effect Pathways.			
Toxicity Endpoint	**RSA-MPOI**		
	Project	**Baseline**	**Application**
Inhalation			
Kidney and Liver ($HQ_{inhalation}$)	2.0E-05	7.3E-05	7.3E-05
Neurological ($HQ_{inhalation}$)	1.7E-03	4.4E-03	4.5E-03
Lung Tumors (ILCR)	3.2E-01	-	-
Multimedia			
Liver (HQ_{oral})	1.2E-02	9.0E-03	1.8E-02
Kidney (HQ_{oral})	8.4E-01	1.9E-01	7.6E-01
Neurological (HQ)	3.9E-07	5.9E-02	5.9E-02
Lung Tumors (ILCR)	1.0E+00	-	-
Combined - Inhalation and Multimedia			
Liver (HQ_{oral})[1]	1.2E-02	9.1E-03	1.8E-02
Kidney (HQ_{oral})[2]	8.4E-01	1.9E-01	7.6E-01
Neurological (HQ)	1.7E-03	6.4E-02	6.4E-02
Lung Tumors (ILCR)	1.4E+00	-	-

[1] Liver $HQ_{combined}$ = Kidney and Liver ($HQ_{inhalation}$) + Liver (HQ_{oral}).
[2] Kidney $HQ_{combined}$ = Kidney and Liver ($HQ_{inhalation}$) + Kidney (HQ_{oral}).

All combined inhalation and oral exposure Hazard Quotient (HQ) results were below 1.0 indicating there is not a potential risk for adverse health effects associated with Project emissions. The HQ results for both liver and kidney effects through chronic inhalation are orders of magnitude lower than calculated for chronic multimedia exposure and therefore can be assumed that more detailed assessment of kidney and liver effects separately would result in even lower HQs.

The Incremental Lifetime Cancer Risk (ILCR) results when combined for chronic inhalation and multiple media exposure are slightly greater than 1.0 at the RSA-MPOI (Table SIR 171-1). The ILCR quotients for all other receptor locations including the FL-MPOI, were less than 1.0 (Table SIR 171-2); with the results for locations other than the MPOIs orders of magnitude below 1.0. Chronic multimedia exposure predicted at the RSA-MPOI is purposefully an overly conservative assumption to provide worst-case results. It is unlikely a person will live a lifetime and be exposed to COPC *via* air and food at this location (on the edge of the pit boundary). Additional, the combined ILCR quotient value of 1.4 indicates the predicted incremental lifetime cancer risk at this location has increased from a value of 0.000010 to a value of 0.000014 (remaining essentially negligible).

As the number of conservative assumptions built into the multimedia model, the marginal nature of the ILCR exceedance, and the fact that the ILCR quotient is greater than 1.0 only at the RSA-MPOI, the combined ILCR value is not considered to indicate a potential risk of adverse human health effects.

Table SIR 171-2 Combined (inhalation and multimedia) ILCR Quotients for Lung Tumors - All Receptor Locations

Receptor Location	Lung Tumors
	Combined ILCR
RSA-MPOI	1.4E+00
FL-MPOI	2.0E-01
R1	7.8E-03
R2	1.1E-02
R3	7.8E-03
R4	5.0E-03
R5	7.7E-03
R6	8.1E-03
R7	5.6E-03
R8	1.1E-02
R9	6.1E-02
R10	4.0E-01
R11	8.1E-02
R12	6.3E-02
R13	1.5E-01
R14	3.1E-03

172. Volume 7, Consultant Report #12.

The conclusions of the HHRA are dependent on exposure predictions which were based on modelling results. Through the SIR process, additional modelling may be required for other assessment disciplines and result in revised or new predicted exposure data.

a) In the event that new or additional exposure concentration data are generated for Project-related COPC, compare the results to health based Toxicity Reference Values (TRVs) and discuss the potential impacts to human health, or provide justification for not completing these steps.

Response:

Exposure concentration data for metals emissions were refined as part of the re-evaluation of chemical groupings (SIR 170 and 171). Metals emissions were originally modelled from total suspended particulate (TSP), which includes non-respirable fractions. In order to provide a more accurate estimate of inhalation exposure the metals emissions were modelled based on $PM_{2.5}$.

In all cases, the total metal concentration in air was reduced. Therefore, the resultant effect on both HQ and ILCR calculations was that they were also lower than previously reported.

Updated HQ and ILCR quotient results for both acute and chronic inhalation are provided in the following tables:

- Acute Inhalation:
  - Appendix A-6, Table SIR 172-1: Predicted Hazard Quotients from Inhalation of Metals.
- Chronic Inhalation:
  - Appendix A-6, Table SIR 172-2: Predicted Hazard Quotients from Inhalation of Metals.

B. COAL CONSERVATION ACT (CCA)

B.1. MINING

173. Volume 1, Section C.1.2.3, Page C-9

Benga states, "Analysis of the USD $110 pit indicated that total volume of mine rock exceeded the estimated disposal area capacities, which ultimately led to the selection of $100 pit as the basis of the detailed ultimate pit design." Coal prices have been on the rise as of late and market speculates rising demand in 2018.

a) Explain how Benga will handle excess waste if $110 pit becomes viable.

Response:

For the feasibility study, the selected pit shell was based on a number of assumptions including the US$100/t coal price, average forecast operating costs, available space for external dumps while maintaining acceptable offsets from water courses, pit and dump wall stability and long-term overburden swell factors.

Long-term forecasting of hard coking coal prices years ahead is a complex process and typically, coal producers are conservative when attempting to develop a forecast. While the market outlook is favourable with rising coal prices, which driven by tightness in coal supply, the market will tend towards a balance of supply and demand, with prices reflecting the marginal cost of production.

If the $110 pit becomes economically viable, then the potential expansion of the pit will be reviewed for dump space after considering the balance of the size of the north, central and south waste dumps, and the ultimate depth of the pit. Any potential modification of pit shell will be considered:

- if the overburden swell is less than the assumed 25%;
- if the geotechnical properties assumed remain appropriate or are more favourable;
- if the marginal cost and stripping ratios to the currently designed pit floor are acceptable;
- if the expanded pit can be accommodated without adversely impacting on the footprint of the external dumps and final mine void; and
- there are no other adverse environmental impacts

174. Volume 1, Section C.1.7, Page C-31

Benga states, "A common fleet of 220t capacity trucks have been chosen for both the rock and coal. With these trucks in mind the haul roads were designed to a maximum ramp grade of 8%." OHS Code, Section 539 requires that a haul road with a gradient over 5% have an emergency escape route.

a) Provide a haul road map showing the location of the run-off ramps.

Response:

Figure 174-1 is a plan of the initial main haul-road and nominated run-out locations.

b) Provide the criteria for the run-off ramps placement.

Response:

Emergency run-out lanes will be cut into the hillside or built using the in-pit rock dump material that was placed by the mine rock truck fleet along the downhill side of the mine rock and coal haul ramps. A run-out lane will be required on all haul roads steeper than 5% grade and spaced every 30 m vertically. Run-out lanes will be graded at a 25% uphill grade with a minimum width of 1.5 times the largest truck width and require approximately 100 m to 200 m of length to safely stop an out-of-control vehicle. Final design of the haul road run-outs will be developed as part of operational readiness prior to construction, or as mining progresses in the event routing changes during actual mining, or both.

175. Volume 1, Section C.1.5.2 , Page C-25

Benga states, "Crawler-mounted, diesel blast-hole drills with rated-capacity of 334 kilonewtons (KN) capable of drilling 229 to 270 mm diameter holes were well suited for the majority of mine rock (overburden and interburden) drilling requirements."

a) Provide a table with proposed blasting details (powder factor, burden, spacing, sub-drilling, stemming, decking etc.) for overburden and interburden.

Response:

Based on experience and similar operating mines in the area and through seam blasting, powder factors of 0.45 to 0.75 kilograms per bank cubic metre of waste is planned for all patterns with an overall average of 0.6 kg/bcm. When blasting both coal and waste in the same pattern, decking will be required within the coal seam to minimise coal heave and ultimately reduce out-of-seam dilution due to blasting both coal and waste together. By decking through the coal intercepts, this will effectively lower the powder factor of the entire shot to a level that the waste will be sufficiently fragmented, but minimal displacement of the material and ultimately mixing of coal and waste will occur.

In addition to the primary production drilling and blasting described above, a portion of the total drilling and blasting volumes will be considered pioneering work (*i.e.*, initial break-in and development of the mining phases).

Based on the above-described design parameters, Table SIR 175-1 provides the proposed drill and blast details.

Table SIR 175-1 Drill and Blast Designs – Production and Pioneering

Quantities	units	Production	Pioneering
Drill Type	Pulldown kN	330kN	330 kN
Bit Diameter	mm	270	229
Nominal Bench Height	m	15	9
Subdrill	m	2	1.5
Drill Hole Length	m	17	10.5
Burden	m	8.5	7
Spacing	m	9.5	8
Stemming	m	5	4
Charge Length	m	12	6.5
PF	kg/bcm	0.65	0.6
Charge per hole	kg	790	308
Yield per hole	bcm	1211	504
Drill rate	m/hr	45	45
Hours per year	hrs	4983	4983
Nominal annual capacity	km	224	224

176. Volume 1, Section C.1.5.3, Page C-28

Benga states, "The planned mining method in the area of the historical underground workings is shown on Figure C.1.5-2."

a) Provide a plan map showing known underground working areas.

Response:

Figure 176-1 provides an illustration of the known legacy underground workings on Grassy Mountain.

B.2. PROCESS

177. Addendum, Plant Water Balance, Figure 1-1 and 2-1 Errata, Section C.5.1, Water Supply and Source, Page C-2

The processing plant water values and balances are not consistent between the documents.

a) Clarify the discrepancy and provide updated water values and balances.

Response:

The water volumes in the October 2017 Addendum 2 Errata, which replaced Section C.5.1 of the August 2016 application, are correct. Section C.5.1.1 (Volume 1) should be reworded slightly. The following modification (in bold) should be made:

C.5.1.1 Volume Required

The Coal Handling and Preparation Plant (CHPP) requires approximately 57 litres (0.057 m^3) of water to wash each metric tonne of raw coal that is processed. The plant has been designed to produce a nominal 4.5 million clean metric tonnes (CMT) of coal per year. Approximately 478,000 m^3 of make up water is required for the coal wash plant each year.

Additional water is also required for washing vehicles and evaporation. The volume of water required for these activities has been estimated at 28,000 m^3 annually. The total annual volume of process water required for the Project operations is 556,631 m^3. The CHPP water balance is shown on ***Figure 2 1 from the October 2017 Addendum 2, Appendix 1E (Water Act Licencing Application) (this replaced Figure C.2.5 1 of the August 2016 Application)****. This will not be potable water.*

An error was noted on Figure 2 1 from the October 2017 Addendum 2, Appendix 1E (Water Act Licencing Application), which has been updated and included as Figure 2-1. There are two changes to the numbers, site water management approval has been changed from 467 ML/y to 478 ML/y and the number for the process plant has changed from 671 ML/y to 682 ML/y.

These same edits will also apply to Figure 1 1 of the October 2017 Addendum 2, Appendix 1C (*Coal Conservation Act* Addendum).

178. Section C Project Description, Section C.2.4.1, Page C-48

Benga states, "The layout of the coal preparation plant is show on Figure C.2.4-1."

b) Provide the estimated tonnage of coal that will be sterilized within the footprint of the plant site.

Response:

Coal Processing and Infrastructure Area

Finding sufficient space with reasonably flat topography for a coal processing and infrastructure area is challenging for the Grassy Mountain Project. Much of the area is either covered by coal seams or needs to be reserved for initial out of pit dumps at the south and northeast limits of the pit.

In selecting the appropriate location for the coal processing and infrastructure area the following criteria was considered:

- minimizing sterilized coal;
- providing direct access for conveying product coal to the CP railway in Blairmore;
- providing direct access for employees without interacting with heavy mine vehicles;
- having sufficient space for the coal handling and processing facilities, the raw water dam, environmental protection dams and the mine infrastructure area (including office, ablution blocks, work shop, service area and warehouse);
- having reasonably flat ground given the hilly topography that is present at Grassy Mountain;
- locating the facilities in an area that is visibly and audibly shielded from the local communities.

In considering these factors, the location selected was adjacent to the south end of the mine, adjacent to the Phase 1 Pit where operations are scheduled to commence. Since the completion of the initial feasibility study in October 2015, further optimisation of the recoverable resources has been undertaken throughout 2016 and 2017, which has resulted in moving the Phase 1 Pit high wall closer to the processing infrastructure and providing a further 8 mt of recoverable run of mine (ROM) coal. This has been reflected in the most recent submission to the AER.

Referring to Figure 179-1 and bounded by the red line, the remaining in situ coal directly under the coal processing and infrastructure area is estimated at approximately 5.5 mt. This is based on a surface area of 190,000 square meters, an average combined thickness of Seams 1, 2 and 4 of 20 m and an insitu density of 1.45 tonnes per cubic meter. The depth to the top of the seams under the coal processing and infrastructure area varies from 70 m to Seam 1 on the eastern edge to 240 m to Seam 4 on the western edge.

179. Section C Project Description, Section C.2.10, Page C-73

Benga states, "Dust suppression is not provided for the following: Product and rejects handling systems (as the conveyed material is already wet) or on the raw and product coal stockpiles where mobile plant will be operating; ROM pad; and product stockpile."

a) Provide a plan to maintain the air quality in the area of the stockpiles with consideration for seasonal weather changes.

Response:

Air quality modelling conducted as part of the environmental assessment assumed that no emission controls were provided for handling of conveyed wet product and rejects, on the raw and product coal stockpiles, and the ROM pad. Thus, model predictions already consider this lack of controls. Furthermore, the modelling was conducted over five years that included periods of high and low wind speeds; the model results already incorporate these periods that contribute to additional windblown dust and periods where dispersion is limited by light winds.

Model results are presented in the Air Quality assessment (CR#1a) for PM_{10} (Figure 5.5-2) and TSP (Figure 5.6-2), the two coarser components of dust associated with mechanical (*e.g.*, non-combustion) sources. Maximum predictions, which occur during dry summer conditions, on the mine permit boundary nearest the plant operations are less than the B.C. 24-hour objective for PM_{10} and the Alberta ambient air quality objective for TSP. Thus, with the controls specified in the project description and applied in the air quality modelling, ambient objectives are met in areas where the public has access.

On-site near the plant, maximum predictions are near the ambient air quality objectives. While ambient objectives are not strictly applicable on site, it is expected that appropriate PPE will be available for worker use.

During winter when surfaces may be snow covered, emissions are expected to be naturally reduced.

As part of the overall site environmental testing regime air quality will be measured around the stockpiles on a regular basis and adjustment in the processing facility will occur to maintain the required air quality.

b) Provide a plan to maintain the target moisture content of the product coal.

Response:

The product moisture target is measured every 12 hours and the plant will be adjusted to align with the moisture target. Cumulative stockpile moisture will be measured and recorded.

B.3. GEOTECHNICAL

180. Volume 3, Appendix 9A, Section 2.0, Figure 1, Page 6 Volume 3, Appendix 9B, Section 3.0, Table 2, Page 5 Volume 3, Appendix 9B, Section 3.0, Table 2, Page 5

Volume 3, Appendix 9A, Section 2.0, Figure 1, Page 6. Figure 1 shows the sampling locations during the 2015 geotechnical site investigations for Waste Dump and Infrastructure. In **Appendix 9B, Section 3.0, Table 2, Page 5**, Golder shows summary of geotechnical drilling program for the pit slope design. Further, **Appendix 9D, Section 2.0, Appendix A, Figure 2** shows the 2016 geotechnical borehole location.

a) Explain the rationale for limited geotechnical site investigation for the Mine Pit Slope, Waste Dumps and Water Impoundment Structures. Include the choice of the number and spatial distribution of the sampling locations, and any planned geotechnical site investigation programs.

Response:

Preliminary (pre-feasibility and feasibility) studies were completed for the Mine Pit Slope, Waste Dumps and Water Impoundment Structures as the project has developed. The waste dumps and other structures site investigation sampling locations were determined by representative/most critical foundation and structure conditions (*i.e.*, steepest and highest slopes, potentially unfavorable subsurface conditions). Site surficial and bedrock geological information was used to determine expected foundation and pit wall conditions and determine critical areas for additional confirmatory site investigation. To determine the necessary investigation effort, Mined Rock and Overburden Piles Investigation and Design Manual Interim Guidelines were also used.

Mine Pit Slopes have been evaluated to a feasibility level based on a geotechnical drilling program (seven diamond cored geotechnical boreholes), rock strength testing, downhole geophysical logging and a hydrogeological field program. Information obtained from resource drilling and the geological model were also utilized to gain understanding on expected pit slope conditions. The work has been focused on initial operations of the mine pits during the first 3-4 years. Additional investigations will be planned as needed when the mine pits are being established.

Waste Dumps were evaluated to a feasibility level based on two (2) field programs, laboratory testing and analyses (2014 and 2015). Another geotechnical site investigation program was then completed for the Central Rock Dump and the South Rock Dump and included borehole drilling, laboratory testing and slope stability analyses (2016). As mining progresses, geotechnical data and performance data from existing rock dumps will be utilized to re-evaluate future rock dumps.

Water Impoundment Structures were evaluated to a feasibility level based on three (3) field programs, laboratory testing and analyses (2014, 2015 and 2016). Geotechnical site investigations (borehole drilling, test pits, laboratory testing) to aid in detailed design have been completed for the Raw Water Pond (2017). Detailed design for the West Sediment Pond, East

Sediment Pond, Plant Sediment Pond, South West Surge Pond and South East Surge Pond will be completed in 2018. Geotechnical investigations required for detailed design will be evaluated and completed along with detailed design.

Appendix B-1, Table 180-1 summarizes the geotechnical site investigations to date. Figure 180-1 presents the spatial distribution of the boreholes.

References:

Mined Rock and Overburden Piles, Investigation and Design Manual, Interim Guidelines, May, 1991, British Columbia Mine Waste Rock Pile Research Committee

referred to as 2014 report: Waste Dump/Infrastructure Geotechnical Report, Grassy Mountain Project Waste Dump and Infrastructure Geotechnical Program, July 2015, Golder Associates

referred to as 2015 report: Waste Dump/Infrastructure Geotechnical Report, Grassy Mountain Project Waste Dump and Infrastructure - Supplemental (2015) Geotechnical Program, January 2016, Golder Associates

referred to as 2016 report: Geotechnical Site Investigation of Waste Storage Dumps and Water Impoundment Structures at Grassy Mountain Coal Project, July 2016, Terracon Geotechnique Ltd.

181. Volume 3, Appendix 9A, Section 4.2, Figure 2, Page 20

Figure 2 shows the stability analysis of the North Rock Dump through Section A-A.

a) Provide estimated storage volume, maximum design height, maximum design elevation and foot print area of the North Rock Dump.

Response:

The following is the estimated storage volume, maximum design height, maximum design elevation and footprint area for the North Rock Dump. A swell factor of 25% was assumed.

- Storage Volume = 253,746,653 lcm;
- Minimum Elevation = 1,600 m;
- Maximum Elevation = 2,025 m;
- Maximum Design Height = 425 m; and
- Footprint Area = 245 ha.

b) Provide cross-sections of the North Rock Dump that show the side slopes at selected locations along its perimeter with their respective stability analyses excluding the mine pit area. Include a plan view map that shows the section lines.

Response:

The North Rock Dump design will be re-examined once performance data from the South Rock Dump and the Central Rock Dump is available. The dump geometry may be optimized once the residual swell factor of the rock waste material is confirmed.

Slope stability analyses were conducted using Geo-Studio International SLOPE/W software (Version 9) to determine the factor of safety against slope failure of the North Waste Dump. The location of the cross – section, used in the models, is shown in Figure 181-1. The Morgenstern-Price method was used in the analyses with a circular failure mode. As the failure planes are unlikely to include the bedrock, the slope stability analyses considered that material as impenetrable (failure surfaces do not penetrate the bedrock). The optimized slip surface feature of the program was also employed to search for the most critical slip surface.

The dump and pit geometries used in the slope stability models are inferred from the original topography, final pit and dump surfaces, and field investigation data.

The material properties used for slope stability analyses are presented in Table SIR 181-1. These are based on previous geotechnical reports, visual/manual soil descriptions, field tests and laboratory testing. The soil stratigraphic colour coding in Table SIR 181-1 matches the soil colour codes on the slope stability models.

Table SIR 181-1 Slope/W Soil Parameter Inputs

Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (°)
Waste Rock	20	0	37
Foundation Soil	19	0	22
Siltstone/Sandstone Bedrock	Impenetrable		

Groundwater was modeled at the ground surface for the conservative case where the soil is fully saturated. Based on the estimated rate of construction and foundation soil and dump material, no excess pore pressure is expected to be developed in the foundation soil and dump material. The North Waste Dump model utilized a seismic load of 0.13 g (as per NBCC 2015 for the selected location).

Based on the local soil properties, groundwater conditions and the length of likely seismic events, soil liquefaction, a high Ru value and strain softening are not seen as significant risks. Therefore shear strength reduction and/or increased pore pressure occurring during seismic events are not included in the models.

The slope models are also based on the following criteria:

- The waste dump design provided by Benga includes an overall slope of 23°, with a maximum height of 218 m.
- The subsurface conditions are interpreted based on field investigations and regional geology.
- The in-situ material properties are represented by the most conservative values derived from the laboratory and field tests.
- The waste rock material is completely drained.

Figure 181-2 and Figure 181-3 (long term static model and long term pseudo – static model respectively) provide a modelled cross - section for the North Waste Dump. This cross - section was selected based on the greatest dump height, the steepest dump slope and excludes the pit impact. The subsurface conditions and analysis results are also presented on Figures 181-2 and 181-3. Table SIR 181-2 below summarizes the FoS analysis results for the selected dump conditions.

Table SIR 181-2 Stability Results – Cross-section 1

Condition	Minimum Target FoS	Minimum FoS	Failure Mode
Drained	1.5	1.8	Foundation
Drained with Seismic	1.1	1.3	Foundation

The structure, modelled in this cross – section, meets the minimum FoS for the corresponding dump stability.

c) Provide stability analyses results for the North Rock Dump facing towards the mine pit, which includes the impact of the pit at representative locations, considering shallow and deep-seated failure.

Response:

The North Rock Dump design will be re-examined once performance data from the South Rock Dump and the Central Rock Dump is available. The dump geometry may be optimized once the residual swell factor of the rock waste material is confirmed.

Slope stability analyses were conducted using Geo-Studio International SLOPE/W software (Version 9) to determine the factor of safety against slope failure of the North Waste Dump, including the impact of the pit. The location of the cross – section, used in the models, is shown in Figure 181-4. The Morgenstern-Price method was used in the analyses with a circular failure mode. The optimized slip surface feature of the program was also employed to search for the most critical slip surface. The Mohr-Coulomb model was used for soil and the Hoek-Brown strength function model (material properties described in Q-183) was used for rock. The critical slip surface search mode was employed.

The dump and pit geometries used in the slope stability models are inferred from the original topography, final pit and dump surfaces, and field investigation data.

The material properties used for slope stability analyses are presented in Table SIR 181-3. These are based on previous geotechnical reports, visual/manual soil descriptions, field tests and laboratory testing. The soil stratigraphic colour coding in Table SIR 181-3 matches the soil colour codes on the slope stability models. The strength function used for the rock is presented in the response SIR 183.

Table SIR 181-3 Slope/W Soil Parameter Inputs

Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (°)
Waste Rock	20	0	37
Foundation Soil	19	0	22
Siltstone/Sandstone Bedrock	25	Hoek-Brown nonlinear strength function	

Groundwater was modeled at the ground surface for the conservative case where the soil is fully saturated. The North Waste Dump model utilized a seismic load of 0.13 g (as per NBCC 2015 for the selected location).

Based on the local soil properties, groundwater conditions and the length of likely seismic events, soil liquefaction, a high Ru value and strain softening are not seen as significant risks. Therefore shear strength reduction and/or increased pore pressure occurring during seismic events are not included in the models.

The slope models are also based on the following criteria:

- The waste dump design provided by Benga includes an overall slope of 23°, with a maximum height of 218 m.
- The subsurface conditions are interpreted based on field investigations and regional geology.
- The in-situ material properties are represented by the most conservative values derived from the laboratory and field tests.
- The waste rock material is completely drained.

Figures 181-5, 181-6, 181-7, 181-8 and 181-9 provide a modelled cross - section for the North Waste Dump. This cross - section was selected based on the greatest dump height, the steepest dump slope and includes the pit impact. The subsurface conditions and analysis results are also presented on the figures. Table SIR 181-4 below summarizes the FoS analysis results for the selected dump conditions.

Table SIR 181-4 Slope Stability Results – Cross section 2				
Condition	**Minimum Target FoS**	**Minimum FoS**	**Failure Mode**	**Figure**
Drained	1.5	1.9	Deep to dump toe	181-5
Drained with Seismic	1.1	1.3	Deep to dump toe	181-6
Drained	1.5	2.5	Deep to pit	181-7
Drained with Seismic	1.1	1.7	Deep to pit	181-8
Drained	1.5	1.5	Shallow	181-9

The structure, modelled in this cross – section, meets the minimum FoS for the corresponding dump stability.

182. Volume 3, Appendix 9A, Section 4.2, Figure 3, Page 21 Volume 3, Appendix 9D, Appendix E, Profile 5 and 6

Volume 3, Appendix 9A, Section 4.2, Figure 3, Page 21. Figure 2 shows the stability analysis of the South Rock Dump through Section B-B and Section C-C. Further, **Appendix 9D, Appendix E, Profile 5 and 6**, show stability analysis of South Waste Dump.

a) Provide estimated storage volume, maximum design height, maximum design elevation and foot print area of the Central Rock Dump and the North Rock Dump.

Response:

The following is the estimated storage volume, maximum design height, maximum design elevation and footprint area for the Central and South Rock Dumps. A swell factor of 25% was assumed.

Central Waste Rock Dump

- Storage Volume = 710,836,277 lcm;
- Minimum Elevation = 1,360 m;
- Maximum Elevation = 1,875 m;
- Maximum Design Height = 515 m; and
- Footprint Area = 585 ha.

South Waste Rock Dump

- Storage Volume = 87,370,384 lcm;
- Minimum Elevation = 1,500 m;
- Maximum Elevation = 1,815 m;
- Maximum Design Height = 315 m; and

- Footprint Area = 138 ha.

b) Provide cross-sections of the Central Rock Dump that show the side slopes at selected locations along its perimeter with their respective stability analyses. Include a plan view map that shows the section lines.

Response:

Slope stability analyses were conducted using Geo-Studio International SLOPE/W software (Version 9) to determine the factor of safety against slope failure of the Central Waste Dump. The location of the cross - section used in the models is shown in Figure 182-1. The Morgenstern-Price method was used in the analysis with a circular failure mode. As the failure planes are unlikely to include the bedrock, the slope stability analyses considered that material as impenetrable (failure surfaces do not penetrate the bedrock). The optimized slip surface feature of the program was also employed to search for the most critical slip surface.

The dump geometries used in the slope stability models are inferred from the original topography, final pit and dump surfaces, and field investigation data.

The material properties used for slope stability analyses are presented in Table SIR 182-1. These are based on previous geotechnical reports, visual/manual soil descriptions, field tests and laboratory testing. The soil stratigraphic colour coding in Table SIR 182-1 matches the soil colour codes on the slope stability models.

Table SIR 182-1 Slope/W Soil Parameter Inputs

Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (°)
Waste Rock	20	0	37
Foundation Soil	19	0	22
Siltstone/Sandstone Bedrock	Impenetrable		

Groundwater was modelled at the ground surface for the conservative case where the soil is fully saturated. The Central Waste Dump model utilized a seismic load of 0.13 g (as per NBCC 2015 for the selected location).

Based on the local soil properties, groundwater conditions and the length of likely seismic events, possible soil liquefaction, a high Ru value and strain softening are not seen as significant risks at the dump areas; therefore, shear strength reduction and/or increased pore pressure occurring during seismic events are not included in the models.

The slope models are also based on the following criteria:

- The waste dump design provided by Benga includes an overall slope of 23°, with a maximum height of 335 m.

- The subsurface conditions are interpreted based on field investigations and regional geology.
- The in-situ material properties are represented by the most conservative values derived from the laboratory and field tests.
- The waste rock material is completely drained.

Figure 182-2 and Figure 182-3 (long term static model and long term pseudo – static model respectively) provide a modelled cross - section for the Central Waste Rock Dump. This cross - section was selected based on the greatest dump height, and the steepest dump slope and excludes the pit impact. The geometry, subsurface conditions and analysis results are also presented on Figures 182-2 and 182-3. Table SIR 182-2 below summarizes the analysis results for the selected dump conditions.

Table SIR 182-2 Slope Stability Results – Cross-section 3

Condition	Minimum Target FoS	Minimum FoS	Failure Mode
Drained	1.5	1.7	Foundation
Drained with Seismic	1.1	1.3	Foundation

The structure modelled in this cross - section meets the minimum FoS for the corresponding dump stability.

c) Provide stability analyses results for the Central Rock Dump facing towards the mine pit and South Rock Dump, which includes the impact of the pit at representative locations, considering shallow and deep-seated failure.

Response:

The Central Rock Dump design will be re-examined once performance data from the South Rock Dump is available. The dump geometry may be optimized once the residual swell factor of the rock waste material is confirmed.

Slope stability analyses were conducted using Geo-Studio International SLOPE/W software (Version 9) to determine the factor of safety against slope failure of the Central Rock Dump, including the impact of the pit. The location of the cross – section, used in the models, is shown in Figure 182-4. The Morgenstern-Price method was used in the analyses with a circular failure mode. The Mohr-Coulomb model was used for soil and the Hoek-Brown strength function model was used for rock. The optimized slip surface feature of the program was also employed to search for the most critical slip surface.

The dump and pit geometries used in the slope stability models are inferred from the original topography, final pit and dump surfaces, and field investigation data.

The material properties used for slope stability analyses are presented in Table SIR 182-3. These are based on previous geotechnical reports, visual/manual soil descriptions, field tests and laboratory testing. The soil stratigraphic colour coding in Table SIR 182-3 matches the soil colour codes on the slope stability models. The strength function used for the rock is presented in the response to SIR 183.

Table SIR 182-3 Slope/W Soil Parameter Inputs

Material	Unit Weight (kN/m^3)	Cohesion (kPa)	Friction Angle (°)
Waste Rock	20	0	37
Foundation Soil	19	0	22
Siltstone/Sandstone Bedrock	25		

Groundwater was modelled at the ground surface for the conservative case where the soil is fully assumed to be saturated. The Central Rock Dump model utilized a seismic load of 0.13 g (as per NBCC 2015 for the selected location).

Based on the local soil properties, groundwater conditions and the length of likely seismic events, soil liquefaction, a high Ru value and strain softening are not seen as significant risks. Therefore shear strength reduction and/or increased pore pressure occurring during seismic events are not included in the models.

The slope models are also based on the following criteria:

- The waste dump design provided by Benga includes an overall slope of 23°, with a maximum height of 218 m.
- The subsurface conditions are interpreted based on field investigations and regional geology.
- The in-situ material properties are represented by the most conservative values derived from the laboratory and field tests.
- The waste rock material is completely drained.

Figures 182-5, 182-6 and 182-7 provide a modelled cross - section for the Central Rock Dump. This cross - section was selected based on the greatest dump height, the steepest dump slope and includes the pit impact. The subsurface conditions and analysis results are also presented on the figures. Table SIR 182-4 below summarizes the FoS analysis results for the selected dump conditions.

Table SIR 182-4 Slope Stability Results – Cross section 4				
Condition	**Minimum Target FoS**	**Minimum FoS**	**Failure Mode**	**Figure**
Drained	1.5	2.4	Deep to pit	182-5
Drained with Seismic	1.1	1.7	Deep to pit	182-6
Drained	1.5	1.6	Shallow	182-7

The structure, modelled in this cross – section, meets the minimum FoS for the corresponding dump stability.

Another cross-section was modeled previously for the Central Rock Dump facing the South Rock Dump. The mine pit does not impact the dumps at this location. The location of the cross - section used in the models is shown in Figure 182-8.

Figures 182-9 and 182-10 (long term static model and long term pseudo – static model respectively) provide a modelled cross - section for the Central Rock Dump. This cross - section was selected based on the greatest dump height, the steepest dump slope and the proximity to existing and planned infrastructure. The geometry, subsurface conditions and analysis results are also presented in the figures.

Table SIR 182-6 Slope Stability Results – Cross-section 5			
Condition	**Minimum Target FoS**	**Minimum FoS**	**Failure Mode**
Drained	1.5	1.6	Foundation
Drained with Seismic	1.1	1.1	Foundation

The structure modelled in this cross - section meets the minimum FoS for the corresponding dump stability.

d) Provide cross-sections of the South Rock Dump that show the side slopes at selected locations along its perimeter with their respective stability analyses excluding the Central Rock Dump area. Include a plan view map that shows the section lines.

Response:

A cross-section was modelled previously for the South Rock Dump. The location of the cross - section used in the models is shown in Figure 182-11.

Figures 182-12 and 182-13 (long term static model and long term pseudo – static model respectively) provide a modelled cross - section for the South Rock Dump. This cross - section was selected based on the greatest dump height, the steepest dump slope and the proximity to existing and planned infrastructure. The geometry, subsurface conditions and analysis results are also presented in the figures.

Table SIR 182-7 Slope Stability Results – Cross-section 6

Condition	Minimum Target FoS	Minimum FoS	Failure Mode
Drained	1.5	1.6	Foundation
Drained with Seismic	1.1	1.2	Foundation

The structure modelled in this cross - section meets the minimum FoS for the corresponding dump stability.

e) Provide stability analyses results for the South Rock Dump facing towards the Central Rock Dump, which includes the impact of the pit at representative locations, considering shallow and deep-seated failure.

Response:

The pit does not impact the South Rock Dump.

f) Include a single cross-section through the Central Rock Dump and South Rock Dump that show the side slopes and setback between the toes of the dumps. Include a plan view map that shows the section lines.

Response:

Figure 182-14 shows a plan view of the cross-section location through the Central Rock Dump and South Rock Dump. Figure 182-15 presents the cross-section showing the side slopes and setback between the toes of the dumps.

183. Volume 3, Appendix 9B, Section 7.0, Page 25

Volume 3, Appendix 9B, Section 8.0, Table 7 and 8, Page 31-34

Volume 3, Appendix 9B, Appendix G, Section 4.0, Table G-7 to G-9, Page 5/6, Figure G-1 to G- 12

Volume 3, Appendix 9B, Appendix H, Figure H-1 to H-8

Golder states, "For this preliminary study overall pit slope stability has not been assessed with two- dimensional limit equilibrium methods. Following completion of the feasibility level mine design overall slope stability can be analyzed to determine Factor of Safety values for the respective critical pit walls... Consequently, a probability of failure approach is not appropriate for this study as there is insufficient data to support the development of reliable probability distributions for the various input parameters required to support a comprehensive probabilistic assessment." In **Appendix 9B, Section 8.0, Table 7 and 8, Page 31-34**, Golder indicated limit-equilibrium overall stability analyses needs to be carried out to confirm the stability of the highwalls, footwalls, and endwalls. In **Appendix 9B, Appendix G, Section 4.0, Table G-7 to G-9, Page 5/6, Figure G-1 to G-12**, Golder carried out overall stability analyses through Section 480, Section 750 and Section 840. Further, **Appendix 9B, Appendix H, Figure H-1 to H-8**, Golder provided a conceptual footwall slope design.

a) Provide additional pit wall stability analyses results at representative locations including worst case scenario for the Western Highwalls, Footwalls and Endwalls. Include scaled cross-sections at selected representative sections with a plan view map showing the section lines.

Response:

Eight representative stability controlling sections are selected at Western, Central and Eastern Pits to analyse the highwall, footwall and endwall stability of the pit slopes at the most controlling locations (Figure 183-1). The stability controlling sections are selected at the highest slope and steepest overall slope locations, representing the possible worst-case scenario for each section. Three sections are selected for West Pit (Sections A, B, C) to evaluate the stability of highwall, endwall and footwall, respectively. Three sections are selected for Central Pit (Sections D, E, F) to evaluate the stability of highwall, endwall and footwall, respectively. To evaluate the Eastern Pit slope stability, two sections are selected (Sections G and H) representing the footwall and highwall slope areas. Considering the similar bench design for the endwalls of Central Pit and Eastern Pit, we selected the higher endwall slope for the Central Pit to be analysed. The Eastern Pit slope stability is inferred by comparison to the Central Pit endwall stability (Section E).

Table SIR 183-1 presents a summary of geometry for selected controlling stability sections.

Table SIR 183-1 Summary of selected stability sections geometry

Pit Areas	Section	Type	Overall Slope		Bench Geometry		
			Height (m)	Slope (°)	Height (m)	Face Angle (°)	Width (m)
Western Pit	A	Highwall	210	48	30	65	10
	B	Endwall	324	56	30	70	10
	C	Footwall	281	19	- (1)	-	-

Table SIR 183-1 Summary of selected stability sections geometry							
Pit Areas	**Section**	**Type**	**Overall Slope**		**Bench Geometry**		
			Height (m)	**Slope (°)**	**Height (m)**	**Face Angle (°)**	**Width (m)**
Central Pit	D	Highwall	344	38	15	60	8
	E	Endwall	243	55	30	70	10
	F	footwall	324	41	45	follow dip	8
Eastern Pit	G	Footwall	83	45	15	follow dip	8
	H	Highwall	86	37	30	70	10

Notes
[1]No Bench/ follow the bedding dips

Rock Strength Properties

A geotechnical and hydrogeological field investigation program was carried out by Golder (Golder 2015). The field and laboratory testing program was used to define the Rock Mass Rating (RMR) of various rock types and overall rock in the Grassy Mountain area.

For stability analysis of general slopes, the slip surfaces pass through various rock type formations. Although the rock strength on the slip surface varies through each rock type, with coal zones being the weakest sections and Moose Mountain Formation (mudstone, carbonaceous mudstone and siltstone) being the strongest sections, the overall stability can be captured by using an average rock mass strength for all rock types. The required strength parameters for the rock mass on the slip surface depends on the rock mass RMR and intact rock strength. The overall effect can be captured using the overall weighted average of the intact rock strength and rock mass rating (RMR).

The weighted average RMR of all rock data was reported to be 56 (a Fair Rock category) (Golder 2015). The field and laboratory observations and measurements reported the intact rock strength in the range of R0 (extremely weak rock for coal) to R4 (moderately strong rock for Blairmore group and Moose Mountain formation) with Uniaxial Compressive Strength (UCS) values between 35.3 MPa and 179.1 MPa (no test was performed on coal). Although there was no test on the coal, the UCS values of the coal (extremely weak rock, R0 rating, to very weak rock, R1 rating) is estimated to be between 0.25 MPa and 5 MPa. The weighted average UCS of all rocks (Mist Mountain (including coal), Blairmore group and Moose Mountain Formation) is estimated to be 50 MPa.

The laboratory test data reported the rock's wet unit weight between 2440 kg/m^3 and 2634 kg/m^3 for all rocks other than coal (Golder 2015). There were no laboratory tests on the coal unit weight, but we expect the coal unit weight to be between 1100 kg/m^3 and 1500 kg/m^3. Based on these data, we selected the weighted average unit weight of the all rocks to be 25 kN/m^3 for our analyses.

Considering the range of effective stress on the slip surface (up to 2 MPa), the rock strength is expected to vary along the slip surface with stress. The Hoek–Brown failure criterion (Hoek and Brown 1980, Hoek *et al.* 2002) is an empirically derived relationship to describe a non-linear increase in peak strength of isotropic rock with increasing confining stress. Therefore, the Hoek-Brown strength model is the best fit for this application and is the selected model for these analyses. Hoek–Brown failure criterion is defined as:

$$\sigma_1' = \sigma_3' + C_\mathrm{o}\left(m_\mathrm{b}\frac{\sigma_3'}{C_\mathrm{o}} + s\right)^a.$$

$$m_\mathrm{b} = m_\mathrm{i}\exp\left(\frac{\mathrm{GSI} - 100}{28 - 14\mathrm{D}}\right)$$

$$s = \exp\left(\frac{\mathrm{GSI} - 100}{9 - 3\mathrm{D}}\right)$$

$$a = \frac{1}{2} + \frac{1}{6}\left(e^{-\frac{GSI}{15}} + e^{-\frac{20}{3}}\right).$$

In the above formulas:

σ_1 : Major principal stress

σ_3 :Minor principal stress

C_o: Uniaxial compressive strength

m_i : Hoek–Brown material constant (intact rock)

m_b Hoek–Brown material constant (rock mass)

s : Hoek–Brown material constant

a : Hoek–Brown material constant

GSI: Geological Strength Index

D: Disturbance factor

In terms of equivalencies, the parameter m is analogous to the frictional strength of the rock and parameter s is equivalent to the rock mass cohesion.

For the Grassy Mountain site, the average GSI is estimated to be 56 (same as RMR), with an average C0 value of 50 MPa. For the pit wall stability analysis, the disturbance factor (D) value of 1 is adopted (mining operation). The intact rock parameter (mi) depends on the rock type. For the rock types in the Grassy Mountain area, a mi value of 15 was adopted. Using the above values, the Hoek-Brown strength parameters for the Grassy Mountain rock mass are estimated as:

mb = 0.6474

s: 0.0006534

a: 0.5042

The Hoek-Brown nonlinear shear stress versus normal effective stress is presented in Figure 183-2. The Hoek-Brown model automatically considers the changes in strength parameters with stress level through its non-linear relationship.

Phreatic Surface

Vibrating Wire Piezometers (VWP) were installed in three boreholes (RGSC-0004 (at centre part of the Western Pit), RGSC-0005 (at south limit of the Western Pit), and RGSC-0009 (at north limits of the Eastern Pit). The water levels prior to grouting in boreholes RGSC-0004, RGSC-0005, RGSC-0009 were 0.9, 15.4, and 113.6 meter below ground surface (mbgs), respectively.

No seepage analysis was performed to evaluate the phreatic surface in the pit slopes. During pit excavation, the water level at the pit base shall always be kept at or lower than the pit base surface to allow for base excavation. The pit excavation will gradually drawdown the phreatic surface from current groundwater level. At each stage of the pit excavation, the phreatic surface is anticipated to be at the pre-excavation groundwater level of the far field and will drop down closer to the pit slopes. At the pit base, the phreatic surface shall be kept at the bottom of the excavation surface. It is estimated that the phreatic surface will be close to the pit excavation surface at height about one third to one fourth of the pit slope height from the toe. The phreatic surface was then estimated on each section based on the above scenario to approximately form a parabolic surface from the wet pit slope area to the far field with groundwater at the pre-excavation groundwater surface. Factors like rock joints and fractures may result in anisotropic conductivity within the rock mass.

It should be noted that the estimated locations of phreatic surface for each analyzed section is based on the above assumptions and need to be confirmed by seepage analysis. A detailed seepage analysis can be included as part of the detailed design of the Pit slopes.

Failure Modes

To evaluate the stability of the pit slopes two types of failure surfaces were considered; these are:

- Global Failure: The general failure is a failure to start from the pit slope pick point passing through the rock mass and exit at the pit slope toe areas. This failure more represents a general failure of major part of the slope.
- Toe Failure: In this case, the failure starts from within the lower portion of the pit slope (two or three bench height), passing through the rock mass and exit at the slope toe. This failure can cause a retrogressive failure condition after the first toe failure.

Another failure mechanism can be a single bench total or partial failure causing further failure retrogression toward the back slope. The bench slope stability is not analysed by a limit equilibrium analysis and it is believed to be controlled by the local rock condition and discontinuity arrangement. The bench stability is governed by designing the bench face slopes with consideration of the possibility of the movement of blocks in the rock mass.

Both static and seismic loading conditions are considered in the stability analysis. Based on the National Building Code of Canada (NBCC) seismic hazard map (NBCC 2015, http://www.seismescanada.rncan.gc.ca/hazard-alea/simphaz-en.php), the Crowsnest Pass area is in a moderate seismic activity zone. For the stability evaluation of the pit slopes in Grassy Mountain area, an Earthquake Design Ground Motion (EDGM) for an earthquake with annual exceedance probability (AEP) of 1/2,475 is selected.

The pit slopes can be classified as Rock (Site class B). The NBCC 2015 provides the mean Peak Ground Acceleration (PGA) values for the site assuming a site class C (very dense soil and soft rock) condition. The mean PGA for AEP of 1/2,475 for the Grassy Mountain area is 0.129g for a site Class C (from NBCC 2015). The NBCC estimated that the PGA in a site Class B can be reduced by a factor of 0.87 in comparison to PGA for a site class C. Therefore, a PGA value of 0.112g was used in the seismic slope stability analysis. The seismic stability is considered using a pseudo-static slope stability analysis with an equivalent seismic loading of 0.112g as a horizontal load.

Stability Analysis

- Methodology

  Two-dimensional (2D) stability analysis for the controlling sections of the pit slope was carried out using the computer program GeoStudio 2016, Version 8.16.2, developed by GeoSlope International Ltd. (2016). The optimization feature available in SLOPE/W was used to refine the geometry of the failure surface with the minimum calculated Factor of Safety (FoS). The rock was modeled as an isotropic uniform rock mass with Hoek-Brown material property. The Hoek-Brown material property was assigned to the rock as a nonlinear strength function (Figure 183-2). The estimated phreatic surface was assigned to the rock mass. Any strength from suction was ignored in the analysis. The analyses were performed for various slip surfaces to find the most controlling failure surface for each failure mode scenario (static and seismic loading for global and toe failure conditions).

- Results

  The stability analysis figures are presented in Figures 183-3 to 183-27. Table SIR 183-2 presents the summary of all analysis results.

Table SIR 183-2 Summary of Slope Stability Analysis Results

Pit Areas	Section	Type	Overall Slope		Loading Condition	Failure Mode	Calculated Factor of Safety	Figure #
			Height (m)	Slope (°)				
Western Pit	A	Highwall	210	48	Static	Global	1.47	183-3
						Toe	2.20	183-4
					Seismic	Global	1.23	183-5

Table SIR 183-2 Summary of Slope Stability Analysis Results

Pit Areas	Section	Type	Overall Slope		Loading Condition	Failure Mode	Calculated Factor of Safety	Figure #
			Height (m)	Slope (°)				
	B	Endwall	324	56	Static	Global	1.17	183-6
						Toe	1.53	183-7
					Seismic	Global	0.99	183-8
	C	Footwall	281	19	Static	Global	2.32	183-9
						Toe (1)	1.81	183-10
						Toe (2)	3.31	183-11
					Seismic	Global	1.82	183-12
Central Pit	D	Highwall	344	38	Static	Global	1.56	183-13
						Toe	3.15	183-14
					Seismic	Global	1.28	183-15
	E	Endwall	243	55	Static	Global	1.27	183-16
						Toe	2.75	183-17
					Seismic	Global	1.08	183-18
	F	footwall	324	41	Static	Global	1.27	183-19
						Toe	1.49	183-20
					Seismic	Global	1.06	183-21
Eastern Pit	G	Footwall	83	45	Static	Global	2.10	183-22
						Toe	2.65	183-23
					Seismic	Global	1.76	183-24
	H	Highwall	86	37	Static	Global	2.73	183-25
						Toe	3.99	183-26
					Seismic	Global	2.24	183-27

- Conclusions

  The deterministic slope stability analysis results show variation on the calculated FoS depending on the overall slope and height of each section.

  The lowest FoS for a global failure surface is calculated for Section B (Western Pit Highwall section) with FoS of 1.17 and 0.99 for static and seismic loading conditions respectively. Section B has the steepest overall slope (56°) and the second highest slope (324 m high). All other slopes have global FoS equal or higher than 1.27 and 1.06 in static and seismic loading conditions respectively.

  The lowest FoS for a toe failure surface is calculated for Section F (Central Pit Footwall section) with FoS of 1.49.

The analyses were only conducted to provide a sense of stability of the pit slopes as part of preliminary design of the slopes to support initial stages of the mine operation (*i.e.* the first 3-4 years of the mine operation). All stability controlling sections are at the north portion of the pit area. The north portion of the pit will be excavated a few years after start of the mine operation. By that time, additional information on the pit slope performance and subsurface condition, during excavation of the slope faces and geotechnical boreholes, if needed, will improve general understanding of the rock mass properties and seepage condition. A detailed analyses of the pit slopes can be then conducted to provide a refinement to the preliminary design options provided in this application. Detailed slope stability analysis shall also include a seepage analysis to eliminate some of the uncertainty in the estimated phreatic surface currently being used for the slope stability analysis.

b) Provide additional pit wall stability analyses results at representative locations including worst case scenario for the Central Highwalls, Footwalls and Endwalls. Include scaled cross-sections at selected representative sections with a plan view map showing the section lines.

Response:

See response SIR 183a.

c) Provide additional pit wall stability analyses results at representative locations including worst case scenario for the Eastern Highwalls, Footwalls and Endwalls. Include scaled cross-sections at selected representative sections with a plan view map showing the section lines.

Response:

See response SIR 183a.

184. Volume 3, Appendix 9C, Section 8.0, Page 15

Golder states, “In addition, an observational pit slope design approach should be adhered to during pit excavation to include mapping and stability performance monitoring, as subsurface geology is exposed during mining.”

a) Provide a detailed geotechnical instrumentation and monitoring plan for pit slopes, rock dumps and other geotechnical structures.

Response:

Design Approach and Monitoring Philosophy

The design of the pit slopes, dumps and dams at the Grassy Mountain site shall be based on the use of the Observational Approach (Peck, 1969). Application of the Observational Approach in design often permits maximum economy and assurance of safety. The application of the Observational Approach, as an integral part of the design, requires a preconceived plan (contingency) for every unfavorable situation that might be disclosed by the observations. The observations should be reliable, reveal significant mechanisms of performance, and be reported in a timely manner to allow prompt mitigative action.

The Observational Approach requires gathering knowledge from ongoing inspection, monitoring and interpretation of field performance during construction. This knowledge is used to confirm the design assumptions, or to modify design and construction rate or plan for remedial actions during dam performance based on the observations.

The instrumentation and monitoring plan for Grassy Mountain site include regular visual observations and gathering and processing instrumentation data, remote sensing and surveying data. The main design issues that require instrumentation and monitoring plan vary for each structure (*i.e.* pit slopes, dumps and dams). At early construction stage, preliminary instrumentation and monitoring plans are developed for each structure. An exception is the Raw Water Pond (RWP) Dam, which requires a detailed instrumentation and monitoring plan in place. The following sections providing an overview of the instrumentation and monitoring plan for each type of structure in the Grassy Mountain site.

Pit Slopes Instrumentation and Monitoring Plan

A major part of the pit slope stability monitoring program is regular visual inspection of the bench faces and crest areas for early identification of slope instability. The crest and benches should be examined for signs of cracking or instability on a regular basis, and more frequently during the spring runoff and the winter freezing. The observation should be recorded in a diary so that a record of the stability performance is available should it be required to evaluate instability.

Slope instrumentation that is normally installed within the pit slopes including wireline extensometers, prisms, seismic monitoring systems, GPS and Radar monitoring. The surface surveying and monitoring systems include Laser scanning and InSAR System.

Groundwater monitoring can be achieved using Vibrating Wire Piezometers (VWP) (already installed in three boreholes, RGSC-0004, RGSC-0005, and RGSC-0009). Additional piezometers shall be installed in controlling sections of the pit. The monitoring data should be uploaded on a regular basis (*i.e.* quarterly) to establish site groundwater trends prior to mining.

Expected Deformation Pattern of the Pit Slope

The movement in a pit slope may be divided to two major types; rock mass movement and block movements. The rock mass pit slope movement can be in many forms including movement during initial response to excavation, regressive and progressive movement, and long-term creep movement. Among these, the identification of regressive and progressive movements is important because it indicates that stress has exceeded the elastic limit of the rock mass. The surface movements may also form due to the rock blocks movement along the joints in the rock mass. The movement may cause local failure and rockfall that create hazards for operation.

The monitoring program should be designed to identify distinct types of slope movement, especially identification of change of rock mass movement from initial excavation response (elastic condition) to a regressive and progressive movement (plastic condition). The pit slopes are designed to have adequate factors of safety against rock mass failure (see response SIR 183). The adequate factor of safety against a slope movement through rock mass means that most of the rock mass should stay in the elastic range (except some zones with locally concentrated stress). To identify the pattern of the pit slope movement associated with change from initial excavation response to a regressive and progressive movement (plastic condition) a deformation analysis with staged excavation is typically conducted.

Two-dimensional (2D) deformation analysis for pit slope Section B (West Pit Endwall) (see Figure 183-1 for section location) was carried out using the computer program Fast Lagrangian Analysis of Continua (FLAC), Version 5.00, developed by Itasca Consulting Group Inc. (2005). The refined mesh (Figure 184-1) allows for detailed modeling of benches geometry at this section. The initial condition included a groundwater surface 20 m below the ground surface. The model was brought to initial state of equilibrium before excavation using elastic model for all rocks. Then the properties of the rock mass were changed to a Mohr-Coulomb model with strength parameters to resemble the average condition of the rock mass (with RMR of 56) as follows:

- Density 2,450 kg/m$^{3;}$
- Poisson's ration: 0.3;
- Elastic Modulus: 19 GPa;
- Cohesion: 250 kPa; and
- Friction Angle: 50°.

The groundwater surface was estimated for each excavation stage based on the approximate method described in SIR 183 (no seepage model). Then, the stress and deformation fields were solved for each bench excavation from original ground surface of 1,900 m to the final excavation elevation of 1,580 m. Selected horizontal deformation contours, calculated by FLAC, are presented in Figures 184-2 to 184-5. To evaluate relative movement at the pit slope locations, three history points are used to record the horizontal movements during the excavation process (Figure 184-6). These points are located at the pit crest and two middle slope benches (see their locations on Figure 184-1).

The current deformation analysis model includes the following simplifications:

- No seepage analysis was conducted. The phreatic surface was estimated using simplified methods described in SIR 183. As a result, no coupling of the pore pressure response with the stress level change was performed. Depending on the rate of excavation and rock mass hydraulic conductivity, some changes to the pore pressure relative to the steady state phreatic surface may develop in the rock mass during excavation (unloading or stress concentration effects) that cannot be captured in this relatively simple model.

- The effect of thrust faults or coal zones were not captured in the model. The movement magnitude can be impacted by weak zones of thrust faults or coal zones.
- The possible horizontal locked-in stress within the rock mass was not considered in the model. The existence of thrust faults in the area indicates possible high horizontal stress (higher than the vertical stress) locked-in the rock mass. Additional refinements to the deformation estimation can be done with modeling the locked-in stress, but the movement pattern is expected to stay similar to what is presented here.
- The effect of rate of pit excavation on the rock mass response was not directly considered in the deformation analysis. Rock mass may have stronger short-term response (*i.e.* high excavation rate) in comparison to a long-term response (*i.e.* low excavation rates). To some degree this is indirectly considered in the material properties assigned.

The following observations can be noted on the analysis results:

- The calculated maximum horizontal displacement is less than 45 mm. This value represents the expected movement if the rock mass stays mainly within elastic range (the initial response to excavation) with minimal plastic zones developed.
- The maximum horizontal displacement is calculated at the crest of the third last bench (not the crest of the pit).
- The deformation history plot (Figure 184-6) shows a minimal horizontal movement of the pit crest (*i.e.* less than 10 mm) and about 40 mm horizontal movement at the lower bench crests.
- The actual movement at the rock mass starts with the start of the excavation even before the excavation reached the level of the history points. This portion of movement can only be measured by a subsurface monitoring method (*i.e.* slope inclinometer). The maximum acceleration (sudden movement) of each bench crest is observed during that specific bench excavation. The movement then increased with deeper excavation, but at a slower rate. The exception is the last bench excavation that creates a relatively large movement. This is because some areas in the rock mass experience plastic condition with this deep excavation. The final stage movement of the history points is generally horizontal (*i.e.* zero acceleration) showing a stable slope despite presence of some possible plastic zones in the rock mass.

Conceptual Pit Slope Instrumentation and Monitoring Plan

The conceptual pit slopes instrumentation and monitoring plan include:

Prism Monitoring

Conventional or automated prism monitoring systems can be used to identify movements at the critical locations of the pit crest and on some of the bench crests. The automated prism system can increase the number of measurements and improve the accuracy. The spacing between the prism locations depends on the height and length of the pit slopes. Longer and steeper slopes have potentially higher risks in comparison to the shorter and flatter slopes. The prisms should be installed in such a way to identify possible global failure mass. The length of the slope (crest to toe) provides some guidelines on selecting the spacing between the prism locations. For example, for the West Pit highwall (Section A, Figure 183-1) with maximum height of 210 m and slope length of 190 m, a failure mass narrower than 300 m may have significant additional strength from 3D effects. Therefore, for preliminary prism location planning, the prism could be installed at 300 m spacing. Additional prisms should be installed at fault locations and soft material zones. Based on the movement pattern estimated from the preliminary deformation analysis (Figures 184-2 to 184-6), prisms should be installed at the pit crest as well as at the lower bench crests, depending on overall slope height. Preliminary suggested locations of the prism stations on the perimeter walls of the pit are presented on Figure 184-7. Additional prism stations should be installed at the fault zones and weak rock (coal) zones. Detailed design of the prism locations should be done after collecting additional site information from the early pit excavations.

The monitoring frequency of prisms that may be installed on the slope will depend upon the stability of slopes, the season, the rate of mining and the nature of mining being carried out along the slopes. Assuming the slopes are stable, wireline extensometers and prism monitoring should be regularly carried out and increased as necessary should instability develop. The GPS and radar units provide continuous, ongoing monitoring.

Laser scanning

Laser scanning can be used in the areas where prism could not be maintained (regular damages by rockfall and block movements). The system can be set to gather data remotely and analyse movement of specific points on the pit walls in a frequency defined by the user. The location of the laser scanning systems should be identified in the detailed design and with prior knowledge of the slope areas prone to frequent rockfalls that may damage the prism system.

Visual Monitoring

Visual monitoring plays a key role in identifying high risk areas. The visual inspections should be done on a regular basis in operational areas. Any hazards that are identified should be immediately reported to the mining personnel for further action. Detailed inspection should be done in areas with high risk or where previous failures have occurred. Comprehensive inspections of all areas should be done by a qualified engineer to determine the risk rating and any remedial or mitigation plans. The frequency of these inspections will be determined based on the rate of pit face advancement, evidence of stability concerns and the season (*i.e.* increased frequency during the spring runoff and winter freezing.

Visual monitoring may also use digital photography and associated software that enable comprehensive mapping of dangerous pit slopes.

Seismic Monitoring System

Seismic monitoring system can predict slope failures by measuring micro-seismic events caused by brittle movements within the rock mass. The system uses multiple geophones to locate the source of microcracks. The data can be then interpreted by a seismologist to identify the possible brittle failure zones on the pit slope. Increase seismic activity can provide early warning of slope failure.

Crack meters

Crack meters (or wire extensometers) can be installed at the location of potential dangerous tension cracks to integrate the visual inspections and digital photography.

InSAR System

Interferometry Synthetic Aperture Radar (InSAR) can be used to identify very small movements of the pit slopes. Both airborne and ground base InSARs can be used to evaluate movements but the airborne InSAR has the benefit of potentially covering the entire pit area in a single flight. InSAR can identify relative movements as small as 10 to 25 mm (Jaroz and Wanke, 2003). The method can integrate with the previous more local methods in identifying movement zones and rate. Normally an annual or twice a year InSAR surveying can provide enough information to complement other movement measurement methods.

Radar Monitoring

Visual inspections, prism and laser scanning, and surveying methods can identify preliminary risk areas. Ground based Slope Stability Radar (SSR) system can be used to monitor areas with possible or past slope failures. The system can scan a large area quickly and can provide early warning of failure in the target area for possible evacuation purposes. This system can work in all weather conditions (Little 2006). The design location of the system shall be done in the detailed design of the monitoring system. The experience during the early years of pit excavation will help with identification of possible problematic areas and the SSR system can be used to monitor those areas.

Figure 184-8 presents suggested slope monitoring strategy for the Grassy Mountain pit slopes.

Rock Dumps Instrumentation and Monitoring Plan

Monitoring of the rock dumps may include crest movements, slope movements, toe movements, internal deformations, dump saturation levels and foundation pore pressures (Klohn Leonoff Ltd. 1991). Rock dump monitoring includes visual inspection, acoustic monitoring, and instrumentation and survey with visual inspection remaining the most useful method for dump monitoring.

Visual Inspections

Regular visual inspection should be performed to identify possible problematic areas. Visual indications of problem areas may include:

- excessive surface cracking;

- movement of safety berms;
- settlement on the crest (indicating additional dump placement is required);
- bulging of the dump surface and toe; and
- toe or foundation movement signs.

Acoustic Monitoring

An audible indication of impending failure can sometime be detected at the toe of coarse material. By monitoring the increase in level of noise, any area of movement can be identified in advance (days or several hours in advance). The acoustic minoring of the rock dump should be part of the regular inspection plan of the dump areas.

Instrumentation and Surveying Methods

Suggested instrumentations for dump monitoring include wireline extensometers, surface surveying, inclinometers. Piezometers may also be used at the clayey foundation layers to identify any excess pore pressure development in the foundation.

Wireline Extensometers: Extensometers can be read manually or linked to a recording device to provide continuous plot of movement with time.

Surface surveying: Various surveying method can be employed to estimate the movements. InSAR or LiDAR can be used to survey the entire dump surfaces. Deformation at sensitive areas or areas detected as possible movement areas shall be surveyed using GPS systems or Radar monitoring systems.

Inclinometers: Inclinometers measure the horizontal component of movement within the foundation.

Piezometers: Vibrating Wire Piezometers (VWP) can be used to identify the phreatic surface within the dump material or excess pore pressure development in the foundation layers. Standpipe Piezometers (SP) can be installed in the rock dump or within the sandy foundation layers to identify phreatic surface within the dump area.

Final design of instrumentation should be part of the detailed design.

Dams

Table SIR 184-1 presents the main design issues and conceptual monitoring plan by instrumentation and site observations for dams in the Grassy Mountain site.

Table SIR 184-1 Summary of Typical Dam Monitoring Approach

Design Issue	Effect on the Dam	Representative Measurement	Suggested Monitoring
Deformation	• Drain pipe hydraulic capacity • Drain pipe stress • Dam integrity	• Foundation settlement • Toe displacement • Crest settlement or lateral movements	• Slope inclinometers at the toe • Slope observations
Slope Stability	• Dam integrity	• Displacement at the toe and slope • Excess porewater pressure within low conductivity foundation layers	• Slope Inclinometers at the toe • Piezometers within clay foundation layer • Slope observations (slumps and cracks)
Seepage through the dam and its foundation	• Internal erosion • Uplift pressure • Surface gully • Dam stability	• Porewater pressure within Blanket Drain • Porewater pressure within sandy foundation layers • Slope cracks and slumps • Pipe flow rates • Fines in the offtake pipe flow	• Piezometers in Blanket Drain • Piezometer in the sandy foundation layer • Pipe flow measurements and observations • Slope observations (seeps, piping, icing)

Instrumentation detailed design has been completed for the Raw Water Pond (RWP) dam and is illustrated in Figures 184-9 through 184-11. Detailed design of instrumentation for other dams and structures to support the early mine operations (*i.e.* the first 3 to 5 years of operation) will be completed prior to start of construction and will follow a similar approach.

References:

Andrew Jarosz and Dieter Wanke (2003). Use of InSAR for Monitoring of Mining Deformation. Proceeding of Fringe 2003 workshop, Dec 1-5, 2003, Frascati, Italy.

Klohn Leonoff Ltd. (1991). Operation and Monitoring of Mine Dumps – Interim Guidelines. May 1991.

Megan J. Little (2006). Slope Monitoring Strategy at PPRUST Open Pit Operation. International Symposium on Stability of Rock Slopes in Open Pit Mining and Civil Engineering, 2006.

185. Volume 1, Section C.2.3.3.3, Page C-47

Benga states, "CPP washed product coal storage capacity…. stockpile height is 18m."

a) As per the CCA/CCR, Benga is expected to submit a design report to the AER (for approval) for the proposed stockpile(s) prior to commencing construction.

Response:

The washed product coal stockpile will be built at its natural angle of repose of 37o to a maximum height of 18m. The initial live design capacity of the overall stockpile is 80,000 tonnes split into 2 x 20,000 t capacity individual stockpiles. The stockpile volume will be managed through the year within the design capacity to avoid were possible building to the maximum height during periods of anticipated high rainfall. This is intended to minimize the impact of minor slumping due to saturated conditions. The stockpile will include a perimeter drain and sediment pit to manage any coal that has been mobilized away from the stockpile pad due to rain.

This stockpile system consists of a radial telescopic stacker and reclaim by "gooseneck' feeders or dozer traps onto the reclaim conveyor. The stacking and reclaiming configuration to be installed at Grassy Mountain is standard technology currently being utilized in numerous mines globally *e.g.* Bocamina – Chile, Wilpingong, Daunia, Sonoma – Australia, Benga – Mozambique, UHG – Mongolia to name a few.

The Grassy Mountain stockpile capacity has been designed to match the residence time between CHPP production and rail loadout to eliminate the requirements of oversized clean coal stockpiles for extensive storage times. The typical residence time is expected to be less than one week. The stockpile area will also include additional room for dead storage using dozers to push out during times of temporary reduced railing rates (*e.g.* CP delays or port delays.

C. ENVIRONMENTAL PROTECTION AND ENHANCEMENT ACT (EPEA)

186. Volume 1, Section A.4 – Project Location, Page A-8 and A-9

Benga provided the project location in terms of UTM Zone and Latitude and Longitude coordinates. Further in this section details are provided on the Mine License Boundary. Addendum 2 from October 2017 contains updated information for the Water Act application. The Water Act application includes a figure showing the fenceline for the Water Act application. This fenceline is the boundary for Water Act aspects. There is no discussion of the limits/extents of the EPEA approval.

a) Provide a map showing the EPEA boundaries including Alberta Township System (ATS) details.

Response:

Please refer to Figure 186-1 for a map showing the EPEA boundary. The proposed Mine Permit Boundary provided in Figure A.1.0 2 outlines the extent of the EPEA approval. The Mine Permit Boundary is also the extent of the Fence line Water Act Boundary outlined in Figure 1 1 of the October 2017 Addendum 2, Appendix 1D Fence line *Water Act* application. The extent of all Project approvals is the Mine Permit Boundary.

b) Provide the basis for the EPEA boundaries for the project.

Response:

The EPEA boundary is the same as the proposed Mine Permit Boundary, within which, all mining related activities will occur.

187. Volume 1, Section A.4 – Project Location, Page A-8 and A-9

Benga provided the project location in terms of UTM Zone and Latitude and Longitude coordinates. The location for the Coal Handling and Processing Plant (CHPP) and the load out facilities was not provided in Dominion Land Survey Format.

a) Provide the project location for two components, the CHPP and the load-out facilities in terms of legal land description with LSD, Section, and Twp-Rge-Meridian format.

Response:

The Coal Handling Processing Plant is located at LSD 07 and 08 Sec 23 Twp 08 Rge 04 W5M. The rail load out facility is located at LSD 05 Sec 02 Twp 08 Rge 04 W5M.

188. Volume 1, Section A.6.2 – Processing, Page A-23

Benga states, "The cleaned coal is then de-watered to produce a saleable product that has 10% moisture content and an air-dried product ash between 9% and 10%." Confirmation of the product composition and its basis (wet or dry) is important in understanding the water balance for the project.

a) Confirm that the air-dried product ash is between 9% and 10% water content.

Response:

Yes, the design moisture in the product coal is between 9% - 10% on an as received or total moisture (TM) basis. It is not standard industry practice to quote product moisture on an air-dried basis. Product Ash is however done on an air-dried basis.

189. Volume 1, Section A.11.1.1 – Air Quality Mitigation, Page A-97

Benga states, for dust control, "water is systematically applied to haul roads and to the plant access road to minimize dust using a water truck dedicated to this purpose." The Grassy Mountain Coal Project area is one where management of water volumes is critical. Understanding the source of water for dust control is required to properly assess the water balance for the project.

a) Provide details on the type of water used and the source of this water.

Response:

Benga plans to use water from the Raw Water Pond for dust suppression purposes. This water will be mine wastewater that is collected from the mine. This water has been included in the water balance for the Project.

190. Volume 1, Section C.2.4.6.2 – Hyperbaric Disk Filter, Page C-50

Benga states, "test-work on the hyperbaric disk filters (HDF) unit has shown a significant improvement in moisture over technologies such as screenbowl centrifuges, vacuum filters or horizontal belt filters." Better understanding of the number of such units in operation and any operational concerns (i.e. reliability) would be beneficial to confirm impacts on the water usage and water balance.

a) Discuss Benga's experience with operations of hyperbaric disk filters. Include in the response references to industry's use of such technology.

Response:

Hyperbaric disc filters are used in other industries in Canada and in coal production worldwide. Usage of this technology was confirmed by a reference list of operating locations by the top bidding vendor to include over 60 units working in nine commodities and eight countries. Other bidders had similar exposure worldwide.

Benga has conducted extensive operational reviews of the hyperbaric filter, including site visits to existing mines to observe how this technology is in operation in a coal application.

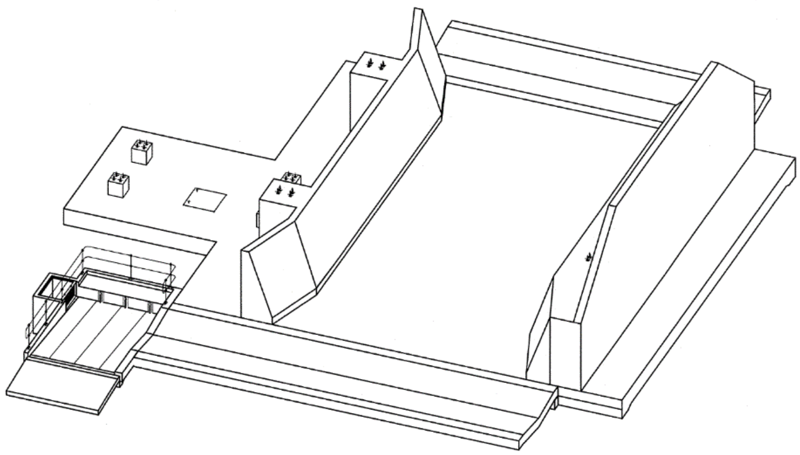
191. Volume 1, Section C.2.6.5.9 – Rejects and Tailings Disposal, Page C-62

Regarding rejects and tailings disposal, Benga states that "the concrete truck pad underneath the rejects bin will be electrically heated to minimize freezing of any spillage on the truck drive path, providing a safe, year-round operation." There is no mention in this section of how runoff from this truck pad will be handled. Runoff from this pad could impact surface water in the area.

a) Provide details on the concrete truck pad perimeter, and how the design will prevent the migration of rejects and tailings into the adjacent environment.

Response:

Drawing SIR 191-1 provides a three-dimensional view of the typical reject bin support slab that is proposed for the Project.



Drawing SIR 191-1 3D View of Typical Reject Bin Support Slab.

In the event of any waste rock spillage and/or water leakage from the bin before, after, and during the loading operation, would be contained within the loading zone. The slab will be contained on both sides of the truck path by high walls and the slab heated and sloped so that all spillage would run off the slab and into the adjacent heated sump. Any water would be pumped away into the dirty water system on the site and solids removed from the sump periodically by mobile equipment.

192. Volume 1, Section C.2.9.2 – Raw / Fire System / Washdown / Dust Suppression Systems, Page C-70 and C-72

Volume 1, Section C.6.16.1 - Fire System Design Criteria, Page C-122

For the fire system design, Benga states that the system will have a "maximum system operating pressure but will not be less than 1,035 kiloPascals (kPa)."

Benga also states that two 300 m3 and two 220 m3 tanks will be provided for fire water and wash- down water.

The information does not include how the tanks will be winterized to prevent freezing of the water. The freezing of tanks could result in operational and safety issues. The pressure rating discussion is unclear as to what the maximum operating pressure of the system will be. An improper understanding of the design pressure could result in design and safety issues.

a) Explain what is meant by maximum operating pressure.

Response:

On development of this information request response, it was noted that there was a typographic error. For Volume 1, Section C.6.16.1 – Fire System Design Criteria, the line reads; "*Each of the* *fire/wash-down water reticulation system will be designed and installed in accordance with NFPA 24 to accommodate the maximum system operating pressure but shall not be less than 1035kPa*.”. It should be amended to read "*The fire water reticulation system will be designed to withstand a maximum pressure of 150 psi (1035kPa)*" as it is more concise and fits with the current paragraph better.

b) Provide details on how the fire water and wash-down water tanks will be winterized.

Response:

The tanks will be insulated with in-tank heaters consistent with standard industry practice.

193. Volume 1, Section C.3.2.1 – Description of a Typical Train Load, Page C-78

For rail loading operations, Benga states that “the loadout also sprays a latex binder solution over the top of the coal load to minimize release of dust as the train travels to port.”

Benga also states that the “Canadian Pacific Railway may also use the access roads to bring fuel trucks up to the locomotives to top up their diesel tanks if required.”

The application does not provide details on the binder agent that could influence how it is to be stored. Means of addressing potential diesel spillage during top up of locomotives is not discussed.

a) Provide details on the proposed latex binder agent.

Response:

The proposed binder is Envirobind DCT, which will be stored in heated and insulated FRP tanks contained in an area surrounded by an earth berm. For further details, Appendix C-1 provides the Safety Data Sheet for Envirobind DCT.

b) Discuss how the latex binder agent will be stored and applied.

Response:

The binder will be stored in heated and insulated FRP tanks contained in a contained (*i.e.*, earth berm) area.

c) Discuss provisions provided to prevent the spillage of diesel fuel associated with any top up fueling of CPR locomotives.

Response:

It is planned that empty trainsets arriving at the mine site for loadout will be delivered by with the locomotives fueled and serviced. Fueling will typically occur in CPR’s existing fueling facility in Golden, BC. However, it may be necessary on an ad-hoc basis to fuel a locomotive at the mine from time to time.

If required, such fueling will be performed by CPR or its agent. It is expected that such fuel will be delivered by truck, with such truck designed and approved specifically for that purpose. As such, all necessary equipment and procedures shall be the responsibility of CPR and its agent, including any local spill containment equipment deemed necessary by CPR. Fueling will only occur in the catchment area of the loading loop storm water pond, which has a closable outlet that would restrict the area impacted by an accidental spill.

194. Volume 1, Section C.6.6 – Fuel and Lube Storage, Page C-115 Volume 1, Section C.6.10 – Lube Storage, Page C-116

Benga states, “after initial set up at the plant site administrative office, shop and maintenance area, additional fuel and lube facilities will be located at various points throughout the mine area. From time to time these facilities are relocated as activities and operations advance to new mine areas.”

The next paragraph indicates that all fuel depots have secondary containment berms, however it is not clear if this reference is to relocatable facilities.

Benga also states that “tanks that are containing combustible lubricants shall be double-walled for spill containment. All other tanks shall be single-walled.”

a) Confirm that these relocatable facilities have secondary containment.

Response:

Yes, relocatable facilities will have secondary containment such as an earth berm.

195. Volume 1, Section C.6.18 – Aboveground Storage Tanks, Page C-128

Volume 1, Section E.3.3.3 – Effects of Surface Facilities on Groundwater Quality, Page E-63

Benga states, for the fire water tank, “primary containment is the internal membrane. Secondary containment is the tank wall.” This terminology is also used for other tanks.

The basis for this containment terminology is not clear, if the internal membrane is adhered to the tank wall (i.e. an epoxy coating); delineating the containment into two envelopes may not be possible.

Benga also states that, for fuel storage, “all fuel depots will have secondary containment berms around the storage tanks and site drainage will be managed.”

Benga further indicates that, “given the presence of fractured bedrock overlain by thin surficial deposits, it is recommended that some additional protection measures may put in place (such as, but not limited to, installation of liners).”

a) Provide details on what is meant by internal membrane.

Response:

Reference to "internal membrane" is found in Section C, Table C.6.18-1 (Summary of Storage Tank Data), and applies to the Fire Water Tank (2 x 300,000 litres) and the TLO Fire Water Tank (2 x 220,000 litres).

These tanks are large volume, water only storage tanks, which provide water reserves for firefighting purposes. The typical construction will use corrugated multi-plate steel sections, bolted together in a circular form. This is the structural element of the tank and carries the loads imposed by the stored water volume. The tank shell is then lined with a fully seal welded HDPE liner which contains the stored water. A metal roof is installed over each tank. In this case, the internal membrane reference refers to the HDPE liner, which will contain the water and is structurally supported by the steel shell. The steel shell is structural only, and because it is made up of multi-plate sections, it is not water tight. This type of large volume water storage is very common in many industrial and rural applications.

Particular tanks, for example those that store chemicals or fuel, will be doubled walled. In these cases, the tanks are essentially a tank within a tank. The inner tank contains the fluid, and the outer tank contains the fluid only if the inner tank fails. There is an air gap between the two tanks and the presence of fluid in this space is monitored. This ensures there is no spillage of the fluid into the environment, and the tank is replaced totally if an inner tank failure is experienced.

b) Provide details on site drainage management associated with all storage tanks. Discuss the basis for deciding when additional protective measures will be employed.

Response:

Containment (*i.e.*, bermed, bunded) tank areas will be designed with a minimum storage volume in accordance with code requirements. Water drainage from rain events, will be pumped from the containment areas and discharged through an oil / water separator. Oil will be disposed of through the waste oil facilities on the site, and water through the site dirty water system. To minimize risk of contained fluid leakage, all containment areas, include relocatable facilities will include a concrete floor slab and concrete retaining walls. Ground conditions in some areas may affect the soundness of the slab floors in bunded areas, but slab condition will be monitored regularly and cracks sealed to prevent leakage. Oil or chemical spills into containment areas will be pumped out and disposed of through the waste oil facilities.

196. Volume 1, Section E.5.3.3 – Summary of Assessment Results, Page E-90

Volume 1, Section E.5.5.1 – Mitigation

Volume 1, Section C.6.13 – Sewage, Page C-117

Benga states, "Facility sewage will be collected and treated in a sewage treatment package plant located on the mine infrastructure area (MIA) pad."

Benga also states that "facility sewage will be collected and treated in a sewage treatment package plant located on the MIA pad. The treatment plant will treat all sewage produced at the MIA facilities and has been based on an estimated sewage treatment requirement of

30 m3/day. Excess sludge will be collected for removal from the package treatment plant by vacuum trucks and disposal off site."

Confirmation of the volumes from operation and construction phases is needed to understand the amount of sludge to be disposed of. Ultimate dispensation of sludge is not discussed.

a) Provide details on the proposed off-site disposal location for sludge and the anticipated volume of sludge to be disposed.

Response:

Excess sewage sludge will be collected for removal off site; however, details on the proposed off site disposal location are not yet available. A third-party contractor licensed to transport and dispose of sewerage sludge from the packaged wastewater treatment plant will be employed to ensure safe and compliant disposal at a licensed and regulated facility. The disposal facility will be determined by the licensed contractor awarded the contract. The licensed contractor will abide by all regulatory requirements for waste disposal. The estimated quantity of sewage waste and residues (sewage sludge) to be disposed of is 10 ML per year.

197. Volume 1, Section C.2.10 – Dust Management and Suppression, Page C-73

Benga has identified the use of enclosures, conveyer hoods, and dust suppression sprays to manage dust from materials handling activities. Dust suppression was not deemed necessary for the product and rejects handling systems as the material is already wet; but the run of mine (ROM) pad and product stockpile will not utilize dust suppression.

a) Provide justification as to why the ROM pad and product stockpile do not utilize dust suppression systems.

Response:

Static dust suppression systems are generally not used in either ROM or product stockpiles, as these stockpiles are essentially dynamic piles managed by mobile equipment. Fixed water suppression systems can significantly restrict machine movements. If spray systems are installed around operating stockpile perimeters, they are generally so far away they are not effective, and waste a lot of water. Dust is minimized in stockpile areas by shaping the stockpile with low profile slopes, so wind passes over the pile in lamina style of flow and does not whip up dust from the pile surface. Correct stockpile shaping also minimizes the potential of spontaneous combustion.

b) Discuss the potential for dust emissions from the ROM pad and product stockpile if no dust suppression is implemented.

Response:

Dust emissions from stockpiles are best minimized by correct stockpile shaping with low profile slopes. Both stockpile areas will be equipped with a nearby water supply, and best practice in very windy conditions will be to put out relocatable spray units, fed by hoses. Very little water is needed to manage the dust in this manner and the sprays can be readily located at the source. Because the product coal is damp when it is placed in the pile, dust emissions with new coal into the pile are negligible. Any dust issues that arise are generally associated with the older coal in the pile and only in dry conditions. Surface dust emissions are best controlled by low profile shaping of the back of the pile and local relocatable sprays if required. As the product coal in this application is a metallurgical coal, it will be important to turn the product stockpiles over completely on a regular basis so that coking properties do not deteriorate. The product coal will therefore be placed and turned over relatively quickly so drying out and related dust issues will be minimal.

As discussed in the response to SIR 179, air quality modelling conducted as part of the environmental assessment assumed that no emission controls were provided for handling of conveyed wet product and rejects, on the raw and product coal stockpiles, and the ROM pad. Thus, model predictions already consider the lack of controls. Furthermore, the modelling was conducted over five years that included periods of high and low wind speeds; the model results already incorporate these periods that contribute to additional windblown dust and periods where dispersion is limited by light winds.

Model results are presented in the Air Quality assessment (CR#1a) for PM_{10} (Figure 5.5-2) and TSP (Figure 5.6-2), the two coarser components of dust associated with mechanical (*e.g.*, non-combustion) sources. Maximum predictions, which occur during dry summer conditions, on the mine permit boundary nearest the plant operations are less than the B.C. 24-hour objective for PM_{10} and the Alberta ambient air quality objective for TSP. Thus, with the controls specified in the project description and applied in the air quality modelling, ambient objectives are met in areas where the public has access.

D. WATER ACT (WA)

D.1. Water Act Approval Application 001-00403431

D.1.1. IMPACTS TO WATERBODIES

198. CR6, Aquatic Ecology Addendum, Section 4.1.2.1, Page 29 CR6, Aquatic Ecology Addendum, Section 4.2.3.1, Page 61

CR6, Aquatic Ecology Addendum, Section 4.3.1.1, Page 70 Addendum 2, Appendix 1D

CR 6, Section 4.2.3.1, page 61 delineates the predicted direct impacts to aquatic habitat within the LSA as a result of the project. The estimated impact to the aquatic environment is 26,947 m2, with the majority occurring in the Blairmore Creek watershed (20967 m2) and 5979 m2 in the Gold Creek watershed. Of this estimated impact, the project is estimated to remove or alter 1796 m2 of direct fish habitat prior to applying any mitigation. The remaining 25151 m2 of impacted habitat is non fish- bearing.

CR 6, Section 4.3.1.1, page 70, lists the watercourses that will be directly affected by the project development.

CR6, Section 4.1.2.1, page 29, indicates that both Gold and Blairmore Creeks are Class B watersheds, considered sensitive to any type of activity, which also includes all tributaries of Gold and Blairmore Creek for 2 km upstream of the their confluences.

Benga mentions that the mine plan was developed to minimize the disturbance on watercourses within the LSA to the extent possible.

The *Water Act* fenceline approval application (Appendix 1 D) does not include any discussion/details with respect to the proposed disturbance of watercourses listed above, avoidance, mitigation measures and reclamation proposals. An activity that affects or has the potential to affect (including cumulative effects) a waterbody and/or the aquatic environment (*Water Act*: Section 36) requires a *Water Act* Approval.

a) Provide the proposed watercourse and aquatic habitat disturbances in the fenceline WA Approval application. Include in the response, plans showing proposed disturbances, avoidance/minimization strategies, mitigation measures and reclamation proposals.

Response:

As discussed with and agreed upon with the AER for the Project's Integrated Application, to avoid redundancy in providing similar information for multiple applications, supporting information for each application could be provided in a concordance table. Please refer to Table 1, Fence-line *Water Act* Concordance Table in Appendix 1D of the Integrated Application for the locations of the information required to support this particular application. Within Table 1, Appendix 1D, direction to information on Project Effects are provided for effects on other users, the aquatic environment, instream or water conservation objectives, hydrology, hydrogeology, neighbouring lands, and wetlands.

In regards to effects to the aquatic environment, the proposed disturbances are provided in the Aquatic Ecology assessment Consultant Report #6 (CR#6), Table 4.6. Avoidance/minimization strategies (mitigation measures) are described in CR#6, Section 4 and summarized in Table 4.2, and the Preliminary Habitat Offsetting Plan is provided in Appendix A4.

D.1.2. IMPACTS TO WATERBODIES: ALBERTA WETLAND POLICY

199. Volume 1, Section E.8.3.7, Page E-158

Benga states, "The area of wetlands that would potentially be impacted by the Project in the Local Study Area is presented in Table E.8.3-7" and "Of the four Alberta Wetland Inventory Classification System wetland types identified in the Local Study Area, three occur in the Project Footprint with a total of 9.7 ha being impacted by the Project".

The Water Act fenceline approval application (Appendix 1 D) does not include any discussion/details with respect to the proposed disturbance of wetlands discussed above. An activity that affects or has the potential to affect (including cumulative effects) a waterbody and/or the aquatic environment (Water Act: Section 36) requires a Water Act Approval.

a) Include proposed wetland disturbances in the fenceline WA Approval application in order to comply with the *Water Act* and the *Alberta Wetland Policy*.

Response:

The *Water Act* Fence-line Approval Application (Appendix 1D) concordance table refers to Section E.8.3.7 for effects on wetlands.

Wetlands that will be removed by mining total 9.7 ha. This is 9.6 ha of shrubby open fens, 0.03 ha of graminoid marsh, and 0.07 ha of shallow open water. Wetlands are described in the Vegetation assessment report (Consultants Report #8).

After reclamation 18.2 ha of treed wetland (STNN or FTNN) will be added. In addition, approximately 1.8 ha of the end pit lake would be approximately < 2.0 m deep (littoral zone) and be shallow open water or graminoid marsh wetland. Methods and schedule for reclamation / establishment of wetlands, and monitoring are provided in Section F - Conservation and Reclamation Plan.

200. Volume 1, Section E.8.5.1, Page E-166

As a mitigation measure, Benga states that placement of culverts will occur in wetlands divided by roads to maintain flow within the wetland. Benga further states that this aligns with the Alberta Wetland Policy. As noted in the application, wetlands are preferentially managed by avoiding, minimizing and replacing lost wetlands. Section E.8.5.1, page E-166 states that wetlands have been avoided or disturbance minimized where possible. Additional details on how the Alberta Wetland Policy was considered in this application are required.

a) Provide rationale on how avoidance and minimization was considered and demonstrated in all planning stages of the project.

Response:

Minimizing the size of the footprint was a primary consideration when designing the mine as described in Section F, Sections F.2.1.4, F2.6.4, F2.6.2, and F.3.7. The Project Description, Section C; C.1.2 describes design of the mine and constraints used to minimize the Projects potential impacts.

In addition to constraints on mine design, the location of the wash plant (Section C, Section C.2.4.1) and haul roads were modified to reduce footprint. Haul roads are routed within the pit boundaries wherever possible and coal haul roads are coincident with rock haul (Section C, Figures C.1.3-1 to C.1.3-26.)

b) Provide details on how avoidance was considered as a strategy with respect to locating roads through wetlands within the project area and provide justification for the proposed location of roads within wetlands.

Response:

No roads will be located through wetlands for the mine area. The rail line will impact 0.03 ha of graminoid marsh, and 0.07 ha of shallow open water located near Highway 3.

201. Volume 5, CR8, Section 4.7.1, Page 170

A description of wetland types on shoreline edges (riparian zones) of end pit lakes is provided. The application states that reclamation of wetlands in LSA does not classify areas of open surface water as wetlands, but that 1.8 hectares around the end pit lake could be considered wetlands. Under the Planned Development Case, open water is expected to increase by 21.0 hectares, but as noted, this is not considered a wetland ecotype. However, Table 4.7-1 (page 170) includes open water and appears to show an increase in wetland from baseline to PDC.

a) Revise Table 4.7-1 and subsequent tables (e.g. Table 4.8-6) and discussions to remove open water as a perceived wetland class.

Response:

Table 4.7-1 does not include the end pit lake as the table is without mitigation (worst case scenario). A revised Table 4.7-2 is provided below. Discussion in text is consistent with the numbers provided in Table 4.7-2 and does not need to be revised.

Table 4.7-2 Planned Development Case - Effects on Wetlands in the Regional Study Area (revised)

Land Cover Class	Ecosite Phase / AVI Equivalent	AWIS Wetland Class Equivalent[1]	Baseline Case (T0)[2]	PDC T41 (With Project with Mitigation)[2]	Baseline T0 - PDC T41[2]
Graminoid Wetland	-	FONG / MONG	158.5	151.9	-6.6
Shrubby Wetland	Subalpine: g1, h2	FONS	762.7	760.9	-1.8
Treed Wetland	Subalpine: h1	FTNN / STNN	126.5	108.1	-18.4
Total Wetlands	**-**	**-**	**1,047.70**	**1,021.00**	**26.7**
Open Water	NWF, NWL	-	1,544.00	1,591.80	47.8

[1] Based on Halsey *et al*. 2004.

[2] Due to rounding of numbers, total values may not equal the sum of the individual values.

\- not applicable.

Table 4.8-6 describes the regional mapping that is a coarser resolution than LSA mapping. At the resolution of the RSA mapping open water is distinguished from treed and graminoid wetland types. Open water is discussed separately in the text and is best grouped with wetlands as it will contain some wetlands as well as lakes. At the LSA level wetlands are clearly distinguished from lakes in the discussion of project impacts and of mitigation.

202. Volume 5, CR8, Section 4.7.4, Page 173

Benga states that wetland soil and propagule materials will be salvaged and stored for replacement during wetland reclamation/reconstruction activities. Wetland reclamation experience has shown that storage of wetland soils and propagules results in very low viability after even a short period of time. Given that the period between construction and closure will extend decades, it is uncertain how Benga proposes to maintain viability and wetland soil properties.

a) Provide details on how viability of propagules and wetland soil properties salvaged during construction will be maintained over the project life.

Response:

Propagules will not be maintained in stored soil due to the length of time from construction to reclamation.

D.1.3. DAM SAFETY

203. Volume 3, Appendix 9A, Section 7.0, Page 66

Volume 3, Appendix 9A, Section 6.0, Page 43

Volume 3, Appendix 9D, Section 7.0, Page 15

Volume 3, Appendix 9D, Appendix E, Profile 1 - 4

Golder states, "Perform additional geotechnical investigation, sampling and testing at Significant to Very High consequence classification dams to obtain undisturbed samples of cohesive materials for advanced testing (e.g. consolidated undrained triaxial) to evaluate shear strength properties. Deep boreholes will be required at some dam sites to determine stratigraphy and depth to bedrock and laboratory testing on core samples to evaluate rock strength. The investigations must provide information to inform the approach for addressing the cohesive materials identified in the foundation of the North East Sediment Pond and the North West Surge Pond." Further, **Appendix 9A, Section 6.0, Page 43**, Golder shows the preliminary analysis and recommendations for eight sediment and surge ponds.

Terracon states, "It is recommended to review/revise the design of the Raw Water Pond dam in order to increase the FoS to acceptable values for both drained and seismic conditions." Further, **Appendix 9D, Appendix E, Profile 1 - 4**, Terracon shows the preliminary stability analyses results for East Sediment Pond, South East Surge Pond and Raw Water Pond.

As per the *Water Act*, Benga is expected to submit complete detailed dam/dyke design report to the AER (for approval) for the eight water retaining structures indicated in the current submission including East Sediment Pond, South East Surge Pond and Raw Water Pond prior to commencing construction.

a) Provide complete detailed design reports for the East Sediment Pond, South East

Surge Pond and Raw Water Pond for consideration under the current Fenceline Water Act approval application as required under Part 6 of the Water Ministerial Regulation.

Response:

Dam Safety applications will be submitted to the Alberta Energy Regulator prior to construction. Benga will apply for the water retaining structures that will be built within the first year of construction (Year 1), which includes the Southeast Surge Pond, Southwest Surge Pond, Plant Site Sedimentation Pond, Load Out Settling Pond, and Raw Water Pond. The location of the ponds that will be built within the first year of construction are provided on the Year 1 progression map in Section C, Figure C.1.3 2. As the mine progresses, applications for the remaining water retaining structures will be submitted prior to construction of each pond, including the West Sedimentation Pond (Year 2), East Sedimentation Pond (Year 6), Northwest Surge Pond (Year 6), and the Northeast Sedimentation Pond (Year 14).

Water management structure design specifications for the sedimentation ponds and the surge ponds have been provided in Section C.5.5.

D.2. Water Act Licence Applications 001-00403428, 001-00403429 and 001-00403430

D.2.1. WATER VOLUME

204. Volume 1, Section C.2.9.2, Page C-70

Addendum 2, Appendix 1E, Section 2, Page 2

Addendum 2, Appendix 1E, Section 2, Table 2.2-1, Page 3

Addendum 2, Appendix 1E, Figure 2-1

In Volume 1, Page C-70, Benga notes that the nominal water make-up requirement for the coal handling and processing plant is 110 litres per raw metric tonne (RMT) of coal processed. As a measure to reduce annual operational water requirements, Benga incorporated coarse reject centrifuges in the coal processing plant resulting in an overall reduction of water use from 110 litres per RMT to 57 litres per RMT of licenced makeup water. Addendum 2 was submitted on October 16, 2017 to reflect these proposed changes in water use volume and associated modifications to the CPP.

Figure 2-1 in Appendix 1E shows that the coarse reject stream will provide 174 ML, i.e. 174,000 m3 of recycled water per year.

Benga shows in Table 2.2-1, page 3 that the maximum year for the total CPP make-up required is year 12 and the volume will be 478,230 m3 per year. Figure 2-1 in Appendix 1E indicates annual water use from raw water pond is 467 ML/year i.e. 467,000 m3/year. Clarification in discrepancies will be required.

a) Discuss in detail how efficiencies in water use were achieved from 110 litres per RMT to 57 litres per RMT of licenced makeup water. Describe how additional centrifuge capacity provides the level of efficiencies proposed.

Response:

To improve efficiency and reductions in the amount of make-up water needed for the CPP, modifications were required in the plant, which primarily consisted of adding coarse reject centrifuges. The modifications to the CPP are discussed in detail in Addendum 2, Appendix 1C, *Coal Conservation Act Addendum* that was submitted in October, 2017.

b) Clarify makeup water volume discrepancies between Table 2.2.-1 and Figure 2-1.

Response:

The make up water volumes provided in Table 2.2 1 in the October 2017 Addendum 2 Appendix 1E (*Water Act* Licencing Application) are correct. The discrepancy in between water volumes listed in Addendum 2, Table 2.2-1 and Figure 2.-1 were addressed in SIR 177, which states "*An error was noted on Figure 2 1 from the October 2017 Addendum 2, Appendix 1E (Water Act Licencing Application), which has been updated and included as Figure 2-1. There are two changes to the numbers, site water management approval has been changed from 467 ML/y to 478 ML/y and the number for the process plant has changed from 671 ML/y to 682 ML/y.?*"

205. Volume 1, Section C.2.4.6.3 – Reject Dewatering, Page C-50

Regarding the dewatering of rejects, Benga states that "this motivated the design team to dewater the entire rejects stream and to co-dispose this material in the rock disposal areas." Benga also stated that, "dewatering of the various reject streams will be accomplished by the following unit operations to minimize reject material moisture and allow for dry co-emplacement." An understanding of the feasibility and reliability of the proposed process configuration would be beneficial in understanding potential impacts on the water balance.

a) Discuss Benga's (and industry's) experience with such a process configuration.

