

Aug 24th, 2017

Our File: ES00078

Yukon Zinc Corporation
Suite 705 – 1030 W Georgia St
Vancouver BC Canada
V6E 2Y3

Attn: Mr. Alex Wu, Manager Corporate Communications & Administration

**Re: 2017 Wolverine Annual Physical Inspection
Evaluation of earth structures, works and installations**

Dear Mr. Wu,

CAP Engineering (CAP) is pleased to provide Yukon Zinc Corporation (YZ) with the 2017 Annual Physical Inspection of the earth structures, works, and installations of the Wolverine Mine site. A site inspection of the Mine and Industrial complex was conducted by Mr. Cory Redmond, E.I.T. and Paul Knysh P.Eng on Aug 15th to 16th, 2017. The inspection included a site tour with Mr. Preston Vowk Site Supervisor from Wolverine Mine to review existing conditions, past and current site problems, and on-going repair and maintenance work. Mr. Paul Knysh, P.Eng completed an engineering review of inspection findings and photographs. The following is a summary of CAP's findings and recommendations.

1. Introduction

CAP was retained by YZ to travel to the Wolverine mine site to conduct the 2017 annual physical inspection report as required by the Quartz Mining License (QML-0006). The Wolverine Mine is an underground lead-zinc-silver mine located in southeastern Yukon approximately 280 km east of Whitehorse. The mine ceased operations in January of 2015 and is currently under Care and Maintenance operations. Since 2015 there have been no mining or milling operations that could have influenced the on-site infrastructure. The Wolverine mine site contains numerous, ditches, culverts and cut and fill earth structures that require regular inspections and maintenance throughout the year. The Wolverine Mine has seen large levels of rainfall totaling 151 mm of precipitation from January to June during 2017 which exceeds the same period for 2016 which saw a total of 76 mm of precipitation, see Appendix B. Rainfall data was obtained from Shuksan Environmental Solutions. The following areas of inspection were identified by YZ for review:

- Industrial Complex – the mill building pad;
- Industrial Complex – the MSE wall;
- Industrial Complex – fuel tanks and generator pad;
- Sumps (1,2 & 5) – includes liners and slopes;

- Diversion Ditch 1 – Includes cut and fill slopes;
- Collection Ditches (2,3,4 & 5) – includes liners and cut and fill slopes;
- Mine Camp Pad & Area – includes upper generator, potable water pad, sewage treatment plant, sewage effluent pond- liner, cut and fill slopes;
- Waste Rock & Ore Pad – includes seepage pond, liners, cut and fill slopes;
- Land Treatment Facility- runoff collection sump;
- Vent Raise – slopes; and
- Truck Shop Pad – slopes.

2. Analysis of On-site Earth Structures

CAP was responsible for providing YZ the following services:

- Site visit and visual observation of the earth structures associated with the above mentioned structures and areas;
- Compile a report that includes: a statement about the status and conditions of each area, photos exhibiting current conditions; and
- Remedial recommendations if required.

Field inspections and observations were completed by Mr. Paul Knysh and Mr. Cory Redmond of CAP. The following is a summary detailing what was observed while conducting the investigation. Photos for each area and structure can be observed in Appendix A.

a. Mill Building Pad

The slope downstream of the mill building appeared to be in good condition. The following is a list of observations observed in the Mill Building Pad area:

- Erosion at the crest of the mill pad slope above the crusher pad which had undermined piping infrastructure was observed at the North West corner of the mill pad next to fire hydrant #10;
- The culvert at the crest of the mechanical stabilized earth (MSE) wall was covered with fines due to the year's precipitation events;
- Erosion down slope of the Mill Pad was observed and appeared to be associated with pipes running along crest of the embankment. Past repairs using rip rap and non-woven geotextile have been instituted;
- A constant flow of water was observed to be flowing from the ground water collect culvert buried under the south west portion of the mill pad; and
- Water was observed seeping out of the toe of the fuel/generator pad access road and running

into Ditch 5.

b. MSE Wall

The MSE wall located around the south western area of the industrial complex appeared to be in good condition and exhibit no signs of deformation or bulging. The following observations were made while conducting the inspection:

- At the South West corner of the crusher building, the telepost below the walkway was noted to be offset from vertical; and
- The culvert located at the bottom of the wall connected to Ditch #5's manhole was partially submerged by fines due to the yearly precipitation events.

