

Third Party Review of Dam Safety Inspection Report MAX Molybdenum Mine

Prepared for

Forty Two Metals Inc.



Prepared by

 **srk** consulting



SRK Consulting (Canada) Inc.
1CF011.000
December 2014

Third Party Review of Dam Safety Inspection Report MAX Molybdenum Mine

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1 Introduction

On August 18, 2014, British Columbia's Chief Inspector of Mines issued a series of orders to owners, agents or managers responsible for tailings dams. Pursuant to the Chief Inspector's orders, and in response to a request from Scott Broughton of Forty Two Metals Inc., SRK Consulting (SRK) has completed a third party review of the dam safety inspection completed by Klohn Crippen Berger (KCB) at the tailings storage facility at the MAX Molybdenum Mine near Trout Lake in the West Kootenay region of BC.

The scope of the third party review is outlined in the notification of the Chief Inspector's orders, a copy of which is included in Appendix A. The requirements of the dam safety inspection (DSI) are provided in Appendix B.

2 Basis of this Review

The main document on which this review has been completed is the KCB report dated November 2014 describing the findings from the DSI in early September 2014. A subsequent document, a letter outlining the results of an inundation study, was issued by KCB on November 28, 2014.

It is noteworthy that SRK completed an independent inspection of the tailings storage facility (TSF) on July 15, 2014 as part of a due diligence study on behalf of a financial institution. The author of this report is, therefore, familiar with the facility.

3 Facility Description

The MAX Molybdenum Mine TSF, which was originally constructed in 2007, is a valley impoundment which straddles a drainage divide. As a result, two dams were constructed approximately 500 m apart to impound tailings. Dam raises were subsequently completed in 2007 and 2010. Today the two dams can be characterized as follows:

- Southeast Dam: approximately 170 m long with a maximum height of 18.6 m; and
- Northwest Dam: approximately 180 m long with a maximum height of 16.8 m.

The TSF is currently in care and maintenance.

4 DSI Review

The BC guidelines for annual DSI reports, provided in Appendix B, are quite clear insofar as what the DSI report should include. The following table summarizes the DSI requirements and SRK's comments on what and where the required information is contained in the KCB DSI report.

Table 4-1- Summary of DSI Report Completeness

Item	Information Req'd	Included (Yes or No) and Location in the DSI	Comments by the Third Party Reviewer
1	Executive Summary	Yes (2 pages)	
1a	Classification of the dam(s) in terms of Consequence of Failure in accordance with Table 2-1 of the CDA Dam Safety Guidelines (2007)	Yes, on page 1 of Executive Summary	The "high" classification was assigned as part of the 2008 KCB design report in consideration of the potential environmental damage to Wilkie Creek and Trout Lake fish and wildlife habitat. The DSI report contains no further information regarding the rationale for the dam classification.
1b	Significant changes in visual monitoring records and/or instrumentation	Yes, on page 1 of Executive Summary	No changes in the past year but there are gaps in the database. This issue is addressed in the DSI report recommendations.
1c	Significant changes in dam stability and/or surface water control	Yes, on page 2 of Executive Summary	
1d	For major impoundments, as defined in Part 10 of the Code, a current Operation, Maintenance and Surveillance (OMS) Manual is required. The annual report shall indicate the latest revision date of the OMS manual.	Yes, on page 2 of Executive Summary	The latest revision of the OMS manual was in 2010, when the TSF was in operation; it needs to be updated to reflect the care and maintenance status of the TSF. This issue is addressed in the DSI report recommendations.
1e	For tailings dam classified as High, Very High, or Extreme Consequence, an Emergency Preparedness (EPP) is required. The annual report shall indicate the latest revision date of the EPP document	Yes, on page 2 of Executive Summary	The EPP was updated in early 2014 but should be updated in 2015. This issue is addressed in the DSI report recommendations.
1f	Schedule date for the next formal Dam Safety Review in accordance with Table 5-1 of the CDA Dam Safety Guidelines (2007)	Yes, on page 2 of Executive Summary	No dam safety review has been completed. DSI report recommends 2015 in accordance with the 7-year interval which corresponds to the CDA Dam Safety Guidelines (2007) for a "high" classification dam.
2	Summary of past years' construction (if any) with a description of any problems and stabilization	Yes, in Ch. 2.2	No construction since 2010.
3	Plan and representative cross sections	Yes, in Appendix V	
4	Site photographs	Yes, in Appendix II	
5	Review of climate data	Yes, in Ch. 4.4	
6	Water balance review	Yes, in Ch. 3.1	
7	Freeboard and storage availability (in excess of the design flood)	Yes, in Ch. 3.2	
8	Water discharge system, volumes and quality	Yes, in Ch. 3.1 & Appendix IV	
9	Seepage occurrence and water quality	Yes, in Ch. 3.3	
10	Surface water control and surface erosion	Yes, in Ch. 5.2 and Ch. 5.3	
11	Instrumentation review; see 11a, 11b and 11c, below	Yes, in Ch. 4.1	
11a	Phreatic surfaces and piezometric data	Yes, in Ch. 4.1	There are gaps in the database. This issue is addressed in the DSI report recommendations.
11b	Settlement	Yes, in Ch. 4.2	There is no instrumentation in place which addresses settlement. This issue is addressed in the DSI report recommendations.
11c	Lateral movement	Yes, in Ch. 4.3	There is no instrumentation in place which addresses lateral movement. This issue is addressed in the DSI report recommendations.

