



July 16, 2014

ISSUED FOR USE  
FILE: W14103418-01

Yukon Zinc Corporation  
Suite 701, 475 Howe Street  
Vancouver, British Columbia V6C 2B3

**Confidential**

**Attention:** Mr. Robin McCall, M.M.M., R.P.Bio.  
Wolverine Mine – Environmental Superintendent

**Subject:** 2014 Annual Observations of the On-site Earth Structures  
Wolverine Mine Site, Southeastern Yukon

## 1.0 INTRODUCTION

As requested by Yukon Zinc Corporation (YZC), Tetra Tech EBA Inc. (Tetra Tech EBA) has completed the 2014 annual observations of the earth structures located throughout the Wolverine Mine site (shown on Figure 1). YZC identified the following areas that required a stability review:

1. Industrial Complex – cut and fill slopes.
2. Industrial Complex Surface and Underground Water Treatment Sumps (1, 2 and 5) - liners and slopes.
3. Industrial Complex Diversion Ditch 1 – cut and fill slopes.
4. Industrial Complex Collection Ditches (2, 3, 4 and 5) – liners, cut and fill slopes.
5. Mine Camp Pad Area including upper generator and potable water treatment pad, sewage treatment plant pad and treated effluent pond – liner, cut and fill slopes.
6. Waste Rock and Ore Storage Facility including seepage collection sump and ore waste stockpile contained within the facility – liners, cut and fill slopes.
7. Land Treatment Facility (hydrocarbon contaminated material) including runoff collection sump – liners and fill slopes.
8. Vent Raise and Propane Tank Pad – cut slopes.
9. Truck Shop Pad – cut and fill slopes.

Authorization to proceed with this work was received from Robin McCall by way of email dated June 3, 2014.

## 2.0 SCOPE OF SERVICES

It is understood that YZC requires annual observations of structures, works, and installations at the site in partial fulfillment of the requirements of the Quartz Mining License QML-0006.

Tetra Tech EBA's scope of service for these annual observations is as follows:

- Complete a visual observation of the earth structures associated with each area of interest;
- Compile a photo log for each area of interest; and
- Prepare an observation report with a brief statement about the status and stability conditions for each area of interest, including any recommendations for remedial action.

## 3.0 FIELD INSPECTION

The field observations were completed by Mr. Chad Cowan, P.Eng. of Tetra Tech EBA on June 24 and 25, 2014. The following is a brief summary of the observations detailing any stability issues including a few photos of each area.

## 4.0 INDUSTRIAL COMPLEX

During the site visit there were no new construction activities in this area of interest. Tetra Tech EBA observed the cut and fill slopes for the mill, fuel tank farm and genset pad locations.

The 1:1 (H:V) design cut slopes in the bedrock for these areas are considered stable (Photo 1).

The fill slope along the western sides of the mill (Photo 2) associated with the fill placement are considered stable and are constructed as per the 2:1 (H:V) design. As noted in previous annual inspection reports, there are still some noticeable erosion channels (shown on Figure 1) along the southwestern side of the mill fill that were created as a result of historical seasonal rainfall run-off events. In 2012, proper perimeter berms and site grading was completed and has been maintained throughout the last couple of years by YZC to divert surface runoff towards designated drainage ditches (Ditches 2 and 5). As a result of this grading, drainage was directed towards the southwestern corner of the mill pad where a large erosion channel has formed (Photo 3).

The eastern cut slopes, and western and southern fill slopes of the fuel tank farm and genset pad (Photo 4) were observed and it was noted that there was a small area of tension cracks and a small erosion channel occurring along the western fill slope between the fuel tank farm and genset pads (Photos 5 and 6). Along the southern fill slope of the genset pad the main drainage channel's splash trough has broken loose from the CSP half culvert resulting in extensive erosion at the culvert's outlet end of the CSP half culvert (Photo 7).