Response:

Benga are proposing to use industry standard dewatering technology including centrifuges, screens and filters and apply it on the rejects streams to support the water balance requirements, rather than just the product stream.

i. Provide details on anticipated system reliability.

Response:

Benga are confident that all equipment in the circuitry is robust and reliable, which is the expectation with all components of the entire operation of the preparation plant.

ii. Discuss contingencies that may be needed in the event of component outages in the proposed dewatering process configuration.

Response:

Benga's operating procedures for the coal handling preparation plant (CHPP) include contingency plans for equipment outages. For example, if this particular situation occurs the feed rate will either be reduced appropriately or stopped until the outage is resolved.

D.2.2. HYDROLOGY

206. Volume 1, C.5.3.3, Page C-93

Appendix E, Section 1.0, Page 1

Volume 3, Appendix 10B, Water and Load Balance Model Report, Section 2.4.1, Page 5

In these three separate sections Benga briefly describes how the settling ponds will operate. In both Volume 1 and Appendix E Benga affirms that water will be returned to the creeks. In Volume 3 Benga, states that water in the settling ponds will be released to the creeks if the water quality allows it, if not, then water will be discharged to the saturated zones. The return flows to both Blairmore and Gold Creek are very important to minimize any potential impacts to both streams. The return flows potentially being compromised by water quality and not being discharged to the creeks poses a risk that may have not been taken into consideration in the model. Little to no information was available with respect to the expected return volumes during low and high runoff years at each model location. Return flows are important for minimizing the impact on the aquatic ecosystem, and will also be a mandatory requirement for the York Creek transfer. The transfer should also be separated with respect to the returns based on the natural conditions and the additional return mandatory by the licence.

a) Clarify the discrepancy between the three sections, and confirm that water will be returned to the creeks at all times. In the event water is not returned provide the potential impacts to the streams.

Response:

The intent of the Project's Water Management Plan is to capture, collect, and treat (as necessary) water within the Project's footprint. For the sedimentation ponds, water will be returned to Blairmore and Gold creeks at all times. The statement that water from sedimentation ponds can be pumped to the saturated zones for treatment is only intended to be a water quality contingency plan mitigation and is not anticipated to occur on a regular basis.

b) Provide detailed information on expected return flows at each location where return flows have been identified; including potential return flows from the treatment plant. Clearly state if all of these return flows were part of the model. Show the annual average return flow and monthly average return flow at each return flow location, and return volumes at each location associated with the 1:10 year low and high runoff.

Response:

Expected return flows were part of the water balance model. Detailed information on the expected return flows were provided in the Hydrology assessment report (Consultant Report #4, Section 5.2, and in Figures 43 to 48). Estimates of potential changes to stream flow for average hydrological conditions are illustrated in Figure 43 for Gold Creek and Figure 46 for Blairmore Creek. This section also provides information and figures illustrating model results as estimated "percent change from baseline" for model nodes in Blairmore Creek and Gold Creek for 1 in 10 dry years, average years and 1 in 10 wet years. These figures are reproduced here as Figures 206-1 to 206-6.

c) Water redirected from both Gold Creek and Blairmore Creek by surface runoff collection/mine operation will require returns to both creeks. The information in the report does not include Gold Creek as a stream that will receive return flows. Discuss how Benga will satisfy the return flow needs of the project to both Blairmore and Gold Creek.

Response:

As stated in Section C.5.3.3, the source of the water directed to the sedimentation ponds will be from surface runoff and groundwater interception from the pit and will not be exposed to selenium enrichment, so they do not require selenium management efforts. This water may contain suspended solids that will require removal prior to release to the environment.

Table SIR 206-1 provides a summary of the sediment pond, the mine year it becomes operational, and where the creek each pond outlets to.

Table SIR 206-1 Summary of Sediment Pond Return Flow Locations

Pond Name	Mine Year Constructed	Return Flow Creek
Plant Site Sedimentation Pond	Year 0	Blairmore Creek
Loadout Sedimentation Pond	Year 0	Blairmore Creek
West Sedimentation Pond	Year 2	Blairmore Creek
East Sedimentation Pond	Year 6	Gold Creek
Northeast Sedimentation Pond	Year 14	Gold Creek

As per the Selenium Management Plan, water collected in the Northwest and Southeast Surge Ponds will be pumped into engineered saturated backfill zones for selenium treatment, (and if deemed necessary through water quality monitoring, metals treatment) will be released back into Blairmore Creek. Water treated for selenium or other constituents will not be released into Gold Creek. This is built into the water and load balance models. The Instream Flow Assessment (Addendum 1, Aquatic Ecology Consultant Report #6, Appendix 3) assessed the effects of this change in flow on Gold Creek (as well as Blairmore Creek).

207. Addendum 2, Appendix 1E, Section 3.2, Page 6

Addendum 2, Appendix 1E, Table 3.3-1, Page 9

Addendum 2, Appendix 1E, Section 3.3.4, Page 11

Addendum 2, Appendix 1E, Section 3.4, Page13

Addendum 2, Appendix 1E, Table 3.4-1, Page 15

CR6, January 2017 Addendum 1, Appendix A3, Instream Flow Assessment

In the above sections Benga provided either a simple computation that showed that the overall allocations on the Crowsnest River do not exceed 55% or mentioned that the Water Conservation Objective (WCO) on the Crowsnest River is met. Benga did not demonstrate how the Instream Objective (IO) factors into determining if the WCO will be met. Also, there is no indication that Benga attempted to obtain naturalized flows from AEP to compute the WCO on a weekly or monthly time step including the portion of the IO. This work is required to be completed using the full criteria of the WCO, which is 45% of natural flow or 110% of the IO, whichever is greater.

Appendix A3 – Instream Flow Assessment (of CR6) mentions that the Instream Flow Needs (IFN) will be met, but does not propose an IFN with respect to flows in either Blairmore or Gold Creek.

a) Present a WCO analysis on a weekly time step showing the current performance of the WCO i.e. without the proposed transfers and reserved allocation in place. Every year where data exists at Frank, present the percentage of time that WCO is not being met.

Response:

The three allocations that have been applied for (described in detail in Addendum 2, Appendix 1E, Section 3), include the following applications:

York Creek temporary transfer:

- This licence has the highest priority (Priority #1 – discussed in more detail in the response to SIR 208) of all water licences in the Crowsnest River System between Crowsnest Lake and the Oldman River Dam. The total volume requested for transfer is 250,400 m3 per year. This licence pre-dates any WCO objectives that were later adopted and is therefore, not subject to the WCO objective.
- The York Creek transfer will allow water to remain in the river for a longer time from the current location in York Creek (Addendum 2, Appendix 1E, Figure 1-1) to the confluence of Gold Creek with the Crowsnest River, an additional 7.4 km.

Devon Licence transfer:

- This licence has a priority of #3 in the Crowsnest River System between Crowsnest Lake and the Oldman River Dam. The total volume requested for transfer is

123,350 m^3 per year. This licence also pre-dates any WCO objectives that were later adopted and is therefore, not subject to the WCO objective.

- The Devon transfer will allow water to remain in the river for a longer time from the current location on the Crowsnest River (Addendum 2, Appendix 1E, Figure 1-1) to the confluence of Gold Creek with the Crowsnest River, an additional 16.5 km.
- The impact of these transfers result in more water staying in the river longer, which is positive to the environment and downstream users.

Industrial Reserve new allocation:

- This licence will be the newest allocation and will have the lowest priority (Priority #16) in the Crowsnest River System between Crowsnest Lake and the Oldman River Dam. The total volume requested for transfer is 185,025 m^3 per year. This licence will be subject to WCO objectives and will be the first licence to be shut down or restricted if the WCO objectives can't be met.
- This new licence can not have any impact on any new licensees or the WCO (either as the 45% of natural flow or as the IO plus 10%).

Since the two transfers are senior priorities and pre-date the WCO objectives, the WCO does not apply to them in the current location and form and therefore will not have any different effect on the WCO at Frank. The new licence will be subject to the WCO and since it will be the most junior licence above the Oldman Dam, will be the first to be shut down to achieve the WCO.

It is not productive to present an analysis of the naturalized flow without the requested transfers in place as the transferred licences are part of the calculated naturalized flows because they currently exist. The analysis of the flow before and after the transfers at Frank would be identical, or at the least present additional river flow due to the use of storage in the new location.

Since new licences are all subject to WCO being met, the new licence applied for can not have any impact on the WCO being met, just risk to the licence holder of being shut down. None of the licenses will have any impact on the WCO at Frank being met by being transferred or by new operations at Grassy Mountain. The potential impacts to Gold Creek, Blairmore Creek and the Crowsnest River are discussed in Addendum 2, Appendix 1E, Section 3.

b) Show the potential impact of each of the three allocations (separately) on the performance of the Crowsnest River WCO using weekly time steps. Show the potential impact of the three allocations combined, on the performance of the WCO using weekly time steps. Provide a conclusion on the potential impacts to the Crowsnest River due to all three allocations being requested.

Response:

See the response to SIR 207a.

In Addendum 2, Appendix 1E, Table 3.3-2 compared the total licenced water allocations in the Crowsnest River (CNR) watershed to the total average flows in the CNR, to evaluate the percent of water that could be taken out of the CNR compared to the total volume. This is an extremely conservative calculation, but at no time do the flows get close to the WCO (either as the 45% of natural flow or as the IO plus 10%). An example of this conservatism is one licence for the Allison Creek Fish Hatchery (Licence # 00032258-00-00 - SE-27-008-05-W5M) which has return flow of 5,063,518 m^3 in the CNR watershed. Table 3.3-2 has been reproduced as Table SIR 207-1, with the Allison Creek return flows removed. Using the new and less conservative assumptions, the maximum volume of water taken from the CNR was 11.6% at the Node 1 (Addendum 2, Appendix 1E, Figure 1-1) which is still extremely conservative. The Allison Creek allocation is actually located upstream of Node 1, and if the additional volume of water from the return flows were added to Node 1, the maximum percentage of water removed from Node 1 would be reduced to 0.1%.

Benga's conclusions remain the same as outlined in Addendum 2, Appendix 1E, Section 3, there will be no impact to the environment and to downstream users. It is very unlikely that the WCO objectives would be exceeded resulting in reduced allocations being available to junior licence holders. There have been no occasions where junior licences (or any licences) were required to stop or reduce withdrawals which supports the conclusion, since the Oldman Dam was operational in 1992.

Table 207-1 Crowsnest River -Flows Compared to Licenced Water Volumes (Less Allison Creek Return Flow)

Point of Measurement (shown on Figure 1-1)	Drainage Basin Area (km^2)	Avg. Annual Flows in Crowsnest River (m^3)	% of Total Licenced Volume to Volume in the Crowsnest River[1]	% of Total Licenced Volume Netting out Return Flow from Allison Creek [2]
Total Flow to 1	88.24	28,501,520	29.3%	11.6%
Total Flow to 2	283.73	91,644,790	9.1%	3.6%
Total Flow to 3	423.45	136,774,350	6.1%	2.4%

1 Total allocation in Crowsnest River (CNR) watershed - 8,359,926 m^3 (sourced from approval viewer in June 2016)
2 Return flow from Allison Creek Fish Hatchery (Licence # 00032258-00-00 - SE-27-008-05-W5M) alone is 5,063518 m^3 in the CNR watershed. Total volume of licenced allocation in CNR watershed minus Allison Creek is 5,063518 m^3. To make the flow comparison more realistic, the Allison Creek return flows have been removed, remaining allocation would be 3,296,409 m^3.

c) Propose IFN flows for both Gold and Blairmore Creek.

Response:

Addendum 1, Aquatic Ecology Consultant Report (CR#6), Appendix 3 provides an Instream Flow Assessment (IFA) to evaluate the potential for flow-related effects on westslope cutthroat trout (WSCT) and their habitat in Gold Creek and Blairmore Creek. Model predictions were made for baseline and all Project phases of hydraulic conditions important to WSCT (*i.e.*, stream depth, width, water velocity, substrate) and the Area Weighted Suitability (AWS) of habitat calculated by applying WSCT life-stage specific Habitat Suitability Curves to these hydraulic conditions. The intent of the IFA was to assess this potential impact of changes in flow not to provide an IFN number.

208. Addendum 2, Appendix 1E, Section 3.2, Page 6

Addendum 2, Appendix 1E, Table 3.3-1, Page 9

Addendum 2, Appendix 1E, Table 3.4-1, Page 15

Benga states that there are no users that maybe affected on either Gold or Blairmore Creek, however the statement that no user will be impacted downstream on the Crowsnest River is not well understood and further information and analysis is required to support this claim. Based on average flows in Gold and Blairmore creek, an impact of 5% reduction in Gold Creek and 8% higher flows in Blairmore indicate an overall reduction of volume of approximately 500,000 m3. Furthermore, the transferred allocations will have an impact due to increase in water usage/diverted. Benga's proposed water use from both transfers will be greater than water use previously reported by Devon or the Municipality of Crowsnest Pass under their licences at their original points of diversion.

a) Provide a map that clearly identifies and separates the location of the junior and senior licensees on Crowsnest River.

Response:

Figure 208-1 identifies the location of each licence on the Crowsnest River and identifies the priority of each licence as well. Table SIR 208-1 lists the current water licences between Crowsnest Lake and the Oldman River Dam. The dates of each licences (which are the priority) and some other details for each licence, including volume are provided. No public information was found to indicate actual current and past water use by any of the listed licences.

Table SIR 208-1 Surface Water Licences on Crowsnest River between Crowsnest Lake and Oldman River Dam

APPROVAL ID	PRIORITY [1]		LICENCE	POINT OF DIVERSION [2]	SOURCE [3]	VOLUME[4]	DIVERSION RATE [5]	TYPE	PURPOSE [6]
45622	1	1910-09-19-001	MUNICIPALITY OF CROWSNEST PASS	NW-34-007-04-5	York Creek	308,380	.105	SW	Municipal
44947	2	1924-02-05-001	ALBERTA INFRASTRUCTURE, CALGARY	SE-07-008-04-5	Crowsnest River	0		SW	Commercial
39493	3	1961-12-14-002	DEVON CANADA CORPORATION	NE-02-008-05-5	Crowsnest River	123,350	.017	SW	Industrial
35946	4	1978-09-11-001	MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9	NE-26-007-02-5	Crowsnest River	24,670	.015	SW	Municipal
35850	5	1980-11-27-002	MUNICIPALITY OF CROWSNEST PASS	SW-10-008-05-5	Crowsnest River	103,610	.019	SW	Municipal
35136	6	1981-05-26-001	GLEN GRAVEL (GLEN RANCHING LTD.)	NE-27-007-02-5	Crowsnest River	61,670	.03	SW	Commercial
35946	7	1983-08-23-001	MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9	NE-26-007-02-5	Crowsnest River	24,670	.015	SW	Municipal
29743	8	1985-03-26-001	WILLIAM & SHIRLEY SARA	NW-17-007-02-5	Crowsnest River	16,040	.014	SW	Irrigation
35946	9	1985-08-09-001	MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9	NE-26-007-02-5	Crowsnest River	49,340	.015	SW	Municipal
34586	10	1987-03-19-010	CERVO, EDWARD	NW-11-007-03-5	Crowsnest River	32,070	.027	SW	Irrigation
26653	11	1990-11-22-001	GREEN, LEONARD	SE-13-007-03-5	Crowsnest River	27,130	.018	SW	Irrigation
24892	12	1993-04-29-002	DARRYL & KATHY ALLSOP	SE-13-007-03-5	Crowsnest River	2,460	.009	SW	Irrigation
31356	13	1994-05-13-002	DUNN CREEK RESOURCES LTD.	SE-28-007-02-5	Crowsnest River	4,930	.006	SW	Commercial
156043	14	1999-01-28-002	CARMEN & NANCY RINKE	NW-20-007-02-5	Crowsnest River	8,641.98	.016	SW	Irrigation
212433	15	2003-12-18-003	DAVIS, JEFF	NW-21-007-03-5	Crowsnest River	1,036.06	.001	SW	Management of Fish

NOTES:

(1) Priority - first in time first in right, based on the date of a complete application (YYYY-MM-DD-00X); e.g. 1958-11-03-001 = 1958(year), 11(month), 03(day), 001(database generated)

(2) Point of Diversion - the legal land location of the works; e.g. 12 or NE 08-007-06-4 = 12 or NE (legal subdivision and/or quarter section), 08 (section), 007(township), 06(range), 4(meridian)

(3) Source - Refer to the licence document for the approved source

(4) Volume - maximum annual quantity that may be diverted; units are in cubic metres

(5) Diversion Rate - maximum instantaneous diversion rate; units for surface water diversion rate are cubic metres/second; units for an aquifer diversion rate are cubic metres/day

(6) Purpose - purposes are grouped into a classification system within a database. Refer to the licence document for approved purpose

Total volume of allocations - 787,998 cubic metres

Total volume of allocations minus licence transfers to Benga - 356,268 cubic metres

b) Discuss how changes in flow in Blairmore and Gold Creeks will affect junior licensees downstream on the Crowsnest River. Include in your response the increase in probability, as applicable, of junior licensees not able to divert (due to WCO/IO not being met).

Response:

The flows in Blairmore Creek are predicted to increase by 8% and flows in Gold Creek are predicted to decrease by 5%. These changes were calculated after the water supply volumes and *Water Act* Licence applications for the project were incorporated. There will be more water in the Crowsnest River from Blairmore Creek to Gold Creek as a result of this. This will benefit downstream users regardless of priority. The two transfers that have been applied for will also keep water in the CNR longer as described in detail in Addendum 2, Appendix 1E, Section 3. Any licensee is entitled to make a priority call if the IO listed on their license prevents them from diverting water. Junior licences downstream from the new licence applied for by Benga will be able to make a call on Benga's new licence and therefore will not be affected. Some of the details include:

- York Creek temporary transfer – this licence has the highest priority (Priority #1) of all water licences in the Crowsnest River System between Crowsnest Lake and the Oldman River Dam. The total volume requested for transfer is 250,400 m^3 per year. The York Creek transfer will allow water to remain in the system from the current location in York Creek (Addendum 2, Appendix 1E, Figure 1-1) to the confluence of Gold Creek with the Crowsnest River, an additional 7.4 km. In Addendum 2, Appendix 1E, Table 3.4-1, impacts to downstream users and the environment were presented based on the proposed transfer of the York Creek licence. The Municipality of Crowsnest is the current holder of the licence and has shown in its assessment of good standing that they are, or can be, fully capable of making full use of their licence if it remains where it is without the temporary transfer and will make full use of the licence when it reverts to their use in 25 years. The temporary transfer in itself has no effect on water availability downstream.
- Devon Licence transfer – this licence has a priority of #3 in the Crowsnest River System between Crowsnest Lake and the Oldman River Dam. The total volume requested for transfer is 123,350 m^3 per year. The Devon transfer will allow water to remain in the system from the current location on the Crowsnest River (Addendum 2, Appendix 1E, Figure 1-1) to the confluence of Gold Creek with the Crowsnest River, an additional 16.5 km. In Table 3.3-1, impacts to downstream users and the environment were presented based on the proposed transfer of the Devon licence. The Devon licence was shown in its good standing assessment to be capable of diverting its full diversion rate and volume at the time of the application for transfer. Although Devon had not historically used its full allocation, it was possible at any time for it to do so, and therefore downstream licencees should have been prepared for that to occur and were aware of that potential at the time they applied for their licences. The transfer of the Devon licence does not represent any additional risk to downstream licensees.

More water will remain in the CNR longer and will benefit downstream users because Benga will use water storage ponds where Devon had no storage and used water directly from the Crowsnest River even during the lowest flows when it was most critical for other licensees to meet IO flows.

There are 15 existing licences on the mainstem of the CNR. The locations and priorities are shown on Figure 208-1 and listed on Table SIR 208-1. The priority system was created and allows for a "first in time, first in right". As such, the senior, highest priority licences will be allowed to with draw water before junior licences in times of water shortages. The system was created to allow this and all licencees are aware of this. The junior licences were always at risk when the Devon and York Creek licences were at their original locations because both licences were in good standing and capable of fully utilizing their allocations at any time, thus juniors downstream should have been prepared operationally in any year to expect the same flow at their diversion points as will occur with the transfers in place, or are better off due to the storage at Grassy that is available in low stream flow periods. There have been no occasions where junior licences (or any licences) were required to stop or reduce withdrawals since the Oldman Dam was operational.

Operationally, Benga will capture water from the site during high flow/runoff period and will store this water in ponds for use for the project. Water will be released regularly when water quality is acceptable. Capture water and store it during periods of high precipitation will reduce the need to remove water from the system during lower flow periods.

c) Discuss how changes in flow in Blairmore and Gold Creeks will affect senior licensees downstream on the Crowsnest River. Include in your response, the increase in probability, as applicable, of senior licensees with WCO or IO conditions calling priority.

Response:

See response SIR 208b.

D.2.3. TRANSFERS MISCELLANEOUS/GENERAL

209. Addendum 2, Appendix 1E, Section 3.4, Page 13

Benga provided some information on the dam on York Creek operated by the Municipality of Crowsnest Pass, from where a temporary transfer is considered. There is no information as to how this dam will change operations to reflect the temporary transfer and the reduced allocation that will remain in York Creek, for the Municipality's use.

a) Discuss how the dam on York Creek will be operated while the temporary transfer to Benga is in place. Include in your response low flow scenarios.

Response:

The dam on York Creek will be operated to allow the reservoir to fill in spring runoff and discharge naturally with water flowing past the spillway into York Creek. The dam will not be operated to release water to an intake downstream to deliver water for the use of the municipality for snowmaking and golf course irrigation. Instead the water that passes the reservoir will be allowed to run down York Creek to the Crowsnest River and past the mouth of both Blairmore and Gold Creeks. During this time, the upper drainages of Blairmore and Gold creeks are flowing and filling the on-site storage ponds. Essentially collecting and storing water during periods when others don't need it.

Special operating measures are not planned for York Creek as the licence has the highest priority on the CNR from Crowsnest Lake to the Oldman Dam, which fits with the intent of "first in time, first in right."

210. Addendum 2, Appendix 1E

Benga did not provide a Water Shortage Response Plan (WSRP) with respect to the licence and transfer applications in consideration. Applications for transfer and new allocations in the South Saskatchewan River Basin should include a WSRP which ensures the applicant is aware of the risk of water shortages to their operation and is able to cope with water shortages. In Benga's case, since surface water is being collected on site, Benga may need to respond to water shortages by releasing water.

a) Provide a water shortage response plan. The plan must include risk to other users (junior and senior) along with appropriate response strategies in water shortage periods.

Response:

Water from surface runoff from snowmelt and precipitation on Grassy Mountain will be captured in storage ponds. During water shortage periods, it is unlikely there will be any surface runoff flowing into the storage ponds. Only flowing water that would naturally reach the active flow of Blairmore or Gold Creeks at the time of need by senior licensees is subject to a priority call downstream on the Crowsnest River. Water stored from a previous runoff period by a licencee is not subject to a priority call.

Benga will monitor active flows into its storage ponds and be able to release up to the same flow rate into either Blairmore or Gold creeks for the new and most junior licence, during a priority call from downstream on the Crowsnest River. If there is any active flow into storage, releases can be made of up to the diversion rate and unused volume from the new licence at the time of the priority call. Similarly, if the WCO restrictions on the new licence require that licence to cease diverting from natural flow, diversion will stop and flows will be released into Blairmore or Gold creeks.

The transferred water allocations are senior and are not subject to priority calls where they are currently located, or at the new location, and will have even less effect on other licencees or the environment at the new location due to storage and the more downstream diversion points.

There are 15 existing licences on the mainstem of the CNR between Crowsnest Lake and the Oldman Dam. The locations and priorities are discussed in detail in the response to SIR 208 and are shown on Figure 208-1. The priority system was created and allows for a "first in time, first in right". As such the senior, highest priority licences will be allowed to with draw water before junior licences in times of water shortages. The system was created to allow this and all licencees are aware of this. If periods of water shortage occur, Benga proposes the following water shortage response plans for each of the three licences under application:

1. York Creek temporary transfer

This licence has the highest priority (Priority #1) of all water licences in the Crowsnest River System between Crowsnest Lake and the Oldman River Dam. The total volume requested for transfer is 250,400 m^3 per year. In the event of a water shortage in the Crowsnest River, this licence would be the very last one that would be subject to withdrawal restrictions.

Risk to others:

- There are 14 more junior licences (Table SIR 208-1, Figure 208-1) that are at risk of reduction of withdrawals from the Crowsnest River during water shortage periods.
- The risk is very low to Benga this licence would be subject to restrictions.

Response strategies:

- Benga plans to impound and store water on site to use for the project. This will usually be done during periods of high precipitation and runoff when excess water is captured and downstream users do not need it.
- If low flow or water shortage periods occur, Benga will be able to use the water stored on site for the operations.
- At some point after mining operations commence, Benga may seek a reliable supply of "true groundwater" to mitigate periods of water shortages.
- During extreme water shortages, Benga could reduce production to reduce water use requirements; the more the shortage, the more the reduction in production.

2. Devon Licence transfer

This licence has a priority of #3 in the Crowsnest River System between Crowsnest Lake and the Oldman River Dam. The total volume requested for transfer is 123,350 m^3 per year. The licence with priority #2 does not have access to any allocation which effectively means it's not an active licence. In the event of a water shortage in the Crowsnest River, the Devon transfer would only be behind the York Creek temporary transfer in terms of priority and subject to remote withdrawal restrictions.

Risk to others:

- There are 12 more junior licences (Table SIR 208-1, Figure 208-1) that are at risk of reduction of withdrawals from the Crowsnest River during water shortage periods.
- Only the York Creek temporary transfer has a higher priority, which will also be managed by Benga so risks of restrictions are also reduced.

- The risk is very low to Benga this licence would be subject to restrictions.

Response strategies:

- Benga plans to impound and store water on site to use for the project. This will usually be done during periods of high precipitation and runoff when excess water is captured and downstream users do not need it.
- If low flow or water shortage periods occur, Benga will be able to use the water stored on site for the operations.
- At some point after mining operations commence, Benga may seek a reliable supply of “true groundwater” to mitigate periods of water shortages.
- During extreme water shortages, Benga could reduce production to reduce water use requirements; the more the shortage, the more the reduction in production.

3. Industrial Reserve new allocation

This licence will be the newest allocation and will have the lowest priority (Priority #16) in the Crowsnest River System between Crowsnest Lake and the Oldman River Dam. The total volume requested for transfer is 185,025 m^3 per year. In the event of a water shortage in the Crowsnest River, this new licence would have the lowest priority and would be subject to the first wave of withdrawal restrictions.

Risk to others:

- There are 15 more senior licences (Table SIR 208-1, Figure 208-1) that would have a lower risk of withdrawals from the Crowsnest River being interrupted during water shortage periods.
- The risk to Benga is highest with this licence and could be subject to restrictions during water shortage periods.

Response strategies:

- Benga plans to impound and store water on site to use for the project. This will usually be done during periods of high precipitation and runoff when excess water is captured and downstream users do not need it.
- If low flow or water shortage periods occur, Benga will be able to use the water stored on site for the operations.
- At some point after mining operations commence, Benga may seek a reliable supply of “true groundwater” to mitigate periods of water shortages.
- During extreme water shortages, Benga could reduce production by approximately 33% to reduce water use by the amount provided by this new licence, if the entire licence was restricted.

211. Addendum 2, Appendix 1E, Table 3.3-1, Page 9

Addendum 2, Appendix 1E, Table 3.4-1, Page 15

Under section 11(3) (a) and 82 (5) of the *Water Act*, an Approved Water Management Plan identifies the matters and factors that must be considered by the designated Director in making a decision on an application for a water allocation transfer. The matters and factors that must be considered in the South Saskatchewan River Basin (SSRB) are listed in the Approved Water Management Plan for SSRB.

Although Benga provides a summary of impacts on downstream users and impacts to the environment due to the proposed transfers in Table 3.3-1 and 3.4-1, the review must include a consideration of all the matters and factors listed in the Approved Water Management Plan.

a) Describe the impacts of the proposed transfers in terms of the matters and factors listed in the Approved Water Management Plan for the SSRB.

Response:

Table SIR 211-1 provides the information of the proposed transfers in terms of the matters and factors listed in the Approved Water Management Plan for the SSRB (was Table 1 on page 14 extracted from Approved Water Management Plan for the South Saskatchewan River Basin (Alberta).

Table SIR 211-2 provides the information of the proposed new licences in terms of the matters and factors listed in the Approved Water Management Plan for the SSRB (was Table 2 on page 15 extracted from Approved Water Management Plan for the South Saskatchewan River Basin (Alberta).

Table SIR 211-1 Matters and Factors Information for Licence Transfers for York Creek and Devon Licence

Matters and Factors	Guidelines	York Creek Licence No. 45622 and Devon Licence No. 39493
Existing, potential and cumulative effects on the aquatic environment.	No significant adverse effect on the aquatic environment	• There are no significant adverse effects on the aquatic Environment. The diversion of water will not occur in a watercourse, storage will be used to avoid diversions in low flow periods and IOs of 85% of the natural flow of Blairmore Creek and Gold Creek will be maintained.
Existing, potential and cumulative effects on any applicable instream objective and/or WCO	No significant adverse effect on existing instream objectives and/or Water Conservation Objectives	• There is no significant adverse effect on existing instream objectives and/or Water Conservation Objectives (WCO). Instream flows (WCO) for the new application will be respected and licences transferred from upstream locations will travel longer in the York Creek and Crowsnest River than they did before the project providing additional instream flow.
Efficiency of use	Industry standards and best practices.	• Benga has incorporated an efficient system to ensure maximum recycle and minimum use of water in this state of the art wash plant. • Water will be captured in storage ponds and recycled.
Net Diversion (See Definition)	Quality and timing of return flow should be benign or beneficial for environment Only net use portion of the allocation is transferable, unless new user has a net consumption operation.	• There will be no return flow to the environment, all water will be recycled in onsite storage ponds. • The transferred licences are currently identified as fully consumptive use and will continue to be managed as fully consumptive. When the York Creek licence reverts to the municipality in 25 years the portion used for snowmaking will return water to the Crowsnest River in the spring snowmelt period.
Existing, potential and cumulative hydraulic, hydrological and hydrogeological effects		• See consultant reports CR #4 – Hydrology and CR #3 - Hydrogeology

Table SIR 211-1 Matters and Factors Information for Licence Transfers for York Creek and Devon Licence

Matters and Factors	Guidelines	York Creek Licence No. 45622 and Devon Licence No. 39493
Existing, potential and cumulative effects on household users, traditional agriculture users and other higher and lower priority licensees	From the *Water Act,* Section 82(3)(b): *the transfer of the allocation, in the opinion of the Director, does not impair the exercise of rights of any household user, traditional agriculture user or other licensee other than the household user, traditional agriculture user or other licensee who has agreed in writing that the transfer of the allocation may take place*	• The transfer of the Devon and York Creek licences will not impair any other persons rights. Both licences are currently fully consumptive and located upstream of the new diversion location so the allocations can flow downstream from their current locations, improving the current condition. • There are no other licensees on the Blairmore or Gold creeks, and livestock and household water users needs will be met.
With respect to irrigation, the suitability of the land to which the allocation of water is to be transferred for irrigated agriculture	The land must be suitable for irrigated agriculture: Class 4 or better in accordance with the standards of Alberta Agriculture, Food and Rural Development	• no irrigation will take place in this project
The historic volume, rate and timing of the diversion under the original and proposed licence		• The timing of the transferred allocations will be similar to the original licence, however tend toward capturing more water in the early spring when it is more likely available. • The rate of diversion will not exceed the original licence as diverted from the storage ponds. The rate water is captured in storage may be greater only when spring runoff produces surplus flows. • The volume will not exceed the original licenced volume. Both transferred licences were active and capable of diverting the full volume of the licences, although not reported to use the full volume recently they are identified as “in good standing”. The transfer applications have demonstrated that full volume use could have been achieved prior to transfer if required as infrastructure that could use the allocations was in place.

Table SIR 211-1 Matters and Factors Information for Licence Transfers for York Creek and Devon Licence

Matters and Factors	Guidelines	York Creek Licence No. 45622 and Devon Licence No. 39493
Location of the existing diversion and the proposed new diversion		• The Devon licence is located 11 km upstream of the new location on the Crowsnest River. • The York Creek licence is located on an upstream tributary of the Crowsnest River, joining the River 1.9 km upstream of the new location. • The new location is off stream storage, capturing the runoff into Blairmore Creek and Gold Creek before it enters the Crowsnest River where the transferred licenced allocations will be available.
Water quality (including public health and safety and assimilative capacity)	No significant adverse effect on public health and safety. No significant adverse effect on assimilative capacity	• There is no return flow other than recycled water into the onsite storages. Diversion of water into the storages will not reduce the flow of Blairmore or Gold Creeks below the WCO which is protective of water quality in the streams.
Linkages between surface and ground water and the effects or changes in overall water use	No significant adverse effect on groundwater quantity or quality	• The transfers will have a positive effect on the Crowsnest River, adjacent aquifers and other water users as the allocation diversions are moved towards spring runoff periods and the use of water storages and recycled water.
Existing, potential and cumulative effects on the operation of reservoirs or other water infrastructure	No significant adverse effect on operations unless the reservoir or infrastructure licensee agrees it is feasible to adjust operations to mitigate effects	• there will be no effects on operation of any reservoirs or other water infrastructure. Any diversion structures on the Crowsnest River will see flows either the same as before or, above the Gold creek confluence, slightly higher than under the full use of the existing water licences
Master Agreement on Apportionment (Alberta's commitments to Saskatchewan)	The terms of the *Apportionment Agreement* will be respected	• There will be no effect on the Master Agreement commitments; the licences being transferred already exist in the same river basin.
First Nation Rights and Traditional Uses	Government of Alberta First Nation consultation policies and guidelines on Land Management and Resource Development Agreements with First Nations.	• Benga has an approved First Nation consultation plan with the Aboriginal Consultation office (ACO) and has included discussions about water licences and water use • Benga has an agreement with the Piikani First Nation

Table SIR 211-2 Matters and Factors Information for the New Licence from the SSRB Industrial Reserve

Matters and Factors	Guidelines	SSRB Industrial Reserve New Licence
Existing, potential and cumulative effects on the aquatic environment.	No significant adverse effect on the aquatic environment	• There is no significant adverse effect on the aquatic environment in Blairmore or Gold creeks. The flows in both creeks will not be reduced below the WCO for those streams, or impair the use for household purposes in the area. The Water Conservation Objective in the Crowsnest River upstream of the Oldman Reservoir of 45% is being met and will not be impaired by this application.
Existing, potential and cumulative effects on any applicable instream objective and/or WCO	No significant adverse effect on existing instream objectives and/or Water Conservation Objectives	• The new licence will be subject to conditions to cease diverting when WCO is not met.
Efficiency of use	Industry standards and best practices.	• Benga has incorporated an efficient system to ensure maximum recycle and minimum use of water in this state of the art wash plant. • Water will be captured in storage ponds and recycled.
Net Diversion (See Definition)	Likely an amendment Existing allocation does not increase Quality and timing of return flow should be benign or beneficial for environment	• This is not an application for a net diversion volume. The new allocation is for a total volume of water (185,025 m^3) diverted into the storage ponds. The storage ponds will also be able to contain the water transfer volumes as well.
Existing, potential and cumulative hydraulic, hydrological and hydrogeological effects	No significant adverse effect	• See consultant reports CR #4 – Hydrology and CR #3 - Hydrogeology
With respect to irrigation, the suitability of the land for irrigated agriculture	The land must be suitable for irrigated agriculture: Class 4 or better in accordance with the standards of Alberta Agriculture, Food and Rural Development	• no irrigation is applied for
Existing, potential, and cumulative effects on the operation of reservoirs or other water infrastructure	No significant adverse effect on operations unless the reservoir or infrastructure licensee agrees it is feasible to adjust operations to mitigate effects	• No significant adverse effect on operations, most of the water will be diverted during spring runoff and the rest of the time water use will be from on site storage ponds.
First Nation Rights and Traditional Uses	Government of Alberta First Nation Consultation Policies and guidelines on Land Management and Resource Development. Agreements with First Nations.	• Benga has an approved First Nation consultation plan with the Aboriginal Consultation office (ACO) and has included discussions about water licences and water use • Benga has an agreement with the Piikani First Nation

D.2.4. GROUNDWATER POTABLE WATER SUPPLY

212. Volume 1, Section A, Page A-65

Benga states, "…Option 3 (use of an onsite construction camp plus the use of off-site accommodations) is the best option for the project."

Although Benga's "Option 3" appears feasible, there are no details on the source of water supply for the anticipated work camp (~ 288 workers). Typically, the source of water would consist of a potable water supply well, drilled and completed in close proximity to the camp location. A pumping test(s) and aquifer impact assessment must be completed and submitted in support of a Water Act application to divert and use groundwater for work camp purposes.

a) Provide an impact assessment for the potable water supply well(s). Include in the response drilling schedule, completion, and sustainable yield.

Response:

Please see Section C.6.17 where the water supply for the camp is described as below:

Construction camp potable water will include two local 63,000-litre potable water storage tanks. This allows for approximately one and a half days of potable water storage for the construction camp based on an estimated daily usage of 225 litres per day per person at the maximum camp size of 360 beds. These tanks will be remotely filled by a potable water supplier.

b) The EIA report (hydrogeology) concludes all groundwater flow within the mine pit is hydraulically connected to surface water (Blairmore, Gold and Daisy Creeks). Clarify whether the groundwater supply proposed for the work camp is hydraulically connected to surface water.

Response:

As per response SIR 212a, this is not applicable.

c) Submit a Water Act licence application to divert and use groundwater for work camp purposes. If the groundwater source is hydraulically connected to surface water, the Bow, Oldman and South Saskatchewan River Basin Water Allocation Order (Alberta Regulation No. 171/2007) applies.

Response:

As per response SIR 212a, this is not applicable.

E. PUBLIC LAND ACT (PLA)

213. Addendum #3, November 9, 2017

Benga submitted an addendum to update the Public Lands Application documents. The application forms were not technically complete for review.

a) Provide a complete Environmental Field Report (EFR) for MSL160757, MSL160758, LOC160841, and LOC160842.

Response:

The Environmental Field Reports (EFRs) provided in the November 9, 2017 *Addendum #3 to August 12, 2016 Technical Application and Environmental Impact Assessment – Public Lands Act Application Addendum* report (Addendum #3), remain unchanged from the October 1, 2016 Public Lands Application submission. The EFR cover documents and associated supplements for MSL160757, MSL160758, LOC160841, and LOC160842 have been provided as pages 80-95, 208-229, 184-196, and 157-171 of Addendum #3, respectively.

b) Provide a completed EFR Supplement A for LOC160841 and LOC160842.

Response:

EFR Supplement A forms for LOC160841 and LOC160842 are provided in Appendix E-1.

F. ERRATA

214. Volume 1, Section E.3.3.2 – Effects of Mine Waste Rock on Groundwater Quality, Page E-60

Volume 4, Section 5.4.2.2.2 – Potential Effects to Water Wells, Page 50

In Volume 4, Benga states, "The presence of the underground mines directly downgradient from the pit has the potential to act as a conduit for groundwater flow, decreasing the travel time between the pit and the Crowsnest River Valley."

b) Clarify if the presence of historic underground mine workings of karst features has a potential to increase or decrease travel time to reaching groundwater users;

Response:

In Section E, Section 5.4.2.2.2 regarding "potential effects to water wells", the hypothesis tested was whether the presence of historic underground mine workings or potential karst features could decrease groundwater travel time to reach groundwater users (and therefore increase the risk of impacts). This was incorrectly stated in the report in Section 5.4.2.1.

The following correction from Section 5.4.2.1 is noted "If groundwater impacted by the Project were to find a pathway into the known historical underground mine workings or potential karst features, the travel times would likely be decreased from the current situation of decades to weeks, months or years, increasing the risk of impacted water from reaching the groundwater users."

c) Clarify the statement relating the karst features and historic underground workings in reducing the risk of impact to the known groundwater users; and

Response:

Potential karst features and historic underground workings have the potential to increase the risk of impact to the known groundwater users by reducing the duration of groundwater travel time from the pit to groundwater users. Results from the assessment determined that these features, if present, do not appear to pose a risk to known groundwater users.

The sentence "*The presence of the underground mines directly downgradient from the pit has the potential to act as a conduit for groundwater flow, decreasing the travel time between the pit and the Crowsnest River Valley*" was the conclusion of a paragraph outlining the general setting between the mine and the water wells. The sentence was immediately followed by a paragraph explaining how this assumption was assessed using particle tracking in the groundwater numerical modelling with the observation that "*Groundwater flow direction and particle path tracking indicates that groundwater potentially impacted from mining operations will not travel from north to south through hypothetical karstic features or the existing underground mine*". This results from the presence of a groundwater divide in this area. The conclusion of the assessment was that "*There is no apparent ability for impacted groundwater to travel southwards towards the Crowsnest River valley where the municipal water wells utilize the alluvial aquifer*".

i. Clarify if the statement in respect to reducing the impact potential is based on the analysis of the preferential flow pattern in Volume 4, page 51.

Response:

The assessment to estimate the potential effects to water wells was based on the analysis of the groundwater flow pattern, and specifically using particle tracking in the numerical model. Both groundwater flow direction and particle path were reviewed for the assessment.

215. Section F.3.2.4, Page F-60, Figure F.3.2-1

Benga states, "Foothills rough fescue dominant communities occupy 3.4 ha of pre-disturbance landscape, grassland communities where foothills rough fescue is a sub-dominant component occupy approximately 18.2 ha, and open forest grassland ecological units which have foothills rough fescue as a component of the ecological unit contain 36.3 ha, as identified in Table F.3.2-2 and as shown in Figure F.3.2-1."

The referenced figure does not show the spatial distribution of fescue containing communities.

a) Update Figure 3.2-1 to show the spatial distribution of fescue containing communities.

Response:

The spatial distribution of the fescue containing communities are provided on Section F, Figure F.3.2 2. Section F.3.2.4 accidentally references Figure F.3.2 1 but should reference Figure F.3.2 2. Further details on the fescue communities, including this same figure, are provided in the vegetation assessment (Consultant Report #8), Section 3.3.2 and Figure 3.2 4.

216. Section F.4.1, Page F-860

In Section F.1.1, Benga states that the total footprint for the project is 1520.ha. In section F.4.1, Benga has indicated that the total disturbance will be 1522.3 ha.

d) Clarify this discrepancy.

Response:

The discrepancy is due to a typing error that was made in Section F, Section F.4.1, which indicated that the total disturbance of the Project is estimated to be 1,522.3 ha. The correct value of total disturbance is 1,520.7 ha, which was used correctly throughout the remainder of Section F, including in Table F.4.1 1. The value 1,520.7 ha is also consistent with the total Project disturbance identified in Section A and other sections and assessments of the application.

217. Volume 2, Section H.5.1 Siksika Nation Overview, Page H-104

Benga states that On April 10, 2015, Siksika Nation filed a SOC, to which Benga responded on April 14, 2015. In the days following, Benga and Siksika Nation discussed the issues surrounding the SOC by email, teleconference, and in an in-person meeting, and on April 28, 2014, Siksika Nation advised Benga that the SOC had been withdrawn.

There is an error in the dates, as the SOC could not have been withdrawn in 2014 if it was filed in 2015.

e) Revise appropriately.

Response:

The discrepancy is due to a typing error that was made in Section H, Section H.5.1. The following modification (**in bold**) should be made:

On April 10, 2015, Siksika Nation filed a SOC, to which Benga responded on April 14, 2015. In the days following, Benga and Siksika Nation discussed the issues surrounding the SOC by email, teleconference, and in an in person meeting, and on April 28, ***2015****, Siksika Nation advised Benga that the SOC had been withdrawn.*

218. Volume 2, Section H.3.1, Kainai Nation Overview, Page H-17

Treaty 7 Management Corporation no longer exists.

f) Revise appropriately.

Response:

Section H.3.1 should be revised to reflect the change by removing the opening sentence "*Kainai Nation is a member nation of the Treaty 7 Management Corporation which acts as a tribal council for Treaty 7 First Nations including Siksika Nation, Piikani Nation, Tsuu T'ina Nation, and Stoney Nakoda Nation.*" The following modification to Section H.3.1 should be made:

H.3.1 Overview

Siksika Nation, Piikani Nation, and Kainai Nation share a common culture and language known as Blackfoot. The Kainai Nation traditional territory is located in southern Alberta and includes Crowsnest Pass and surrounding areas (Figure H.3.1-1). There are two reserves and the main community is located on the reserve called Blood 148. The proximity of Kainai Nation reserves in relation to the Project is summarized in Table H.3.1-1.

219. Volume 2, Section H.4.1, Piikani Nation Overview, Page H-58

Treaty 7 Management Corporation no longer exists.

g) Revise appropriately.

Response:

Section H.4.1 should be revised to reflect the change by removing the opening sentence "*Piikani Nation is a member nation of the Treaty 7 Management Corporation which acts as a tribal council for Treaty 7 First Nations including Siksika Nation, Kainai Nation, Tsuu T'ina Nation, and Stoney Nakoda Nation.*" The following modification to Section H.4.1 should be made:

H.4.1 Overview

Several Treaty 7 First Nations share a common culture and language known as Blackfoot. The Piikani Nation traditional territory is located in southern Alberta and includes Crowsnest Pass and surrounding areas (Figure H.4.1-1). There are two reserves and the town site is located at the main reserve called Piikani (Piikani Nation, 2015a). The proximity of Piikani Nation reserves in relation to the Project is summarized in Table H.4.1-1.

220. Volume 2, Section H.5.1, Siksika Nation Overview, Page H-101

Treaty 7 Management Corporation no longer exists.

h) Revise appropriately.

Response:

Section H.5.1 should be revised to reflect the change by removing the opening sentence "*Siksika Nation is a member nation of the Treaty 7 Management Corporation which acts as a tribal council for Treaty 7 First Nations including Piikani Nation, Blood Tribe (Kainai Nation), Tsuu T'ina Nation, and Stoney Nakoda Nation.*" The following modification to Section H.5.1 should be made:

H.5.1 Overview

Several Treaty 7 First Nations share a common culture and language known as Blackfoot. The Siksika Nation traditional territory is located in southern Alberta and includes Crowsnest Pass and surrounding areas (Figure H.5.1-1). The proximity of the Siksika Nation reserve in relation to the Project is summarized in Table H.5.1-1.

221. Volume 2, Section H.6.1, Stoney Nakota Nation Overview, Page H-138

Treaty 7 Management Corporation no longer exists.

i) Revise appropriately.

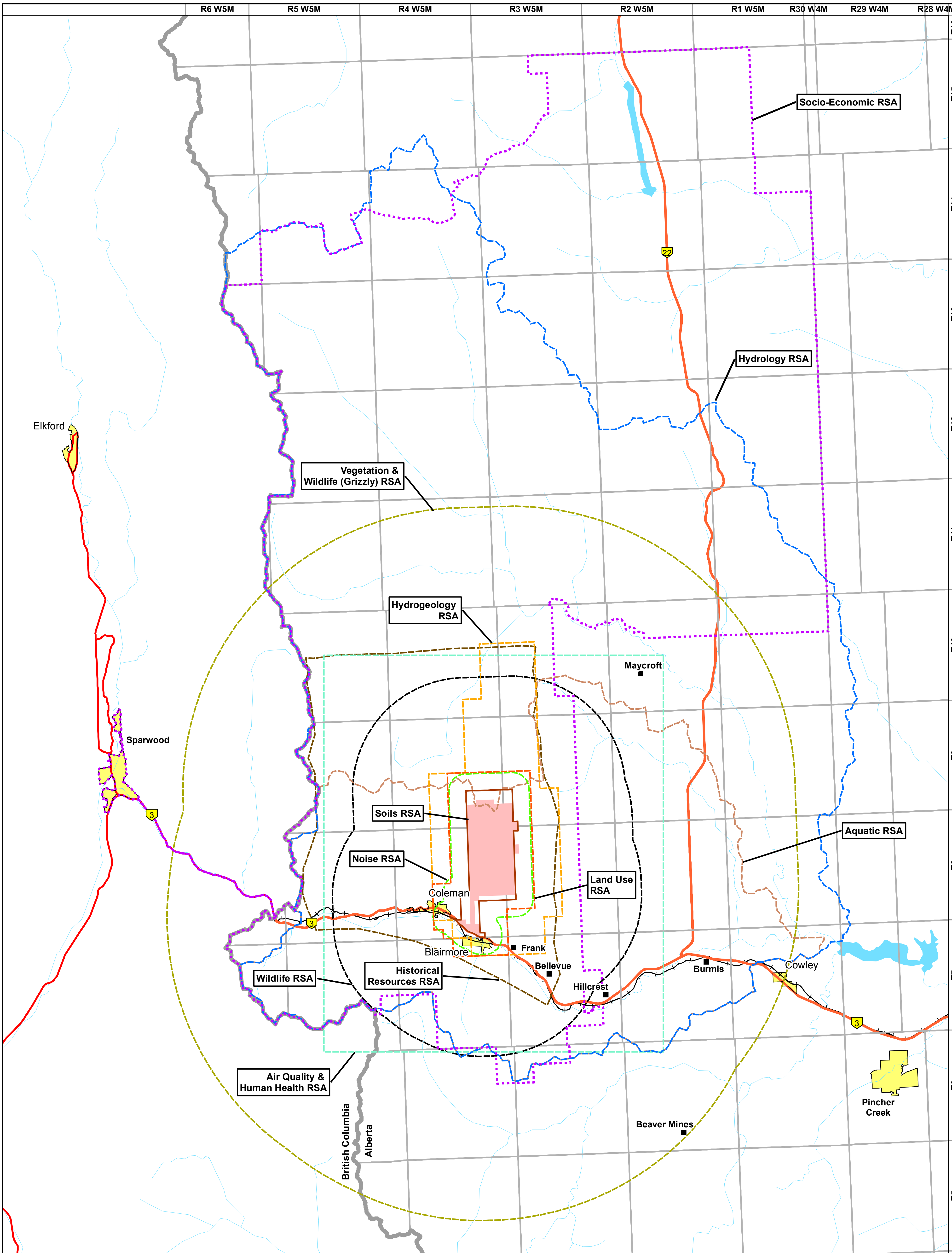
Response:

Section H.6.1 should be revised to reflect the change by removing the opening sentence "*Stoney Nakoda Nation is a member nation of the Treaty 7 Management Corporation, which acts as a tribal council for Treaty 7 First Nations including Siksika Nation, Blood Tribe (Kainai Nation), Tsuu T'ina Nation, and Piikani Nation.*" The following modification to Section H.6.1 should be made:

H.6.1 Overview

The Stoney Nakoda Nation traditional territory is located in southern Alberta and includes Crowsnest Pass and surrounding areas (Figure H.6.1 1). The Stoney Nakoda Nation population is located in three communities – Eden Valley, Big Horn reserve and Morley (RMN 2015). The proximity of Stoney Nakoda Nation reserves in relation to the Project is summarized in Table H.6.1 1.

Figures



Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIRS\AER\Fig 51-1 Regional Study Areas 14-00201.mxd

LEGEND

- Proposed Mine Permit Boundary
- Soils RSA
- Land Use RSA
- Hydrology RSA
- Noise RSA
- Air Quality & Human Health RSA
- Hydrogeology RSA
- Aquatic RSA
- Wildlife RSA
- Vegetation & Wildlife (Grizzly) RSA
- Historical Resources RSA
- Socio-Economic RSA Boundary

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

PROJECT REGIONAL STUDY AREA (RSA) BOUNDARIES

AltaLIS, 2018; NRCAN, 2015; MEMS, 2018; Riversdale, 2016

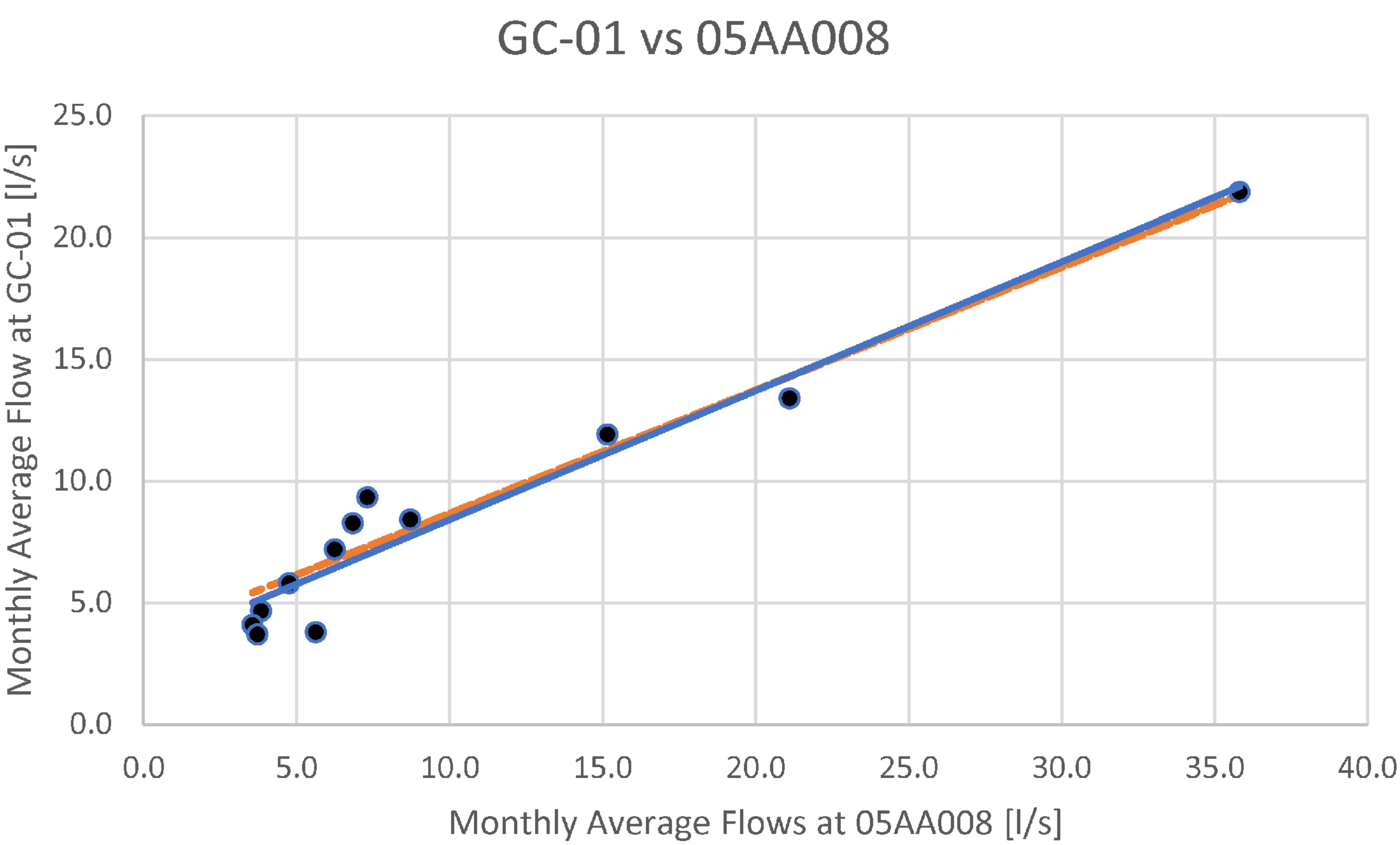
Projection/Datum: UTM Zone 11 Nad 83

0 10 20
Kilometres

MILLENNIUM EMS Solutions Ltd.

PROJECT: 14-00201
DRAWN BY: JL
CHECKED BY: CH
DATE: FEBRUARY 26, 2018

FIGURE
51-1
Update to Figure D.2.4-2



Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIRS\AER\Fig 83-1 Monthly Avergae Flow GC-01 and 05AA008 14-00201.mxd

LEGEND

Report — Linear (Update)

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

RELATIONSHIP BETWEEN MONTHLY AVERAGE FLOW AT GC-01 AND 05AA008

MILLENNIUM EMS Solutions Ltd.

PROJECT: 14-00201

DRAWN BY: JL

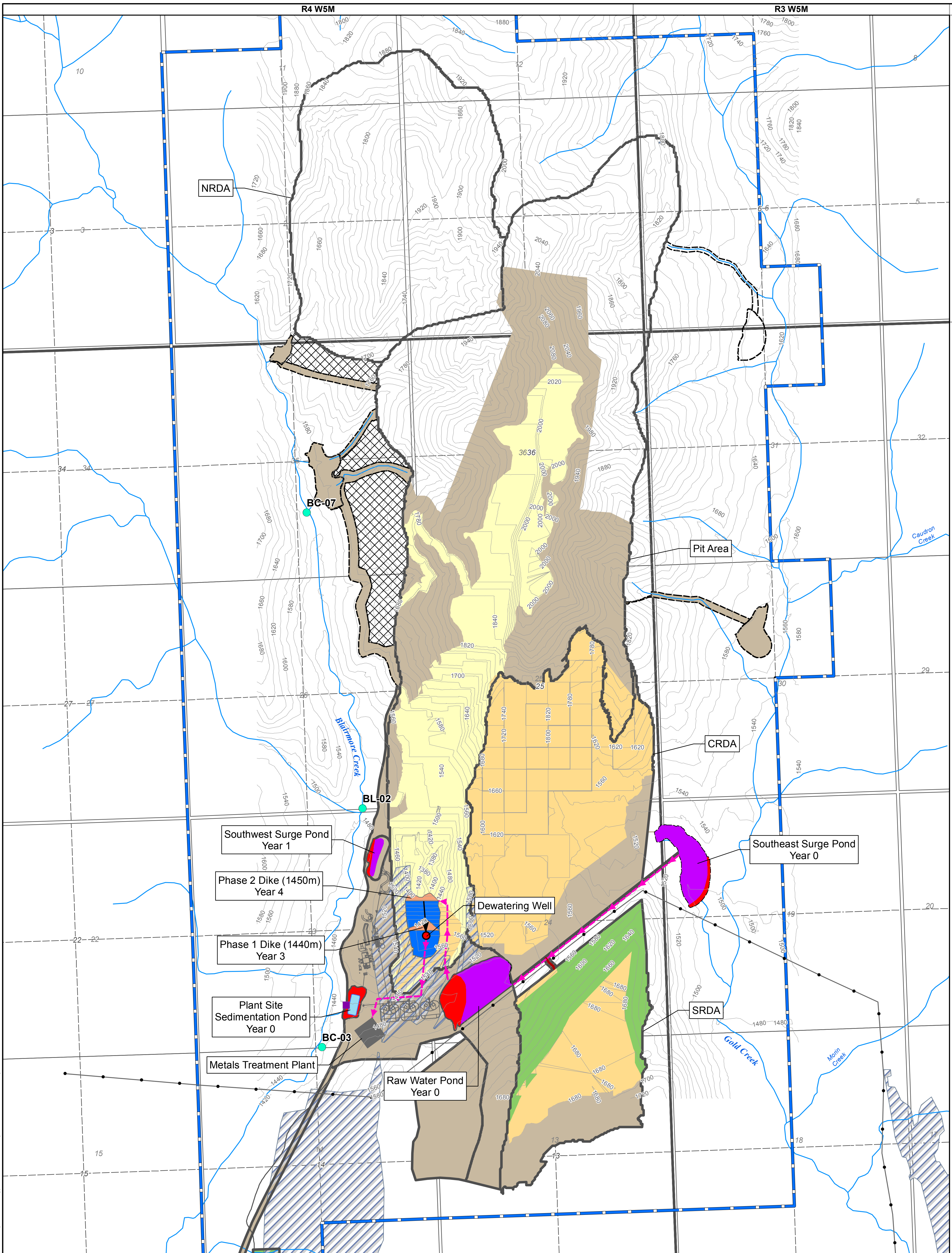
CHECKED BY: CH

DATE: FEBRUARY 27, 2018

MEMS, 2017

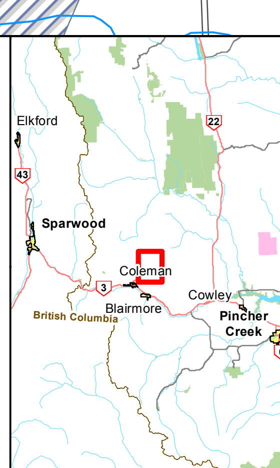
FIGURE

83-1



LEGEND

- Dewatering Well
- Model Node
- Release Point
- Existing Powerline
- CHPP Facilities
- Surface Water Drainage
- Subsurface Flow
- Topographic Contour (20m interval)
- Proposed Mine Permit Boundary
- Project Footprint
- Future Pond
- Undisturbed Area
- Release Pond
- Dam
- Surge Pond (No Release)
- Dike
- Saturated Fill Zone
- Rock Disposal Area
- Active Mining Area
- Topsoil Replacement
- Disturbed Area
- Legacy Underground Mine



RIVERSDALE RESOURCES

GRASSY MOUNTAION COAL PROJECT

WATER MANAGEMENT - EOY 2022 (YEAR 4)

AltaLIS, 2018; Deswik, 2016; Golder 2016; MEMS, 2018; NRCAN, 2015; Riversdale, 2018

Datum/Projection: UTM Zone 11 Nad 83

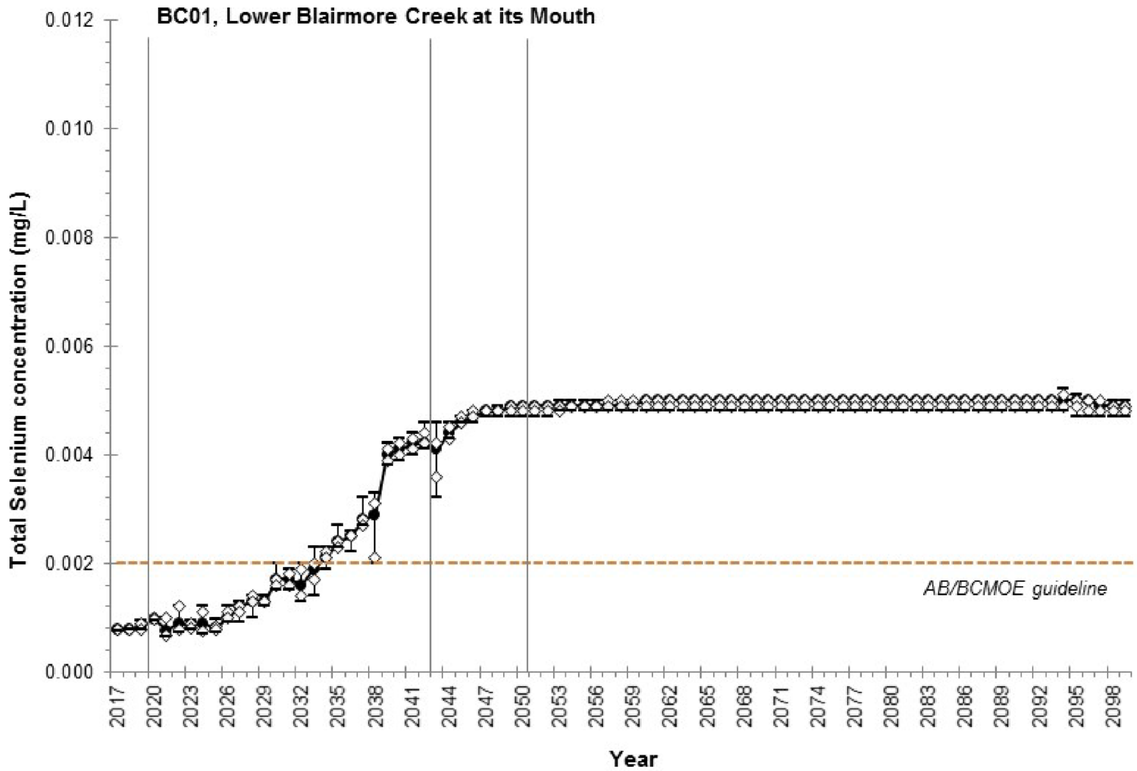
0 1 2 Kilometres

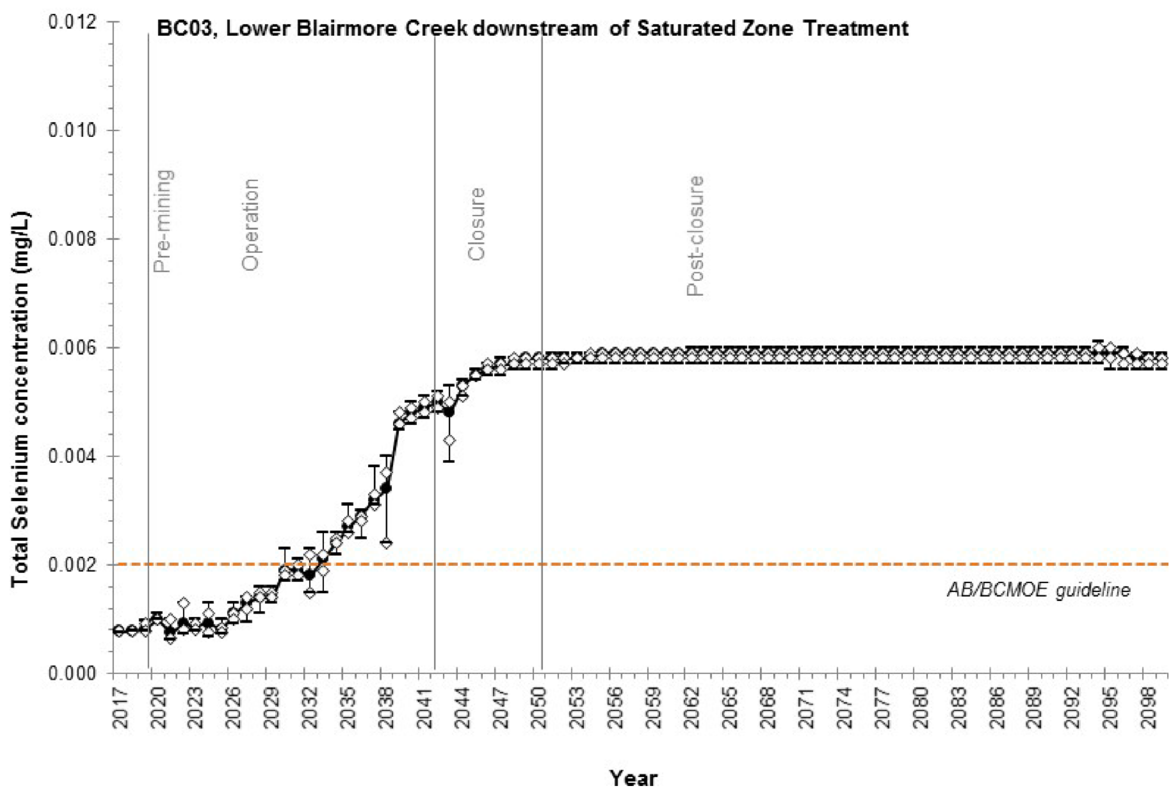
MILLENNIUM EMS Solutions Ltd.

PROJECT: 14-00201
DRAWN BY: SL/JL
CHECKED BY: MB
DATE: FEBRUARY 20, 2018

FIGURE 94-1

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\Geology\Resubmission\Fig C.5.3-1 Water Management - EOY 4.mxd





LEGEND

- Maximum
- 75%ile
- Median
- 25%ile
- Minimum

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

PREDICTED SELENIUM CONCENTRATIONS IN THE BLAIRMORE CREEK NODES (LSA) AS COMPARED TO AB/BCMOE WATER QUALITY GUIDELINES FOR SELENIUM

MILLENNIUM EMS Solutions Ltd.

PROJECT: 14-00201

DRAWN BY: JL

CHECKED BY: CH

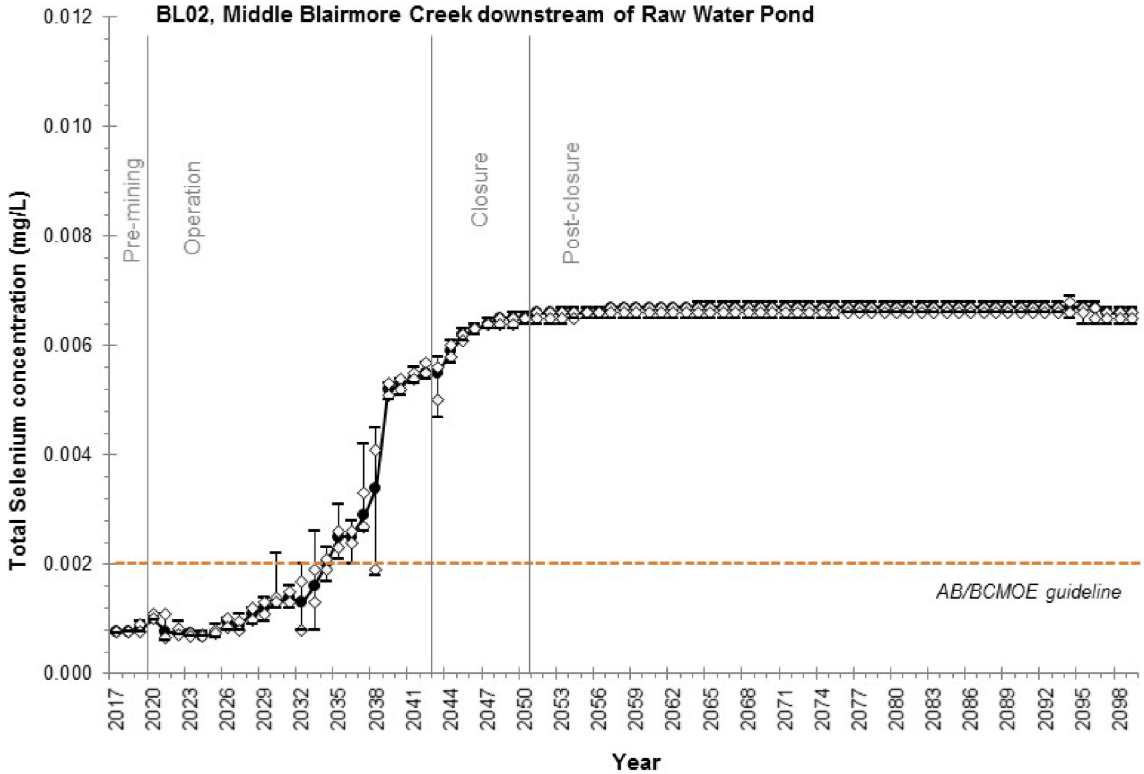
DATE: FEBRUARY 23, 2018

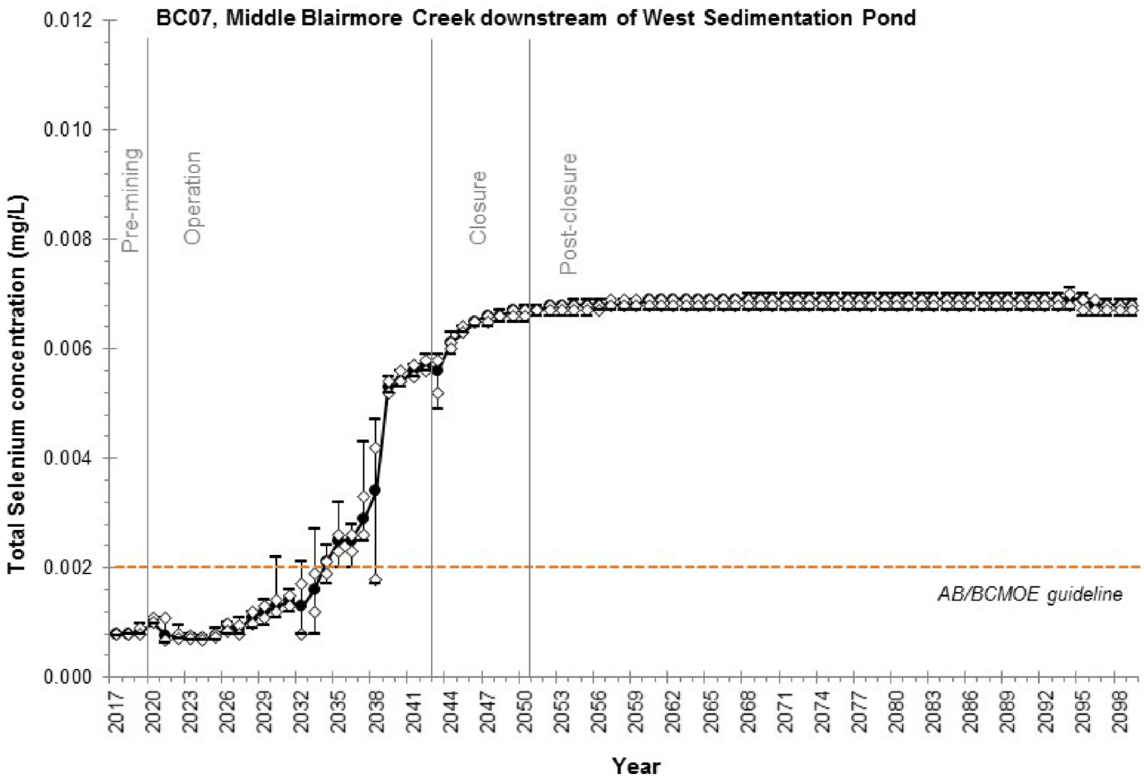
MEMS, 2017

FIGURE

108-1a

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIRS\AER\Fig 108-1a Predicted Selenium Concentrations 14-00201.mxd





LEGEND

- Maximum
- 75%ile
- Median
- 25%ile
- Minimum

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

PREDICTED SELENIUM CONCENTRATIONS IN THE BLAIRMORE CREEK NODES (LSA) AS COMPARED TO AB/BCMOE WATER QUALITY GUIDELINES FOR SELENIUM

MILLENNIUM EMS Solutions Ltd.

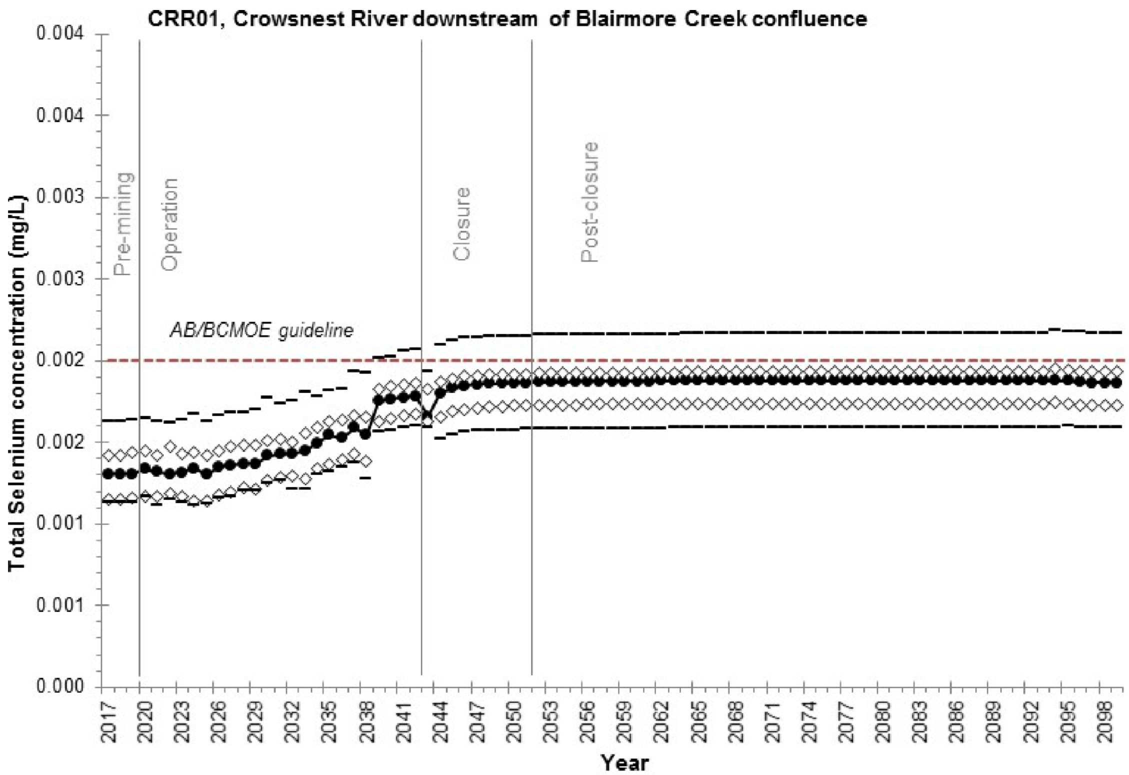
PROJECT: 14-00201
DRAWN BY: JL
CHECKED BY: CH
DATE: FEBRUARY 23, 2018

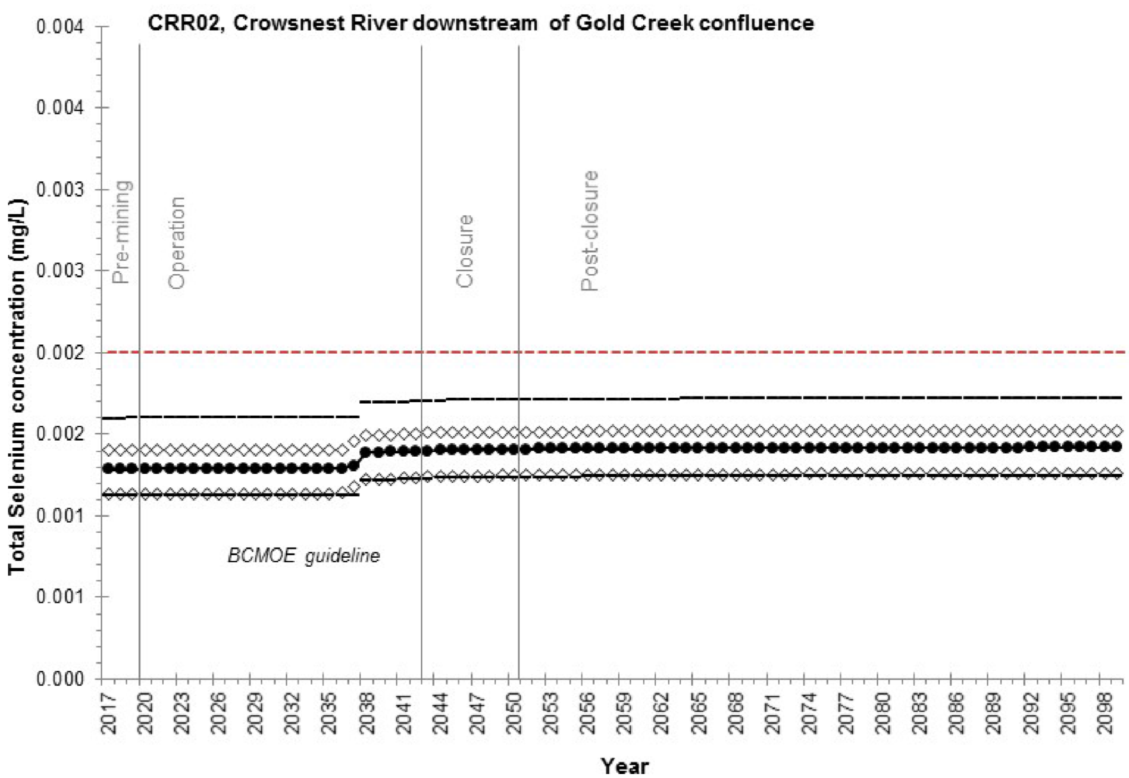
MEMS, 2017

FIGURE

108-1b

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIRS\AER\Fig 108-1b Predicted Selenium Concentrations 14-00201.mxd





Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIRS\AER\Fig 108-2 Modelled Selenium Concentrations 14-00201.mxd

LEGEND

- Maximum
- 75%ile
- Median
- 25%ile
- Minimum

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

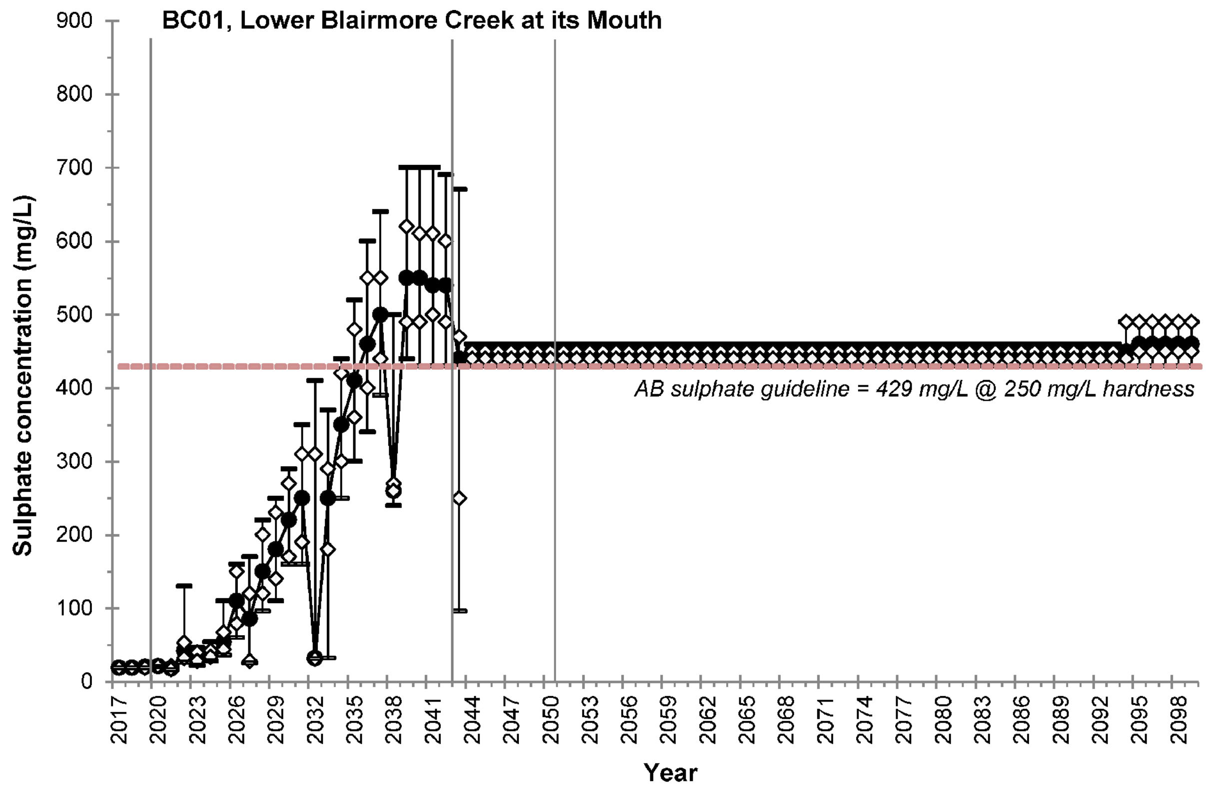
MODELLED SELENIUM CONCENTRATIONS IN THE CROWSNEST RIVER NODES (RSA) AS COMPARED TO AB/BCMOE WATER QUALITY GUIDELINES FOR SELENIUM

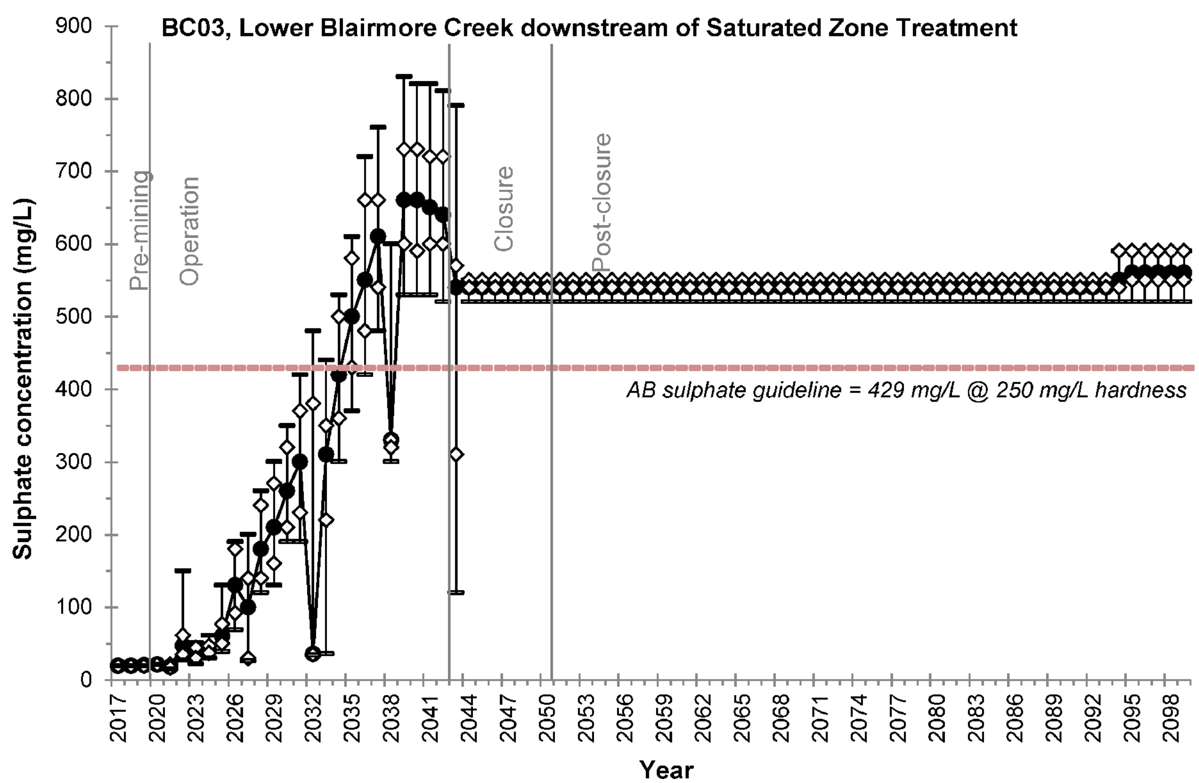
MILLENNIUM EMS Solutions Ltd.

PROJECT: 14-00201
DRAWN BY: JL
CHECKED BY: CH
DATE: FEBRUARY 23, 2018

MEMS, 2017

FIGURE
108-2





LEGEND

- Maximum
- 75%ile
- Median
- 25%ile
- Minimum

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

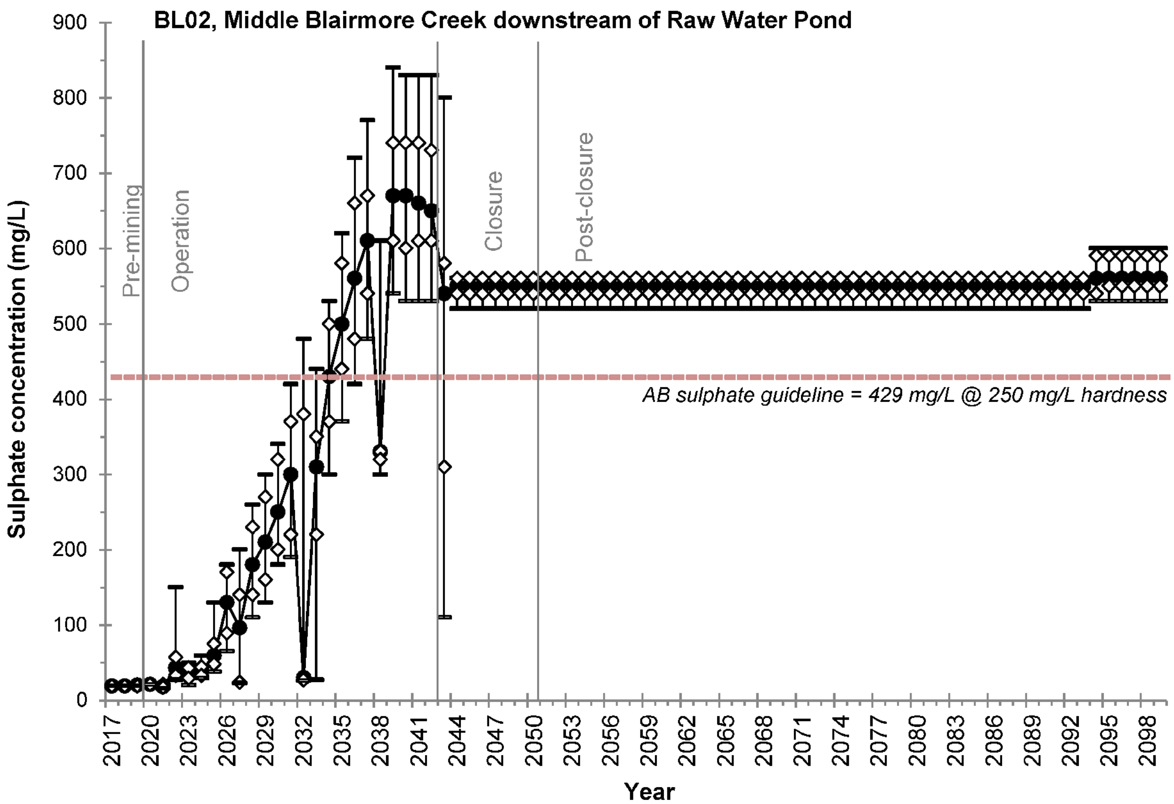
PREDICTED SULPHATE CONCENTRATIONS AT LOCATIONS ALONG BLAIRMORE CREEK DURING DIFFERENT MINE PHASES

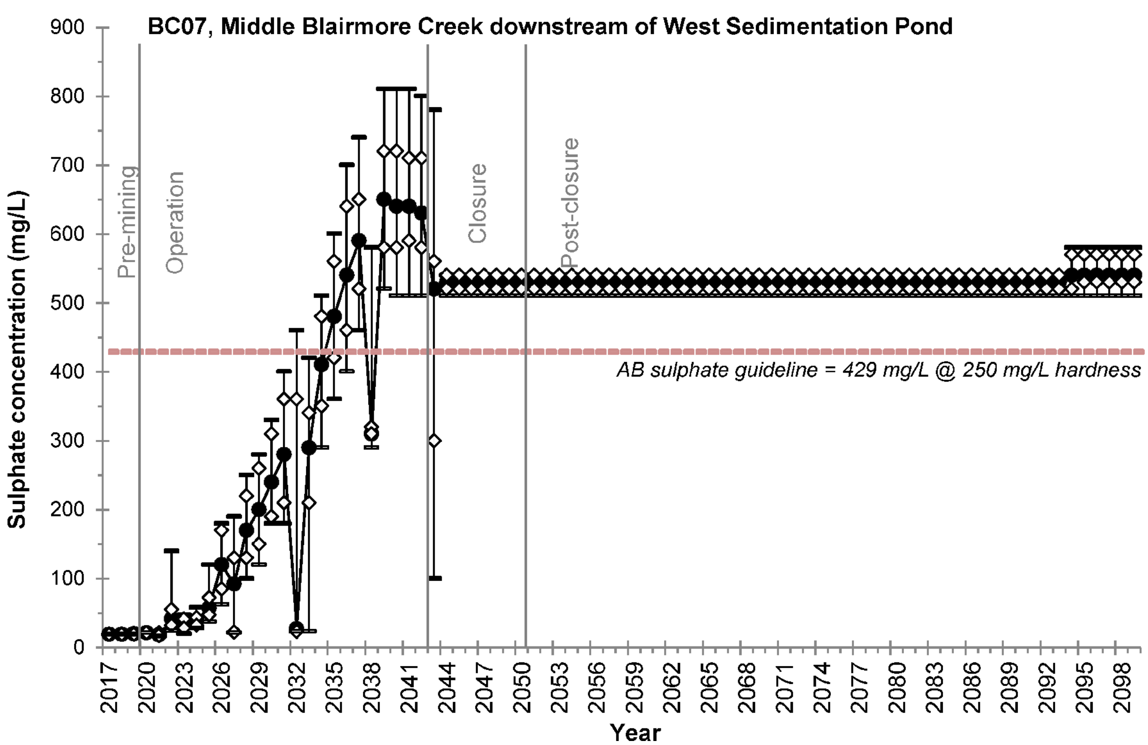
MILLENNIUM EMS Solutions Ltd.

PROJECT: 14-00201	
DRAWN BY: JL	
CHECKED BY: CH	
DATE: FEBRUARY 23, 2018	

MEMS, 2017

FIGURE 109-1a





LEGEND

- Maximum
- 75%ile
- Median
- 25%ile
- Minimum

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

PREDICTED SULPHATE CONCENTRATIONS AT LOCATIONS ALONG BLAIRMORE CREEK DURING DIFFERENT MINE PHASES

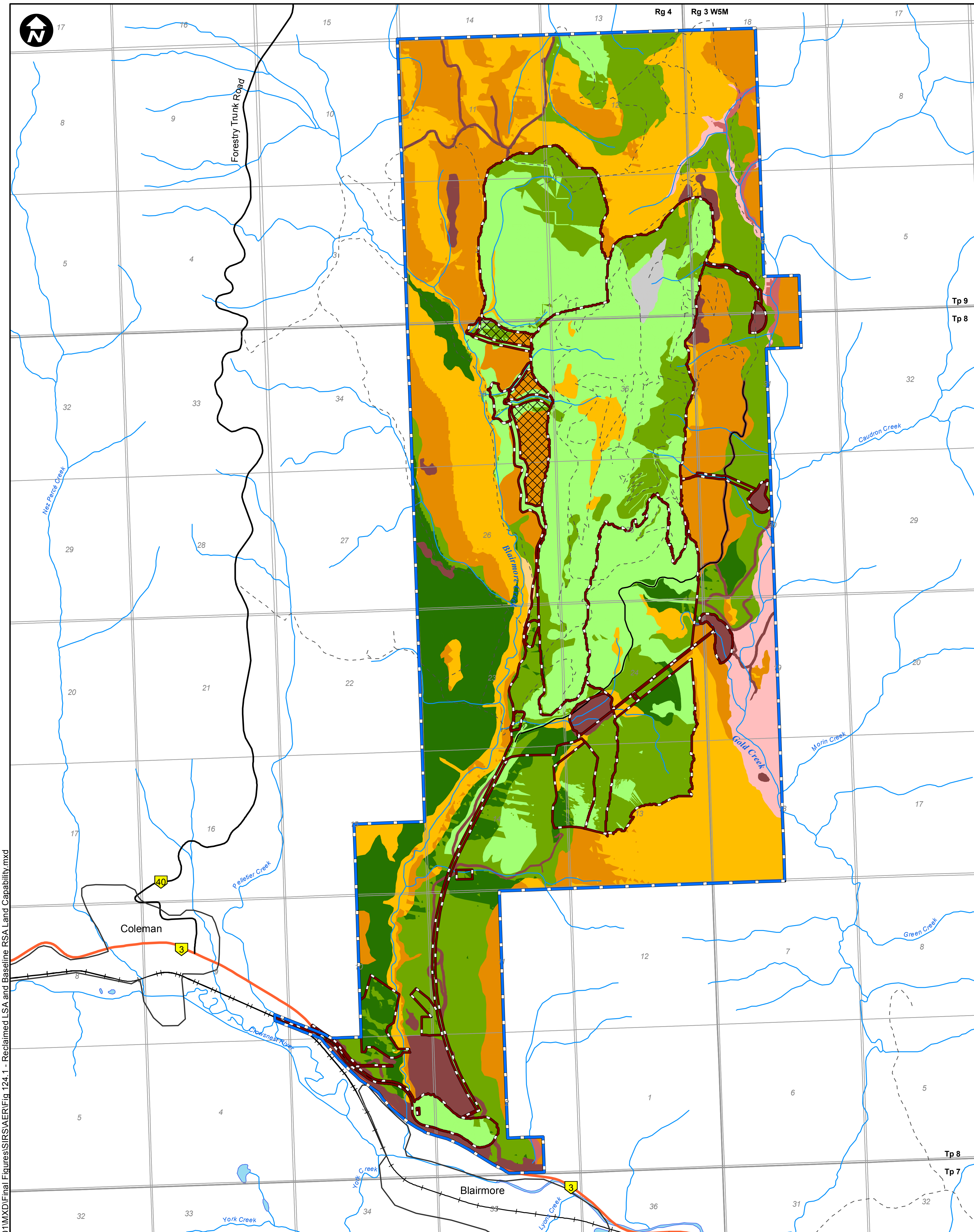
MILLENNIUM EMS Solutions Ltd.