Source: \\VAN-SVR0\Projects\01_SITES\MAX Molybdenum\3rd party dam safety review\Text\DSI Completeness Table_CS

The Chief Inspector's orders are specific in relation to the need for the third party review to assess the dam consequence classification. As noted in Table 4.1, the consequence classification for both dams is "high" and is based on the potential "environmental damage to Wilkie Creek and Trout Lake fish and wildlife habitat." The DSI report provides no specific information on the quality of fish habitat between the TSF and Trout Lake, or in Trout Lake, nor has the geochemistry of the tailings been addressed, which is critical to understand potential environmental impacts. Based on the results of the inundation study (KCB 2014b), judgement suggests that the environmental and cultural losses are likely to be "significant" to "high", but based on current information, they would appear to be no higher than "high." Figures 1 and 2, extracted from the inundation study, suggest that the consequences in the other two categories (i.e. loss of life category and the economic and social loss category) would be classified as "low" to "significant."

In conclusion, we do concur with the "high" dam consequence classification but believe it would be appropriate to re-evaluate the dam consequence classification, in accordance with dam safety review requirements, as part of the next dam safety review.


5 Recommendations

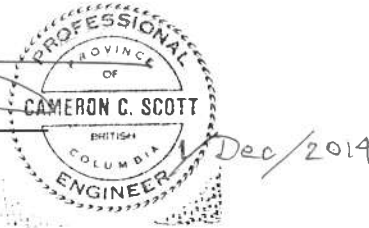
The DSI report contains recommendations, with assigned priorities, including those from previous DSI reports completed by KCB. We have reviewed these recommendations and believe them to be appropriate based on the findings contained within the DSI report and our knowledge of the site.

6 Conclusions

It is the opinion of the writer that the content of the 2014 DSI report by KCB conforms with the BC guidelines for DSI reports. Furthermore the writer concurs with the dam consequence classification of "high" for the two dams at the TSF. Lastly, the writer concurs with the recommendations contained in the DSI report, and has no additional recommendations.

This report, Third Party Review of Dam Safety Inspection Report - MAX Molybdenum Mine, was prepared by


Cameron C. Scott, PEng
Principal Consultant



All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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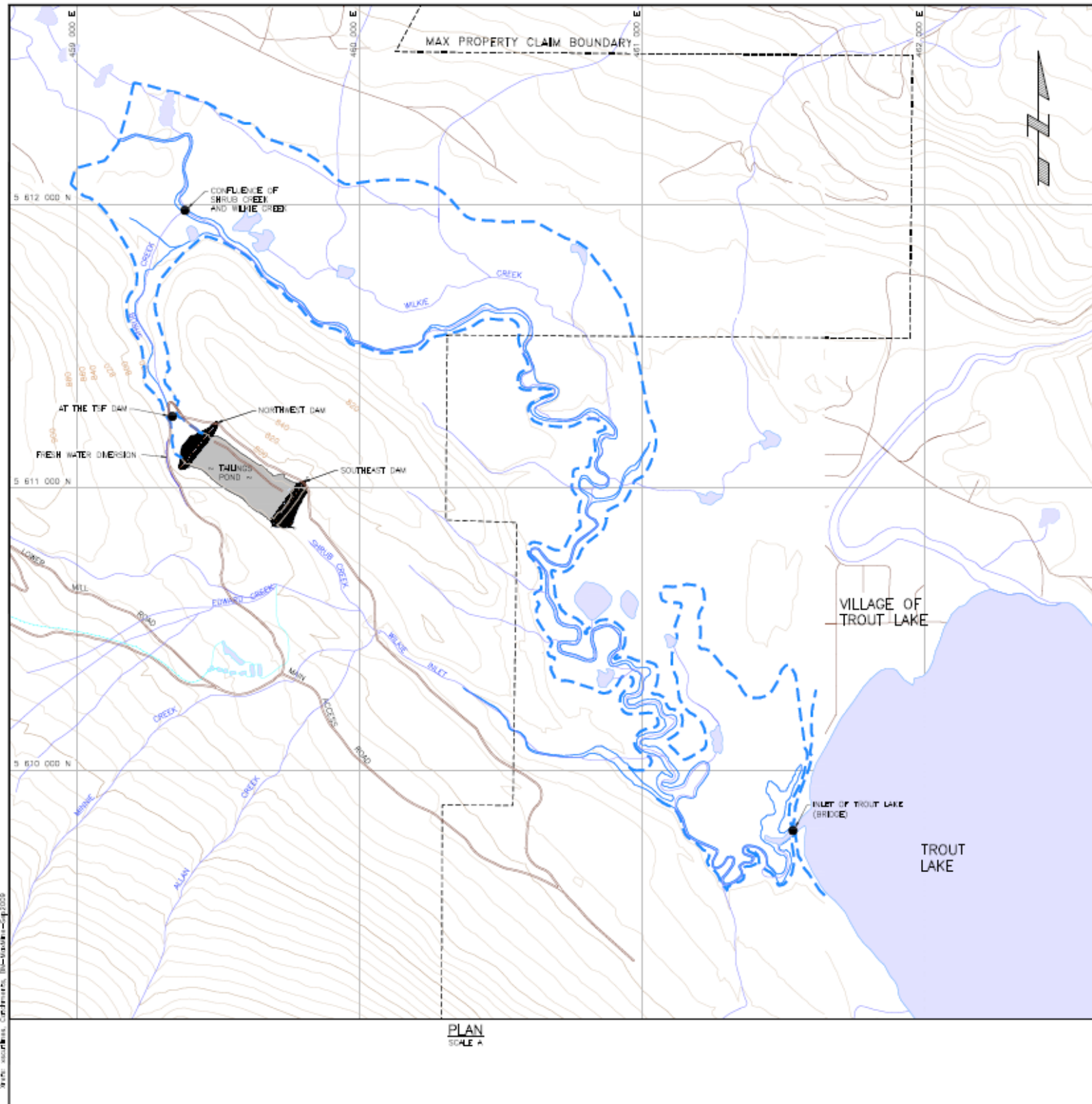
The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