The Mechanically Stabilized Earth (MSE) wall (Photo 8) that is situated along the south western portion of the mill fill and the north and east sides of the crusher building were observed and there were no signs of bulging or noticeable zones of failure. There is the odd smaller rock that has worked its way through the wire mesh. These rocks are considered falling hazards and when labourers are working in the area along the MSE wall, they should be cautious of possible falling rocks.



**Photo 1**

The bedrock cut backslope north of the mill location. (June 24, 2014)



**Photo 2**

The southern fill slope of the mill site between the concentrate loadout and crusher buildings. (June 24, 2014)



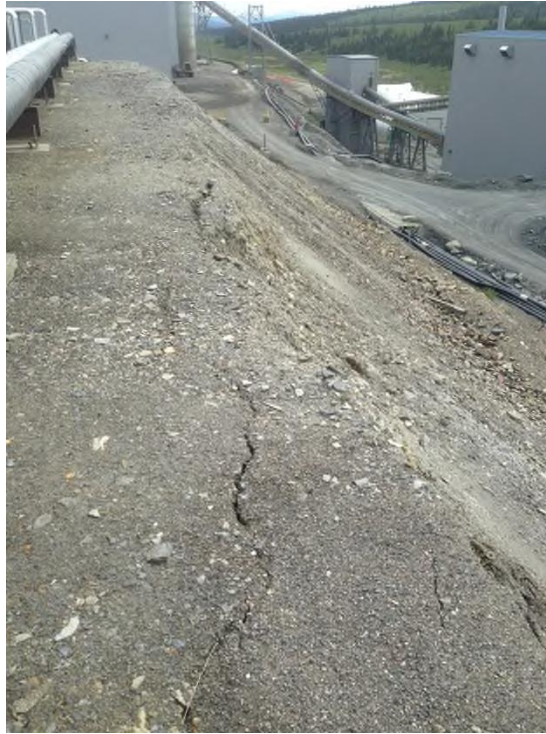
**Photo 3**

Large erosion channel along the eastern fill slope of the mill site pad location. (June 24, 2014)



**Photo 4**

The southern fill slope of the Fuel Tank Farm and Genset Pads locations. (June 24, 2014)



**Photo 5**

Small tension cracks along the southern fill slope of the genset pad location. (June 24, 2014)



**Photo 6**

Small erosion channel along the southern fill slope between the fuel tank farm and genset pad locations. (June 24, 2014)



**Photo 7**

Genset pad runoff culvert location. Splash trough is missing and major erosion of the slope fill has occurred. (June 24, 2014)



**Photo 8**

The MSE wall along the toe of the Mill fill. (June 24, 2014)

## 5.0 INDUSTRIAL COMPLEX SURFACE AND UNDERGROUND WATER TREATMENT SUMPS (1, 2 AND 5)

The foundations for Sumps 1, 2 and 5 were observed. Both Sumps 1 and 5 were not being used at the time of the site visit but still contained wastewater and sediment from underground. Sump 1 was about half full and there were areas of bulging in the liner indicating that groundwater continues to impact the liner placement when the sump is less than  $\frac{3}{4}$  full. The exposed liner of Sump 1 was visually inspected and found to be in good condition (Photo 9). Sump 5 was only partially full, mostly sediment with some water. The exposed liner of Sump 5 was visually inspected and found to be in good condition (Photo 10).

Sump 2 was reconstructed in 2013 and was in use during the site visit. It was being used to collect runoff water from Ditches 2 and 5, and the water from Sump 2 was being used as a water supply for underground workings (Photo 11).

The foundation conditions noted in the 2013 annual observation report for Sumps 1 and 5 remain the same. There was still some marginal settlement along the key trenches of Sump 1 as the backfill material was not compacted during original construction. The foundation conditions for Sump 2 are good as this sump was reconstructed in 2013.