PROJECT: 14-00201
DRAWN BY: JL
CHECKED BY: CH
DATE: FEBRUARY 23, 2018

MEMS, 2017

FIGURE **109-1b**

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIRS\AER\Fig 109-1b Predicted Sulphate Concentrations 14-00201.mxd



Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIRS\AER\Fig 124.1 - Reclaimed LSA and Baseline RSA Land Capability.mxd

LEGEND

- Primary Highway
- Secondary Highway
- Existing Railway
- Existing Trails
- Surface Water Drainage
- Waterbody
- Soils Regional Study Area
- Soils Local Study Area
- Undisturbed Area

Land Capability Class

- 4
- 4-5
- 4-6
- 5
- 5-6
- 5-7
- 6
- 6-7
- 7
- NA

PROJECT

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

TITLE

RECLAIMED LCC WITHIN THE LSA AND BASELINE LCC FOR SURROUNDING LAND WITHIN THE RSA

NOTES

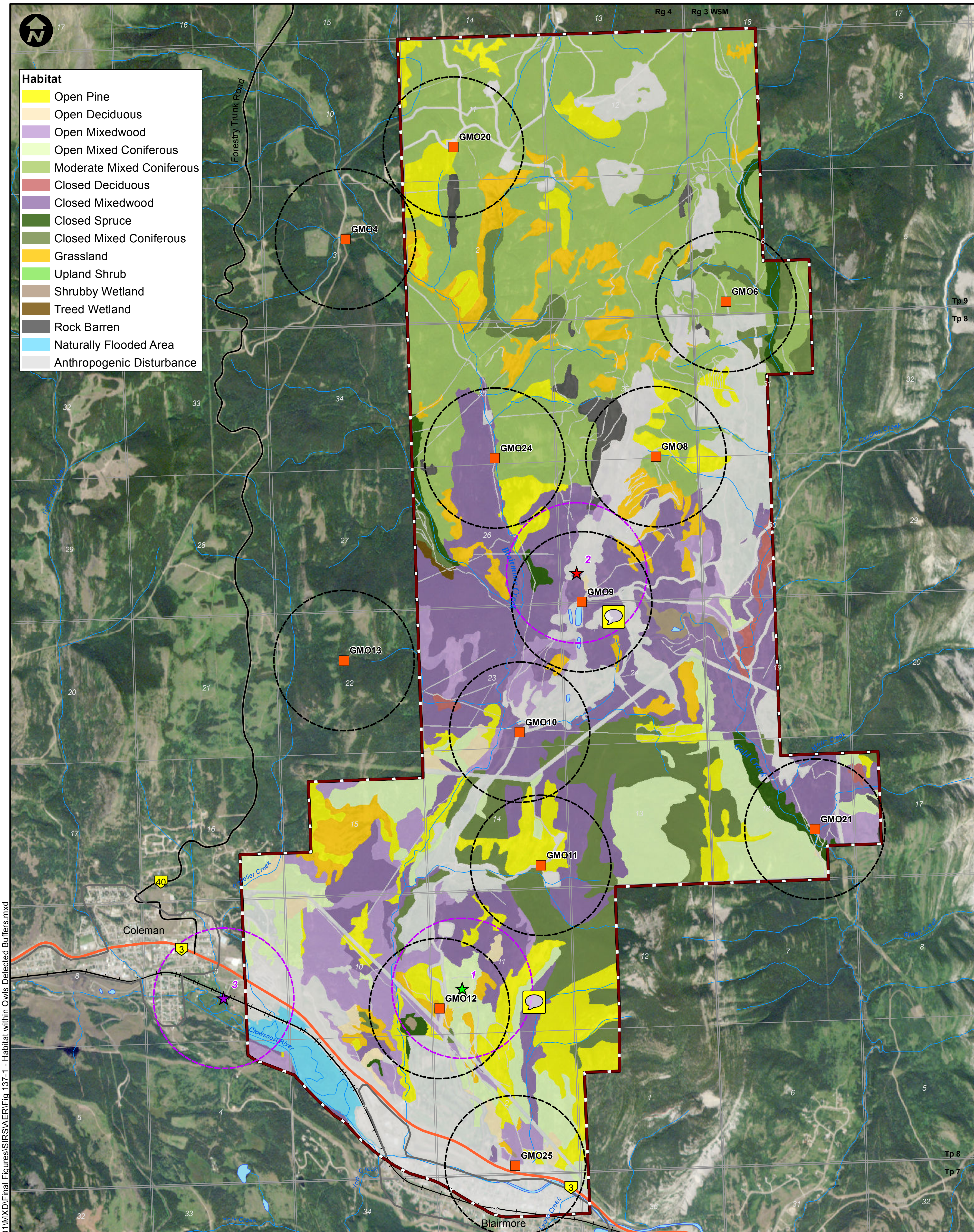
AltaLIS, 2017; Geobase, 2015; MEMS, 2016; Riversdale, 2016
Datum/Projection: UTM NAD 83 Zone 11

0 0.75 1.5 3
Kilometres

PROJECT: 14-00201-01
DRAWN BY: SL
CHECKED BY: VL
DATE: JANUARY 29, 2018

FIGURE

124-1



LEGEND

- Owl Survey Station
- Owl Detection Zone
- Great Horned Owl
- Great Grey Owl (Incidental June 2014)
- Two Great Horned Owls
- Owl Locations 800m Buffer
- Primary Highway
- Secondary Highway
- Existing Railway
- Surface Water Drainage
- Waterbody
- Wildlife Local Study Area

PROJECT

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

TITLE

HABITAT TYPES ASSOCIATED WITH OWL SURVEY STATIONS AND OWL DETECTION LOCATIONS

NOTES

AltaLIS, 2016; Geobase, 2015; MEMS, 2016; RapidEye, 2015 (Image Date: Jul 26/13); Riversdale, 2016
Datum/Projection: UTM NAD 83 Zone 11

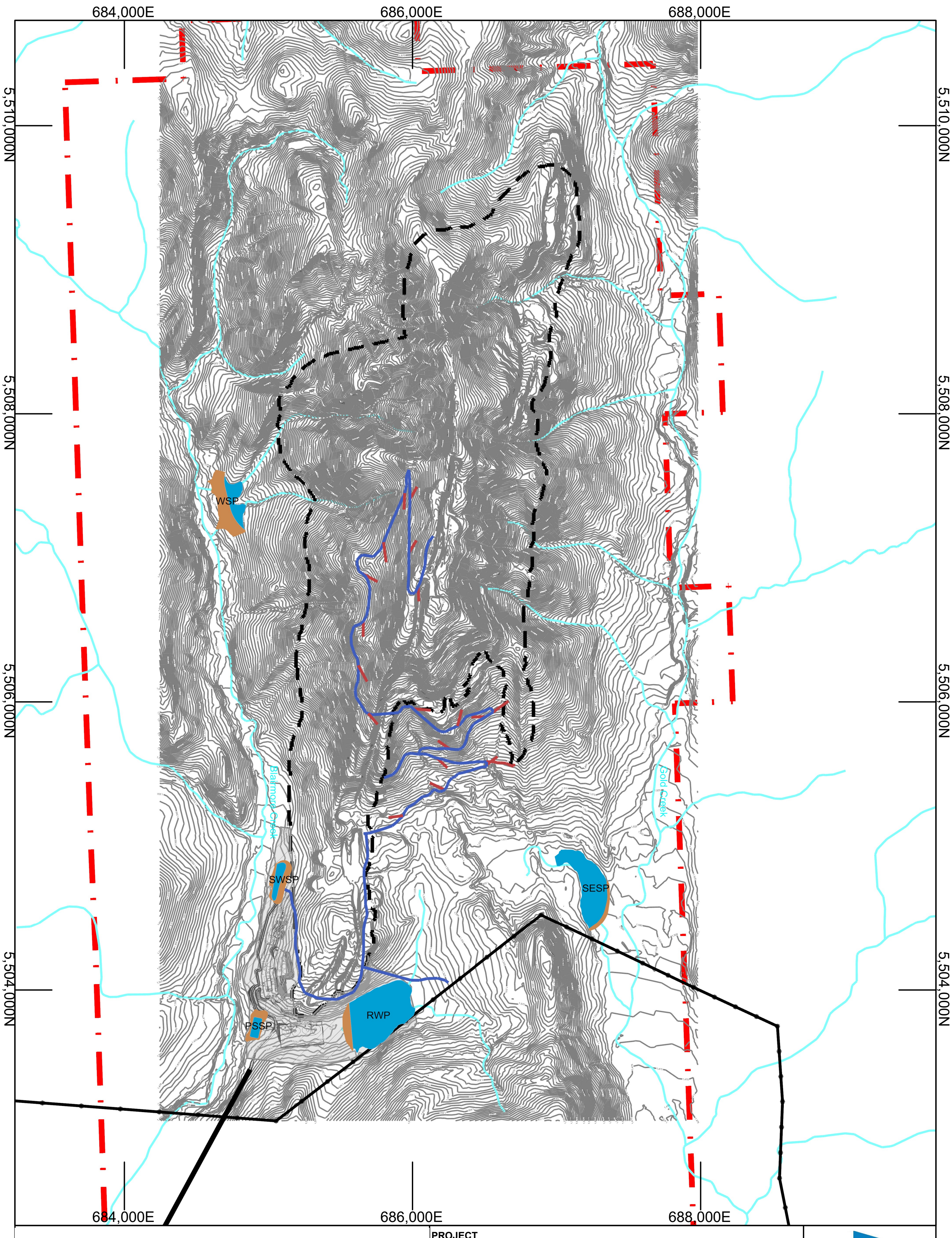
0 0.75 1.5 3
Kilometres

PROJECT: 14-00201-01
DRAWN BY: SL
CHECKED BY: LB
DATE: JANUARY 30, 2018

FIGURE

137-1

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIRS\AER\Fig 137-1 - Habitat within Owls Detected Buffers.mxd



HAULROAD
HAULROAD RUN-OUT
POND
DAM
PLANT AND ADMINISTRATION AREA
EXISTING POWERLINE
ULTIMATE PIT CREST
MINE PERMIT BOUNDARY
DRAINAGE
SURFACE CONTOUR

PROJECT

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

Deswik

TITLE

Haulroad Run Outs-RevA

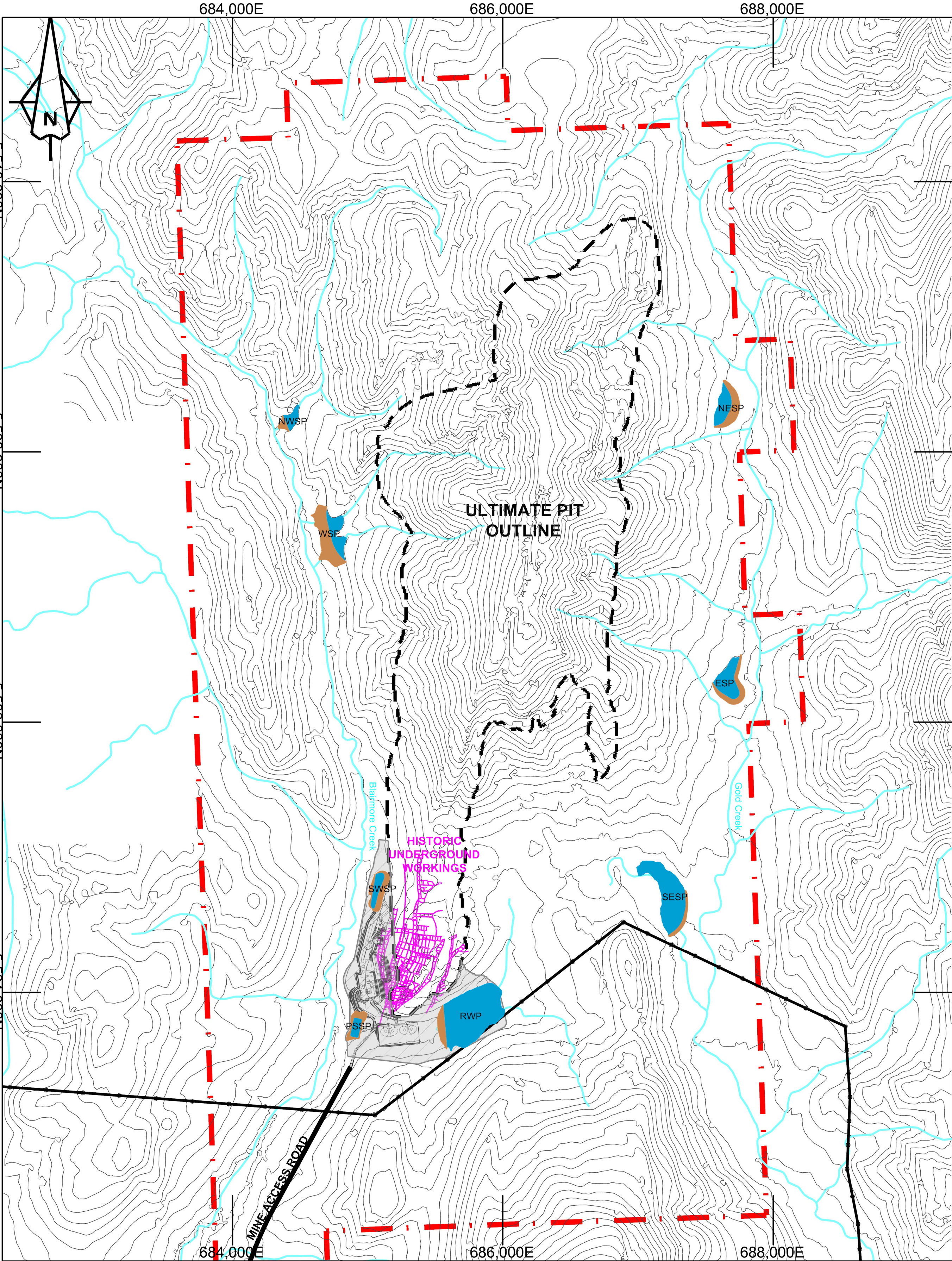
NOTES

1.) Topographic LIDAR Data - Riversdale, 2015;
2.) Mine Plan Data - Deswik, 2015;
Datum/Projection: UTM NAD 83 Zone 11

0 500 1000 1500 2000

PROJECT: RDR - 20150827
DRAWN BY: AG
CHECKED BY: MD
DATE: 09 Jan 2018

Figure 174-1



LEGEND

- HISTORIC UNDERGROUND
- POND
- DAM
- PLANT AND ADMINISTRATION AREA
- EXISTING POWERLINE
- ULTIMATE PIT CREST
- MINE PERMIT BOUNDARY
- DRAINAGE
- SURFACE CONTOUR

PROJECT

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

Deswik

TITLE

Known Underground Plots

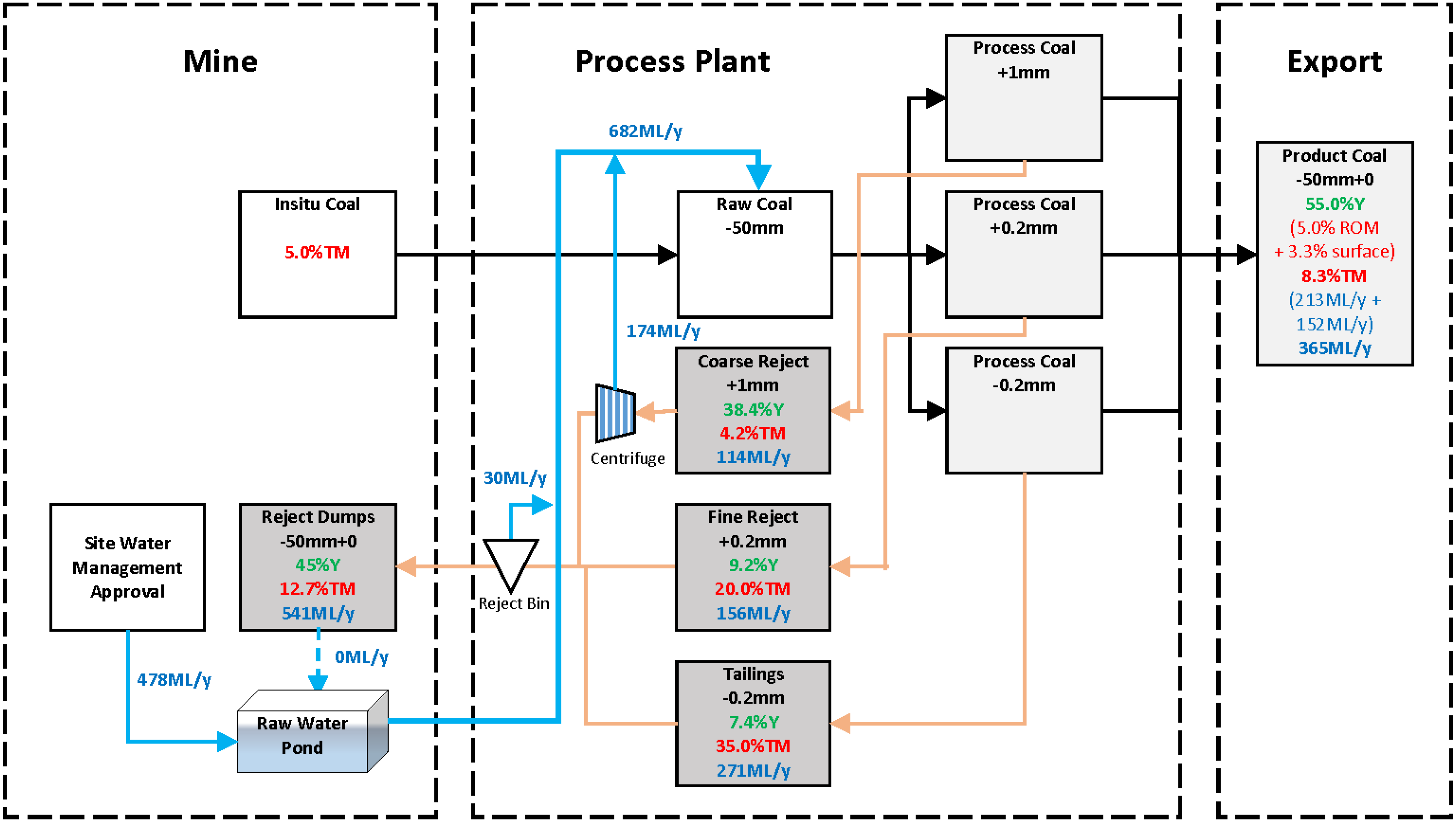
NOTES

1.) Topographic LIDAR Data - Riversdale, 2015;
2.) Mine Plan Data - Deswik, 2015;
Datum/Projection: UTM NAD 83 Zone 11

0 500 1000 1500 2000 2500

PROJECT: RDR - 20150827
DRAWN BY: AG
CHECKED BY: MD
DATE: 09 Jan 2018

FIGURE **176-1**



RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

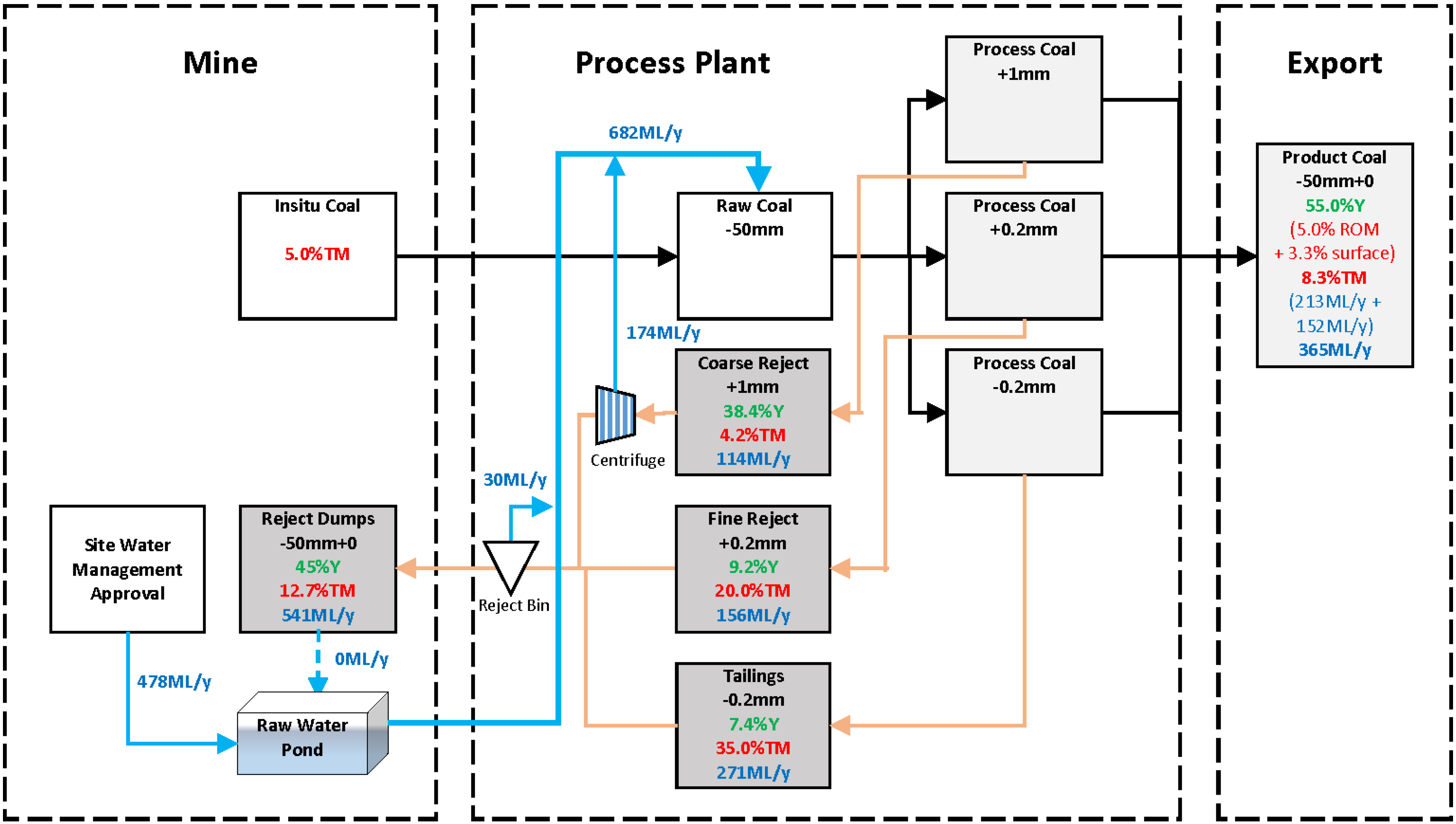
PLANT WATER BALANCE (478 ML/Y) INCLUDING REJECT SIZING AND COARSE REJECTS CENTRIFUGE

PROJECT: 14-00201
DRAWN BY: JL
CHECKED BY: CH
DATE: FEBRUARY 22, 2018

Riversdale Resources, 2018

SCALE: N/A

FIGURE
2-1
(replaces Figure C.2.5-1 in the application)



RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

PLANT WATER BALANCE (478 ML/Y) INCLUDING REJECT SIZING AND COARSE REJECTS CENTRIFUGE

PROJECT: 14-00201
DRAWN BY: JL
CHECKED BY: CH
DATE: FEBRUARY 22, 2018

Riversdale Resources, 2018

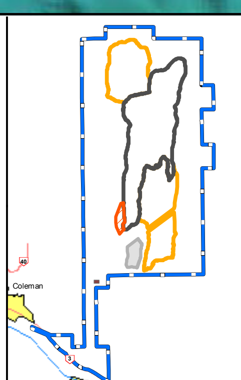
SCALE: N/A

FIGURE
1-1
(replaces Figure C.2.5-1 in the application)

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\Licence Applications\Water_Act\B2.0 Process\Fig 1-1 Plant Water Balance 14-00201.mxd

LEGEND

- Remaining insitu coal (sterilized coal)
- Proposed Mine Permit Boundary
- Ultimate Pit Extent
- Ultimate Rock Disposal Area Extent
- Topsoil Storage
- Construction Camp



RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

AREA OF STERILIZED COAL WITHIN THE FOOTPRINT OF THE PLANT SITE

MILLENNIUM EMS Solutions Ltd.

MEMS, 2018

Projection/Datum: UTM Zone 11 Nad 83

0 100 200 Metres

PROJECT: 14-00201

DRAWN BY: JL

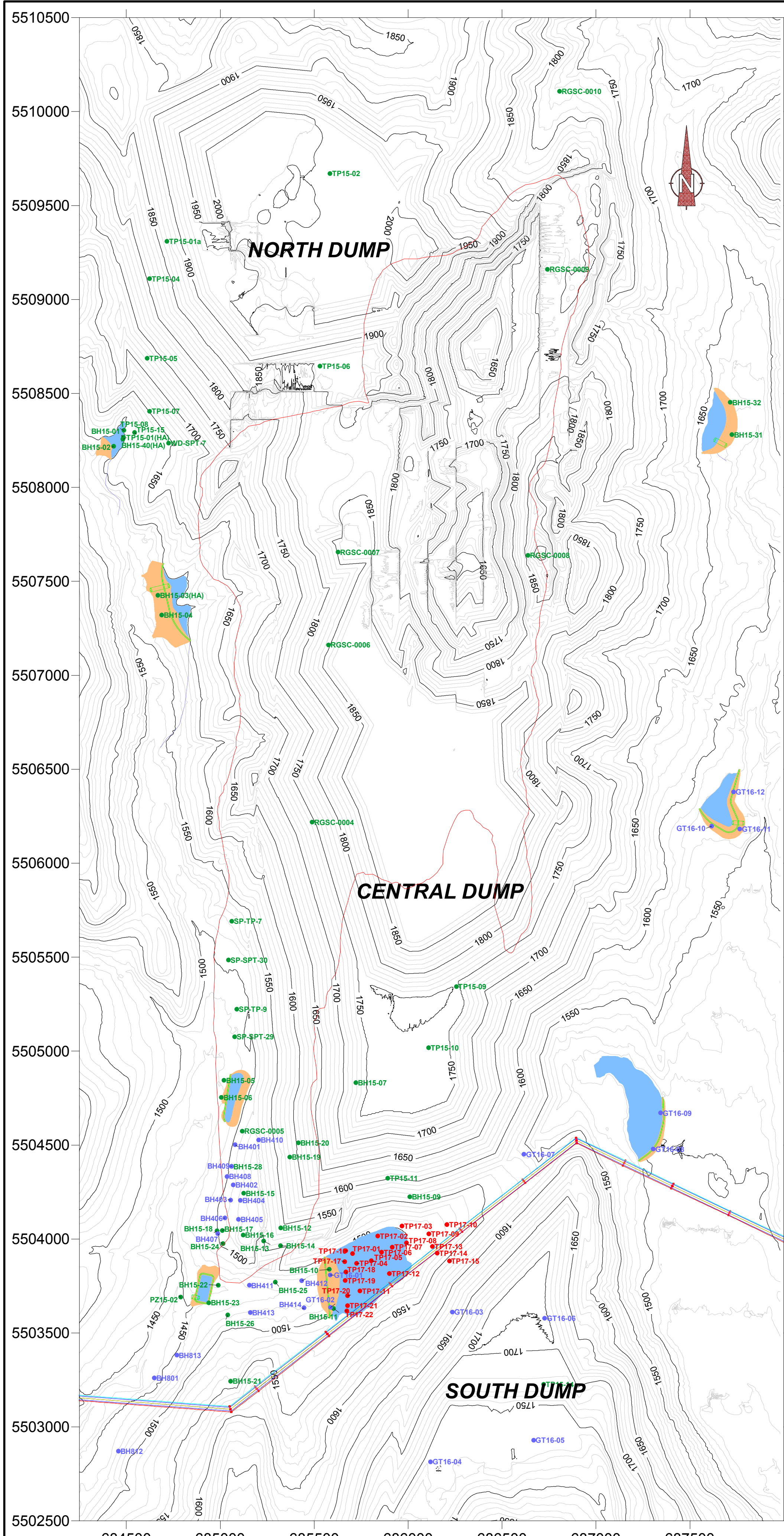
CHECKED BY: CH

DATE: FEBRUARY 27, 2018

FIGURE

178-1

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIRS\AER\Fig 178-1 Area of Sterilized Coal 14-00201.mxd



LEGEND

BH15-10 Historical Geotechnical Borehole/Test Pit Location (Golder 2014 and 2015)

GT16-01 Geotechnical Borehole Location (Terracon 2016)

TP17-18 Test Pit Location (Terracon 2017)

Existing KV Powerline

1600 Final Surface Elevation 50 m Contour Line
Final Surface Elevation 10 m Contour Line

Proposed Pond Footprint

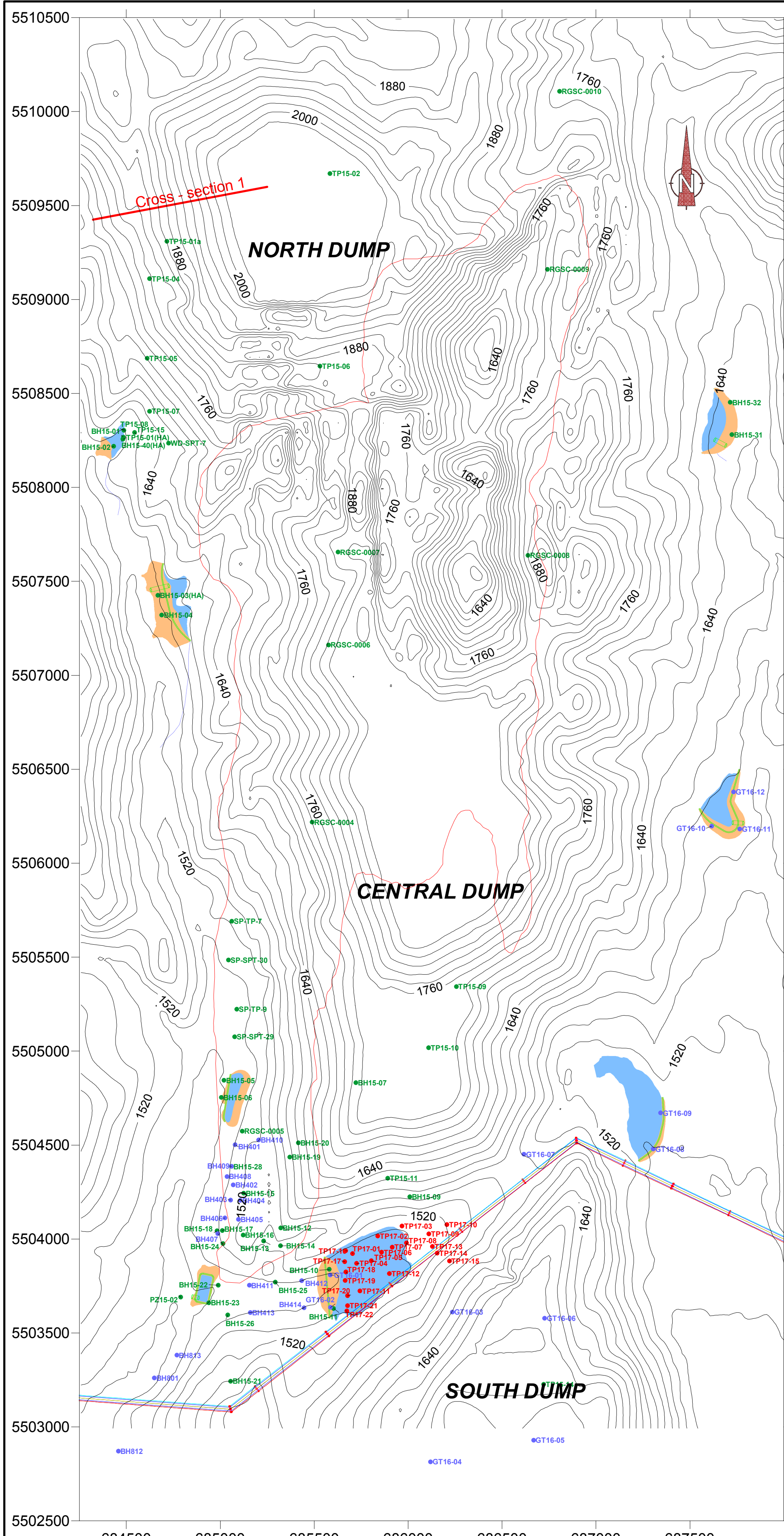
0 500 1000 1500
Metres

Riversdale Resources Limited
Benga Mining Limited
Grassy Mountain Project, Alberta

TERRACON GEOTECHNIQUE LTD.
CONSULTING ENGINEERS AND GEOLOGISTS

Figure 180-1
CROSS - SECTION 1 LOCATION

Date: February, 2018	Designed By: B.K.	DWG Size: custom	
Scale: 1 : 22500	Drawn By: O.G.	Sheet:	
Project No.: 184140	Reviewed By: B.K.	File Name: Benga Topo_3.srf	



LEGEND

- BH15-10 — Historical Geotechnical Borehole/Test Pit Location (Golder 2014 and 2015)
- GT16-01 — Geotechnical Borehole Location (Terracon 2016)
- TP17-18 — Test Pit Location (Terracon 2017)
- Existing KV Powerline
- 1600 — Final Surface Elevation 50 m Contour Line; Final Surface Elevation 10 m Contour Line
- Proposed Pond Footprint

0 500 1000 1500

Metres

Riversdale Resources Limited
Benga Mining Limited
Grassy Mountain Project, Alberta

TERRACON GEOTECHNIQUE LTD.
CONSULTING ENGINEERS AND GEOLOGISTS

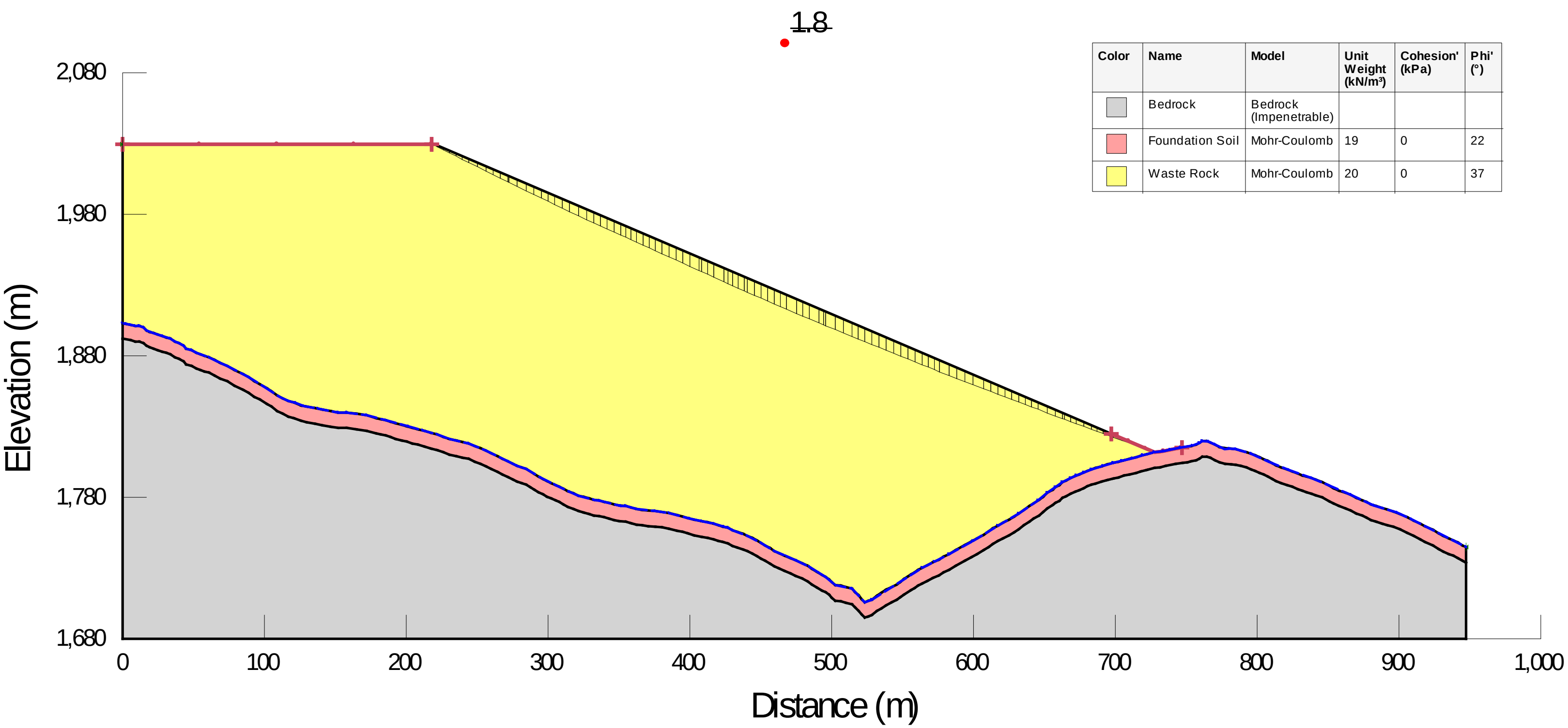
Figure 181-1

CROSS - SECTION 1 LOCATION

Date:	February, 2018	Designed By:	B.K.	DWG Size:	custom
Scale:	1 : 22500	Drawn By:	O.G.	Sheet:	
Project No.:	184140	Reviewed By:	B.K.	File Name:	Benga Topo_3.srf

Figure 181-2

North Dump Cross - section 1
Long Term Static Conditions



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Foundation Soil	Mohr-Coulomb	19	0	22
	Waste Rock	Mohr-Coulomb	20	0	37

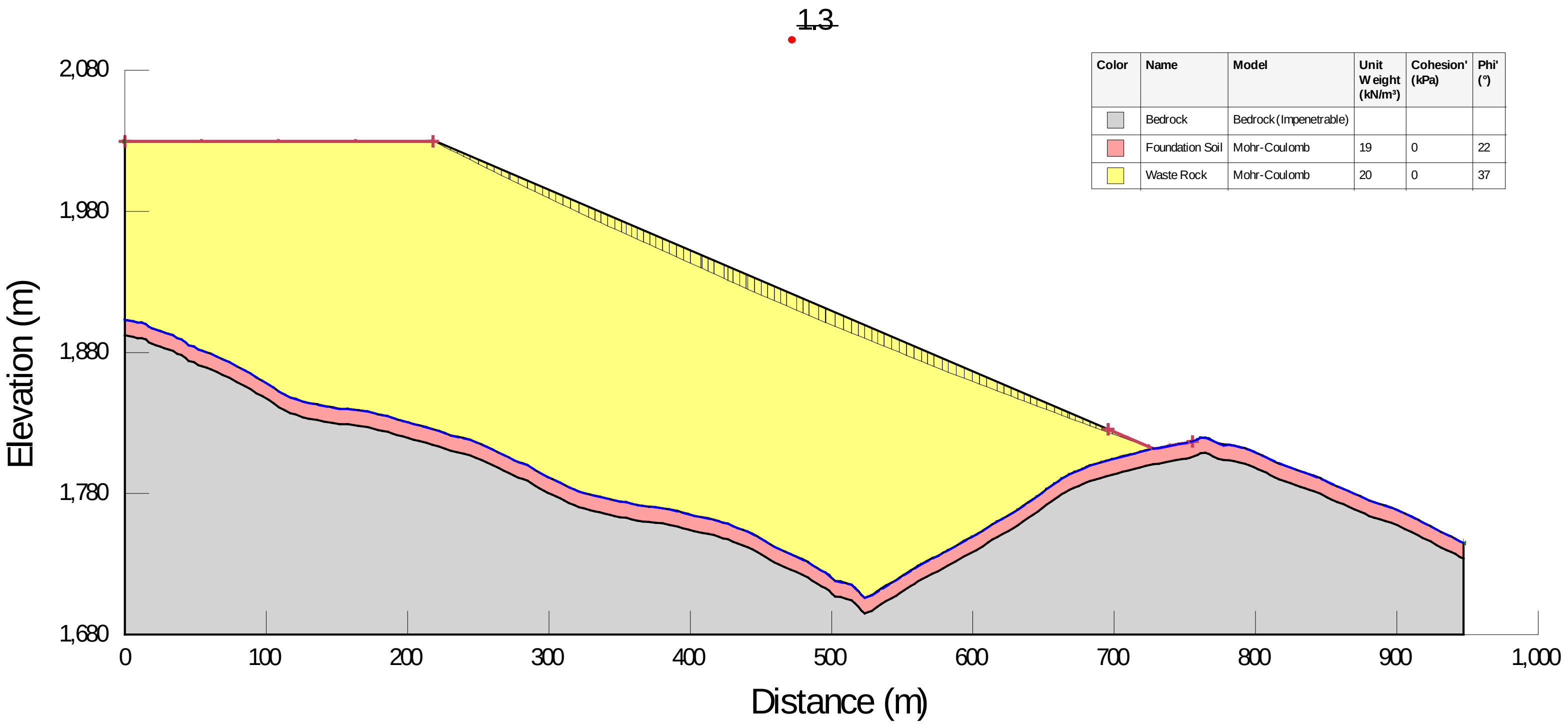
RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140	
DRAWN BY: OG	
CHECKED BY: BK	
DATE: 26Feb, 2018	
FIGURE	181-2

North Dump Cross - section 1
Long Term Pseudo - static Conditions (PGA=0.13g)



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Bedrock	Bedrock (Impenetrable)			
	Foundation Soil	Mohr-Coulomb	19	0	22
	Waste Rock	Mohr-Coulomb	20	0	37

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140

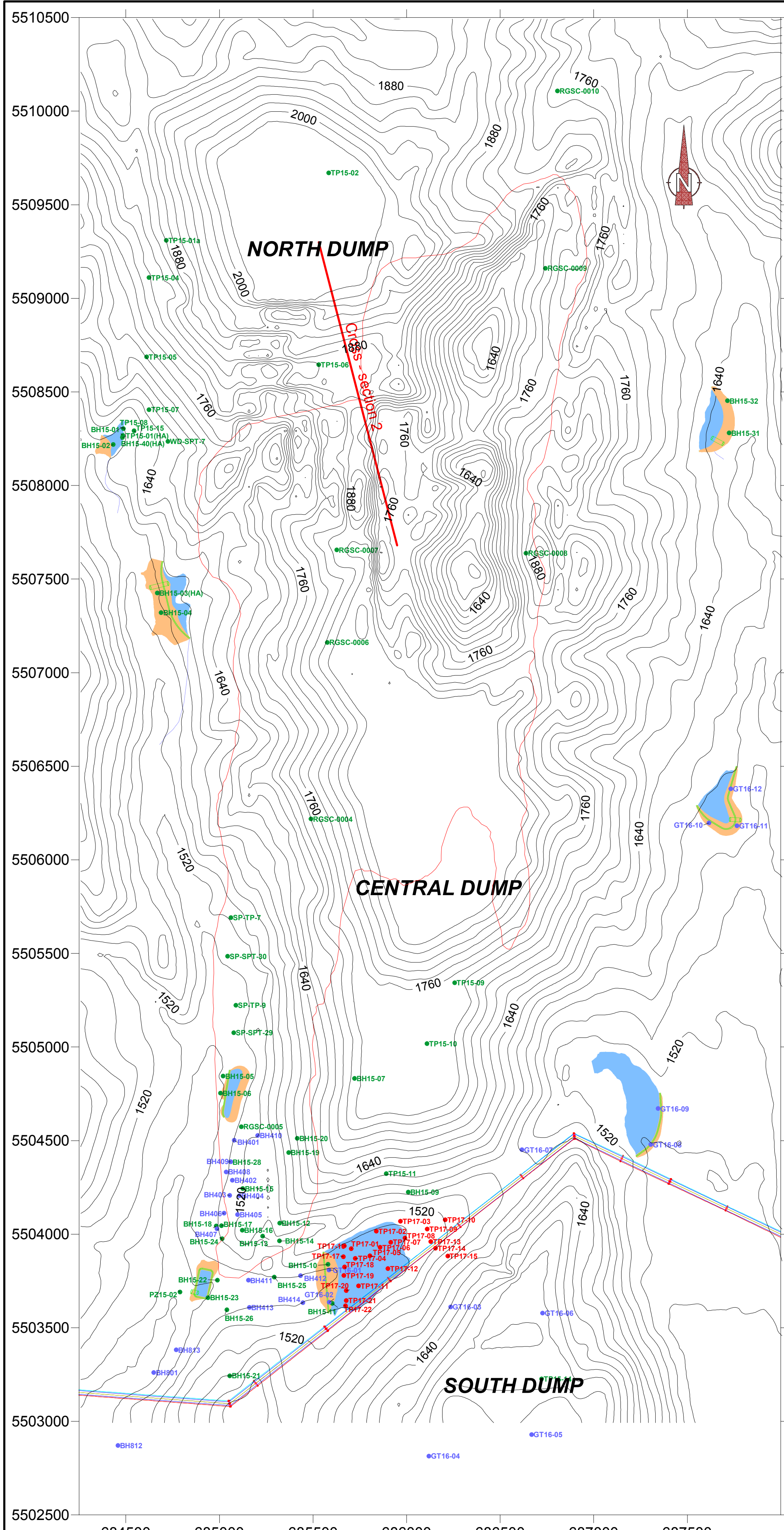
DRAWN BY: OG

CHECKED BY: BK

DATE: 26Feb, 2018

FIGURE

181-3



LEGEND

BH15-10	Historical Geotechnical Borehole/Test Pit Location (Golder 2014 and 2015)
GT16-01	Geotechnical Borehole Location (Terracon 2016)
TP17-18	Test Pit Location (Terracon 2017)
	Existing KV Powerline
1600	Final Surface Elevation 50 m Contour Line Final Surface Elevation 10 m Contour Line
	Proposed Pond Footprint

0 500 1000 1500

Metres

Riversdale Resources Limited
Benga Mining Limited
Grassy Mountain Project, Alberta

TERRACON GEOTECHNIQUE LTD.
CONSULTING ENGINEERS AND GEOLOGISTS

Figure 181-4

CROSS - SECTION 2 LOCATION

Date: February, 2018	Designed By: B.K.	DWG Size: custom
Scale: 1 : 22500	Drawn By: O.G.	Sheet:
Project No.: 184140	Reviewed By: B.K.	File Name: Benga Topo_3.srf

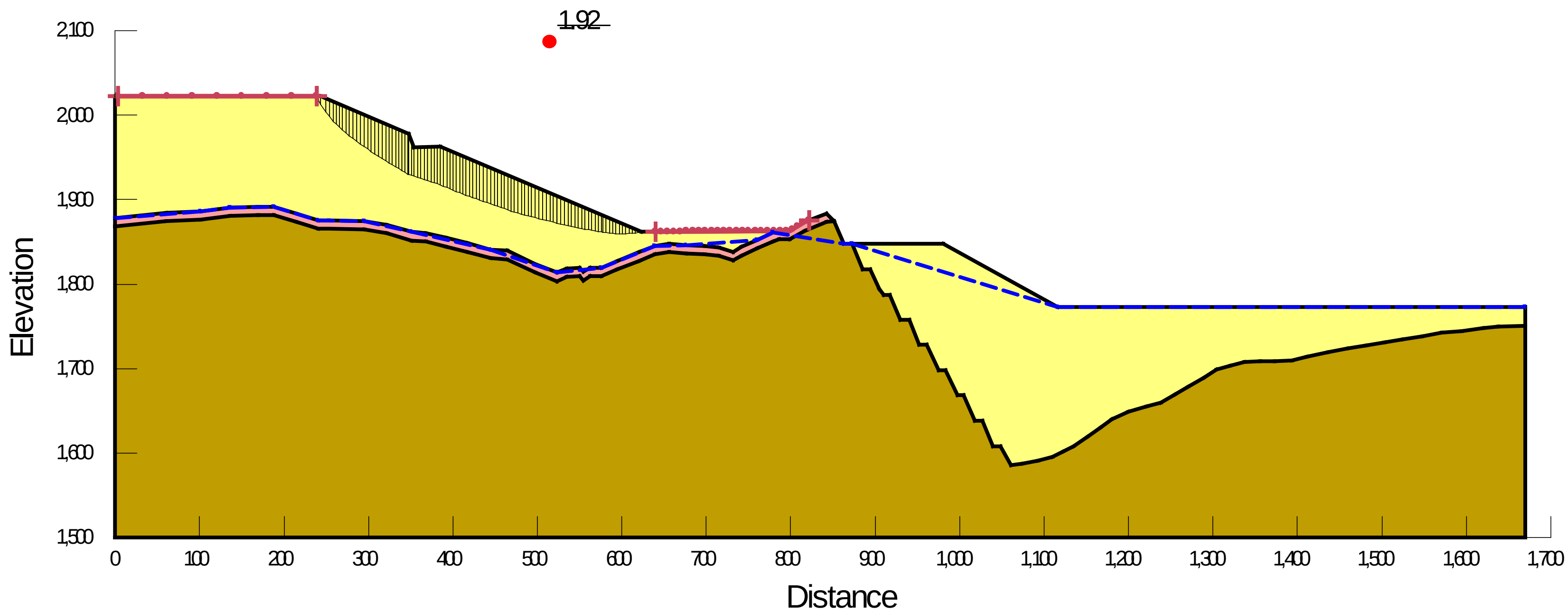
Model Setting

Name: Static - Deep Failure (to Dump Toe)

Description:
North Dump Cross - section 2

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Strength Function	Piezometric Line	Cohesion' (kPa)	Phi' (°)
	Bedrock (RMR 56)	*Shear/Normal Fn.*	*25*	*H-B Function - All Rocks*	*1*		
	Foundation Soil	*Mohr-Coulomb*	*19*		*1*	*0*	*22*
	Waste Rock	*Mohr-Coulomb*	*20*		*1*	*0*	*37*



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
181-5

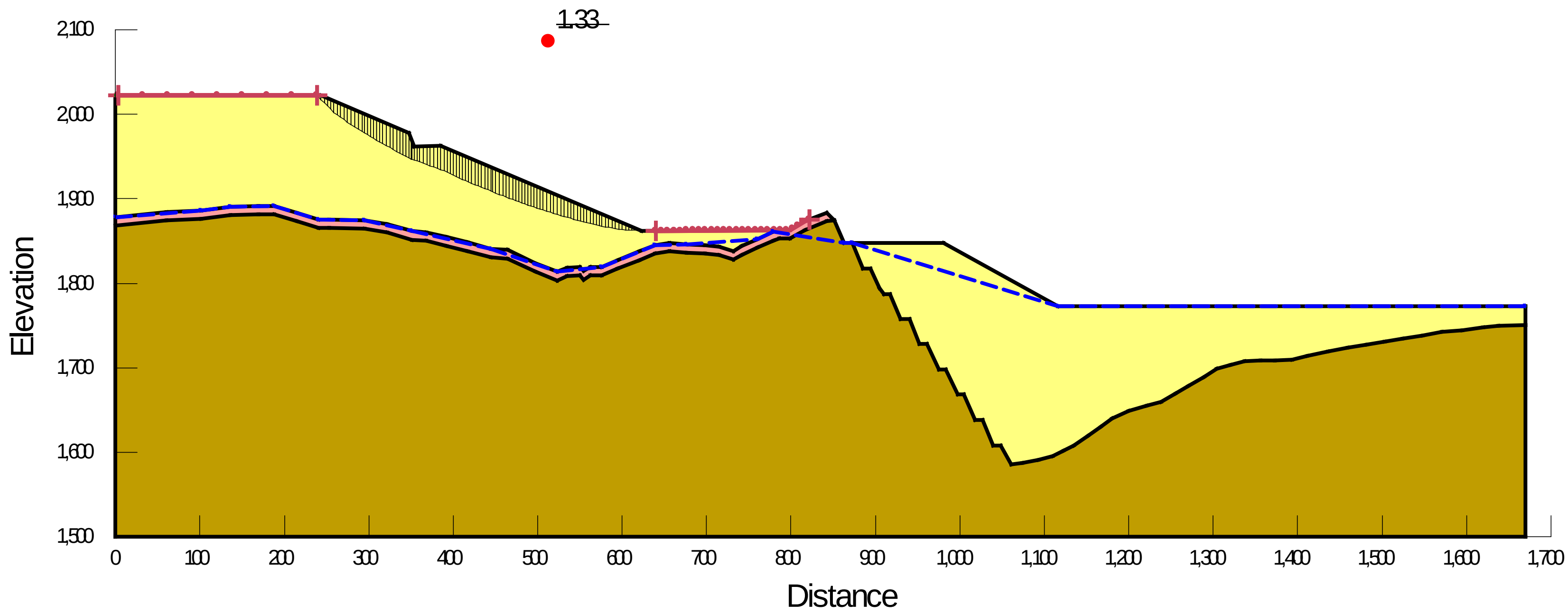
Model Setting

Name: Seismic - Deep Failure (Dump Toe)

Description:
North Dump Cross - section 2

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.13
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Strength Function	Piezometric Line	Cohesion' (kPa)	Phi' (°)
	Bedrock (RMR 56)	*Shear/Normal Fn.*	*25*	*H-B Function - All Rocks*	*1*		
	Foundation Soil	*Mohr-Coulomb*	*19*		*1*	*0*	*22*
	Waste Rock	*Mohr-Coulomb*	*20*		*1*	*0*	*37*



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
181-6

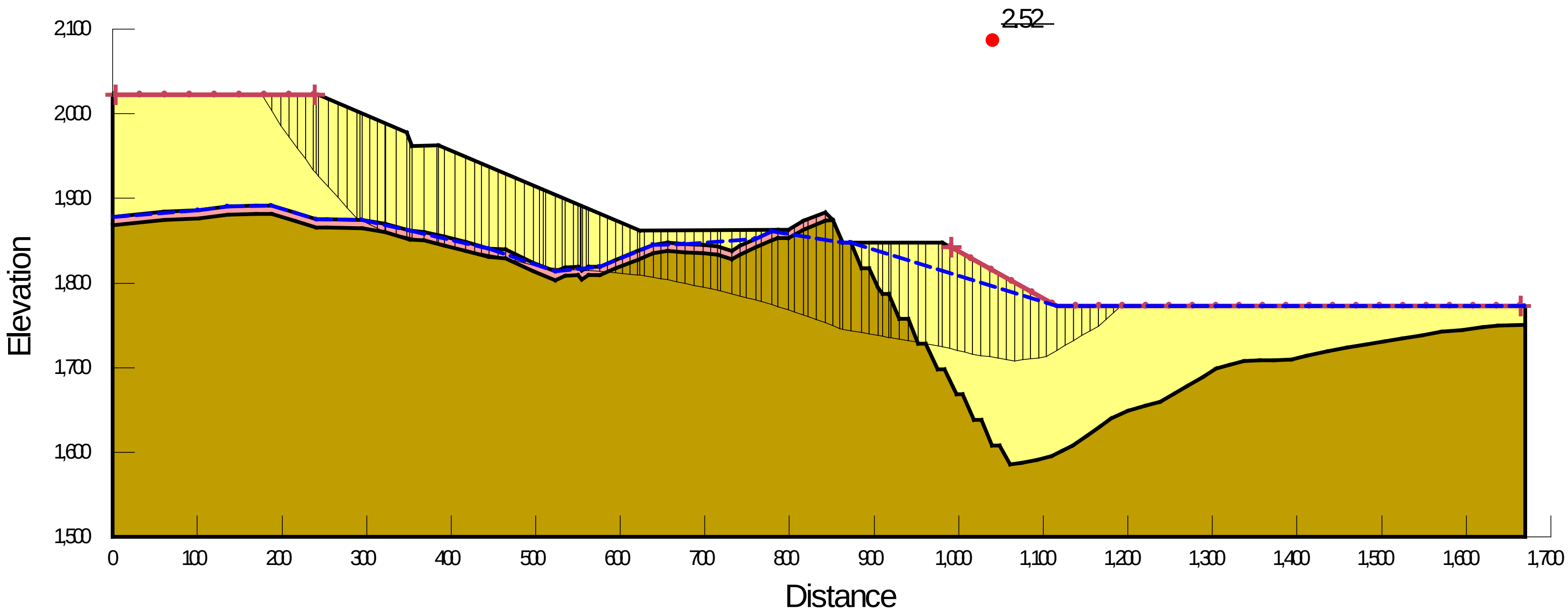
Model Setting

Name: Static - Deep Failure into Pit

Description:
North Dump Cross - section 2

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Strength Function	Piezometric Line	Cohesion' (kPa)	Phi' (°)
	Bedrock (RMR 56)	*Shear/Normal Fn.*	*25*	*H-B Function - All Rocks*	*1*		
	Foundation Soil	*Mohr-Coulomb*	*19*		*1*	*0*	*22*
	Waste Rock	*Mohr-Coulomb*	*20*		*1*	*0*	*37*



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
181-7

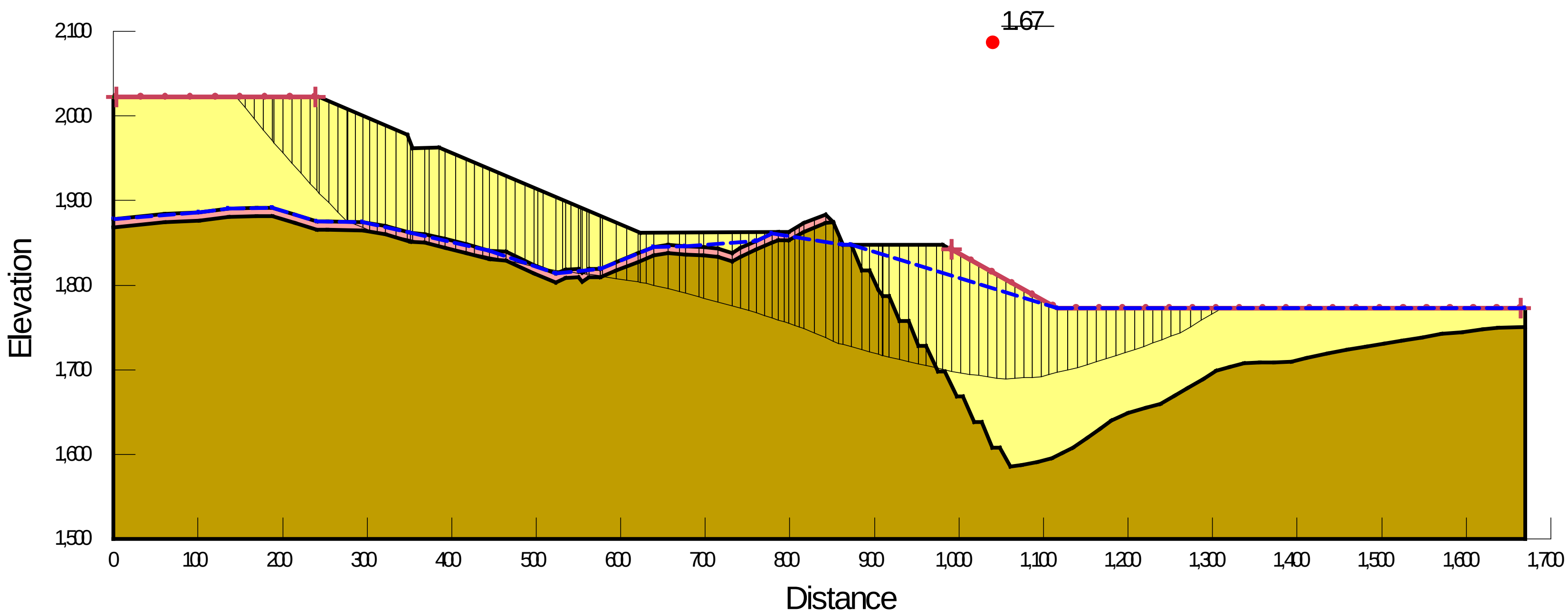
Model Setting

Name: Seismic - Deep Failure into Pit

Description:
North Dump Cross - section 2

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.13
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Strength Function	Piezometric Line	Cohesion' (kPa)	Phi' (°)
	Bedrock (RMR 56)	*Shear/Normal Fn.*	*25*	*H-B Function - All Rocks*	*1*		
	Foundation Soil	*Mohr-Coulomb*	*19*		*1*	*0*	*22*
	Waste Rock	*Mohr-Coulomb*	*20*		*1*	*0*	*37*



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
181-8

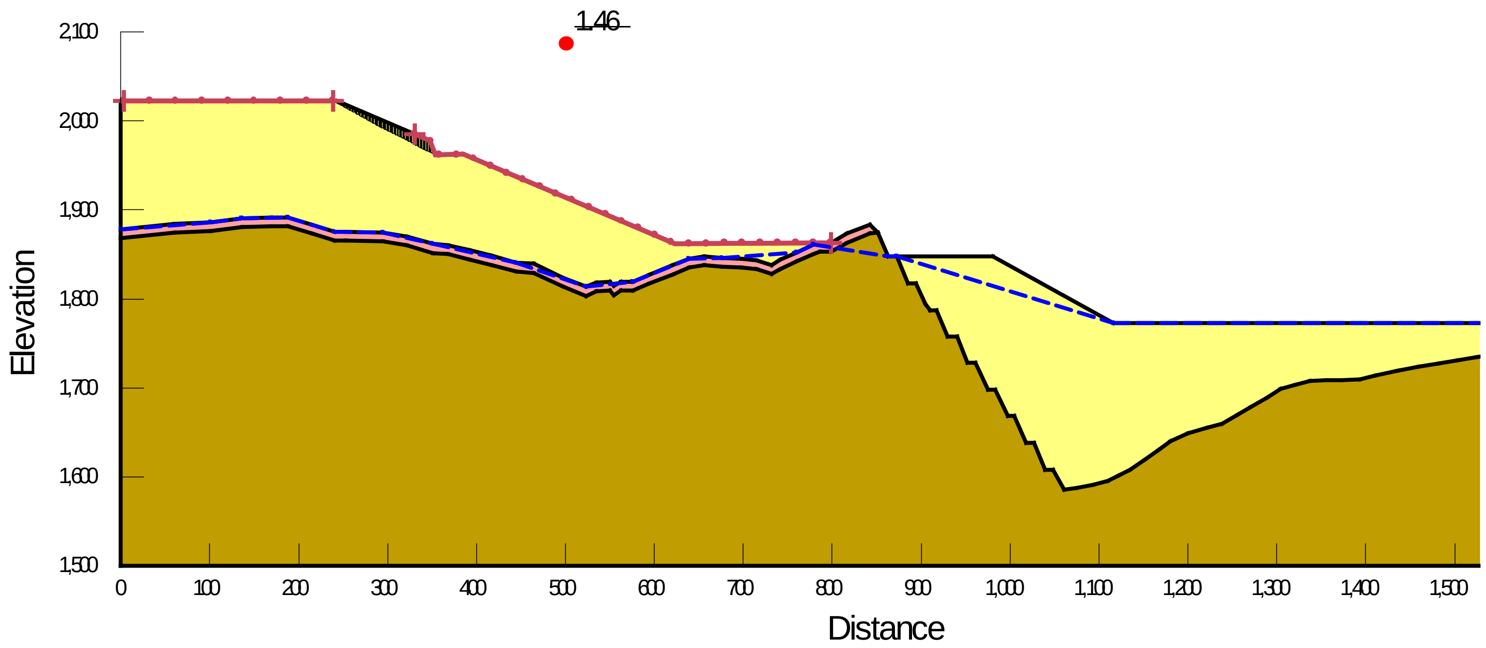
Model Setting

Name: Static - Shallow Failure

Description:
North Dump Cross - section 2

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Strength Function	Piezometric Line	Cohesion' (kPa)	Phi' (°)
	Bedrock (RMR 56)	*Shear/Normal Fn.*	*25*	*H-B Function - All Rocks*	*1*		
	Foundation Soil	*Mohr-Coulomb*	*19*		*1*	*0*	*22*
	Waste Rock	*Mohr-Coulomb*	*20*		*1*	*0*	*37*



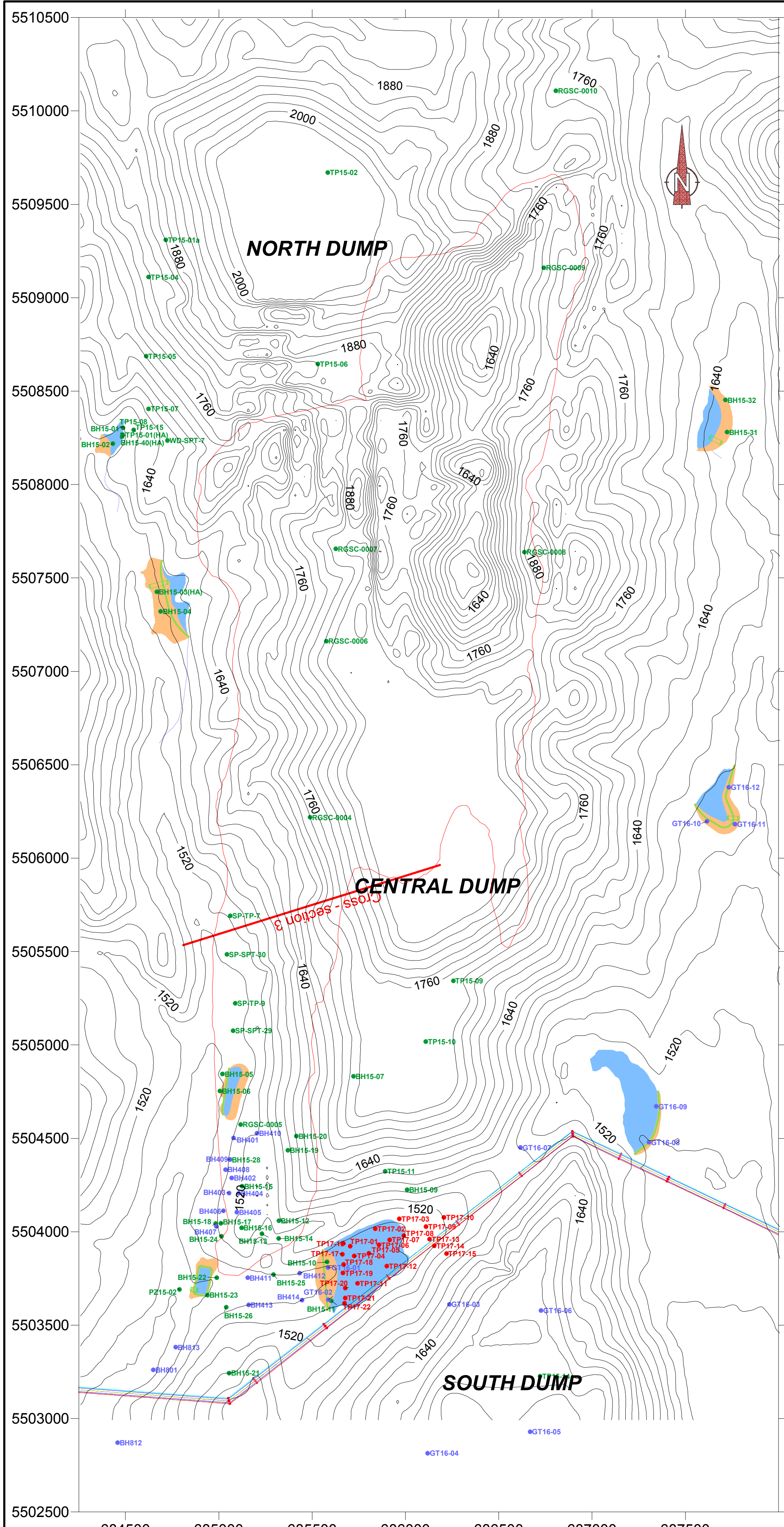
RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
181-9



LEGEND

- BH15-10 — Historical Geotechnical Borehole/Test Pit Location (Golder 2014 and 2015)
- GT16-01 — Geotechnical Borehole Location (Terracon 2016)
- TP17-18 — Test Pit Location (Terracon 2017)
- Existing KV Powerline
- Final Surface Elevation 50 m Contour Line
- Final Surface Elevation 10 m Contour Line
- Proposed Pond Footprint

0 500 1000 1500

Metres

Riversdale Resources Limited
Benga Mining Limited
Grassy Mountain Project, Alberta

TERRACON GEOTECHNIQUE LTD.
CONSULTING ENGINEERS AND GEOLOGISTS

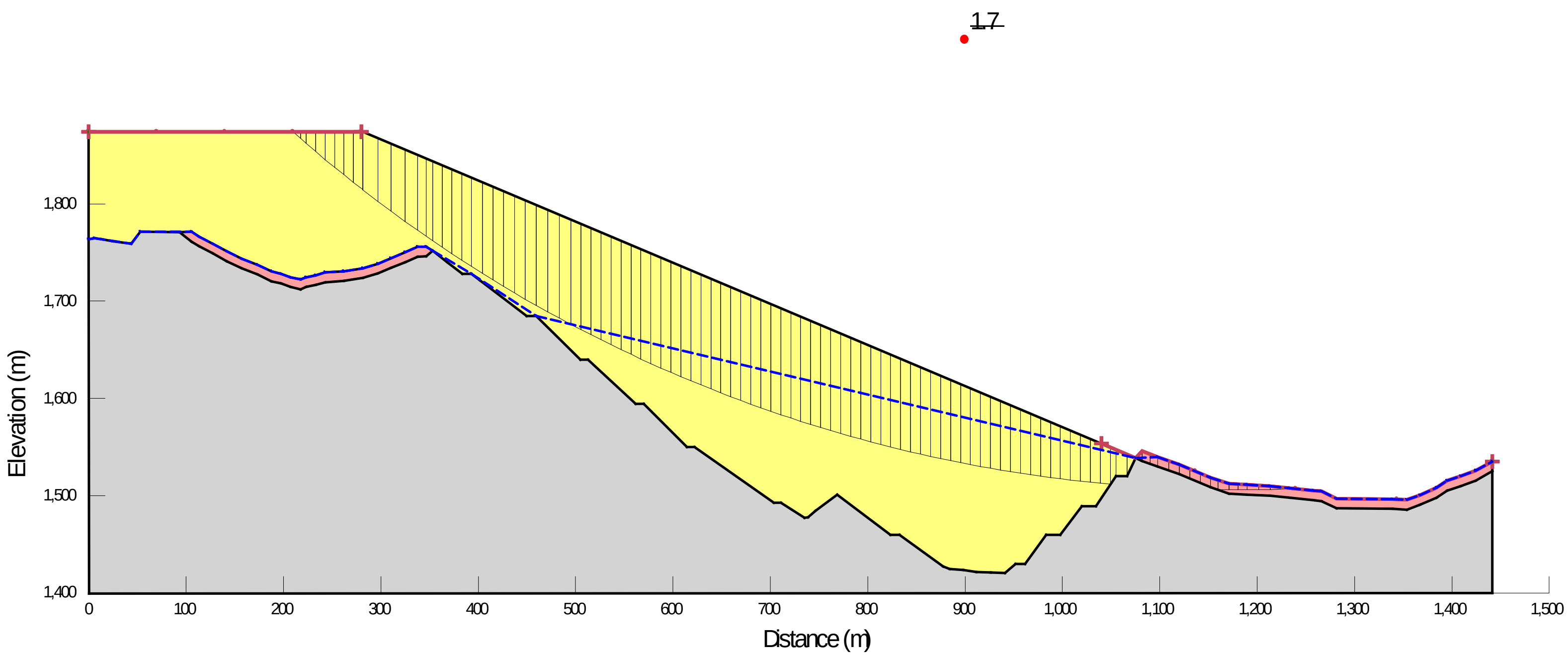
Figure 182-1

CROSS - SECTION 3 LOCATION

Date: February, 2018	Designed By: B.K.	DWG Size: custom
Scale: 1 : 22500	Drawn By: O.G.	Sheet:
Project No.: 184140	Reviewed By: B.K.	File Name: Benga Topo_3.srf

Central Dump Cross - section 3
Long Term Static Conditions

Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Bedrock	Bedrock (Impenetrable)				1
	Foundation Soil	Mohr-Coulomb	19	0	22	1
	Waste Rock	Mohr-Coulomb	20	0	37	1



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

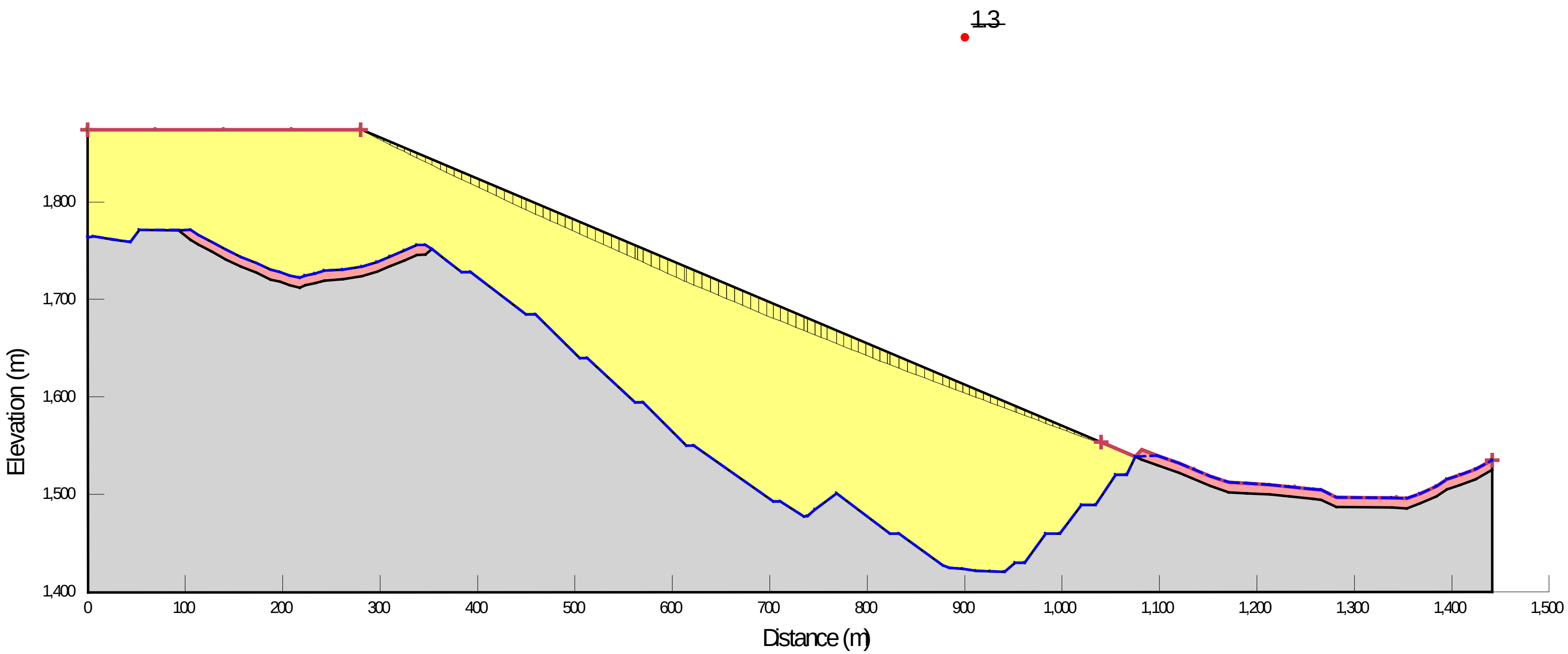
TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
182-2

Central Dump Cross - section 3
Long Term Pseudo - static Conditions

Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Bedrock	Bedrock (Impenetrable)				1
	Foundation Soil	Mohr-Coulomb	19	0	22	1
	Waste Rock	Mohr-Coulomb	20	0	37	1



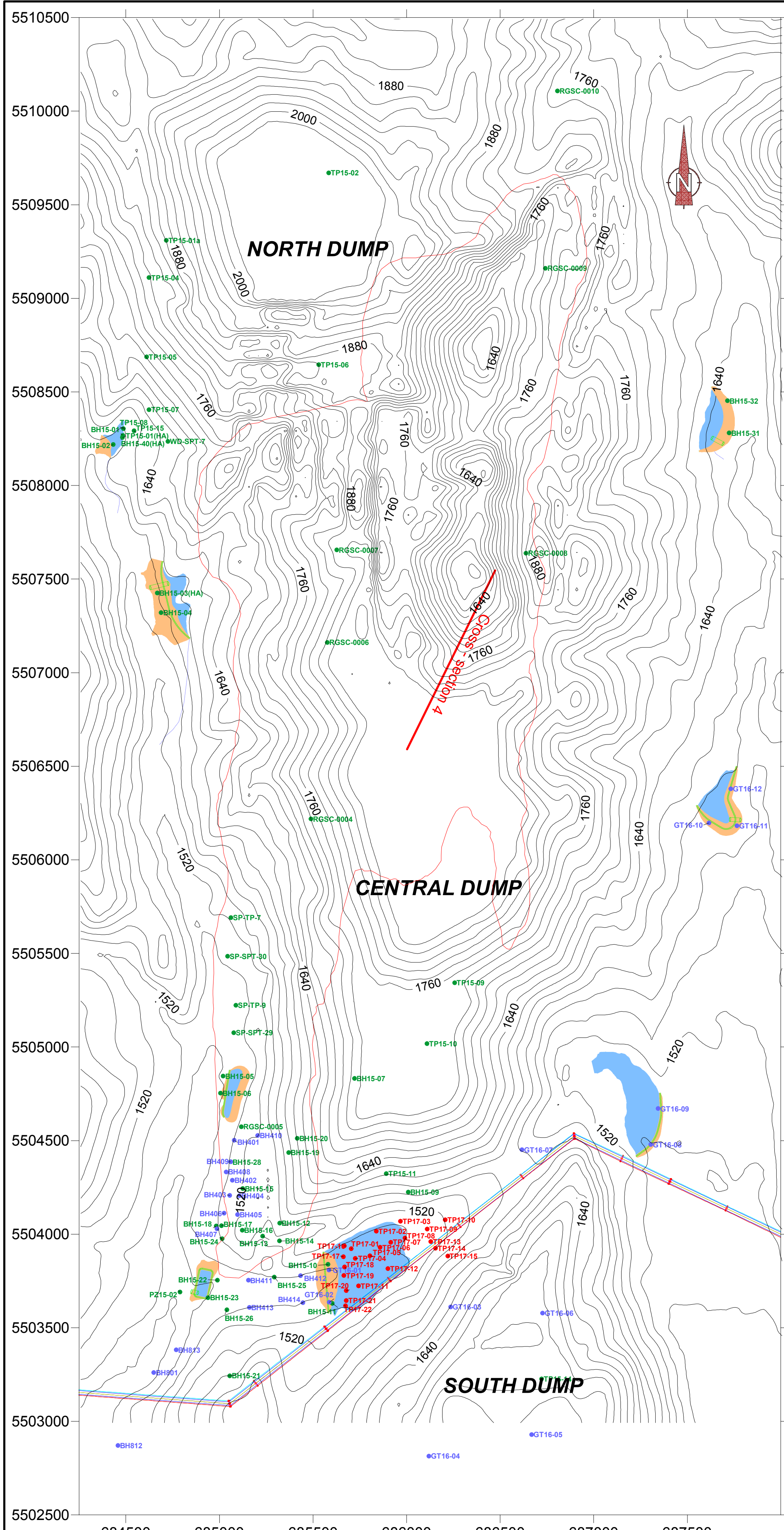
RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
182-3



LEGEND

- BH15-10 — Historical Geotechnical Borehole/Test Pit Location (Golder 2014 and 2015)
- GT16-01 — Geotechnical Borehole Location (Terracon 2016)
- TP17-18 — Test Pit Location (Terracon 2017)
- Existing KV Powerline
- Final Surface Elevation 50 m Contour Line
- Final Surface Elevation 10 m Contour Line
- Proposed Pond Footprint

0 500 1000 1500
Metres

Riversdale Resources Limited Benga Mining Limited Grassy Mountain Project, Alberta		TERRACON GEOTECHNIQUE LTD. CONSULTING ENGINEERS AND GEOLOGISTS	
Figure 182-4 CROSS - SECTION 4 LOCATION			
Date: February, 2018	Designed By: B.K.	DWG Size: custom	
Scale: 1 : 22500	Drawn By: O.G.	Sheet:	
Project No.: 184140	Reviewed By: B.K.	File Name: Benga Topo_3.srf	

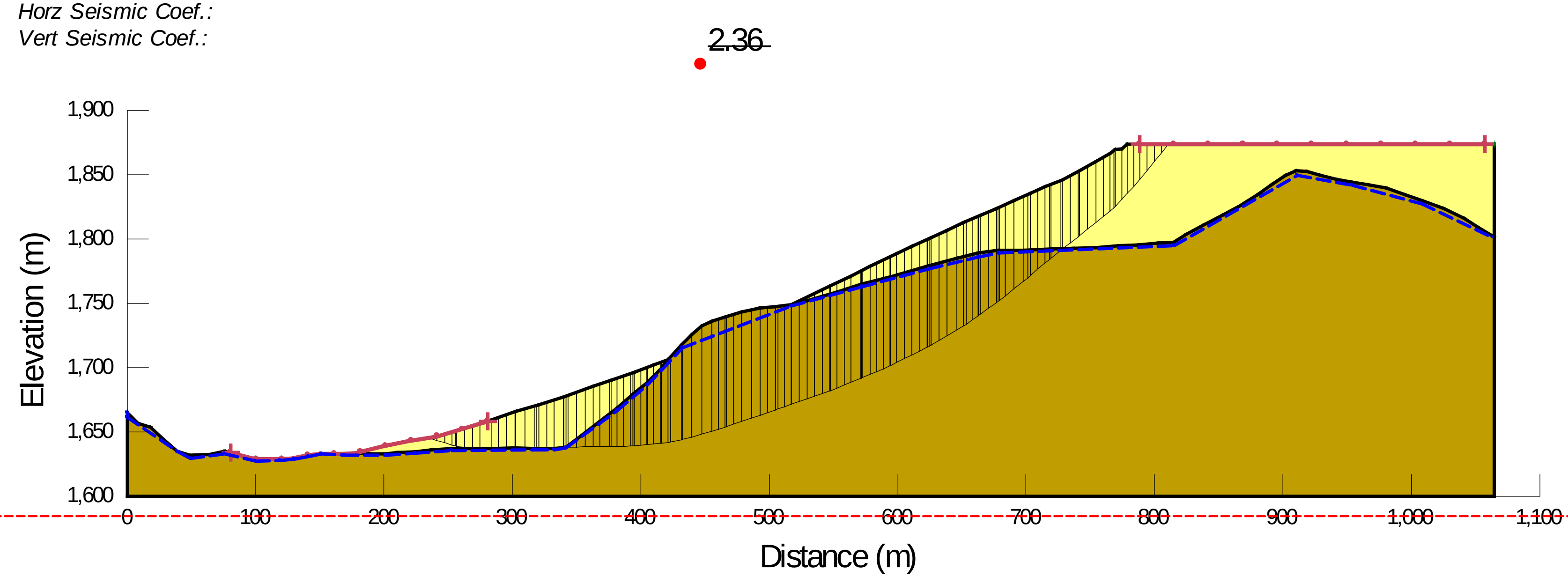
File not found: E:\BENGA_SIR\Initial, Mined, Final Surfaces O4.png.
Re-link picture using Sketch Pictures.

Name: Static - Deep (to Pit)

Description:
North Dump Cross - section 4

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.:
Vert Seismic Coef.:

Color	Name	Model	Unit Weight (kN/m³)	Strength Function	Piezometric Line	Cohesion' (kPa)	Phi' (°)
	Bedrock (RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks	1		
	Waste Rock	Mohr-Coulomb	20		1	0	37



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
182-5

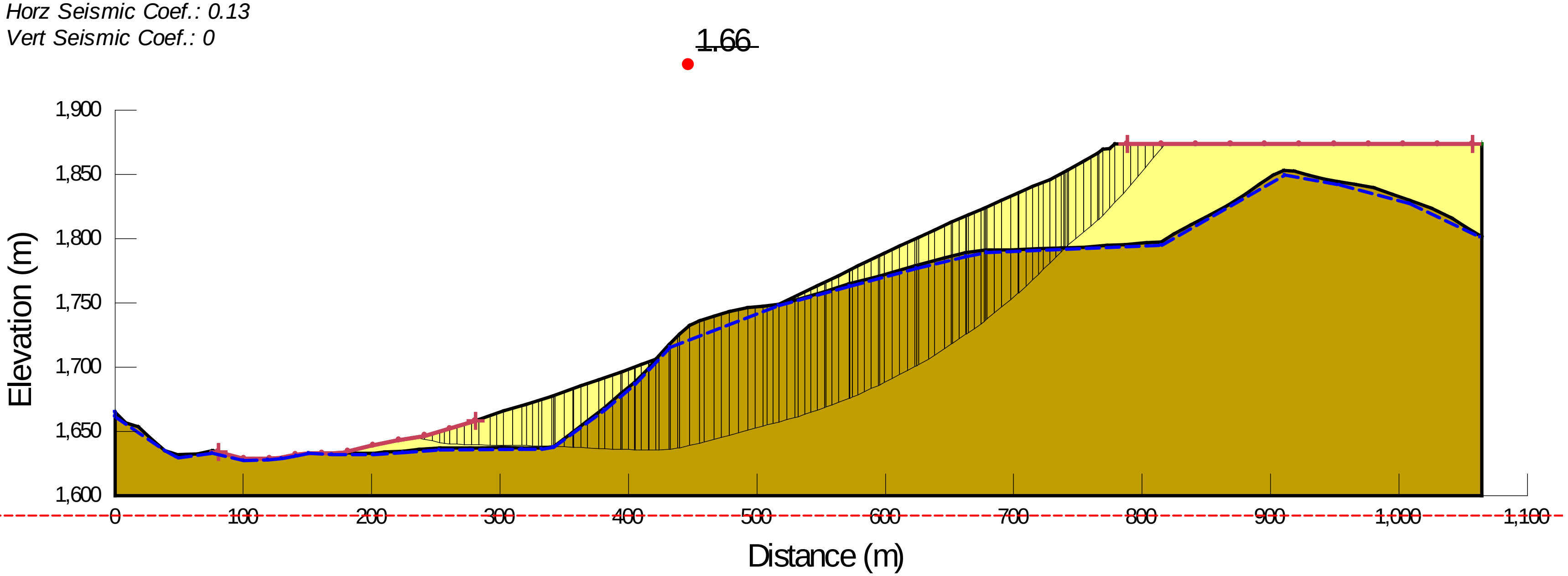
Disclaimer: This figure was derived from multiple data sources and while we make every effort to assure its accuracy, Terracon Geotechnique Ltd. disclaims any representation or warranty and assumes no liability either for any errors, omission or inaccuracies that may occur.

Name: Seismic - Deep (to Pit)

Description:
North Dump Cross - section 4

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.13
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Strength Function	Piezometric Line	Cohesion' (kPa)	Phi' (°)
	Bedrock (RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks	1		
	Waste Rock	Mohr-Coulomb	20		1	0	37



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
182-6

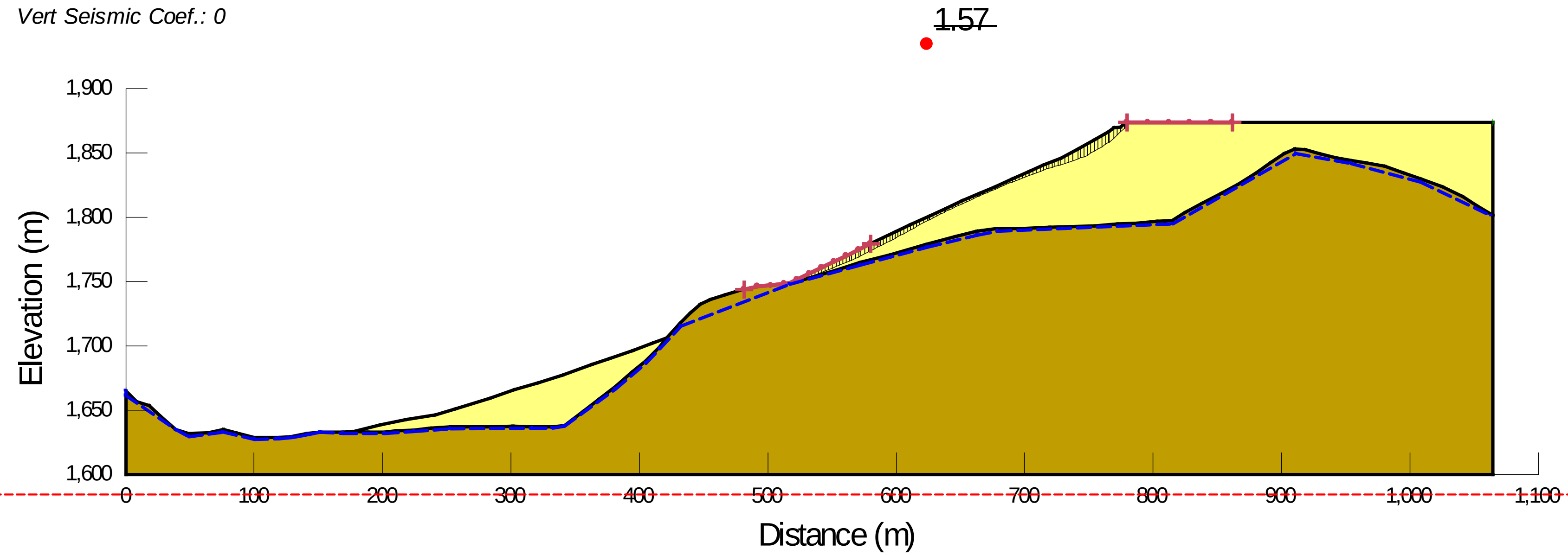
Re-link picture using Sketch Pictures.