c. Fuel Tank and Generator Pad

The fuel tank and generator pad were observed to be in good condition. The following observations were made:

- Small rill erosion present on the old exploration roadway embankment behind the fuel tank and generator pad;
- The two erosion gullies that had been previously repaired with rip rap were still in good condition and have withstood the annual melt and precipitation events; and
- A small erosion gully at the North West portion of the fuel pad has begun to undermine a concrete support block.

d. Sumps – 1, 2 & 5

The foundation, liners and slopes of sumps 1, 2 & 5 were observed to be in good working condition. At the time of the inspection report Sump 1 remains decommissioned, Sump 5 was observed to be a third full and both the slopes and exposed geomembrane appeared to be in good condition. During the site investigation it was noted that Sump 2 was in the process of being emptied, hydro vacuumed, and installing a new geomembrane. A temporary sump north of Sump #2 was constructed to control flow during the relining of Sump #2. The Care and Maintenance team noted that an underground pump was being utilized to lower the groundwater and diminish the influence of groundwater upon the sump liner that had been noted in previous year's inspection reports. No bulges were observed in the liner of Sump 2 with the removal of water.

e. Diversion Ditch 1

Diversion Ditch 1 located above the Fuel and Generator Pad access road and east of the Mill Pad was observed to be in good condition. As reported in the previous year's inspection reports the large approximately 20 m long tension or settlement crack was observed on the crest of the downstream berm of Ditch 1. There were no signs of distress or movement during the site investigation. The culvert located at the end of Ditch 1 running under the Mill Pad was observed to be damaged.

f. Collection Ditches 2, 3, 4 & 5

Ditch 2

Collection Ditch 2 and the entrance to the culvert leading to the Ditch 3 located east of the Mill pad and below the fuel/generator access road appeared to be in good condition.

Ditch 3

Collection Ditch 3, liner, and embankment berm located at the South West side of the Mill Pad appeared to be in good condition. Ditch 3's culvert leading to Sump 2 is partially filled with fines and sediment due to the annual precipitation events.

Ditch 4

Collection Ditch 4, liner and embankment berm appeared to be in good condition. The downslope embankment has withstood the yearly melt and precipitation events.

Ditch 5

Collection Ditch 5 and outlet culvert appeared to be in good working condition. The Ditch 5 appears to be working properly as water was seen to be flowing and diverting correctly during the inspection. As mentioned above the outlet culvert at the bottom of the MSE has had some sediment and fine materials accumulated over the year, and the manhole was covered with fines and sediment as well.

g. Mine Camp Area

The overall condition of the Mine Camp Area including the potable water pad, and core shack appeared to be in good condition. The following observations were made:

- Due to the recent high precipitation a small section of berm had been washed away in the North West corner of the Camp Area which caused an erosion gully leading down to the mill pad and Ditch #1. Upon inspection the berm had been repaired; and
- Erosion repair on past erosion areas have withstood the yearly precipitation.

h. Sewage Treatment Plant

The cut and fill slopes around the sewage treatment plant were observed to be in good condition. A remnant of an erosion control blanket (geotextile, etc.) was observed between the Mine Camp Pad and sewage treatment facility.

i. Sewage Effluent Pond

As mentioned in previous year's reports the sewage effluent pond has been decommissioned and is no longer in use. The embankment, fill and liner were observed to be in good condition. The water elevation was observed to be at an acceptable level.

j. Waste Rock Pad #1

Waste Rock Pad #1, sumps, and liner located south of the Mine Camp Area were observed to be in good condition. Minor surface erosion on the steep portion of the access South East of Waste Rock Pad area was observed on approach. Additionally, a berm across the stockpile ramp appeared to be missing, this could potentially lead to portions of runoff flows to the nearby culvert, see Figure 26.

k. Waste Rock & Ore Pad #2

Waste Rock & Ore Pad #2, exposed liner and berm located north of the TSF was observed to be in good condition.

l. Tailings Storage Facility Seepage Pond

The TSF Seepage Pond located south of the TSF appeared to be in good condition. The Mine Access Roadway serves as the Seepage Pond dam and the embankment slope has settled which has caused over steepening of the slope as well as tension cracks which were visible along the shoulder of the road.

m. Land Treatment Facility (LTF) Pad

The LTF Pad located North East of the airstrip was observed to be in good condition. The non-woven geotextile covering the impermeable liner has been lifted by winds and will need to be mitigated before the LTF is put into operation.