**Photo 9**

Sump 1 about half full of underground mine water. (June 24, 2014)



**Photo 10**

Sump 5 full of underground sediments and some waste water. (June 24, 2014)



**Photo 11**

Sump 2 reconstruction complete and full of surface runoff water from Ditches 2 and 5. (June 24, 2014)



## 6.0 INDUSTRIAL COMPLEX DIVERSION DITCH 1 AND COLLECTION DITCHES 2, 3, 4 AND 5

During the previous site visits, it was noted that there were sections of diversion Ditch 1 that were lined with non-woven geotextile but for the most part the ditch remains unlined. There were small amounts of debris or slough from the upper slope deposited in the bottom of the ditch. In the future, this material may have to be removed to allow for continuous water flow along the ditch bottom. As noted in previous observation reports, the tension cracks and areas of settlement along the upper portion of the ditch embankment (Photo 12) were still noticeable. The tension cracks should be monitored and filled in as required to reduce the amount of water infiltration which may lead to instability of the embankment. The recompacted areas of settlement should also be graded to match the upper and lower sections of the ditch embankment.

Ditch 2 was observed and only a portion of the collection ditch along the lower section between the mill building location and the lower bypass road was lined. The inlet end of the culvert coming from the upper mill pad should be monitored for potential plugging and may require periodic cleaning to allow for positive flow through the culvert. The lower portion of Ditch 2 was in good shape allowing for surface runoff to flow towards Ditch 3 (Photo 13).

Ditch 3 liner was replaced last year and during this site visit there was no water flowing through it. Tetra Tech EBA was informed that it performed well for directing surface water collected from the Mill Pad through Ditch 2 during the Spring freshet. All surface runoff flowing through Ditch 2 and 3 is now directed into Sump 2. During the site visit there were small tension cracks noted along the exterior slope (Photo 14).

As noted in previous observation reports, there were still many small tears or punctures to the northern portion of the liner along both side slopes of Ditch 4. The base of the liner appeared to be undamaged but the side slopes still require repair. As noted in previous reports, there were still small tension cracks, areas of settlement located along the crest and downslope side of the ditch and erosion channels throughout the downslope side. There was no evidence of more recent additional movement as the crest and slope soils were promoting vegetation growth (Photo 15). As mentioned in the previous reports, these areas should be monitored and repaired as required. YZC did mention to Tetra Tech EBA that repairs to Ditch 4 are scheduled for this summer. It was also noted that along the upslope side of the ditch there was a lower portion of the embankment (native material) that was sluffing away undercutting the fill material for the lower bypass road next to the shotcrete batch plant (Photo 16).

Ditch 5 was observed and the upper portion of the ditch on the mill pad had some construction debris littered throughout that could potentially plug off the inlet end or buried portion of the culvert (Photo 17). The discharge end of the culvert located at the bottom of the MSE wall had been cleaned out and future surface runoff is now able to flow towards Sump 2 (Photo 18).



**Photo 12**

Tension cracks and depression of an upper portion of the Ditch 1 embankment. (June 24, 2014)



**Photo 13**

The inlet end of the culvert from the upper mill pad to the lower section of Ditch 2. (June 24, 2014)



**Photo 14**  
The reconstructed Ditch 3. (June 24, 2014)



**Photo 15**  
Vegetation growth throughout the tension cracks, areas of settlement and erosion channels. (June 24, 2014)



**Photo 16**

The lower sluffing portion of the fill slope of the lower bypass road near the shotcrete plant. (June 24, 2014)



**Photo 17**

The inlet end of the Ditch 5 culvert on the mill pad. (June 24, 2014)



**Photo 18**

The discharge end of the Ditch 5 culvert allowing surface runoff flow towards Sump 2. (June 24, 2014)

## **7.0 MINE CAMP PAD AREA INCLUDING UPPER GENERATOR AND POTABLE WATER TREATMENT PAD, SEWAGE TREATMENT PLANT PAD AND TREATED EFFLUENT POND**

The 2:1 cut and 1.5:1 fill slopes for the camp pad, upper generator and water treatment pad, sewage treatment plant pad, and the treated sewage effluent pond were observed and the slopes were considered stable (Photos 19 and 20).