Name: Static - Shallow

Description:
North Dump Cross - section 4

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Strength Function	Piezometric Line	Cohesion' (kPa)	Phi' (°)
	Bedrock (RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks	1		
	Waste Rock	Mohr-Coulomb	20		1	0	37



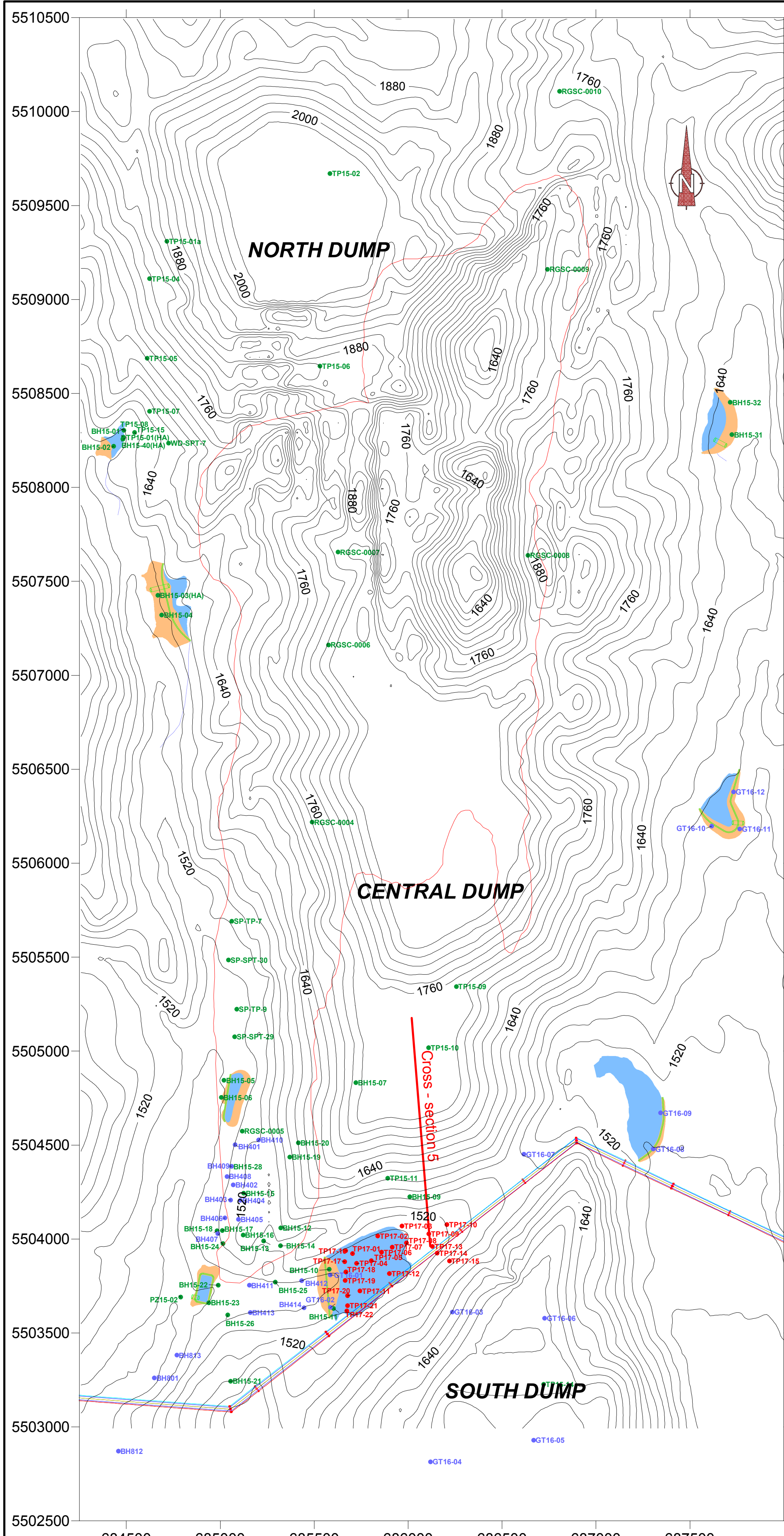
RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
182-7



LEGEND

● BH15-10	Historical Geotechnical Borehole/Test Pit Location (Golder 2014 and 2015)
● GT16-01	Geotechnical Borehole Location (Terracon 2016)
● TP17-18	Test Pit Location (Terracon 2017)
	Existing KV Powerline
1600	Final Surface Elevation 50 m Contour Line Final Surface Elevation 10 m Contour Line
	Proposed Pond Footprint

0 500 1000 1500
Metres

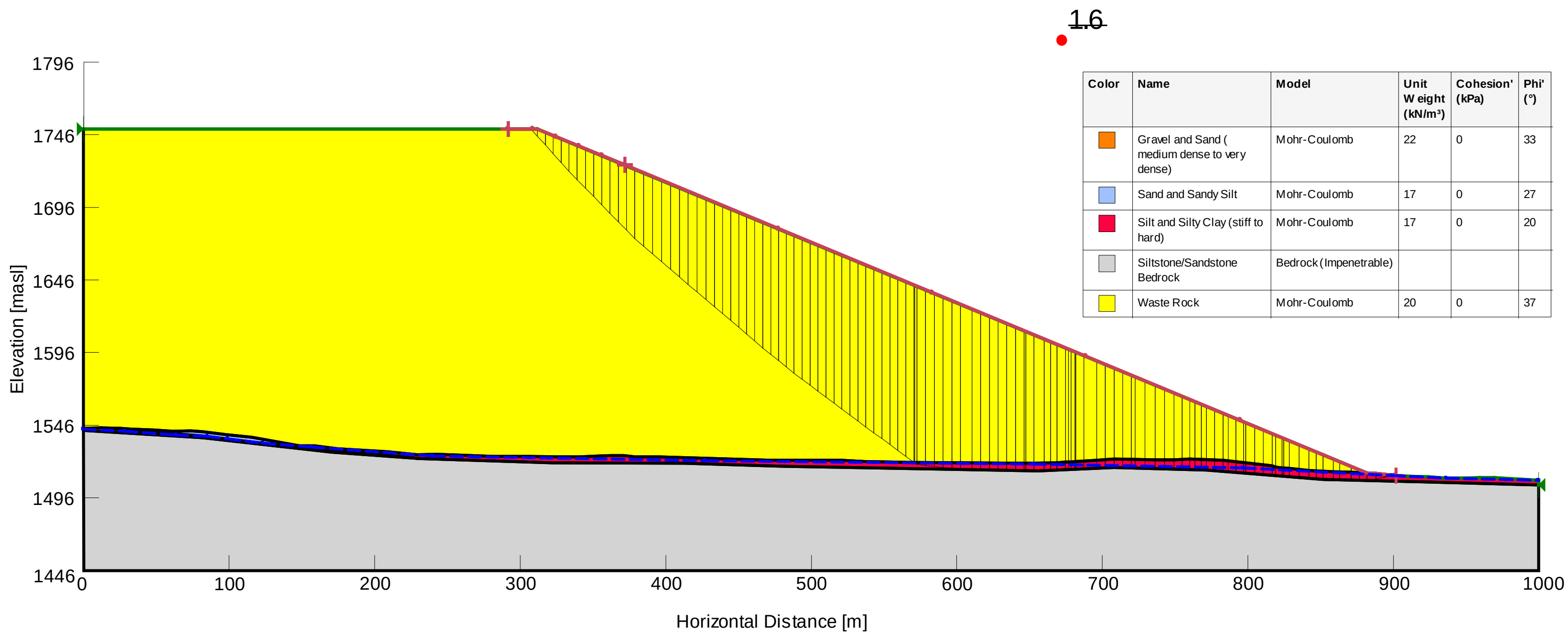
Riversdale Resources Limited
Benga Mining Limited
Grassy Mountain Project, Alberta

TERRACON GEOTECHNIQUE LTD.
CONSULTING ENGINEERS AND GEOLOGISTS

Figure 182-8
CROSS - SECTION 5 LOCATION

Date: February, 2018	Designed By: B.K.	DWG Size: custom	
Scale: 1 : 22500	Drawn By: O.G.	Sheet:	
Project No.: 184140	Reviewed By: B.K.	File Name: Benga Topo_3.srf	

Central Dump Cross - section 5
Long Term Static Conditions



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Gravel and Sand (medium dense to very dense)	Mohr-Coulomb	22	0	33
	Sand and Sandy Silt	Mohr-Coulomb	17	0	27
	Silt and Silty Clay (stiff to hard)	Mohr-Coulomb	17	0	20
	Siltstone/Sandstone Bedrock	Bedrock (Impenetrable)			
	Waste Rock	Mohr-Coulomb	20	0	37

RIVERSDALE RESOURCES

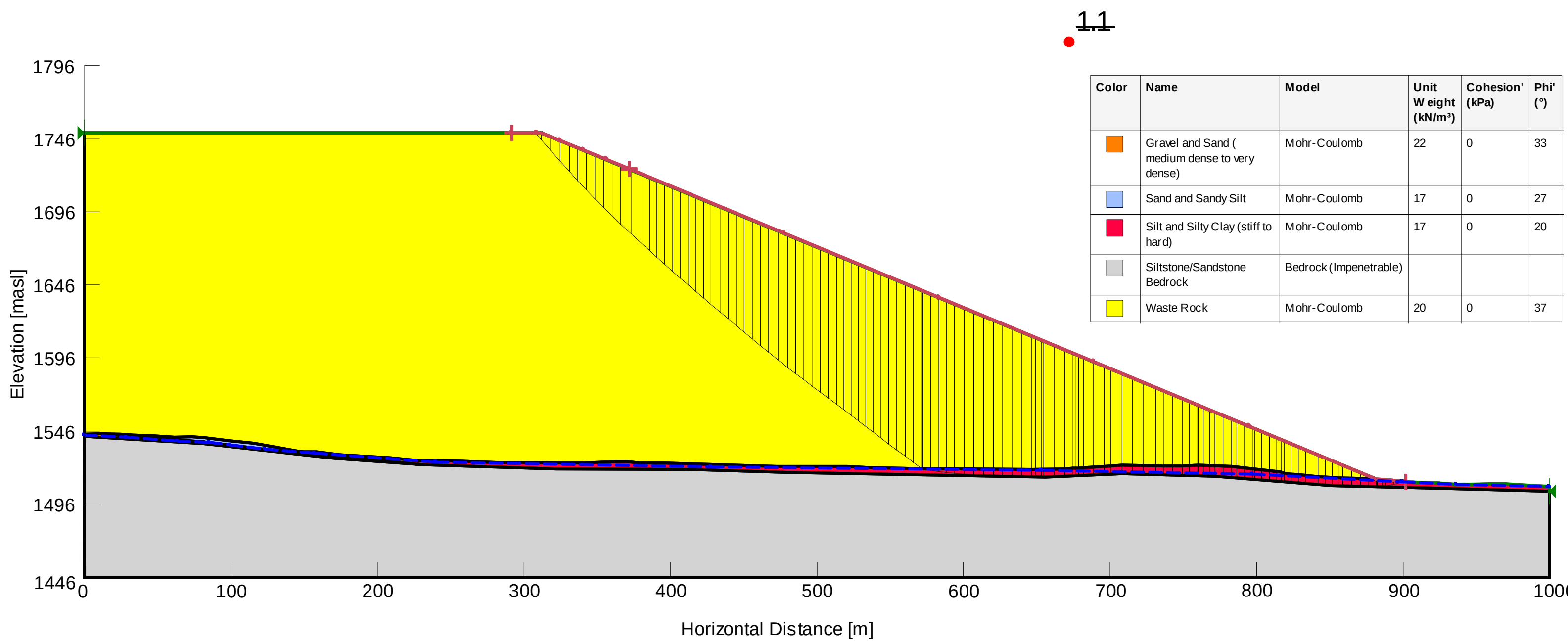
GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
182-9

Central Dump Cross - Section 5
Long Term Pseudo-static Conditions



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Gravel and Sand (medium dense to very dense)	Mohr-Coulomb	22	0	33
	Sand and Sandy Silt	Mohr-Coulomb	17	0	27
	Silt and Silty Clay (stiff to hard)	Mohr-Coulomb	17	0	20
	Siltstone/Sandstone Bedrock	Bedrock (Impenetrable)			
	Waste Rock	Mohr-Coulomb	20	0	37

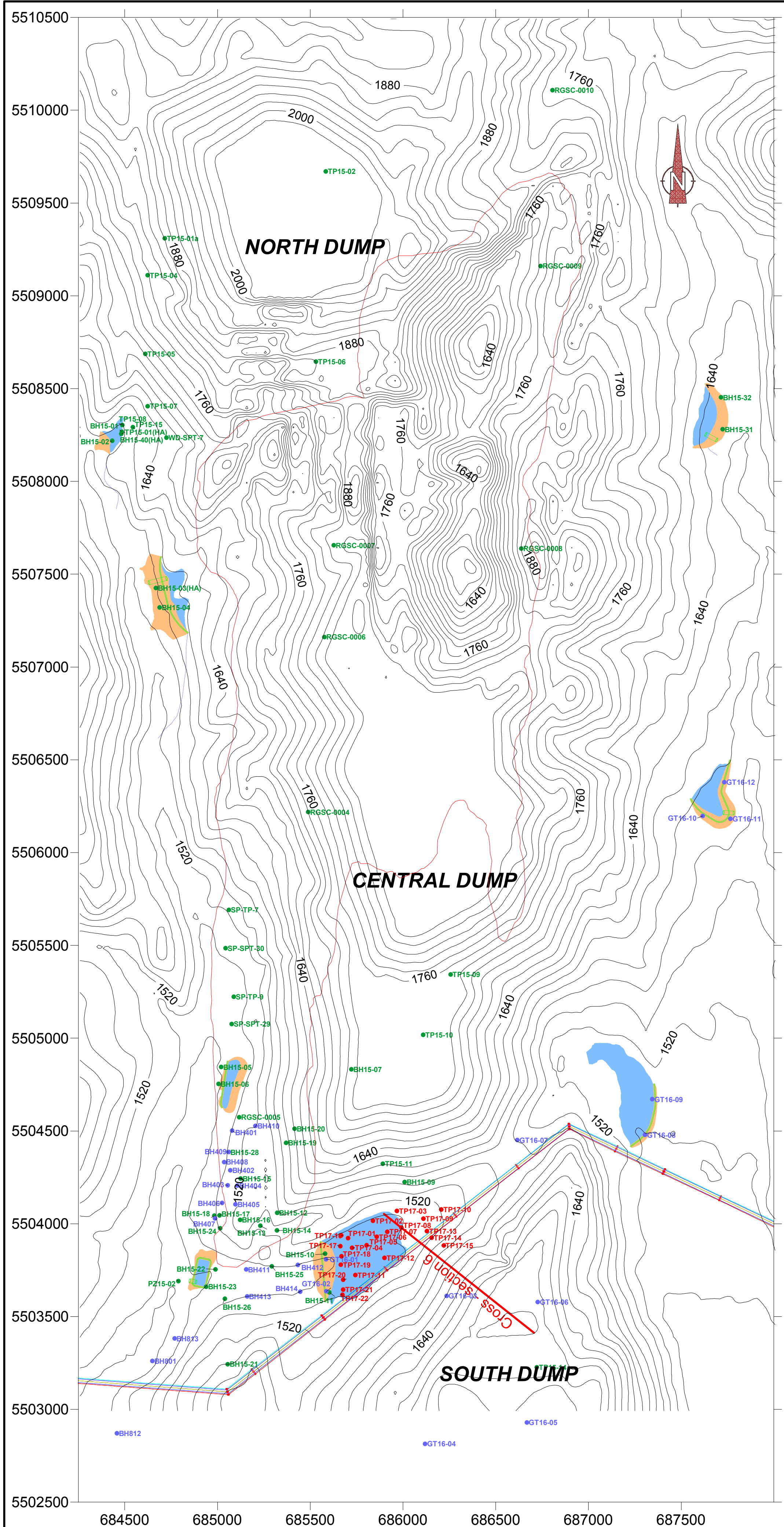
RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
182-10



LEGEND

- BH15-10 — Historical Geotechnical Borehole/Test Pit Location (Golder 2014 and 2015)
- GT16-01 — Geotechnical Borehole Location (Terracon 2016)
- TP17-18 — Test Pit Location (Terracon 2017)
- Existing KV Powerline
- Final Surface Elevation 50 m Contour Line
- Final Surface Elevation 10 m Contour Line
- Proposed Pond Footprint

0 500 1000 1500
Metres

Riversdale Resources Limited
Benga Mining Limited
Grassy Mountain Project, Alberta

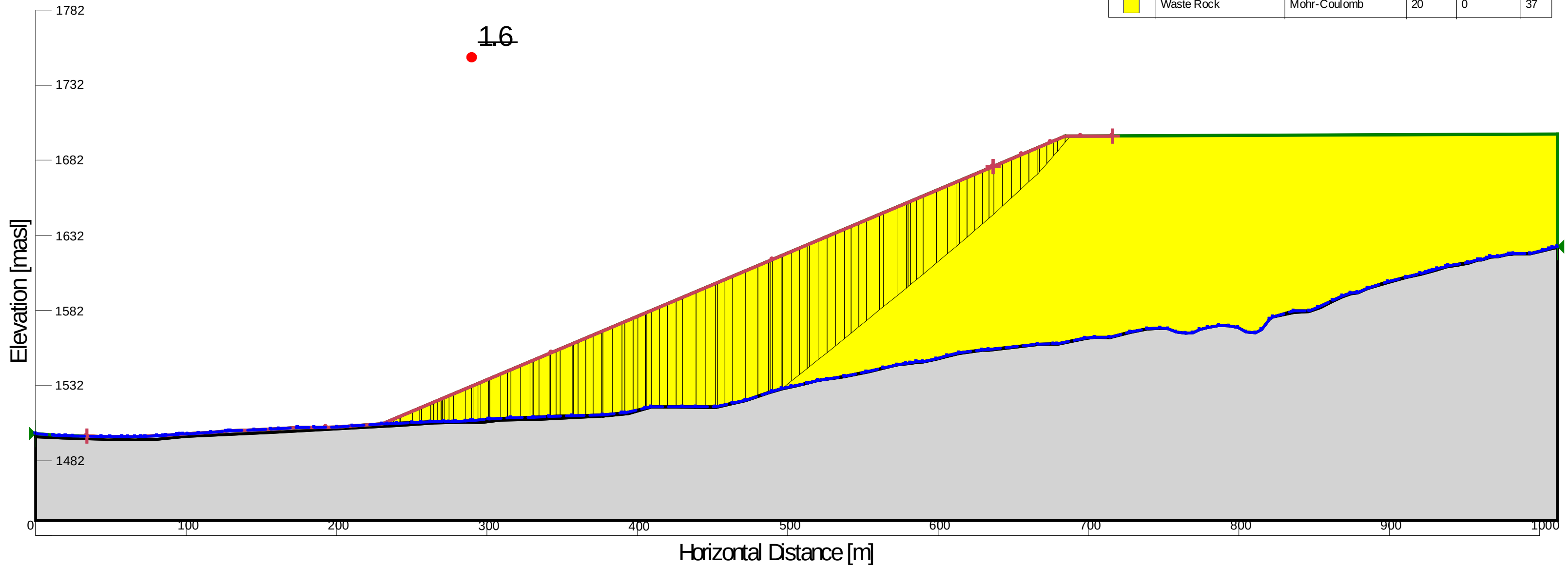
TERRACON GEOTECHNIQUE LTD.
CONSULTING ENGINEERS AND GEOLOGISTS

Figure 182-11
CROSS - SECTION 6 LOCATION

Date: February, 2018	Designed By: B.K.	DWG Size: custom
Scale: 1 : 22500	Drawn By: O.G.	Sheet:
Project No.: 184140	Reviewed By: B.K.	File Name: Benga Topo_3.srf

South Dump Cross - section 6
Long Term Static Conditions

Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Gravel and Sand (loose to medium dense)	Mohr-Coulomb	20	0	30
	Sand and Sandy Silt	Mohr-Coulomb	17	0	27
	Silt and Silty Clay (stiff to hard)	Mohr-Coulomb	17	0	20
	Siltstone/Sandstone Bedrock	Bedrock (Impenetrable)			
	Waste Rock	Mohr-Coulomb	20	0	37



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

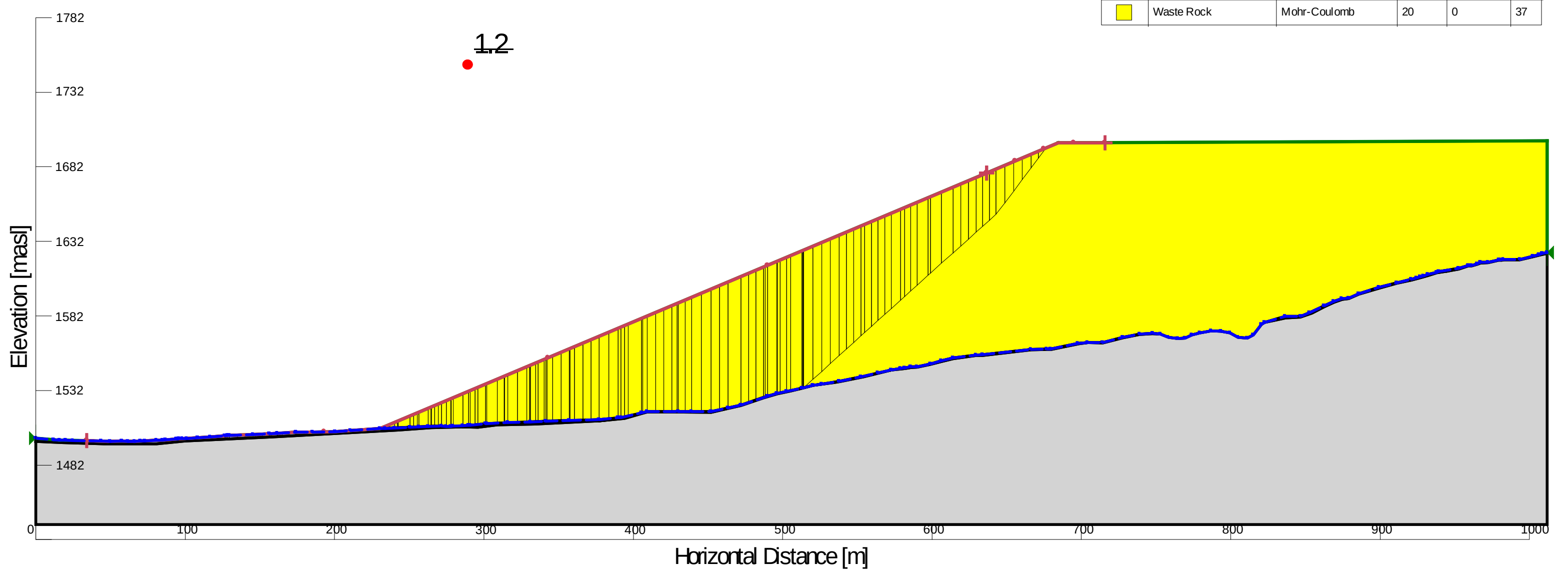
TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
182-12

South Dump Cross - section 6
Long Term Pseudo - static Conditions

Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Gravel and Sand (loose to medium dense)	Mohr-Coulomb	20	0	30
	Sand and Sandy Silt	Mohr-Coulomb	17	0	27
	Silt and Silty Clay (stiff to hard)	Mohr-Coulomb	17	0	20
	Siltstone/Sandstone Bedrock	Bedrock (Impenetrable)			
	Waste Rock	Mohr-Coulomb	20	0	37



RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY: OG
CHECKED BY: BK
DATE: 26Feb, 2018

FIGURE
182-13

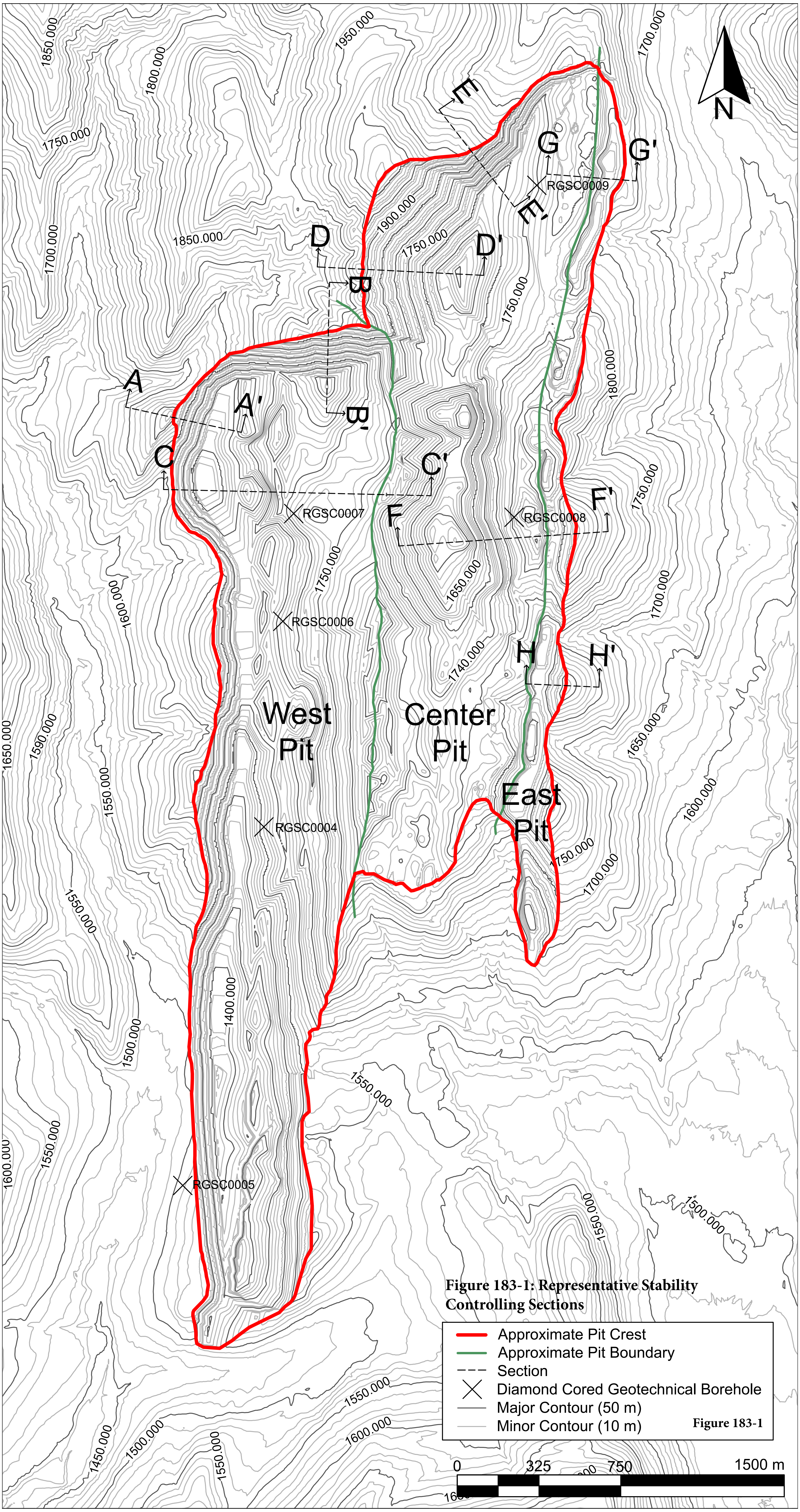
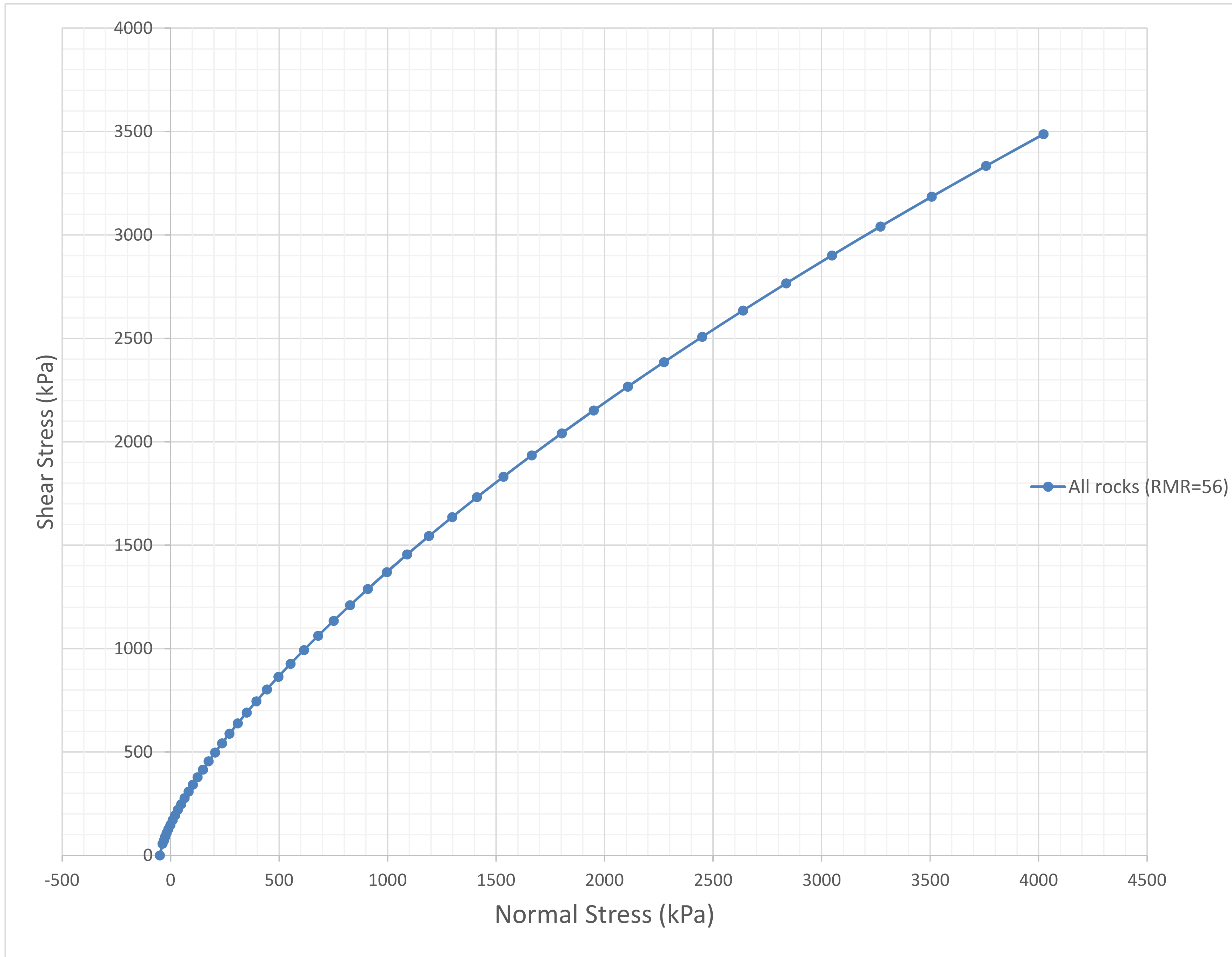


Figure 183-1: Representative Stability Controlling Sections

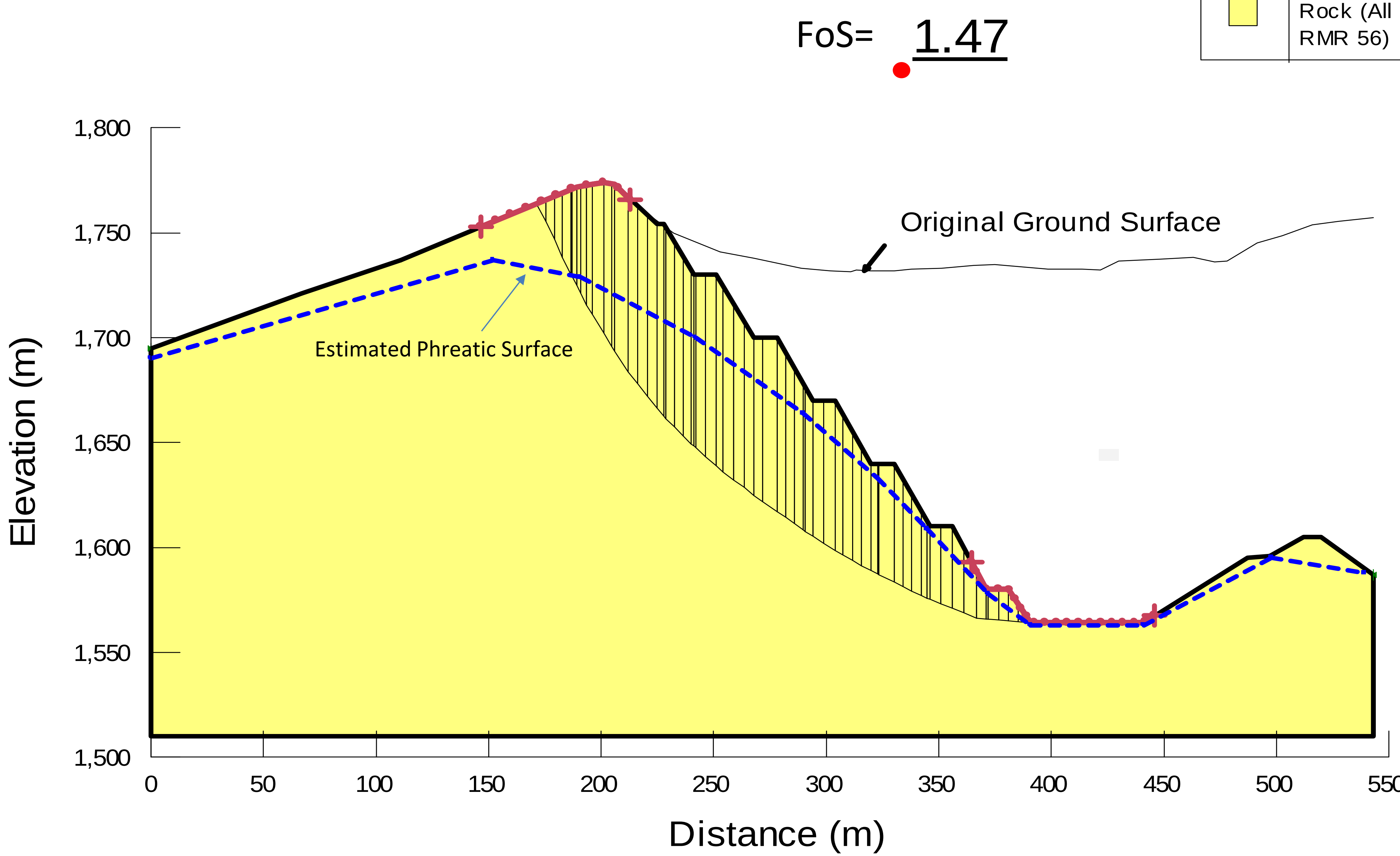
Figure 183-1



TERRACON GEOTECHNIQUE

Client: Benga Mining Limited			BENGA SIR SUPPORT PIT SLOPE STABILITY	
Design:	AE	February-20-18	**Hoek-Brown Strenght Function for All Rocks (RMR=56)**	
Checked	AE	February-20-18	Project #: 184140	**Figure: 183-2**
Reviewed:	NH	February 23, 2018	Rev: 0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

Name: Static - General Failure

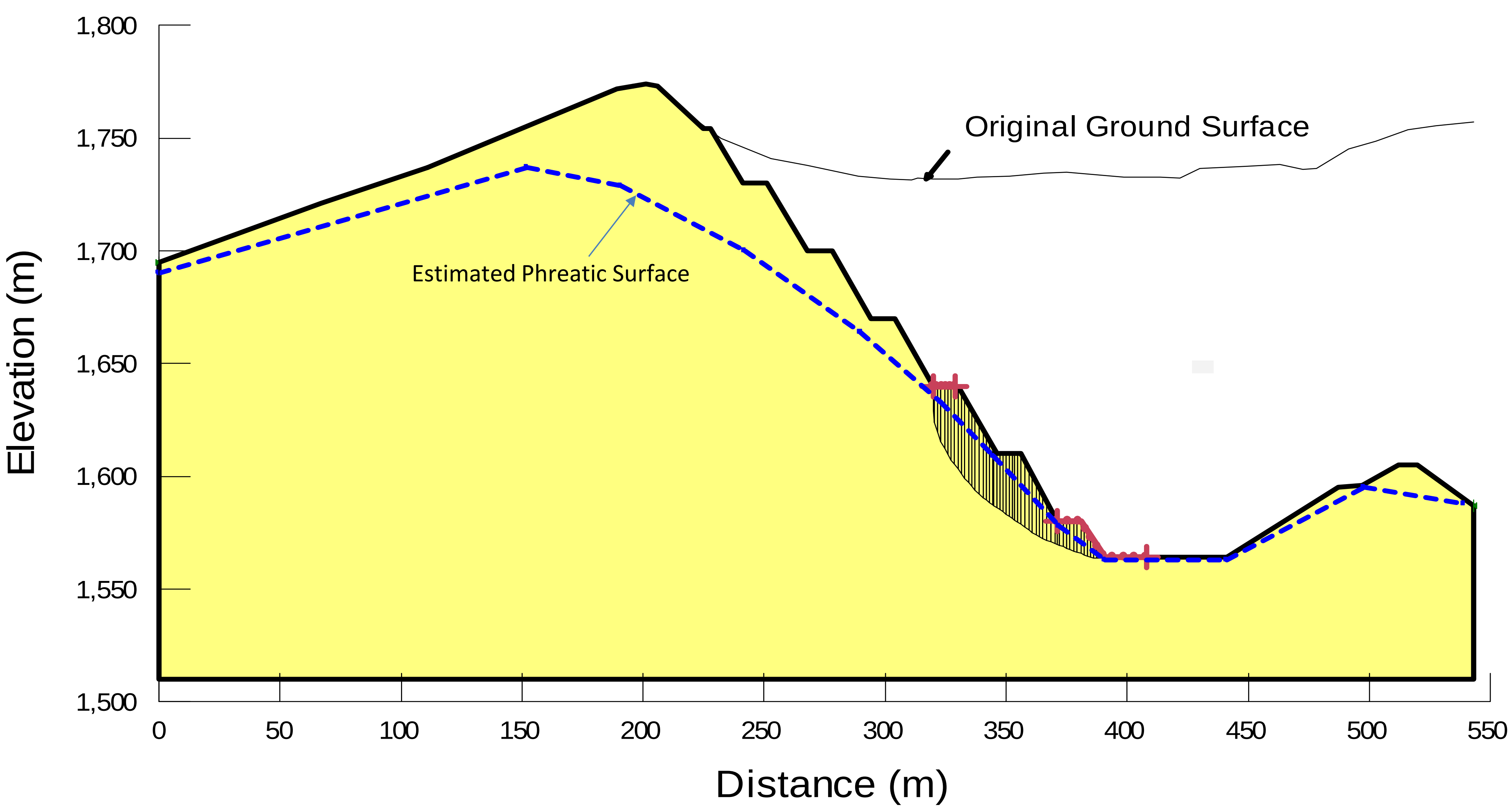
Description:
Double Bench 30 m high
Face angle= 65 degree
Bench width= 10 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			West Pit - Highwall (Section A) - General Failure, Static Loading		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	Figure: 183-3
Reviewed:	NH	February 23, 2018	Rev:	0	

FoS= 2.20

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

Name: Static - Toe Failure

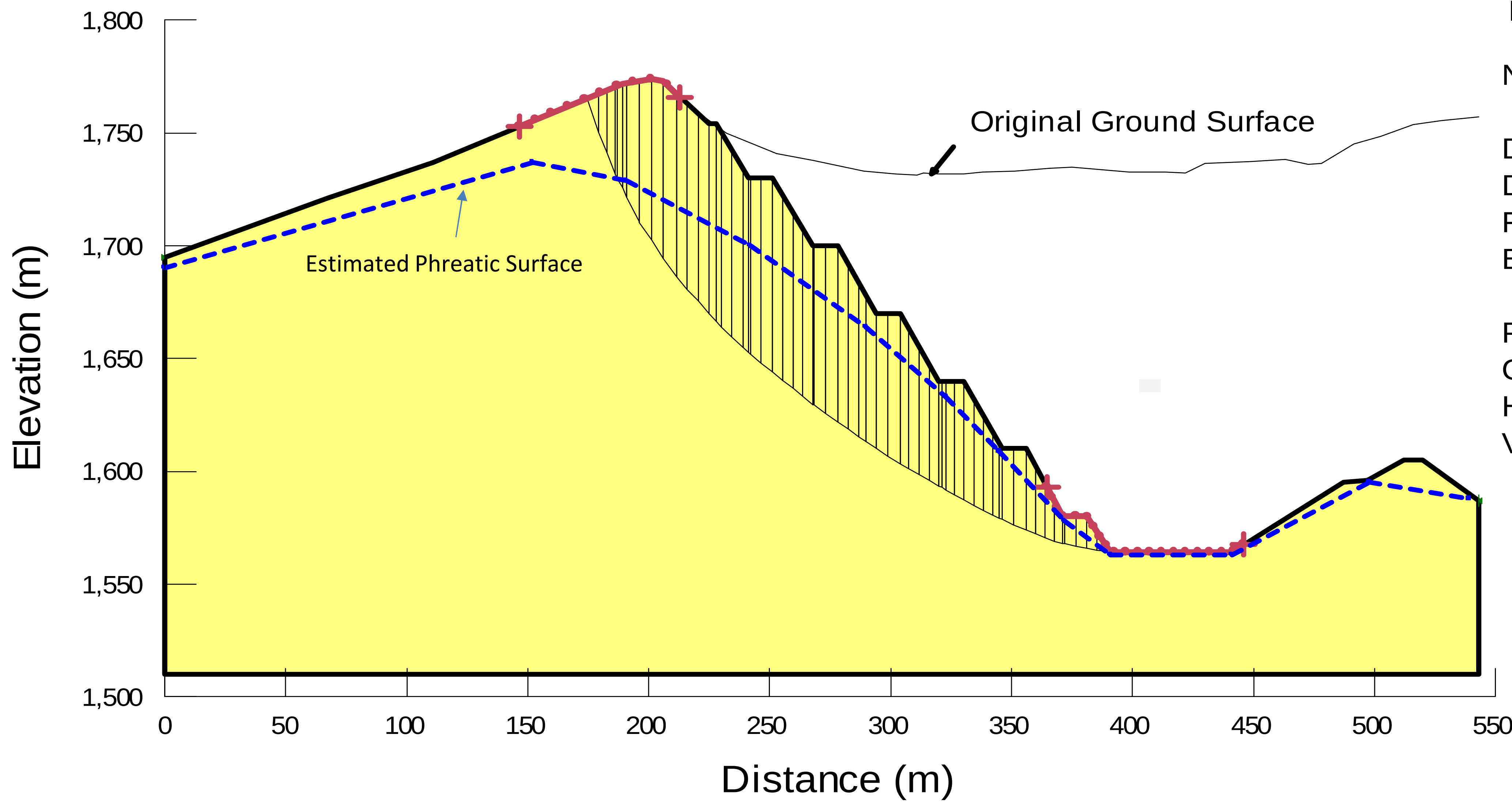
Description:
Double Bench 30 m h
Face angle= 65 degree
Bench width= 10 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			West Pit - Highwall (Section A) - Toe Failure, Static Loading		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	Figure: 183-4
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks

FoS= 1.23



Model Setting

Name: Seismic - General Failure

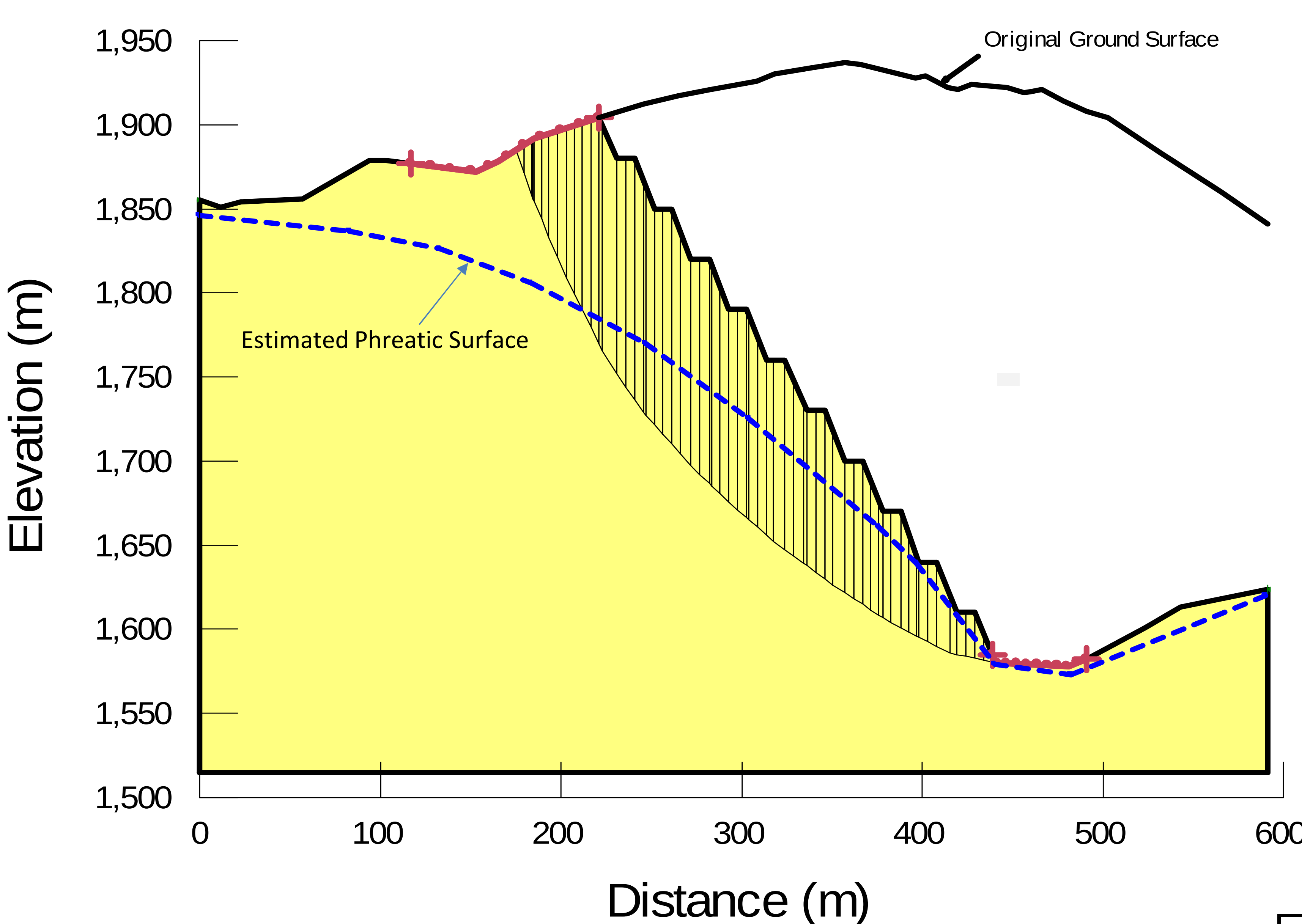
Description:
Double Bench 30 m h
Face angle= 65 degree
Bench width= 10 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.112
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**West Pit - Highwall (Section A) - General Failure, Seismic Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-5**
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks

FoS= 1.17



Analysis Setting

Name: Static - General Failure

Description:
Double Bench 30 m h
Face angle= 70 degree
Bench width=10 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE

BENGA SIR SUPPORT
PIT SLOPE STABILITY

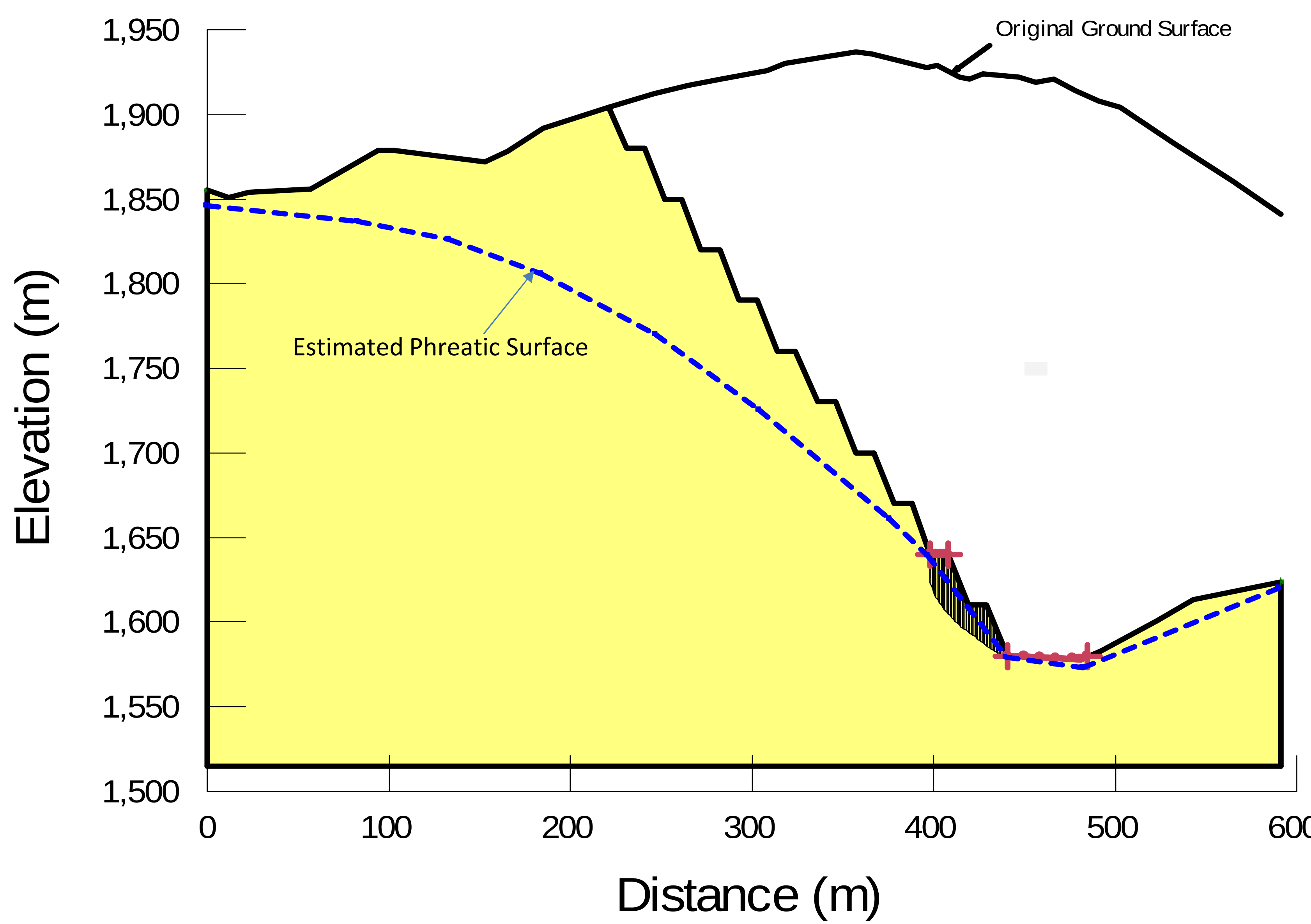
Client: Benga Mining Limited

West Pit - Endwall (Section B) - General Failure, Static Loading

Design:	AE	February-20-18	Project #:	184140	**Figure: 183-6**
Checked	AE	February-20-18			
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks

FoS= 1.53



Analysis Setting

Name: Static - Toe Failure

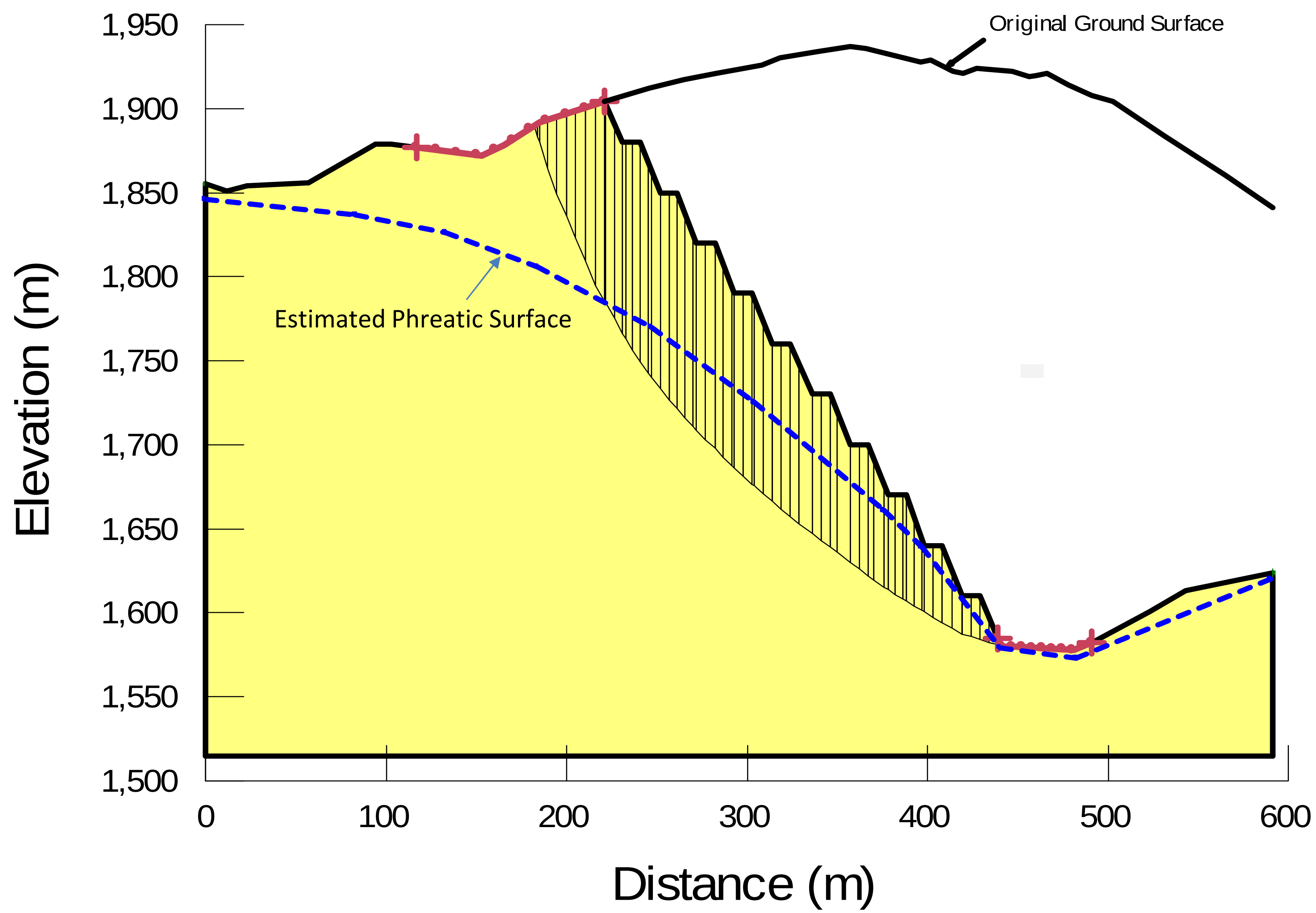
Description:
Double Bench 30 m h
Face angle= 70 degree
Bench width=10 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**West Pit - Endwall (Section B) - Toe Failure, Static Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-7**
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks

FoS= 0.99



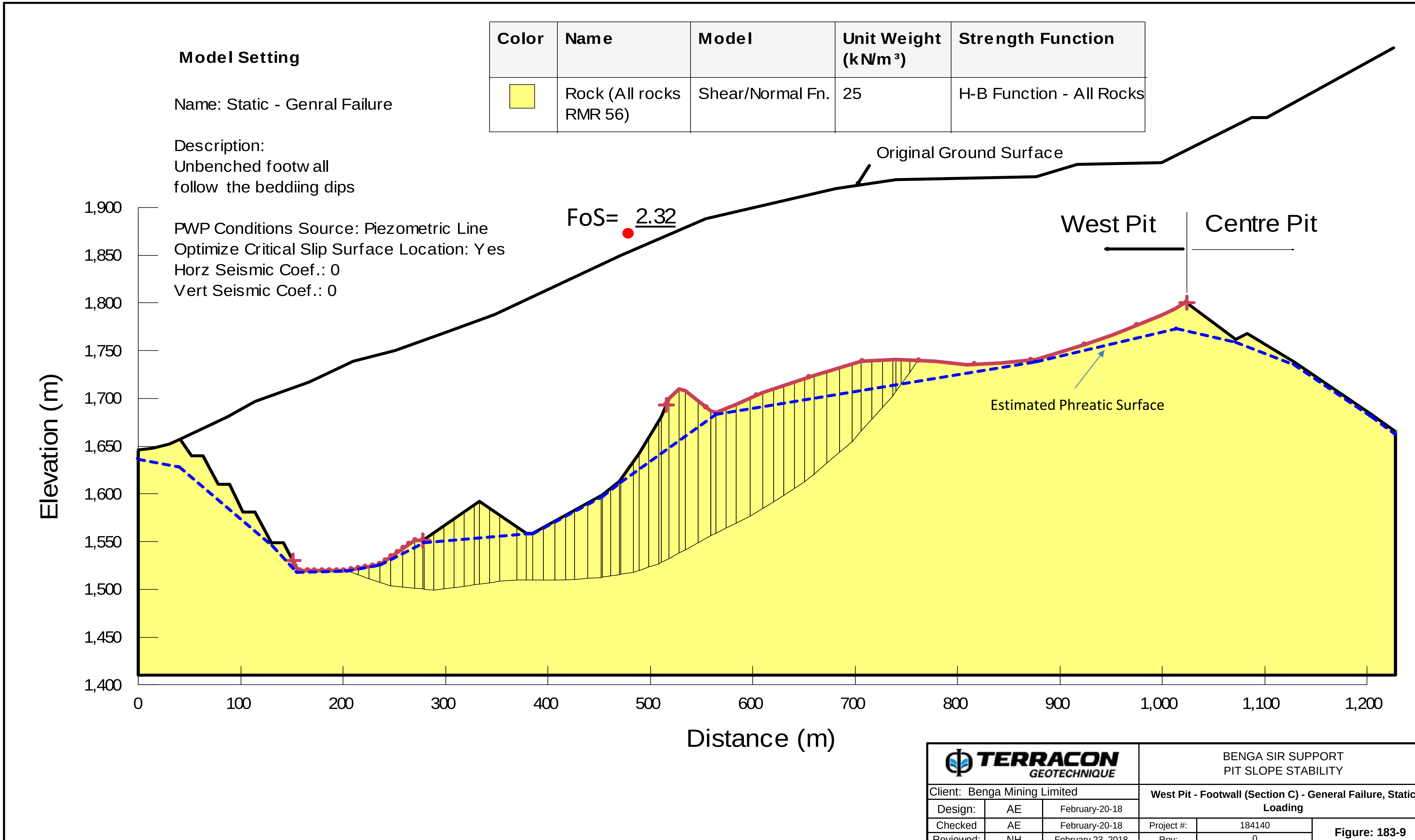
Analysis Setting

Name: Seismic - General Failure

Description:
Double Bench 30 m h
Face angle= 70 degree
Bench width=10 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.112
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**West Pit - Endwall (Section B) - General Failure, Seismic Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-8**
Reviewed:	NH	February 23, 2018	Rev:	0	


Model Setting
Name: Static - Genral Failure
Description:
Unbenched footw all
follow the beddiing dips
PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0
Color
Name
Model
Unit Weight (kN/m³)
Strength Function
Rock (All rocks RMR 56)
Shear/Normal Fn.
25
H-B Function - All Rocks
Original Ground Surface
FoS= 2.32
West Pit
Centre Pit
Estimated Phreatic Surface
Elevation (m)
1,900
1,850
1,800
1,750
1,700
1,650
1,600
1,550
1,500
1,450
1,400
0
100
200
300
400
500
600
700
800
900
1,000
1,100
1,200
Distance (m)
TERRACON GEOTECHNIQUE
BENGA SIR SUPPORT
PIT SLOPE STABILITY
Client: Benga Mining Limited
West Pit - Footwall (Section C) - General Failure, Static Loading
Design: AE February-20-18
Checked AE February-20-18
Reviewed: NH February 23, 2018
Project #: 184140
Rev: 0
Figure: 183-9

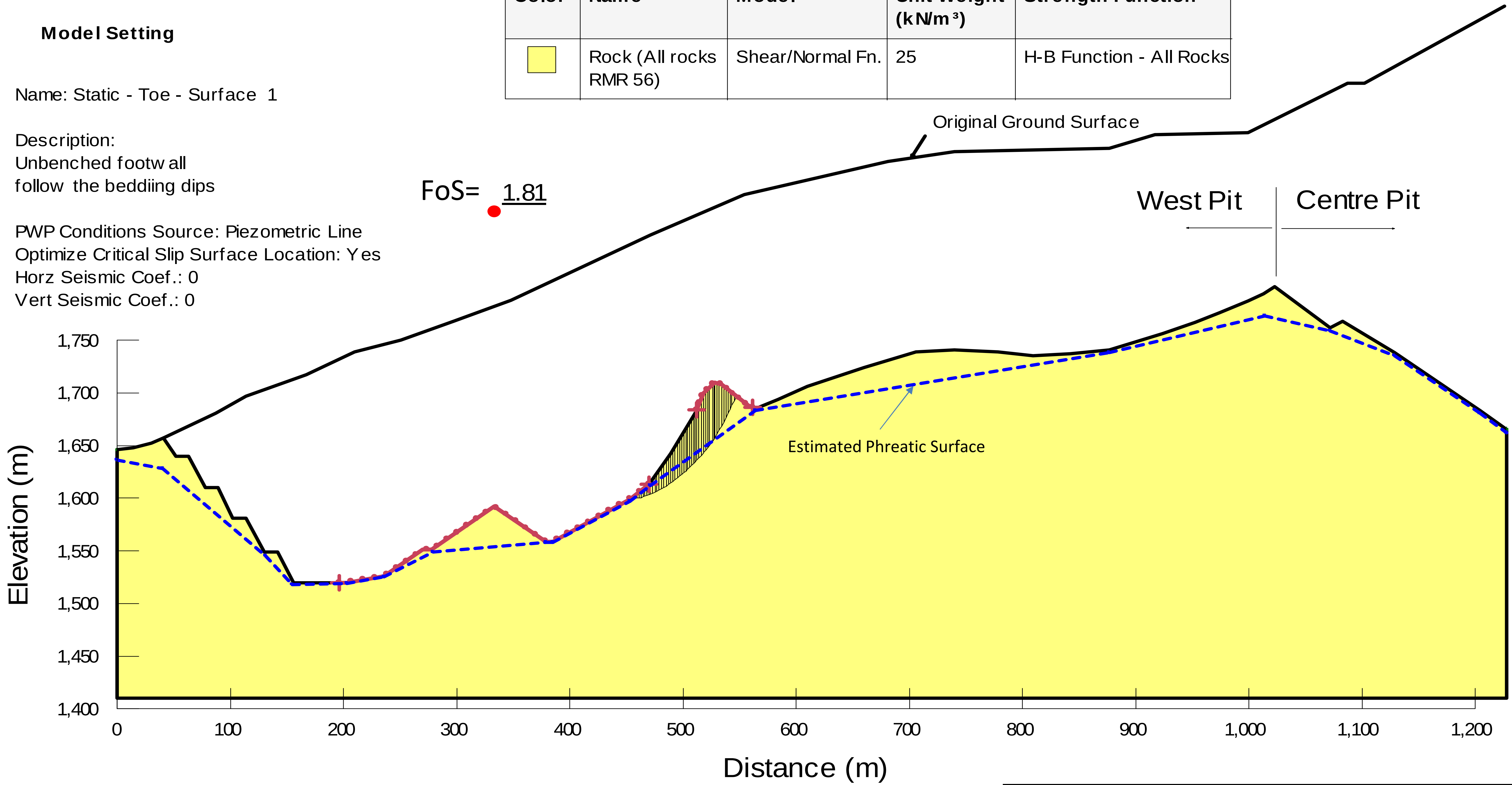
Model Setting

Name: Static - Toe - Surface 1

Description:
Unbenched footw all
follow the beddiing dips

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
(yellow)	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			West Pit - Footwall (Section C) - Toe Failure (Surface 1), Static Loading		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	Figure: 183-10
Reviewed:	NH	February 23, 2018	Rev:	0	

Model Setting

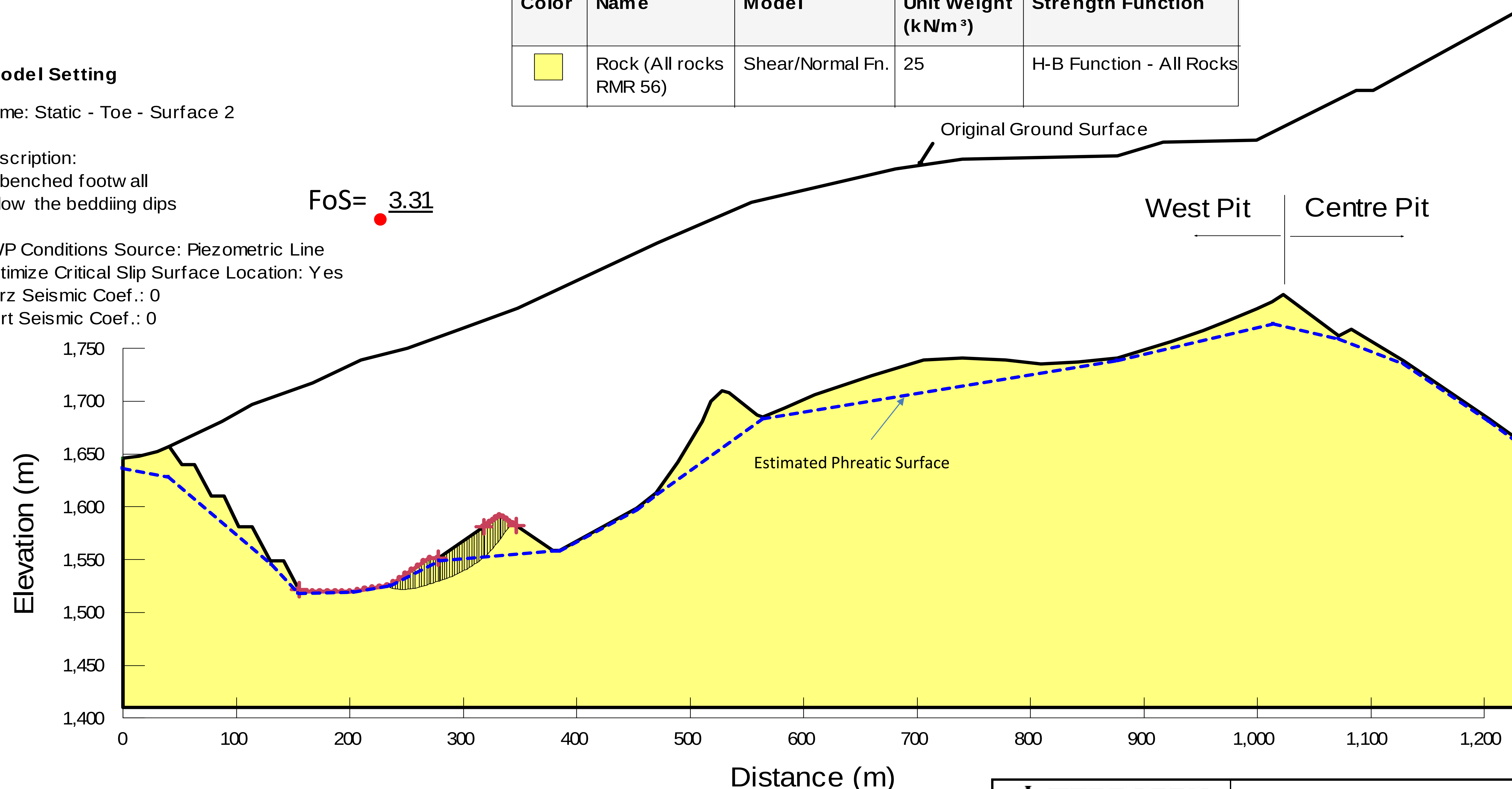
Name: Static - Toe - Surface 2

Description:
Unbenched footw all
follow the beddiing dips

FoS= 3.31

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
(yellow)	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**West Pit - Footwall (Section C) - Toe Failure (Surface 2), Static Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-11**
Reviewed:	NH	February 23, 2018	Rev:	0	

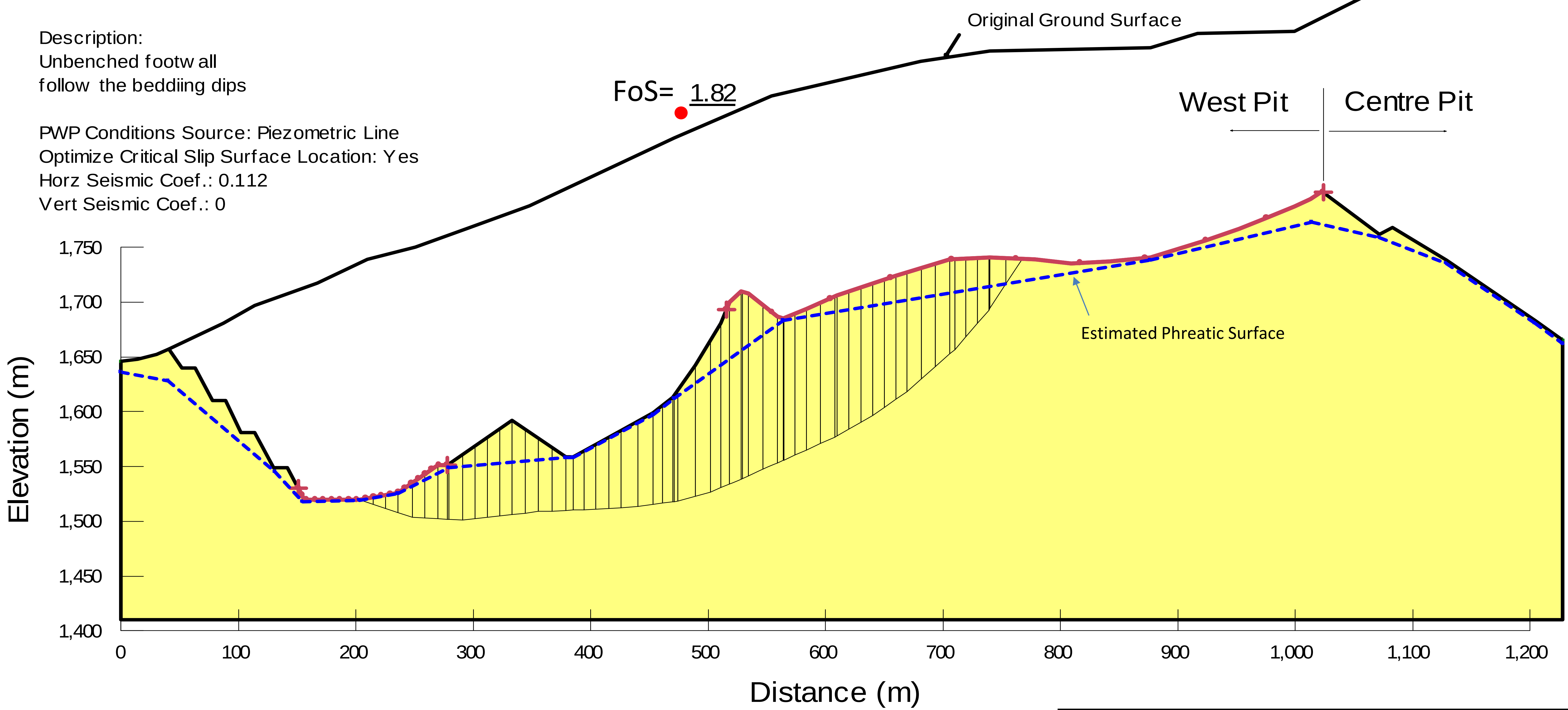
Model Setting

Name: Seismic - Genral Failure

Description:
Unbenched footw all
follow the beddiing dips

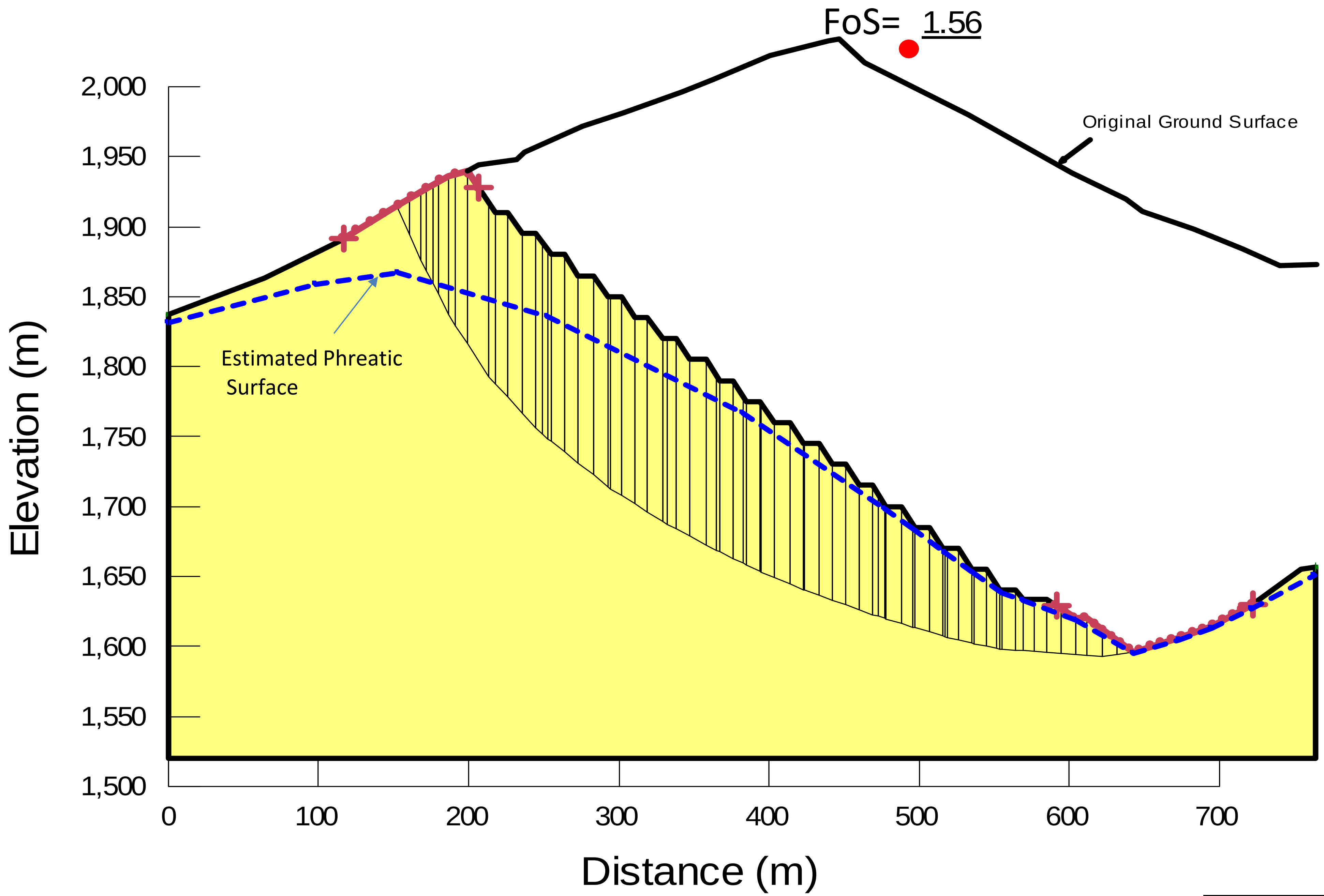
PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.112
Vert Seismic Coef.: 0

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
(yellow)	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			West Pit - Footwall (Section C) - General Failure, Seismic Loading		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	Figure: 183-12
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

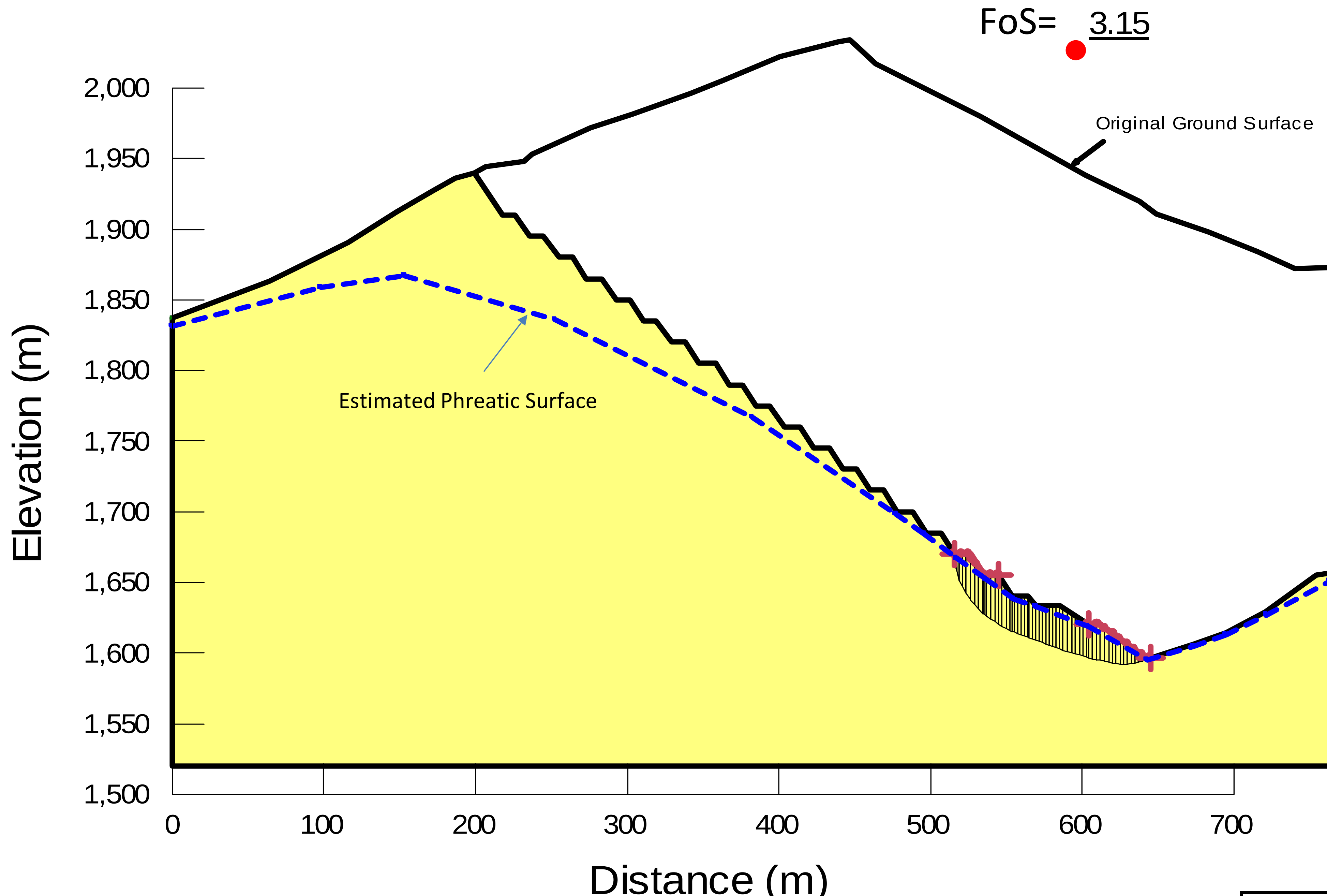
Name: Static - General Failure

Description:
Single Bench 15 m h
Face angle= 60 degree
Bench width= 8 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			Central Pit - highwall (Section D) - General Failure, Static Loading		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	Figure: 183-13
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

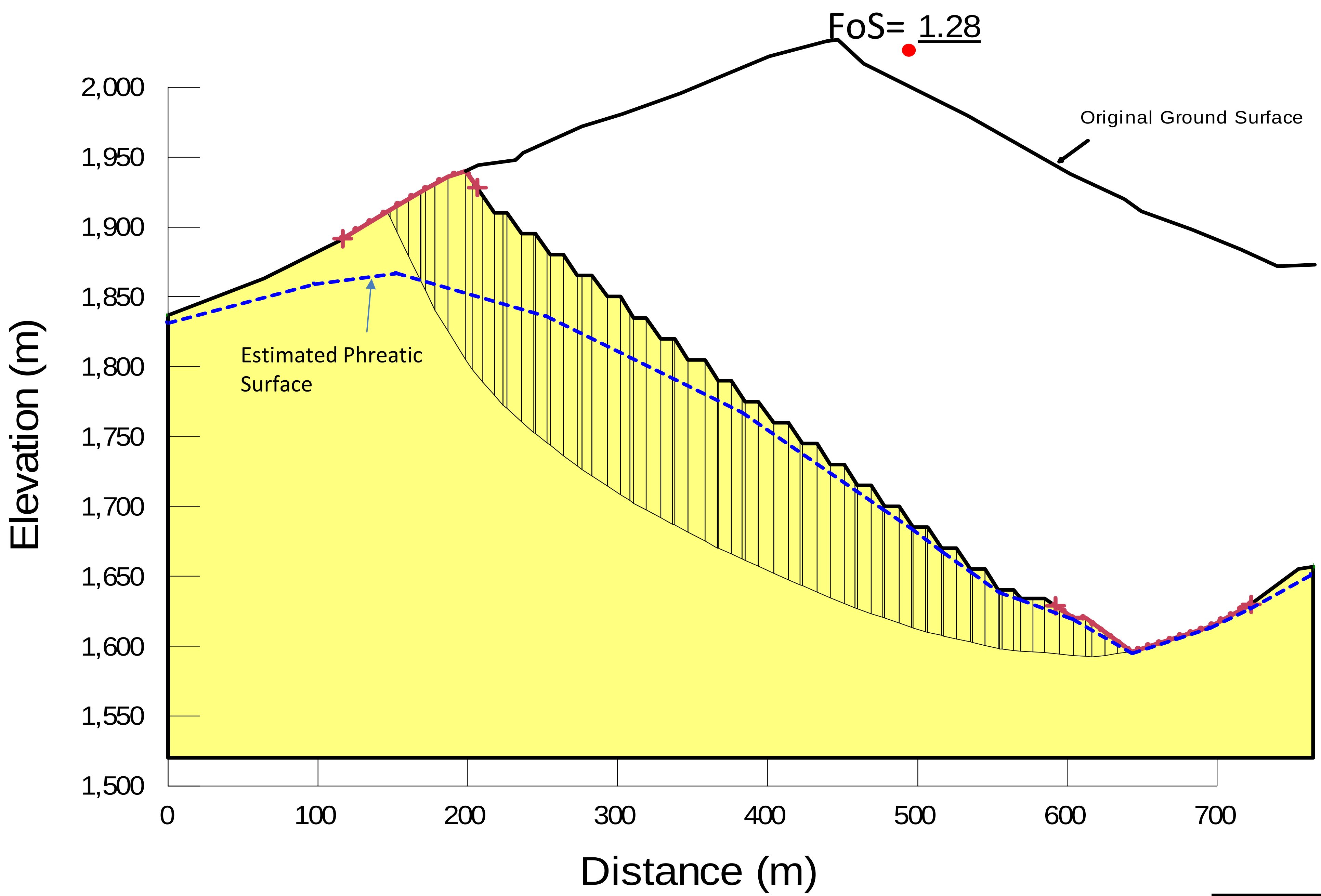
Name: Static - Toe Failure

Description:
Single Bench 15 m h
Face angle= 60 degree
Bench width= 8 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**Central Pit - Highwall (Section D) - Toe Failure, Static Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-14**
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

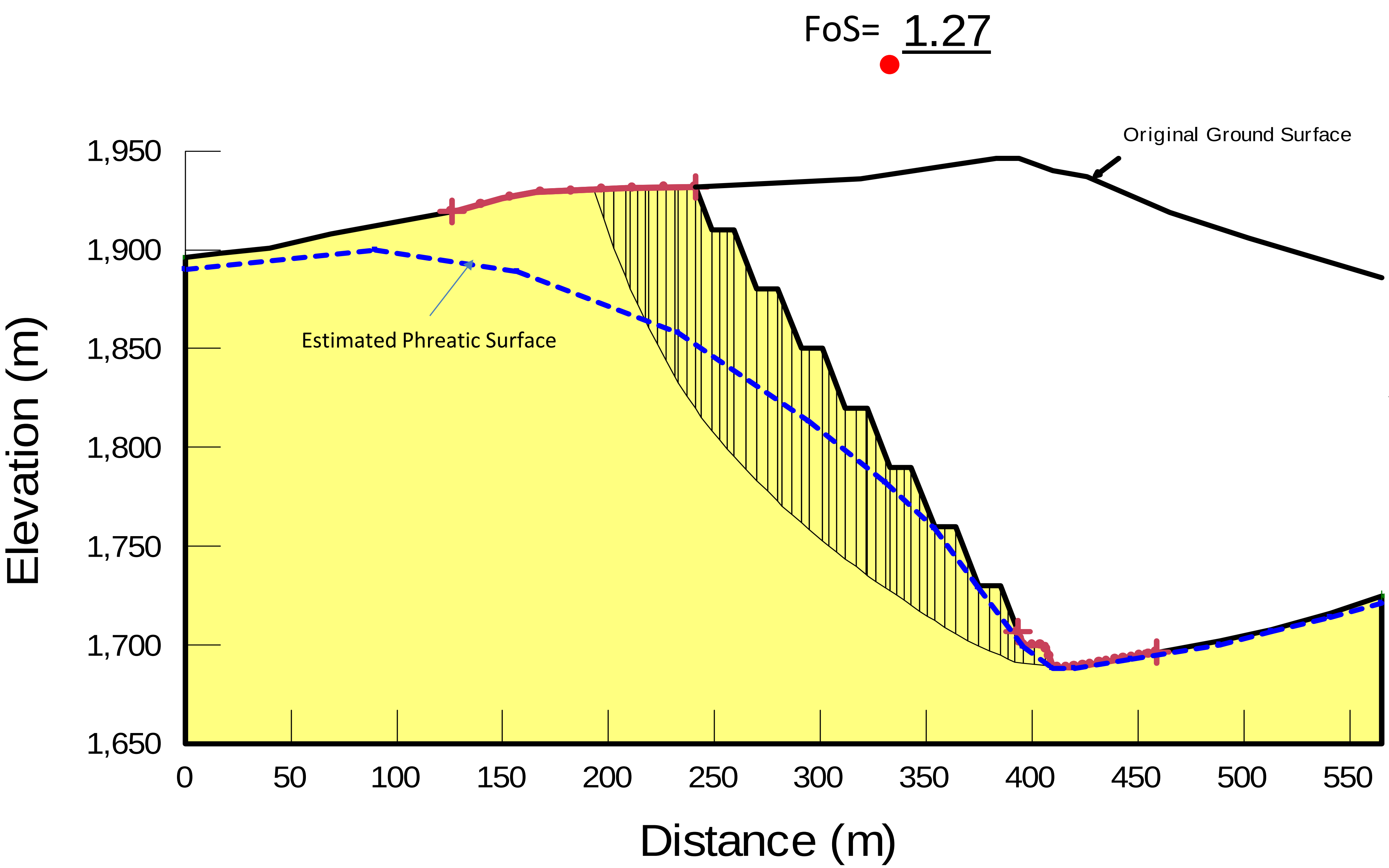
Name: Seismic- General Failure

Description:
Single Bench 15 m h
Face angle= 60 degree
Bench width= 8 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.112
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			Central Pit - Highwall (Section D) - General Failure, Seismic Loading		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	Figure: 183-15
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
(yellow)	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

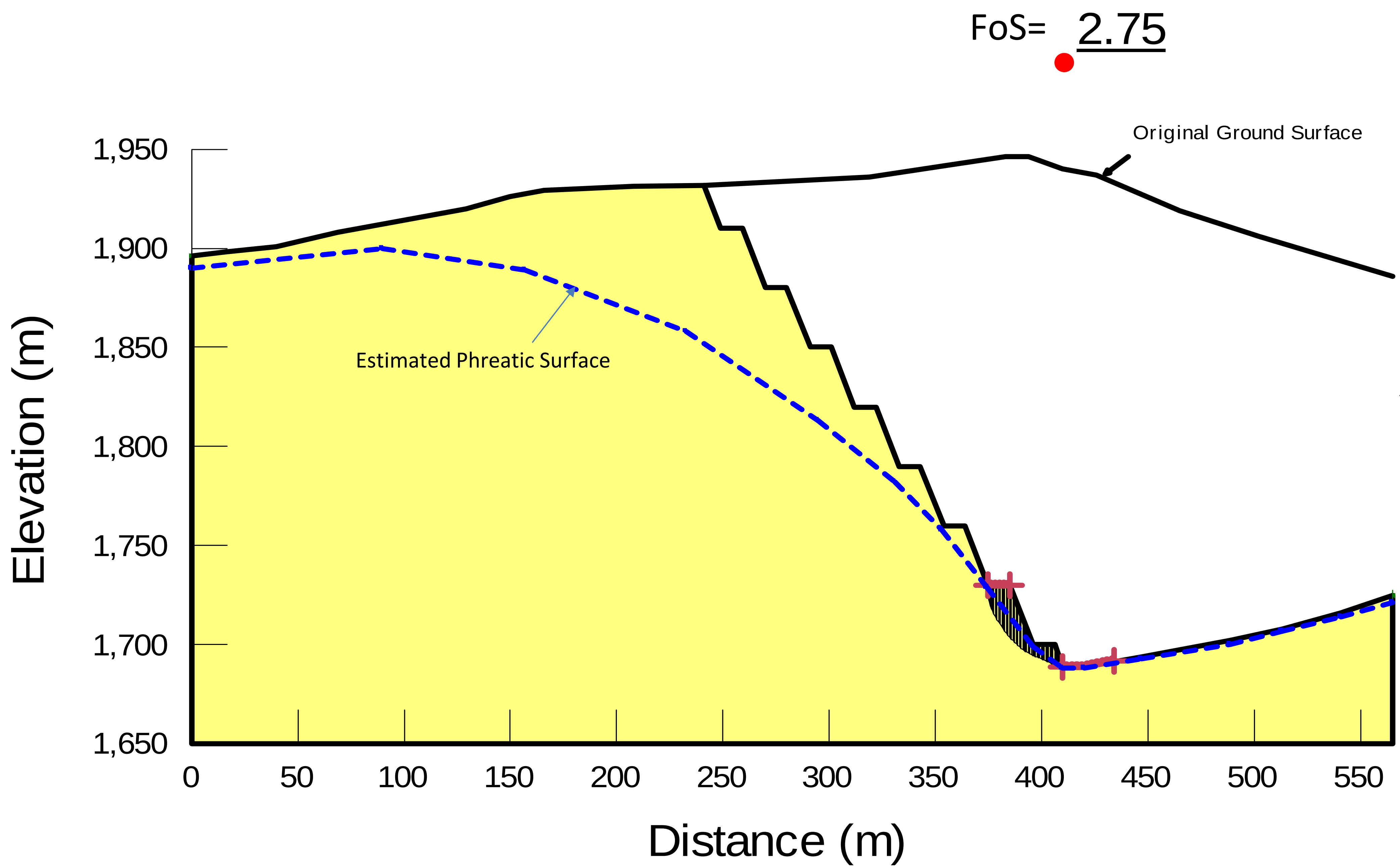
Name: Static - General Failure

Description:
Double Bench 30 m h
Face angle= 70 degree
Bench width=10 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			Central Pit - Endwall (Section E) - General Failure, Static Loading		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	Figure: 183-16
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
(yellow)	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

Name: Static -Toe Failure

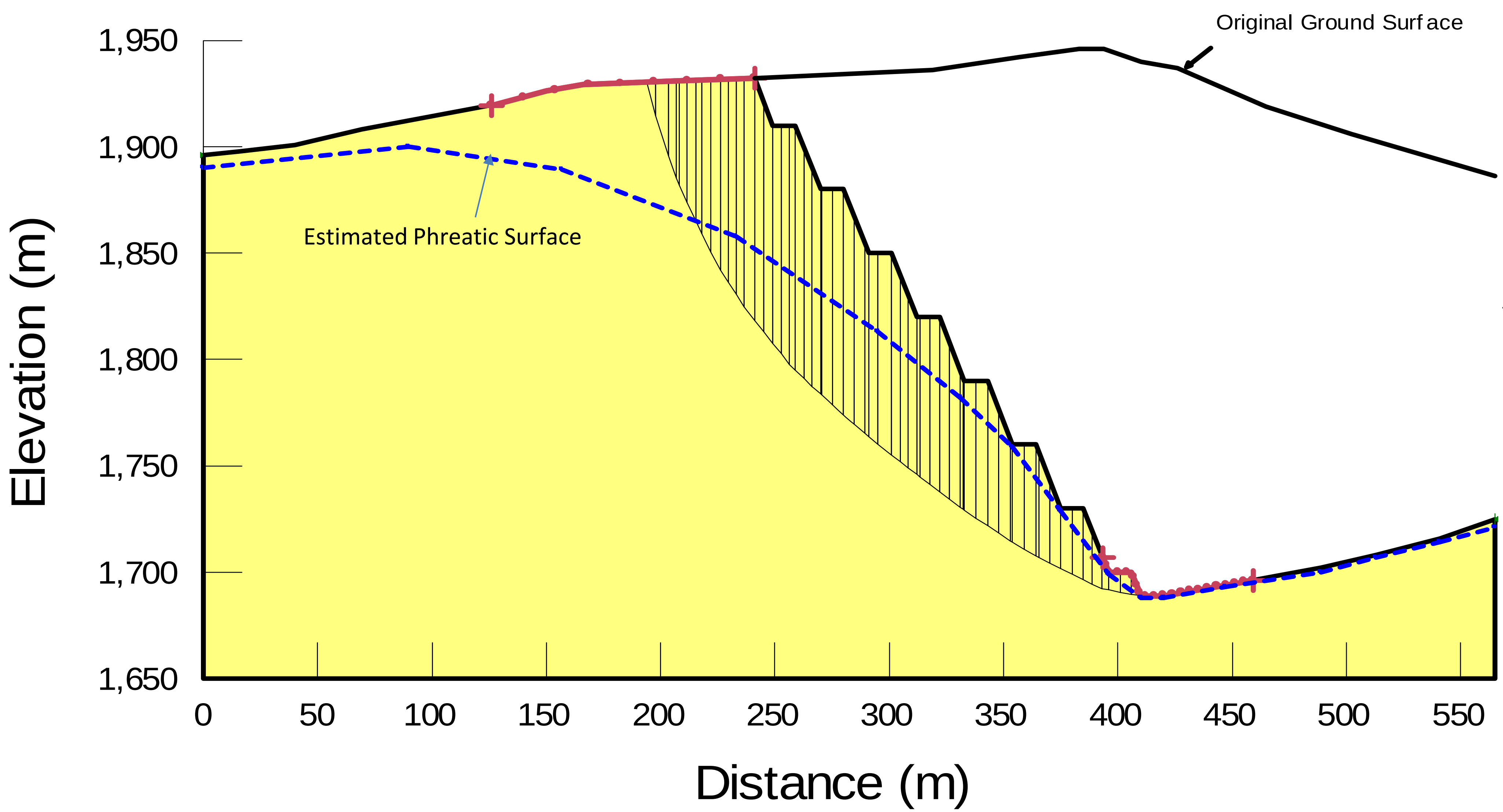
Description:
Double Bench 30 m h
Face angle= 70 degree
Bench width=10 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY	
Client: Benga Mining Limited			Central Pit - Endwall (Section E) - Toe Failure, Static Loading	
Design:	AE	February-20-18		
Checked	AE	February-20-18	Project #: 184140	Figure: 183-17
Reviewed:	NH	February 23, 2018	Rev: 0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks

FoS= 1.08



Model Setting

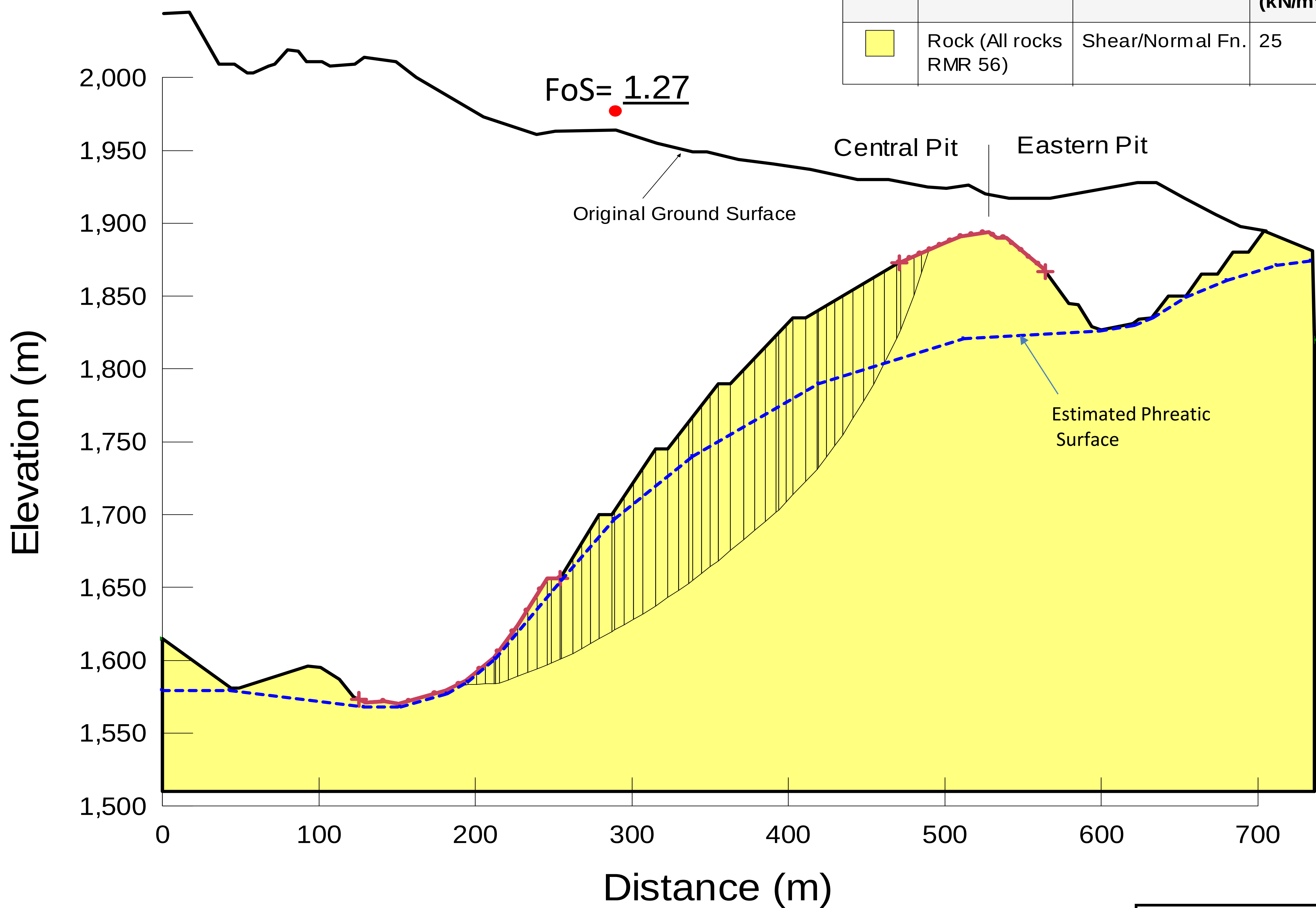
Name: Seismic- General Failure

Description:
Double Bench 30 m h
Face angle= 70 degree
Bench width=10 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.112
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			Central Pit - Endwall (Section E) - General Failure, Seismic Loading		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	Figure: 183-18
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