n. Truck Shop

The cut slope into bedrock located behind the truck shop appeared to be in good condition. During the inspection and after the year's rain events there was no indication of erosion in the slope.

o. Vent Raise and Mine Office

The cut slope into bedrock located behind the Mine Office and Vent Raise appeared to be in good condition. Minor rill erosion was noted in the slope behind the Mine Office and Vent Raise. No signs of distress were noted at the crest of the cut.

p. Mine Portal

The cut slope and supported ground around the Mine Portal appeared to be in okay condition with minor defects. It was observed that sections of shotcrete have come loose and fallen from the slope around the portal. The exposed bedrock appears to be relatively stable, although it may become erodible under flow and/or weathering.

3. Conclusion

Overall the conditions of the earth structures at the Wolverine Mine site were in good working condition. The majority of the structures, sumps, and liners had withstood the years higher than normal rainfall events and exhibited no signs of recent instabilities. Most notably the Care and Maintenance crew have done an excellent job of maintaining, monitoring and repairing the on-site earth structures throughout the year. The photographs taken during this year's site investigation are included as a comparison and reference to previous and future year's inspection reports.

4. Recommendations

The main recommendations from the 2017 annual inspection are summarized below. All recommended repairs should be completed before winter and ready for next spring's melt runoff.

- **Site Culverts** – It is recommended that all culverts on site should be cleaned of all fines and sediment. Additionally, if culverts are damaged repairs should also be completed;
- **Site Erosion and Cracks** – Continue monitoring and repairing erosion rills and gullies as they appear throughout the year. Tension and settlement cracks can be visually monitored by backfilling the crack with soil and spray painting over the filled soil.
- **Mill Pad** – Figure 2, erosion at the North West corner of the Mill Pad around hydrant #10 should be repaired with rip rap as reasonably as possible;
- **Fuel Pad** – Figure 9, erosion undermining the concrete anchor should be repaired as best as possible;
- **Waste Rock Pad #1** – Figure 26, construct a berm between the waste rock pad access ramp. This will fully enclose the waste rock pad and help contain runoff water; and
- **Mine Portal** – Figure 38, monitor the shotcrete at the mine portal for additional peeling and bedrock erosion.

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PERMIT TO PRACTICE
Signature <u>Paul Knysh</u>
Date <u>2017/08/24</u>
PERMIT NUMBER: PP189
Association of Professional Engineers of Yukon

APPENDIX A

SITE INVESTIGATION PICTURES



Figure 1 – Erosion down slope of mill pad. Repairs from previous years using rip rap and non-woven geotextile can be observed in the background.



Figure 2 - Base of erosion from North West corner of Mill Pad.



Figure 3 – Outlet of culverts draining to the environment and Ditch #3. Culvert outlet at the right with running water connected to groundwater collection and was observed with significant flows.



Figure 4 – Embankment seepage from North West corner of the Mill Pad. Toe of the embankment paralleling Diversion Ditch #1, water flows to Ditch #5, shed at centre of photo contains vertical sump pump.

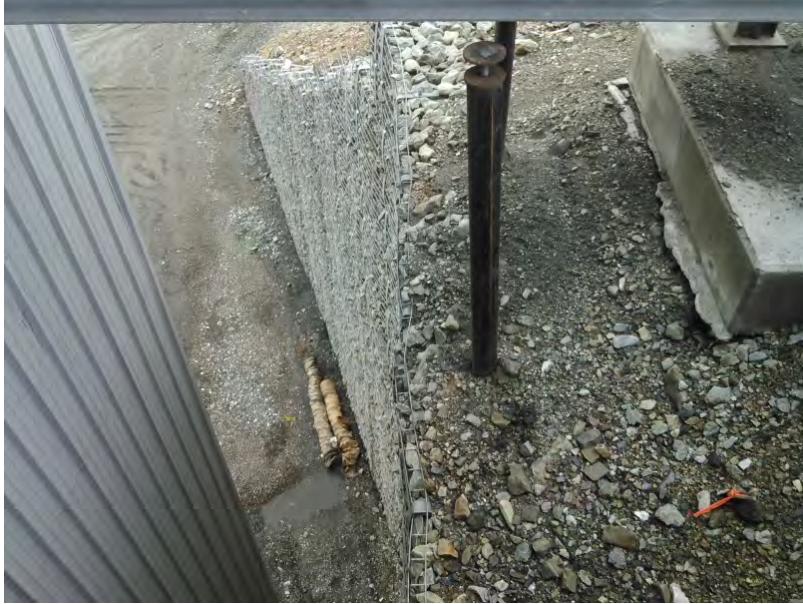


Figure 5 – MSE wall at south west corner of crusher building, post offset from vertical, possible indication of movement.