As noted during previous site visits, there were still some noticeable tension cracks and erosion channels along the perimeter of the fill slope of the camp pad. As mentioned in the previous reports, these areas should be monitored and repaired as required. There was one area of the fill slope at the southwestern end of the camp pad that developed into a very large drainage channel during spring freshet. To reduce the any further erosion of the fill slope, YZC filled in the channel with rock (Photo 21).

The treated effluent pond is no longer being used as originally intended and was half full of precipitation runoff, allowing for only partial visual observation of the liner (Photo 22). There were no indications of slumping or bulging of the liner. The perimeter exterior fill slopes were also observed and there were no noticeable signs of instability.



**Photo 19**

The backslope of the camp pad. (June 25, 2014)



**Photo 20**

The downslope side of the camp pad. (June 25, 2014)



**Photo 21**

The southwestern erosion channel that was filled in with rock. (June 25, 2014)



**Photo 22**

The former sewage effluent pond for the camp. (June 24, 2014)

## 8.0 TEMPORARY WASTE ROCK AND ORE STORAGE FACILITY

The cut and fill slopes in the facility were observed and considered stable (Photo 23). The collection sump was also observed and at the time was full of runoff water (Photo 24).



**Photo 23**

The waste rock and ore stockpile. (June 24, 2014)



**Photo 24**

The ore stockpile area water run-off collection sump. (July 24, 2014)



## 9.0 LAND TREATMENT FACILITY (HYDROCARBON CONTAMINATED MATERIAL) INCLUDING RUNOFF COLLECTION SUMP

The berms and the liner of the land treatment facility (LTF) were observed and there was no noticeable deterioration of the berms or damage to the exposed liner (Photo 25). The LTF was about 50% full of hydrocarbon contaminated material and the collection sump was about 25% full of seasonal runoff (Photo 26).



**Photo 25**

The containment area of the LTF. (June 24, 2014)



**Photo 26**

The LTF sump was  $\frac{3}{4}$  full. (June 24, 2014)

## 10.0 VENT RAISE AND PROPANE TANK PAD

The 2:1 cut slopes for the vent raise and propane tank pad were observed and were considered stable (Photos 27 and 28). The vent raise back slope is showing some signs of erosion and should be monitored for instabilities at the top of the slope.



**Photo 27**

The backslope of the vent raise. (June 24, 2014)



**Photo 28**

The backslope behind the propane tank pad. (June 24, 2014)

## 11.0 TRUCK SHOP PAD

The 2:1 cut and fill slopes for the truck shop pad were observed and the majority of the slopes were considered stable (Photos 29 and 30). The northwestern end of the backslope has a small area of slumping that should be monitored and repaired as required.



**Photo 29**

The downslope of the truck shop pad. (June 24, 2014)



**Photo 30**

The backslope behind the truck shop pad. (June 24, 2014)

## 12.0 CONCLUSIONS

Tetra Tech EBA has concluded that all of the tension cracks, sloughing, erosion channels, damage to liners and areas of settlement associated with the on-site earth structures pose no significant risk to the environment or human health and safety. These areas of interest still require frequent monitoring (monthly) and repairs as required. Collection Ditch 4 will require repair to the tears and punctures in the liners and filling of the tension cracks, settlement areas, erosion channels and undercut area; prior to freshet in spring 2015 to avoid possible complete failure of the upslope and downslope ditch embankments. A summary of recommendations is presented in the following Table 1:

**Table 1: Summary of Recommendations from 2014 Observations**

Item Description	Recommended Maintenance	Status
Mill Area	Fill erosion channels with coarse grained material. Still large erosion channel that requires filling at southwestern corner of the mill pad	Majority of channels completed spring 2014.
Mill Area	The MSE wall has small rocks working their way through the mesh that are considered falling hazards and should be monitored and removed as required.	
Fuel Tank Farm and Genset Pads	Small erosion channel between the two pads along the southwestern slope that requires monitoring – repair as necessary.	
Genset Pad	The main drainage channel's splash trough has broken loose and should be repaired to reduce the amount of additional extensive erosion.	
Water Treatment Sump 1	Settlement in geomembrane anchor/key trench.	No work required. Planning decommissioning for summer 2014.
Ditch 1	Fill tension cracks and areas of settlement along berm.	Still only monitoring.
Ditch 3	Minor tension cracks in new fill placement.	Monitoring.
Ditch 4	Repair liner, fill tension cracks, areas of settlement and erosion channels.	Repair work planned for summer 2014.
Ditch 5	Clean out discharge towards Sump 2.	Completed spring 2014.
Ditch 5	Clean out construction debris from upper mill pad portion of ditch.	
Camp Area	Monitor tension cracks and erosion channels – repair as necessary.	Major southwestern erosion channel has been filled in with rock.
Truck Shop Area	Small area of slumping – repair as necessary	

## 13.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Yukon Zinc Corporation and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Yukon Zinc Corporation, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in the General Conditions attached.

## 14.0 CLOSURE

We trust this report meets your present requirements. Should you have any questions or comments, please contact the undersigned.

Sincerely,  
Tetra Tech EBA Inc.



Chad Cowan, P.Eng.  
Project Director – Yukon, Arctic Region  
Direct Line: 867.668.9214  
Chad.Cowan@tetrattech.com



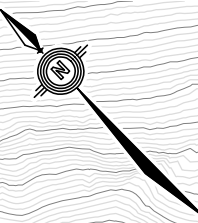
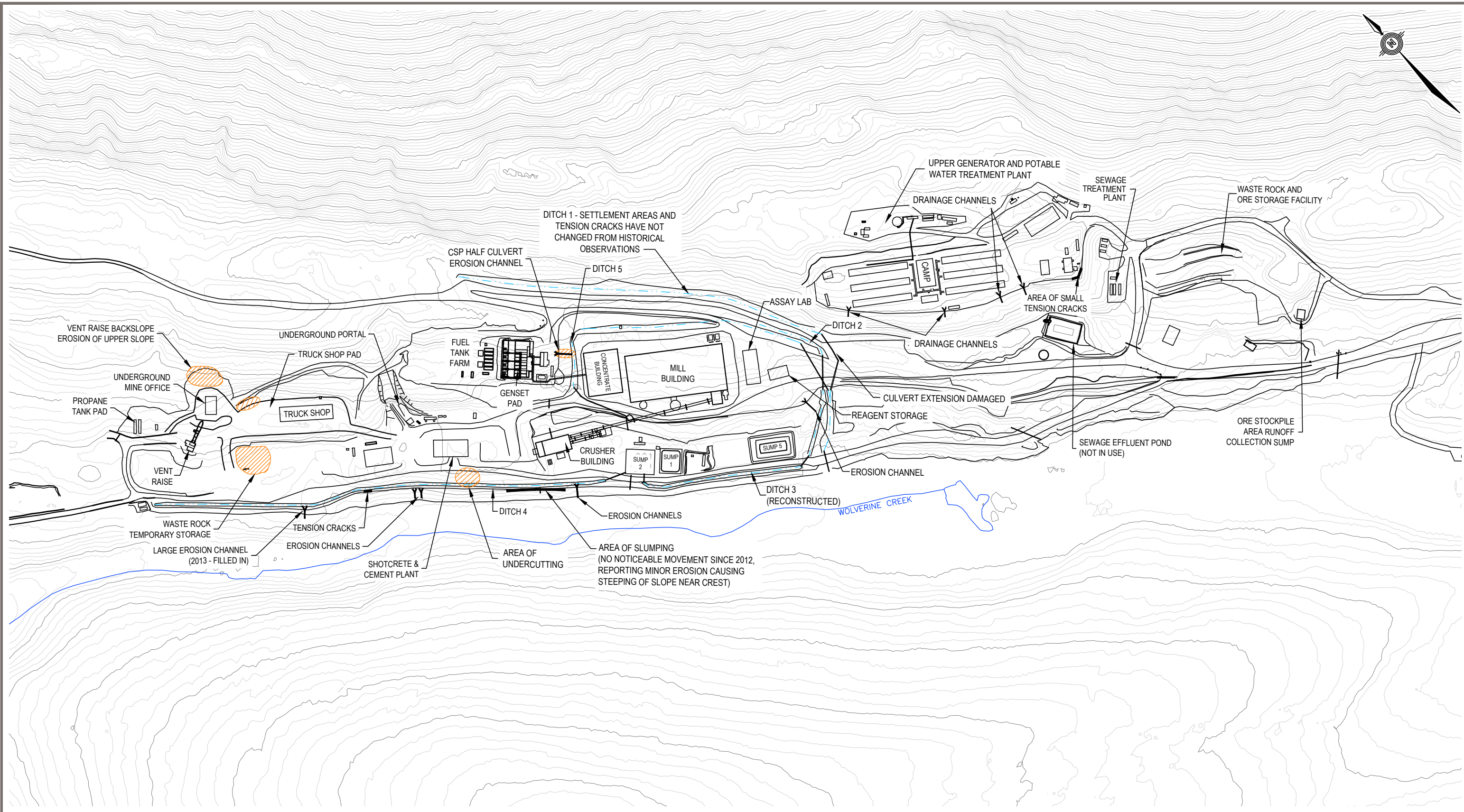
J. Richard Trimble, P.Eng., FEC  
Principal Consultant, Arctic Region  
Direct Line: 867.668.9216  
Richard.Trimble@tetrattech.com