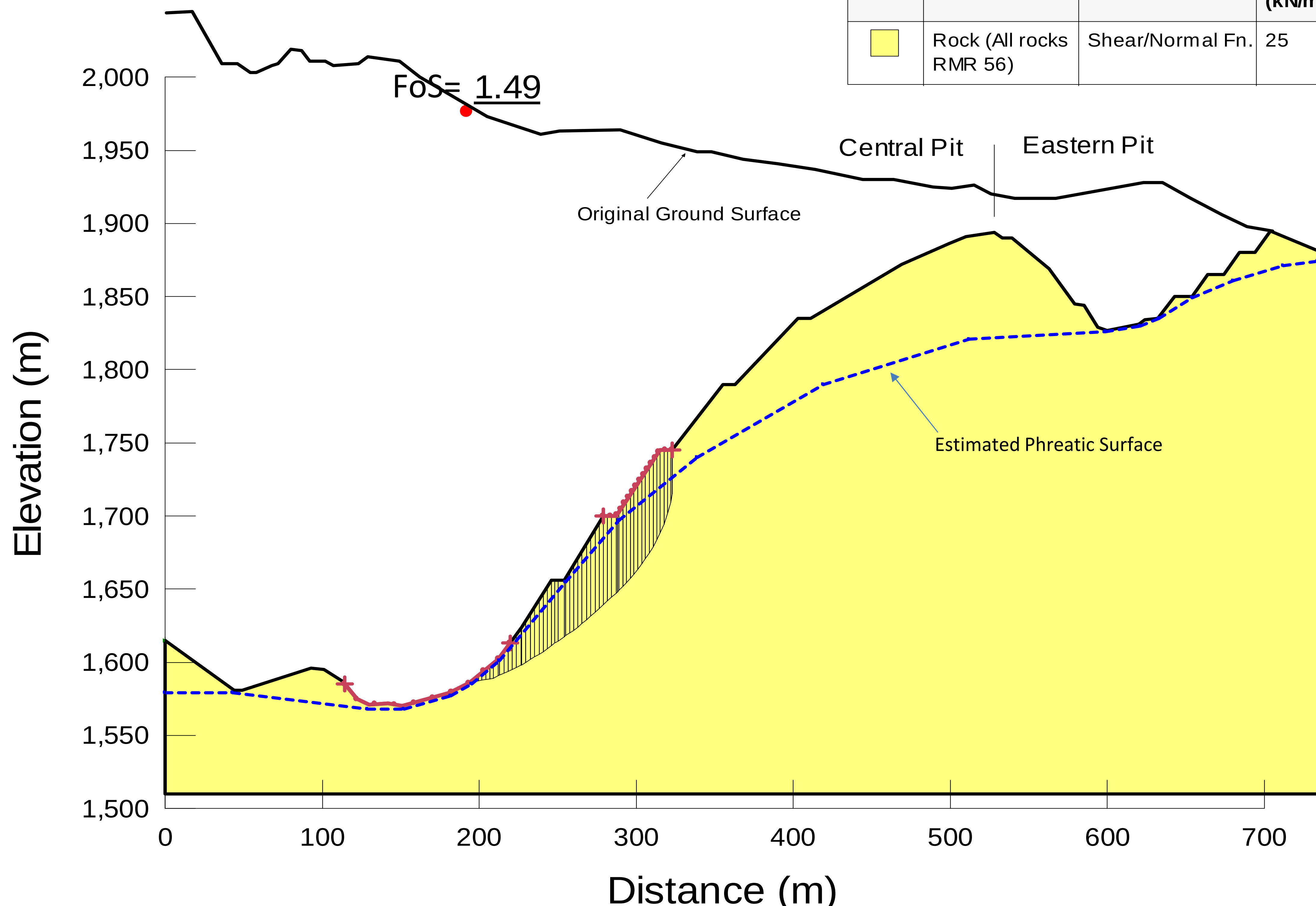
Name: Static - General Failure

Description:
Triple Bench 45 m h
Bench width=8 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			Central Pit - Footwall (Section F) - General Failure, Static Loading		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	Figure: 183-19
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

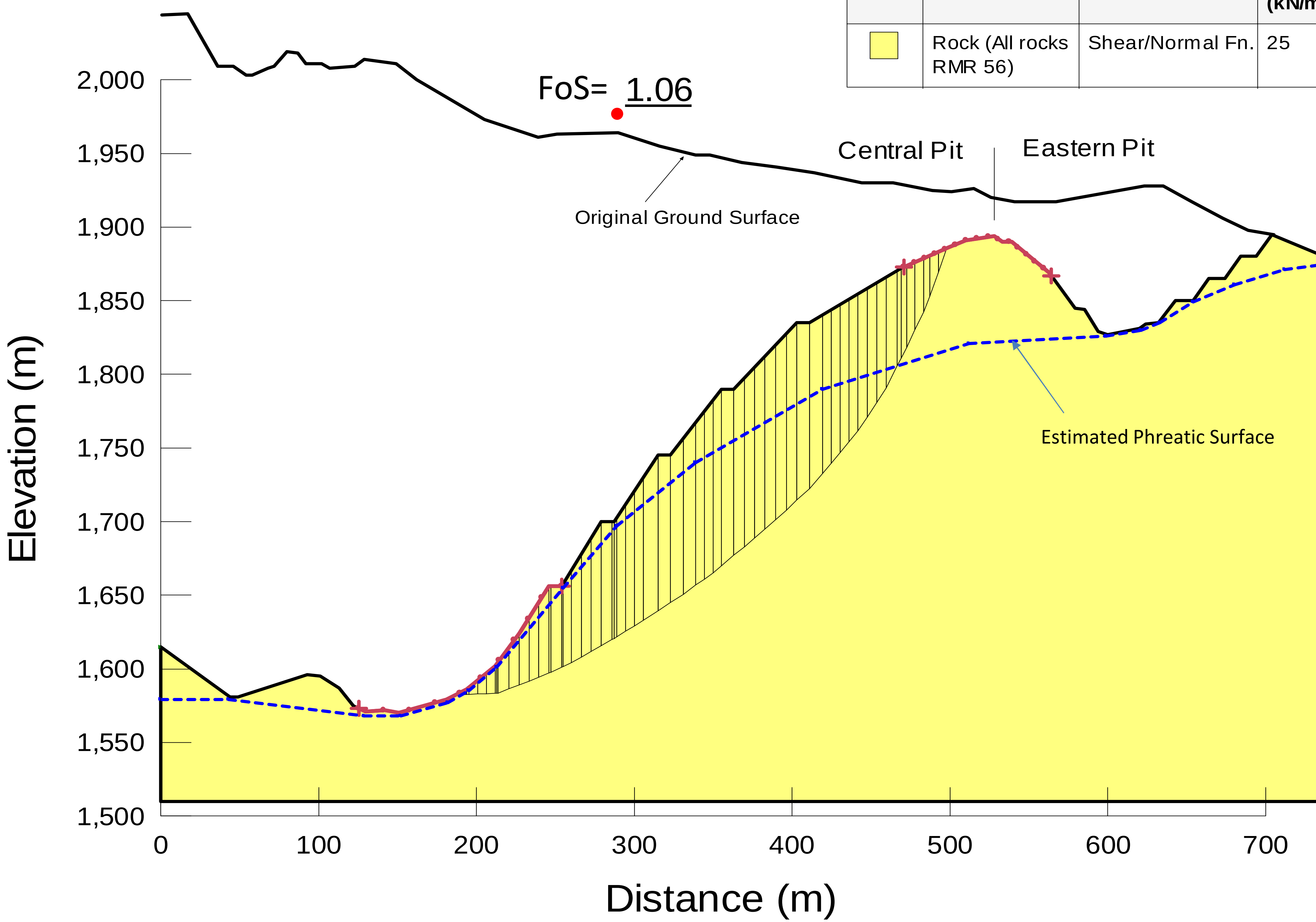
Name: Static - Toe failure

Description:
Triple Bench 45 m h
Bench width=8 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Ye
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**Central Pit - Footwall (Section F) - Toe Failure, Static Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-20**
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

Name: Seismic - General Failure

Description:
Triple Bench 45 m h
Bench width=8 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.112
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**Central Pit -Footwall (Section F) - General Failure, Seismic Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-21**
Reviewed:	NH	February 23, 2018	Rev:	0	

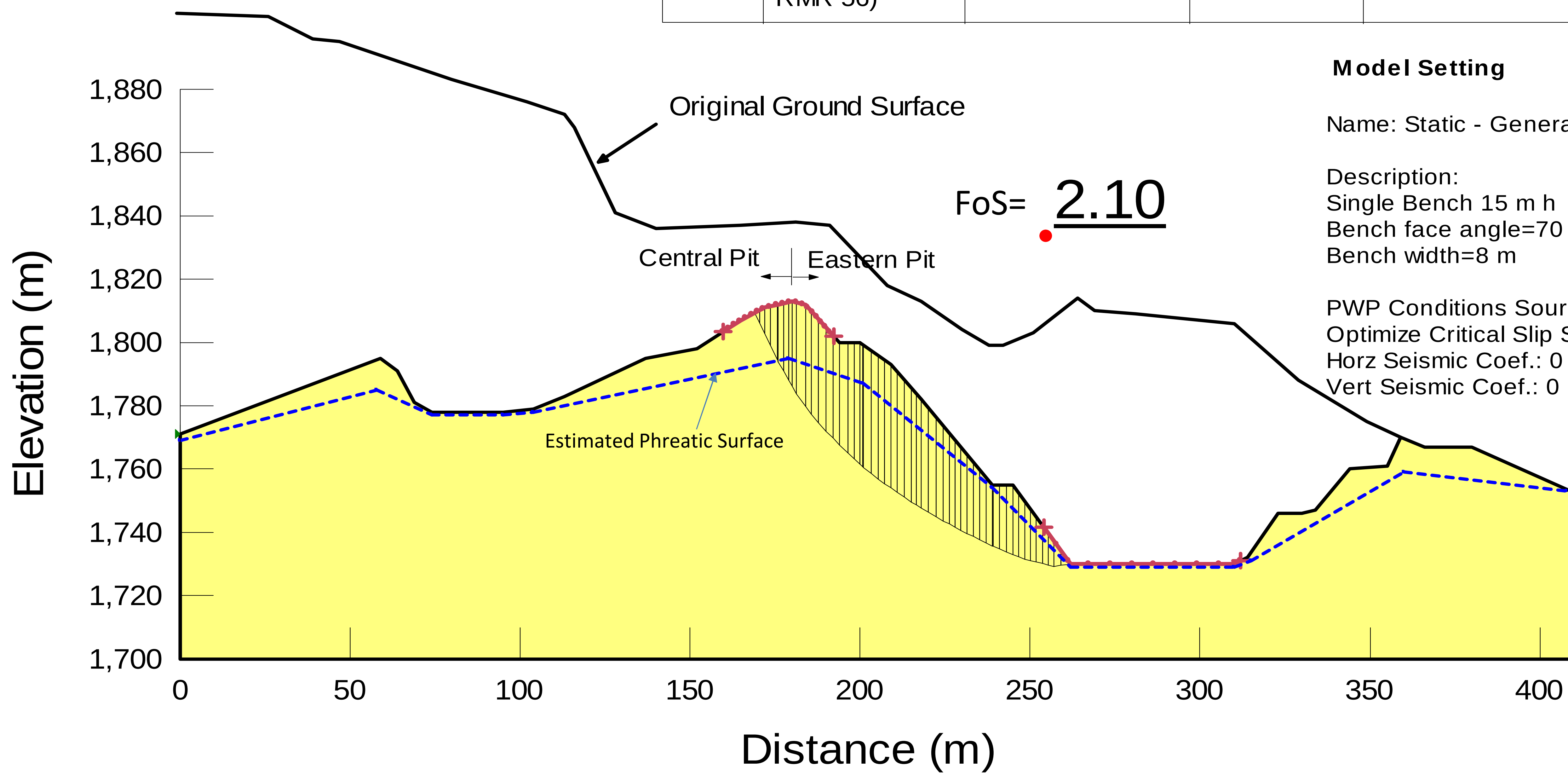
Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks

Model Setting

Name: Static - General Failure

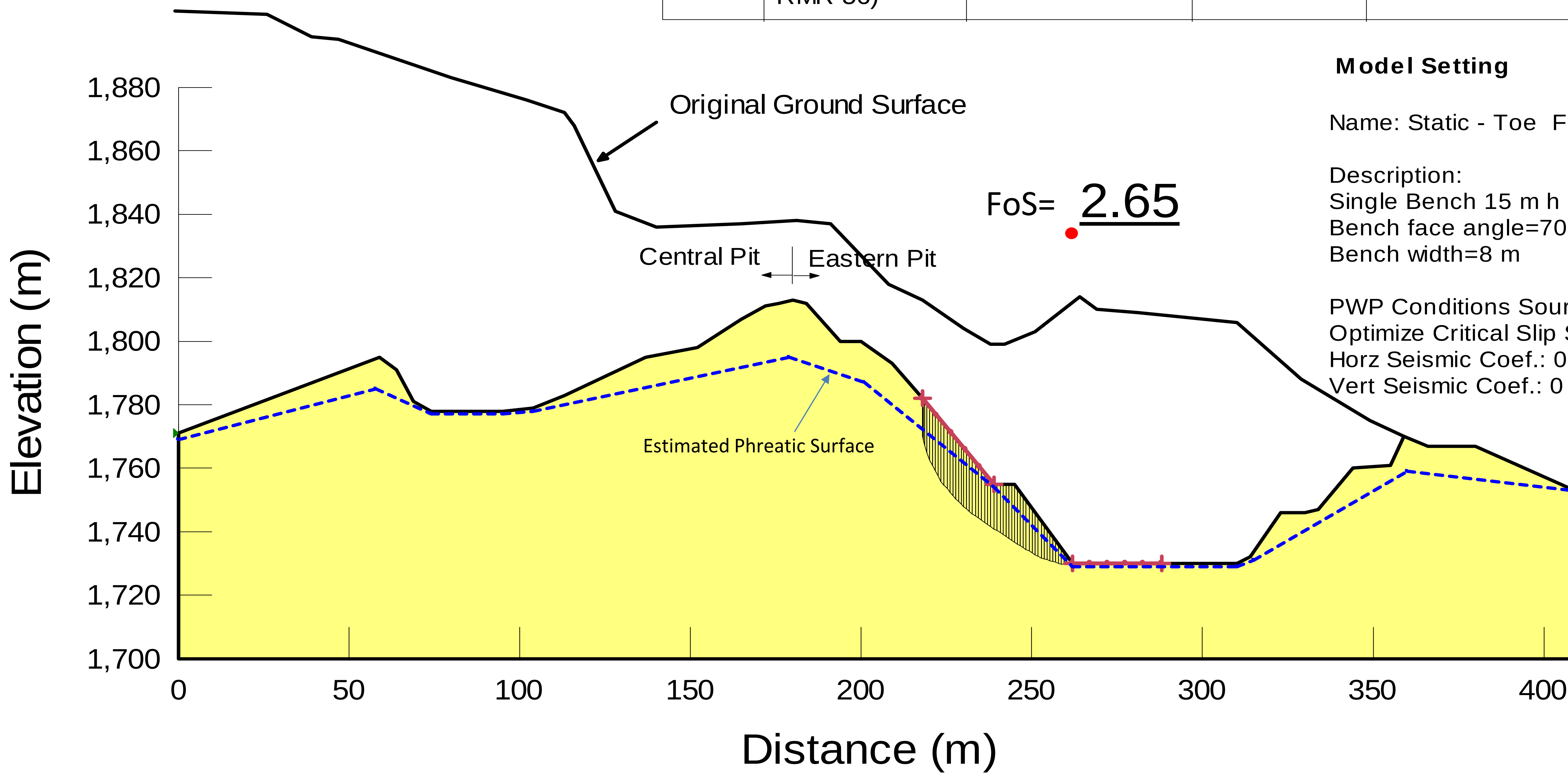
Description:
Single Bench 15 m h
Bench face angle=70 degrees or follow dip
Bench width=8 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0



TERRACON GEOTECHNIQUE	BENGA SIR SUPPORT PIT SLOPE STABILITY			
Client: Benga Mining Limited			Eastern Pit - Footwall (Section G) - General Failure, Static Loading	
Design:	AE	February-20-18		
Checked	AE	February-20-18	Project #: 184140	Figure: 183-22
Reviewed:	NH	February 23, 2018	Rev: 0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

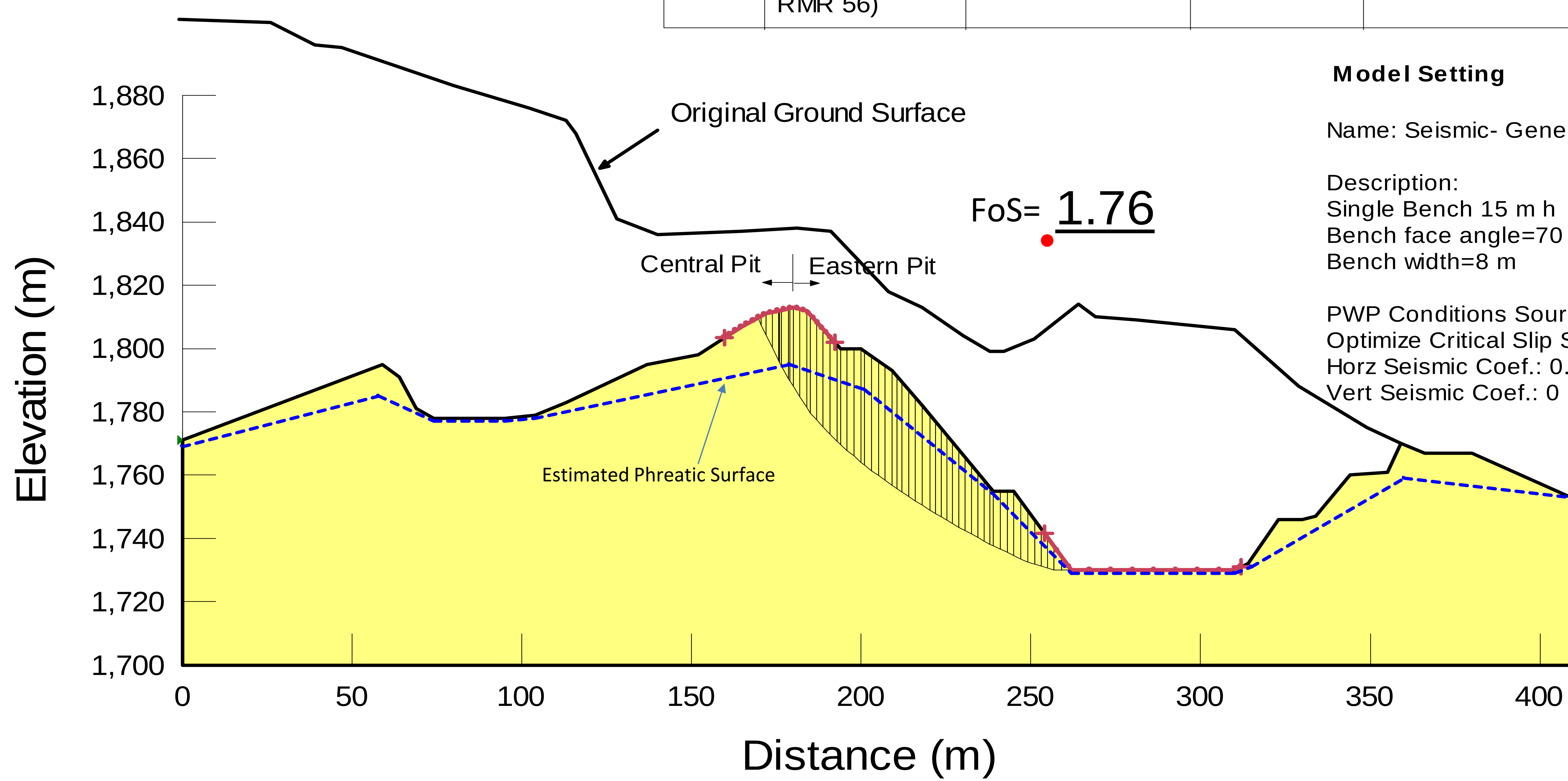
Name: Static - Toe Failure

Description:
Single Bench 15 m h
Bench face angle=70 degrees
Bench width=8 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			Eastern Pit - Footwall (Section G) - Toe Failure, Static Loading		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	Figure: 183-23
Reviewed:	NH	February 23, 2018	Rev:	0	

Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks



Model Setting

Name: Seismic- General Failure

Description:
Single Bench 15 m h
Bench face angle=70 degrees or follow dip
Bench width=8 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.112
Vert Seismic Coef.: 0

TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**Eastern Pit - Footwall (Section G) - General Failure, Seismic Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-24**
Reviewed:	NH	February 23, 2018	Rev:	0	

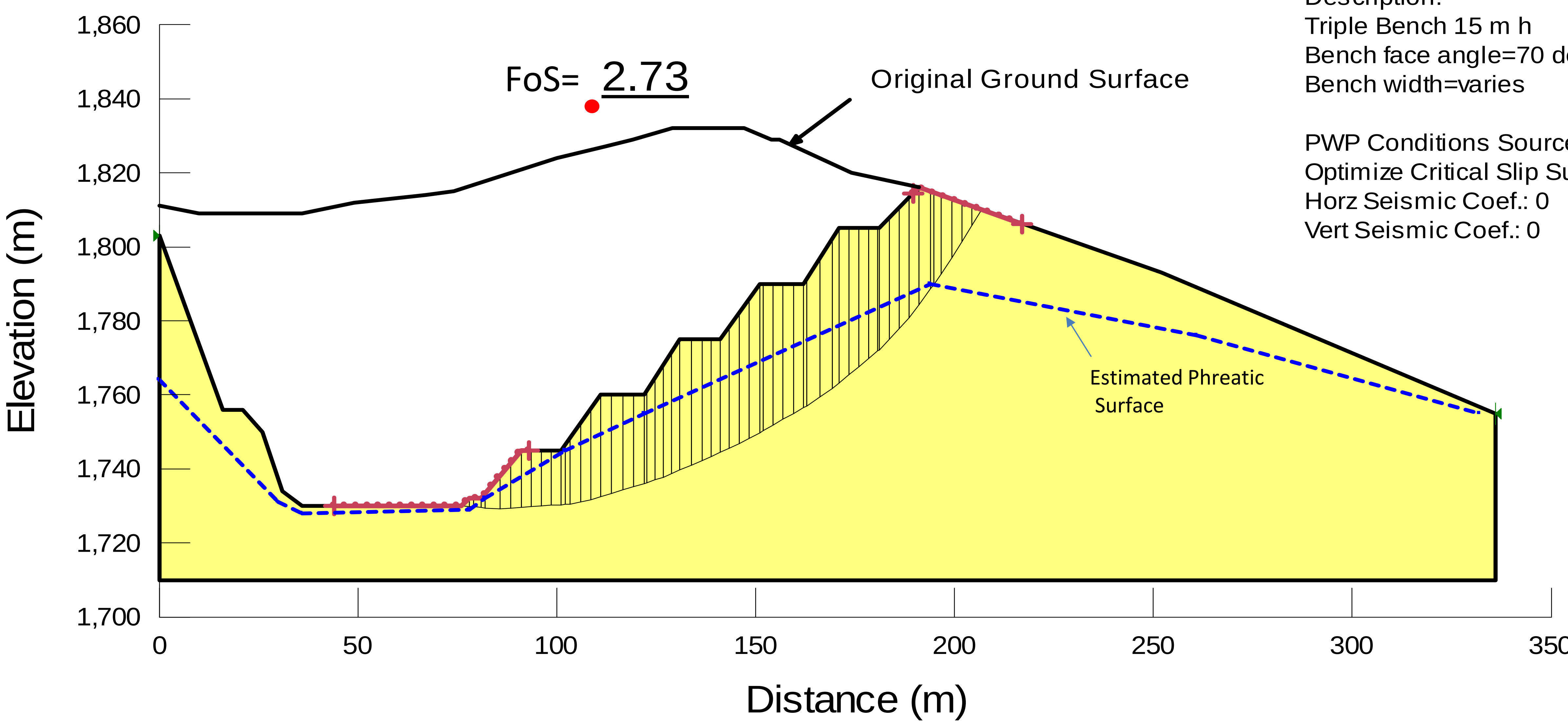
Color	Name	Model	Unit Weight (kN/m³)	Strength Function
(yellow)	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks

Model Setting

Name: Static - General Failure

Description:
Triple Bench 15 m h
Bench face angle=70 degrees
Bench width=varies

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0



TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**Eastern Pit - Highwall (Section H) - General Failure, Static Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-25**
Reviewed:	NH	February 23, 2018	Rev:	0	

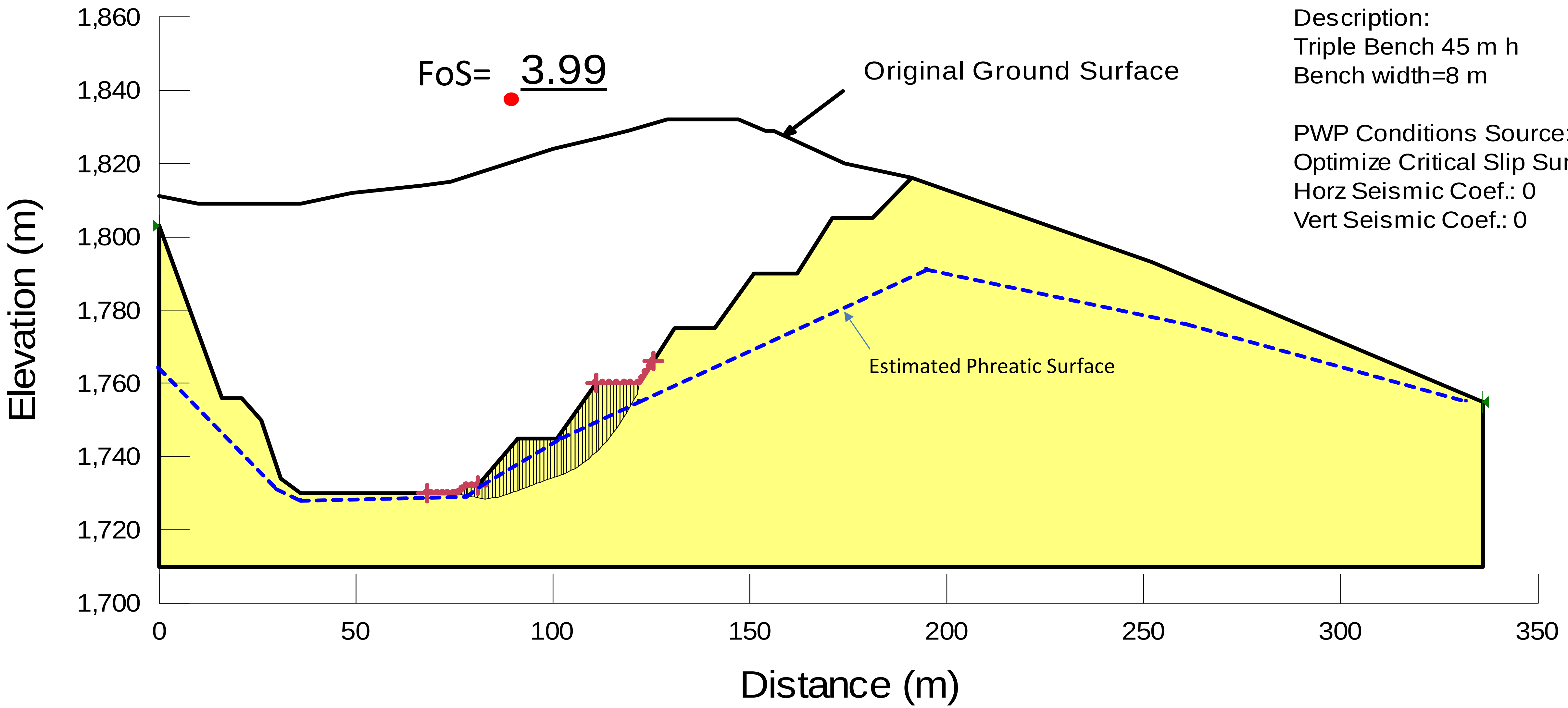
Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks

Model Setting

Name: Static Toe Failure

Description:
Triple Bench 45 m h
Bench width=8 m

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0
Vert Seismic Coef.: 0



TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**Eastern Pit - Highwall (Section H) - Toe Failure, Static Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-26**
Reviewed:	NH	February 23, 2018	Rev:	0	

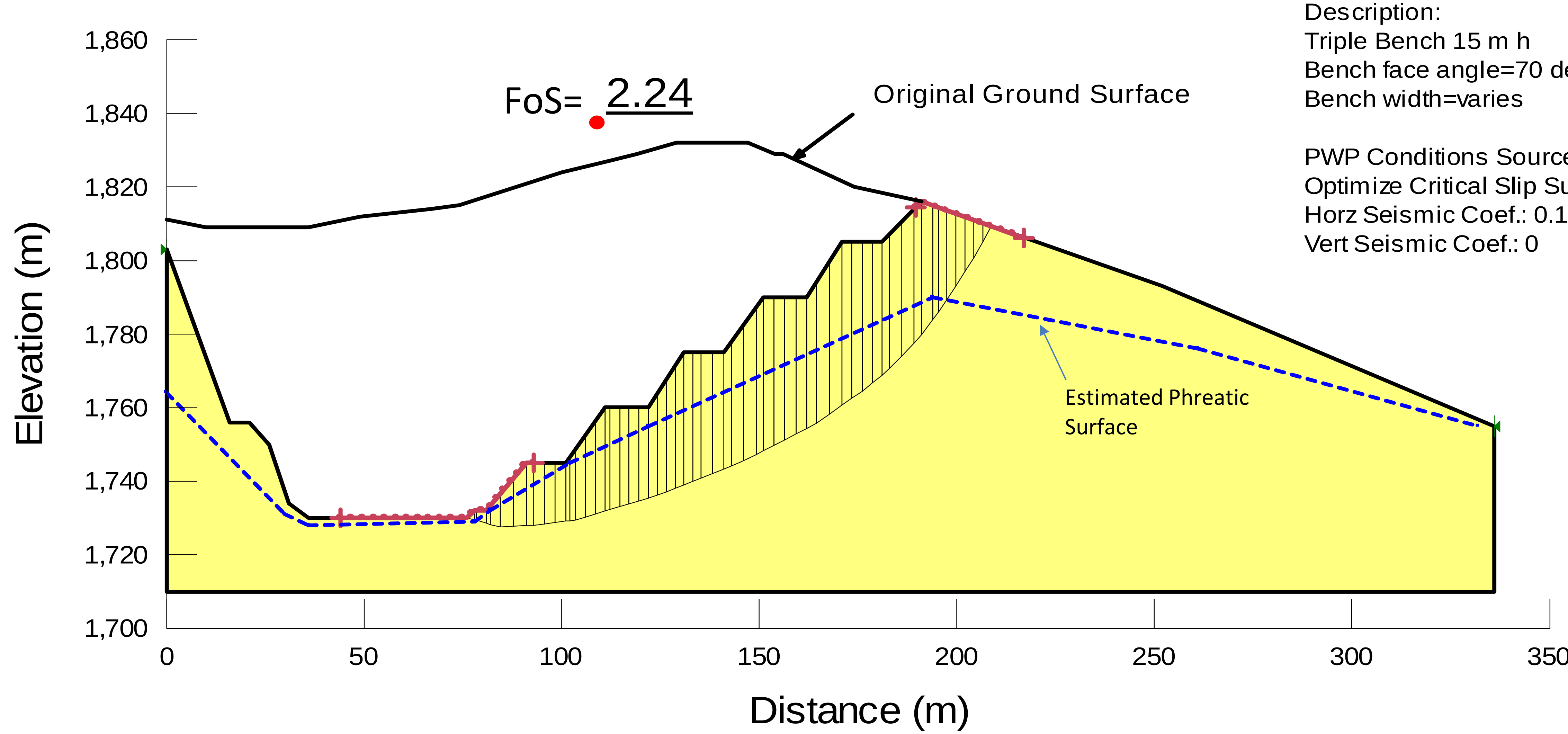
Color	Name	Model	Unit Weight (kN/m³)	Strength Function
	Rock (All rocks RMR 56)	Shear/Normal Fn.	25	H-B Function - All Rocks

Model Setting

Name: Seismic- General Failure

Description:
Triple Bench 15 m h
Bench face angle=70 degrees
Bench width=varies

PWP Conditions Source: Piezometric Line
Optimize Critical Slip Surface Location: Yes
Horz Seismic Coef.: 0.112
Vert Seismic Coef.: 0



TERRACON GEOTECHNIQUE			BENGA SIR SUPPORT PIT SLOPE STABILITY		
Client: Benga Mining Limited			**Eastern Pit - Highwall (Section H) - General Failure, Seismic Loading**		
Design:	AE	February-20-18			
Checked	AE	February-20-18	Project #:	184140	**Figure: 183-27**
Reviewed:	NH	February 23, 2018	Rev:	0	

JOB TITLE : Analysis Mesh for Excavation to Elevation 1580 (m)

FLAC (Version 5.00)

LEGEND

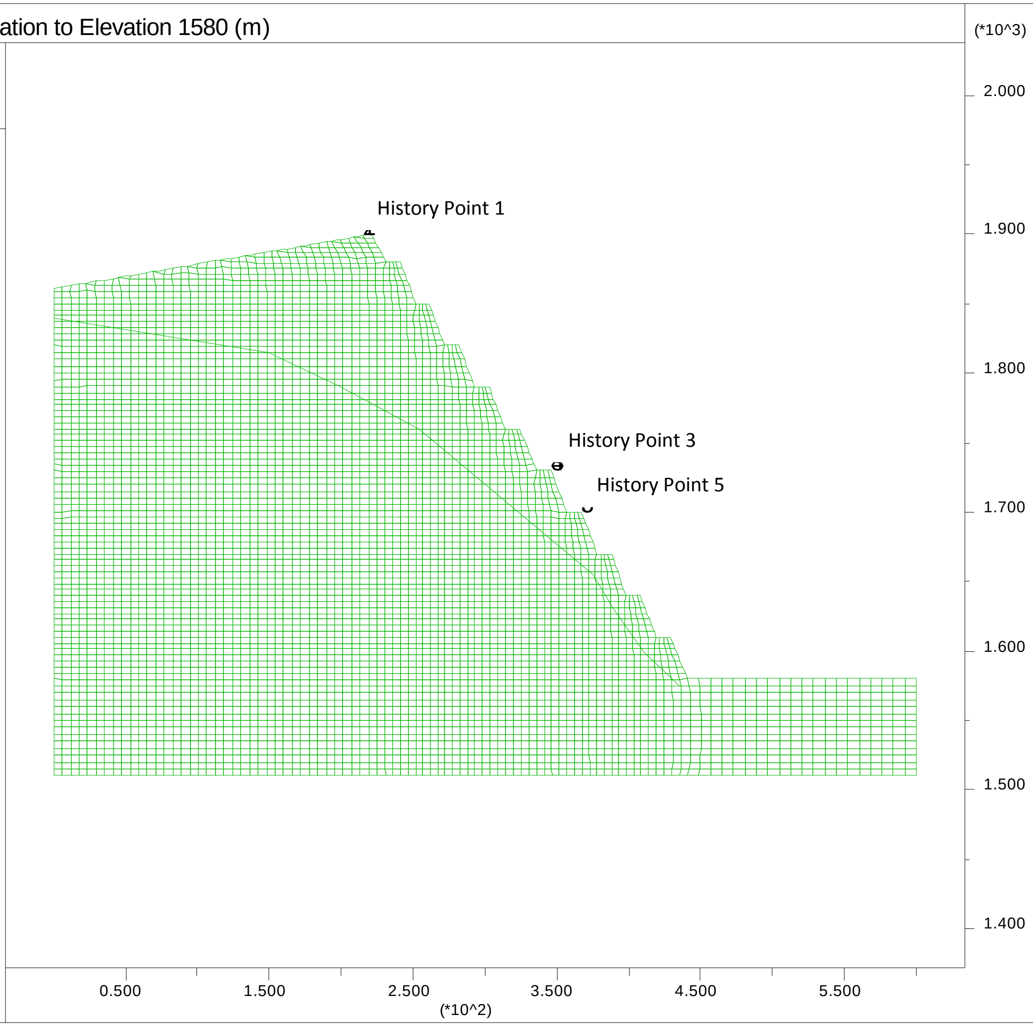
25-Feb-18 16:21
step 167240
-3.333E+01 <x< 6.333E+02
1.372E+03 <y< 2.038E+03

Water Table
Grid plot

0 2E 2

History Locations

Terracon Geotechnique Ltd.
A.Eshraghian



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY::
CHECKED BY:
DRAWN BY::

FLAC Analysis Mesh for excavation to Elevation 1580 (m)

FIGURE:
184-1

JOB TITLE : X Displacement Contours - Excavation to Elevation 1790 m

FLAC (Version 5.00)

LEGEND

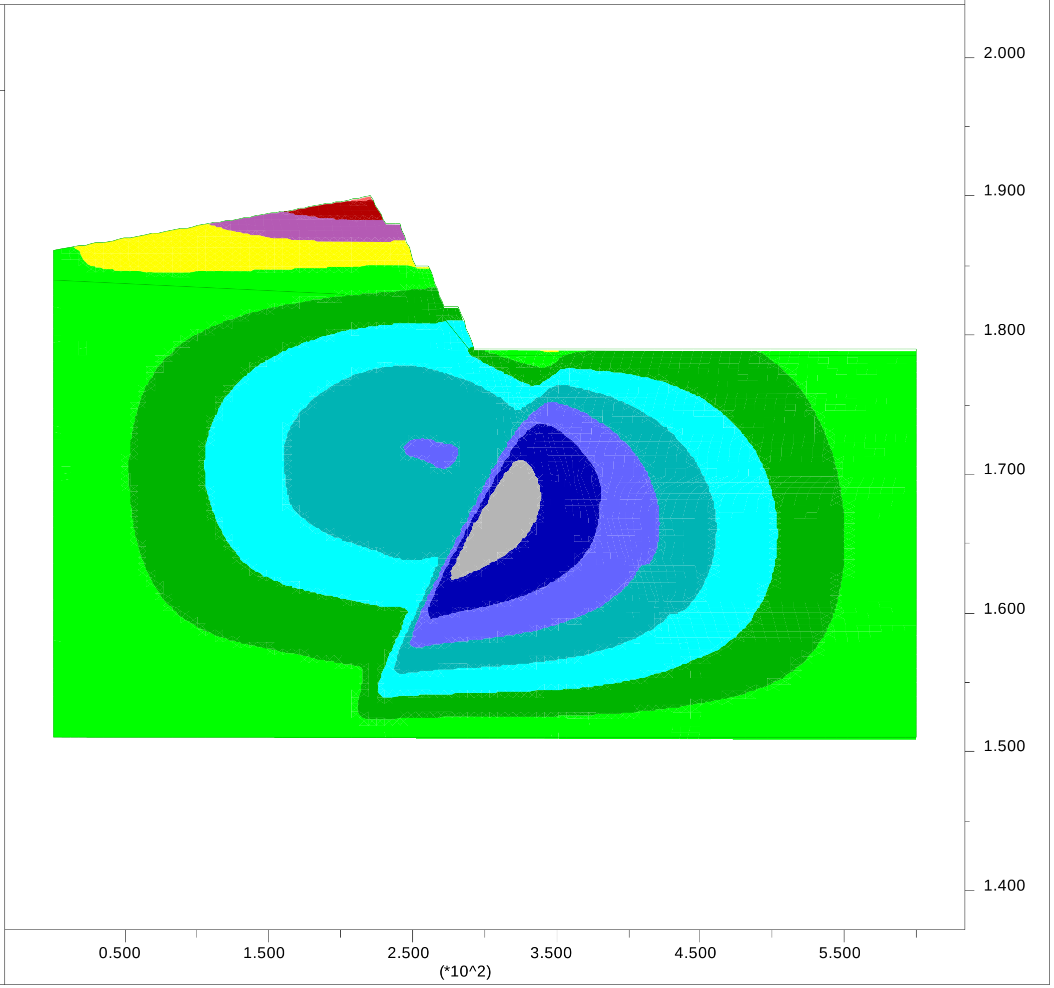
25-Feb-18 15:53
step 31116
-3.333E+01 <x< 6.333E+02
1.372E+03 <y< 2.038E+03

X-displacement contours
-3.00E-03
-2.00E-03
-1.00E-03
0.00E+00
1.00E-03
2.00E-03
3.00E-03
4.00E-03
5.00E-03
6.00E-03

Contour interval= 1.00E-03
Water Table
Boundary plot

0 2E 2

Terracon Geotechnique Ltd.
A.Eshraghian



RIVERSDALE RESOURCES

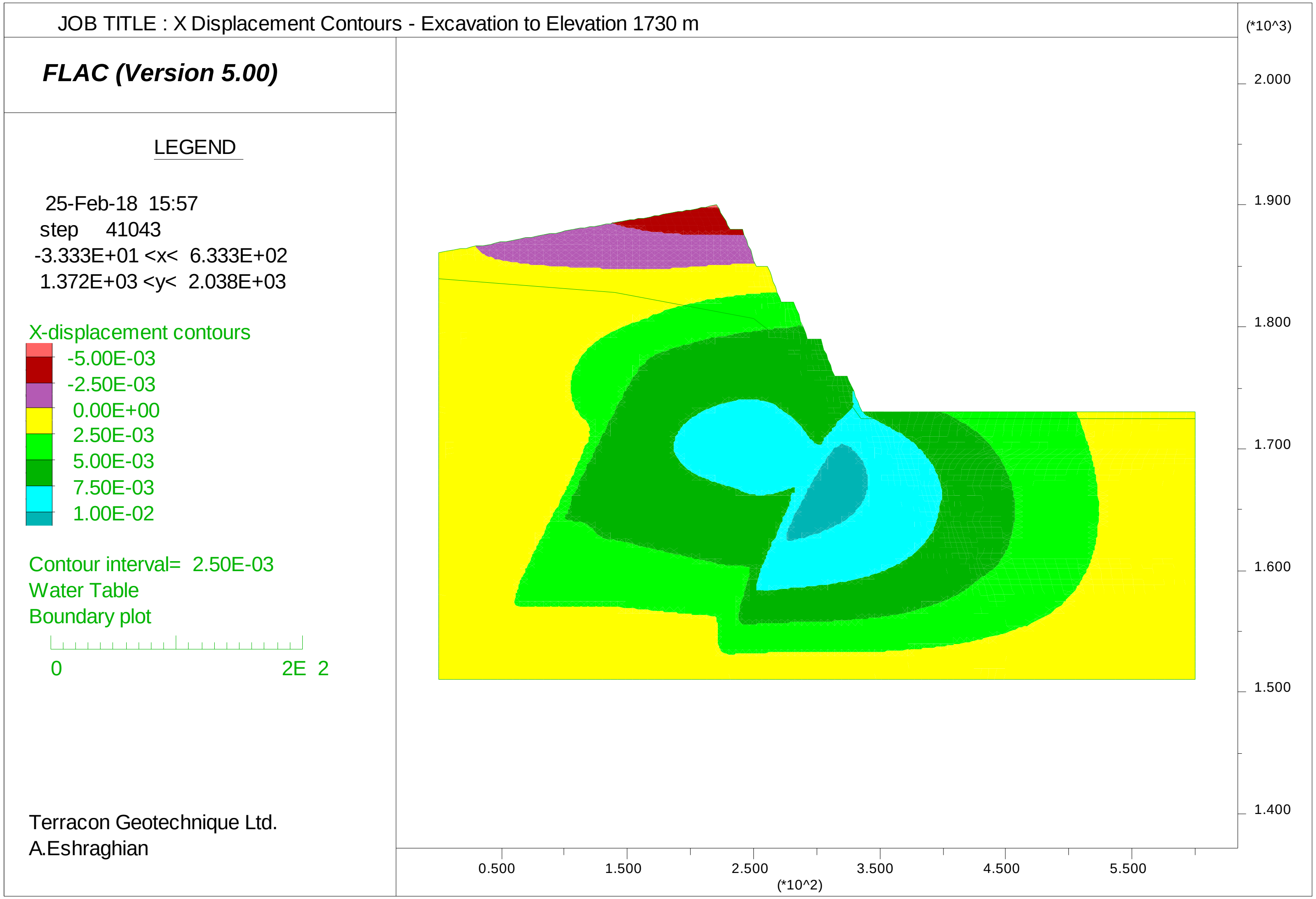
GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY:
CHECKED BY:
DATE:

FLAC Analysis Section B Horizontal Displacement Contours – Excavation to Elevation 1790 m

FIGURE:
184-2



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

PROJECT: 184140
DRAWN BY:
CHECKED BY:
DATE:

FLAC Analysis Section B Horizontal Displacement Contours –
Excavation to Elevation 1730 m

FIGURE:
184-3

JOB TITLE : X Displacement Contours - Excavation to Elevation 1670 m

FLAC (Version 5.00)

LEGEND

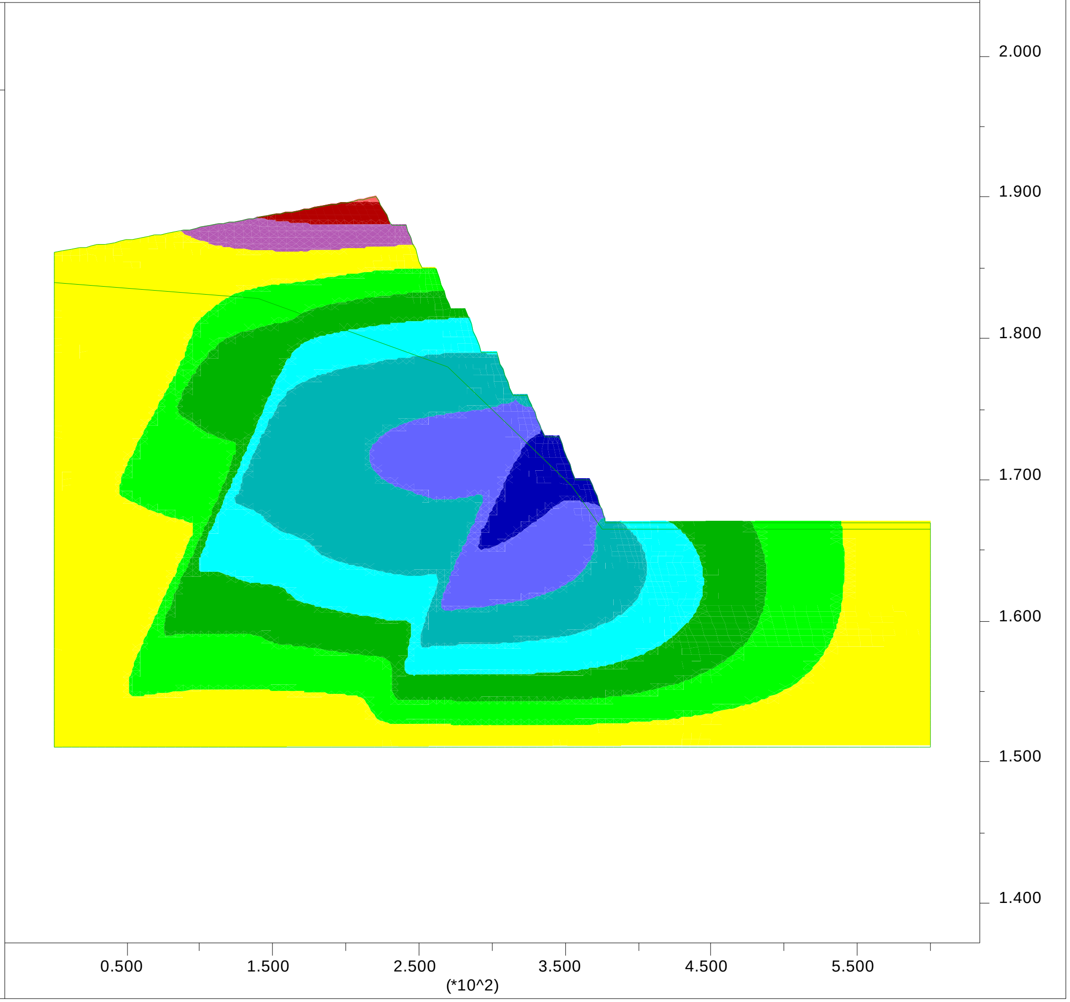
25-Feb-18 15:59
step 53432
-3.333E+01 <x< 6.333E+02
1.372E+03 <y< 2.038E+03

X-displacement contours
-5.00E-03
-2.50E-03
0.00E+00
2.50E-03
5.00E-03
7.50E-03
1.00E-02
1.25E-02
1.50E-02

Contour interval= 2.50E-03
Water Table
Boundary plot

0 2E 2

Terracon Geotechnique Ltd.
A.Eshraghian



RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

FLAC Analysis Section B Horizontal Displacement Contours –
Excavation to Elevation 1670 m

PROJECT: 184140
DRAWN BY:
CHECKED BY:
DATE:
FIGURE:
184-4

JOB TITLE : X Displacement Contours - Excavation to Elevation 1580 m

FLAC (Version 5.00)

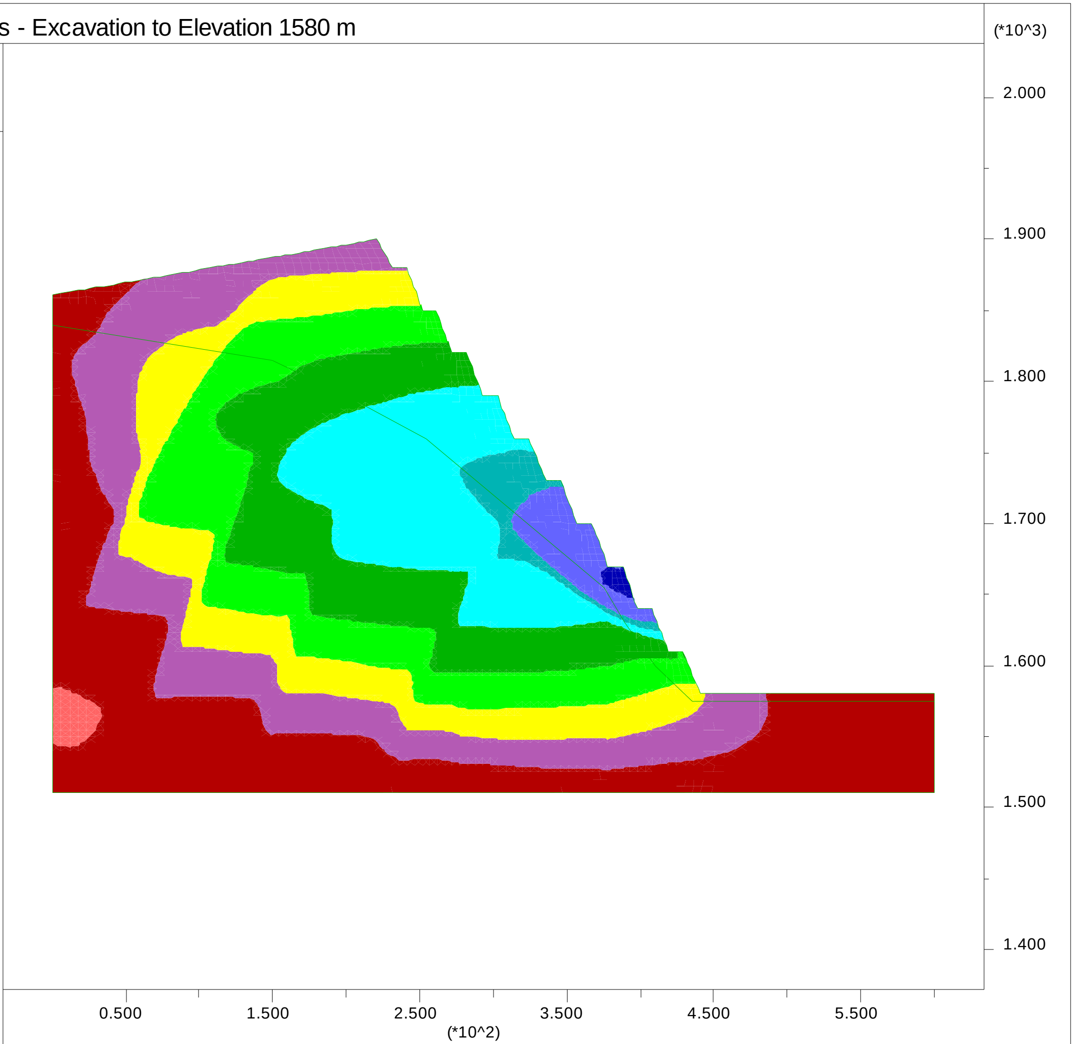
LEGEND

25-Feb-18 16:21
step 167240
-3.333E+01 <x< 6.333E+02
1.372E+03 <y< 2.038E+03

X-displacement contours
0.00E+00
5.00E-03
1.00E-02
1.50E-02
2.00E-02
2.50E-02
3.00E-02
3.50E-02
4.00E-02

Contour interval= 5.00E-03
Water Table
Boundary plot

0 2E 2



Terracon Geotechnique Ltd.
A.Eshraghian

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

TERRACON GEOTECHNIQUE

FLAC Analysis Section B Horizontal Displacement Contours – Excavation to Elevation 1580 m

PROJECT: 184140
DRAWN BY:
CHECKED BY:
DATE:
FIGURE: 184-5

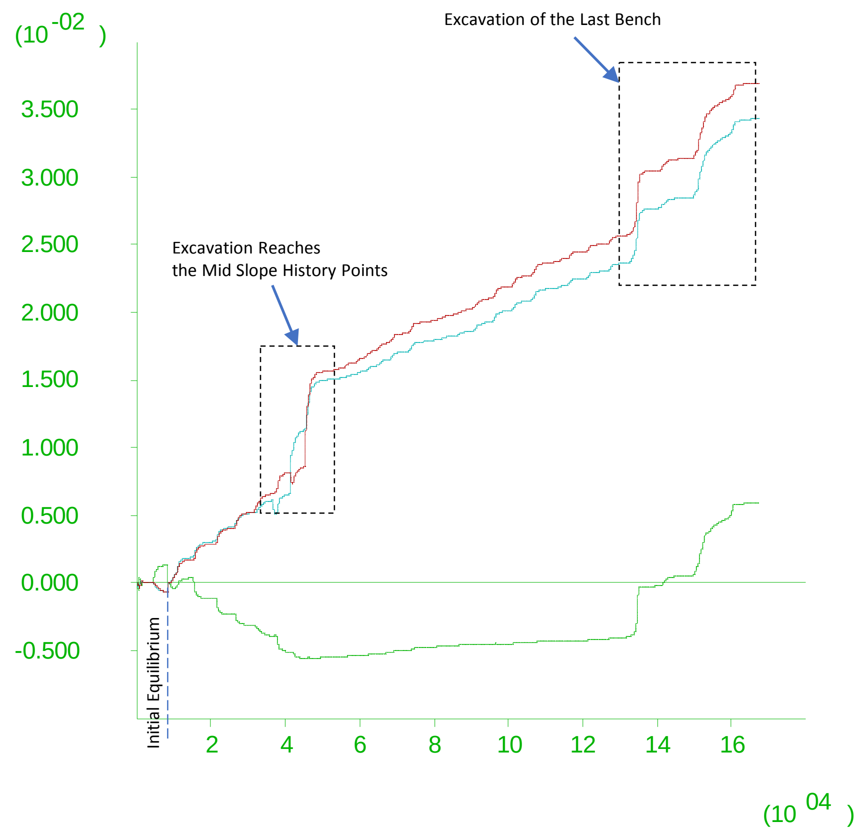
JOB TITLE : Horizontal Displacement (History Points)

FLAC (Version 5.00)

LEGEND

25-Feb-18 16:21
step 167240

HISTORY PLOT
Y-axis :
1 X displacement(39, 89)
3 X displacement(64, 49)
5 X displacement(68, 43)
X-axis :
Number of steps



Terracon Geotechnique Ltd.
A.Eshraghian

Note:
See location of History Points in Figure 184-1

RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

FLAC Analysis Section B - Horizontal Displacement At Selected Points

PROJECT: 184140
DRAWN BY:
CHECKED BY:
DATE:
FIGURE:
184-6

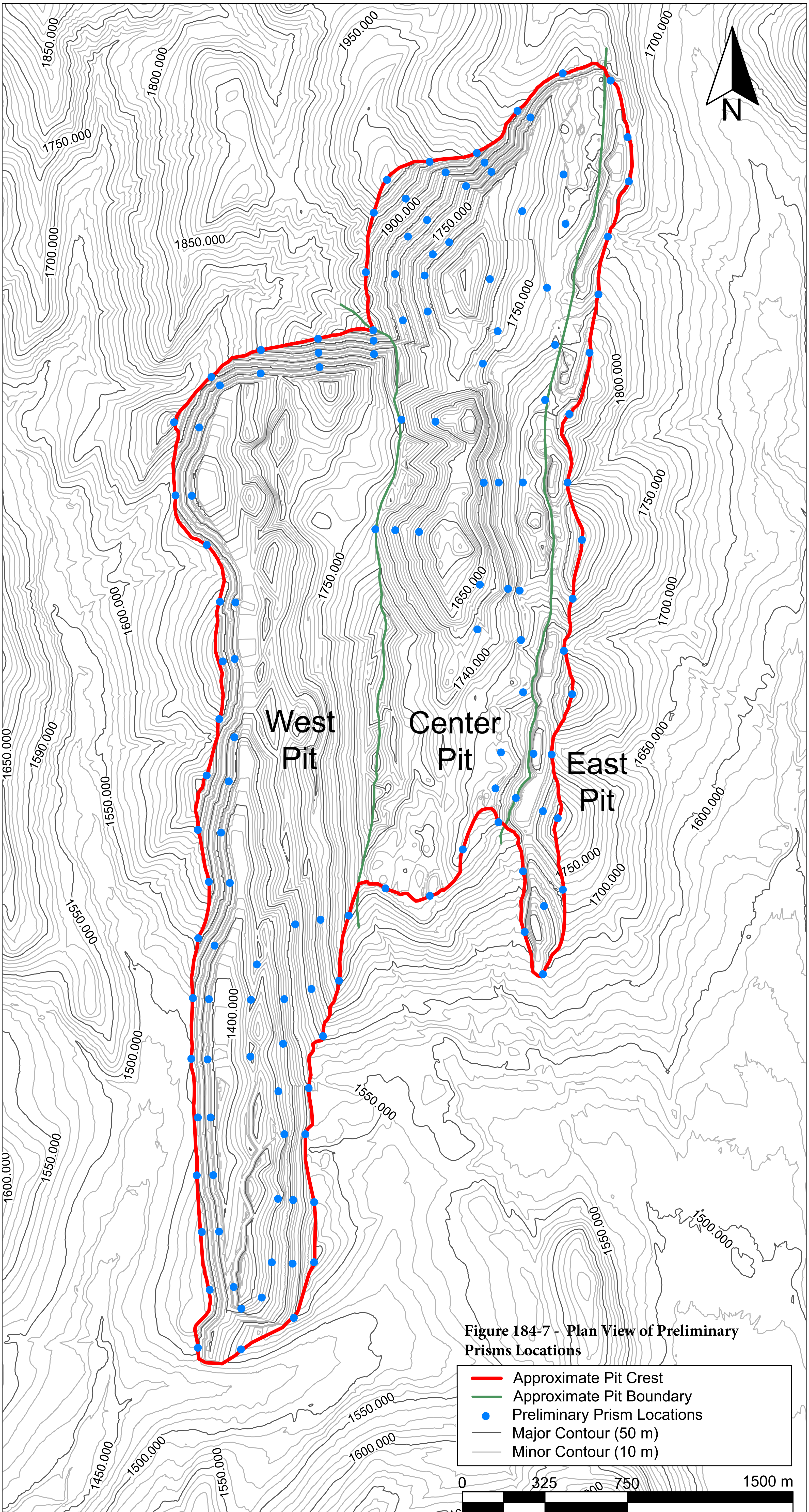
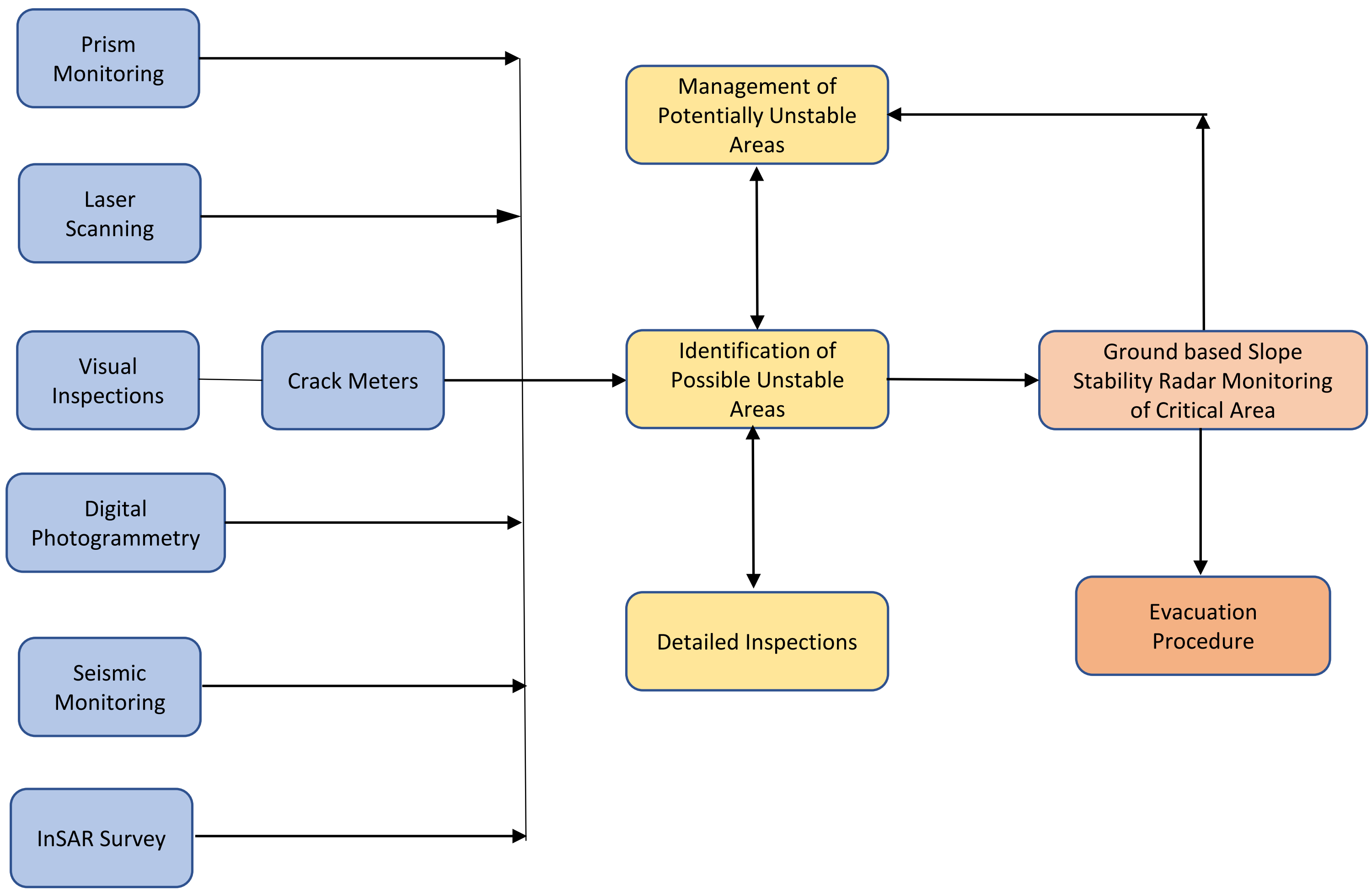


Figure 184-7 - Plan View of Preliminary Prisms Locations



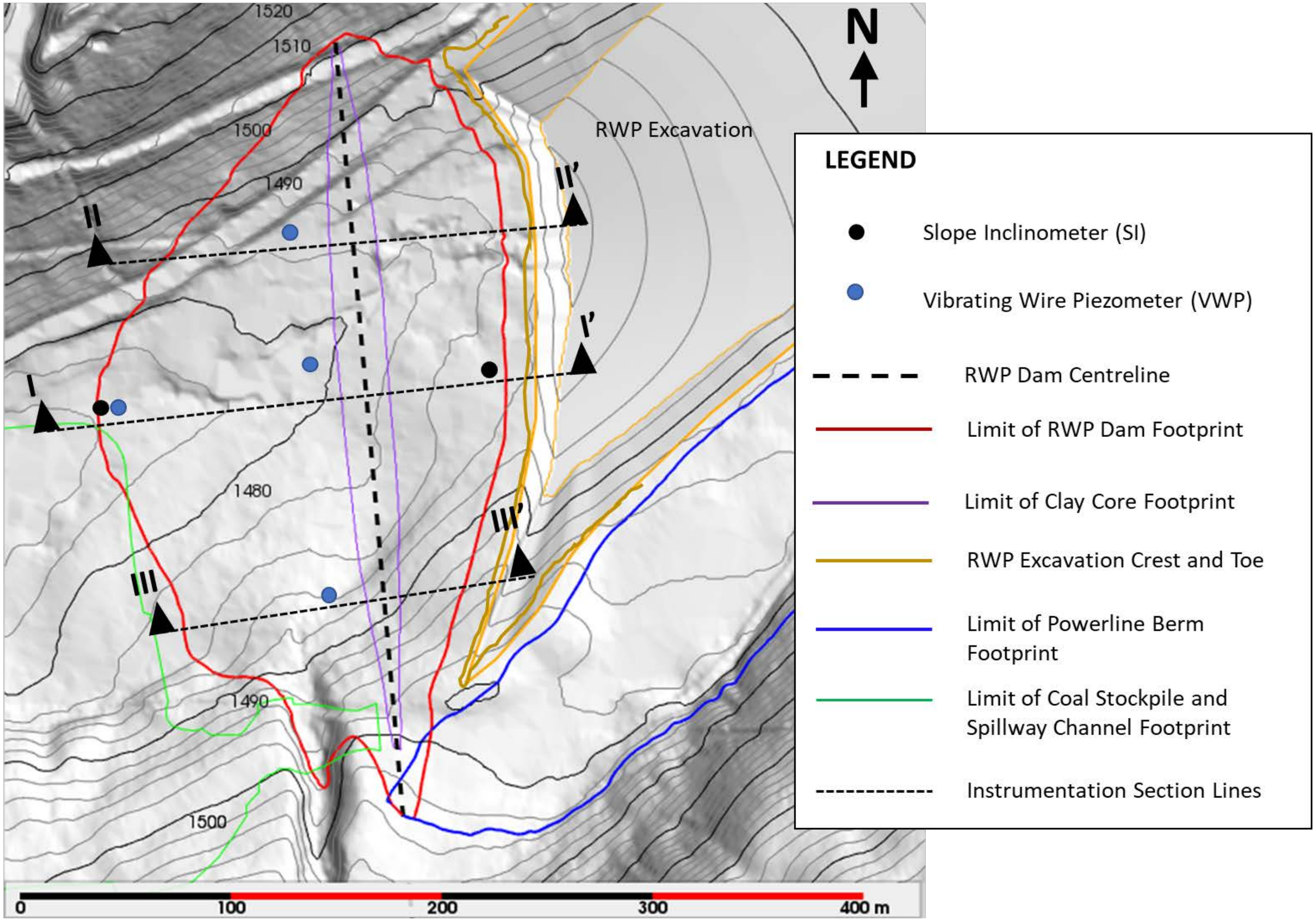
RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

TERRACON GEOTECHNIQUE

Pit Slope Monitoring Plan Strategy

PROJECT: 184140
DRAWN BY:
CHECKED BY:
DATE:
FIGURE: 184-8



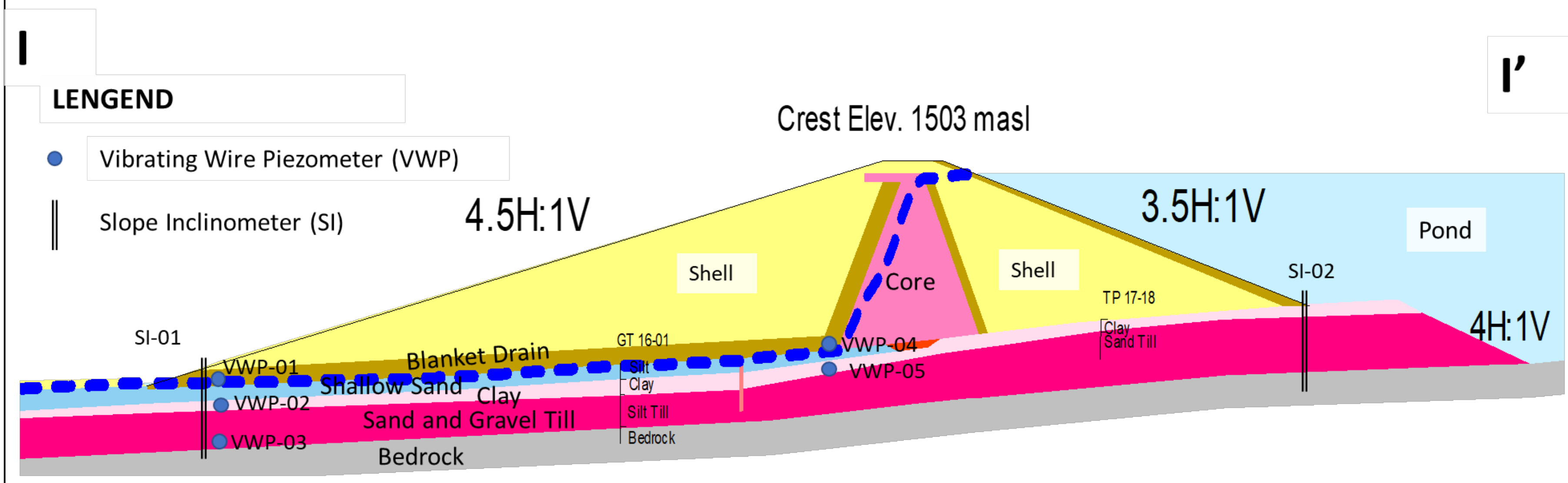
RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

TERRACON GEOTECHNIQUE

RWP Dam Instrumentation Plan

PROJECT: 184140	
DRAWN BY:	
CHECKED BY:	
DATE:	
FIGURE: 184-9	



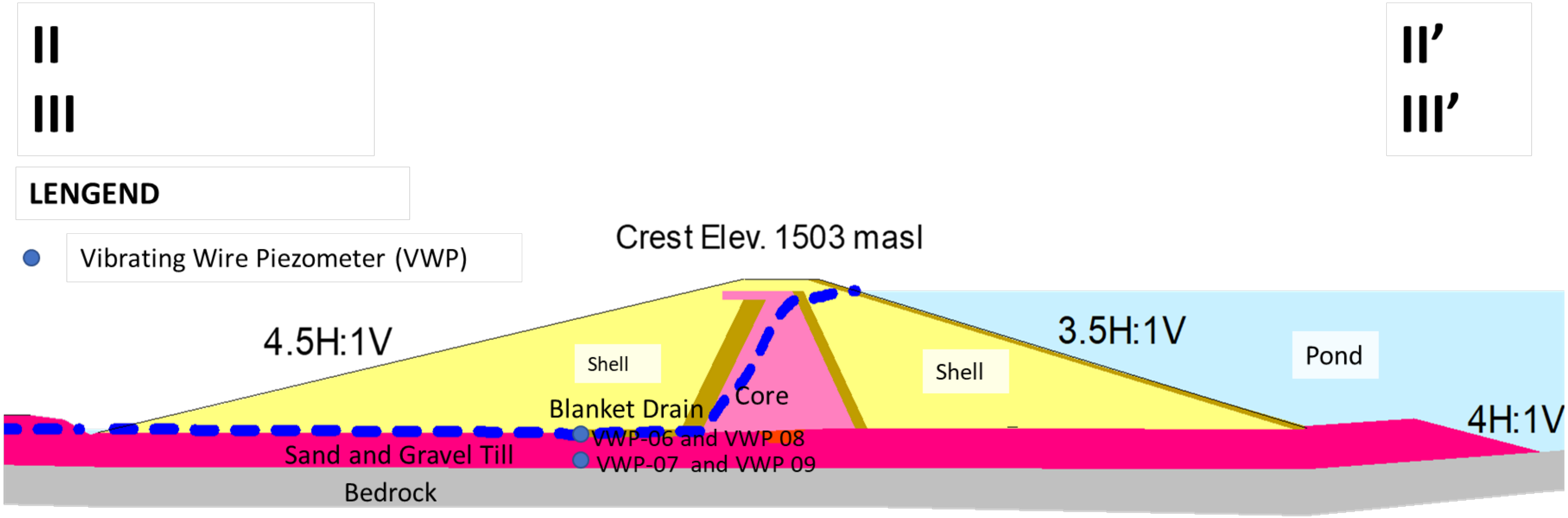
RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

TERRACON GEOTECHNIQUE

RWP Dam Instrumentation Plan – Instrumentation Section I-I’

PROJECT: 184140	
DRAWN BY:	
CHECKED BY:	
DATE:	
FIGURE: 184-10	



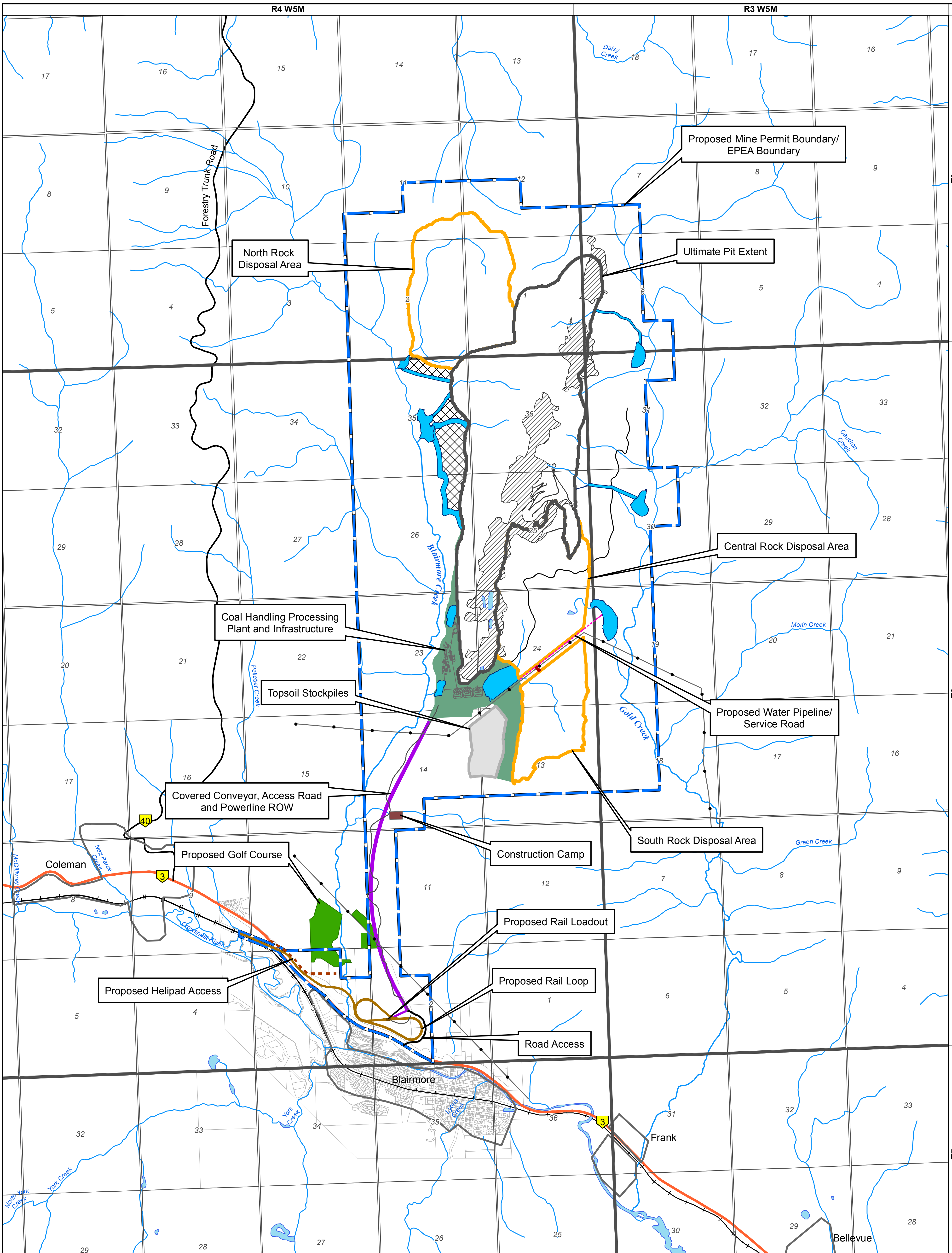
RIVERSDALE RESOURCES

GRASSY MOUNTAIN
COAL PROJECT

TERRACON GEOTECHNIQUE

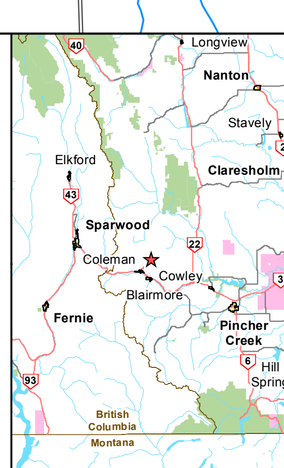
RWP Dam Instrumentation Plan – Instrumentation Sections II-II’ and III-III’

PROJECT: 184140	
DRAWN BY:	
CHECKED BY:	
DATE:	
FIGURE: 184-11	



LEGEND

- Primary Highway
- Secondary Highway
- Existing Railway
- Existing Access Road
- Existing Powerline
- CHPP Facilities
- Proposed Water Pipeline/ Service Road
- Railway Loop
- Proposed Helipad Access
- Proposed Mine Permit Boundary/EPEA Boundary
- Ultimate Pit Extent
- Ultimate Rock Disposal Area Extent
- Topsoil Storage
- Construction Camp
- Ponds and Ditches
- Coal Handling Processing Plant and Infrastructure
- Covered Conveyor, Access Road
- Proposed Golf Course Area
- Undisturbed Area



RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

PROPOSED MINE PERMIT BOUNDARY AND EPEA BOUNDARY

MILLENNIUM EMS Solutions Ltd.

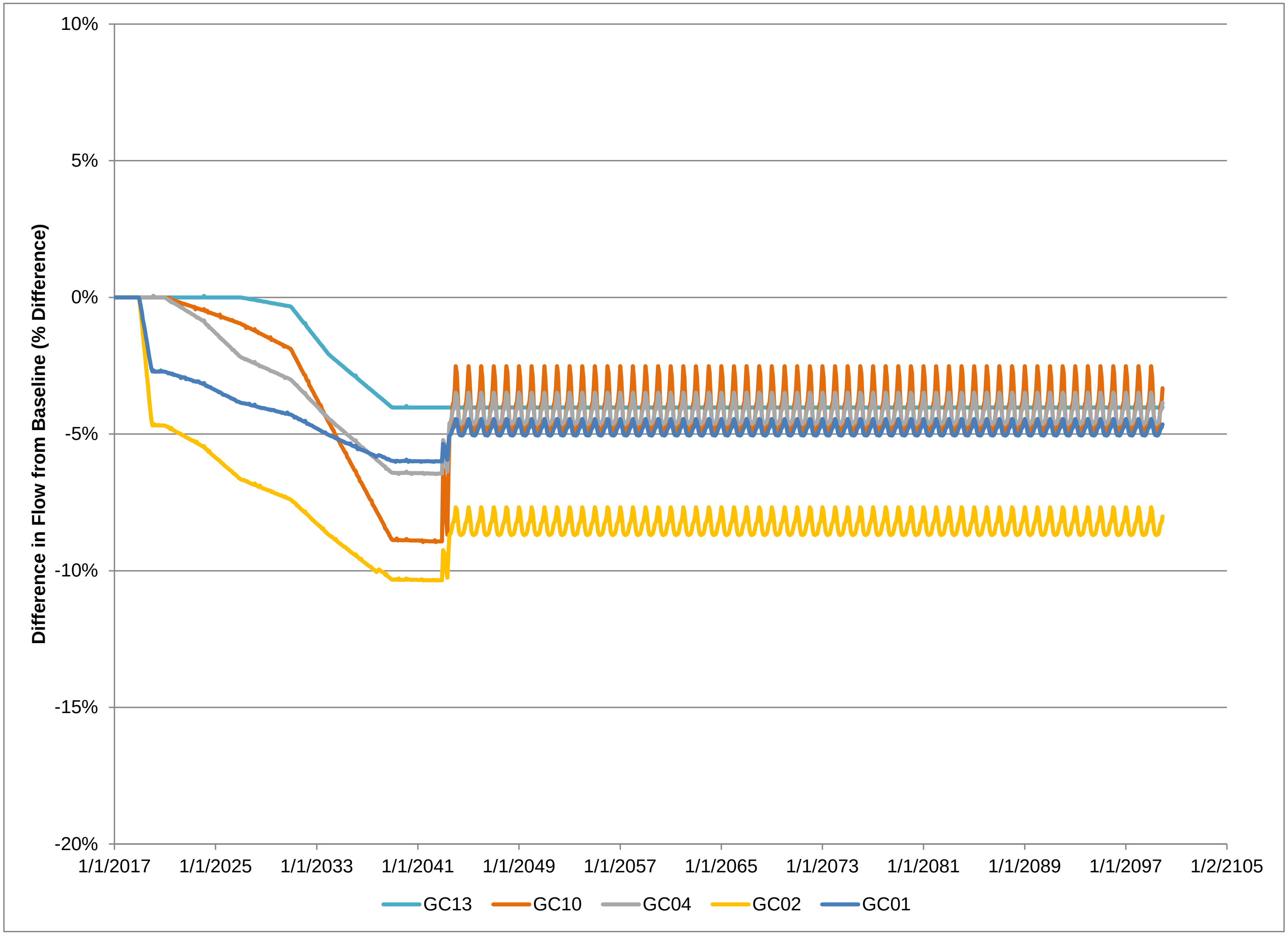
AltaLIS, 2018; NRCAN, 2015; Riversdale, 2016

Projection/Datum: UTM Zone 11 Nad 83

0 1 2
Kilometres

PROJECT: 14-00201
DRAWN BY: JL
CHECKED BY: CH
DATE: FEBRUARY 23, 2018

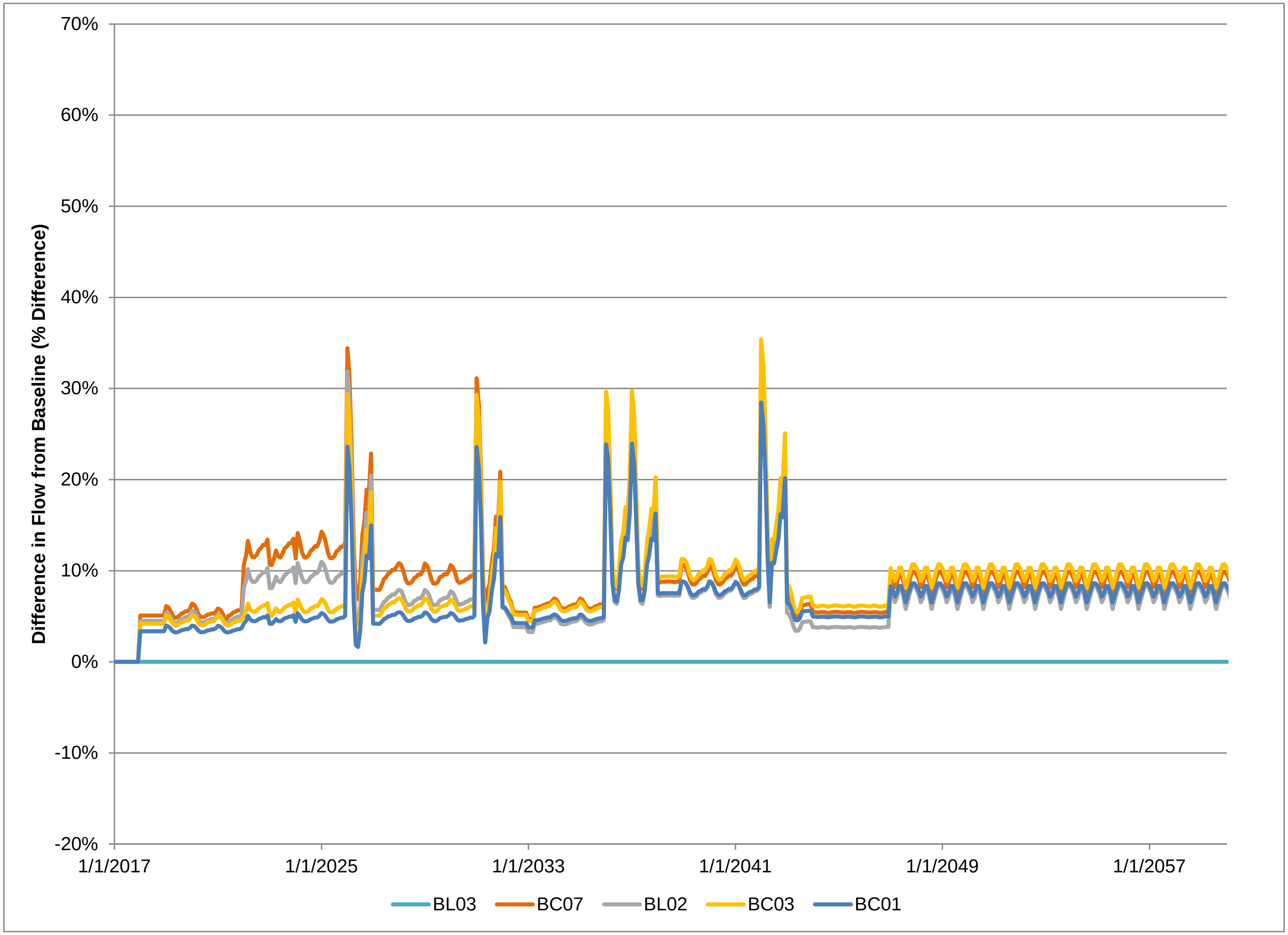
FIGURE
186-1



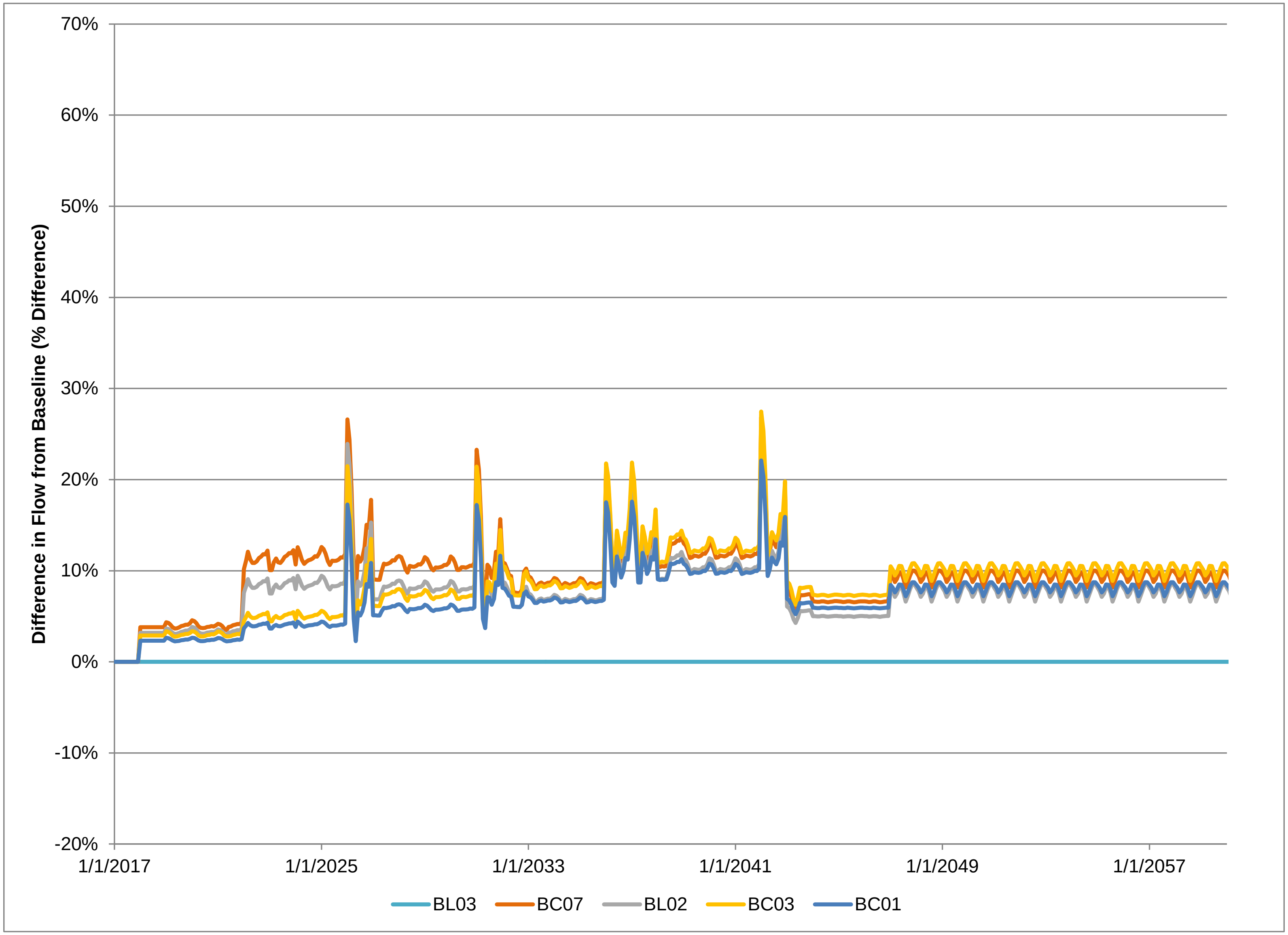
srk consulting	MILLENNIUM EMS Solutions Ltd.	Hydrology Impact Assessment **Estimated Flow Changes in Gold Creek w.r.t. Baseline Flow**
Job No: 1CM029.011 Filename: Figure_41_to_47_SRJ_20160808	Grassy Mountain Project	Date: August 2016 / Approved: SJ / Figure: **206-1**

srk consulting	MILLENNIUM EMS Solutions Ltd.	Hydrology Impact Assessment **Estimated Flow Changes in Gold Creek w.r.t. Baseline Flow, 1 in 10 Dry Years (All Years)**
Job No: 1CM029.011 Filename: Figure_41_to_47_SRJ_20160808	Grassy Mountain Project	Date: August 2016 | Approved: SJ | Figure: **206-2**

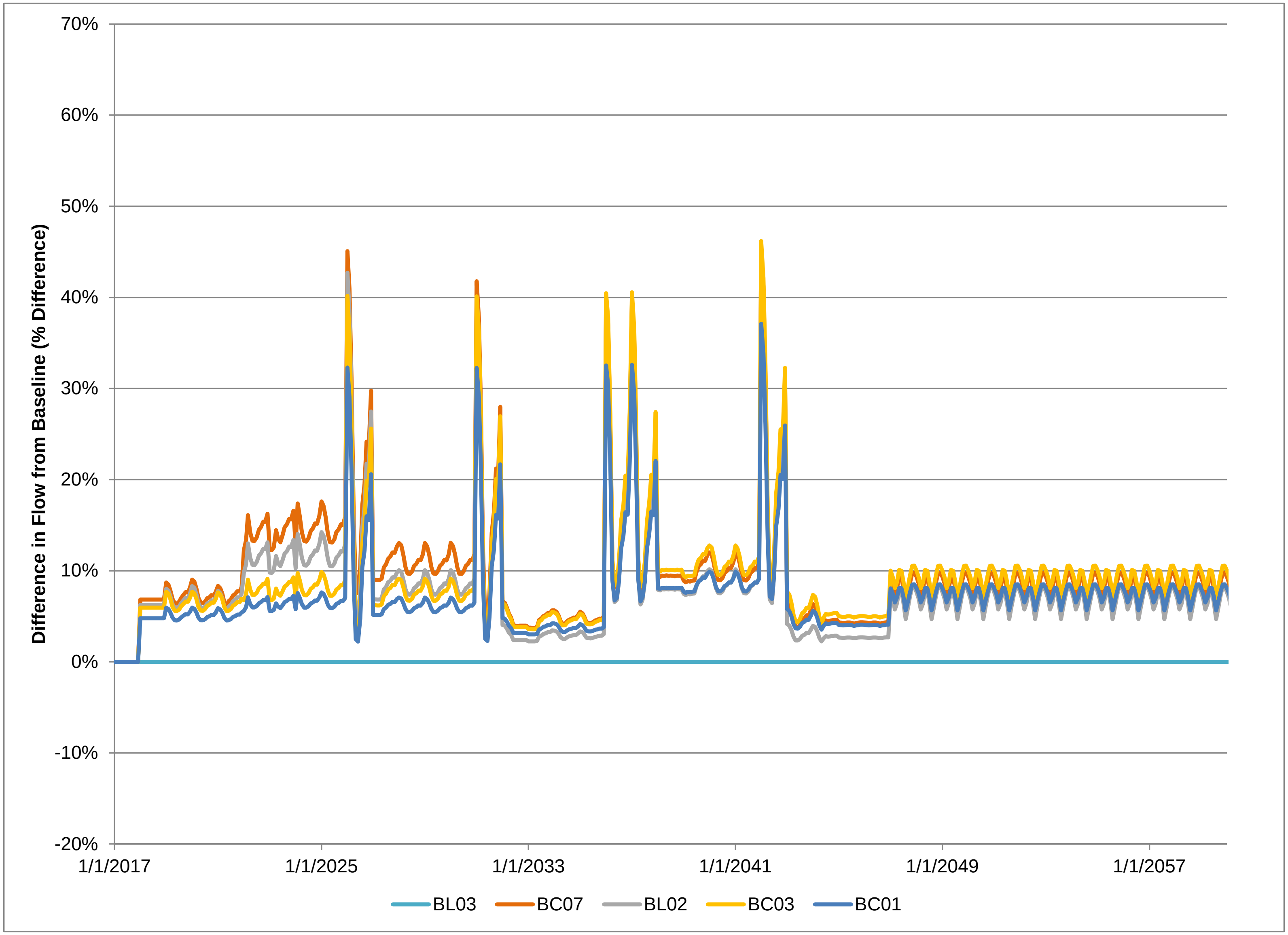
srk consulting	MILLENNIUM EMS Solutions Ltd.	Hydrology Impact Assessment **Estimated Flow Changes in Gold Creek w.r.t. Baseline Flow, 1 in 10 Wet Years (All Years)**		
Job No: 1CM029.011 Filename: Figure_41_to_47_SRJ_20160808	Grassy Mountain Project	Date: August 2016	Approved: SJ	Figure: **206-3**



srk consulting	MILLENNIUM EMS Solutions Ltd.	Hydrology Impact Assessment **Estimated Flow Changes in Blairmore Creek w.r.t. Baseline Flow, Average Flow Conditions**
Job No: 1CM029.011 Filename: Figure_41_to_47_SRJ_20160808	Grassy Mountain Project	Date: August 2016 / Approved: SJ / Figure: **206-4**



srk consulting	MILLENNIUM EMS Solutions Ltd.	Hydrology Impact Assessment
		Estimated Flow Changes in Blairmore Creek w.r.t. Baseline Flow, 1 in 10 Dry Years (All Years)
Job No: 1CM029.011 Filename: Figure_41_to_47_SRJ_20160808	Grassy Mountain Project	Date: August 2016 | Approved: SJ | Figure: **206-5**



srk consulting

MILLENNIUM EMS Solutions Ltd.