Figure 6 – MSE wall facing North West towards the crusher and conveyor belts. Culvert from Ditch #5 can be seen in the lower right section of the photo.



Figure 7 – MSE wall behind crusher.



Figure 8 – Culverts and rip rap leading from Generator Pad to Ditch #5.



Figure 9 – Erosion undermining concrete anchor at the North West side of the Fuel Pad.



Figure 10 – Embankment slope below Generator Pad, small rill erosion can be observed.



Figure 11 – Sump #2 being drained for replacement of liner, drainage from Ditch #3 visible at the right of the photo.



Figure 12 – Recently constructed sump excavated upstream of Sump #2 in order to control flow during the relining of Sump #2.



Figure 13 –Sump #5 as seen above from the Mill Pad.



Figure 14 – Settlement/tension cracks observed in berm adjacent to Ditch #1. Area has been noted in previous reports and no new indication of soil distress was noted.



Figure 15 - Ditch #1 culvert at the south end of the Mill Pad. Buildup of sediments and damage to the culvert can be seen.



Figure 16 – Ditch #3 looking west towards Sump #2.



Figure 17 – Ditch #4 at the edge of site storage pad looking east.



Figure 18 – Outfall of Ditch #5 at base of MSE wall.



Figure 19 – Ditch #5 manhole located at the top of the MSE wall on the west side of the Mill Pad.



Figure 20 – Previously repaired erosion along the Camp Pad as seen from the Sewage Pond.



Figure 21 - Mine Camp Slope looking south towards the airstrip.



Figure 22 – Recently repaired erosion rill due to heavy rainfalls located in the North West corner of the Camp Pad facing north.



Figure 23 – Sewage Treatment Facility looking west.



Figure 24 – Decommissioned Sewage Effluent pond.



Figure 25 – Waste Rock Pad #1 sump and liner located in the South West corner of the pad. Sump level is controlled by a float and pump system.



Figure 26 – Waste Rock Pad #1 berm isn't continued past the waste pad access ramp.



Figure 27 – Waste Rock Pad #2 on the North East side looking south along the containment berm.



Figure 28 – Waste Rock Pad #2 settling pond located at the south end of the pad. Settling pond is discharged through the Bio Reactor.



Figure 29 - Seepage Pond downstream of the TSF. Wolverine access roadway serves as dam. Embankment slope has settled causing over steepening of slope as well as tension cracks.



Figure 30 – Seepage Pond as seen from the TSF facing south.



Figure 31 – Diversion Ditch B facing north and located above and on the east side of the TSF.



Figure 32 – Diversion Ditch A head waters parallels bio-reactor channel and drainage from Waste Rock Pad #2.



Figure 33 - Diversion Ditch A, beginning of lined portion of drainage ditch which flows along the southern edge of the tailings pond.



Figure 34 – Land Treatment Facility (LTF) Pad and sump looking east.



Figure 35 – Cut slope behind Truck Shop looking north.



Figure 36 – Mine Office cut slope looking south.



Figure 37 – Cut slope above the Vent Raise looking North East.



Figure 38 – Mine Portal, some shotcrete has come loose and fallen from the slope. Exposed bedrock appears relatively stable, but could be erodible under flow and/or weathering.