Attachments: Figure 1: Site Plan Showing Location of On-site Earth Structures  
Tetra Tech EBA's General Conditions - Geotechnical

/chr



Q:\Whitehorse\Data\0201\Drawings\Campbell\W14103418-01 Wolverine Mine 2014 Annual Observation Report\W14103418-01 Annual Report 2014.dwg [FIGURE 1] July 07, 2014 - 9:13:49 am (BY: BUCHAN, CAMERON)



**LEGEND:**

- TENSION CRACKS
- EROSION CHANNEL
- WATER COURSE
- AREAS OF INTEREST (APPROXIMATE)

STATUS  
ISSUED FOR USE

Scale: 1: 4 000 (metres)

CLIENT

WOLVERINE MINE ANNUAL OBSERVATION REPORT WOLVERINE MINE, SOUTH EASTERN YUKON				
SITE PLAN SHOWING ON-SITE EARTH STRUCTURES				
PROJECT NO. W14103418-01	DWN CB	CKD CPC	REV 0	<b>Figure 1</b>
OFFICE EBA-WHSE	DATE June 26, 2014			

# GENERAL CONDITIONS

---

## GEOTECHNICAL REPORT

This report incorporates and is subject to these “General Conditions”.

---

### 1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of Tetra Tech EBA's Client. Tetra Tech EBA does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than Tetra Tech EBA's Client unless otherwise authorized in writing by Tetra Tech EBA. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of Tetra Tech EBA. Additional copies of the report, if required, may be obtained upon request.

### 2.0 ALTERNATE REPORT FORMAT

Where Tetra Tech EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed Tetra Tech EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by Tetra Tech EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of Tetra Tech EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except Tetra Tech EBA. Tetra Tech EBA's instruments of professional service will be used only and exactly as submitted by Tetra Tech EBA.

Electronic files submitted by Tetra Tech EBA have been prepared and submitted using specific software and hardware systems. Tetra Tech EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

### 3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, Tetra Tech EBA has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

### 4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. Tetra Tech EBA does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

### 5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

### 6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. Tetra Tech EBA does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

## 7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

## 8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

## 9.0 INFLUENCE OF CONSTRUCTION ACTIVITY

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

## 10.0 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

## 11.0 DRAINAGE SYSTEMS

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

## 12.0 BEARING CAPACITY

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

## 13.0 SAMPLES

Tetra Tech EBA will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

## 14.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of the report, Tetra Tech EBA may rely on information provided by persons other than the Client. While Tetra Tech EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.