Hydrology Impact Assessment

Estimated Flow Changes in Blairmore Creek w.r.t. Baseline Flow, 1 in 10 Wet Years (All Years)

Job No: 1CM029.011

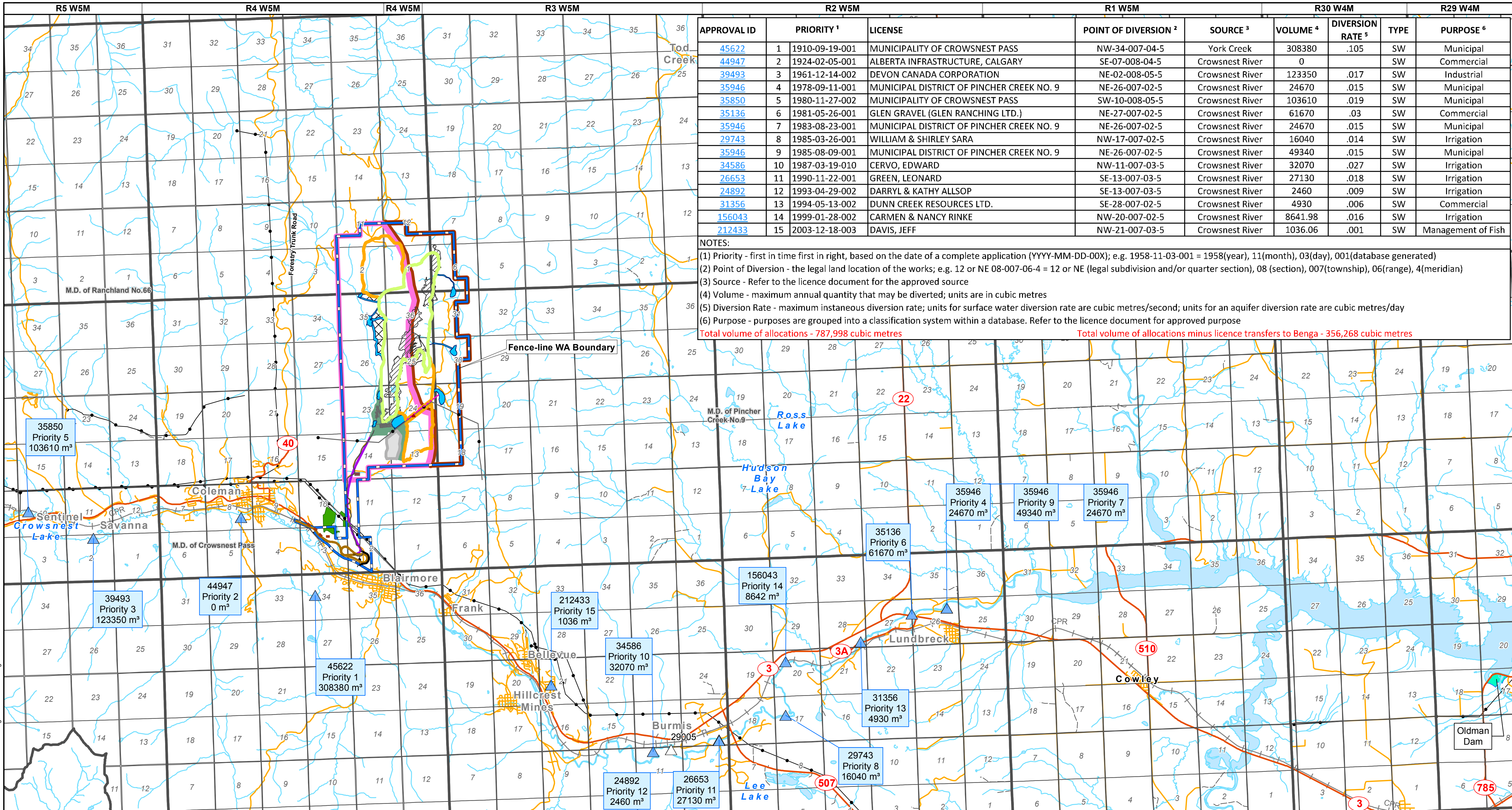
Filename: Figure_41_to_47_SRJ_20160808

Grassy Mountain Project

Date: August 2016

Approved: SJ

Figure: **206-6**



APPROVAL ID	PRIORITY [1]		LICENSE	POINT OF DIVERSION [2]	SOURCE [3]	VOLUME [4]	DIVERSION RATE [5]	TYPE	PURPOSE [6]
45622	1	1910-09-19-001	MUNICIPALITY OF CROWSNEST PASS	NW-34-007-04-5	York Creek	308380	.105	SW	Municipal
44947	2	1924-02-05-001	ALBERTA INFRASTRUCTURE, CALGARY	SE-07-008-04-5	Crowsnest River	0		SW	Commercial
39493	3	1961-12-14-002	DEVON CANADA CORPORATION	NE-02-008-05-5	Crowsnest River	123350	.017	SW	Industrial
35946	4	1978-09-11-001	MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9	NE-26-007-02-5	Crowsnest River	24670	.015	SW	Municipal
35850	5	1980-11-27-002	MUNICIPALITY OF CROWSNEST PASS	SW-10-008-05-5	Crowsnest River	103610	.019	SW	Municipal
35136	6	1981-05-26-001	GLEN GRAVEL (GLEN RANCHING LTD.)	NE-27-007-02-5	Crowsnest River	61670	.03	SW	Commercial
35946	7	1983-08-23-001	MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9	NE-26-007-02-5	Crowsnest River	24670	.015	SW	Municipal
29743	8	1985-03-26-001	WILLIAM & SHIRLEY SARA	NW-17-007-02-5	Crowsnest River	16040	.014	SW	Irrigation
35946	9	1985-08-09-001	MUNICIPAL DISTRICT OF PINCHER CREEK NO. 9	NE-26-007-02-5	Crowsnest River	49340	.015	SW	Municipal
34586	10	1987-03-19-010	CERVO, EDWARD	NW-11-007-03-5	Crowsnest River	32070	.027	SW	Irrigation
26653	11	1990-11-22-001	GREEN, LEONARD	SE-13-007-03-5	Crowsnest River	27130	.018	SW	Irrigation
24892	12	1993-04-29-002	DARRYL & KATHY ALLSOP	SE-13-007-03-5	Crowsnest River	2460	.009	SW	Irrigation
31356	13	1994-05-13-002	DUNN CREEK RESOURCES LTD.	SE-28-007-02-5	Crowsnest River	4930	.006	SW	Commercial
156043	14	1999-01-28-002	CARMEN & NANCY RINKE	NW-20-007-02-5	Crowsnest River	8641.98	.016	SW	Irrigation
212433	15	2003-12-18-003	DAVIS, JEFF	NW-21-007-03-5	Crowsnest River	1036.06	.001	SW	Management of Fish

NOTES:
(1) Priority - first in time first in right, based on the date of a complete application (YYYY-MM-DD-00X); e.g. 1958-11-03-001 = 1958(year), 11(month), 03(day), 001(database generated)
(2) Point of Diversion - the legal land location of the works; e.g. 12 or NE 08-007-06-4 = 12 or NE (legal subdivision and/or quarter section), 08 (section), 007(township), 06(range), 4(meridian)
(3) Source - Refer to the licence document for the approved source
(4) Volume - maximum annual quantity that may be diverted; units are in cubic metres
(5) Diversion Rate - maximum instaneous diversion rate; units for surface water diversion rate are cubic metres/second; units for an aquifer diversion rate are cubic metres/day
(6) Purpose - purposes are grouped into a classification system within a database. Refer to the licence document for approved purpose

Total volume of allocations - 787,998 cubic metres

Total volume of allocations minus licence transfers to Benga - 356,268 cubic metres

LEGEND

- Diversion Licence
- Diversion Licence (Historical Location)
- Railway
- Powerline
- Resource/Recreation/Winter Road
- Road
- Highway
- Existing Access Road
- Existing Powerline
- CHPP Facilities
- Proposed Water Pipeline/ Service Road
- Railway Loop
- Proposed Helipad Access
- Access Road
- Rail Loadout
- Proposed Haul Road
- Proposed Mine Permit Boundary
- Ultimate Pit Extent
- Ultimate Rock Disposal Area Extent
- Topsoil Storage
- Construction Camp
- Ponds and Ditches
- Coal Handling Processing Plant and Infrastructure
- Covered Conveyor, Access Road and Powerline ROW
- Proposed Golf Course Area
- Undisturbed Area
- Legacy Mine Disturbance
- Gold Creek Catchment
- Blairmore Creek Catchment
- Aboriginal Land
- Oldman Dam
- Gold Creek Catchment
- Blairmore Creek Catchment

RIVERSDALE RESOURCES

GRASSY MOUNTAIN COAL PROJECT

MILLENNIUM EMS Solutions Ltd.

SURFACE WATER LICENCES AND PRIORITIES ON CROWSNEST RIVER ABOVE OLDMAN RIVER DAM

AltaLIS, 2018; MEMS, 2018; NRCAN, 2015; SRK, 2017

Projection/Datum: UTM Zone 11 Nad 83

0 4 8
Kilometres

PROJECT: 14-00201
DRAWN BY: JL
CHECKED BY: CH
DATE: FEBRUARY 27, 2018

FIGURE
208-1

Document Path: K:\Active Projects 2014\AP 14-00201 to 14-00250\14-00201\MXD\Final Figures\SIR5\AER\Fig 208-1 Surface Water Licenses and Priorities 14-00201.mxd

Appendix A-1: ACO – Specific Concern and Response Tables

SPECIFIC CONCERN AND RESPONSE TABLE

First Nation or Metis Settlement	Blood Tribe
Date	Dec 15, 2017

This table is designed to capture project specific concerns raised—by the First Nation/Metis Settlement that is being consulted—during consultation and the proponent's response to address the concerns through avoidance or mitigation. Any reply provided by the First Nation/Metis Settlement to the proponent's response should be documented and noted in this table where applicable.

Add/ Delete Row	Document or Meeting Reference	Specific Concern Expressed	Project Specific Aspect of the Concern Expressed	Proponent Response on Effort to Avoid or Mitigate Concern	First Nation/Metis Settlement Response to Proponent's Effort to Avoid or Mitigate Concern	Details on how concerns were addressed, including avoidance or mitigation measures	Outcomes/Comments

+ -	Minutes for the January 13, 2015 meeting with Blood Tribe and Arbutus Consulting	To ensure that the Reclamation Plan satisfies their needs and expectations, Blood Tribe expressed interest in participating in its development.	Reclamation Plan	Section F in the August 2016 EIA document provides the proposed Conservation and Reclamation (C&R) Plan for the Project. This was provided to Blood Tribe in August 2016. Section F.1.5 describes the reclamation goals and principles that were incorporated in the C&R and closure plans. Section F.1.6 describes proposed End Land Use goals and includes a commitment that end land use decisions will be made in consultation with affected First Nations (including Blood Tribe) as well as local and government stakeholders.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Feedback received on the C&R plan in the EIA will be incorporated into the next version of the plan. Additionally, Blood Tribe will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with Blood Tribe to gather input on the plan.	Ongoing; working with Blood Tribe.
+ -	Minutes from the June 23, 2015 Meeting with Blood Tribe, Dialectic consulting and Merjent.	The Project's direct and indirect effects to water quality impose a cumulative effect to aquatic life in streams already carrying an increased phosphorous load from farming and sewage (Kainai Nation (Blood Tribe) 2015b).	Cumulative Effects on Water Quality	Cumulative effects within the Project's defined Cumulative Effects Assessment study area were assessed. Cumulative effects outside of the project study area are out of the scope of this assessment.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Concerns have been noted and Benga has forwarded to the Brett Maracle from the Canadian Environmental Assessment Agency.	Complete

+ -	Minutes from the June 23, 2015 Meeting with Blood Tribe, Dialectic consulting, and Merjent.	Blood Tribe community members' participation in environmental monitoring (including wildlife monitoring) before, during and after the project.	Community Participation in Monitoring	Benga has provided information to Blood Tribe about potential ways they can participate in environmental monitoring.	Blood Tribe has indicated that they would like to participate in environmental monitoring.	Benga is beginning to develop monitoring plans, and will continue to work with Blood Tribe to identify ways in which community members can contribute to and participate in monitoring. Blood Tribe will have an opportunity to provide input into the Reclamation Plan and into Project activities. Benga is proposing a workshop with Blood Tribe the first half of 2018 to gather input on wildlife monitoring.	Ongoing; working with Blood Tribe.
+ -	Minutes from the June 23, 2015 Meeting with Blood Tribe, Dialectic consulting, and Merjent.	Traditional Knowledge (TK) must influence all aspects of the environmental assessment, rather than simply be considered as a step in the Traditional Use (TU) process.	TK Incorporation	Benga has worked with Blood Tribe to collect TK and will continue to work with Blood Tribe to identify ways in which TK can be considered through the Environmental Assessment process and during Project activities. TK information has been used throughout the application process to inform and enhance the biophysical assessment and to assess potential effects to Blood Tribe. Benga has provided the Environmental Assessment (EA) to Blood Tribe for their review.	Blood Tribe has indicated that they will review the EA and provide additional feedback.	Benga will continue to work with Blood Tribe to identify ways in which TK can be considered during Project activities and in the development of environmental management plans. Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Blood Tribe.

+ -	Minutes from the June 23, 2015 Meeting with Blood Tribe, Dialectic consulting, and Merjent.	Concerns that field work did not sufficiently cover Traditional Knowledge (TK) which should be used together with western science to manage environmental and cultural effects.	TK and management of environmental and cultural effects.	Benga has worked with Blood Tribe to collect TK and will continue to work with Blood Tribe to identify ways in which TK can be considered through the Environmental Assessment (EA) process and during Project activities. TK information has been used throughout the application process to inform and enhance the biophysical assessment and to assess potential effects to Blood Tribe. Benga has provided the EA to Blood Tribe for their review.	Blood Tribe has indicated that they will review the EA and provide additional feedback.	Benga will continue to work with Blood Tribe to identify ways in which TK can be considered during Project activities and in the development of environmental management plans. Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Blood Tribe.
+ -	Minutes from the June 23, 2015 Meeting with Blood Tribe, Dialectic consulting, and Merjent.	Concerns that none of the non-Blackfoot Aboriginal groups included by the Canadian Environmental Assessment Agency (CEAA) have a legitimate claim on the area.	Consultation process (CEAA)	Benga is committed to adhering to consultation and engagement requirements as identified by provincial Alberta Consultation Office (ACO) and federal (CEAA) authorities.	Blood Tribe has not provided a response.	Concerns have been noted and Benga has forwarded to Brett Maracle at CEAA.	Complete

+ -	Minutes from the June 23, 2015 Meeting with Blood Tribe, Dialectic consulting, and Merjent.	Particulate matter from the mine may settle in nearby towns, including Nanton and Cardston.	Impact of particulate matter on Human Health	The results of the Environmental Assessment (EA) were submitted in 2015 and again in August 2016. Section E.1.3 of the EA provides an assessment of potential effects of the Project including the potential for effects on air quality in the region especially related to dust and particulates. Mitigation measures are proposed in Section E.1.5 of the EA including measures for dust management. No significant impacts were predicted in the EA.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Blood Tribe.
+ -	Minutes from the June 23, 2015 Meeting with Blood Tribe, Dialectic consulting, and Merjent.	Insufficient consideration of the effect to Blood Tribe hunting during wildlife surveys, as Blood Tribe technicians did not participate in the fieldwork.	Consideration of the Project effect on hunting during the wildlife assessment.	The results of the EA were submitted in 2015 and updated in August 2016. Information provided in the Blood Tribe Traditional Use Study, including information about wildlife, is considered in the EA under potential effects to wildlife and potential effects to hunting. This information has been provided to Blood Tribe.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga will also continue to work with Blood Tribe to address this concern during the development of the wildlife monitoring plan in the first half of 2018.	Ongoing; working with Blood Tribe.

+ -	Minutes from the June 23, 2015 Meeting with Blood Tribe, Dialectic consulting, and Merjent.	Dust particulates may render the soil more acidic, which may cause a change to the species of vegetation that can grow in the area.	Impact of dust on soil and vegetation	The results of the Environmental Assessment (EA) were submitted in 2015 and again when updated in August 2016. Soil sensitivity to acid depositions is discussed in Section 4.4 of the soil assessment report (Consultant Report #7). All soils were rated for sensitivity to acids deposition based upon soil characteristics. The vast majority of soils in the Project area were rated as having low to moderate sensitivity to acid depositions. This means they have a good buffering capacity and can absorb a significant amount of acid depositions without long-term harmful changes in their properties. No area was found where acid depositions values exceed critical, target or monitoring load for the soils within the Local Study Area (LSA) or the Regional Study Area (RSA). The potential effects of the Project with respect to potential soil acidification is negligible at the local and regional scale. This information has been provided to Blood Tribe.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Blood Tribe.

+ -	Minutes from the June 23, 2015 Meeting with Blood Tribe, Dialectic consulting, and Merjent.	Removal of native vegetation such as lodgepole pine in the vicinity of the Project may cause non-native species such as willow or sweet pine to invade, rendering the area more susceptible to forest fire.	Impact of vegetation removal on fire susceptibility.	The results of the Environmental Assessment (EA) were submitted in 2015 and again when updated in August 2016. The potential for invasive species is assessed in EA Update (August 2016) (with technical detail in Consultant Report # 8 - Vegetation). Proposed mitigation measures related to invasive species are outlined in Section 4.9.4 of Consultant Report #8. An adaptive management approach, including non-native invasive species control and monitoring, and re-vegetation establishment assessments will be used to ensure that sites have been re-vegetated to meet target vegetation communities. This information has been provided to Blood Tribe.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Blood Tribe.
+ -	Minutes from the June 23, 2015 Meeting with Blood Tribe, Dialectic consulting, and Merjent.	A ceremony should be performed in advance of ground or vegetation disturbance.	Ceremony required prior to ground disturbance.	Benga supports this event and has discussed options and planning for a ceremony with Blood Tribe.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga commits to arranging a ceremony in advance of ground disturbance for construction of the Project.	Complete

+ -	July 2015 Grassy Mountain Coal Project Public Report on Blood Tribe Traditional Knowledge and Use of the Grassy Mountain Area.	The Project will make some land inaccessible for hunting, which will impose cumulative effects on Blood Tribe's land base which has already been reduced due to the inaccessibility of private land and reduced acreage of Crown land.	Cumulative effect of development on land access and impact to hunting	Cumulative effects within the Project's defined cumulative effects assessment study area were assessed. Cumulative effects on Blood Tribe's hunting rights outside of the project area are outside of the scope of the assessment. Benga has forwarded this comment on to Canadian Environmental Assessment Agency (CEAA) and Aboriginal Consultation Office (ACO).	Blood Tribe has indicated that they will review the information and provide additional feedback.	Concerns have been noted and Benga has forwarded to the provincial and federal government.	Complete
+ -	July 2015 Grassy Mountain Coal Project Public Report on Blood Tribe Traditional Knowledge and Use of the Grassy Mountain Area.	Timely harvest of medicinal and ceremonial plants prior to effect by the Project.	Plant Gathering; medicinal and ceremonial.	Benga has committed to providing lodgepole pine that is cleared for the Project to Nations. Benga has expressed to Blood Tribe an interest in obtaining their input into the development of environmental management plans. Access to harvesting areas will be included as a component of the Aboriginal Access Management plan.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will hold a workshop with Blood Tribe in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Blood Tribe.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Blood Tribe Traditional Knowledge and Use of the Grassy Mountain Area.	Plan project footprint and activities so as to limit effect to medicinal and ceremonial plants in the vicinity of the Project site.	Effect of Project activities on medicinal and ceremonial plants.	The results of the Environmental Assessment (EA) were submitted in 2015 and again when updated in August 2016. Potential effects of the Project on vegetation including medicinal and ceremonial plants are described in Section E.8.3 of the EA. A discussion of proposed mitigation measures is provided in the EA document. Section E.8.5 and the C&R Plan in Section F.1 describe how traditional plants were incorporated into the proposed closure plan. Mitigation measures include opportunities to transplant to limit potential effects to identified medicinal and ceremonial plants, and incorporating traditional use plant species, native to the area, into reclamation plans. This information has been provided to Blood Tribe.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a workshop in the first half of 2018 to discuss the access management plan and access to harvesting areas.	Ongoing; working with Blood Tribe.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Blood Tribe Traditional Knowledge and Use of the Grassy Mountain Area.	Request for trees slated for removal at the Project site be replanted on the Blood Reserve or added to riparian areas.	Plant gathering and tree planting.	Benga has committed to providing lodgepole pine that is cleared for the Project to Nations. The results of the Environmental Assessment (EA) were submitted in 2015 and again in August 2016. Potential effects of the Project on vegetation including medicinal and ceremonial plants are described in Section E.8.3 of the EA. A discussion of proposed mitigation measures is provided in Section E.8.5 of the EA. Mitigation measures include opportunities to transplant to limit potential effects to identified medicinal and ceremonial plants. This information has been provided to Blood Tribe.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has developed a conceptual access management plan and will hold a workshop with Blood Tribe in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Blood Tribe.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Blood Tribe Traditional Knowledge and Use of the Grassy Mountain Area.	Continued and/or improved access to ceremonial plants.	Plant Gathering; ceremonial plants.	Benga has expressed to Blood Tribe an interest in obtaining their input into the development of environmental management plans. Access to harvesting areas will be included as a component of the Aboriginal Access Management plan.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has developed a conceptual access management plan and will meet with Blood Tribe in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Blood Tribe.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Blood Tribe Traditional Knowledge and Use of the Grassy Mountain Area.	Requested that Benga provide lodgepole pine to Blood Tribe community members.	Timber (lodgepole pine) harvesting.	Benga has committed to providing lodgepole pine that is cleared for the Project to Blood Tribe.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has developed a conceptual access management plan and will meet with Blood Tribe in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Blood Tribe.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Blood Tribe Traditional Knowledge and Use of the Grassy Mountain Area.	Prepare an Emergency Preparedness Plan in the event of leak, spill, or other unanticipated release. This plan is to address concerns about effects to water quality and species that depend on water quality.	Emergency Response and Water Quality.	The results of the Environmental Impact Assessment (EIA) were submitted in 2015 and again in August 2016. Benga provided a discussion of the Emergency Response Plan as part of the EA in Section C.7.6.3.Benga will be implementing a Water Management Plan (WMP) that will prevent any unwanted release of water that may not meet provincial or federal water quality guidelines. All water (surface and groundwater) will be collected, held, and only released once it meets the appropriate or applicable water quality guideline.For any acute releases (i.e.., in the event of an emergency), Benga will have the appropriate (and effective) Emergency Response Plans in place, and will ensure qualified staff are in place to implement these plans. All of the holding ponds that will be onsite were over engineered to meet Alberta's Dam Safety requirements. Benga will develop and implement an Emergency Response Plan in relation to potential accidents that would affect the environment, and are committed to	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Emergency Response plan and Water Management Plan. Benga also plans to hold a workshop with the Blood Tribe 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Blood Tribe.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Blood Tribe Traditional Knowledge and Use of the Grassy Mountain Area.	Concerns that the Project's reclamation program may not achieve objectives (Kainai Nation (Blood Tribe) 2015c).	Reclamation Plan	Section F in the August 2016 EIA document provides the proposed Conservation and Reclamation (C&R) Plan for the Project. This was provided to Blood Tribe in August 2016. Section F.1.5 describes the reclamation goals and principles that were incorporated in the C&R and closure plans. Section F.1.6 describes proposed End Land Use goals and includes a commitment that end land use decisions will be made in consultation with affected First Nations (including Blood Tribe) as well as local and government stakeholders.	Blood Tribe has indicated that they will review the information and provide additional feedback	Feedback on the C&R plan in the EIA will be incorporated into the next version of the plan. Additionally, Blood Tribe will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with Blood Tribe to gather input on the plan.	Ongoing; working with Blood Tribe.
+ -	January 4, 2016 Statement of Concern to Benga	Blood Tribe has raised the concern that as a part of the remediation process the land must be returned as Alberta Crown land. Benga has not sufficiently responded to this concern, answering instead that "there will be opportunity to discuss steps for decommissioning and reclamation."	Decommissioning, Reclamation and access to Crown land.	This comment is outside of the scope of this assessment.	Blood Tribe has indicated that they will review the information and provide additional feedback. for consideration.	Concerns have been noted and Benga has forwarded to ACO and CEAA	Complete

+ -	January 4, 2016 Statement of Concern to Benga	The proponent intends to divert surface and groundwater for use in the Project. Further, the Project area is located at the headwaters of many downstream rivers used by the Blood Tribe. This is likely to permanently reduce the suitability of affected water-ways for traditional use activities. Any leaching or spills from the Project's tailings ponds could prove catastrophic.	Water Management and potential effect on traditional use activities.	In the August 2016 Environmental Assessment (EA) Update, Benga provided information and clarification around the Project's Water Management Plan (WMP). This WMP was developed to ensure all water within the mine site is captured in appropriately sized holding ponds that allow for the testing of water quality prior to being released into the surrounding environment. The WMP was assessed to determine potential effects on river flows and water quality in the neighbouring and downstream rivers. The results of the assessment indicate that there will not be any impacts to the environment with the implementation of the WMP. To verify that changes in flow do not affect fish and their habitat, Benga also conducted a detailed Instream Flow Needs study (IFN).	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Blood Tribe 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	I am also concerned about the introduction of foreign plants that will affect the native plants in the area. They may cause irreversible changes to the native flora and fauna.	Impact of foreign invasive Plants on native vegetation and wildlife	Section E.8 of the August 2016 Environmental Impact Assessment (EIA) document assessed the potential for invasive species (with technical detail in Consultant Report # 8 - Vegetation). Proposed mitigation measures related to invasive species are outlined in Section 4.9.4 of Consultant Report #8. An adaptive management approach, including non-native invasive species control and monitoring, and monitoring of post-reclamation re-vegetation establishment will be used to manage the risk of non-native and invasive species to help ensure that reclaimed sites meet target vegetation communities and reclamation certification requirements.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Blood Tribe 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	Blood Tribe understands that Benga activities in or near the Project area may have resulted in a release of contaminants into Gold Creek and the Crowsnest River, resulting in an AER investigation (July - August 2015). This is of concern to Blood Tribe as it may speak to the availability of Benga to conduct its operations without harming the biophysical environment. Equally concerning is the fact that Benga was not proactive in directly advising Blood Tribe of the circumstances of this release and subsequent investigation.	Water quality; Consultation	To date, Benga have only conducted coal quantity and quality exploration programs on Grassy Mountain. For each program, the appropriate drilling procedures and mitigations were in place, and there have not been any releases of contaminants from any of these programs. The 2015 Alberta Energy Regulator (AER) investigation pertained to the deposition of silt and coal fines from the historical (or legacy) coal piles that already exist on Grassy Mountain from the mining activities back in the 1950s and 1960s. This deposition occurred during multiple high rainfall events in a short period of time in 2015. Benga has been working with the AER, as well as the Department of Fisheries and Oceans (DFO), to ensure proper mitigations are in place to prevent any further deposition of silt and coal fines from these historical coal piles. As part of the Project mine plan, it is Benga's intention to clean up and reclaim the environment affected by the legacy mining activities.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	There has been found to be a direct correlation between cumulative waste rock volumes and increases in selenium concentrations found in local rivers and streams. According to the Blood Tribe Traditional Knowledge (TK)/Traditional Use (TU) Report, several Elders recommended an emergency preparedness plan in the event of leaks, spills, or other disasters to address concerns about effects on water quality and species dependent on clean water sources.	Water Quality; Water Management Plan; Emergency Response Plan	Benga will implement a Water Management Plan (WMP) that will prevent any unwanted release of water that may not meet provincial or federal water quality guidelines. All water (surface and groundwater) will be collected, held, and only released once it meets the appropriate or applicable water quality guideline. For any acute releases (i.e.., in the event of an emergency), Benga will have the appropriate (and effective) Emergency Response Plans in place, and will ensure qualified staff are in place to implement these plans. All of the holding ponds that will be onsite were over engineered to meet Alberta's Dam Safety requirements. Benga will develop and implement an Emergency Response Plan in relation to potential accidents that would affect the environment, and are committed to discussing and receiving input from the Blood Tribe on these plans.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Blood Tribe 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	The Project will have irreparable adverse impacts on Blood Tribe's ability to exercise its traditional activities in and around the Project area. The Project would be located in Blood Tribe's traditional territory in the heart of an area used intensively by Blood Tribe members for hunting, fishing, gathering and ceremonial purposes.	Adverse impacts to traditional activities, hunting, fishing, and plant gathering; ceremonies	This information has been included in the updated Environmental Assessment (EA) (August 2016) which has been provided to Blood Tribe. Information from the Blood Tribe will help shape the structure and objectives of monitoring plan.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will hold a workshop with Blood Tribe in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	The Blood Tribe are concerned that this may be irreparable and the herds may never return. A project of this scope and size will affect the migratory patterns of the wildlife in the area.	Wildlife; wildlife migratory patterns.	The results of the Environmental Impact Assessment (EIA) were submitted in 2015 and again after updating in August 2016. The assessment of potential effects to wildlife is considered in Sec E.9.3. Many of the project effects associated with habitat loss and wildlife movement will be minimized through the implementation of the Project's reclamation plan. As seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop with Blood Tribe in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	The noise and traffic from the construction and development of the mine will scare away the animals and affect their migratory patterns.	Noise; Wildlife	The results of the Environmental Impact Assessment (EIA) were submitted in 2015 and again after updating in August 2016. The assessment of potential effects to wildlife is considered in Sec E.9.3. Many of the project effects associated with habitat loss and wildlife movement will be minimized through the implementation of the Project's reclamation plan. As seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year. This information has been provided to Blood Tribe.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop for Blood Tribe in the first half of 2018 to obtain further input on the plan.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	I am concerned with the impact of development on the waterways and lakes that sustain the animals. Moose and elk need a lot of water in particular when they are in rut.	Water Management Plan; Wildlife	As part of the August 2016 Environmental Impact Assessment (EIA) Update, Benga have added additional information and clarification around the Project's Water Management Plan (WMP). This WMP was developed to ensure all water within the mine site is captured in appropriately sized holding ponds that allow for the testing of water quality prior to being released into the surrounding environment. The WMP was assessed to determine potential effects on river flows and water quality in the neighbouring and downstream rivers. The results of the assessment indicate that there will not be any impacts to the environment with the implementation of the WMP. To verify that changes in flow do not affect fish and their habitat, Benga also conducted a detailed Instream Flow Needs study (IFN).	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop for Blood Tribe in the first half of 2018 to obtain further input on the plan.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	I am concerned that the chemicals and pollutants resulting from the development will affect the health of the animals, fish and birds. If the animals are sick, and we eat the animals, then we will get sick.	Pollution and Wildlife Health; Fish; Hunting; Fishing; Human Health	A list of wildlife species specifically identified as being potential country foods, culturally, or spiritually important by Blood Tribe is provided in Table 2.2-1 of the wildlife assessment in Consultant Report #9. A wildlife risk assessment (WRA) was conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk of adverse effects associated with Project emissions on the health of wildlife in the study areas.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop for Blood Tribe in the first half of 2018 to obtain further input on the plan.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	My main concern is the impact on the water. I am concerned that if the water gets polluted this would make the animals, fish and birds unhealthy.	Water Quality; Water Management; Wildlife Health; Fish Health	A list of wildlife species specifically identified as being potential country foods, culturally, or spiritually important by Blood Tribe is provided in Table 2.2-1 of the wildlife assessment in Consultant Report #9. A wildlife risk assessment (WRA) was conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk of adverse effects associated with Project emissions on the health of wildlife in the study areas. Benga will implement a Water Management Plan (WMP) that will prevent any unwanted release of water that may not meet provincial or federal water quality guidelines. All water (surface and groundwater) will be collected, held, and only released once it meets the appropriate or applicable water quality guideline.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop for Blood Tribe in the first half of 2018 to obtain further input on the plan.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	I am concerned about hunting and fishing in the Project area because of the effect of the chemicals on the animals and fish. I am concerned about the tailings ponds leaching into the waterways and affecting the fish health and habitat and the health of the moose and elk that drink out of those waterways. I am concerned this will affect the quality of the meat.	Water Management Plan; Emergency Response; Hunting; Fishing; Water Quality; Wildlife	A list of wildlife species specifically identified as being potential country foods, culturally, or spiritually important by Blood Tribe is provided in Table 2.2-1 of the wildlife assessment in Consultant Report #9. A wildlife risk assessment (WRA) was conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk of adverse effects associated with Project emissions on the health of wildlife in the study areas. This information has been provided to Blood Tribe. Benga will be implementing a Water Management Plan (WMP) that will prevent any unwanted release of water that may not meet provincial or federal water quality guidelines. All water (surface and groundwater) will be collected, held, and only released once it meets the appropriate or applicable water quality guideline.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop for Blood Tribe in the first half of 2018 to obtain further input on the plan.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	The Blood Tribe are concerned that new roads and access points constructed for the Project will result in greater accessibility and use by non-Aboriginal hunters and recreational users. This will further impact and disturb the wildlife population in the area.	Access; Hunting; Wildlife	Benga provided a conceptual Access Management Plan in the August 2016 update to the Environmental Impact Assessment (EIA). This information has been provided to Blood Tribe. Due to site safety reasons access will be restricted within the Project Permit boundary during construction and operations. This will be enforced by mine operations managers and personnel during the construction and operations phase.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a workshop in the first half of 2018 to discuss the access management plan and access to harvesting areas.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	The construction of the Project will lead to increased noise in this area. Blood Tribe members understand that noise has an effect on the wildlife that they harvest, and are concerned that animals will avoid the Project area and surrounding environs altogether due to such noise. Blood Tribe is concerned that this in turn may affect the success of its' members harvesting activity.	Noise; Wildlife; Hunting	Potential interactions with wildlife related to noise are assessed in the Environmental Impact Assessment (EIA) update (August 2016), Wildlife Consultant Report #9, Section 3. This assessment included sensory disturbance during construction and operations. Noise from the active mine site would be mitigated through the use of mufflers on all internal combustion engines, installing berms around the southern dump to absorb noise, utilizing mine pit topography to shield noise generated from haul trucks, and conducting blasting during daylight hours. This information has been provided to Blood Tribe. Reclamation efforts on similar mines in Alberta have found that through proper reclamation, wildlife species return to restored habitats.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a workshop in the first half of 2018 to discuss the access management plan, wildlife monitoring and access to harvesting areas.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	In addition to removing the lands for use by Blood Tribe members, this taking-up will impact Blood Tribe members' ability to transmit traditional knowledge about the area to younger generations. In short, the Applications, if approved, will have lasting adverse impacts on Blood Tribe's culture.	Traditional Knowledge; Culture	As part of the review of the Conservation and Reclamation (C&R) plan, Benga will collaborate with Blood Tribe in establishing end land use objectives and developing and implementing its reclamation plans for the project. This could include ongoing Blood Tribe participation in progressive reclamation activities and performance monitoring of reclaimed areas. Collaboration will enable the sharing of Traditional Knowledge and learnings from site monitoring with all members of the Blood Tribe throughout the life of the mine to final closure.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Additionally, Blood Tribe will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with Blood Tribe to gather input on the plan.	Ongoing; working with Blood Tribe.

+ -	January 4, 2016 Statement of Concern to Benga	The Blood Tribe are concerned that non-native invasive plant species will be introduced in the area and affect the native plants in the area or the plants in the area or the animals that eat them.	Invasive Plants; Vegetation; Wildlife	The potential for invasive species is assessed in the Environmental Impact Assessment (EIA) Update (August 2016) (with technical detail in Consultant Report # 8 - Vegetation). Proposed mitigation measures related to invasive species are outlined in Section 4.9.4 (Consultant Report #8). An adaptive management approach, including non-native invasive species control and monitoring, and re-vegetation establishment assessments will be used to ensure that sites have been re-vegetated to meet target vegetation communities.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Feedback received on the C&R plan in the EIA will be incorporated into the next version of the plan. Additionally, Blood Tribe will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with Blood Tribe to gather input on the plan.	Ongoing; working with Blood Tribe.
+ -	May 24, 2016 email from Mike Oka to Cal Clark	The Blood Tribe expressed concern about long-term visual impacts to Grassy Mountain.	Potential visual impacts	Benga entered into an agreement with the Municipality of Crowsnest Pass to provide a natural tree line immediately north of Highway 3 as part of a visual and noise impact mitigation.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Blood Tribe.
+ -	May 24, 2016 email from Mike Oka to Cal Clark	The Blood Tribe expressed concern that many of the jobs created would not be long-term.	Employment	Benga will be employing a variety of different positions of different durations during their 30 year mine life.	Blood Tribe has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Blood Tribe.

+ -	Minutes from the June 6, 2017 Meeting with Blood Tribe.	Monitoring may need to be done further out than the area currently being considered. When looking at adverse impacts to First Nation Treaty rights, this is something that needs to be focused on because the impact to sensitive wildlife may go beyond current monitoring boundaries. Noise will bounce off the mountains and carry over. This may cause impacts to the wildlife. The Nation will need to find out where the wildlife are moving to.	Monitoring; Wildlife; Noise	Benga has provided information to Blood Tribe about potential ways they can participate in environmental monitoring. Benga is beginning to develop monitoring plans and will continue to work with the Blood Tribe to identify ways in which community members can contribute to and participate in monitoring. Benga is scheduling a meeting with the Blood Tribe in October 2017 to discuss further. Potential interactions with wildlife related to noise are assessed in the Environmental Impact Assessment (EIA) update (August 2016), Wildlife Consultant Report #9, Section 3. This assessment included sensory disturbance during construction and operations. Noise from the active mine site would be mitigated through the use of mufflers on all internal combustion engines, installing berms around the southern dump to absorb noise, utilizing mine pit topography to shield noise generated from haul trucks, and conducting blasting during daylight hours.	The Blood Tribe has indicated that they will review the response and provide feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop for Blood Tribe in the first half of 2018 to obtain further input on the plan.	Ongoing; working with Blood Tribe.

+ -	Minutes from the June 6, 2017 Meeting with Blood Tribe.	Blood Tribe would like active involvement in the monitoring program.	Community Participation in Monitoring	Benga has provided information to Blood Tribe about potential ways they can participate in environmental monitoring.	The Blood Tribe has indicated that they will review the Environmental Impact Assessment and provide feedback. Blood Tribe has not yet provided input into the design of monitoring programs.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop for Blood Tribe in the first half of 2018 to obtain further input on the plan.	Ongoing; working with Blood Tribe
+ -	Minutes from the June 6, 2017 Meeting with Blood Tribe.	Treaty rights are impacted adversely if we cannot hunt or fish. Need to figure out how to address and mitigate this.	Treaty rights; Hunting; Fishing	This information has been included in the updated Environmental Impact Assessment (EIA) (August 2016) which has been provided to Blood Tribe. Information from the Blood Tribe will help shape the structure and objectives of monitoring plan. The results of the EA were submitted in 2015 and updated in August 2016. Information provided in the Blood Tribe Traditional Use Study, including information about wildlife, is considered in the EIA under potential effects to wildlife and potential effects to hunting.	The Blood Tribe has indicated that they will review the Environmental Impact Assessment and provide feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop for Blood Tribe in the first half of 2018 to obtain further input on the plan.	Ongoing; working with Blood Tribe

+ -	Minutes from the June 6, 2017 Meeting with Blood Tribe.	There are a great deal of problems with phosphorus in the water. Will the explosions create cracks in the earth and lead to added releases of nutrients in the water?	Water quality	Benga will implement a Water Management Plan (WMP) that will prevent any unwanted release of water that may not meet provincial or federal water quality guidelines. All water (surface and groundwater) will be collected, held, and only released once it meets the appropriate or applicable water quality guideline. For any acute releases (i.e., in the event of an emergency), Benga will have the appropriate (and effective) Emergency Response Plans in place, and will ensure qualified staff are in place to implement these plans. All of the holding ponds that will be onsite were over engineered to meet Alberta's Dam Safety requirements. Benga will develop and implement an Emergency Response Plan in relation to potential accidents that would affect the environment, and are committed to discussing and receiving input from the Blood Tribe on these plans.	The Blood Tribe has indicated that they will review the response and provide feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Blood Tribe.

+ -	Minutes from the June 6, 2017 Meeting with Blood Tribe.	A ceremony is needed in advance of ground disturbance.	Ceremony required prior to ground disturbance.	Benga supports this event and has continued to discuss options and planning for a ceremony with Blood Tribe.	Blood Tribe has indicated that they will work with Benga to schedule a ceremony before ground disturbance.	Benga will arrange for a ceremony to be performed in advance of ground disturbance for construction of the Project.	Ongoing; working with Blood Tribe.

+ -	October 5, 2017 Phone call from Erin Slater to Mike Oka	Mike indicated that the camp site, Dj Po-98 is of particular concern. Blood Tribe would like to assess the area either this October or in the spring/summer of 2018. The Blood Tribe would also like a presentation on the HRIA results.	Sites of Concern	Currently the proposed plant site sedimentation pond overlays a portion of the identified historical resource site. Benga advised the Blood Tribe of the potential to relocated the sedimentation pond to avoid the site Dj Po-98. Historical Resource DjPo-98 is an unnamed Pre-contact Period Site located on private land within the proposed the proposed CHPP area. This site was partly evaluated and excavated when it was first recorded, however, 2015 testing and assessment indicated the presence of additional deeply buried material. The mitigation measures for historical resource DjPo-98 are discussed in Section E.13.3.3.4 of the August 2016 EIA Summary. Benga advised that if snow free conditions persist, a site visit to Dj Po-98 can be arranged in October 2017. They will also arrange for a presentation on the HRIA to be included as part of the mitigation discussion.	Blood Tribe acknowledged they received the information and will follow up with Benga.	Benga is looking into engineering options to move the pond and will advise the Blood Tribe when they become available.	Ongoing; working with Blood Tribe.

+ -	October 11, 2017 email from Mike Oka to Erin Slater	The Blood Tribe requested the HRIA assessment for the Grassy Mountain Project	Cultural Resources; HRIA	Benga responded by email that the HRIA is still under review by Alberta Culture and is not available for release at this point. The name and contact information for the Alberta Culture representative on the GMP HRIA was provided. Benga sent the Historic Resources section (Sect E 13) of the Environmental Impact Assessment, and a presentation that was put together by Bison Archaeology on the results of the HRIA. Benga will provide an updated HRIA presentation when it is complete. Benga offered to have the archaeologists present the HRIA during the meeting scheduled in October, 2017.	The Blood Tribe acknowledged receipt of the information.	Benga has provided a summary presentation of the field work results from the HRIA, and will advise Blood Tribe when Alberta Culture completes their review of the HRIA.	Ongoing; working with Blood Tribe.

SPECIFIC CONCERN AND RESPONSE TABLE

First Nation or Metis Settlement	Piikani Nation
Date	Dec 15, 2017

This table is designed to capture project specific concerns raised—by the First Nation/Metis Settlement that is being consulted—during consultation and the proponent's response to address the concerns through avoidance or mitigation. Any reply provided by the First Nation/Metis Settlement to the proponent's response should be documented and noted in this table where applicable.

Add/ Delete Row	Document or Meeting Reference	Specific Concern Expressed	Project Specific Aspect of the Concern Expressed	Proponent Response on Effort to Avoid or Mitigate Concern	First Nation/Metis Settlement Response to Proponent's Effort to Avoid or Mitigate Concern	Details on how concerns were addressed, including avoidance or mitigation measures	Outcomes/Comments
+ -	Minutes for the June 17, 2013 Meeting between Piikani Nation, Benga, and Arbutus Consulting.	Piikani Nation expressed concern that the Project is an infringement on Piikani Nation's hunting rights.	Potential effects of the project on hunting rights.	The results of the EIA were submitted in 2015 and updated in August 2016. An assessment of potential effects of the Project to Piikani Nation is provided in Section H.4 of the EIA. Information provided by Piikani Nation, including information about wildlife, is considered in Section E 10 the EIA under potential effects to wildlife and potential effects to hunting. Impacts from the project to hunting is predicted to be not significant.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and access management plan and will hold a workshop for the Piikani Nation in the first half of 2018 to obtain further input on the plan.	Ongoing; working with Piikani Nation.

+ -	Minutes for the June 17, 2013 Meeting between Piikani Nation, Benga, and Arbutus Consulting.	Piikani Nation expressed concern that the Project is an infringement on Piikani Nation's water rights.	There are two licences associated with Benga's Water Act application for diversion licences, which include: the available crown reserve for industrial purposes, and the existing Devon Licence.	As part of the August 2016 Environmental Impact Assessment (EIA) Update, Benga have added additional information and clarification around the Project's Water Management Plan (WMP). This WMP was developed to ensure all water within the mine site is captured in appropriately sized holding ponds that allow for the testing of water quality prior to being released into the surrounding environment. The WMP was assessed to determine potential effects on river flows and water quality in the neighbouring and downstream rivers. The results of the assessment indicate that there will not be any impacts to the environment with the implementation of the WMP. To verify that changes in flow do not affect fish and their habitat, Benga also conducted a detailed Instream Flow Needs study (IFN). Based on the detailed hydrology, groundwater, water quality, and fisheries assessments, no significant residual impacts were identified that would permanently reduce the suitability of the water-ways that are used for traditional use	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga plans to hold a workshop with the Piikani Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	Minutes for the June 17, 2013 Meeting between Piikani Nation, Benga, and Arbutus Consulting.	Expressed interest in job-readiness programs to ensure that Piikani community members are prepared to take advantage of employment opportunities related to the project.	Potential effects of the project on Aboriginal socio-economic conditions.	Benga signed Impact Benefit Agreement (IBA) with Piikani Nation in July 2016. Terms of the IBA include a comittment for job readiness training and other employment commitments over the life of the Project.	Piikani Nation would like to address this issue as part of the IBA process.	Benga will continue to work with Piikani Nation to address this concern through implementation of the signed IBA.	Complete
+ -	Minutes for the March 25, 2014 Meeting between Piikani Nation, Benga, Arbutus Consulting, and Dialectic Research.	Concern that Piikani businesses may be invited to bid on contracts, being led along through the process, and then not awarded contracts.	Potential effects of the project on Aboriginal socio-economic conditions.	Benga and Piikani Nation are developing a plan and processes to enhance contracting opportunities to Piikani Nation businesses.	Piikani Nation would like to address this issue as part of the IBA process.	Benga will continue to work with Piikani Nation to address this concern through implementation of the signed IBA.	Complete
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	The Project will adversely affect wildlife by increasing animal-vehicle collisions.	Potential effects of the project on hunting.	Information provided in the Traditional Use Study, including information about wildlife, is considered in the EIA under potential effects to wildlife and potential effects to hunting. Proposed mitigation measures related to managing this potential effect. Proposed mitigation measures related to managing this potential effect include access management and enforcing speed limits along the main access road and utility corridors. In addition, wildlife crossing signs will be used to minimize wildlife-vehicle collisions.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed conceptual access management and wildlife monitoring plans and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	The Project will adversely affect wildlife by diminishing their access to clean water.	Potential effects of the project on hunting.	Habitat connectivity and movement is assessed in Section E.9.3 of the EIA. This information has been provided to Piikani Nation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed conceptual wildlife monitoring plans and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Restriction of access to traditional land for hunting now, and for future generations.	Potential effects of the project on hunting.	Access to hunting locations is included in the assessment of potential effects to hunting in the EA. This information has been provided to Piikani Nation. Benga will develop and implement an Aboriginal Access Management Plan.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed conceptual access management and wildlife monitoring plans and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Reduction in hunting effectiveness in the area as the Project will alter migration routes and dissuade from its vicinity.	Potential effects of the project on hunting.	Section E.9.3 of the Environmental Impact Assessment (EIA) details the assessment of potential effects to wildlife including habitat fragmentation and the disruption of natural movement patterns of wildlife. The results of the wildlife assessment are included in the assessment of potential effects to hunting.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed conceptual access management and wildlife monitoring plans and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Timely harvest of medicinal and ceremonial plants prior to impact by the Project.	Potential effects of the project on plant gathering.	Access to harvesting areas will be included as a component of the Aboriginal Access Management plan.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	The Project will decrease water quality in waterbodies in the vicinity of the Project by clearcutting forested areas.	Potential effects of the project on water quality.	In the August 2016 Environmental Impact Assessment (EIA) Update, Benga provided information and clarification around the Project's Water Management Plan (WMP). This WMP was developed to ensure all water within the mine site is captured in appropriately sized holding ponds that allow for the testing of water quality prior to being released into the surrounding environment. The WMP was assessed to determine potential effects on river flows and water quality in the neighbouring and downstream rivers. The results of the assessment indicate that there will not be any impacts to the environment with the implementation of the WMP. To verify that changes in flow do not affect fish and their habitat, Benga also conducted a detailed Instream Flow Needs study (IFN). Based on the detailed hydrology, groundwater, water quality, and fisheries assessments, no significant residual impacts were identified that would permanently reduce the suitability of the water-ways that are used for traditional use activities.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Waterbodies in the vicinity of the Project risk contamination through contact with mining by- products.	Potential effects of the project on water quality.	In the August 2016 Environmental Impact Assessment (EIA) Update, Benga provided information and clarification around the Project's Water Management Plan (WMP). This WMP was developed to ensure all water within the mine site is captured in appropriately sized holding ponds that allow for the testing of water quality prior to being released into the surrounding environment. The WMP was assessed to determine potential effects on river flows and water quality in the neighbouring and downstream rivers. The results of the assessment indicate that there will not be any impacts to the environment with the implementation of the WMP. To verify that changes in flow do not affect fish and their habitat, Benga also conducted a detailed Instream Flow Needs study (IFN). Based on the detailed hydrology, groundwater, water quality, and fisheries assessments, no significant residual impacts were identified that would permanently reduce the suitability of the water-ways that are used for traditional use activities. In January	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Historic mining operations did not provide economic opportunity to Piikani Nation.	Potential effects of the project on Aboriginal socio-economic conditions.	Benga is committed to providing economic opportunities and benefits to Piikani Nation. Benga and Piikani Nation have signed an IBA that specifies economic opportunities between both parties.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga will continue to work with Piikani Nation to address this concern through implementation of the signed IBA.	Complete
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	In recognition of their traditional role of providing security, Benga should consider employing members of the Piikani Nation Brave Dog Society in a similar role on the Project.	Potential effects of the project on Aboriginal socio-economic conditions.	As part of the IBA signed between Benga and the Piikani Nation, potential joint-venture opportunities will be discussed including the provision of security services to the Project.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga will continue to work with Piikani Nation to address this concern through implementation of the signed IBA.	Complete
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Expressed interest in employment opportunities connected to the Project, particularly those for young Piikani.	Potential effects of the project on Aboriginal socio-economic conditions.	Benga and Piikani Nation are committed and working together to provide employment opportunities for Piikani Nation members. Human Resources development is included in Impact-Benefit Agreement (IBA) discussions.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga will continue to work with Piikani Nation to address this concern through implementation of the signed IBA.	Complete
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Concern about negative socio-economic effects caused by the potential for increased spending among Piikani Nation community members.	Potential effects of the project on Aboriginal socio-economic conditions.	IBA discussions include potential provisions for socio-economic transition measures.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga will continue to work with Piikani Nation to address this concern through implementation of the signed IBA.	Complete

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Effects to culturally-important sites that are wholly or partially located within the Project's footprint including locations identified at waypoint sites.	Potential effects of the project on physical and cultural heritage.	Waypoints identifying physical and cultural heritage sites that are wholly or partially within the Project footprint were identified as confidential by the Piikani Nation and not to be used in the Environmental Impact Assessment (EIA).	Piikani Nation has indicated that they will provide the locations of the culturally important sites.	Benga will continue to work with Piikani Nation to better understand potential effects to these sites as more information is provided by Piikani Nation.	Ongoing; working with Piikani Nation.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Inadvertent impact to culturally- important and sacred sites. To prevent this Piikani Nation recommends a well flagged buffer around all sacred sites.	Potential effects of the project on physical and cultural heritage.	Sites of cultural and sacred importance within 100 m of project activity that are identified by Piikani Nation will be flagged prior to construction. Restricted access to areas within the Project Permit Boundary surrounding the project physical footprint will reduce the risk of inadvertent impacts to these sites.	Piikani Nation has indicated that they will provide the locations of the culturally important sites.	Benga will continue to work with Piikani Nation to better understand potential effects to these sites as more information is provided by Piikani Nation.	Ongoing; working with Piikani Nation.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Inadvertent impact to as-of-yet undetected culturally-important sites. To prevent this, Piikani Nation recommends developing a Chance Find Procedure.	Potential effects of the project on physical and cultural heritage.	Section E.13 of the Environmental Impact Assessment (EIA) considers potential effects to large polygon areas identified by Piikani Nation during field visit where specific sites have not been identified but may still occur within the general area. If culturally-important sites are identified during construction, a Cultural Site Discovery Contingency Plan will be implemented. Piikani Nation will have an opportunity to contribute to the Plan.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Blood Tribe 3 to 6 months prior to the start of construction to request further input on the Cultural Site Discovery Contingency Plan.	Ongoing; working with Piikani Nation.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	The Project may impose a loss of culture for present and future generations.	Potential effects of the project on physical and cultural heritage.	Benga is committed to working with Piikani Nation to better understand potential effects of the Project to Piikani Nation's physical and cultural heritage. Benga will continue to work with Piikani Nation to discuss ways to mitigate potential effects to Piikani Nation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Requested that Benga provide lodge pole pine cleared from the site to Piikani Nation community.	Potential effects of the project on plant gathering.	Benga has committed to allow First Nation including Piikani, access to the site prior to or during clearing operations to enable them to harvest Lodgepole pine for cultural purposes (e.g. teepee poles). Benga has expressed to Piikani Nation an interest in obtaining their input into the development of environmental management plans.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Blood Tribe 3 to 6 months prior to the start of construction to request further input on the Vegetation Management Plan.	Ongoing; working with Piikani Nation.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	A ceremony should be performed with Piikani Elders and youth in advance of ground disturbance.	Potential effects of the project on physical and cultural heritage.	Benga supports this event and has discussed options and planning for a ceremony with Piikani.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga will arrange for a ceremony to be performed in advance of ground disturbance for construction of the Project. This will include moving the effigy.	Ongoing; working with Piikani Nation.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	A ceremony must be conducted prior to moving the effigy that was placed on the Project site in 2014.	Potential effects of the project on physical and cultural heritage.	Benga supports this event and has discussed options and planning for a ceremony with Piikani.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga will arrange for a ceremony to be performed in advance of ground disturbance for construction of the Project.	Ongoing; working with Piikani Nation.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	To help create cultural awareness among non-Native Benga employees and sub-contractors, Benga is urged to support a cultural orientation program on Piikani cultural practices and sacred sites.	Potential effects of the project on physical and cultural heritage.	Benga will support a cultural orientation program as described in the Impact-Benefit Agreement between Benga and the Piikani Nation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga commits to supporting a cultural orientation for staff and sub-contractors.	Ongoing; working with Piikani Nation.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	The Project may introduce disturbance to areas that have not been previously disturbed instead of keeping disturbance confined to the areas that had been disturbed by historic mining activities. Particularly where it effects Crown Land, the Project will result in the loss of access to, and use of, traditional lands.	Potential effects of the project on physical and cultural heritage.	Yes, the project will disturb some previously undisturbed crown lands and access to crown lands during construction and operations will be restricted for safety reasons. To the extent possible on Crown land, Benga has incorporated areas that are already disturbed into the construction and operational plans of the Project to try to minimize new disturbance. Benga provided a conceptual Access Management Plan in the August 2016 update to the Environmental Impact Assessment (EIA). This information has been provided to Piikani. Access on site will be enforced by mine operations managers and personnel during the construction and operations phase.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Changes to the Project may be made on a schedule that prevents meaningful participation by Piikani Nation.	Consultation process	Benga is committed to adhering to consultation and engagement requirements as identified by provincial Alberta Consultation Office (ACO) and federal (CEAA) authorities.	Piikani Nation has provided input into the consultation plan.	Benga is adhering to requirements and has developed a consultation plan along with the Piikani Nation.	Complete

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Piikani Nation expressed an interest in additional TK/TU fieldwork.	Consultation process	Benga is open to discussing additional TK work based on specific scope and objectives. If an agreed scope can be clarified, additional field work could be funded through the provisions in the Project Agreement (IBA).	Benga and Piikani Nation continue discussions about this topic.	Benga will continue to work with Piikani Nation to address this concern through implementation of the signed IBA.	Ongoing; working with Piikani Nation.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Piikani Nation urges that Benga commit to continuing transparent and meaningful communications with Piikani Nation over the long-term.	Consultation process	Benga is committed to adhering to consultation and engagement requirements as identified by provincial Alberta Consultation Office (ACO) and federal (CEAA) authorities.	Piikani Nation has provided input into the consultation plan.	Benga is adhering to requirements and has developed a consultation plan along with the Piikani Nation.	Complete

+ -	July 2015 Grassy Mountain Coal Project Public Report on Piikani Traditional Knowledge and Use of the Grassy Mountain Area.	Concerns that the Project's reclamation program may not achieve objectives.	Project decommissioning	Section F in the August 2016 Environmental Impact Assessment (EIA) document provides the proposed Conservation and Reclamation (C&R) Plan for the Project. This was provided to Piikani Nation in August 2016. Section F.1.5 describes the reclamation goals and principles that were incorporated in the C&R and closure plans. Section F.1.6 describes proposed End Land Use goals and includes a commitment that end land use decisions will be made in consultation with Piikani Nation. Benga has committed to progressive reclamation of sites as they no longer part of the mining operations. Reclamation of some areas may begin as early as year 7. Monitoring of reclaimed sites will provide a measure of reclamation success and enable measures to be implemented in a timely manner as part of Benag's adaptive management strategy to resolve issues as they arise.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Additionally, the Piikani Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with the Piikani Nation to gather input on the plan.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	The proposed Project is 45km from our reserve and is wholly within our traditional territory and effects are expected to both traditional land use as well as traditionally used resources in the form of decreased air quality including the deposition of dust and acidifying emissions on traditionally harvested plants and traditionally used rivers and lakes. Emission sources include blasting, handling, hauling, and loading on rail cars. Piikani is concerned about the large relative increases in predicted maximum 1-hour concentrations of blasting combustion emissions (S02, N02, CO) on the eastern pit boundary as well as the expected provincial exceedances of PM2.5, PM10, TSP.	Air quality	As part of the Environmental Impact Assessment (EIA) Update provided in August 2016, a revised air model was provided that aligned with optimization of the mine plan. In addition, another air model was provided in the EIA Update for the coal product load-out/rail loop area. The results of both models indicated no significant changes to air quality beyond the project footprint. Elevation of total suspended particulate (TSP) was identified; however, this was limited to what is referred to as maximum points of impingement that only occur on the haul roads in the deeper portions of the proposed mine pit. These areas of elevated TSP are short-term and will not affect the neigbouring communities or surrounding environment.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	The Project, which is in close proximity to Piikani Reserve lands and within our traditional lands, will be affected by both ongoing noise from the Project as well as intermittent blasting and rail hauling. Directive 038 does not account for pure tone frequencies that also effect traditional land use activities and the ability to practice our rights in areas of relative solitude. As well, the Project is predicted to also create sensory disturbances to traditionally harvested wildlife that can lead to changes in habitat use, health, breeding success and longevity. Modeled noise predictions from operations, including blasting and from locomotives indicative that the Project noise levels during the night-time and day-time, with the addition of the Ambient Sound Levels (ASLs), will be below the Permissible Sound Levels (PSLs) for all residential and theoretical 1,500 m receptors. However, for half of the receptors, the dBC-dBA sound levels are greater than 20 dB, indicating the possibility of a low frequency tonal noise from operations.	Noise	A revised noise model was provided in the Environmental Impact Assessment (EIA) Update (August 2016) that covered the mine site as a whole, as well as more focused study at the product coal load-out/rail loop area. No significant changes in noise levels were identified in either of the models. Sensory disturbance to wildlife from mine activity noise is provided in the Wildlife assessment. Disturbance due to low tonal noise is difficult to model. Benga commits to investigate any complaints once the mine is in service.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	Water is a key cultural resource to the practice of Piikani traditional land use and is critical for sustaining life on the land for members and for traditionally harvested species. Piikani is also concerned about potential effects from unplanned spills or leaks to shallow groundwater quality and the resultant effects to traditional land use in areas adjacent to the Project. The Project will permanently affect the underlying and surrounding groundwater system through physical removal and pit de-watering. Piikani is concerned about the effects to shallow groundwater quality, surface water quality via groundwater-surface water interaction and	Groundwater	No significant Project effects on surface water or groundwater quality are anticipated. Exposure to waterborne COPCs (Chemicals of Potential Concern) is not an operative exposure pathway for human or wildlife receptors. Benga will implement a Water Management Plan (WMP) that will prevent any unwanted release of water that may not meet provincial or federal water quality guidelines. All water (surface and groundwater) will be collected, held, and only released once it meets the appropriate or applicable water quality guideline. For any acute releases (i.e.., in the event of an emergency), Benga will have the appropriate (and effective) Emergency Response Plans in place, and will ensure qualified staff are in place to implement these plans. As mentioned earlier, all of the holding ponds that will be onsite were over engineered to meet Alberta's Dam Safety requirements. Also, unlike the northern oilsands minds, the Grassy Project will not have a tailings pond. Benga will develop and implement an	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -		January 4, 2016 Statement of Concern to Benga	The Project footprint lies entirely within the Blairmore creek and Gold creek watersheds and has the potential to interact with other projects within the Crowsnest River watershed. Effects on flows include water flows for Blairmore Creek, Gold Creek, and their associated tributaries that are part of the Oldman River watershed all of which are used for traditional purposes by Piikani members for fishing and navigation. There will be interaction with both surface water and groundwater resources during the construction, operation and reclamation of the Project and Piikani is concerned about impacts to these resources from dewatering as well as from changes to surface runoff based on the location of the proposed mine pit,	Groundwater	As part of the August 2016 Environmental Impact Assessment (EIA) Update, Benga have added additional information and clarification around the Project's Water Management Plan (WMP). This WMP was developed to ensure all water within the mine site is captured in appropriately sized holding ponds that allow for the testing of water quality prior to being released into the surrounding environment. The WMP was assessed to determine potential effects on river flows and water quality in the neighbouring and downstream rivers. The results of the assessment indicate that there will not be any impacts to the environment with the implementation of the WMP. To verify that changes in flow do not affect fish and their habitat, Benga also conducted a detailed Instream Flow Needs study (IFN). Based on the detailed hydrology, groundwater, water quality, and fisheries assessments, no significant residual impacts were identified that would permanently reduce the suitability of the water-ways that are used for traditional use	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	Surface water quality is extremely important to Piikani's traditional livelihood as it plays a role in overall ecosystem health, supporting traditional plant and animal communities in addition to Piikani traditional use and culture. Piikani is concerned about the potential for deleterious substances being released into the receiving environment as well as impacts to surrounding watercourses and associated plant and animal communities upon with our members depend, including for our health and well-being. The Environmental Assessment (EA) assesses potential Project effects on surface water quality resulting from Project releases and discharges, including from accidental spills and leaks. Assessment predictions classified release of process water as moderately significant with other issues (e.g. effects from acidifying emissions, waste management) predicted to have insignificant residual effects considering proposed mitigation and management. Six Project process	Water quality	As part of the August 2016 Environmental Impact Assessment (EIA) Update, Benga have updated the water quality model and have provided additional context around the significance evaluation criteria and final significance rating. Benga will implement a Water Management Plan (WMP) that will prevent any unwanted release of water that may not meet provincial or federal water quality guidelines. All water (surface and groundwater) will be collected, held, and only released once it meets the appropriate or applicable water quality guideline. For any acute releases (i.e.., in the event of an emergency), Benga will have the appropriate (and effective) Emergency Response Plans in place, and will ensure qualified staff are in place to implement these plans. As mentioned earlier, all of the holding ponds	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	Piikani is concerned about the losing Aboriginal fisheries as a result of the Project. There will be both a direct loss from physical works as well as losses due to changes in water quality and quantity. Important traditionally harvested species that will be lost or impacted include: westslope cutthroat trout, cutthroat trout, rainbow trout, mountain whitefish, bull trout, brown trout, brook trout, and lake trout. Piikani is very concerned that fisheries offsetting will not provide for important Aboriginal fisheries that will be used for protection of endangered species such as the cutthroat trout or opportunities for continued harvesting by Community members in artificially altered or constructed habitats. The Project will result in loss of fish and fish habitat from pits, waste dumps and processing facilities as well as from construction and operation as associated changes to hydrology and water quality. There will be direct removal of habitat in a number of tributaries to both Blairmore and Gold creeks from the development footprint	Potential effect to fishing	An Addendum that comprised a comprehensive Aquatic Environment Impact Assessment was provided to the Alberta Energy Regulator (AER) and Canadian Environmental Assessment Agency (CEAA) on January 31, 2017. This Addendum provides a detailed baseline data site, including a benchmark for fish population in both creeks, a comprehensive habitat assessment, geomorphology assessment, benthic invertebrate assessment, and an instream flow needs (IFN) assessment. The IFN was used to quantify the impacts of the project on the watercourses, focusing in on the potential impacts changes in flow will have on fish and fish habitat in both Gold Creek and Blairmore Creek. As part of the Addendum, a revised impact assessment on Aquatic Resources was provided. There were	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the Fisheries management plan.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	Piikani members are not confident that the proposed progressive reclamation will provide end land uses that will support the traditional uses and cultural aspects of the land and waters that historically and currently exist. Piikani is concerned that the Project, an open-pit mining operation, will drastically change the terrain and soils of the project development area that lies entirely within Piikani's traditional territory. This includes not only the mine itself but project infrastructure such as roads and related facilities. Reclamation after mine life will not put the land back to its pre-disturbance condition	Reclamation	Section F in the August 2016 Environmental Impact Assessment (EIA) document provides the proposed Conservation and Reclamation (C&R) Plan for the Project. This was provided to Piikani Nation in August 2016. Section F.1.5 describes the reclamation goals and principles that were incorporated in the C&R and closure plans. Section F.1.6 describes proposed End Land Use goals and includes a commitment that end land use decisions will be made in consultation with Piikani Nation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Additionally, the Piikani Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with the Piikani Nation to gather input on the plan.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	Piikani is concerned about the loss of wildlife habitat as well as traditionally used plants and medicines from the construction and operation of the open-pit mine and associated infrastructure. Benga proposes that effects are reversible with reclamation, however Piikani considers these losses irreversible and does not have confidence that the proposed progressive reclamation will provide end land uses that will support the traditional uses and cultural aspects of the land and waters that historically and currently exist. The Local Study Area (LSA) for vegetation and wetlands covers a total area of 4,776 ha. This area lies within the heart of Piikani traditional territory and extensively used lands for traditional purposes. During baseline field surveys 480 plant species were identified including 298 vascular plants, 77 mosses and liverworts, and 105 lichens species. Of these, 41 species are listed as tracked or watched in Alberta (ACIMS 2014). Traditional important plants were also identified by Piikani	Potential effects to hunting, plant gathering and cultural heritage	Section F in the August 2016 Environmental Impact Assessment (EIA) document provides the proposed Conservation and Reclamation (C&R) Plan for the Project. This was provided to Piikani Nation in August 2016. Section F.1.5 describes the reclamation goals and principles that were incorporated in the C&R and closure plans. Section F.1.6 describes proposed End Land Use goals and includes a commitment that end land use decisions will be made in consultation with Piikani Nation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Additionally, the Piikani Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with the Piikani Nation to gather input on the plan.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	Piikani is concerned that the construction and operation of the Project will result in direct habitat loss, increased habitat fragmentation, disruption of wildlife movement, sensory disturbance to wildlife (particularly to sensitive species), mortality risk, and overall abundance. The Project lies within Piikani's high use area for trapping and harvesting and the direct and indirect loss of traditionally important species is significant to our current use and future use of a large area in close proximity to our community.	Potential effect to hunting, trapping and wildlife	The results of the Environmental Impact Assessment (EIA) were submitted in 2015 and again after updating in August 2016. The assessment of potential effects to wildlife is considered in Sec E.9.3. Many of the project effects associated with habitat loss and wildlife movement will be minimized through the implementation of the Project's reclamation plan. As seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and wildlife monitoring plan and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	Piikani is concerned about the impact that increased pressure that a larger non-aboriginal population could place on traditional resources. As well, Piikani expects that a Chance Find procedure will be in place prior to construction. The Project lies entirely with Piikani traditional territory and Piikani actively uses the area for hunting, fishing and harvesting. As well, a number of Piikani historic sites are located within or surround the project area including traditional trails and ceremonial sites. As an area used extensively by Piikani harvesters and land users we expect to be consulted by Benga to avoid or mitigate impacts to important traditionally and currently used sites.	Access management; cultural heritage	Benga provided a conceptual Access Management Plan in the August 2016 update to the Environmental Impact Assessment (EIA). Due to site safety reasons access will be restricted within the Project Permit boundary during construction and operations. This will be enforced by mine operations managers and personnel during the construction and operations phase. Benga will be developing a cultural site discovery contingency plan and would like to get Piikani Nation' input on the plan.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Blood Tribe to review this issue, and is scheduling a workshop in the first half of 2018 to discuss the access management plan and access to harvesting areas.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	Increased employment for Piikani members is important, however the Piikani First Nation is concerned about the potential for increased income disparity and how it could negatively impact social cohesion in the community. The increase in local population and traffic volumes is of concern to Piikani as it has the potential to increase demand on social services, Royal Canadian Mounted Police (RCMP), ambulance and fire services that Piikani members rely on. Piikani also has concerns about negative impacts from the Project on the biophysical environment as described in other sections, as this would affect where and how traditional activities are undertaken. Piikani has already experienced a major impact on its culture from the change in the Oldman River created by the Oldman River Dam, and any new changes, not matter how small, could have an impact on Piikani culture. The Project will result in changes to local population, employment, traffic volumes and traditional land use and culture. Employment effects	Socio-economic conditions	Benga and Piikani Nation have signed an agreement that includes provisions for the ongoing engagement (Schedule G of Agreement July 25, 2016) through the Joint Implementation Committee. Benga and Piikani Nation have signed an agreement that includes provisions for the ongoing engagement (Schedule G of Agreement July 25, 2016) through the Joint Implementation Committee.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga will continue to work with Piikani Nation to address this concern through implementation of the signed IBA.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	The Human Health Risk Assessment (HHRA) describes the nature and significance of potential health risks to the local human population, associated with exposure to chemicals that could be released to the environment from the proposed Project.	Human health	The assessment of potential effects to Aboriginal health includes potential effects of air quality and air emissions. The assessment shows that residual effects of the Project on Aboriginal health are not anticipated.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	Piikani is concerned about Project effects to the health and well-being of community members who are actively using the Project area and surrounding area on a regular basis, sometimes for extended periods of time. In the absence of a detailed review of the Human Health Risk Assessment at this time, Piikani is concerned that the assessment was limited (looking at the physical environment, and the presence and quantity of particular pollution exposure at various modeled locations) and did not account for all factors of human health including diet, mental wellbeing, and integrity of family and cultural values. Community members are also concerned about wildlife health and the quality of traditionally harvested foods in and around industrial developments. This concern results in avoidance behaviour and more reliance on store-bought foods.	Health risk associated with diet, mental wellbeing and impacts on family and cultural values.	A list of wildlife species specifically identified as being potential country foods, culturally, or spiritually important by Piikani Nation is provided in Table 2.2-1 of the wildlife assessment in Consultant Report #9. A wildlife risk assessment (WRA) was conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk of adverse effects associated with Project emissions on the health of wildlife in the study areas.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	January 4, 2016 Statement of Concern to Benga	Once a technical review of the Environmental Assessment (EA) is conducted by Piikani, we will be able to provide more detailed concerns as well as provide recommendations to Benga and the regulators to address deficiencies, issues and community concerns. Piikani expects that these recommendations will be addressed in a fashion similar to the Supplemental Information Requirements (SIRs) provided by the regulators to Benga to become part of the public record where appropriate to assess the sufficiency of the information provided in the EA and impacts of the proposed Project (including adequacy of mitigation).	Hunting, gathering, ceremonial sites and the associated loss of culture.	Information provided in the Traditional Use Study, including information about wildlife, is considered in the Environmental Impact Assesment (EIA) under potential effects to wildlife and potential effects to hunting. Benga received the Piikani Technical Report Information and addressed the issues raised in the August 2016 update to the EIA.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	December 15, 2016 Letter re: Consultation Plan sent to Cal Clarke, Benga Mining Ltd., from Dustin Wolfe, Piikani Consultation Manager.	Piikani would like to work with Riversdale in the design, implementation and monitoring of the Dust Mitigation, Management and Monitoring Plan.	Dust Mitigation, Management and Monitoring Plan	Benga has provided information to Piikani Nation about potential ways they can participate in environmental monitoring.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	December 15, 2016 Letter re: Consultation Plan sent to Cal Clarke, Benga Mining Ltd., from Dustin Wolfe, Piikani Consultation Manager.	Piikani would like to work with Riversdale on an assessment of the projects impacts on Piikani members, potential mitigations to reduce noise effects that may result in avoidance behaviour, as well as involvement in the long-term monitoring of noise.	Noise Impact Assessment, and Noise Mitigation and Monitoring	A revised noise model was provided in the Environmental Impact Assessment (EIA) Update (August 2016) that covered the mine site as a whole, as well as more focused study at the product coal load-out/rail loop area. No significant residual impacts were identified in either of the models. Sensory disturbance to wildlife from mine activity noise is provided in the Wildlife assessment. Benga has recently entered into an agreement with the Municipality of Crowsnest Pass to provide a natural tree line immediately north of Highway 3 as part of a visual and noise impact mitigation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	December 15, 2016 Letter re: Consultation Plan sent to Cal Clarke, Benga Mining Ltd., from Dustin Wolfe, Piikani Consultation Manager.	Piikani would like to work with Riversdale in the design, implementation and monitoring of the Project's Groundwater and Surface Water Management and Monitoring Plans.	Groundwater and Surface Water Management and Monitoring Plans	Benga would welcome the opportunity to work with the Piikani on developing details associated with the Groundwater and Surface Water Management and Monitoring Plans	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	December 15, 2016 Letter re: Consultation Plan sent to Cal Clarke, Benga Mining Ltd., from Dustin Wolfe, Piikani Consultation Manager.	Piikani requests that Riversdale develop a plan to replace any fish habitat they disturb. This will include a couple of different programs, which Piikani would like to be involved with, they are: Piikani Fisheries Offset Plan (create or protect more habitat than Riversdale removes) and a Westslope Cut-throat Trout Recovery Plan	Fisheries Offset and Trout Recovering Plans	An Addendum that comprised a comprehensive Aquatic Environment Assessment was provided to the Alberta Energy Regulator (AER) and Canadian Environmental Impact Assessment Agency (CEAA) on January 31, 2017. This Addendum provides a detailed baseline data site, including a benchmark for fish population in both creeks, a comprehensive habitat assessment, geomorphology assessment, benthic invertebrate assessment, and an instream flow needs (IFN) assessment. Offsetting options were identified in this Addendum, and Benga are in the process of providing details around the final Offset Plan. Benga welcome the opportunity to discuss the process and request any suggestions regarding this from the Piikani Nation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	December 15, 2016 Letter re: Consultation Plan sent to Cal Clarke, Benga Mining Ltd., from Dustin Wolfe, Piikani Consultation Manager.	Piikani would like to work with Riversdale in the design, implementation and monitoring of the Reclamation Plan.	Reclamation Plan	Section F in the August 2016 Environmental Impact Assessment (EIA) document provides the proposed Conservation and Reclamation (C&R) Plan for the Project. This was provided to Piikani Nation in August 2016. Section F.1.5 describes the reclamation goals and principles that were incorporated in the C&R and closure plans. Section F.1.6 describes proposed End Land Use goals and includes a commitment that end land use decisions will be made in consultation with affected Piikani Nation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Additionally, the Piikani Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with the Piikani Nation to gather input on the plan.	Ongoing; working with Piikani Nation.
+ -	December 15, 2016 Letter re: Consultation Plan sent to Cal Clarke, Benga Mining Ltd., from Dustin Wolfe, Piikani Consultation Manager.	Piikani would like to work with Riversdale in the design, implementation and monitoring of the Biodiversity Management Plan.	Biodiversity Management Plan	Benga has provided information to Piikani Nation about potential ways they can participate in environmental monitoring.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	December 15, 2016 Letter re: Consultation Plan sent to Cal Clarke, Benga Mining Ltd., from Dustin Wolfe, Piikani Consultation Manager.	Piikani would like to work with Riversdale in the design, implementation and monitoring of the Wildlife Mitigation and Management Plan including monitoring.	Wildlife Mitigation and Management Plan	Benga has provided information to Piikani Nation about potential ways they can participate in environmental monitoring.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed conceptual wildlife monitoring plans and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.

+ -	December 15, 2016 Letter re: Consultation Plan sent to Cal Clarke, Benga Mining Ltd., from Dustin Wolfe, Piikani Consultation Manager.	Piikani would like to work with Riversdale in the design, implementation and monitoring of access including the development of measures to minimize access restrictions and ensure continued access to undisturbed Crown land areas around the Project.	Access Management Plan	Benga provided a conceptual Access Management Plan in the August 2016 update to the Environmental Impact Assessment (EIA). Due to site safety reasons access will be restricted within the Project Permit boundary during construction and operations. This will be enforced by mine operations managers and personnel during the construction and operations phase.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed conceptual access management plan and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.
+ -	December 15, 2016 Letter re: Consultation Plan sent to Cal Clarke, Benga Mining Ltd., from Dustin Wolfe, Piikani Consultation Manager.	Piikani would like to work with Riversdale input into the Human Health Risk Assessment, specifically the analysis of consumption and rates and patterns for Piikani members, and the mitigation and monitoring plans should effects be predicted.	Human Health and Aboriginal Food Consumption Study	A list of wildlife species specifically identified as being potential country foods, culturally, or spiritually important by Piikani Nation is provided in Table 2.2-1 of the wildlife assessment in Consultant Report #9. A wildlife risk assessment (WRA) was conducted, using the same models and air concentrations as the human health risk assessment. The results of the screening-level WRA indicates that there is no potential risk of adverse effects associated with Project emissions on the health of wildlife in the study areas.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	Will there be multiple blast per day, or minimum offset period?	Dust Mitigation, Management and Monitoring Plan	Blasting will occur during day shift (daylight hours) only with approximately four to five blasts per week. All drilling and blasting designs have been developed using a design average powder factor of 0.65 kg/BCM (bank cubic meters) following a review of blasting experience in the respective geological formations and review of the rock strength data. The drilling and blasting parameters will be adjusted as required with operation experience to optimize coal recovery and costs. The blast pattern is expected to be the same as most mining operations where blasting is required; creation of a shock wave that fragments the rock but at a reduced trajectory of the material. This shock wave, which starts out at the velocity of the explosive, decreases quite rapidly once it enters the rock and the sonic velocity of that rock is greatly reduced within a short distance. Any dust created is minimal and local to the blast site.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	What is the brush burning management plan?	Dust Mitigation, Management and Monitoring Plan	Benga does not intend to dispose of debris through burning. All non-salvageable timber and brush will be chipped or windrowed to promote vegetation growth on disturbed areas.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	March 22 - 23, 2017 Technical Review Conference Calls	As the haul road contributes 90% of fugitive dust, are your average speeds realistic? They seem too low, how will you enforce them?	Dust Mitigation, Management and Monitoring Plan	Based on road grades and for mine operations health safety and environment reasons, Benga's maximum speed limit on mine roads will be 50 km/hr. Again, this maximum speed limit is a manageable compromise among the variables of safety, production and Air Quality. Through the detailed Air Quality assessment, it has determined that the highest impacts from road dust are immediately adjacent to the roads, with much less impact in communities. During non-winter months, water will be applied to the roads as dust suppression mitigation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	How often will roads be watered under different weather conditions?	Dust Management	A general road watering protocol will be designed by the Mine Operation Manager; however, road watering requirements will be monitored on a daily basis. Weather conditions and expected patterns throughout each day, as well as daily mining equipment activities will be factored in to determine final road watering requirements.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	March 22 - 23, 2017 Technical Review Conference Calls	What is the maximum timeframe for reclamation of mined areas – backfill and revegetation?	Dust Management	The Projects Conservation and Reclamation Plan (C&R Plan) is a progressive plan meaning that it will start at the early stages of the mine operations, extend through the operations phase and continue through to the end of mine, which will be the start of the 'final reclamation phase' Benga plans to conduct biophysical monitoring in Final Reclamation years 1-12, with a goal of receiving a Reclamation Certificate by Year 15-20.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	What is the maximum drop height and drop time for coal transfer from conveyor?	Dust Management	Conveyor hoods will be installed over the top of all the conveyor belts that are not within enclosed galleries or structures, in order to protect the belt and product coal from the prevailing weather conditions and minimize potential dust generation. The conveyor belt will terminate at a cladded surge bin structure. A second covered conveyor belt will transfer the coal to the cladded train loadout bin. The cladded bin structures will designed in such a way that there will minimal to no dust creation or coal spillage. The loadout will also sprays a latex binder solution over the top of the coal load to minimize release of dust as the train travels to port.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	March 22 - 23, 2017 Technical Review Conference Calls	What will be the process for regular reporting to the First Nation?	Dust Management	Benga expects it will be required to submit regular reports to the regulators as conditions of its project approvals. These reports are publicly available and will be posted on the Benga website. Copies can be provided to the Piikani if desired.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	How will the First Nation be involved in design and monitoring location selection?	Dust Monitoring	Currently, Benga have ambient dust monitoring locations located in Blairmore, the hospital and near the proposed coal handling and preparation plant (CHPP). Final locations of dust monitoring stations have not be determined at this time. Priority will be set for neighbouring communities and cabins. Benga will meet with Piikani and other stakeholders in developing its environmental monitoring programs including dust.Benga is prepared to work with Piikani Nation and other affected stakeholders to develop a mechanism for implementing environmental monitoring at the site.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	What will be the complaint reporting and resolution system?	Dust Monitoring	Benga is required to comply with provincial and federal regulations, and the conditions of its approvals. Any violations of these terms and conditions can be reported to the regulatory authority that oversees the regulation (e.g. Alberta Energy Regulator, Department of Fisheries and Oceans, Canadian Environmental Impact Assessment Agency, etc.). Any other issues or concerns can be brought directly to the attention of Benga management through its Community and First Nation liaisons.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	March 22 - 23, 2017 Technical Review Conference Calls	Did the project update include additional mitigations to reduce noise effects?	Noise Impact Assessment and Noise Mitigation and Monitoring	No additional noise mitigations are proposed in the project update. The update did include revised noise modelling results that covered the mine site as a whole, as well as more focused study at the product coal load-out/rail loop area. No significant residual impacts were identified.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	How will the First Nation be involved in the development of the Plan?	Noise Management	A noise management plan is not warranted at this time. Should one be warranted in the future, then Piikani Nation will be consulted in its development as with other environmental management plans.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	March 22 - 23, 2017 Technical Review Conference Calls	Which best practices you will use to minimize noise?	Noise Management	Noise mitigations and best practices are outlined in Section A of the Environmental Impact Assessment (EIA). These address mitigations for material hauling, blasting noise and vibration, train noise, light duty vehicle back up alarms, and equipment mechanical condition requirements.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	How will the First Nation be involved in design and monitoring location selection?	Noise Monitoring	Currently, Benga have ambient dust monitoring locations located in Blairmore, the hospital and near the proposed coal handling and preparation plant (CHPP). Final locations of dust monitoring stations have not be determined at this time. Priority will be set for neighbouring communities and cabins. Benga will meet with Piikani and other stakeholders in developing its environmental monitoring programs including dust.Benga is prepared to work with Piikani Nation and other affected stakeholders to develop a mechanism for implementing environmental monitoring at the site.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	What will be the complaint reporting and resolution system?	Noise Monitoring	Benga is required to comply with provincial and federal regulations, and the conditions of its approvals. Any violations of these terms and conditions can be reported to the regulatory authority that oversees the regulation (e.g. Alberta Energy Regulator, Department of Fisheries and Oceans, Canadian Environmental Impact Assessment Agency, etc.). Any other issues or concerns can be brought directly to the attention of Benga management through its Community and First Nation liaisons.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	Did the update include more specific information on best practices that will be used for air and water pollution mitigation?	Human Health and Aboriginal Food Consumption	Impacts to air and water runoff/discharge into the receiving environments have been assessed and through implementation of project specific mitigations, will not result in air or water 'pollution'. For each assessment (i.e., Air Quality, Hydrology, Hydrogeology, Water Quality, Aquatic Resources) mitigations to minimize any impact are provided. Additional information on process and mining related mitigations (either through design or as a specific equipment specification) are also provided in the Project Description (Section C of Application).	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	Did the update include assessment of contaminant exposure to wildlife through consumption of contaminated water releases?	Human Health and Aboriginal Food Consumption	Through the Water Management Plan (WMP) all water will be captured and treated accordingly (e.g., sediment ponds, saturation zones) which will prevent the release of 'contaminated' water. The Project will not result in the release of any contaminated water to the surrounding environment (terrestrial or aquatic). Based on this, the release of contaminated water was not identified as an operative pathway for exposure to wildlife (surface water assessment); subsequently, no potential risk was identified. In the Human Health Risk Assessment potential exposure to wildlife via deposition of chemicals from predicted air emissions onto water, soil and vegetation was assessed.This information has been provided to Piikani Nation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	March 22 - 23, 2017 Technical Review Conference Calls	How will the First Nation be involved in the design, site selection and monitoring work?	Air Quality Monitoring Plan	Benga would like to work with the Piikani Nation to understand how they would like to participate in environmental monitoring.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	Want to see the results in terms of human and wildlife health effects	Air Quality Monitoring Plan	An update to the Human Health and Wildlife Risk Assessment was provided in the August 2016 Updated Environmental Impact Assessment (EIA). Similar to the previous modeling, there will be no significant impacts to humans or wildlife heath from the Project.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	March 22 - 23, 2017 Technical Review Conference Calls	We would like to develop an Aboriginal Food Consumption Study and an associated Monitoring Plan	Air Quality Monitoring Plan	Benga will consider a proposal and the justification from the Piikani Nation to conduct an Aboriginal Food Consumption Study related to the project and its predicted effects.	Piikani Nation is considering a request.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	March 22 - 23, 2017 Technical Review Conference Calls	How can we incorporate TK into the design?	Groundwater Management	Key aspects of a groundwater management plan (for seepage capture) are part of the Project's Water Management Plan (WMP); however, final operational details have not be developed at this time. Benga would like to meet with the Piikani to determine how to use information from Piikani Nation's traditional land use report and integrate it into the groundwater management plan.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	How will the First Nation be involved in the development of the Plan?	Groundwater Management	Similar to the previous statement Benga would welcome the review and feedback of a technical groundwater management plan by the Piikani. Again, the final plan has not been developed; however, it would be coordinated by the Mine Operations Manager as the Project moves through the final approval process and into the construction phase. Benga would like to discuss options for the integration of Traditional Knowledge (TK) into the groundwater management plan. Examples of integration could include, 1) obtain feedback on the design and implementation of the groundwater management plan 2) Assist the interpretation of the monitoring data, from a cultural perspective 3) gain input on long-term resource management strategies.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	Assess if the natural springs affected by project are culturally important	Groundwater Management	Benga will work with the Piikani Nation to further assess the locations of natural springs on Grassy Mountain. This could be addressed through a focused (site specific) cultural assessment of the natural springs or as a cultural monitoring component of the project Monitoring Plan.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	How will your communicate results to the First Nation members, especially for unexpected events?	Groundwater Management	Unexpected events that violate the terms and conditions of the project approvals (noncompliance) must be reported to the appropriate regulatory authority (e.g. Alberta Energy Regulator). All such events are posted publicly and proper notification given to affected stakeholders including First Nations. Should an incident occur on site that poses a risk to public health or safety, or the environment, Benga will enact its emergency management plan (EMP) which will include notification of anyone affected.In regards to any emergency situations, prior to the Operational Phase of the Project, Benga will be developing a process so that any emergency events are communicated to First Nation and other public stakeholders.Benga will work with Piikani FN in the development of its emergency management plan (EMP) to ensure it incorporates adequate procedures to properly notify Piikani Nation members, ensure the safety and wellbeing of anyone at risk and implement the proper procedures to protect the environment	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	How frequent will we monitor, want frequency of tri-annual?	Groundwater Monitoring	High level details are presented in Section 7.0 of the August 2016 Environmental Impact Assessment (EIA) Update. Section 7.1 states: “The water level monitoring may be monthly during an initial period when water levels are stabilizing in order to establish baseline conditions prior to mining. Once drawdowns become more predictable, monitoring frequency may be decreased. The water sampling frequency is expected to be either bi-annual or annual. Analytical parameters are expected to include major ion chemistry, metals and hydrocarbons depending on location”. This information has been provided to Piikani Nation. As for reporting frequency, it will likely be dictated by the approval, but if bi-annual reporting is implemented, then an annual memo could be prepared on the off year and distributed to the Nation to communicate results.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	We would like to see biomonitoring that includes measuring Se in attached algae (periphyton) and benthic invertebrates in Blairmore and Gold creeks to ensure that fish tissues remain below the chronic tissue residue guideline of 4 µg Se/g.	Surface Water Management	Detailed plans on monitoring selenium have not been developed to date. Benga welcomes the opportunity to discuss monitoring plans with Piikani Nation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.
+ -	March 22 - 23, 2017 Technical Review Conference Calls	The First Nation would like to include options for more equitably dividing flows between the two rivers so that fish habitat in Gold Creek can be sustained under low flow conditions.	Surface Water Management	Benga have conducted a detailed instream flow needs (IFN) for the project area, and the flows needs for the aquatic environment are well understood. The potential impacts of the project on aquatic resources are well understood under normal seasonal conditions as well as a dry year scenario were now understood. The mitigation of flow augmentation is available under operational conditions if needed. Offset Planning may account for this as well.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Piiknai Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	Is there an opportunity to do a more detailed study of traditional use vegetation so we know what to strive for in the reveg plan? e.g., bearberry, sweet pine, juniper, mountain holly fern, yarrow, alpine fern, tree lichen, lodgepole pine, willow, poplar, cottonwood, birch, Saskatoon berry, sage.	Conservation and Reclamation Plan	Much information has been gathered on traditionally valued plant species on the project site. Through its ongoing relationship with Piikani Nation and involvement with the project, Benga believes there will be additional opportunity to share more information around traditionally used resources which can be incorporated into the sites final conservation and reclamation plans. Benga’s reclamation plans will include the use of native species and wherever possible will support revegetation of traditional-use species as part of its end land use objectives during reclamation.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Additionally, the Piikani Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with the Piikani Nation to gather input on the plan.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	The First Nation would like to see specific plans for revegetation with native species.	Conservation and Reclamation Plan	One of the goals in the updated Conservation & Reclamation Plan is that reclaimed areas will be developed into self-sustaining ecosystems with an acceptable degree of biodiversity (relative number of native species and structural layers as early stage target community). As such, Benga is committed to using native species in its reclamation plans. There is a revegetation plan in place which is outlined in the Environmental Impact Assessment. As the mine progresses, more detailed site specific plans for revegetation can be provided to Piikani Nation for review and comment.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Additionally, the Piikani Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with the Piikani Nation to gather input on the plan.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	The First Nation wants to see specific details about restoring the area so that it can be used for traditional land use opportunities.	Conservation and Reclamation Plan	During the development of the Environmental Impact Assessment (EIA), Benga conducted Aboriginal Consultation with the various Piikani Nation that may be affected by the Project. Elders and technicians provided input on the key issues, themes, observations, wisdom, insights, Traditional Knowledge (TK) and land use through a series of site visits, workshops, meetings, and other communication events. Recommendations and ideas expressed to date by Piikani Nation that are relevant to conservation and reclamation planning were summarized in the Conservation and Reclamation (C&R) Plan. Various traditional land uses objectives were also identified during the consultation (and associated TK reports). Some of the TK principles that Benga will incorporate into the C&R and Closure Plans were summarized in the C&R Plan. Benga is willing to incorporate traditional land use opportunities as part of the end land use objectives of the reclaimed landscape.As the mine progresses, more detailed site specific reclamation plans can be provided	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Additionally, the Piikani Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with the Piikani Nation to gather input on the plan.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	How did you address the weaknesses in cumulative impacts assessment in the Project Update? We would like to talk about including explicit provision of pre- and post-development Eco site phases and reduction in quality and how to address this; this information is critical for discussion of any required biodiversity offsetting programs.	Biodiversity Management	The assessment scenarios in the Environmental Impact Assessment and Update are identified in the project terms of reference. Much of the project site area is disturbed through historical and ongoing land use activities, mining, logging, cattle grazing, recreational use, access, etc. Benga's final land use objectives and final reclamation plans include rehabilitating the site, post-development, to a state that is better than the pre-development conditions which we find it in now. This includes the re-establishing of natural, self-sustaining ecosite conditions able to support a diversity of ecosite phases typical of the site and surrounding natural environment.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	How can we develop more detailed monitoring and adaptive management programs.	Wildlife Mitigation and Monitoring	Benga supports an adaptive management approach to its monitoring and environmental programs and will try to incorporate this approach into its environmental management plans. Benga will be developing specific environmental monitoring and management plans that comply with its regulatory requirements. Benga will provide Piikani Nation the opportunity to participate in the development and implementation of it's environmental programs on site.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	Is there more detail about where access will be limited in the update?	Access Management Plan	For site safety reasons access will be restricted to those lands within the Project Permit boundary during construction and operations. Limited access may be permitted after operations, during reclamation, so long as it does not directly interfere with final reclamation programs (e.g. revegetation, soil contouring). Access through the mine permit area or onto adjacent private lands owned by Benga to Crown lands outside the mine permit boundary can be arranged with sufficient notice in advance and, in the case of the mine site, provided it is safe to do so and does not disrupt operations. Crossing of the mine permit area will require a check in – check out procedure, a site safety orientation, proper personal and vehicle safety equipment and may require an escort. Firearms are not permitted on Benga property or within the project permit boundary.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and wildlife monitoring plan and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.

+ -	March 22 - 23, 2017 Technical Review Conference Calls	We will need a plan for getting First Nation input and communicating any changes to access through the site during the project.	Access Management Plan	Benga provided a conceptual Access Management Plan in the August 2016 update to the Environmental Impact Assessment (EIA). Due to site safety reasons access will be restricted within the Project Permit boundary during construction and operations. This will be enforced by mine operations managers and personnel during the construction and operations phase.	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and wildlife monitoring plan and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.
+ -	March 22 - 23, 2017 Technical Review Conference Calls	We will want to look at the Projects contribution to cumulative impact and impact of the project to regional access issues.	Access Management Plan	Benga looks forward to discussing regional access issues through the development of the Access Management Plan	Piikani Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Piikani Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and wildlife monitoring plan and will hold a workshop with the Piikani Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Piikani Nation.