APPENDIX B

PRECIPITATION EVENTS

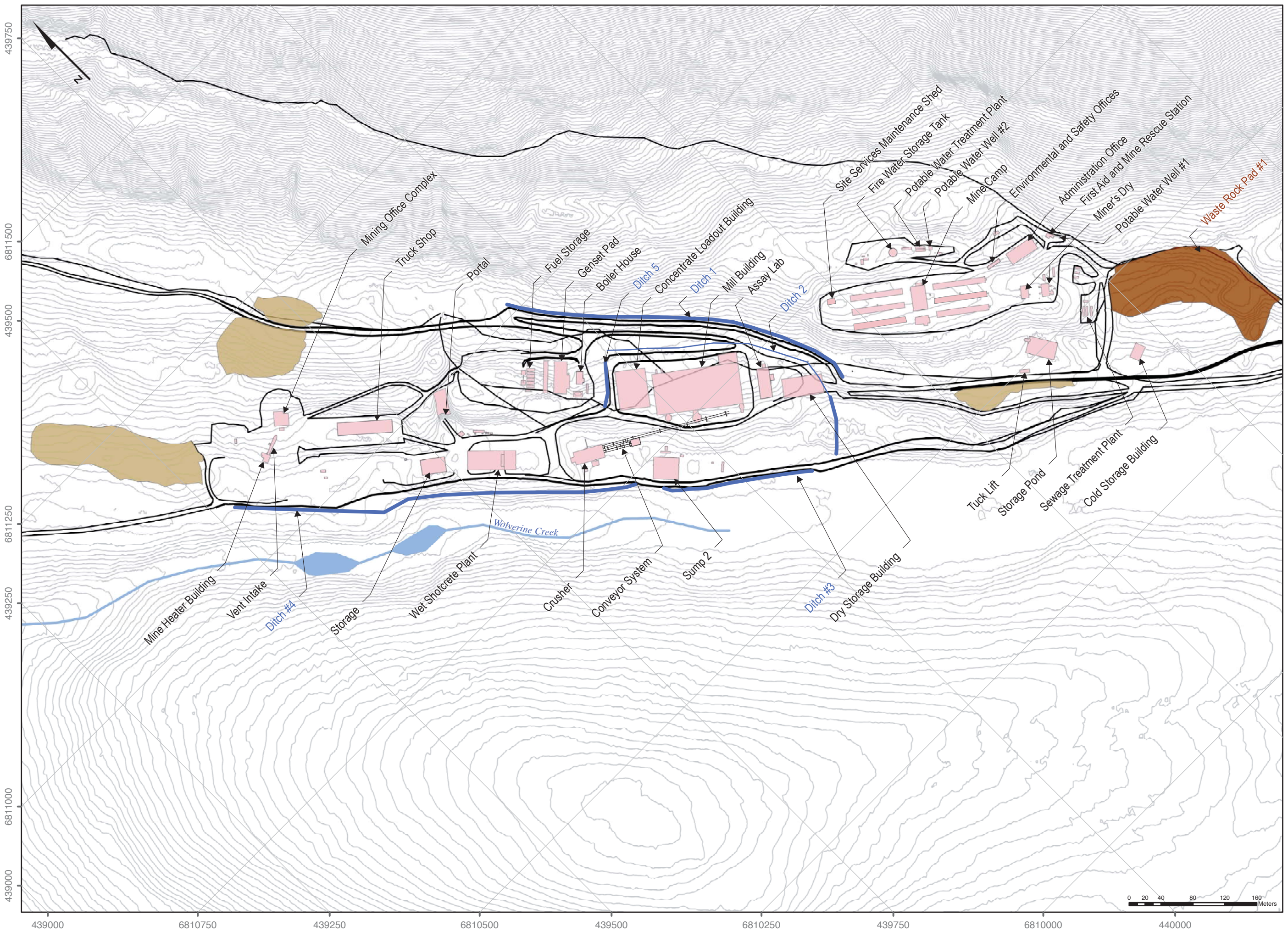
Cumulative Monthly Precipitation (as rain)												
	January	February	March	April	May	June	July	August	September	October	November	December
2015								102.8	28	22.8	0	0
2016	0.4	3.8	4.4	17.2	24	26.2	72.8	63.6	37	0.8	2	0.2
2017	0	2.4	8.6	2.2	21.2	116.41						

Average Monthly Temperature												
	January	February	March	April	May	June	July	August	September	October	November	December
2015								7.2	2.0	-2.0	-9.9	-15.2
2016	-11.7	-10.8	-6.3	0.1	5.7	10.4	11.4	9.6	3.6	-6.1	-10.5	-16.2
2017	-12.0	-13.0	-15.9	-3.0	4.6	8.7						

APPENDIX C

SITE MAPS

**Figure 4-4
Wolverine Mine:
Industrial Complex
General Arrangement**



- Ditch
- Existing Road
- Mine Access Road
- Infrastructure
- Organic Stockpile
- Waste Rock Pad