SPECIFIC CONCERN AND RESPONSE TABLE

First Nation or Metis Settlement	Siksika Nation
Date	Dec 15, 2017

This table is designed to capture project specific concerns raised—by the First Nation/Metis Settlement that is being consulted—during consultation and the proponent's response to address the concerns through avoidance or mitigation. Any reply provided by the First Nation/Metis Settlement to the proponent's response should be documented and noted in this table where applicable.

Add/ Delete Row	Document or Meeting Reference	Specific Concern Expressed	Project Specific Aspect of the Concern Expressed	Proponent Response on Effort to Avoid or Mitigate Concern	First Nation/Metis Settlement Response to Proponent's Effort to Avoid or Mitigate Concern	Details on how concerns were addressed, including avoidance or mitigation measures	Outcomes/Comments
+ -	Minutes for July 20, 2014 Meeting with Siksika Nation, Arbutus Consulting, and Thorpe Consulting Services.	Siksika Nation is concerned about timely harvest of medicinal and ceremonial plants prior to impact by the Project. Traditional Use (TU) plants that will be otherwise destroyed by the mine should be dug up and moved just off site, or to the edge of the mine site property out of harms way. Year round access to those plants should be made available for Siksika traditional use. The TU mitigation and remediation strategy should address this.	Potential effects of the project on plant gathering.	Benga will continue to work with Siksika Nation to identify species of importance for harvesting in advance of construction activities in the Aboriginal Access Management Plan. Currently, Siksika Nation has not identified locations or species that may be affected. Benga will work with Siksika to allow for gathering of traditional plants prior to construction where practicable.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will plan a workshop with the Siksika Nation in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Siksika Nation.

+ -	Minutes for October 17, 2014 Meeting with Siksika Nation, Arbutus Consulting, and Thorpe Consulting Services.	Siksika Nation is at a disadvantage in reviewing the Project's Environmental Assessment (EA) because of a lack of expertise related to coal mining.	Consultation process	A technical review was completed by the Piikani Nation and the results of the review were shared with the Siksika Nation for their consideration. CEAA funding is available for applicants that wish to engage specialists to review the document.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.
+ -	Minutes for October 17, 2014 Meeting with Siksika Nation, Arbutus Consulting, and Thorpe Consulting Services.	Concerned that participating in the consultation process may be seen to contradict the Siksika position of not wanting any ceremonial lands destroyed.	Potential effect on ceremonial lands	Benga appreciates the participation to date by Siksika Nation. Information shared is important in the process of identifying potential effects to Siksika Nation interests. Benga looks forward to receiving any additional feedback from Siksika Nation on how the Project may affect ceremonial lands and will work with Siksika Nation to identify appropriate ways to mitigate potential effects. In addition, a Reclamation Plan will be included in the application and Aboriginal groups will have an opportunity to review and provide comments.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.
+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	Remediation of the Project site is insufficient to restore traditional use rights and interests to the Project area. To remedy this, at the end of Project's life, the site must be returned to Alberta Crown land.	Decommissioning	Benga commits to consult with Siksika in the development and implementation of detailed remediation and reclammation plans to ensure Siksika views are incorporated.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.

+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	To ensure that the Reclamation Plan satisfies Siksika Nation's needs and expectations, a Traditional Use (TU) mitigation and remediation strategy and plan funded by Riversdale should be prepared with the meaningful participation of Siksika Consultation Office (SCO) and Siksika Elders and Societies' representatives: -The plan needs to be informed by further TU work to cover the seasonality and detail of our traditional use there; -Siksika Nation must also have meaningful participation in the implementation of the TU mitigation and remediation strategy and plan - The plan should be integrated with, and implemented as part of, the Grassy Mountain mine plan -Siksika Nation must have meaningful participation in implementation	Decommissioning	Benga will continue to work with Siksika Nation and share project information. The Siksika Nation did participate in additional TU field work in 2017, and Benga looks forward to seeing the report that is generated by Siksika Nation that will provide feedback on mitigation measures. TU information provided to date was considered and incorporated into the Conservation and Reclamation plan.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Feedback received on the Conservation and Reclamation plan that was submitted as part of the EIA will be incorporated into the next version of the plan. Additionally, the Siksiksa Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with the Siksika Nation to gather input on the plan.	Ongoing; working with Siksika Nation.

+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	The Project will effect the movement and well-being of animals by displacing them for many years and blocking their migratory routes. The Project should include the establishment of appropriate alternative nesting locations off the site but nearby for eagles that will be affected by the project.	Potential effects of the project on hunting	The assessment of potential effects to wildlife includes potential effects to migration and movement with a discussion of proposed mitigation measures in Section E.9.5 of the Environmental Impact Assessment. No eagle nesting sites were identified during the baseline field surveys. As part of the adaptive environmental management of the site, should monitoring identify sites in the future appropriate mitigation measures will be undertaken to protect the eagles including avoidance of the nesting site during the breeding season and relocation, if feasible, in the off season.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga will also continue to work with Siksika to address this concern during the development of the wildlife monitoring plan in the first half of 2018.	Ongoing; working with Siksika Nation.

+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	The waterbodies adjacent to the Project site seem likely to be affected by run-off from the mine, causing wildlife deaths. An effective water protection plan should comprise part of the consultation process with Siksika Nation and the necessary Traditional Use (TU) mitigation and remediation strategy.	Potential effects of the project on hunting	Through the Water Management Plan (WMP) all water will be captured and treated accordingly (e.g., sediment ponds, saturation zones) which will prevent the release of 'contaminated' water. The Project will not result in the release of any contaminated water to the surrounding environment (terrestrial or aquatic). Based on this, the release of contaminated water was not identified as an operative pathway for exposure to wildlife (surface water assessment); subsequently, no potential risk was identified. In the Human Health Risk Assessment potential exposure to wildlife via deposition of chemicals from predicted air emissions onto water, soil and vegetation was assessed. Relevant Traditional Use (TU) information that was provided was considered and incorporated into the plan as appropriate.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Relevant Traditional Use (TU) information that was provided prior to the submission of the WMP incorporated into the plan as appropriate. If the Siksika Nation provides additional TU information, that information will be considered in the development of the next draft of the plan. Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga will also continue to work with the Siksika Nation to address this concern during the development of the the Water Management Plan that will be further developed 3 to 6 months prior to the start of construction.	Ongoing; working with Siksika Nation.

+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	The springs appearing at elevation throughout the mine site property seem likely to be destroyed by the project. If this is the case, it must be done in such a way that no industrial sediment or other downstream effects are allowed to effect the Blairmore or Gold Creeks or the Crowsnest River because those effects could cause serious harm to the animals that rely on that spring water to live (Siksika Nation 2015). A Traditional Use (TU) mitigation and remediation strategy and plan funded by Benga should be prepared with the meaningful participation of Siksika Consultation Office (SCO) staff and Siksika Elders and Societies' representatives to ensure that the animals, waters and plants located at the mine site and nearby are protected during project construction and operation, and are restored fully by end-project remediation work.	Potential effects of the project on hunting.	Benga has suggested a suite of mitigation and monitoring measures in this Environmental Impact Assessment that have been shared with the Siksika Nation (Section E.4.5 - Hydrology Mitigation and Monitoring, and Section E.5.5 Water Quality Mitigation and Monitoring). Benga welcomes input from the Siksika Nation on the mitigation measures. Benga will work with Siksika to get input into the design of the reclamation of the site through consultation on the Conservation and Reclamation plan. Benga will implement a Water Management Plan (WMP) that will prevent any unwanted release of water. All water (surface and groundwater) will be collected, held, and only released once it meets the appropriate or applicable water quality guideline.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Feedback received on the Conservation and Reclamation plan that was submitted as part of the EIA will be incorporated into the next version of the plan. Additionally, the Siksiksa Nation will have an opportunity to provide further input into the Reclamation Plan after detailed engineering has taken place. At that time, Benga will hold a workshop with the Sikika Consultation Office staff and Siksika Elders and Societies' representatives to gather input on the plan.	Ongoing; working with Siksika Nation.

+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	Siksika Consultation Office (SCO) needs to revisit the site in the Spring and Summer growing seasons to obtain the full list of medicinal and ceremonial plants found at the project site that will require protection. The Project site needs to be assessed in detail by the SCO team using a grid system, to ensure no key plants or animal habitat is overlooked.	Potential effects of the project on hunting and plant gathering	Benga provided additional funding for Siksika to revisit the Project site, which occurred in the summer of 2015 and 2017. Benga looks forward to receiving the report outlining the findings from the field work.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga is currently awaiting the TU report, and will consider information provided.	Ongoing; working with Siksika Nation.
+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	Mitigation strategies must be devised jointly with Siksika Elders and Consultation Office to protect, and avoid disturbance to wildlife.	Mitigation measures	Benga has provided mitigation strategies as part of the EIA, and has presented those strategies to the Siksika Consultation Office and at open houses in the community.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.
+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	Non-Native Benga employees and sub-contractors may not understand the sacred nature of the Project area. Benga is urged to develop and implement a cultural training program in collaboration with Siksika Nation.	Potential effects of the project on physical and cultural heritage	In June 2017, Benga employees and invited guests from the ACO and local municipal government participated in a cultural awareness session at Head-Smashed In Buffalo Jump with the Siksika Nation. Benga supports cultural awareness training for its staff and contractors.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.

+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	Siksika Nation is concerned about potential effects to the continued traditional use of the Southern Gate and Crowsnest Mountain by Siksika hunters, herbalists, ceremonialists, and Elders. To support the continued traditional use of the Southern Gate and Crowsnest Mountain by Siksika hunters, herbalists, ceremonialists, and Elders, Benga is encouraged to provide support for Siksika ceremonies and community events.	Potential effects of the project on physical and cultural heritage	Benga has and will continue to support the Siksika Nation cultural events and ceremonies through its community and First Nation engagement and initiatives such as its community sponsorship program.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.
+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	The project should include the establishment of appropriate alternative nesting locations off the site but nearby for eagles that will be affected by the Project.	Potential effects of the project on physical and cultural heritage	No eagle nesting sites were identified during the baseline field surveys. As part of the adaptive environmental management of the site, should monitoring identify sites in the future appropriate mitigation measures will be undertaken to protect the eagles including avoidance of the nesting site during the breeding season and relocation, if feasible, in the off season.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Siksika Nation.

+ -	March 2015 Siksika Interim TUS Assessment and Report for the Grassy Mountain Project.	Construction and operation of the Project may directly or indirectly disturb medicinal and ceremonial plants. Mitigation strategies must be devised jointly with Siksika Elders and Consultation Office to protect, and avoid disturbance these plants. Siksika Nation recommends harvesting pre-construction, replanting, and green housing activities as ways to mitigate potential effects.	Potential effects of the project on plant gathering.	All great suggestions for mitigation. Benga has incorporated many of these suggestions into its proposed mitigation plans in the Environmental Impact Assessment (EIA) and will be included where feasible into its environmental management plans.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will plan a workshop with the Siksika Nation in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Siksika Nation.
+ -	January 4, 2016 Statement of Concern	The construction of the Project will lead to increased noise in this area. Siksika members understand that noise has an effect on the wildlife that they harvest, and are concerned that animals will avoid the Project area and surrounding environs altogether due to such noise.	Potential effects of noise	Potential interactions with wildlife related to noise are assessed in Section 3 of the wildlife assessment including sensory disturbance during construction. Sensory disturbance would result in indirect habitat loss and may result in in wildlife avoiding otherwise suitable habitat. Noise from the active mine site would be mitigated through the use of mufflers on all internal combustion engines, installing berms around the southern dump to absorb noise, utilizing mine pit topography to shield noise generated from haul trucks, and conducting blasting during daylight hours.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop in the first half of 2018 to ask for further input on the plan	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	The Project would be located in Siksika's traditional territory in the heart of an area used intensively by Siksika members for hunting, fishing, gathering and ceremonial purposes.	Potential effects of the project on hunting, fishing, plant gathering, and physical and cultural heritage	A conceptual of the Aboriginal Access Management Plan has been provided to Siksika Nation, and Benga looks forward to receiving comments on the plan from the Siksika Nation. For site safety reasons access will be restricted to those lands within the Project Permit boundary during construction and operations. Limited access may be permitted after operations, during reclamation, so long as it does not directly interfere with final reclamation programs (e.g. revegetation, soil contouring). Access through the mine permit area or onto adjacent private lands owned by Benga to Crown lands outside the mine permit boundary can be arranged with sufficient notice in advance and, in the case of the mine site, provided it is safe to do so and does not disrupt operations. Crossing of the mine permit area will require a check in – check out procedure, a site safety orientation, proper personal and vehicle safety equipment and may require an escort. Firearms are not permitted on Benga property or within the project permit	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will plan a workshop with the Siksika Nation in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	The project may irreparably harm the vegetation and biodiversity of the area. I am concerned that the animal habitats will be destroyed and the animals will leave and never return to this area.	Potential effects of the project on hunting and plant gathering.	Consultant Report #8 provides an assessment of potential effects to vegetation including sensitivity of plant community biodiversity to disturbance. The removal of vegetation within the Project footprint will initially reduce species habitat and increase habitat fragmentation. Mitigation and monitoring are described in Section 4.8.4 of the report including reclamation which will reduce present fragmentation from existing disturbances (primarily previous mining operations). Mitigation measures for biodiversity include an adaptive re-vegetation strategy and re-establishing native species.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	I am concerned that this Project will affect the wildlife migratory patterns and the reproduction rates. This will in turn affect our culture because our culture is so closely intertwined with the land and animals. As the animals become more scarce it will put more pressure on our culture. These are all the effects of development.	Potential effects of the project on hunting and wildlife	As seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Benga would like to continue to meet with the Siksika Nation for traditional knowledge (TK) input regarding wildlife migrations and to identify monitoring objectives important to the Siksika Nation. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year. Wildlife mitigation and monitoring are described in Section 7 of Consultant Report #9.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	I am concerned about impacts of the Project on the bear habitat and migratory patterns. I have seen bear scat and markings in the Project area.	Potential effects of the project on hunting and wildlife	Consultant Report #9 provides an assessment of potential effects to wildlife. Grizzly bear is one of the wildlife valued components selected for the assessment. Grizzly bears are expected to be displaced from portions of the Project footprint during the active mining period. Benga will mitigate potential effects of the Project on grizzly bear movement by maintaining a minimum 100 m undisturbed forested zone around Blairmore Creek and other riparian corridors. Benga will leave patches of residual forest within and adjacent to the mine footprint to the extent possible and initiate reclamation early on in mine operations by seeding reclaimable areas with preferred forage species and plant shrub and tree species that provide suitable cover for grizzly bears. Progressive reclamation is the key mitigation measure that would return the Project footprint to suitable habitat for grizzly bear. Changes in movement, habitat availability and habitat state for grizzly bear are described in more	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop with the Siksika Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	In addition to removing the lands for use by Siksika members, this taking-up will impact Siksika members' ability to transmit traditional knowledge about the area to younger generations. In short, the Applications, if approved, will have lasting adverse impacts on Siksika's culture.	Potential effects of the project on physical and cultural heritage	Benga appreciates the input from Siksika Nation and is committed to working with Siksika Nation to minimize potential impacts to culture. Section H.3.4 of the Environmental Impact Assessment (EIA) provides an assessment of potential effects to Siksika Nation physical and cultural heritage including proposed mitigation measures to minimize potential effects. Benga welcomes any feedback on the proposed mitigations.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.
+ -	January 4, 2016 Statement of Concern	The eagle is sacred to the Siksika people and they are concerned about the destruction of their nesting grounds. Further, there are concerns about the effects of noise pollution and air pollution from the Project on the eagles' health. A proposed mitigation strategy is to establish alternative nesting locations for the eagles for the duration of the Project.	Potential effects of the project on physical and cultural heritage	No eagle nesting sites were identified during the baseline field surveys. As part of the adaptive environmental management of the site, should monitoring identify sites in the future appropriate mitigation measures will be undertaken to protect the eagles including avoidance of the nesting site during the breeding season and relocation, if feasible, in the off season.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop with the Siksika Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	The mine project will affect migratory patterns. We are particularly concerned about the eagle habitat. The eagles will be disturbed by this Project and may never return to the area. In our tradition, the eagle is symbolic in many of our ceremonies. They are very sacred to our people.	Potential effects of the project on physical and cultural heritage	Eagles are described in Consultant Report #9 and Section H of the Environmental Impact Assessment as culturally and spiritually significant to Treaty 7 First Nations. The wildlife assessment found that project development is unlikely to affect the migration pathways of bald eagles (Section 5.4.4 of Consultant Report #9). The US Fish and Wildlife Service (USFWS) (2015) notes that bald eagles are more tolerant of human activities during the non-breeding season than during the breeding season. Bald eagles may slightly alter their flight pathways or increase their altitudes if very high disturbance activities (e.g. blasting) occur during migration. Project development is not predicted to adversely affect migrating birds. Both bald and golden eagles will migrate over highly disturbed areas they would not otherwise use as habitat, including large cities (e. g. City of Toronto 2009). Project development may result in indirect habitat loss for overwintering or breeding bald eagles if they begin avoiding the Crowsnest River in	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop with the Siksika Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	I am concerned about the impacts this Project will have on our culture and way of life. It will impact our hunting and other traditional activities in the area for over 30 years.	Potential effects of the project on physical and cultural heritage	An assessment of potential effects to Siksika Nation current use for traditional purposes is provided in Section H.5 of the Environmental Impact Assessment. Potential effects to Siksika Nation hunting are described in Section H.5 of the EIA and are considered to be local to the Project area and reversible. The ability to hunt in Siksika Nation territory outside of the Project Area would not be affected.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	The Siksika members still gather material, such as sweet pine, from the area for their ceremonies. Some of these materials do not grow on their reserve lands so they need to harvest them from the Project area.	Potential effects of the project on plant gathering	Benga provided a conceptual Access Management Plan in the August 2016 update to the Environmental Impact Assessment (EIA). Due to site safety reasons access will be restricted within the Project Permit boundary during construction and operations. This will be enforced by mine operations managers and personnel during the construction and operations phase. Limited access may be permitted after operations, during reclamation. Access through the mine permit area or onto adjacent private lands owned by Benga to Crown lands outside the mine permit boundary may also be arranged. These access provisions will be worked out in the Access Management Plan and Siksika input into the plan is welcome.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will plan a workshop with the Siksika Nation in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	I am concerned that the Project will affect the biodiversity in the area. Many plants we have gathered in this area are not available on our reserve land. It is getting more difficult to find these plants.	Potential effects of the project on plant gathering.	Siksika Nation did not identify plant species in the Traditional Use study provided. Benga requests Siksika Nation to identify plant species in the Project area that may not be available throughout Siksika Nation territory. Consultant Report #8 provides an assessment of potential effects to vegetation including sensitivity of plant community biodiversity to disturbance. Mitigation measures for biodiversity include an adaptive re-vegetation strategy and re-establishing native species.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will plan a workshop with the Siksika Nation in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	Siksika has raised the concern that as a part of the remediation process the land must be returned as Alberta Crown land. Benga has not sufficiently responded to this concern, answering instead that "there will be opportunity to discuss steps for decommissioning and reclamation." The Environmental Assessment contemplates taking up 1,582.4 ha of land, much of which is currently, and would otherwise be, used by Siksika members to exercise Treaty and Aboriginal rights. Based on Benga's Applications and their timeline for reclamation, the Project area would not be available to Siksika members for over 30 years.	Reclamation	It is normal that any Crown Land used for the project would be under a lease arrangement. Ultimate title to the Crown Land will remain with the Crown.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has forwarded this concern to CEAA and the ACO.	Complete

+ -	January 4, 2016 Statement of Concern	Siksika Nation expressed concerns regarding Gold Creek and Crowsnest River in relation to an article reporting an incident of coal wash and possible environmental infractions at the Project location.	Potential effects of the project on water quality	The incident involved exposed coal and sediment that was released – or 'washed' - by heavy rain from near the top of Grassy Mountain. The exposed coal and sediment is a legacy from historic mining operations that ceased when the site was abandoned in the early 1960s. Reclamation was not a requirement at the time and events such as the release that occurred in July 2015 have occurred periodically since that time. Benga in an effort to prevent further impacts to Gold Creek, implemented mitigation measures at the location of the incident and elsewhere on Grassy Mountain. Benga continues to monitor and maintain the installed measures. Benga's mine development plans include permanent reclamation of the mine site which will prevent similar future incidents.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	The proponent intends to divert surface and groundwater for use in the Project. This is likely to permanently reduce the suitability of affected water-ways for traditional use activities. Further, the Project area is located at the headwaters of many downstream rivers used by the Siksika and any leaching or spills from the Project's tailings ponds could prove catastrophic.	Potential effects of the project on water quality	Potential effects of the Project to water-ways including leaching are summarized in Section E.5 of the Environmental Impact Assessment (EIA). Benga is dedicated to implementing the proposed mitigation measures, reclamation plan, and ongoing monitoring programs to minimize or avoid potential effects to water quality.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.
+ -	January 4, 2016 Statement of Concern	There has been found to be a direct correlation between cumulative waste rock volumes and increases in selenium concentrations found in local rivers and streams. A suggested mitigation strategy in the Siksika Traditional Use Study TUS Report is for Benga to establish an effective water protection plan which would attempt to preserve the quality of the water in the Project area.	Potential effects of the project on water quality	Benga has developed a Water Management Plan to manage and control all water on site and ensure that water quality of surrounding surface and groundwater is maintained. This plan includes the collection, treatment, and monitoring of water affected by selenium.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Siksika Nation 3 to 6 months prior to the start of construction to request further input on the Water Management plan.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	I am mainly concerned about the impact on the water quality. This area is at the headwaters. Any damage in the quality of water will affect the downstream rivers and waterways.	Potential effects of the project on water quality	Potential effects of the Project to water-ways are summarized in Section E.5 of the Environmental Impact Assessment. Benga is dedicated to implementing the proposed mitigation measures, reclamation plan, and ongoing monitoring programs to minimize or avoid potential effects to water quality.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Siksika Nation 3 to 6 months prior to the start of construction to request further input on the Water Management plan.	Ongoing; working with Siksika Nation.
+ -	January 4, 2016 Statement of Concern	I am concerned about the impacts on the water quality, particularly the creeks on both sides of the Project area, Blairmore Creek and Gold Creek. If the creeks and waterways are polluted this will affect the waters downstream and will in turn hurt the animals and birds that drink it.	Potential effects of the project on water quality	Potential effects of the Project to water-ways are summarized in Section E.5 of the Environmental Impact Assessment. Benga is dedicated to implementing the proposed mitigation measures, reclamation plan, and ongoing monitoring programs to minimize or avoid potential effects to water quality. Water quality mitigations will be put into place to ensure that all parameters meet regulatory guidelines in the operation and closure phases to the project to protect downstream users. The plan is to leave the proposed project location in better environmental condition than it is currently.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Siksika Nation 3 to 6 months prior to the start of construction to request further input on the Water Management plan.	Ongoing; working with Siksika Nation.

+ -	January 4, 2016 Statement of Concern	Siksika understands that Benga activities in or near the Project area may have resulted in a release of contaminants into Gold Creek and the Crowsnest River, resulting in an Alberta Energy Regulator (AER) investigation (July - August 2015). This is of concern to Siksika as it may speak to the availability of Benga to conduct its operations without harming the biophysical environment. Equally concerning is the fact that Benga was not proactive in directly advising Siksika of the circumstances of this release and subsequent investigation.	Potential effects of the project on water quality; consultation	The incident involved exposed coal and sediment that was released – or 'washed' - by heavy rain from near the top of Grassy Mountain. The exposed coal and sediment is a legacy from historic mining operations that ceased when the site was abandoned in the early 1960s. Reclamation was not a requirement at the time and events such as the release that occurred in July 2015 have occurred periodically since that time. Benga in an effort to prevent further impacts to Gold Creek, implemented mitigation measures at the location of the incident and elsewhere on Grassy Mountain. Benga continues to monitor and maintain the installed measures. Benga's mine development plans include permanent reclamation of the mine site which will prevent similar future incidents.	Siksika Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Siksika Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Siksika Nation.

+ -	October 6, 2017 Email	Siksika expressed concerns about the pre-contact camp site Dj Po-98	Sites of Concern	Currently the proposed plant site sedimentation pond overlays a portion of the identified historical resource site DjPo-98 which is an unnamed Pre-contact Period Site located on private land within the proposed the proposed CHPP area. This site was partly evaluated and excavated when it was first recorded, however, 2015 testing and assessment indicated the presence of additional deeply buried material. Benga committed to relocate the sedimentation pond to avoid the site Dj Po-98 and to protect it from disturbance.The mitigation measures for historical resource DjPo-98 are discussed in Section E.13.3.3.4 of the August 2016 EIA Summary.	Siksika indicated that they have received the update.	Benga is looking into engineering options to move the ponds and will advise Siksika when they become available.	Siksika Nation has not yet provided a response to the proposed mitigation

SPECIFIC CONCERN AND RESPONSE TABLE

First Nation or Metis Settlement: Stoney (Bearspaw) Band

Date: Dec 15, 2017

This table is designed to capture project specific concerns raised—by the First Nation/Metis Settlement that is being consulted—during consultation and the proponent's response to address the concerns through avoidance or mitigation. Any reply provided by the First Nation/Metis Settlement to the proponent's response should be documented and noted in this table where applicable.

Add/ Delete Row	Document or Meeting Reference	Specific Concern Expressed	Project Specific Aspect of the Concern Expressed	Proponent Response on Effort to Avoid or Mitigate Concern	First Nation/Metis Settlement Response to Proponent's Effort to Avoid or Mitigate Concern	Details on how concerns were addressed, including avoidance or mitigation measures	Outcomes/Comments
+ -	Minutes from May 22, 2014 Meeting between Stoney Nakoda Nation and Thorpe Consultation Services.	Concern for effects, inadvertent or otherwise, to sites of cultural or spiritual significance. To forestall this, Benga must install cultural monitoring and implement a mitigation plan for any newly-identified sites.	Effects of the project on physical and cultural heritage.	Benga has developed a cultural site discovery contingency plan and would like to get the Stoney Nation's input on the plan.	The Stoney Nation recommended Benga include the Shuswap Tribal Council as a potentially affected group, as the Stoney Nation has an MOU with this group to allow joint hunting on gathering on their respective territories. The Stoney Nation can provide a copy of this MOU as part of their Cultural Assessment.	Benga expressed a desire to work together with the Stoney Nation to complete the cultural site discovery contingency plan Management Plan in EIA Appendix 7(d) specific to the Stoney Nation.	Ongoing; working with Stoney Bearspaw Nation.

+ -	Minutes from January 15, 2015 Meeting between Stoney Nakoda Nation and Laureen Whyte, Arbutus Consulting.	Concern about lack of reference to the objectives of the South Saskatchewan Regional Plan and wanted confirmation that current legislated standards and land use designations apply to the Grassy Mountain Project.	Land and resource use.	The assessment of potential effects to Land and Resource Use in Section E.10 of the Application considers the South Saskatchewan Regional Plan (SSRP).	The Stoney Nation expressed that as long as connections between the frameworks and the proponents are made, the follow-through is making sure the Ministries that should be involved are in fact involved.	Benga followed up with the Alberta government and received confirmation that existing legislated standards and land use designations continue to apply to the Project.	Complete
+ -	Minutes from January 15, 2015 Meeting between Stoney Nakoda Nation and Laureen Whyte, Arbutus Consulting.	Concern about air emissions. In Section 2.5 of the PTOR, Stoney Nation would like the EIA report to include information about government standards and exceedances.	Potential effects of the project on health and air quality.	As part of the EA update provided in August 2016, a revised air model was provided that aligned with optimization of the mine plan. In addition, another air model was provided in the EA Update for the coal product load-out/rail loop area. The results of both models indicated no exceedences or significant residual impacts that would affect the neigbouring communities or surrounding environment.	The Stoney Nation is interested in regional air monitoring, and inquired if Benga's air monitoring results could be combined with a future regional air-shed study. Benga agreed the site results could be incorporated into a regional study, and agreed to work on the air monitoring management plans with the Stoney Nation.	Benga will look into air research at the University of Lethbridge.	Ongoing; working with Stoney Bearspaw Nation.

+ -	January 4, 2016 Statement of Concern	Potential loss of important deer, elk, and moose habitat throughout the region hunted by the Stoney Nakoda Nation (SNN) from Eden Valley, along the Whaleback and along the eastern side of the foothills.	Potential effects of the project on hunting.	The results of the EIA were submitted in 2015 and again after updating in August 2016. The assessment of potential effects to wildlife is considered in Sec E.9.3. Many of the project effects associated with habitat loss and wildlife movement will be minimized through the implementation of the Project's reclamation plan. Grassy mountain is a previously disturbed area and, as seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year.	The Stoney Nation indicated the Cultural Assessment site visits are scheduled for completion in 2018 and once complete the Stoney Nation will have more to add to the Conservation and Reclamation plan. Benga would like specifics so they understand the scope of the mitigation required, be it ceremony, plan changes, etc.	Benga is looking forward to receiving the results of the Cultural Assessment.	Ongoing; working with Stoney Bearspaw Nation.

+ -	January 4, 2016 Statement of Concern	Potential interruption and alteration of migratory and traveling routes for various species of the area.	Potential effects of the project on hunting.	As seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Benga would like to meet with the Stoney Nakoda Nation (prior to project approvals) for traditional knowledge (TK) input regarding wildlife migrations and to identify monitoring objectives important to the Stoney Nakoda. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year.	The Stoney Nation indicated the Cultural Assessment site visits are scheduled for completion in 2018 and once complete the Stoney Nation will have more to add to the Conservation and Reclamation plan. Benga would like specifics so they understand the scope of the mitigation required, be it ceremony, plan changes, etc.	Benga is looking forward to receiving the results of the Cultural Assessment.	Ongoing; working with Stoney Bearspaw Nation.

+ -	January 4, 2016 Statement of Concern	Potential loss of important whitefish and trout habitat that includes the Highwood River, Pekisko Creek, Willow Creek, Johnson Creek, Oldman River, and Livingstone River, which is closest to the Project.	Potential effects of the project on fishing.	The Highwood River, Livingstone River, Pekisko Creek, Willow Creek and Johnson Creek are in the Livingstone Watershed, which is north of the project, and will not be impacted by the project. The watercourses associated with the project are in the Oldman River watershed (specifically Gold Creek and Blairmore Creek which flow into the Crowsnest River, and eventually into the Oldman River). Benga have developed a Water Management Plan (WMP) to protect the quantity and quality of the water on and around the mine site, as well as an Instream Flow Needs assessment to quantify any impacts to fish habitat (i.e. reduction in flow or loss in habitat). Through the hydrology, groundwater, water quality and fisheries assessments, no significant residual impacts were identified.	The Stoney Nation has not looked at fish in their Cultural Assessment studies so far, but they will include them in future fieldwork as there are fishing sites as well as hunting and gathering sites. The Stoney Nation is interested to see if any ongoing cumulative effect within the watershed, and is interested in short and long term monitoring.	Benga's Fisheries plan includes habitat restoration and Benga would like the Stoney Nation's input as the plan is finalized. Ongoing monitoring may be an outcome of the Fisheries plan.	Ongoing; working with Stoney Bearspaw Nation.

+ -	January 4, 2016 Statement of Concern	Potential decrease common fur-bearing animals, such as black bear, coyote, lynx, squirrel, beaver, mink and marten, in Registered Fur Management Areas, particularly those registered to SNN members.	Potential effects of the project on hunting and trapping.	Information provided by Stoney Nation members during the initial site tour, including information about wildlife, is considered in the EA under potential effects to wildlife and potential effects to hunting. The assessment of potential effects to wildlife is considered in Sec E.9.3. Many of the project effects associated with habitat loss and wildlife movement will be minimized through the implementation of the Project's reclamation plan. Grassy mountain is a previously disturbed area and, as seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year.	The Stoney Nation indicated the Cultural Assessment site visits are scheduled for completion in 2018 and then the Stoney Nation will have recommendations to contribute to the Conservation and Reclamation plan.	Benga will provide data from the existing wildlife fieldwork completed in support of the EIA to the Stoney Nation to inform the Cultural Assessment.	Ongoing; working with Stoney Bearspaw Nation.

+ -	January 4, 2016 Statement of Concern	Adverse impacts on Traditional uses of the land, which are diverse and include, but are not limited to subsistence hunting, fishing and trapping, harvesting herbs, plants and berries for nutritional and medicinal purposes, and using rocks and lumber for tools, campfire rings, and sweat lodges;	Potential effects of the project on hunting, fishing, trapping, plant gathering, and physical and cultural heritage.	The results of the EA were submitted in 2015 and updated in August 2016. An assessment of potential effects of the Project to Stoney Nation is provided in Section H.6 of the EA. Information provided by Stoney Nation, including information about wildlife, is considered in the EA under potential effects to wildlife and potential effects to hunting. Access to harvesting areas will be included as a component of the Aboriginal Access Management plan. Potential effects of the Project on vegetation including medicinal and ceremonial plants are described in Section E.8.3 of the EA. A discussion of proposed mitigation measures is provided in the EA document. Section E.8.5 and the C&R Plan in Section F.1 describes how traditional plants were incorporated into the proposed closure plan. Mitigation measures include opportunities to transplant to limit potential effects to identified medicinal and ceremonial plants, and incorporating traditional use plant species, native to the area, into reclamation plans.	The Stoney Nation indicated the Cultural Assessment site visits are scheduled for completion in 2018 and then the Stoney Nation will have recommendations to contribute to the Conservation and Reclamation plan.	Benga is looking forward to receiving the results of the Cultural Assessment.	Ongoing; working with Stoney Bearspaw Nation.

+ -	January 4, 2016 Statement of Concern	Diminished water quality resulting from accidental spills.	Accidents and malfunctions.	As part of the August 2016 EA update, Benga has added additional information and clarification around the Project's Water Management Plan (WMP). This WMP was developed to ensure all water within the mine site is captured in appropriately sized holding ponds that allow for the testing of water quality prior to being released into the surrounding environment. The WMP was assessed to determine potential effects on river flows and water quality in the neighbouring and downstream rivers. The results of the assessment indicate that there will not be any impacts to the environment with the implementation of the WMP. To verify that changes in flow do not affect fish and their habitat, Benga also conducted a detailed Instream Flow Needs study (IFN). Based on the detailed hydrology, groundwater, water quality, and fisheries assessments, no significant residual impacts were identified that would permanently reduce the suitability of the water-ways that are used for traditional use activities. It is important to note that the Grassy	The Stoney Nation would like to provide input into the Water Management Plan and be involved in water monitoring. The Stoney Nation would also like to provide input into the Emergency Response Plan.	Benga welcomes feedback on the information provided in the EIA specific to the Emergency Response plan and Water Management Plan. Benga also plans to hold a workshop with the the Stoney Nation 3 to 6 months prior to the start of construction to request further input on the plans. Benga committed to update the Aboriginal Access Management Plan to have a ban on fishing by employees, with input from the Stoney Nation, to protect the streams near the mine from impact from possible invasive aquatic species due to contaminated fishing gear.	Ongoing; working with Stoney Bearspaw Nation.

+ -	January 4, 2016 Statement of Concern	Diminished air quality resulting from industrial emissions.	Potential effects of the project on health and air quality.	As part of the EA update provided in August 2016, a revised air model was provided that aligned with optimization of the mine plan. In addition, another air model was provided in the EA Update for the coal product load-out/rail loop area. The results of both models indicated no exceedences or significant residual impacts that would affect the neigbouring communities or surrounding environment.	The Stoney Nation is interested in regional air monitoring, and inquired if Benga's air monitoring results could be combined with a future regional air-shed study. Benga agreed the site results could be incorporated into a regional study, and agreed to work on the air monitoring management plans with the Stoney Nation.	Benga will look into air research at the University of Lethbridge.	Ongoing; working with Stoney Bearspaw Nation.
+ -	January 4, 2016 Statement of Concern	The decision made by the AER with respect to the Project will likely not consider the federal land and jurisdictional fields impacted by the Project.	Environmental Assessment process.	The Grassy Mountain Coal Project is under both provincial (Alberta Energy Regulator; AER) and federal (Canadian Environmental Assessment Act; CEAA) review based on provincial Environmental Protection and Enhancement Act (EPEA), and federal CEAA triggers. Benga anticipates that the project will undergo a joint panel review (representatives from AER and CEAA), with final decisions taking into consideration or ensuring both government requirements are addressed.	The Stoney Nation is satisfied with the response.	No further action required	Complete

+ -	January 4, 2016 Statement of Concern	Unemployment in Eden Valley is of great concern to the SNN. The Globe and Mail reported in September 2011 that the unemployment rate in Eden Valley was 70 per cent which is significantly higher than the rate of 37.5 per cent noted in the Application. The Court of Appeal has already deemed Eden Valley to be an "urban centre"; therefore, the AER and Benga Mining Ltd must consider the socio-economic impacts of the Project on the community and residents of Eden Valley.	Effects of the project on socio-economic conditions.	The information used to identify employment statistics is from the Statistics Canada 2011 census. Benga welcomes feedback from the Stoney Nation including identification of potential effects to socio-economic conditions or ways to mitigate potential effects.	The Stoney Nation expressed a concern that Statistics Canada does not include First Nation employment in their employment statistics and this is not explained in the EIA. The Stoney Nation noted that they have human resources people at Morley and Eden with lists of the qualifications of community members.	Benga has met with the the Stoney Nation to review this issue, and is scheduling a workshop in the first half of 2018 to discuss the Human Resources Management Plan with the Stoney Nation.	Ongoing; working with Stoney Bearspaw Nation.
+ -	January 4, 2016 Statement of Concern	It would be valuable to the SNN that Benga Mining Ltd offer advance training or on-the-job training for SNN members residing in Eden Valley. It would be our desire to see that 10 per cent of both the construction crew and the operation crew be hired from qualified SNN members.	Effects of the project on socio-economic conditions.	Benga thanks Stoney Nation for the interest in working together on the Project. Benga would like to further discuss the request with Stoney Nation.	The Stoney Nation requested a list of jobs and the required qualifications. he Stoney Nation noted that they have human resources people at Morley and Eden with lists of the qualifications of community members.	Benga will provide the Stoney Nation with the requested list of jobs and required qualifications. Benga is scheduling a workshop in the first half of 2018 to discuss the Human Resources Management Plan with the Stoney Nation.	Ongoing; working with Stoney Bearspaw Nation.

+ -	January 4, 2016 Statement of Concern	The TEK of the SNN should not be made public. The 15 traditional use sites, identified during the preliminary site tour conducted on July 25, 2014, remain undisturbed by the Project.	Environmental assessment process.	The Stoney Nation produced a public version of their TEK report which was provided to Benga and which can be shared publicly. Benga does not have access to the confidential report. The Stoney Nation TK report provided to Benga does not disclose the location of any traditional use sites.	The Stoney Nation has indicated that they provide the confidential information if Benga will enter into a confidentiality agreement with the Stoney Nation.	Benga indicated it is willing to do a confidentiality agreement with The Stoney Nation.	Ongoing; working with Stoney Bearspaw Nation.
+ -	November 24, 2017 Meeting	The Stoney Nation would like to have input into the Wildfire Control and Prevention Plan	Potential effects of the project on Wildfires	The draft Wildfire Control and Prevention Plan is part of the EA and is focused on wildfire prevention and control on the mine site due to industrial activities.	The Stoney Nation would like to use the Cultural Assessment report to identify concerns with the wildfire plan, and for Benga to use the Cultural Assessment report to inform details of the Environmental Management Plan's mitigation.	Benga welcomes feedback on the information provided in the EIA specific to the Wilfire Control and Prevention Plan. Benga will review and incorporate results from the Cultural Assessment into the plan as appropriate. Benga also plans to hold a workshop with the Blood Tribe 3 to 6 months prior to the start of construction to request further input on the Wildfire Control and Prevention Plan.	Ongoing; working with Stoney Bearspaw Nation.

SPECIFIC CONCERN AND RESPONSE TABLE

Alberta Government

First Nation or Metis Settlement	Tsuut'ina Nation
Date	Dec 15, 2017

This table is designed to capture project specific concerns raised—by the First Nation/Metis Settlement that is being consulted—during consultation and the proponent's response to address the concerns through avoidance or mitigation. Any reply provided by the First Nation/Metis Settlement to the proponent's response should be documented and noted in this table where applicable.

Add/ Delete Row	Document or Meeting Reference	Specific Concern Expressed	Project Specific Aspect of the Concern Expressed	Proponent Response on Effort to Avoid or Mitigate Concern	First Nation/Metis Settlement Response to Proponent's Effort to Avoid or Mitigate Concern	Details on how concerns were addressed, including avoidance or mitigation measures	Outcomes/Comments
+ -	Minutes from April 23, 2014 Meeting between Tsuut'ina Nation, Arbutus Consulting, Thorpe Consulting Services, Dialectic Research.	Traditional Use (TU) sites must be logged so that they are protected and ceremonial and medicinal plants are harvested before being destroyed. The Tsuut'ina Nation expressed interest in harvesting lodge pole pine during the Spring on a regular and ongoing basis with financial support for doing so provided by Benga.	Potential effects of the project on plant gathering.	Benga has committed to allow First Nations including Tsuut'ina, access to the site prior to or during clearing operations to enable them to harvest Lodgepole pine for cultural purposes (e.g. teepee poles).	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will hold a workshop with Tsuut'ina in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Tsuut'ina.

+ -	Minutes from October 17, 2014 Meeting between Tsuut'ina Nation and Arbutus Consulting Services.	Concern that mining activity could cause instability and landslides.	Potential effects of the project on soils.	Geotechnical stability is addressed in Section B of the Environmental Impact Assessment (EIA). The analysis demonstrates an adequate factor of safety for slope stability even considering potential seismic activity	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Tsuut'ina.
+ -	Comments from January 15, 2015 Meeting between Tsuut'ina Nation and Laureen Whyte, Arbutus Consulting.	Concern about sources of water and water management. Want to be involved in discussion about determining key aquatic indicators to assess project effects.	Potential effects of the project on water quality.	No significant Project effects on surface water or groundwater quality are anticipated. Benga will implement a Water Management Plan (WMP) that will prevent any unwanted release of water. All water (surface and groundwater) will be collected, held, and only released once it meets the appropriate or applicable water quality guideline. Benga will implement a ground water monitoring program with the project to ensure that groundwater quality is not adversely affected due to mining activities.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga also plans to hold a workshop with the Tsuut'ina Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Tsuut'ina.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area.	Concern about the possible use of explosives.	Potential effects of the project from construction activities.	A description of construction activities including blasting procedures is provided in Section C of the EIA. The potential effects on the environment as a result of blasting activities including to wildlife are considered throughout the EIA. Benga has proposed mitigation measures to reduce or avoid potential effects of blasting on the environment.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Tsuut'ina.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area.	The Project will limit Tsuut'ina Nation in their ability to hunt and practice traditional ways on the site.	Potential effects of the project on hunting.	The results of the Environmental Impact Assessment (EIA) were submitted in August 2016. The assessment of potential effects to wildlife is considered in Sec E.9.3. The ability to continue hunting practices is included in the assessment of potential effects to Tsuut'ina Nation in Section H. Many of the project effects associated with habitat loss and wildlife movement will be minimized through the implementation of the Project's reclamation plan. As seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will hold a workshop with Tsuut'ina Nation in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Tsuut'ina.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area.	Health and wellness of wildlife, including birds, may be compromised indirect effects such as increased animal-vehicle collisions.	Potential effects of the project on hunting.	Habitat connectivity and movement is assessed in Section E.9.3 of the Environmental Impact Assessment (EIA) including potential effects to wildlife from traffic. Proposed mitigation measures related to managing this potential effect include access management and enforcing speed limits along the main access road and utility corridors. In addition, wildlife crossing signs will be used to minimize wildlife-vehicle collisions.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop with Tsuut'ina Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Tsuut'ina.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area.	To ensure continued protection of the Project area, Benga should provide adequate funding for Tsuut'ina Nation members to conduct annual environmental monitoring.	Monitoring	Benga will provide annual updates on environmental monitoring, management and remediation activities related to its activities over the life of the project. Reporting is required by Statutory Authorities and Benga, to the extent permitted by regulators, will facilitate engagement with Tsuut'ina when reports are filed.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop with Tsuut'ina Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Tsuut'ina.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area.	Tsuut'ina Nation is concerned about inadvertent effects to sacred sites. To prevent this Tsuut'ina Nation recommends a 100 m buffer around all sacred sites including at Waypoint 03.	Potential effects of the project on physical and cultural heritage.	The Tsuut'ina Nation traditional knowledge (TK)/ Traditional Use (TU) Study did not identify the location of Waypoint 03. Benga will continue to work with Tsuut'ina Nation to identify the location of sacred sites and discuss ways to mitigate potential effects including protective measures like fences and buffer zones where appropriate. Benga will arrange for a ceremony to be performed in advance of ground disturbance for construction of the Project. Benga will continue to work with Tsuut'ina Nation through the life of the Project and looks forward to continued discussion of how Tsuut'ina Nation's traditional use in the area can continue.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has requested the location of Waypoint 03, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Tsuut'ina.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area.	The Project will limit access to plants, and potentially damage plant health.	Potential effects of the project on plant gathering.	Benga will continue to work with Tsuut'ina Nation to identify other species of importance for harvesting in advance of construction activities in the Aboriginal Access Management Plan.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual access management plan and will hold a workshop with Tsuut'ina Nation in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Tsuut'ina.
+ -	July 2015 Grassy Mountain Coal Project Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area.	Employment opportunities for Tsuut'ina in all phases of the Project life cycle, particularly for Tsuu T'ina youth.	Potential effects of the project on socio-economic conditions.	Benga and Tsuut'ina Nation are committed and working together to provide employment opportunities for Tsuut'ina Nation members.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the the Tsuut'ina Nation to review this issue, and is scheduling a workshop in the first half of 2018 to discuss the Human Resources Management Plan with the Tsuut'ina Nation.	Ongoing; working with Tsuut'ina.

+ -	July 2015 Grassy Mountain Coal Project Public Report on Tsuut'ina Traditional Knowledge and Use of the Grassy Mountain Area.	The waterbodies adjacent to the project site – Blairmore Creek and Gold Creek, in particular – should be protected and their water quality monitored.	Potential effects of the project on water quality.	As part of the August 2016 Environmental Impact Assessment (EIA) Update, Benga have added additional information and clarification around the Project's Water Management Plan (WMP). This WMP was developed to ensure all water within the mine site is captured in appropriately sized holding ponds that allow for the testing of water quality prior to being released into the surrounding environment. The WMP was assessed to determine potential effects on river flows and water quality in the neighbouring and downstream rivers. The results of the assessment indicate that there will not be any impacts to the environment with the implementation of the WMP. To verify that changes in flow do not affect fish and their habitat, Benga also conducted a detailed Instream Flow Needs study (IFN). Based on the detailed hydrology, groundwater, water quality, and fisheries assessments, no significant residual impacts were identified that would permanently reduce the suitability of the water-ways that are used for traditional use	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Tsuut'ina Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Tsuut'ina.

+ -	Minutes from April 6 2016 Meeting between Tsuut'ina Nation, Benga and CEAA.	Tsuut'ina Nation is concerned about contamination of groundwater. Describe any potential contamination of groundwater aquifers.	Potential effects of the project on groundwater.	The pits will be lined with materials such as clays so there will be no seepage, and the water won't percolate into the groundwater system. By putting water back into the pit, water will naturally want to flow downhill into the natural filtration system. Groundwater monitoring wells will be added to confirm the effectiveness of the Water Management System.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga welcomes feedback on the information provided in the EIA specific to the Water Management Plan. Benga has also met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga also plans to hold a workshop with the Tsuut'ina Nation 3 to 6 months prior to the start of construction to request further input on the plans.	Ongoing; working with Tsuut'ina.

+ -	Minutes from April 6 2016 Meeting between Tsuut'ina Nation, Benga and CEAA.	Tsuut'ina Nation is concerned about losing access and the ability to hunt and gather on the land designated to them in their Treaty rights.	Potential effects of the project on hunting and plant gathering.	Benga provided a conceptual Access Management Plan in the August 2016 update to the Environmental Impact Assessment (EIA). Due to site safety reasons access will be restricted within the Project Permit boundary during construction and operations. This will be enforced by mine operations managers and personnel during the construction and operations phase. Information provided in the Traditional Use Study, including information about wildlife, is considered in the Environmental Impact Assesment (EIA) under potential effects to wildlife and potential effects to hunting.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga reviewed and incorporated the results of the Tsuut'ina Nation traditional use studies into the EIA, however, there were no site specific locations provided. Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Furthermore, Benga has developed a conceptual access management plan and will hold a workshop with Tsuut'ina Nation in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas.	Ongoing; working with Tsuut'ina.

+ -	Minutes from April 6 2016 Meeting between Tsuut'ina Nation, Benga and CEAA.	Tsuut'ina Nation is concerned about waste. What is going into the waste areas identified in the components map? Will there be chemicals in the waste sites?	Project design	Inert waste rock which will be left over after the coal has been extracted. Water quality is being considered heavily in this process. Fines from mining process will be put back into the pit so tailings ponds won't be required. Dumps are oriented north/south instead of the original east/west plan in order to avoid the Blairmore Creek and Gold Creek watersheds and habitats as much as possible. Only rock will be going into the waste piles, but through erosion, chemicals can be leached from the rock. Water that comes into contact with these rocks will be cycled through the pit, and filtered naturally before going back into the environment. There is potential for acid generation which will be mitigated by mixing rock into the pit.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion.	Ongoing; working with Tsuut'ina.

+ -	Minutes from April 6 2016 Meeting betweenTsuut'ina Nation, Benga and CEAA.	Tsuut'ina Nation is concerned about wildlife. Will the project footprint area be fenced off from wildlife?	Potential effects of the project on wildlife.	The results of the Environmental Impact Assessment (EIA) were submitted in 2015 and again after updating in August 2016. The assessment of potential effects to wildlife is considered in Sec E.9.3. Many of the project effects associated with habitat loss and wildlife movement will be minimized through the implementation of the Project's reclamation plan. As seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year. There are currently no plans to fence off the main mine site.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Feedback on the Conservation and Reclamation plan provided in the EIA is welcome and will be incorporated into the next version of the plan. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop with Tsuut'ina Nation in the first half of 2018 to ask for further input on the plan. Additionally, Tsuut'ina Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with Tsuut'ina Nation to gather input on the plan.	Ongoing; working with Tsuut'ina.

+ -	Minutes from Meeting on June 8, 2017 between Tsuut'ina, CEAA and Benga	Tsuut'ina asked about fencing around the water capture ponds. Will wildlife be able to drink from the ponds?	Wildlife	The results of the Environmental Impact Assessment (EIA) were submitted in 2015 and again after updating in August 2016. The assessment of potential effects to wildlife is considered in Sec E.9.3. Many of the project effects associated with habitat loss and wildlife movement will be minimized through the implementation of the Project's reclamation plan. As seen on other mines in Alberta, through proper reclamation, wildlife will and do return to reclaimed mine site areas. Sensory disturbance and habitat loss is expected to occur to elk, deer, and moose during the operations phase, which will cause them to find more suitable areas in the area surrounding the Project site. As the Project will go through progressive reclamation, it is expected that there will be more suitable habitat for wildlife prior to the final end of mine year. There are currently no plans to fence off the main mine site.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Feedback on the Conservation and Reclamation plan provided in the EIA is welcome and will be incorporated into the next version of the plan. Benga has developed a conceptual wildlife monitoring plan and will hold a workshop with Tsuut'ina Nation in the first half of 2018 to ask for further input on the plan. Additionally, Tsuut'ina Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with Tsuut'ina Nation to gather input on the plan.	Ongoing; working with Tsuut'ina.

+ -	Minutes from Meeting on June 8, 2017 between Tsuut'ina, CEAA and Benga	Tsuut’ina Nation would like water monitoring to be continuous. Water is seen as a medicine and has ceremonial use.	Monitoring	High level details of the water monitoring plan are presented in Section 7.0 of the August 2016 Environmental Impact Assessment (EIA) Update. Monitoring frequency will vary depending on the parameters being monitored and the plan will be approved by AER. Water held in storage ponds will always be tested prior to being released to ensure water quality parameters are being met.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Benga has met with the Tsuut'ina Nation to review this issue, and is scheduling a meeting in the first quarter of 2018 to continue the discussion. Benga has developed a conceptual water monitoring plan and will hold a workshop with Tsuut'ina Nation in the first half of 2018 to ask for further input on the plan.	Ongoing; working with Tsuut'ina.

+ -	Minutes from Meeting on June 8, 2017 between Tsuut'ina, CEAA and Benga	Tsuut'ina would like to see the environment revert back to its natural state once the mining is complete. There is some vegetation of interest to Tsuut'ina in the area (e.g. sweet pine, bear root, subalpine fir). Some of this information was documented during Tsuut'ina's TLU assessment. Tsuut'ina Nation would like to be able to access the plants noted in the TLU report.	Reclamation	Section F in the August 2016 Environmental Impact Assessment (EIA) document provides the proposed Conservation and Reclamation (C&R) Plan for the Project. This was provided to Tsuut'ina in August 2016. Section F.1.5 describes the reclamation goals and principles that were incorporated in the C&R and closure plans. Section F.1.6 describes proposed End Land Use goals and includes a commitment that end land use decisions will be made in consultation with Tsuut'ina. Currently, Benga does not have detailed site specific TLU information to incoporate into the plan since it was not provided in the public report. However, Benga will continue to consult with Tsuut'ina and incorporate comments into the final reclamation plan.	Tsuut'ina Nation has indicated that they will review the information and provide additional feedback.	Feedback on the Conservation and Reclamation plan provided in the EIA is welcome and will be incorporated into the next version of the plan. Benga has developed a conceptual access management plan and will hold a workshop with Tsuut'ina Nation in the first half of 2018 to ask for further input on species of importance and access requirements to harvesting areas. Additionally, Tsuut'ina Nation will have an opportunity to provide further input into the Reclamation Plan and into Project activities after detailed engineering has taken place. At that time, Benga will hold a workshop with Tsuut'ina Nation to gather input on the plan.	Ongoing; working with Tsuut'ina.

+ -	Minutes from Meeting on June 8, 2017 between Tsuut'ina, CEAA and Benga	Tsuut'ina Nation indicated that they would like to see permanent workers from each of the Treaty 7 First Nations, gain employment on the project. Would like to be able to access employment and training, especially for higher level positions. Tsuut'ina Nation would like a list of employment positions and opportunities.	Employment and Training	Benga to provide a list of employment opportunities when they are available.	Tsuut'ina Nation is awaiting the list from Benga.	Benga will provide the Tsuut'ina Nation with the requested list of jobs and required qualifications. Benga is scheduling a workshop in the first half of 2018 to discuss the Human Resources Management Plan with the Tsuut'ina Nation.	Ongoing; working with Tsuut'ina.

Appendix A-2: First Nations Consultation Activities

Table H.3.2-1 Chronology of Key Consultation Activities with Kainai Nation (Blood Tribe)

Date	Method of Communication	Topic of Communication
July 15, 2016	Letter by mail	Benga sent a project update newsletter to Kainai Nation by mail.
September 2, 2016	Letter by mail	Benga mailed a copy of the updated Environmental Impact Assessment application that was submitted to regulators in August 2016 and a cover letter to Kainai Nation.
October 25, 2016	Email	Benga provided Kainai Nation with a brief update on the status of the Environmental Impact Assessment (EIA) review by the Alberta Energy Regulator (AER), introduced Kainai Nation to Benga's new Aboriginal Relations representative Erin Slater, and requested Kainai Nation's availability for a project meeting.
October 28, 2016	Meeting	Meeting took place between Benga and Kainai Nation to review project updates. Key discussion points included: Kainai Nation Community events and elections, and the transition to a new Chief and Council. Economic opportunities (contracts, employment) were discussed. Benga provided an update on project activities, and the status of the Alberta Energy Regulator review and joint panel review process with the Canadian Environmental Assessment Agency. Site specific mitigation was discussed, and the need for a ceremony. Benga and Kainai Nation discussed potential timing for a meeting to review issues and concerns, and mitigations. Benga acknowledged receipt of the Statement of Concern (SOC) issued by the Kainai Nation on January 4, 2016, and advised that the SOC will be formally addressed in a response letter from Benga.
November 2, 2016	Email	Benga sent an email to Kainai Nation with the October 28, 2016 meeting notes attached for review and feedback.
November 8, 2016	Meeting	Meeting took place between Benga and Kainai Nation to review Kainai Nation's draft consultation workplan. Items discussed were: updates to phases outlined in the workplan, site specific results of Kainai Nation's Traditional Land Use assessment, and Kainai Nation's review of the Project's Environmental Impact Assessment.

Table H.3.2-1 Chronology of Key Consultation Activities with Kainai Nation (Blood Tribe)

Date	Method of Communication	Topic of Communication
November 25, 2016	Email	Meeting between Benga and Kainai Nation to review the Draft Consultation Plan. The Consultation Plan is to be finalized by early January, 2017. Discussion items included a review of consultation planning and activities; potential timing for a tour of the Blood Tribe reserve and communities; local advertising of project information; site specific Traditional Land Use location data, and timing for a project presentation to the new Chief and Council.
November 29, 2016	Email	Benga provided Kainai Nation with contact information for the contact for land access to the area where the Nation would like to harvest.
November 29, 2016	Email	Benga sent an email with the November 25, 2016 meeting notes and the revised Consultation Workplan for review, and requested a time to follow up and further develop the Consultation Plan.
December 9, 2016	Meeting	Kainai Nation provided Benga a guided tour of the reserve communities. The tour was organized to provide a view of the communities and for project proponents to get a first hand perspective into some of the issues facing Nation members on reserve.
December 15, 2016	Email	Benga sent an email with the December 9, 2016 meeting notes for review.
January 13, 2017	Email	Benga sent an email to Kainai Nation with a copy of the Draft Consultation Workplan, and provided a summary of each phase in the Workplan.
January 27, 2017	Email	Benga sent Kainai Nation a copy of the Draft Consultation Workplan and offered assistance in reviewing.
February 9, 2017	Email	Benga email Kainai Nation the Draft Consultation Workplan, and requested a meeting to discuss the plan.

Table H.3.2-1 Chronology of Key Consultation Activities with Kainai Nation (Blood Tribe)

Date	Method of Communication	Topic of Communication
February 15, 2017	Meeting	Meeting between Benga and Kainai Nation to further develop the Consultation Workplan and review upcoming planning for consultation related tasks.
February 22, 2017	Email	Benga sent the February 15, 2017 meeting notes for review in addition to a copy of the revised Consultation Workplan.
February 23, 2017	Email	Benga sent information related to completed Traditional Land Use fieldwork.
March 13, 2017	Phone call	Benga and Kainai Nation discussed the Consultation Workplan and the timing for a follow up meeting.
April 18 and 21, 2017	Phone call	Benga and Kainai Nation discussed the Consultation Workplan.
May 8, 2017	Email	Benga sent a copy of the Draft Consultation Workplan to Kainai Nation, and requested a phone call to review the document.
May 19, 2017	Meeting	Meeting took place to review project updates, provide Addendums to the Environmental Impact Assessment (EIA), and discuss consultation activities moving forward. Benga hand delivered a USB containing the updated aquatic ecology assessment (Consultant Report #6) and the updated wildlife assessment (Consultant Report #8). Main discussion items included a meeting date for EIA presentation, technical review of the EIA, timing for a project ceremony, a cultural awareness session, and harvesting by the Blood Tribe.
May 23, 2017	Email	Summary of May 19, 2017 meeting discussion points and follow up items sent to Kainai Nation.

Table H.3.2-1 Chronology of Key Consultation Activities with Kainai Nation (Blood Tribe)

Date	Method of Communication	Topic of Communication
June 6, 2017	Meeting	Meeting took place to provide a presentation and summary of the main objectives and results of the Environmental Impact Assessment (EIA, August 2016 version) and to answer questions related to consultation timelines, the technical aspects of the assessment, and follow up programs. Representatives from the Canadian Environmental Assessment Agency (CEAA) attended to provide a consultation process update. Handouts included a hard copy of EIA presentation, and project infrastructure and Crown land maps. Main discussion items were the EIA project presentation which included a review of timelines, project components, overview of construction, operations, reclamation and closure phases and status of Project applications, including federal and provincial approvals; and the development of the monitoring program and adaptive management plans.
June 28, 2017	Email	Benga provided an electronic version of the Environmental Impact Assessment (EIA), the January 2017 Aquatic and Wildlife Addenda, and a copy of the Spring 2017 project newsletter.
July 19, 2017	Hand delivery	Benga delivered a printed copy of the Environmental Impact Assessment.

Table H.4.2-1 Chronology of Key Consultation Activities with Piikani Nation

Date	Method of Communication	Topic of Communication
May 10, 2016	Email	Benga sent the draft meeting notes and presentation slides from meetings with Piikani Nation on April 7, 2016. The email included a tabulated list of questions and answers which were voiced at the April 7th meeting. A table identifying issues and concerns raised by Piikani Nation Members, dated April 7, was also included in the email.
June 15, 2016	Email	A site visit for Benga was arranged but the visit was cancelled due to scheduling conflicts.
June 20, 2016	Email	Community Validation meeting postponed until June 23, 2016.
June 20, 2016	Email	Piikani Nation requested support for a technical review of Benga's updated Environmental Impact Assessment (EIA), and a summary table with descriptions of updates to the EIA and 3) a technical session to discuss EIA updates.
July 13, 2016	Email	Updated technical review report submitted by Piikani Nation.
July 28, 2016	Letter by mail	Benga sent a project update newsletter to Piikani Nation by mail.
September 27, 2016	Email	Benga provided a copy of the updated Environmental Impact Assessment application that was submitted to regulators in August 2016 and a cover letter to Piikani Nation.
November 15, 2017	Email	Email advising Piikani Nation of new contact, Erin Slater at Benga on the Sustainability team.
December 22, 2017	Email	Piikani Nation sent a letter (dated December 15, 2016) outlining plans for on-going consultation with Piikani Nation on the Grassy Mountain Project.
January 10, 2017	Phone call	Benga phoned Piikani Nation to set up a follow up meeting as requested in the December 15, 2016 letter from Piikani Nation. Meeting to take place on January 20, 2017.

Table H.4.2-1 Chronology of Key Consultation Activities with Piikani Nation

Date	Method of Communication	Topic of Communication
January 13, 2017	Email	Email from Benga to Piikani Nation containing a summary of the items discussed during the January 10, 2017 phone call.
January 20, 2017	Phone call	Meeting planned for January 20, 2017 was rescheduled to January 23, 2017.
January 27, 2017	Email	Meeting rescheduled for February 2, 2017.
February 2, 2017	Meeting	Meeting took place between Benga and Piikani Nation to review project updates. Hand delivery of 1 USB containing the Environmental Impact Assessment (EIA, August 2016 update) and Addenda (wildlife and aquatics). Key discussion points were a regulatory update on project activities, and status of the AER review and joint review panel process with CEAA; consultation planning and upcoming tasks related to the EIA technical review workshop planned to discuss issues presented in the summary letter (December 15, 2016); timing and format of an issues and mitigations meeting; and review of the nine issues and recommendations presented in the summary letter and the implementation of a monitoring program.
February 13, 2017	Email	Meeting request for the Environmental Impact Assessment Technical Review workshop sent for March 9-10, 2017.
March 1, 2017	Email	Benga provided Traditional Land Use fieldwork location data for Piikani Nation’s review.
March 2, 2017	Email	Piikani Nation provided a letter (dated February 27, 2017) outlining the process for the technical review sessions.
March 10, 2017	Email	Benga sent a letter (dated March 9, 2017) outlining dates and process for the conference calls and options for a follow up meeting mid April, 2017.
March 20, 2017	Email	Piikani Nation provided questions for the conference call series to be held from March 20-24, 2017.
March 22, 2017	Email	For discussion purposes during the conference calls, Benga provided draft responses to the questions sent by Piikani Nation on March 20, 2017. Benga advised that the responses will be updated after the conference call.
May 1, 2017	Email	Piikani Nation provided comments on a map, and a draft agenda for the May 4, 2017 meeting for Benga’s review.

Table H.4.2-1 Chronology of Key Consultation Activities with Piikani Nation

Date	Method of Communication	Topic of Communication
May 1, 2017	Email	Benga emailed a draft agenda for the Piikani Nation technical session to the Piikani Nation staff and consultants.
May 2, 2017	Email	Benga emailed several documents: Conceptual Offset Plan Memo; Environmental Impact Assessment update Memo; Meeting Agenda; and Questions and Answers for March 22-23, 2017 conference calls.
May 4, 2017	Meeting	Meeting was arranged as a follow up to the community based Technical Review Workshop that took place on May 3, 2017 at Piikani Nation. Intent was to address the nine key issue areas outlined in Piikani Nation's technical review of the Environmental Impact Assessment report, and to discuss what Piikani Nation would like to see in the follow up and monitoring programs.
June 20, 2017	Email	Benga emailed Piikani Nation with a copy of the Environmental Management Plan summary for the Nation's review that included a summary of each plan proposed.
June 28, 2017	Email	Benga emailed electronic files from a mailout sent to Piikani Nation in May 2017, including the August 2016 Environmental Impact Assessment, the January 2017 Aquatic and Wildlife addenda, and the spring 2017 project newsletter.

Table H.5.2-1 Chronology of Key Consultation Activities with Siksika Nation

Date	Method of Communication	Topic of Communication
June 29, 2016	Email	Benga proposed a meeting with Siksika Nation during the week of July 18, 2016 to discuss include comments from Siksika Nation on the Consultation Plan and the issues list.
June 29, 2016	Open house	The Siksika Nation open house was held on the Siksika Nation Reserve in the business Centre. The open house was scheduled between 10:00am and 4:00pm and was set up with several stations that covered: an overview of the project, the regulatory process, baseline studies, Environmental Impact Assessment Valued Components, fish and aquatics, mine components, closure topography, mine progression panel, reclamation plan, assessment of effects on Siksika Nation, and employment opportunities. Approximately 50 Siksika Nation community members attended the open house during the day, and Benga and the Canadian Environmental Assessment Agency were in attendance speaking about the project.
July 22, 2016	Email	Benga requested that Siksika Nation provide a draft Consultation Plan.
July 28, 2016	Letter by mail	Benga sent a project update newsletter to Siksika Nation by mail.
August 11, 2016	Email	A meeting date for August 26, 2016 was confirmed.
August 16, 2016	Email	Siksika Nation requested an update on the status of the Environmental Impact Assessment filing. Benga responded that the filing of the Environmental Impact assessment report is anticipated for August 26, 2016.
August 24, 2016	Email	Benga shared a draft meeting agenda with Siksika Nation and asked if the Nation would like to provide feedback on the agenda topics.
August 26, 2016	Meeting	Benga provided a copy of the updated Environmental Impact Assessment application that was submitted to regulators in August 2016 and a cover letter to Siksika Nation at the meeting. Meeting topics included: reviewing key actions identified from the previous meeting, discussing the submission of the environmental assessment, next steps in the regulatory process, consultation planning, and organizing the open house.

Table H.5.2-1 Chronology of Key Consultation Activities with Siksika Nation

Date	Method of Communication	Topic of Communication
October 3, 2016	Email	The Siksika Nation requested access for two-day site-visit for a supplemental traditional use study. Benga responded that accommodating access to the site would not be a problem.
October 17, 2016	Email	Benga sent an email to Siksika Nation which provided details regarding site access for traditional land use fieldwork.
October 18, 2016	Email	Siksika Nation and Benga confirmed fieldwork dates.
October 25, 2016	Phone call	Phone call between Cal Clark from Benga and Scotty Many Guns, from Siksika Nation. Traditional land use fieldwork planned for October 27-28 cancelled due to weather conditions.
November 15, 2016	Email	Email from Benga to Siksika Nation introducing Erin Slater as part of the Benga team supporting Aboriginal and Community Consultation.
November 23, 2016	Email	Benga provided Erin Slater's contact information and introduced her role on the project team. Benga requested Siksika Nation's availability for a project meeting.
December 9, 2016	Email	Benga emailed Siksika Nation a copy of the Conveyor - the Grassy Mountain Fall 2016 Community Newsletter (Vol. 4 Issue 4).
December 16, 2016	Email	Benga requested a meeting date with Siksika Nation.
January 27, 2017	Email	Benga and Siksika Nation confirmed the time and location for a meeting on February 10, 2017.
February 10, 2017	Meeting (via conference call)	Conference call took place with Benga and Siksika Nation to review the Consultation Workplan and consultation steps moving forward. Main discussion items included; 1) Project regulatory updates on the AER and Joint Panel Review process 2) Consultation process and planning with Siksika Nation 4) traditional land use assessment fieldwork
February 10, 2017	Email	Benga sent Siksika Nation the Grassy Mountain First Nation Consultation Plan and Draft Consultation Workplan for Siksika Nation.
March 9, 2017	Phone call	Benga and Siksika Nation confirmed a time and location for a meeting on March 10, 2017.

Table H.5.2-1 Chronology of Key Consultation Activities with Siksika Nation

Date	Method of Communication	Topic of Communication
March 10, 2017	Meeting	Meeting took place between Benga and Siksika Nation to discuss project updates, provide addenda to the Environmental Impact Assessment (EIA), and discuss consultation activities moving forward. Hand delivery of USB containing the updated aquatic ecology assessment (Consultant Report #6) and the updated wildlife assessment (Consultant Report #8). Main discussion items included: the Traditional Land Use assessment and the Consultation Workplan.
March 15, 2017	Email	Siksika Nation requested archaeological information related to the project. Benga responded that they would help get the HRIA information as soon as possible.
March 15, 2017	Email	Benga sent an updated version of the Consultation Workplan to Siksika Nation.
March 20, 2017	Email	Siksika Nation requested contact information for the federal agency working on the file. Benga provided the contact information for the Panel Manager at the Canadian Environmental Assessment Agency.
March 21, 2017	Phone call	Benga and Siksika Nation discussed the Consultation Workplan.
March 27, 2017	Email	Benga provided Section E 13 of the Environmental Impact Assessment including a summary of the Historic Resources Impact Assessment in response to Siksika Nation's request for archaeological information on March 15, 2017.
March 31, 2017	Email	Benga sent an updated version of the Consultation Workplan to Siksika Nation.
April 6, 2017	Email	Benga confirmed that Siksika Nation received Traditional Knowledge/Traditional Land Use information and quarter section spreadsheet. Benga offered to review the information.
May 11, 2017	Email	Benga emailed Siksika Nation to inform them that the consultation workplan has been approved as well as the request for blankets.
May 15, 2017	Phone call	Benga and Siksika Nation discussed the approval of the consultation workplan, and the request for ceremonial blankets. Discussed potential meeting dates and locations.

Table H.5.2-1 Chronology of Key Consultation Activities with Siksika Nation

Date	Method of Communication	Topic of Communication
May 17, 2017	Email	Benga emailed Siksika Nation to request a meeting on June 1 2017, and to propose discussion points for their call the next day. The Siksika Nation responded and indicated that they could meet June 2 2017.
May 18, 2017	Email	Benga proposed dates for fieldwork planning and the cultural awareness session.
May 29, 2017	Email	Benga emailed the Siksika Nation to request updates to the consultation work plan, confirm method of delivery for the newsletter, and get approval of the Traditional Land Use workplan.
June 5, 2017	Email	Benga emailed Siksika Nation with information and scheduling details for Traditional Land Use field work and the Cultural Session.
June 15, 2017	Phone call	Benga and Siksika Nation discussed arrangements and agenda for the cultural session.
June 19, 2017	Email	Siksika Nation emailed Benga with an agenda for the June 23 2017 cross cultural presentation.
June 24, 2017	Email	Siksika Nation emailed Benga with an invitation to a shared Dropbox folder titled "Siksika Saikiminakssin Grassy Mtn Site Tour June 2014".
June 26, 2017	Email	Siksika Nation emailed Benga to request a list of attendees from the June 23 2017 meeting.
June 27, 2017	Email	Benga provided a list of the attendees from the June 23 meeting, and also attached the agenda for the Siksika Nation.
June 28, 2017	Email	Benga emailed the Siksika Nation the materials which were provided in a May mailout, including the August 2016 Environmental Impact Assessment, the January 2017 Aquatic and Wildlife Addenda, and the spring 2017 project newsletter.
July 6, 2017	Email	The Siksika Nation emailed Benga to ask for copies of the Joint Review Panel's Environmental Assessment report, the Draft Review Panel Terms of Reference, the Joint Review Panel Agreement, the Environmental Impact Statement (EIS), and the EIS summary.
July 17, 2017	Email	Benga emailed Siksika Nation to propose a meeting in the following two weeks to discuss upcoming fieldwork, to notify them of fieldwork arrangements the first week of August, to ask how they should deliver the printed Environmental Impact Assessment (EIA), and to propose a meeting to present the EIA.

Table H.5.2-1 Chronology of Key Consultation Activities with Siksika Nation

Date	Method of Communication	Topic of Communication
July 28, 2017	Email	The Siksika Nation called to set up a meeting time to discuss fieldwork planning. Meeting time and date were determined for August 4, 2017.
August 4, 2017	Meeting	Benga and the Siksika Nation met to discuss the upcoming Traditional Land Use fieldwork and to provide Siksika Nation with a printed copy of the Environmental Impact Assessment (EIA) and EIA Summary.
August 7, 2017	Email	Benga emailed the Siksika Nation with fieldwork details agreed to at the Aug 4, 2017 meeting.
August 9, 2017	Email	Benga emailed the Siksika Nation to provide the notes from their meeting on August 4, 2017, and request any revisions that are required. Benga also included a workplan for Traditional Land Use fieldwork which required a signature from Siksika Nation.

Table H.6.2-1 Chronology of Key Consultation Activities with Stoney Nakoda Nation

Date	Method of Communication	Topic of Communication
July 28, 2016	Mail	Benga sent a project update newsletter to the Stoney Nakoda Nation by mail.
September 2, 2016	Mail	Benga mailed a copy of the updated Environmental Impact Assessment application that was submitted to regulators in August 2016 and a cover letter to the Stoney Nakoda Nation.
November 15, 2016	Email	Email from Benga to the Stoney Nakoda Nation introducing Erin Slater as part of the Benga team supporting Aboriginal and Community Consultation.
November 30, 2016	Email	Benga sent an email to the Stoney Nakoda Nation requesting a project meeting.
December 9, 2016	Email	Benga emailed the Stoney Nakoda Nation a copy of the "Conveyor - the Grassy Mountain Fall 2016 Community Newsletter (Vol. 4 Issue 4)".
January 12, 2017	Email	Meeting took place between Benga and the Stoney Nakoda Nation to discuss project updates, status of the Environmental Impact Assessment (EIA) and consultation activities moving forward. Main discussion items included: activities and events in which Stoney Nation is involved, Project Regulatory updates and status of the AER review and joint panel review process, the consultation process and planning with Stoney Nation, technical review of the EIA, place naming and trail signage within Project area, and Cultural assessment of the Project area.
January 20, 2017	Email	Benga sent the January 12, 2017 meeting notes for review, and a copy of the Piikani Nation Technical Review of the Environmental Impact Assessment for the Siksika Nation's information. Benga requested a meeting to discuss the development of a Nation specific consultation workplan.
February 28, 2017	Email	Benga asked about potential meeting dates to discuss consultation activities including, development of a consultation workplan, technical review of the Environmental Impact Assessment, and issues, concerns and mitigations.

Table H.6.2-1 Chronology of Key Consultation Activities with Stoney Nakoda Nation

Date	Method of Communication	Topic of Communication
March 18, 2017	Meeting	Meeting took place between Benga and the Stoney Nakoda Nation to discuss project updates, provide addenda to the Environmental Impact Assessment (EIA) and consultation activities moving forward. Hand delivery of USB containing the updated aquatic ecology assessment (Consultant Report #6) and the updated wildlife assesment (Consultant Report #8). Main items discussed included project regulatory updates, timing for a meeting to review the updated version of the EIA and Canadian Environmental Assessment Agency (CEAA) process, consultation planning, completion of a Cultural Assessment Overview (CAO), and Benga's community-based programs.
March 23, 2017	Email	Benga proposed dates for the Environmental Impact Assessment (EIA) update review and meeting with the Canadian Environmental Assessment Agency (CEAA).
March 31, 2017	Email	Benga asked the Stoney Nakoda Nation about a time to discuss the fieldwork completed for the Project.
April 3, 2017	Phone call	Phone call from Benga to the Stoney Nakoda Nation. Benga called as a follow up to the discussion about the discussion of fieldwork at the March 18, 2017 meeting. The Stoney Nakoda Nation indicated that the report included in the Environmental Impact Assessment was based on a site tour of the Project area. A Cultural Assessment Overview (CAO) has not yet been completed for the Project area. Stoney Nation would like the opportunity to complete fieldwork for the project, and harvesting was one of the recommendations outlined in the report. As a follow up, the Stoney Nakoda Nation will check about the status of the reporting. Benga indicated that a CAO can be scheduled during the upcoming field season. Benga also advised that they would provide copies of the files and reporting related to the site tour if needed.
April 4, 2017	Phone call	Benga reviewed the history of the Stoney Nation Traditional Knowledge/Traditional Use report. Benga offered to resend access to the report and other information for the Nation's review. The Stoney Nakoda Nation agreed to the offer.
April 11, 2017	Email	The Stoney Nakoda Nation sent a draft report prepared for the Project Environmental Impact Assessment. The report was based on the results of the site tour that took place in July 2015.

Table H.6.2-1 Chronology of Key Consultation Activities with Stoney Nakoda Nation

Date	Method of Communication	Topic of Communication
April 28, 2017	Meeting	Assessment updates presentation and an overview of the Canadian Environmental Assessment Agency (CEAA) process. Handouts provided: meeting Agenda, 11x17 hard copy maps of Project area with Crown land and proposed infrastructure, hard copy of project Environmental Impact Assessment (EIA) update presentation. Attendees from CEAA: Brett Maracle and Candace Anderson. Agenda included an EIA update presentation and CEAA presentation with discussion.
June 29, 2017	Email	Benga emailed the Stoney Nakoda Nation to provide a draft Crown land map which included details related to the project infrastructure. Benga indicated that they would draft a workplan for fieldwork and send it to the Stoney Nakoda Nation soon.
June 30, 2017	Email	Benga emailed the Stoney Nakoda Nation to provide meeting notes from meetings on March 18, 2017 and April 24, 2017 for their review.

Table H.7.2-1 Chronology of Key Consultation Activities with Tsuut'ina Nation

Date	Method of Communication	Topic of Communication
June 8, 2016	Email	Benga sent draft notes from the meeting held on June 1, 2016, asking that changes be submitted by June 22, 2016.
August 13, 2016	Mail	Benga sent a project update newsletter to the Tsuut'ina Nation by mail.
August 16, 2016	Email	The Tsuut'ina Nation emailed Benga to request a copy of the Piikani Nation third party technical review document, and to request information regarding any updates regarding the environmental assessment application in response to Canadian Environmental Assessment Agency requirements.
August 16, 2016	Email	Benga emailed a copy of the updated version of the Piikani Nation third party technical review.
September 2, 2016	Mail	Benga mailed a copy of the updated Environmental Impact Assessment application that was submitted to regulators in August 2016 and a cover letter to Tsuut'ina Nation.
November 15, 2016	Email	Benga introduced Erin Slater as part of the Benga team supporting Aboriginal and Community Consultation.
November 16, 2016	Email	Benga requested a potential project meeting date.
November 30, 2016	Email	Automatic email reply from Tsuut'ina Nation advising that Tonya Crowchild was no longer an employee of Tsuut'ina Nation. Provided Violet Meguinis and Declan Starlight as alternate contacts.
December 9, 2017	Email	Benga emailed Tsuut'ina Nation a copy of the "Conveyor - the Grassy Mountain Fall 2016 Community Newsletter (Vol. 4 Issue 4)".
March 3, 2017	Phone call	Benga asked about Tsuut'ina Nation's availability to meet on Friday March 10, 2017.
March 9, 2017	Email	Benga asked about Tsuut'ina Nation's availability to meet on Friday March 10, 2017 or March 17, 2017.

Table H.7.2-1 Chronology of Key Consultation Activities with Tsuut'ina Nation

Date	Method of Communication	Topic of Communication
March 10, 2017	Meeting	Meeting took place between Benga and Tsuut'ina Nation to discuss project updates. Benga hand delivered an electronic version (USB) of Addendum to the Grassy Mountain, Environmental Impact Assessment including an updated aquatic ecology assessment and summary and an updated wildlife assessment. They discussed project and regulatory updates, changes to the consultation department and organization under the newly appointed Chief and Council, general project updates and activities, information sharing within the community, status of traditional land use fieldwork.
March 13, 2017	Email	As a follow up items from the March 10, 2017 meeting, Benga sent a digital copy of the delivery verification form for the Environmental Impact Assessment addendum provided at the March 10, 2017 meeting and advised that a second USB and project update letter is forthcoming. Benga provided contact information for Brett Maracle (Canadian Environmental Assessment Agency) and requested dates for a follow up meeting.
April 4, 2017	Email	Erin Slater from Benga Mining requested a meeting on April 21, 2017 in advance of the meeting with the Canadian Environmental Assessment Agency in May.
April 21, 2017	Meeting	A meeting took place with to plan for upcoming consultation activities and to discuss project updates. Main discussion items included: changes within the Tsuut'ina Nation's consultation department; Violet Meguinis confirming her role as acting Director of Tsuut'ina consultation; provincial and federal consultation process and the Environmental Impact Assessment; planning for consultation activities including an project ceremony; and status of traditional land use fieldwork.
April 24, 2017	Email	Benga sent the March 10, 2017 meeting notes to the Tsuut'ina Nation for review and comment. As a follow up to the April 21, 2017 meeting, Benga indicated that they would advise on the Canadian Environmental Assessment Agency 's availability to meet in June, and send the April 21, 2017 meeting notes and draft consultation workplan as soon as possible.
May 15, 2017	Email	As a follow up to the April 21, 2017 meeting, Benga advised of the Canadian Environmental Assessment Agency's availability to meet June 2, 2017; sent a draft consultation workplan with tasks associated to steps in the consultation process and offered assistance to develop the plan further; asked about the timing for the project ceremony; asked about the status of the Traditional Land Use fieldwork; and sent the Piikani Environmental Impact Assessment Technical Review report. Benga requested a phone call with Tsuut'ina Nation to discuss the proposed June 2, 2017 meeting and the project information provided.

Table H.7.2-1 Chronology of Key Consultation Activities with Tsuut'ina Nation

Date	Method of Communication	Topic of Communication
May 18, 2017	Email	Benga accepted Tsuut'ina Nation's alternate proposed meeting date of June 8, 2017.
May 18, 2017	Email	Tsuut'ina Nation proposed that the project ceremony take place on June 15, 2017.
May 23, 2017	Email	Benga confirmed the ceremony date of June 15, 2017, and provided safety information related to the ceremony.
May 25, 2017	Email	The Tsuut'ina Nation provided an overview of the cultural importance and rationale for the ceremony.
June 8, 2017	Meeting	A meeting took place to provide a presentation and summary of the main objectives and results of the Grassy Mountain Environmental Impact Assessment (EIA, August 2016 version) and to answer questions related to consultation timelines, the technical aspects of the assessment and follow up programs. Representatives from the Canadian Environmental Assessment Agency (CEAA) participated to provide a consultation process update. Hard copy hand outs included a hard copy of EIA presentation, project infrastructure and Crown land map (June, 2017), and a Project newsletter (Spring 2017 Issue).
June 12, 2017	Email	Benga sent Tsuut'ina Nation the June 8, 2017 meeting sign in sheet, Environmental Impact Assessment presentation, and a link to the Canadian Environmental Assessment Agency 's portal where public information about the project can be accessed. Benga confirmed logistical details and protocols for the ceremony on June 15, 2017.
June 15, 2017	Ceremony	A pipe ceremony was conducted by Tsuut'ina Nation at Gold Creek. Benga staff participated in the ceremony which was held to mitigate the impact of the project on the land, environment, wildlife and people working on or in relation to the project.
June 15, 2017	Email	Benga emailed the Tsuut'ina Nation as a follow up to discussions about Traditional Land Use fieldwork planning. Benga requested a time to meet to review fieldwork requirements and proposed meeting on June 26, June 29 or June 30, 2017.
June 15, 2017	Email	Benga emailed the Tsuut'ina Nation to provide some options for dates/times to meet in June and review the locations where fieldwork has taken place and where Traditional Land Use fieldwork needs to be completed. Benga indicated that if none of the proposed times works, she could propose some dates in July.

Table H.7.2-1 Chronology of Key Consultation Activities with Tsuut'ina Nation

Date	Method of Communication	Topic of Communication
June 28, 2017	Email	Benga emailed the Tsuut'ina Nation to provide electronic copies of files sent in a project mailout in May: the August 2016 Environmental Impact Assessment, 2017 Aquatic and Wildlife addenda, and the spring 2017 project newsletter.
July 5, 2017	Email	Benga offered to deliver a draft workplan for fieldwork the following Friday and confirm fieldwork logistics and the locations.
July 19, 2017	Phone call	Benga called the Tsuut'ina Nation to discuss fieldwork planning and logistics, and to confirm plans.
July 20, 2017	Email	Benga emailed the Tsuut'ina Nation to provide fieldwork details, and indicated Benga would send them a workplan for review and signature.
July 24, 2017	Email	Benga emailed the Tsuut'ina Nation to provide the Traditional Land Use workplan for Violet's review and signature.
July 24, 2017	Phone call	Benga called the Tsuut'ina Nation to discuss plans for the Traditional Land Use fieldwork on July 26-28 2017.
July 31, 2017	Email	The Tsuut'ina Nation emailed Benga to indicate that some medicinal plants had been found, and recommended site visits to look into it further.
July 31, 2017	Email	Benga responded to the Tsuut'ina Nation's email to say that they were open to discussing the medicinal plant findings, and that any recommendations should be included in the field report to provide to Cal Clark (Benga) for consideration.
August 2, 2017	Email	Benga emailed the Tsuut'ina Nation to ask if they would like a short meeting the coming Friday to follow up on the fieldwork that took place the previous week.
August 11, 2017	Email	The Tsuut'ina Nation emailed Benga to enquire about timing for harvesting a rare plant found during fieldwork.

Appendix A-3: GW Seepage Conceptual Plan

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Memo

To:	<Name>, <Company>	**Client:**	Benga Mining
From:		**Project No:**	1CM029.011
Cc:	<Name>, <Company>	**Date:**	January 14, 2016
Subject:	Evaluation of Waste Rock Seepage Collection and Pit Lake Level Control Options, Grassy Mountain		

1 Waste Rock Seepage Collection

1.1 Background

The Grassy Mountain Coal Project (the Projects) water and load balance model accounts for direct precipitation, surface and groundwater flow, evaporation and transpiration and calculates water quality parameter loadings from developed mine areas, including waste rock, open pits and product stockpiles. The focus of the water management strategy is to control the inventory of mine water stored on site, maximize separation of clean and contact water and to pass water with elevated selenium and nitrate concentrations through saturated portions of in-pit waste rock dumps to facilitate attenuation of these parameters in this anoxic environment.

Model runs suggest that, with the mine in full operation, and applying a conservative assumption of no attenuation of selenium between the waste rock dumps and discharge points on Blairmore Creek, approximately 95% capture of waste rock–sourced selenium would be required to meet Blairmore Creek low-flow water quality objectives at compliance point B-1.

This memo summarizes a preliminary evaluation of the options available for collection of waste rock seepage, and presents conceptual-level costing for the preferred alternatives.

1.2 Coal Waste Rock Dumps – Water Balance and Seepage Collection

1.2.1 Bare dumps

A significant amount of practical experience has been gained in dealing with waste rock seepage in the Elk Valley coal mining area. The experience with unlined coal waste rock dumps of significant thickness (e.g. >30 m) is that percolation through the dump is a lengthy process and that seasonal variations in recharge to the sumps is attenuated significantly, hence vertical accretion of recharge to the saturated base of the waste rock dump is relatively even, favouring infiltration to the foundation of the waste rock dump, with relatively little reporting to the toe as seepage along the former ground surface where dumps are unlined and not equipped with underdrains. Figure 1, drawn from the Elk Valley Water Quality Management Plan (Teck, 2014), suggests a typical waste rock dump without cover or enhanced basal drainage will pass approximately 50% of mean annual precipitation (MAP), or more, to the foundation as infiltration. This will vary, of course, dependant on a number of factors, including intensity of precipitation events, waste rock composition, foundation permeability, slope and regularity. It is also noted that the proportion of infiltration would typically be greater during wet years and lower during dry years.

1.2.2 Lining and use of enhanced foundation drainage

A significant amount of research has been undertaken on the use of rock drains at the base of coal waste dumps, notably to pass clean surface water below the piles without significant water quality effects (e.g. Piteau, 1998). The research has demonstrated that rock underdrains constructed of durable, non-acid generating rock, with 90% coarser than 30 cm diameter generally function well with little degradation in performance over the periods monitored. The experience in the U.S, has been that the drains must usually be constructed along the drainage courses in advance of dump construction with purpose-sourced durable rock. However the coal mines in mountainous regions of British Columbia and Alberta typically produce waste rock that is durable, hence use of end dumping techniques for waste rock generally provides for a good basal drainage layer for dumps > 20 m thickness.

There has been limited use of liners in these settings, due to the cost, and also due technical issues with dump settlement and basal movement and placement of liners on slopes.

1.2.3 Groundwater collection

The stability issues with coal waste rock dumps noted above has resulted in exclusion zones being placed around these dumps in the Elk Valley, which typically extend out several hundred meters. Hence groundwater monitoring and groundwater collection works are difficult or impossible to establish and maintain in this exclusion zone.

1.3 Grassy Mountain - Creek Baseflows

At the Grassy mountain site, mean annual precipitation is estimated at 628 mm and mean annual lake evaporation is estimated at 738 mm (Hydrology assessment, Consultant Report #4 [CR#4]). Regional groundwater recharge is estimated at 123 mm, or 3.9 L/s/km^2 (CR#4).

Numerical groundwater modelling undertaken to date suggests that at EOM, approximately 23% of the baseflow at gauging station B1 (formerly BL-01) will have originated from mine areas, most of that from rock disposal areas. At gauging station B2 (formerly BL-02), it is estimated that approximately 7% of baseflow will have originated from mine areas. In contrast, at Gold Creek gauging station G2 (formerly GC-01), only 3% of baseflow will have originated from mine areas. This is largely due to the position of the ex-pit waste rock dumps largely within the Blairmore Creek watershed.

In addition, limited site-specific creek gauging data for 2014 suggests that Gold Creek, at gauging station GC-01 receives 2.5 to 3 times the baseflow per unit area than does Blairmore Creek at gauging station BL-02. Potential reasons for the difference in baseflow include:

- Gold Creek watershed average elevation to GC-01 is higher than BL-02, resulting in higher precipitation and lower potential evapotranspiration, hence higher water surplus;
- The eastern Gold Creek watershed includes a large area of talus, which should favor infiltration;
- The Gold Creek water shed includes a large clear-cut area (about 12.5 km^2), which should increase recharge and runoff.

The estimates of baseflow reporting to Blairmore and Gold Creeks will be updated with the new mine plan and an updated hydrogeological calibration, which includes a more detailed recharge distribution. Estimates of recharge applied to uncovered waste rock areas will also be increased. The net result will likely be:

- Substantially increased baseflow to Gold Creek;
- A higher proportion of mine-influenced baseflow reporting to Blairmore Creek.

Blairmore Creek will receive a much higher proportion of selenium loadings than Gold Creek, hence seepage reduction and capture from the western margins of the North and South Waste Rock dumps will become critical for this creek.

1.4 Grassy Mountain Waste Rock Dumps – Water Balance and Seepage Collection

1.4.1 Seepage Reduction and Capture

Estimates of seepage generation from ex-pit waste rock dumps have been used as the basis for estimating costs associated with recovery of this seepage. Costing has been undertaken with a preference for passive seepage reduction and seepage collection measures, in view of the substantial reduction in operational costs. During the operational phase of these dumps, seepage generation will be somewhat greater than during the closure phase, where waste rock dumps have been fully re-contoured, and re-vegetated to enhance runoff and evapotranspiration.

1.4.2 North Rock Disposal Area

The North Rock Disposal Area (NRDA) is situated to conform with the upper catchment of a tributary which drains to Blairmore Creek. The dump toes generally coincide with the ridges of the catchment, hence little run-on is anticipated to this dump and runoff is also expected to be lower than is typical. As a result, infiltration into the foundation of this dump is expected to be enhanced, with relatively low rates of runoff. Given the presence of a well-developed drainage under the dump, it is anticipated that some basal drainage reporting to the downstream toe of the pile may be extracted through the development of a permeable basal layer through end dumping practices. It is anticipated that seepage will drain to the southwest, towards Blairmore Creek hence seepage capture would be restricted to a zone approximately 525 m in length, or less. However, monitoring could be required along the entire perimeter not draining to the pit (approximately 3700 m).

Reclamation will begin between Years 9 and 11, and will commence on the northwest and west margins of the NRDA, gradually expanding to the southeast. The area will be substantially built out by Year 15. The waste rock will be re-contoured to include maximum slopes of 3V:1H.

Operational Phase

A preliminary estimate of percolation reporting to the toe of the NRDA in this manner is 10% of MAP (63 mm), leaving 40% of MAP (251 mm) to infiltrate the foundation of the dump. This represents an estimated 147 mm (141%) increase in recharge over a pre-dump natural annual groundwater recharge estimate of about 104 mm, or 16.5% of MAP (Appendix 10B). The remaining precipitation would evaporate, sublimate or runoff. At full buildout, with an area of 252 Ha, this represents an annual volume of 633,024 m^3, or 20 L/s. This remaining seepage would need to be collected dominantly through the use of groundwater capture wells situated downslope and to the west of the NRDA. The increased recharge reporting to the dump foundation would result in a mounding of the water table directly under, and peripheral to the dump, notably to the west. As noted previously, active groundwater seepage capture systems would need to be sited several hundred meters downslope of the waste rock dump. We have assumed an average depth to groundwater of 20 m downslope of the North Dump during the operational phase.

Estimates of potential seepage recovery well yields have been based on using site hydraulic testing data (average horizontal hydraulic conductivity (K_h) is assumed to be 1 x 10^{-6} m/s. Using simple analytical Theis equations which do not consider variability in the subsurface environment in a significant manner. Assuming seepage-affected groundwater does not extend 40 m below water table, recovery wells extending this distance below water table would be expected to yield an average of about 1 L/s.

Seepage capture wells would consist of 150 mm PVC wells, extending ~ 40 m below water table, with a 24 m slotted section, and with filter gravel placed in the annular space to just above water table. In a homogeneous environment, and given the annual recharge rate, the radius of influence of these wells would be on the order of about 250 - 300 m over the long term. We estimate a required well spacing at a minimum of approximately 100 m to approach 95% seepage capture, with infill installations (e.g. at 50 m intervals) where monitoring indicates this is necessary.

Figure 1 Expected zones of required seepage capture

Groundwater monitoring upstream of, between and downstream of the seepage capture wells would be required to (1) refine the capture well network design and (2) confirm that adequate capture is occurring. The upstream monitoring network could be installed first, and the capture well network (well design, placement and depth) designed on the basis of the hydraulic data obtained from the monitoring wells and on the basis of the water level and quality data. Seepage capture wells will not be installed until upstream monitoring wells indicate the presence of constituents which exceed water quality objectives.

The monitoring wells between and downstream of the capture wells would be installed at the same time as the capture well network. Both monitoring networks would be used to confirm hydraulic capture is occurring and to monitor level of critical contaminants (e.g. selenium). Analytical costs may be reduced if early monitoring determines that critical contaminant concentrations are proportional to a low-cost monitoring parameter (e.g. fluid electrical conductivity).

We have assumed a spacing of 200 m for monitoring wells, and that each monitoring well will extend 30 m below water table.

1.4.3 South Rock Disposal Area

Like the NRDA, the SRDA largely overlies a tributary catchment which drains to Blairmore Creek, while a portion of this dump drains to Gold Creek. Some basal drainage reporting to the downstream toe of the pile may be extracted through the development of a permeable basal layer through end dumping practices.

It is anticipated that seepage will drain to the east from the eastern margin south of the pit and also to a tributary of Blairmore Creek to the west-southwest, as shown in Figure 1. Seepage capture would be required across both areas, with a total of about 2075 m, or less. However, monitoring would be required along the entire perimeter not draining to the pit (approximately 5750 m).

Operational Phase

We have assumed a similar water balance for the SRDA relative to the NRDA. While the drainage is not as well developed as in the NRDA, the water table is higher in this area, hence an estimated 10% of MAP seepage would report to the toe of the dump, leaving 35% of MAP (219 mm) to infiltrate the foundation of the dump. 15% of MAP is estimated to run off the dump. At full buildout, with an area of 349 Ha, this represents an annual infiltration volume of 764,310 m^3, or 24 L/s. This remaining seepage would need to be collected dominantly through the use of groundwater capture wells situated downslope and to the west of the SRDA. The increased recharge reporting to the dump foundation would result in a mounding of the water table directly under, and peripheral to the dump, notably to the west. It is anticipated that a higher proportion of seepage may be captured using interception ditches, given the elevated water table at this location, and fewer seepage capture wells as a result. We have assumed an average depth to groundwater of 5 m downslope of the North Dump during the operational phase.

1.5 Capital and Operating Costs

As shown in Table 1, total capital costs, without contingency, are estimated at about $6.79M. Seepage capture wells and monitoring wells capital costs are estimated at $2.0M and $1.9M, respectively.

Operating costs are estimated at $1.8M annually during the operational phase and $1.2M during the closure phase, based on an estimated reduction of 50% of the monitoring effort, and 50% reduction in the seepage collection.

The largest costs include seepage capture well maintenance, replacement and power costs and seepage monitoring and monitoring well replacement and augmentation costs. The potential requirement for ongoing active seepage capture and treatment is uncertain and will depend largely on the effectiveness of the waste rock cover, basal drainage and intrinsic attenuation of critical parameters.

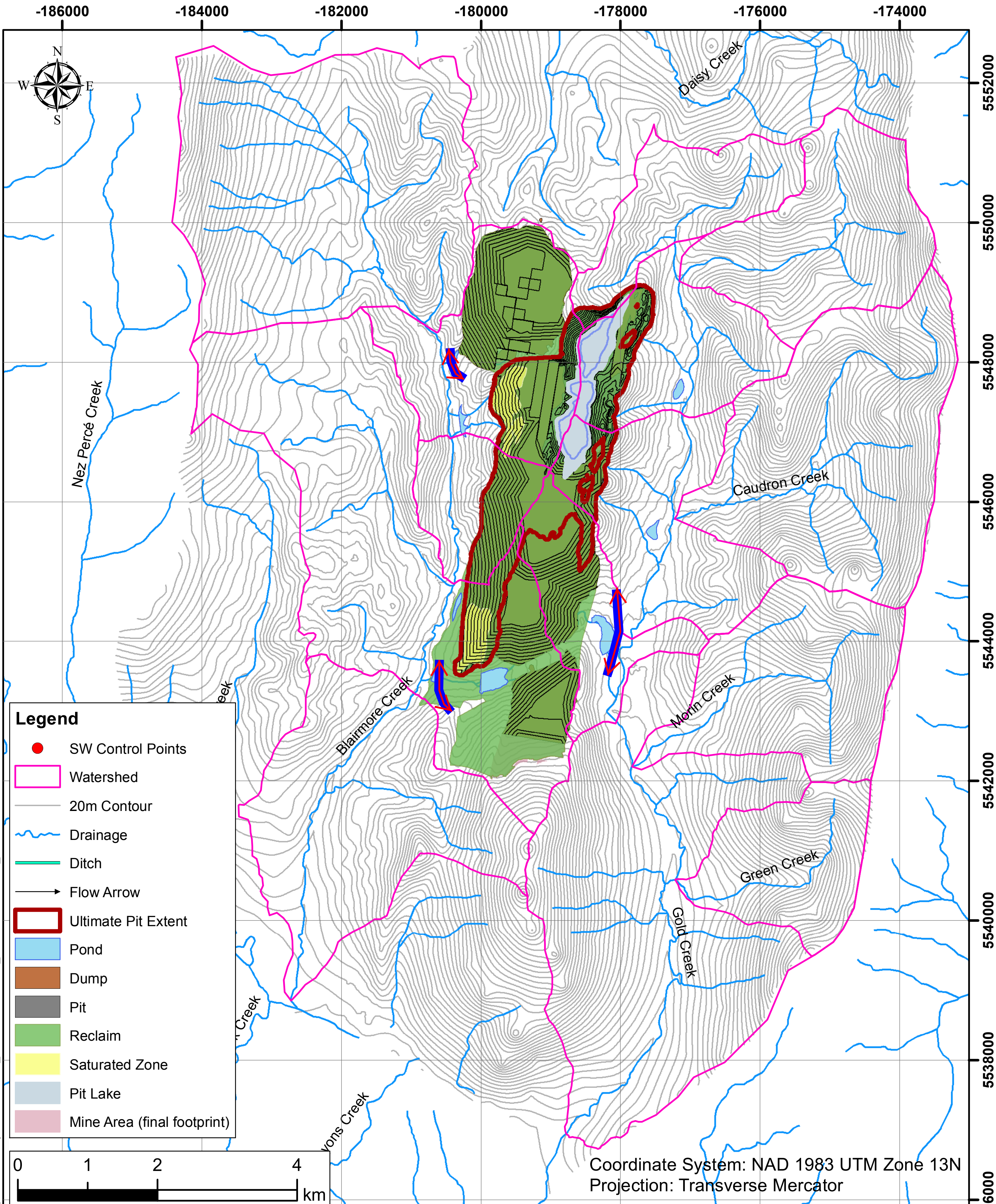
Table 1 Estimated capital and operating costs, seepage reduction and collection

Item	Estimated Capital Cost ($M)	Estimated Annual Operating Cost, Operational Phase ($M)	Estimated Annual Operating Cost, Closure Phase ($M)
1.0 Seepage collection ditches	0.19	0.01	0.01
2.0 Seepage monitoring wells	1.94	0.34	0.17
3.0 Seepage capture wells	1.97	0.34	0.17
4.0 Pipeline	0.10	0.01	0.01
5.0 Power Infrastructure	0.26	0.06	0.03
7.0 Engineering	2.33	0.10	0.08
Total	**6.79**	**0.86**	**0.47**

2 References

Piteau Engineering Ltd., 1997. Rock Drain Research Program. Final report, March 1997.

Teck Resources Ltd., 2014. Elk Valley Water Quality Plan.



srk consulting

Water Quality Prediction Model

Probable zones of required seepage capture

Job No: 1CM029.010

Filename: ModeledYears_AD2

Grassy Mountain Coal Project

Date:	Approved:	Figure:
July 19, 2016		1

Path: \\VAN-SVR0\Projects\01_SITES\Grassy Mountain\!040_AutoCAD\GIS\MXD_Files\ModeledYears_AD2.mxd

Appendix A-4: Hydrology Data

Provided electionically

Appendix A-5: Water Quality Data

Table 100-1

		Input to Goldsim Model		BC-W01 2013 MAY Spring	BC-W01 2013 JULYH High Water	BC-W01 2013 JULYR Summer	BC-W01 2013 SEPT Fall	BC-W01 2014 AUG Summer	BC-W01 2016 March Winter	GC-W01 2014 April Spring	GC-W01 2013 JulyR Summer	GC-W01 2013 Sept Fall	GC-W01 2014 August Summer	CC-W01 2016 March Winter	CC-W01 2016 May Spring
		Average	P95												
Date Sampled				5/28/2013 4:54:00 PM	7/3/2013 8:30:00 AM	7/24/2013 9:35:00 AM	9/24/2013 10:03:00 AM	8/29/2014 2:20:00 PM	3/18/2016	4/1/2014 6:20:00 PM	7/23/2013 2:27:00 PM	9/23/2013 11:50:00 AM	8/29/2014 3:30:00 PM	3/22/2016	5/18/2016
Analyte	Units														
Major Nutrients															
Ammonia, Total (as N)	mg/L	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
Nitrate and Nitrite (as N)	mg/L	*0.085*	*0.164*	*0.071*	*0.071*	*0.071*	*0.071*	*0.054*	*0.05*	0.108	*0.071*	*0.071*	*0.054*	0.15	0.18
Nitrate (as N)	mg/L	*0.072*	*0.164*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.02*	0.108	*0.05*	0.053	*0.05*	0.150	0.18
Nitrite (as N)	mg/L	*0.01*	*0.01*	*0.05*	*0.05*	*0.05*	*0.05*	*0.02*	*0.01*	*0.05*	*0.05*	*0.05*	*0.02*	*0.01*	*0.01*
Total Kjeldahl Nitrogen	mg/L	*0.21*	*0.24*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.20*	0.21	*0.2*	*0.2*	*0.2*	*0.2*	0.27
Phosphorus (P)-Total Dissolved	mg/L	0.0027	0.0041	0.0036	0.0036	0.0043	0.0018	0.0038	0.0036	0.0019	0.0015	0.001	*0.001*	0.0031	0.0027 *
Phosphorus (P)-Total	mg/L	0.0053	0.0119	0.0162	0.0084	0.0059	0.0029	0.0052	0.0049	0.0023	0.0022	0.0022	0.0045	0.0056	0.0037
Biochemical Oxygen Demand	mg/L	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Major Ions															
Calcium (Ca)-Dissolved	mg/L	50.3	61.4	30.5	47.1	58.1	57.2	54.5	65.50	50.9	50.5	49.8	50.7	42.8	46.2
Magnesium (Mg)-Dissolved	mg/L	10.9	12.3	5.89	10.5	12.1	11.7	11.3	12.60	11.6	11.5	10.7	11.2	10.4	10.8
Potassium (K)-Dissolved	mg/L	0.63	0.94	0.556	0.83	0.937	0.74	0.94	0.67	*0.5*	0.404	*0.5*	*0.5*	*0.5*	*0.5*
Sodium (Na)-Dissolved	mg/L	3.1	6.0	2.68	3.9	5.28	5.2	5.5	6.70	1.8	1.67	1.3	1.5	*1*	*1*
Bicarbonate (HCO3)	mg/L	185	223	123	188	219	227	218	216.00	188	187	190	186	146	136
Carbonate (CO3)	mg/L	*5.3*	*6.7*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	6.2	*5*	7.3
Chloride (Cl)	mg/L	0.425	0.618	0.28	0.34	0.43	0.75	0.51	0.51	0.48	0.27	0.26	0.27	*0.5*	*0.5*
Hydroxide (OH)	mg/L	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*	*5*
Sulfate (SO4)	mg/L	19.4	25.1	9.76	21.3	24.5	19	18.9	19.60	25.8	20.3	21.6	21	19.2	11.7
Sulphide	mg/L	*0.0018167*	*0.002*	*0.002*	*0.002*	*0.002*	*0.002*	*0.0015*	*0.0015*	*0.002*	*0.002*	*0.002*	*0.0015*	*0.0015*	0.0018
Dissolved Metals															
Aluminum (Al)-Dissolved	mg/L	0.005	0.014	0.0134	*0.01*	*0.001*	0.0011	0.015	0.0123	0.0033	*0.001*	*0.001*	0.0013	*0.001*	0.0011
Antimony (Sb)-Dissolved	mg/L	*0.00013*	*0.00024*	*0.0001*	*0.0004*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*
Arsenic (As)-Dissolved	mg/L	0.00019	0.00032	0.0002	*0.0004*	0.00025	0.00022	0.00022	0.00016	0.00012	0.00013	0.00012	0.00015	0.00015	0.00016
Barium (Ba)-Dissolved	mg/L	0.08	0.13	0.0777	0.124	0.131	0.124	0.125	0.1100	0.0517	0.0584	0.0534	0.0653	0.0281	0.0276
Beryllium (Be)-Dissolved	mg/L	*0.00044*	*0.00073*	*0.0005*	*0.001*	*0.0005*	*0.0005*	*0.0005*	*0.000100*	*0.0005*	*0.0005*	*0.0005*	*0.0005*	*0.0001*	*0.0001*
Boron (B)-Dissolved	mg/L	*0.015*	*0.032*	*0.01*	*0.05*	0.015	0.014	0.017	0.014	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*	*0.01*
Cadmium (Cd)-Dissolved	mg/L	0.000013	0.000030	0.000013	*0.00005*	*0.00001*	*0.00001*	0.000014	0.000012	*0.00001*	*0.00001*	*0.00001*	*0.00001*	*0.000005*	*0.000005*
Chromium (Cr)-Dissolved	mg/L	*0.00052*	*0.00234*	*0.0001*	*0.005*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	0.00014	*0.0001*	0.00011	*0.0001*	0.00016	0.00012
Cobalt (Co)-Dissolved	mg/L	0.00027	0.0010	0.00018	*0.002*	0.00011	*0.0001*	*0.0001*	0.000110	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*
Copper (Cu)-Dissolved	mg/L	0.00039	0.0011	0.00105	0.0011	0.00048	0.00026	0.00047	0.00041	0.00018	0.00012	*0.0001*	0.00012	*0.0002*	*0.0002*
Iron (Fe)-Dissolved	mg/L	0.0243	0.0300	0.022	*0.01*	*0.01*	*0.03*	*0.03*	*0.03*	*0.03*	*0.01*	*0.03*	*0.03*	*0.03*	*0.03*
Lead (Pb)-Dissolved	mg/L	*0.000054*	*0.000073*	*0.00005*	*0.0001*	*0.00005*	*0.00005*	*0.00005*	*0.00005*	*0.00005*	*0.00005*	*0.00005*	*0.00005*	*0.00005*	*0.00005*
Lithium (Li)-Dissolved	mg/L	*0.0042*	*0.0050*	*0.005*	0.0039	*0.005*	*0.005*	*0.005*	0.0033	*0.005*	*0.005*	*0.005*	*0.005*	0.0016	0.0012
Manganese (Mn)-Dissolved	mg/L	0.0048	0.0079	0.00695 *	0.0108	0.00206	*0.005*	*0.005*	*0.005*	*0.005*	0.000407	*0.005*	*0.005*	*0.005*	*0.005*
Mercury (Hg)-Dissolved	ug/L	0.00028	0.00048	-	-		-	-	*DL*	*0.0005*		*0.00005*		DL	DL
Molybdenum (Mo)-Dissolved	mg/L	0.0011	0.0029	0.000558	*0.005*	0.000861	0.000851	0.000856	0.000758	0.000765	0.000657	0.000731	0.000674	0.00120	0.000676
Nickel (Ni)-Dissolved	mg/L	0.00066	0.00156	0.00108	0.0021	0.00111	0.00073	0.00066	0.00052	0.00017	0.00022	0.00018	0.00016	*0.0005*	*0.0005*
Selenium (Se)-Dissolved	mg/L	0.00078	0.00123	0.00064	0.00083	0.0006	0.00045	0.00042	0.000798	0.0011	0.00072	0.00076	0.00064	0.00139	0.00098
Silver (Ag)-Dissolved	mg/L	*0.000018*	*0.000050*	*0.00001*	*0.0001*	*0.00001*	*0.00001*	*0.00001*	*0.00001*	*0.00001*	*0.00001*	*0.00001*	*0.00001*	*0.00001*	*0.00001*
Thallium (Tl)-Dissolved	mg/L	*0.000044*	*0.000073*	*0.00005*	*0.0001*	*0.00005*	*0.00005*	*0.00005*	*0.00001*	*0.00005*	*0.00005*	*0.00005*	*0.00005*	*0.00001*	*0.00001*
Tin (Sn)-Dissolved	mg/L	*0.0043*	*0.0226*	*0.0001*	*0.05*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*	*0.0001*
Titanium (Ti)-Dissolved	mg/L	0.00038	0.00077	0.00058	*0.001*	*0.0003*	*0.0003*	*0.0003*	*0.0003*	*0.0003*	*0.0003*	*0.0003*	*0.0003*	*0.0003*	*0.0003*
Uranium (U)-Dissolved	mg/L	0.00044	0.00060	0.000236	0.00043	0.000595	0.000605	0.000596	0.000587	0.000449	0.000368	0.000349	0.000341	0.000433	0.000309
Vanadium (V)-Dissolved	mg/L	0.00033	0.00073	0.00015	*0.001*	0.00022	0.00013	0.00017	*0.000500*	0.0002	0.00019	0.00016	0.00022	*0.0005*	*0.0005*
Zinc (Zn)-Dissolved	mg/L	0.0033	0.0056	0.0064	0.0026	*0.001*	*0.005*	*0.005*	0.0010	*0.005*	*0.001*	*0.005*	*0.005*	*0.001*	*0.001*

Notes: **Green** font indicate concentration equal to analytical detection limit

Appendix A-6: Human Health Risk Assessment Data

TABLE SIR 172-1: Predicted Hazard Quotients from Inhalation of Metals

Criteria Air Contaminant	Aluminum			Antimony			Arsenic			Cadmium			Chromium			Copper			Mercury			Nickel			Selenium			Vanadium		
Averaging Time	1 hour			1 hour			1 hour			1 hour			1 hour			1 hour			1 hour			1 hour			1 hour			1 hour		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	3.39E-04	3.68E-04	3.68E-04	3.41E-05	8.10E-06	3.42E-05	1.01E-01	1.00E-01	1.01E-01	6.60E-05	4.16E-05	6.62E-05	2.51E-04	1.85E-04	2.52E-04	9.56E-05	6.17E-05	9.59E-05	4.11E-05	9.18E-06	4.12E-05	2.18E-02	4.88E-03	2.19E-02	1.07E-05	2.40E-06	1.08E-05	3.65E-04	2.61E-04	3.66E-04
FL-MPOI	5.38E-05	3.07E-04	3.07E-04	5.40E-06	7.03E-06	7.03E-06	1.53E-02	8.33E-02	8.33E-02	9.82E-06	3.62E-05	3.62E-05	3.66E-05	1.61E-04	1.62E-04	1.42E-05	5.37E-05	5.37E-05	6.51E-06	7.97E-06	7.97E-06	3.46E-03	4.23E-03	4.23E-03	1.70E-06	2.08E-06	2.08E-06	5.34E-05	2.28E-04	2.28E-04
R1	1.30E-05	1.34E-04	1.34E-04	1.08E-06	3.09E-06	3.09E-06	3.81E-03	3.64E-02	3.64E-02	2.34E-06	1.60E-05	1.60E-05	9.14E-06	7.09E-05	7.09E-05	3.41E-06	2.37E-05	2.37E-05	1.30E-06	3.50E-06	3.50E-06	6.91E-04	1.86E-03	1.86E-03	3.40E-07	9.13E-07	9.13E-07	1.32E-05	1.00E-04	1.00E-04
R2	1.38E-05	2.52E-06	1.54E-05	9.92E-07	5.59E-08	1.02E-06	3.95E-03	6.84E-04	4.38E-03	2.15E-06	2.64E-07	2.32E-06	8.80E-06	1.25E-06	9.59E-06	3.15E-06	3.96E-07	3.40E-06	1.19E-06	6.39E-08	1.22E-06	6.34E-04	3.40E-05	6.48E-04	3.12E-07	1.67E-08	3.19E-07	1.26E-05	1.75E-06	1.37E-05
R3	1.03E-05	7.43E-05	7.46E-05	8.32E-07	1.93E-06	1.99E-06	2.91E-03	2.02E-02	2.03E-02	1.66E-06	8.52E-06	8.67E-06	6.35E-06	3.73E-05	3.79E-05	2.41E-06	1.26E-05	1.28E-05	1.00E-06	2.21E-06	2.29E-06	5.31E-04	1.18E-03	1.22E-03	2.61E-07	5.78E-07	5.98E-07	9.21E-06	5.27E-05	5.36E-05
R4	4.34E-06	1.15E-06	5.45E-06	3.09E-07	2.62E-08	3.12E-07	1.24E-03	3.11E-04	1.54E-03	6.65E-07	1.22E-07	7.81E-07	2.73E-06	5.70E-07	3.28E-06	9.73E-07	1.80E-07	1.15E-06	3.72E-07	3.00E-08	3.75E-07	1.98E-04	1.59E-05	1.99E-04	9.71E-08	7.84E-09	9.80E-08	3.91E-06	7.95E-07	4.68E-06
R5	6.77E-06	1.69E-06	7.58E-06	4.38E-07	3.80E-08	4.51E-07	1.93E-03	4.58E-04	2.15E-03	1.04E-06	1.78E-07	1.12E-06	4.26E-06	8.39E-07	4.66E-06	1.52E-06	2.65E-07	1.65E-06	5.26E-07	4.35E-08	5.41E-07	2.79E-04	2.31E-05	2.87E-04	1.37E-07	1.13E-08	1.41E-07	6.10E-06	1.17E-06	6.66E-06
R6	1.15E-05	1.47E-04	1.48E-04	9.06E-07	4.41E-06	4.43E-06	3.26E-03	4.02E-02	4.02E-02	1.91E-06	1.87E-05	1.88E-05	7.42E-06	8.16E-05	8.18E-05	2.78E-06	2.77E-05	2.77E-05	1.09E-06	5.08E-06	5.11E-06	5.78E-04	2.70E-03	2.71E-03	2.84E-07	1.33E-06	1.33E-06	1.07E-05	1.15E-04	1.16E-04
R7	1.05E-05	9.22E-05	9.24E-05	6.35E-07	2.66E-06	2.75E-06	3.01E-03	2.55E-02	2.55E-02	1.66E-06	1.17E-05	1.17E-05	6.75E-06	5.12E-05	5.13E-05	2.43E-06	1.73E-05	1.73E-05	7.56E-07	3.10E-06	3.21E-06	4.01E-04	1.65E-03	1.70E-03	1.97E-07	8.10E-07	8.38E-07	9.68E-06	7.24E-05	7.24E-05
R8	1.19E-05	2.96E-04	2.96E-04	9.84E-07	6.65E-06	6.65E-06	3.50E-03	8.19E-02	8.19E-02	2.14E-06	3.62E-05	3.62E-05	8.37E-06	1.61E-04	1.62E-04	3.11E-06	5.37E-05	5.37E-05	1.18E-06	7.49E-06	7.49E-06	6.26E-04	3.97E-03	3.98E-03	3.08E-07	1.95E-06	1.96E-06	1.21E-05	2.28E-04	2.28E-04
R9	5.38E-05	1.49E-05	5.82E-05	2.96E-06	3.82E-07	3.06E-06	1.49E-02	4.13E-03	1.60E-02	6.46E-06	1.87E-06	6.78E-06	2.90E-05	8.24E-06	3.08E-05	9.59E-06	2.76E-06	1.01E-05	3.56E-06	4.35E-07	3.67E-06	1.89E-03	2.31E-04	1.95E-03	9.29E-07	1.13E-07	9.57E-07	4.09E-05	1.16E-05	4.33E-05
R10	4.62E-05	4.97E-06	4.69E-05	5.40E-06	1.24E-07	5.42E-06	1.40E-02	1.35E-03	1.42E-02	9.82E-06	5.87E-07	9.91E-06	3.66E-05	2.59E-06	3.70E-05	1.42E-05	8.69E-07	1.43E-05	6.51E-06	1.42E-07	6.53E-06	3.46E-03	7.53E-05	3.47E-03	1.70E-06	3.70E-08	1.71E-06	5.34E-05	3.65E-06	5.39E-05
R11	5.32E-05	3.06E-06	5.58E-05	3.66E-06	7.62E-08	3.70E-06	1.53E-02	8.31E-04	1.60E-02	8.52E-06	3.51E-07	8.79E-06	3.45E-05	1.54E-06	3.58E-05	1.24E-05	5.19E-07	1.29E-05	4.42E-06	8.73E-08	4.46E-06	2.35E-03	4.63E-05	2.37E-03	1.15E-06	2.28E-08	1.16E-06	4.95E-05	2.18E-06	5.13E-05
R12	2.68E-05	8.09E-06	2.92E-05	1.53E-06	2.08E-07	1.55E-06	7.65E-03	2.25E-03	8.29E-03	4.08E-06	1.01E-06	4.33E-06	1.68E-05	4.48E-06	1.80E-05	5.97E-06	1.50E-06	6.35E-06	1.85E-06	2.36E-07	1.86E-06	9.80E-04	1.25E-04	9.89E-04	4.82E-07	6.17E-08	4.86E-07	2.40E-05	6.32E-06	2.57E-05
R13	1.99E-05	5.82E-06	2.06E-05	2.01E-06	1.53E-07	2.03E-06	5.94E-03	1.62E-03	6.14E-03	3.93E-06	7.33E-07	4.02E-06	1.49E-05	3.23E-06	1.53E-05	5.68E-06	1.09E-06	5.82E-06	2.42E-06	1.75E-07	2.44E-06	1.29E-03	9.29E-05	1.30E-03	6.32E-07	4.57E-08	6.38E-07	2.17E-05	4.57E-06	2.22E-05
R14	1.09E-05	3.07E-04	3.07E-04	9.23E-07	7.03E-06	7.03E-06	3.20E-03	8.33E-02	8.33E-02	1.98E-06	3.58E-05	3.58E-05	7.70E-06	1.59E-04	1.59E-04	2.87E-06	5.31E-05	5.31E-05	1.11E-06	7.97E-06	7.97E-06	5.88E-04	4.23E-03	4.23E-03	2.89E-07	2.08E-06	2.08E-06	1.11E-05	2.24E-04	2.24E-04

TABLE SIR 172-2: Predicted Hazard Quotients from Inhalation of Metals

COPC	Aluminum			Antimony			Arsenic			Barium		
Averaging Time	Annual			Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	5.24E-05	1.91E-04	1.92E-04	3.14E-05	1.49E-05	3.15E-05	2.43E-01	8.19E-01	8.21E-01	1.71E-03	7.16E-04	1.71E-03
FL-MPOI	9.76E-06	1.58E-04	1.58E-04	4.79E-06	1.22E-05	1.23E-05	4.46E-02	6.75E-01	6.77E-01	2.59E-04	5.86E-04	5.97E-04
R1	3.24E-07	4.20E-05	4.23E-05	7.91E-08	3.53E-06	3.61E-06	1.42E-03	1.80E-01	1.81E-01	4.21E-06	1.72E-04	1.76E-04
R2	4.92E-07	1.93E-07	6.84E-07	1.97E-07	1.67E-08	2.12E-07	2.22E-03	8.25E-04	3.04E-03	1.06E-05	8.18E-07	1.13E-05
R3	2.33E-07	2.12E-05	2.15E-05	8.09E-08	1.78E-06	1.87E-06	1.04E-03	9.10E-02	9.20E-02	4.34E-06	8.69E-05	9.12E-05
R4	1.46E-07	7.95E-08	2.25E-07	5.58E-08	6.14E-09	6.17E-08	6.54E-04	3.40E-04	9.95E-04	3.00E-06	2.99E-07	3.29E-06
R5	2.33E-07	1.30E-07	3.63E-07	9.01E-08	1.01E-08	9.99E-08	1.05E-03	5.55E-04	1.60E-03	4.85E-06	4.94E-07	5.32E-06
R6	2.40E-07	1.02E-04	1.02E-04	8.01E-08	1.06E-05	1.07E-05	1.07E-03	4.36E-01	4.37E-01	4.30E-06	5.29E-04	5.33E-04
R7	2.46E-07	4.84E-05	4.86E-05	7.31E-08	4.16E-06	4.22E-06	1.09E-03	2.07E-01	2.08E-01	3.90E-06	2.06E-04	2.09E-04
R8	1.42E-06	1.54E-04	1.56E-04	2.21E-07	1.21E-05	1.23E-05	6.14E-03	6.61E-01	6.67E-01	1.14E-05	5.86E-04	5.97E-04
R9	3.83E-06	2.99E-06	6.81E-06	6.85E-07	3.02E-07	9.44E-07	1.66E-02	1.28E-02	2.94E-02	3.58E-05	1.50E-05	4.84E-05
R10	9.76E-06	8.13E-07	1.05E-05	4.79E-06	7.73E-08	4.86E-06	4.46E-02	3.49E-03	4.76E-02	2.59E-04	3.82E-06	2.63E-04
R11	2.22E-06	3.86E-07	2.59E-06	9.82E-07	3.52E-08	1.01E-06	1.01E-02	1.66E-03	1.17E-02	5.30E-05	1.73E-06	5.45E-05
R12	2.75E-06	1.55E-06	4.19E-06	5.40E-07	1.48E-07	6.73E-07	1.20E-02	6.66E-03	1.82E-02	2.83E-05	7.34E-06	3.49E-05
R13	2.41E-06	1.13E-06	3.49E-06	7.42E-07	1.08E-07	8.36E-07	1.07E-02	4.85E-03	1.53E-02	3.97E-05	5.36E-06	4.43E-05
R14	2.83E-07	1.58E-04	1.58E-04	6.81E-08	1.22E-05	1.23E-05	1.24E-03	6.75E-01	6.77E-01	3.61E-06	5.86E-04	5.90E-04

COPC	Beryllium (threshold)			Beryllium (carcinogenic)			Cadmium			Chromium (II/III)		
Averaging Time	Annual			Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	4.66E-05	1.92E-05	4.66E-05	1.63E-03	-	-	1.81E-02	3.88E-02	3.90E-02	8.27E-03	2.13E-02	2.14E-02
FL-MPOI	7.08E-06	1.57E-05	1.60E-05	2.48E-04	-	-	3.09E-03	3.20E-02	3.21E-02	1.45E-03	1.75E-02	1.76E-02
R1	1.14E-07	4.62E-06	4.72E-06	4.01E-06	-	-	7.90E-05	8.60E-03	8.68E-03	4.03E-05	4.70E-03	4.74E-03
R2	2.90E-07	2.20E-08	3.09E-07	1.01E-05	-	-	1.44E-04	3.91E-05	1.83E-04	6.89E-05	2.14E-05	9.04E-05
R3	1.18E-07	2.33E-06	2.45E-06	4.14E-06	-	-	6.36E-05	4.34E-03	4.41E-03	3.10E-05	2.37E-03	2.41E-03
R4	8.18E-08	8.02E-09	8.94E-08	2.86E-06	-	-	4.18E-05	1.61E-05	5.79E-05	2.02E-05	8.83E-06	2.90E-05
R5	1.32E-07	1.33E-08	1.45E-07	4.63E-06	-	-	6.71E-05	2.62E-05	9.33E-05	3.24E-05	1.44E-05	4.68E-05
R6	1.17E-07	1.43E-05	1.44E-05	4.10E-06	-	-	6.50E-05	2.13E-02	2.14E-02	3.20E-05	1.15E-02	1.16E-02
R7	1.06E-07	5.54E-06	5.62E-06	3.72E-06	-	-	6.48E-05	9.88E-03	9.94E-03	3.22E-05	5.40E-03	5.43E-03
R8	3.09E-07	1.57E-05	1.60E-05	1.08E-05	-	-	3.18E-04	3.13E-02	3.16E-02	1.67E-04	1.72E-02	1.73E-02
R9	9.72E-07	4.04E-07	1.31E-06	3.40E-05	-	-	8.69E-04	6.26E-04	1.50E-03	4.56E-04	3.39E-04	7.94E-04
R10	7.08E-06	1.03E-07	7.17E-06	2.48E-04	-	-	3.09E-03	1.69E-04	3.24E-03	1.45E-03	9.17E-05	1.53E-03
R11	1.45E-06	4.66E-08	1.49E-06	5.06E-05	-	-	6.73E-04	7.98E-05	7.49E-04	3.19E-04	4.34E-05	3.61E-04
R12	7.70E-07	1.98E-07	9.45E-07	2.69E-05	-	-	6.48E-04	3.23E-04	9.46E-04	3.35E-04	1.75E-04	4.97E-04
R13	1.08E-06	1.44E-07	1.21E-06	3.78E-05	-	-	6.42E-04	2.35E-04	8.62E-04	3.18E-04	1.28E-04	4.39E-04
R14	9.81E-08	1.57E-05	1.58E-05	3.43E-06	-	-	7.01E-05	3.20E-02	3.21E-02	3.56E-05	1.75E-02	1.76E-02

COPC	Chromium (VI)			Cobalt			Copper			Lead		
Averaging Time	Annual			Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	2.97E-02	-	-	7.69E-03	3.17E-03	7.71E-03	3.65E-04	8.04E-04	8.06E-04	1.05E-03	2.29E-03	2.30E-03
FL-MPOI	5.54E-03	-	-	1.17E-03	2.59E-03	2.64E-03	6.24E-05	6.62E-04	6.64E-04	1.80E-04	1.89E-03	1.89E-03
R1	1.84E-04	-	-	1.89E-05	7.62E-04	7.80E-04	1.62E-06	1.78E-04	1.80E-04	4.63E-06	5.07E-04	5.12E-04
R2	2.79E-04	-	-	4.79E-05	3.63E-06	5.11E-05	2.91E-06	8.09E-07	3.72E-06	8.36E-06	2.31E-06	1.07E-05
R3	1.32E-04	-	-	1.96E-05	3.85E-04	4.05E-04	1.29E-06	8.99E-05	9.12E-05	3.71E-06	2.56E-04	2.60E-04
R4	8.26E-05	-	-	1.35E-05	1.32E-06	1.48E-05	8.48E-07	3.33E-07	1.18E-06	2.43E-06	9.50E-07	3.38E-06
R5	1.32E-04	-	-	2.18E-05	2.19E-06	2.39E-05	1.36E-06	5.44E-07	1.90E-06	3.91E-06	1.55E-06	5.46E-06
R6	1.36E-04	-	-	1.94E-05	2.36E-03	2.37E-03	1.32E-06	4.41E-04	4.42E-04	3.79E-06	1.26E-03	1.26E-03
R7	1.40E-04	-	-	1.76E-05	9.15E-04	9.28E-04	1.32E-06	2.04E-04	2.06E-04	3.79E-06	5.83E-04	5.87E-04
R8	8.03E-04	-	-	5.11E-05	2.59E-03	2.64E-03	6.54E-06	6.47E-04	6.54E-04	1.87E-05	1.85E-03	1.86E-03
R9	2.17E-03	-	-	1.61E-04	6.68E-05	2.16E-04	1.79E-05	1.29E-05	3.08E-05	5.11E-05	3.69E-05	8.80E-05
R10	5.54E-03	-	-	1.17E-03	1.70E-05	1.18E-03	6.24E-05	3.49E-06	6.54E-05	1.80E-04	9.96E-06	1.88E-04
R11	1.26E-03	-	-	2.39E-04	7.70E-06	2.46E-04	1.36E-05	1.65E-06	1.52E-05	3.91E-05	4.71E-06	4.36E-05
R12	1.56E-03	-	-	1.27E-04	3.27E-05	1.56E-04	1.33E-05	6.67E-06	1.95E-05	3.80E-05	1.90E-05	5.56E-05
R13	1.37E-03	-	-	1.79E-04	2.38E-05	1.99E-04	1.31E-05	4.85E-06	1.76E-05	3.75E-05	1.38E-05	5.05E-05
R14	1.60E-04	-	-	1.62E-05	2.59E-03	2.61E-03	1.43E-06	6.62E-04	6.64E-04	4.10E-06	1.89E-03	1.89E-03

COPC	Manganese			Mercury			Molybdenum			Nickel (threshold)		
Averaging Time	Annual			Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	5.19E-04	1.90E-03	1.90E-03	3.02E-05	1.24E-05	3.03E-05	8.64E-07	3.56E-07	8.65E-07	4.58E-02	1.89E-02	4.59E-02
FL-MPOI	9.66E-05	1.56E-03	1.56E-03	4.59E-06	1.02E-05	1.04E-05	1.31E-07	2.91E-07	2.97E-07	6.97E-03	1.55E-02	1.57E-02
R1	3.20E-06	4.16E-04	4.19E-04	7.43E-08	2.99E-06	3.06E-06	2.12E-09	8.56E-08	8.76E-08	1.13E-04	4.54E-03	4.65E-03
R2	4.87E-06	1.91E-06	6.78E-06	1.88E-07	1.43E-08	2.00E-07	5.38E-09	4.08E-10	5.73E-09	2.85E-04	2.16E-05	3.04E-04
R3	2.31E-06	2.10E-04	2.12E-04	7.68E-08	1.51E-06	1.59E-06	2.20E-09	4.33E-08	4.55E-08	1.16E-04	2.29E-03	2.41E-03
R4	1.44E-06	7.87E-07	2.23E-06	5.31E-08	5.20E-09	5.80E-08	1.52E-09	1.49E-10	1.66E-09	8.05E-05	7.89E-06	8.80E-05
R5	2.31E-06	1.28E-06	3.59E-06	8.58E-08	8.60E-09	9.39E-08	2.45E-09	2.46E-10	2.69E-09	1.30E-04	1.30E-05	1.43E-04
R6	2.37E-06	1.00E-03	1.01E-03	7.60E-08	9.25E-06	9.31E-06	2.17E-09	2.64E-07	2.66E-07	1.15E-04	1.40E-02	1.41E-02
R7	2.44E-06	4.79E-04	4.81E-04	6.89E-08	3.59E-06	3.65E-06	1.97E-09	1.03E-07	1.04E-07	1.05E-04	5.45E-03	5.53E-03
R8	1.40E-05	1.53E-03	1.54E-03	2.01E-07	1.02E-05	1.04E-05	5.73E-09	2.91E-07	2.97E-07	3.04E-04	1.55E-02	1.57E-02
R9	3.79E-05	2.96E-05	6.74E-05	6.30E-07	2.62E-07	8.50E-07	1.80E-08	7.50E-09	2.43E-08	9.56E-04	3.98E-04	1.29E-03
R10	9.66E-05	8.05E-06	1.04E-04	4.59E-06	6.67E-08	4.65E-06	1.31E-07	1.91E-09	1.33E-07	6.97E-03	1.01E-04	7.05E-03
R11	2.19E-05	3.82E-06	2.56E-05	9.39E-07	3.03E-08	9.64E-07	2.68E-08	8.65E-10	2.76E-08	1.42E-03	4.59E-05	1.46E-03
R12	2.72E-05	1.54E-05	4.15E-05	4.99E-07	1.28E-07	6.13E-07	1.43E-08	3.67E-09	1.75E-08	7.57E-04	1.94E-04	9.30E-04
R13	2.39E-05	1.12E-05	3.46E-05	7.01E-07	9.35E-08	7.82E-07	2.00E-08	2.67E-09	2.24E-08	1.06E-03	1.42E-04	1.19E-03
R14	2.80E-06	1.56E-03	1.56E-03	6.36E-08	1.02E-05	1.03E-05	1.82E-09	2.91E-07	2.93E-07	9.65E-05	1.55E-02	1.56E-02

COPC	Nickel (carcinogenic)			Selenium			Uranium			Vanadium		
Averaging Time	Annual			Annual			Annual			Annual		
Receptor Location	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application	Project	Baseline	Application
RSA-MPOI	2.08E-02	8.58E-03	2.09E-02	3.94E-07	1.62E-07	3.95E-07	6.33E-03	2.01E-03	6.33E-03	3.20E-02	1.92E-02	3.21E-02
FL-MPOI	3.17E-03	7.02E-03	7.16E-03	6.00E-08	1.33E-07	1.36E-07	6.64E-04	1.55E-03	1.58E-03	3.58E-03	1.53E-02	1.53E-02
R1	5.12E-05	2.06E-03	2.11E-03	9.70E-10	3.91E-08	4.00E-08	1.20E-05	2.75E-04	2.87E-04	7.23E-05	3.43E-03	3.50E-03
R2	1.30E-04	9.84E-06	1.38E-04	2.45E-09	1.86E-10	2.62E-09	1.58E-05	4.34E-07	1.61E-05	9.83E-05	1.17E-05	1.10E-04
R3	5.29E-05	1.04E-03	1.10E-03	1.00E-09	1.98E-08	2.08E-08	9.48E-06	1.16E-04	1.25E-04	5.57E-05	1.63E-03	1.68E-03
R4	3.66E-05	3.59E-06	4.00E-05	6.93E-10	6.79E-11	7.58E-10	3.93E-06	1.59E-07	4.08E-06	2.57E-05	4.79E-06	3.05E-05
R5	5.91E-05	5.93E-06	6.48E-05	1.12E-09	1.12E-10	1.23E-09	7.20E-06	2.63E-07	7.46E-06	4.54E-05	7.83E-06	5.32E-05
R6	5.24E-05	6.38E-03	6.42E-03	9.93E-10	1.21E-07	1.22E-07	9.30E-06	1.16E-03	1.17E-03	5.47E-05	1.06E-02	1.07E-02
R7	4.75E-05	2.48E-03	2.51E-03	9.00E-10	4.69E-08	4.76E-08	7.46E-06	4.46E-04	4.53E-04	4.72E-05	4.43E-03	4.47E-03
R8	1.38E-04	7.02E-03	7.16E-03	2.62E-09	1.33E-07	1.36E-07	6.52E-05	1.52E-03	1.58E-03	3.75E-04	1.47E-02	1.51E-02
R9	4.35E-04	1.81E-04	5.86E-04	8.23E-09	3.43E-09	1.11E-08	1.29E-04	9.40E-06	1.36E-04	7.89E-04	1.97E-04	9.57E-04
R10	3.17E-03	4.60E-05	3.21E-03	6.00E-08	8.71E-10	6.07E-08	6.64E-04	2.12E-06	6.66E-04	3.58E-03	5.16E-05	3.63E-03
R11	6.47E-04	2.09E-05	6.65E-04	1.23E-08	3.95E-10	1.26E-08	1.04E-04	9.26E-07	1.05E-04	5.95E-04	2.41E-05	6.18E-04
R12	3.44E-04	8.84E-05	4.23E-04	6.52E-09	1.67E-09	8.01E-09	8.21E-05	4.31E-06	8.58E-05	5.22E-04	9.97E-05	6.13E-04
R13	4.83E-04	6.45E-05	5.39E-04	9.15E-09	1.22E-09	1.02E-08	9.38E-05	3.06E-06	9.60E-05	5.48E-04	7.22E-05	6.21E-04
R14	4.39E-05	7.02E-03	7.07E-03	8.31E-10	1.33E-07	1.34E-07	9.08E-06	1.55E-03	1.56E-03	5.60E-05	1.53E-02	1.53E-02

Appendix B-1: Geotechnical Data

Identification	East	North	TD (m)	Bedrock Depth (m)	Groundwater Depth (2) (m)	Type	Piezometer	Location	Date	Notes	Company
#02	682850	5500023	6.10		Dry @ TD	Solid Stem Auger		Rail Loop / Highway 3	12-Dec-16		TERRACON
#03	683022	5499834	2.59	2.59	Dry @ TD	Solid Stem Auger		Rail Loop / Highway 3	12-Dec-16		TERRACON
#05	683507	5499618	19.81		Dry @ TD	Solid Stem Auger & HQ		Rail Loop	12-Dec-16		TERRACON
#06	683672	5499529	6.10		1.68	Solid Stem Auger		Rail Loop	9-Dec-16		TERRACON
#07	683739	5499462	3.35		Dry @ TD	Solid Stem Auger		Rail Loop	9-Dec-16		TERRACON
#08	683773	5499212	4.57		Dry @ TD	Solid Stem Auger		Rail Loop / Golf Course	8-Dec-16		TERRACON
#09	683815	5499242	0.91		Dry @ TD	Solid Stem Auger		Rail Loop / Golf Course	8-Dec-16		TERRACON
#10	684140	5499094	2.29		Dry @ TD	Solid Stem Auger		Rail Loop / Golf Course	8-Dec-16		TERRACON
#11	684259	5499050	1.83		Dry @ TD	Solid Stem Auger		Rail Loop / Golf Course	8-Dec-16		TERRACON
#12	684524	5498911	7.62	7.00	Dry @ TD	Solid Stem Auger		Rail Loop / Grassy Mountain Road	6-Dec-16		TERRACON
#13	684991	5498696	3.05		Dry @ TD	Solid Stem Auger		Access Road	12-Dec-16		TERRACON
#14	684921	5498753	0.30		Dry @ TD	Solid Stem Auger		Access Road	8-Dec-16		TERRACON
#15	684917	5498910	4.88	1.50	Dry @ TD	Solid Stem Auger		Access Road	7-Dec-16		TERRACON
#16	684850	5499013	5.79	5.79	5.33	Solid Stem Auger		Access Road	7-Dec-16		TERRACON
#17	684754	5499129	6.10	5.60	Dry @ TD	Solid Stem Auger		Access Road	7-Dec-16		TERRACON
#18	684668	5499087	7.62		Dry @ TD	Solid Stem Auger		Rail Loop	7-Dec-16		TERRACON
#19	684648	5499213	7.62	7.00	Dry @ TD	Solid Stem Auger		Access Road	7-Dec-16		TERRACON
#21	684073	5499381	8.53		Dry @ TD	Solid Stem Auger		Rail Loop / Golf Course	8-Dec-16		TERRACON
#22	684247	5499765	3.35	2.75	Dry @ TD	Solid Stem Auger		Access Road / Rail Loop	6-Dec-16		TERRACON
#23	684193	5499921	5.18	4.75	Dry @ TD	Solid Stem Auger		Access Road / Rail Loop	6-Dec-16		TERRACON
BH15-01	684485	5508267	11.10	10.80	Dry @ TD	Solid Stem Auger		Surge Pond (North West)	5-Nov-15		GOLDER
BH15-02	684433	5508219	9.30	7.90		Solid Stem Auger		Surge Pond (North West)	5-Nov-15		GOLDER
BH15-03 (HA)	684668	5507425	0.20	0.20	Dry @ TD	Solid Stem Auger		West Sediment Pond	6-Nov-15		GOLDER
BH15-04	684689	5507320	4.80	0.80	Dry @ TD	Solid Stem Auger		West Sediment Pond	6-Nov-15		GOLDER
BH15-05	685020	5504844	4.60	4.10	Dry @ TD	Solid Stem & Hollow Stem Auger		Surge Pond (South West)	25-Jul-15		GOLDER
BH15-06	685006	5504753	3.10	2.00	Dry @ TD	Solid Stem & Hollow Stem Auger		Surge Pond (South West)	25-Jul-15		GOLDER
BH15-07	685722	5504831	8.50	8.5*	Dry @ TD	Solid Stem & Hollow Stem Auger		Dump (South)	24-Jul-15		GOLDER
BH15-08	683215	5504669	4.00	4.0*	0.8	Solid Stem Auger		West of Blairmore Creek (1.65 km)	20-Jul-15		GOLDER
BH15-09	686010	5504224	10.70	-	8	Solid Stem Auger		Dump (South)	21-Jul-15		GOLDER
BH15-10	685581	5503838	10.70	10.7*	3.3	Solid Stem Auger		Raw Water Pond	21-Jul-15		GOLDER
BH15-11	685604	5503630	4.60	1.60	Dry @ TD	Solid Stem Auger		Raw Water Pond	25-Jul-15		GOLDER
BH15-12	685322	5504058	0.30	0.30	Dry @ TD	Solid Stem Auger		Pit (South)	25-Jul-15		GOLDER
BH15-13	685231	5503989	4.70	-	Dry @ TD	Solid Stem Auger		Pit (South)	24-Jul-15		GOLDER
BH15-14	685321	5503963	3.10	1.80	Dry @ TD	Solid Stem Auger		Pit (South)	25-Jul-15		GOLDER
BH15-15	685125	5504243	0.20	0.20	Dry @ TD	Shovel		CHPP Area	25-Jul-15		GOLDER
BH15-16	685122	5504021	15.40	-	Dry @ TD	Solid Stem Auger		CHPP Area	24-Jul-15		GOLDER
BH15-17	685011	5504044	0.40	0.30	Dry @ TD	Solid Stem Auger		CHPP Area	23-Jul-15		GOLDER

Identification	East	North	TD (m)	Bedrock Depth (m)	Groundwater Depth (2) (m)	Type	Piezometer	Location	Date	Notes	Company
BH15-18	684983	5504043	0.30	0.3*	Dry @ TD	Solid Stem Auger		CHPP Area	23-Jul-15		GOLDER
BH15-19	685371	5504436	0.20	0.20	Dry @ TD	Shovel		Pit (South)	25-Jul-15		GOLDER
BH15-20	685416	5504511	0.20	0.20	Dry @ TD	Shovel		CHPP Area	25-Jul-15		GOLDER
BH15-21	685056	5503243	7.00	7.00	1.3	Solid Stem Auger		South of CHPP Area	23-Jul-15		GOLDER
BH15-22	684990	5503754	9.60	9.60	8.1	Solid Stem Auger		Surge Pond (Sout West /Access Road)	23-Jul-15		GOLDER
BH15-23	684939	5503660	11.10	-	9	Solid Stem Auger		Surge Pond (Sout West /Access Road)	22-Jul-15		GOLDER
BH15-24	685015	5503975	0.80	0.80	Dry @ TD	Solid Stem Auger		CHPP Area	23-Jul-15		GOLDER
BH15-25	685293	5503770	12.20	12.2*	6.8	Solid Stem Auger		CHPP Area	22-Jul-15		GOLDER
BH15-26	685040	5503596	9.30	8.50	Dry @ TD	Solid Stem Auger		CHPP Area	22-Jul-15		GOLDER
BH15-27	686129.00	5503141.00				Borehole		Pit (South)		Not Completed	GOLDER
BH15-28	685060	5504386	2.60	2.00	Dry @ TD	Solid Stem Auger		CHPP Area	25-Jul-15		GOLDER
BH15-29	687355	5510554	5.00	2.10	Dry @ TD	Solid Stem Auger		East of Gold Creek (Along Teddy's Trail)	4-Nov-15		GOLDER
BH15-30	687396	5510663	11.10	9.10	Dry @ TD	Solid Stem Auger		East of Gold Creek (Along Teddy's Trail)	4-Nov-15		GOLDER
BH15-31	687724	5508280	11.10	-	Dry @ TD	Solid Stem Auger		Sediment Pond (North East)	3-Nov-15		GOLDER
BH15-32	687715	5508452	11.10	-	Dry @ TD	Solid Stem Auger		Sediment Pond (North East)	3-Nov-15		GOLDER
BH15-36	686944.11	5504989.81				Borehole		Dump (South)		Not Completed	GOLDER
BH15-37	686990.28	5504780.02				Borehole		Surge Pond (South East)		Not Completed	GOLDER
BH15-38	686700.00	5505025.19				Borehole		Dump (South)		Not Completed	GOLDER
BH15-39	686700.00	5504126.00				Borehole		Dump (South)		Not Completed	GOLDER
BH15-40 (HA)(4	684483	5508256	0.20	0.20		Hand Auger		Surge Pond (North West)	7-Nov-15		GOLDER
BH401	685093	5504508	9.14	3.65	Dry @ TD	Solid Stem Auger & HQ		CHPP Area	1-Dec-16		TERRACON
BH402	685068	5504285	1.83		Dry @ TD	Solid Stem Auger		CHPP Area	2-Dec-16		TERRACON
BH403	685053	5504210	0.76	0.76	Dry @ TD	Solid Stem Auger		CHPP Area	3-Dec-16		TERRACON
BH404	685107	5504216	4.57		Dry @ TD	Solid Stem Auger		CHPP Area	2-Dec-16		TERRACON
BH405	685099	5504097	3.05	3.05	Dry @ TD	Solid Stem Auger		CHPP Area	2-Dec-16		TERRACON
BH406	685032	5504102	2.74	2.74	Dry @ TD	Solid Stem Auger		CHPP Area	2-Dec-16		TERRACON
BH407	684986	5504028	1.52	1.52	Dry @ TD	Solid Stem Auger		CHPP Area	2-Dec-16		TERRACON
BH408	685038	5504330	7.62	1.80	Dry @ TD	Solid Stem Auger & HQ		CHPP Area	2-Dec-16		TERRACON
BH409	685064	5504386	3.66		Dry @ TD	Solid Stem Auger		CHPP Area	1-Dec-16		TERRACON
BH410	685206	5504528	18.29	1.22	Dry @ TD	Solid Stem Auger & HQ		A-road / Pit Area	11-Dec-16		TERRACON
BH411	685149	5503751	9.14		Dry @ TD	Solid Stem Auger		CHPP Area	3-Dec-16		TERRACON
BH412	685432	5503781	10.67		Dry @ TD	Solid Stem Auger		CHPP Area	3-Dec-16		TERRACON
BH413	685163	5503607	4.57		Dry @ TD	Solid Stem Auger		CHPP Area	4-Dec-16		TERRACON
BH414	685450	5503631	6.10		Dry @ TD	Solid Stem Auger		CHPP Area	3-Dec-16		TERRACON
BH801	684622	5503274	3.66	3.66	Dry @ TD	Solid Stem Auger		Access Road / Conveyor Belt	4-Dec-16		TERRACON
BH802	684227	5502421	0.15	0.00	Dry @ TD	Solid Stem Auger		Access Road / Conveyor Belt	4-Dec-16		TERRACON
BH803	684210	550235	0.15	0.00	Dry @ TD	Solid Stem Auger		Access Road / Conveyor Belt	4-Dec-16		TERRACON

Identification	East	North	TD (m)	Bedrock Depth (m)	Groundwater Depth (2) (m)	Type	Piezometer	Location	Date	Notes	Company
BH804	684017	5501498	1.52	0.00	Dry @ TD	Solid Stem Auger		Access Road / Conveyor Belt	5-Dec-16		TERRACON
BH805	684000	5500893	1.52	0.00	Dry @ TD	Solid Stem Auger		Access Road / Conveyor Belt	5-Dec-16		TERRACON
BH806	684000	5500893	1.52	0.00	Dry @ TD	Solid Stem Auger		Access Road / Conveyor Belt	6-Dec-16		TERRACON
BH808	684479	5499315	19.20	12.50	Dry @ TD	Solid Stem Auger & HQ		Access Road / Conveyor Belt	10-Dec-16		TERRACON
BH809	684517	5499241	6.71	6.10	Dry @ TD	Solid Stem Auger		Access Road / Conveyor Belt	6-Dec-16		TERRACON
BH810	684486	5499171	6.10	4.60	Dry @ TD	Solid Stem Auger		Rail Loop	6-Dec-16		TERRACON
BH811	684208	5499187	3.81	3.30	Dry @ TD	Solid Stem Auger		Rail Loop / Golf Course	8-Dec-16		TERRACON
BH812	684467	5502866	9.14	4.40	Dry @ TD	Solid Stem Auger & HQ		Access Road / Conveyor Belt	5-Dec-16		TERRACON
BH813	684775	5503383	5.79	4.60	Dry @ TD	Solid Stem Auger		Access Road / Conveyor Belt	4-Dec-16		TERRACON
CCR-SPT-31	683224	5504597				Test Pit		West of Blairmore Creek (1.7 km)		Bedrock at d = 2.3 m	GOLDER
CCR-SPT-33	684292	5503963	11.10		8.7	Solid Stem Auger		West of Blairmore Creek (0.45 km)	8-Oct-14	-	GOLDER
CCR-SPT-33	684289	5503961	3.90		2.7	Test Pit		West of Blairmore Creek (0.45 km)	8-Aug-14	-	GOLDER
CCR-SPT-35	684131	5503966	11.10		10.7	Solid Stem Auger		West of Blairmore Creek (0.60 km)	8-Oct-14	-	GOLDER
CCR-SPT-35	683979	5503977	4.30		3	Test Pit		West of Blairmore Creek (0.75 km)	8-Aug-14	-	GOLDER
CCR-SPT-36	683837	5504403	11.10		3	Solid Stem Auger		West of Blairmore Creek (1.0 km)	8-Oct-14	-	GOLDER
CCR-SPT-36	683828	5504424	4.20			Test Pit		West of Blairmore Creek (1.0 km)	8-Aug-14		GOLDER
CCR-TP-11	683514	5504767	1.70	1.70		Test Pit		West of Blairmore Creek (1.35 km)	8-Aug-14	Bedrock at d = 1.7 m	GOLDER
CCR-TP-13	683269	5504459	4.10	4.10	0.9	Test Pit		West of Blairmore Creek (1.55 km)	8-Aug-14	Bedrock at d = 4.1 m	GOLDER
CCR-TP-14	683472	5503711	4.30	4.30		Test Pit		West of Blairmore Creek (1.30 km)	9-Aug-14	Bedrock at d = 4.3 m	GOLDER
CCR-TP-15	683837	5503715	2.20	2.20		Test Pit		West of Blairmore Creek (0.92 km)	9-Aug-14	Sandstone at d = 2.1 - 2.2 m	GOLDER
GC-12-A	684249	5499635	6.10	5.30	Dry @ TD	Solid Stem Auger		Access Road (West of Conveyor Belt)	15-Oct-14	Sandstone at d = 5.3m	GOLDER
GC-12-B	684354	5499534	3.90	3.00	Dry @ TD	Solid Stem Auger		Access Road / Conveyor Belt	15-Oct-14	Sandstone at d = 3.0m	GOLDER
GT16-01	685585.00	5503808.42	9.14	7.62	7.62	Solid Stem Auger and HQ Coring		Raw Water Pond	14-May-16	Switched to coring at 7.62 m depth	TERRACON
GT16-02	685586.87	5503635.48	7.62	4.57	Dry @ TD	Solid Stem Auger and HQ Coring		Raw Water Pond	14-May-16	Dry hole, switched to coring at 6.10 m depth	TERRACON
GT16-03	686235.49	5503610.61	3.05	0.61	Dry @ TD	Solid Stem Auger and HQ Coring		Dump (South)	14-May-16	Dry hole, switched to coring at 0.76 m depth	TERRACON
GT16-04	686120.14	5502813.87	0.46	0.46	Dry @ TD	Hand Auger		Dump (South)	15-May-16		TERRACON
GT16-05	686668.14	5502928.82	0.76	0.76	Dry @ TD	Hand Auger		Dump (South)	15-May-16	Bedrock at 0.76 m depth.	TERRACON
GT16-06	686726.85	5503577.69	2.29	0.76	Dry @ TD	Solid Stem Auger and HQ Coring		Dump (South)	14-May-16	Dry hole, switched to coring at 0.76 m depth	TERRACON
GT16-07	686616.85	5504450.64	6.10	3.05	Dry @ TD	Hollow Stem Auger and HQ coring	Y	Dump (South)	14-May-16	Dry hole, switched to coring at 3.05 m depth	TERRACON
GT16-08	687304.90	5504478.29	7.62	6.86		Solid Stem Auger and Hollow Stem Auger		Surge Pond (South East)	11-May-16	Switched to hollow stem at 3.05 m depth	TERRACON
GT16-09	687344.87	5504670.28	10.06	9.45		Hollow Stem Auger		Surge Pond (South East)	11-May-16		TERRACON
GT16-10	687615.85	5506197.18	4.27		Dry @ TD	Solid Stem Auger and Hollow Stem Auger		Sediment Pond (East)	12-May-16	Switched to hollow stem at 3.05 m depth	TERRACON
GT16-11	687765.52	5506181.92	10.67	9.14	Dry @ TD	Solid Stem Auger and Hollow Stem Auger	Y	Sediment Pond (East)	13-May-16	Switched from solid to hollow stem at 3.05 m	TERRACON
GT16-12	687732.60	5506379.47	4.57	3.35	Dry @ TD	Solid Stem Auger		Sediment Pond (East)	12-May-16		TERRACON
PZ15-01a	684792	5503690	13.70	7.60	3	Solid Stem Auger and Coring	Y	Surge Pond (South West)	29-Jul-15		GOLDER
PZ15-01b	684792	5503690	6.90	N/A	3	Solid Stem Auger	Y	Surge Pond (South West)	29-Jul-15		GOLDER

Identification	East	North	TD (m)	Bedrock Depth (m)	Groundwater Depth (2) (m)	Type	Piezometer	Location	Date	Notes	Company
PZ15-02a	684792	5503690	18.60	3.3*	3.5	Solid Stem Auger and Coring		CHPP Area	27-Jul-15	Groundwater measured at 4.42 mbgs after standpipe installation July 28, 2015; Standpipe installed by Millenium EMS Solutions Ltd. at completion of drilling	GOLDER
PZ15-02b	684792	5503690	9.10	N/A		Solid Stem Auger		CHPP Area	27-Jul-15	Groundwater measured at 9.0 mbgs after standpipe installation July 28, 2015; Borehole located within 2 m of PZ15-02a.	GOLDER
RBH15-01	682607	5500181	9.14	4.60	2.8	SPT/COREHOLE/STANDPIPE		Rail Loop	30-Jul-15		GOLDER/SEDGMAN
RBH15-02	682637	5500158	15.24	1.80		SPT/CORE		Rail Loop	30-Jul-15		GOLDER/SEDGMAN
RBH15-03	N/A	N/A				Borehole		Rail Loop		Deleted do to utility conflict	GOLDER
RBH15-04	682743	5500131	15.24	4.60		SPT/CORE/STANDPIPE		Rail Loop	14-Jul-15		GOLDER/SEDGMAN
RBH15-05	682927	5499939	2.44	1.80		SPT		Rail Loop	15-Jul-15		GOLDER/SEDGMAN
RBH15-06	683167	5499701	3.00	N/A		SPT		Rail Loop	15-Jul-15		GOLDER/SEDGMAN
RBH15-07	N/A	N/A				Borehole		Rail Loop		Deleted, inaccessible due to steep bank	GOLDER
RBH15-08	683563	5499367	9.30	5.00		SPT/CORE/STANDPIPE		Rail Loop	15-Jul-15		GOLDER/SEDGMAN
RBH15-09	683646	5499249	9.14	N/A		SPT		Rail Loop	16-Jul-15		GOLDER/SEDGMAN
RBH15-10	683854	5499153	6.43	N/A		SPT		Rail Loop	16-Jul-15		GOLDER/SEDGMAN
RBH15-11	684400	5498933	6.10	N/A		SPT/STANDPIPE		Rail Loop	16-Jul-15		GOLDER/SEDGMAN
RBH15-12	684645	5499178	24.38	11.90		SPT/CORE/STANDPIPE		Rail Loop	19-Jul-15		GOLDER/SEDGMAN
RBH15-13	N/A	N/A				Borehole		Rail Loop		Deleted due to revised alignment	GOLDER
RBH15-14	683827	5499433	22.86	2.40		SPT/CORE/STANDPIPE		Rail Loop	18-Jul-15		GOLDER/SEDGMAN
RBH15-15	684220	5499202	7.77	3.30		SPT/CORE/		Rail Loop	17-Jul-15		GOLDER/SEDGMAN
RBH15-16	684236	5499353	15.39	3.70		SPT/CORE/STANDPIPE		Rail Loop	17-Jul-15		GOLDER/SEDGMAN
SP-SPT-29	685077	5505080	4.70	4.70	0.6	Hollow Stem Auger		T-road / West of Pit Crest	10-Oct-14	Auger refusal at d = 4.7m	GOLDER
SP-SPT-29	685081	5505095	3.70			Test Pit		T-road / West of Pit Crest	7-Aug-14	-	GOLDER
SP-SPT-30	685048	5505486	9.10		0.6	Solid Stem Auger		T-road / West of Pit Crest	10-Oct-14	-	GOLDER
SP-SPT-30	685044	5505507	4.00		2.1	Test Pit		T-road / West of Pit Crest	7-Aug-14	-	GOLDER
SP-SPT-37	684681	5504533	7.60	7.00	2.6	Solid Stem Auger		West of Blairmore Creek (0.25 km)	9-Oct-14	Sandstone at d = 7.0m	GOLDER
SP-SPT-37	684674	5504542	4.00	2.40		Test Pit		West of Blairmore Creek (0.25 km)	10-Oct-14	-	GOLDER
SP-SPT-38	684595	5504199	11.10		3.8	Solid Stem Auger		West of Blairmore Creek (0.12 km)	9-Oct-14	-	GOLDER
SP-SPT-38	684586	5504213	4.20		2.5	Test Pit		West of Blairmore Creek (0.12 km)	10-Oct-14	-	GOLDER
SP-TP-06	684889	5505654	4.40		1.7	Test Pit		T-road / West of Pit Crest	11-Aug-14	-	GOLDER
SP-TP-06	684973	5505664	10.70		4	Solid Stem Auger		T-road / West of Pit Crest	9-Oct-14	-	GOLDER
SP-TP-07	685061	5505694	2.50	2.50	1.7	Test Pit		T-road / West of Pit Crest	11-Aug-14	-	GOLDER
SP-TP-08	685071	5505411	3.60		1.6	Test Pit		T-road / West of Pit Crest	7-Aug-14	-	GOLDER
SP-TP-09	685089	5505226	3.40		2.9	Test Pit		T-road / West of Pit Crest	7-Aug-14	Steady seepage at d = 2.9 m	GOLDER
SP-TP-10	684893	5504984	4.00		1.5	Test Pit		West of Blairmore Creek (0.05 km)	10-Aug-14	-	GOLDER
SP-TP-10	684681	5504969	2.00		Dry @ TD	Hollow Stem Auger		West of Blairmore Creek (0.25 km)	9-Oct-14	-	GOLDER
SP-TP-16	684527	5504586	1.30	1.30		Test Pit		West of Blairmore Creek (0.40 km)	10-Aug-14	Bedrock at d = 1.3 m	GOLDER

Identification	East	North	TD (m)	Bedrock Depth (m)	Groundwater Depth (2) (m)	Type	Piezometer	Location	Date	Notes	Company
SP-TP-17	684022	5504192	4.30			Test Pit		West of Blairmore Creek (0.70 km)		-	GOLDER
SP-TP-17	684030	5504199	5.60	5.20	Dry @ TD	Solid Stem Auger		West of Blairmore Creek (0.70 km)	8-Oct-14	Sandstone at d = 5.2m	GOLDER
SP-TP-19	684634	5504393				Test Pit		West of Blairmore Creek (0.18 km)		-	GOLDER
SP-TP-20	684554	5504086				Test Pit		West of Blairmore Creek (0.17 km)		-	GOLDER
TP15-01 (HA)	684744	5509548	0.50	0.50	Dry @ TD	Hand Auger		Dump (North)	7-Nov-15	Hand auger hole could not be advanced due to presence of boulders/bedrock.	GOLDER
TP15-01A	684704	5509322	4.70		3.6	Test Pit		Dump (North)	5-Nov-15		GOLDER
TP15-02	685585	5509670	5.00			Test Pit		Dump (North)	6-Nov-15		GOLDER
TP15-03	N/A	N/A				Test Pit		Surge Pond (North West)		Replaced by BH15-40	GOLDER
TP15-04	684624	5509110	5.30			Test Pit		Dump (North)	4-Nov-15		GOLDER
TP15-05	684612	5508686	4.70			Test Pit		Dump (North)	5-Nov-15		GOLDER
TP15-06	685531	5508645	5.00			Test Pit		Dump (North)	5-Nov-15		GOLDER
TP15-07	684624	5508405	5.00			Test Pit		Dump (North)	5-Nov-15		GOLDER
TP15-08	684488	5508303	5.00			Test Pit		Surge Pond (North West)	5-Nov-15		GOLDER
TP15-09	686257	5505343	5.00			Test Pit		Dump (South)	7-Nov-15		GOLDER
TP15-10	686109	5505018	5.10			Test Pit		Dump (South)	7-Nov-15		GOLDER
TP15-11	685892	5504323	5.00			Test Pit		Dump (South)	7-Nov-15		GOLDER
TP15-14 (HA)	686722	5503226	0.37			Hand Auger		Dump (South)	7-Nov-15		GOLDER
TP15-15 (HA)	684544	5508292	0.43	0.43		Hand Auger		Surge Pond (North West)	7-Nov-15		GOLDER
TP17-01	685705	5503922.00	5.5		1.7	Test Pit		Raw Water Pond	23-May-17		TERRACON
TP17-02	685839	5504015.10	5.5	5	2.5	Test Pit		Raw Water Pond	24-May-17		TERRACON
TP17-03	685968	5504068.10	5.5	5.5	1.5	Test Pit		Raw Water Pond	24-May-17		TERRACON
TP17-04	685727	5503869.50	5.5	5	1.5	Test Pit		Raw Water Pond	24-May-17		TERRACON
TP17-05	685805	5503884.10	4.5	4	3	Test Pit		Raw Water Pond	24-May-17		TERRACON
TP17-06	685859	5503929.40	4	3.5	1.5	Test Pit		Raw Water Pond	24-May-17		TERRACON
TP17-07	685916	5503956.10	4.5	4.5	2.5	Test Pit		Raw Water Pond	25-May-17		TERRACON
TP17-08	685992	5503978.30	3.5	3.5	1.5	Test Pit		Raw Water Pond	25-May-17		TERRACON
TP17-09	686111	5504026.50	4.5	4.5	2.5	Test Pit		Raw Water Pond	25-May-17		TERRACON
TP17-10	686208	5504076.70	4	2	2	Test Pit		Raw Water Pond	25-May-17		TERRACON
TP17-11	685744	5503722.70	4	1.5		Test Pit		Raw Water Pond	23-May-17		TERRACON
TP17-12	685901	5503815.90	4.5	1.5		Test Pit		Raw Water Pond	23-May-17		TERRACON
TP17-13	686130	5503959.90	3.5	3	0	Test Pit		Raw Water Pond	26-May-17		TERRACON
TP17-14	686156	5503923.80	2	0		Test Pit		Raw Water Pond	26-May-17		TERRACON
TP17-15	686221	5503883.20	3.5	1		Test Pit		Raw Water Pond	26-May-17		TERRACON
TP17-16	685668	5503937.60	4.5	4	2.5	Test Pit		Raw Water Pond	23-May-17		TERRACON
TP17-17	685662	5503879.00	5.5	5	1.5	Test Pit		Raw Water Pond	24-May-17		TERRACON
TP17-18	685669	5503824.80	3.5	0.5		Test Pit		Raw Water Pond	26-May-17		TERRACON

Identification	East	North	TD (m)	Bedrock Depth (m)	Groundwater Depth (2) (m)	Type	Piezometer	Location	Date	Notes	Company
TP17-19	685665	5503778.40	4.5	1		Test Pit		Raw Water Pond	26-May-17		TERRACON
TP17-20	685678	5503697.80	4.5	4.5	1.5	Test Pit		Raw Water Pond	26-May-17		TERRACON
TP17-21	685678	5503645.30	4.5	4	2.5	Test Pit		Raw Water Pond	23-May-17		TERRACON
TP17-22	685674	5503616.50	5	2.5		Test Pit		Raw Water Pond	23-May-17		TERRACON
TP17-23	682711	5500148	1.50	1.20		Test Pit		Rail Loop / Highway 3	29-May-17		TERRACON
TR17-01	682736	5500104	5.00	5.00		Test Pit		Rail Loop / Highway 3	29-May-17		TERRACON
TR17-02	682647	5500143	1.50	1.50		Test Pit		Rail Loop / Highway 3	30-May-17		TERRACON
WD-SPT-01	684959	5505839	4.40	4.30	2.4	Test Pit		T-road / East of Blairmore Creek	11-Aug-14	Bedrock at d = 4.3 m	GOLDER
WD-SPT-03	684626	5507218	1.90		1.2	Test Pit		Surge Pond (West)	13-Aug-14	Terminated due to garabge. Suspected landfill in clearing surrounding test pit.	GOLDER
WD-SPT-04	684545	5507460	4.10		2.5	Test Pit		Surge Pond (West)	13-Aug-14	-	GOLDER
WD-SPT-04	684555	5507479	3.80		Dry @ TD	Hollow Stem Auger		Surge Pond (West)	11-Oct-14	-	GOLDER
WD-SPT-05	684552	5507708	4.60		1.2	Test Pit		T-road / East of Blairmore Creek	13-Aug-14	Oil staining present.	GOLDER
WD-SPT-05	684549	5507721	11.10		2.9	Solid Stem Auger		T-road / East of Blairmore Creek	14-Oct-14	Oil staining at d = 1.2 -2.6m	GOLDER
WD-SPT-06	684386	5508137	3.90			Test Pit		Surge Pond (North West)	13-Aug-14	-	GOLDER
WD-SPT-06	684353	5507888	10.80	10.40	6.1	Solid Stem Auger		T-road / East of Blairmore Creek	14-Oct-14	Sandstone at d = 10.4m	GOLDER
WD-SPT-07	684725	5508233	4.10	4.10		Test Pit		Dump (North)	14-Aug-14	Sandstone at d = 3.7 - 4.1 m	GOLDER
WD-SPT-08	685198	5508364	5.20			Test Pit		Dump (North)	14-Aug-14	-	GOLDER
WD-SPT-08	684160	5508384	11.10		2.1	Solid Stem Auger		T-road / West of Blairmore Creek	14-Oct-14	-	GOLDER
WD-SPT-09	683930	5508492	4.40	4.40		Test Pit		T-road / West of Blairmore Creek	13-Aug-14	Bedrock at d = 4.4 m	GOLDER
WD-SPT-11	683648	5509460	11.10		1.4	Solid Stem Auger		East of Blairmore Creek / West of Dump - North	15-Oct-14	-	GOLDER
WD-SPT-11	683648	5509468	4.70		4.3	Test Pit		East of Blairmore Creek / West of Dump - North	14-Aug-14	-	GOLDER
WD-SPT-12	684120	5510260	1.90	1.90		Test Pit		North-West of Dump (North)	15-Aug-14	Bedrock at d = 0.5 - 1.9 m	GOLDER
WD-SPT-13	684356	5510290	2.20	2.00		Test Pit		North-West of Dump (North)	15-Aug-14	Bedrock at d = 2.0 - 2.2 m	GOLDER
WD-SPT-14	684982	5510086	2.70		2.7	Test Pit		Dump (North)	15-Aug-14	Bedrock at d = 1.7 - 2.7 m	GOLDER

Appendix C-1: Material Data Sheet

Envirobind DCT

SECTION 1. IDENTIFICATION

Product Identifier	Envirobind DCT
Other Means of Identification	Envirobind DCT
Product Family	Envirobind
Recommended Use	Rail car top treatment.
Restrictions on Use	None known.
	POWER Chemicals LTD, 1620 West 75th Ave., Vancouver, BC, V6P 6G2, Canada, 604 263 0803, www.powerchem.net
Emergency Phone No.	Canutec, 613-996-6666, 24 hours

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Acute toxicity (Oral) - Category 4; Acute toxicity (Dermal) - Category 4; Skin corrosion/irritation - Category 2; Serious eye damage/eye irritation - Category 2A

GHS Label Elements

Warning
Harmful if swallowed.
Harmful in contact with skin.
Causes skin irritation.
Causes serious eye irritation.

Prevention:
Wash hands and skin thoroughly after handling.
Do not eat, drink or smoke when using this product.
Wear protective gloves/protective clothing.
Wear eye protection/face protection.

Response:
IF ON SKIN: Wash with plenty of water.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
Call a POISON CENTRE/doctor if you feel unwell.
If skin irritation occurs: Get medical advice/attention.
If eye irritation persists: Get medical advice/attention.
Take off contaminated clothing and wash it before reuse.

Dispose of contents/container in accordance with local, regional, national and international regulations.

Other Hazards

None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	%	Other Identifiers
Alkyl Ester	**	**	**

Notes

** HMIRC 9291, granted March 3, 2015
Concentrations are expressed in % weight/weight.

SECTION 4. FIRST-AID MEASURES

First-aid Measures

Inhalation

Move to fresh air. If breathing is difficult, trained personnel should administer emergency oxygen if advised to do so by Poison Centre or doctor. Call a Poison Centre or doctor if you feel unwell or are concerned.

Skin Contact

Wash gently and thoroughly with lukewarm, gently flowing water and mild soap for 5 minutes. If skin irritation occurs get medical advice/attention. Thoroughly clean clothing, shoes and leather goods before reuse or dispose of safely.

Eye Contact

Immediately rinse the contaminated eye(s) with lukewarm, gently flowing water for 15-20 minutes, while holding the eyelid(s) open. If eye irritation persists, get medical advice/attention.

Ingestion

Never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Do not induce vomiting. Rinse mouth with water. Call a Poison Centre or doctor if you feel unwell or are concerned.

Most Important Symptoms and Effects, Acute and Delayed

If inhaled:
At high concentrations can irritate the nose and throat. Can harm the kidneys. Can harm the liver. Symptoms may include headache, nausea, dizziness, drowsiness and confusion. A severe exposure can cause unconsciousness.
If on skin:
Symptoms include pain, redness, and swelling.
If in eyes:
May cause moderate to severe irritation.
If swallowed:
Large amounts can harm the kidneys. Can harm the liver.

Immediate Medical Attention and Special Treatment

Target Organs

Eyes, skin.

Special Instructions

Not applicable.

Medical Conditions Aggravated by Exposure

None known.

SECTION 5. FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media

Carbon dioxide, dry chemical powder or appropriate foam.

Unsuitable Extinguishing Media

None known.

Specific Hazards Arising from the Chemical

Can ignite if strongly heated.
Heating increases the release of toxic vapour. Solutions of product are extremely slippery.
In a fire, the following hazardous materials may be generated: very toxic carbon monoxide, carbon dioxide; corrosive, oxidizing nitrogen oxides; corrosive sulfur oxides.

Special Protective Equipment and Precautions for Fire-fighters

Dust explosion hazard. Use water spray or fog to prevent dust formation and minimize risk of explosion.
See Skin Protection in Section 8 (Exposure Controls/Personal Protection) for advice on suitable chemical protective materials.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures

Do not touch damaged containers or spilled product unless wearing appropriate protective equipment. Use the personal protective equipment recommended in Section 8 of this safety data sheet. Remove or isolate incompatible materials as well as other hazardous materials.

Environmental Precautions

It is good practice to prevent releases into the environment. Do not allow into any sewer, on the ground or into any waterway.

Methods and Materials for Containment and Cleaning Up

Dike spilled product to prevent runoff. Ventilate the area to prevent the gas from accumulating, especially in confined spaces. Remove or recover liquid using pumps or vacuum equipment. Contain and soak up spill with absorbent that does not react with spilled product. Place used absorbent into suitable, covered, labelled containers for disposal.

SECTION 7. HANDLING AND STORAGE

Precautions for Safe Handling

Prevent accidental contact with incompatible chemicals.
It is good practice to: avoid breathing product; avoid skin and eye contact and wash hands after handling.

Conditions for Safe Storage

Store in an area that is: cool, dry. See advice on temperature in Conditions to Avoid in Section 10 (Stability and Reactivity) to determine suitable storage temperature.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

Not available.

Appropriate Engineering Controls

General ventilation is usually adequate. Provide eyewash and safety shower if contact or splash hazard exists.

Individual Protection Measures

Eye/Face Protection

Wear chemical safety goggles.

Skin Protection

Prevent skin contact. In case of an emergency (e.g. an uncontrolled release): wear chemical protective clothing e.g. gloves, aprons, boots.

Respiratory Protection

Concentrated product: not usually required when working with small quantities. Product (diluted as directed): wear a NIOSH approved air-purifying respirator with an appropriate cartridge.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Basic Physical and Chemical Properties

Appearance	Light tan powder. Particle Size: Not available

Odour	Odourless
Odour Threshold	Not applicable
pH	Not available
Melting Point/Freezing Point	Not available (melting); Not applicable (freezing)
Initial Boiling Point/Range	Not applicable
Flash Point	Not applicable
Evaporation Rate	Not available
Flammability (solid, gas)	Not available
Upper/Lower Flammability or Explosive Limit	Not applicable (upper); Not applicable (lower)
Vapour Pressure	Not applicable
Vapour Density (air = 1)	Not applicable
Relative Density (water = 1)	Not available
Solubility	Not available in water; Not applicable (in other liquids)
Partition Coefficient, n-Octanol/Water (Log Kow)	Not applicable
Auto-ignition Temperature	Not applicable
Decomposition Temperature	Not applicable
Viscosity	Not applicable (kinematic)

Other Information

Physical State	Solid
Molecular Formula	Not applicable
Molecular Weight	Not applicable
Bulk Density	Not available
Surface Tension	Not applicable
Vapour Pressure at 50 deg C	Not available

SECTION 10. STABILITY AND REACTIVITY

Reactivity

None known.

Chemical Stability

Normally stable.

Possibility of Hazardous Reactions

Not applicable.

Conditions to Avoid

Heat. Incompatible materials. Generation of dust. Temperatures above 100 ºC

Incompatible Materials

Strong reducing agents (e.g. hydrides), strong oxidizing agents (e.g. perchloric acid).

Hazardous Decomposition Products

Not applicable.

SECTION 11. TOXICOLOGICAL INFORMATION

Likely Routes of Exposure

Inhalation; eye contact; skin contact; skin absorption; ingestion.

Acute Toxicity

LC50: No information was located.

Alkyl Ester: LD50 (oral, rat) > 500 mg/kg

LD50 (dermal): No information was located.

Skin Corrosion/Irritation

May cause moderate or severe irritation based on information for closely related materials.
SKIN IRRITANT. Symptoms include pain, redness, and swelling.

Serious Eye Damage/Irritation

There is limited evidence of mild irritation.
May cause moderate to severe irritation.

STOT (Specific Target Organ Toxicity) - Single Exposure

Inhalation

At high concentrations: can irritate the nose and throat. Can harm the kidneys. Can harm the liver. Symptoms may include headache, nausea, dizziness, drowsiness and confusion. A severe exposure can cause unconsciousness.

Ingestion

If large amounts are ingested: can harm the kidneys. Can harm the liver.

No information was located for: Skin Corrosion/Irritation, STOT (Specific Target Organ Toxicity) - Single Exposure, Aspiration Hazard, STOT (Specific Target Organ Toxicity) - Repeated Exposure, Respiratory and/or Skin Sensitization, Carcinogenicity, Development of Offspring, Sexual Function and Fertility, Effects on or via Lactation, Germ Cell Mutagenicity, Interactive Effects

SECTION 12. ECOLOGICAL INFORMATION

Toxicity

Harmful to aquatic life, based on acute toxicity tests.
Rainbow trout 96H LC50 = 17.2 mg/L

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal Methods

Recommended disposal methods are for the product, as sold. (Used material may contain other hazardous contaminants). The required hazard evaluation of the waste and compliance with the applicable hazardous waste laws are the responsibility of the user. The preferred waste management options are: bury in a licensed landfill according to federal, provincial/state, and local regulations.

SECTION 14. TRANSPORT INFORMATION

Not regulated under Canadian TDG regulations. Not regulated under US DOT Regulations.

Special Precautions Not applicable

Transport in Bulk According to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

SECTION 15. REGULATORY INFORMATION

Safety, Health and Environmental Regulations

Canada

WHMIS Classification

D2B - Toxic (Skin irritant; Eye irritant)

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all of the information required by the Controlled Products Regulations.

SECTION 16. OTHER INFORMATION

SDS Prepared By Regulatory Affairs

Phone No. 604 261 3019

Date of Preparation January 01, 2016

Date of Last Revision	January 01, 2016
Disclaimer	Every effort is made to ensure that the data presented herein is current and factual; however, no warranty nor any other legal responsibility is to be construed from this document. Numerical values reported represent nominal and/or typical properties and do not constitute specifications. Any use of the information presented herein must be determined by the user to be in accordance with applicable federal, provincial, and local laws and regulations.

Appendix E-1: Environmental Field Reports

LOC 160841

Sites and Installations
3.0 Completion of Supplement A
Environmental Field Report (EFR)

The cover document and the appropriate supplement form must be submitted for each surface disposition application. All blanks must either be filled in or 'N/A' noted where applicable.
Failure to fill out the document and form(s) completely will result in the EFR being rejected.

☒ **New** ☐ **Revised**

Date Submitted: 02/06/2018 **MSL Number** LOC160841
dd/mm/yyyy

PIL Number: _____

Site/Project Name: Grassy Mountain Coal Project

Legal land description: LSD 03-06 **Sec** 02 **Twp** 008 **Rge** 04 **W** 5

A. Site Description

1. Stability concerns: ☐ **Yes** ☒ **No** **If 'Yes', explain mitigation:** _____

Questions 2, 3, 4 and 5 of section A apply to MSL only. The "Wellsite Spacing Recommendations" may be used as a guide, search for "Wellsite Spacing Recommendations" on srd.alberta.ca .

2. Well type: ☐ **Oil** ☐ **Sweet Gas** ☐ **Sour Gas (H_2S)** ☐ **Coalbed Methane** ☐ **Single Well pad** ☐ **Multi-well pad**

☒ **Other** A description of the proposed rail loop is presented in Section 5.1 of the PLA Application.

3. Well depth: N/A**m**

4. Flare requirements for drilling: ☐ **50 m** ☐ **35 m** ☐ **25 m**

☐ **Flare pit** ☐ **Flare tank** ☐ **Flare stack**

5. Number of zones to be completed/produced N/A **Inter-well spacing** N/A **m.**

B. Vehicle/Equipment Access

How will the site be accessed? (Check boxes that apply)

☒ **By an existing access held under disposition or jurisdiction (specify name, disposition number, and owner):**
The proposed LOC will be accessed via Grassy Mountains main access road.

☒ **New application (LOC)**

☐ **New access included in this application.**

Note: If access is part of the site and installation application, an access supplement must be submitted.

C. Contamination Prevention

1. Is the boundary of the site located within 100 m of a watercourse? ☐ **Yes** ☒ **No**
If 'Yes', specify distance from edge of lease to top of breaks in meters _____
Explain mitigation strategy if within 100 meters _____

2. Will the site be diked during drilling? ☐ **Yes** ☒ **No** **During production?** ☐ **Yes** ☒ **No**
If 'No', explain why not. N/A

Will other methods of on-site contamination prevention be required? Explain Construction stragegies are discussed in Section 5.4 of the PLA Application.

Applicable to MSL only

D. Sump

Type of sump (check appropriate box): ☐ **On-site pit** ☐ **Above-ground tank on site** ☐ **In-ground tank on site** ☐ **Remote sump**

Remote sump location: LSD ______ Sec ______ Twp _____ Rge _____ W __

☐ **Private land** ☐ **Public land (if location known, indicate on the survey plan)**

GPS coordinates: (deg/min/decimal) NAD83 Latitude _______ Longitude ________

Proposed mud type: ☐ **Hydrocarbon: ______** ☐ **Salt base: ______** ☐ **Gel chem: ______**
☐ **Other: _____**

Applicable to MSL only

Disposal
Estimate volumes to be disposed of: Solids _____ m^3 Liquids _____ m^3

Proposed disposal method: ☐ **Mix/bury/cover** ☐ **Land spreading** ☐ **Land farming** ☐ **Pump-off**
☐ **Disposal on forested public land**
☐ **Other _____ Approximate date of disposal _____**
☐ **Private Land**
☐ **Public Land**

Indicate land farming or land spreading location if off site on public land.

LSD ______ Sec ______ Twp ______ Rge ______ W _____

Applicable to MSL only

E. Source of Water

1. Water Required: ☐ **Yes** ☐ **No** ☐ **Water well on lease**

2. Offsite source: ☐ **Offsite water well** ☐ **Lake** ☐ **Stream** ☐ **River**

☐ **Other (specify type)** _____

Location: LSD ______ **Sec** ______ **Twp** ______ **Rge** ______ **W** ___

3. Access required to water source? ☐ **Yes** ☐ **No If 'Yes' attach a sketch.**

F. Construction Strategy

1. Vegetation Removal

Explain: See below.

2. Brush Disposal

Explain: See below

3. Topsoil handling: (Check appropriate boxes) ☐ **No stripping** ☐ **Minimum surface disturbance**
☐ **Stripping** ☐ **Single Lift** ☐ **Two Lift** ☒ **Other (Explain)** See below

Additional details: The proposed construction strategy, including vegetation/brush removal and topsoil handling, is discussed in Section 5.4 of the PLA Application. A figure showing exisitng clearing and new clearings required is provided in the PLA Application as Figure 5-2.

4. Will padding of the wellsite be required? ☐ **Yes** ☒ **No,**
If 'Yes' Explain: N/A - no wellsite is proposed

G. Reclamation Strategy

Revegetation strategy: (Check appropriate boxes) ☐ **Natural Recovery** ☐ **Native Seed**
☐ **Non-native Seed** ☒ **Other** See Section 5.5 of the PLA Application

Interim: The reclamation strategy for the rail loop is discussed in Section 5.5 of the PLA Application

Production/Operation: The reclamation strategy for the rail loop is discussed in Section 5.5 of the PLA Application

Applicable to MSL only

See Appendix III - Lease Description and Wellsite Sizing Information

Note: Complete and attach the lease description and wellsite sizing template (in the Appendix) if a non-standard wellsite is required as per the lease description and wellsite sizing document (see instructions).

Operating Condition

Contamination Prevention

136 In addition to complying with Federal, provincial and local laws and regulations respecting the environment, including release of substances, the holder shall, to the regulatory body's satisfaction, take necessary precautions to prevent contamination of land, water bodies and the air with

particulate and gaseous matter, which, in the opinion of the regulatory body in its sole discretion, is or may be harmful.

LOC 160842

Sites and Installations
3.0 Completion of Supplement A
Environmental Field Report (EFR)

The cover document and the appropriate supplement form must be submitted for each surface disposition application. All blanks must either be filled in or 'N/A' noted where applicable.
Failure to fill out the document and form(s) completely will result in the EFR being rejected.

☒ **New** ☐ **Revised**

Date Submitted: 02/06/2018 **MSL Number** LOC160842
dd/mm/yyyy

PIL Number: _____

Site/Project Name: Grassy Mountain Coal Project

Legal land description: LSD 09 **Sec** 03 **Twp** 008 **Rge** 04 **W** 5

A. Site Description

1. Stability concerns: ☐ **Yes** ☒ **No** **If 'Yes', explain mitigation:** _____

Questions 2, 3, 4 and 5 of section A apply to MSL only. The "Wellsite Spacing Recommendations" may be used as a guide, search for "Wellsite Spacing Recommendations" on srd.alberta.ca .

2. Well type: ☐ **Oil** ☐ **Sweet Gas** ☐ **Sour Gas (H^2S)** ☐ **Coalbed Methane** ☐ **Single Well pad** ☐ **Multi-well pad**

☒ **Other** A description of the proposed rail loop is presented in Section 5.1 of the PLA Application.

3. Well depth: N/A**m**

4. Flare requirements for drilling: ☐ **50 m** ☐ **35 m** ☐ **25 m**

☐ **Flare pit** ☐ **Flare tank** ☐ **Flare stack**

5. Number of zones to be completed/produced N/A **Inter-well spacing** N/A **m.**

B. Vehicle/Equipment Access

How will the site be accessed? (Check boxes that apply)

☒ **By an existing access held under disposition or jurisdiction (specify name, disposition number, and owner):**
The proposed LOC will be accessed via private land.

☒ **New application (LOC)**

☐ **New access included in this application.**

Note: If access is part of the site and installation application, an access supplement must be submitted.

C. Contamination Prevention

1. Is the boundary of the site located within 100 m of a watercourse? ☒ **Yes** ☐ **No**

If 'Yes', specify distance from edge of lease to top of breaks in meters Approximately 10 m

Explain mitigation strategy if within 100 meters No instream work will be undertaken as part of this proposed LOC. Construction activities within 100m of Blairmore Creek area associated with the rail crossing and will follow the best practices outlined in the Water Act Code of Practice for Watercourse Crossings.

2. Will the site be diked during drilling? ☐ **Yes** ☒ **No** **During production?** ☐ **Yes** ☒ **No**

If 'No', explain why not. N/A

Will other methods of on-site contamination prevention be required? Explain Construction stragegies are discussed in Section 5.4 of the PLA Application.

Applicable to MSL only

D. Sump

Type of sump (check appropriate box): ☐ **On-site pit** ☐ **Above-ground tank on site** ☐ **In-ground tank on site** ☐ **Remote sump**

Remote sump location: LSD ______ Sec ______ Twp _____ Rge _____ W __

☐ **Private land** ☐ **Public land (if location known, indicate on the survey plan)**

GPS coordinates: (deg/min/decimal) NAD83 Latitude _______ Longitude ________

Proposed mud type: ☐ **Hydrocarbon: ______** ☐ **Salt base: ______** ☐ **Gel chem: ______**
☐ **Other: _____**

Applicable to MSL only

Disposal

Estimate volumes to be disposed of: Solids _____ m^3 Liquids _____ m^3

Proposed disposal method: ☐ **Mix/bury/cover** ☐ **Land spreading** ☐ **Land farming** ☐ **Pump-off**

☐ **Disposal on forested public land**

☐ **Other _____ Approximate date of disposal _____**

☐ **Private Land**

☐ **Public Land**

Indicate land farming or land spreading location if off site on public land.

LSD ______ Sec ______ Twp ______ Rge ______ W _____

Applicable to MSL only

E. Source of Water

1. Water Required: ☐ **Yes** ☐ **No** ☐ **Water well on lease**
2. Offsite source: ☐ **Offsite water well** ☐ **Lake** ☐ **Stream** ☐ **River**

☐ **Other (specify type)** _____

Location: LSD ______ **Sec** ______ **Twp** ______ **Rge** ______ **W** ___

3. Access required to water source? ☐ **Yes** ☐ **No If 'Yes' attach a sketch.**

F. Construction Strategy

1. Vegetation Removal
Explain: See below.

2. Brush Disposal
Explain: See below

3. Topsoil handling: (Check appropriate boxes) ☐ **No stripping** ☐ **Minimum surface disturbance**
☐ **Stripping** ☐ **Single Lift** ☐ **Two Lift** ☒ **Other (Explain)** See below

Additional details: The proposed construction strategy, including vegetation/brush removal and topsoil handling, is discussed in Section 5.4 of the PLA Application. A figure showing exisitng clearing and new clearings required is provided in the PLA Application as Figure 5-2.

4. Will padding of the wellsite be required? ☐ **Yes** ☒ **No,**
If 'Yes' Explain: N/A - no wellsite is proposed

G. Reclamation Strategy

Revegetation strategy: (Check appropriate boxes) ☐ **Natural Recovery** ☐ **Native Seed**
☐ **Non-native Seed** ☒ **Other** See Section 5.5 of the PLA Application

Interim: The reclamation strategy for the rail loop is discussed in Section 5.5 of the PLA Application

Production/Operation: The reclamation strategy for the rail loop is discussed in Section 5.5 of the PLA Application

Applicable to MSL only

See Appendix III - Lease Description and Wellsite Sizing Information

Note: Complete and attach the lease description and wellsite sizing template (in the Appendix) if a non-standard wellsite is required as per the lease description and wellsite sizing document (see instructions).

Operating Condition

Contamination Prevention

136 In addition to complying with Federal, provincial and local laws and regulations respecting the environment, including release of substances, the holder shall, to the regulatory body's satisfaction, take necessary precautions to prevent contamination of land, water bodies and the air with particulate and gaseous matter, which, in the opinion of the regulatory body in its sole discretion, is or may be harmful.