- Topography**
- Contour
 - Watercourse
 - Waterbody

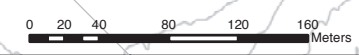
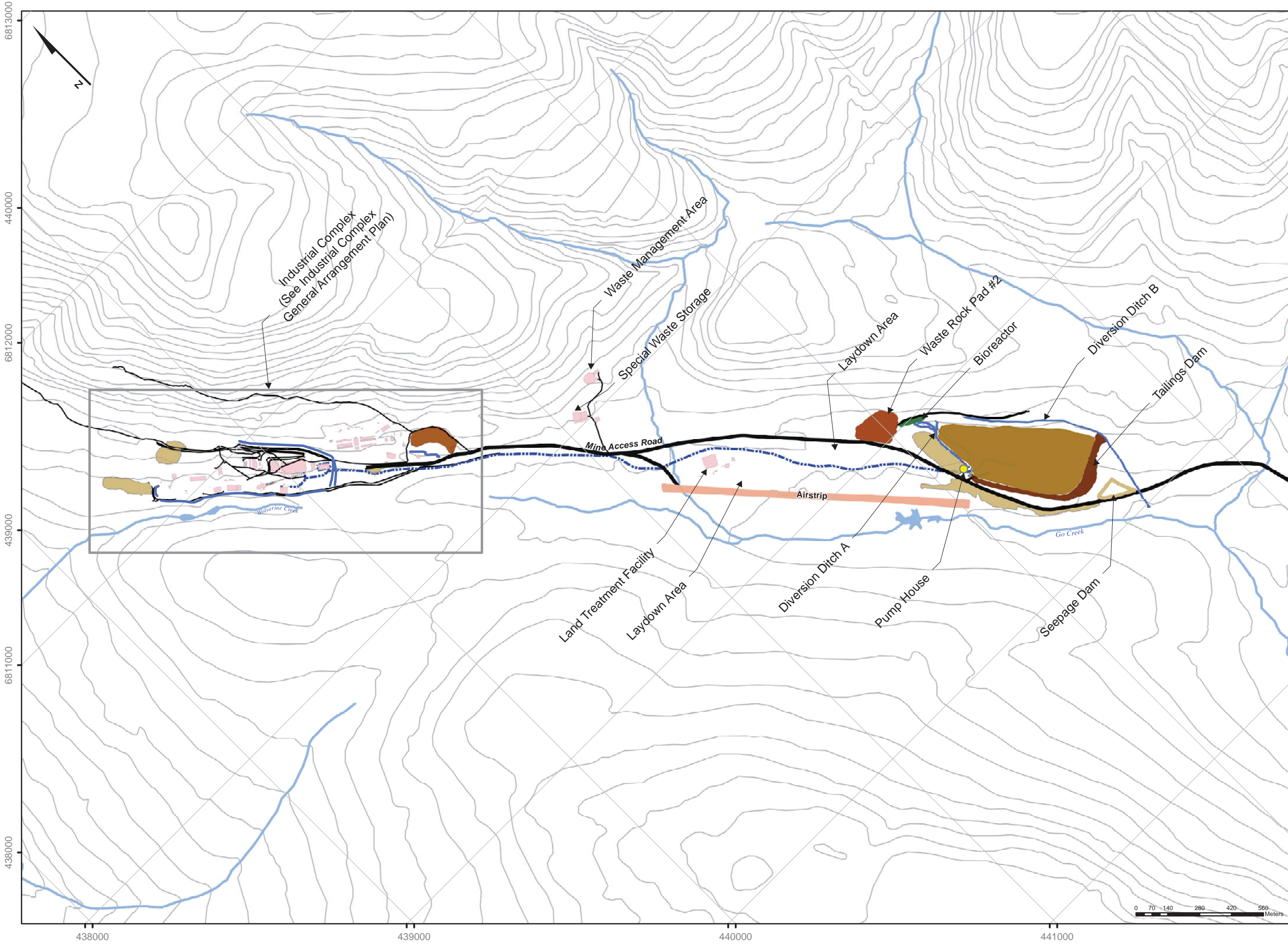


Figure 4-3
Wolverine Mine:
Site Location
General Arrangement



- Existing Road
- Mine Access Road
- Winter Road
- Tailings Pipeline
- Culvert
- Diversion Ditch
- Infrastructure
- Seepage Collection Pond
- Spillway Stage 2
- Pump House
- Bioreactor
- Airstrip
- Organic Stockpile
- Waste Rock Pad