7 References

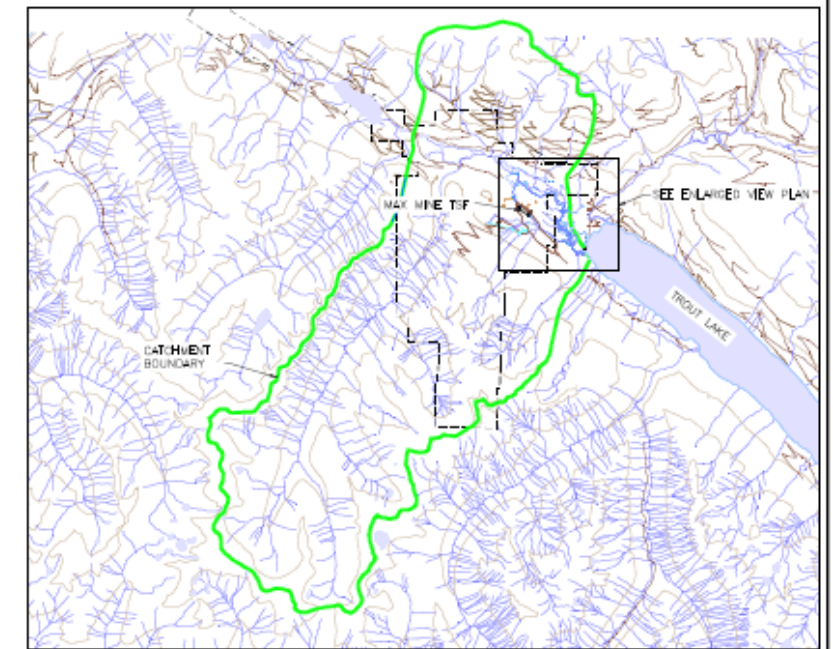
Klohn Crippen Berger Ltd. 2014a. 2014 Dam Safety Inspection Report on the MAX Mine Tailings Storage Facility report prepared for Forty Two Metals Inc. November 2014.

Klohn Crippen Berger Ltd. 2014b. Tailings Storage Facility Dam Breach and Inundation Study letter prepared for Forty Two Metals Inc. November 28, 2014.

Figures



Date: 14/10/14
 Date: 17/11/2014
 Drawn by: J. Crippen
 Checked by: J. Crippen
 Title: Northwest Dam Flood Inundation Mapping
 Project: M09508A07



LOCATION AND CATCHMENT PLAN
SCALE B

- LEGEND**
- DAM BREACH INUNDATION EXTENT (SUNNY-DAY DAM FAILURE)
 - NATURAL CREEK FLOW
 - CATCHMENT BOUNDARY
 - ROAD
 - STREAMS
 - POINTS OF INTEREST

- NOTES:**
1. BASE DATA INCLUDING TOPOGRAPHIC CONTOURS, RIVERS AND LAND COVER IS DERIVED FROM THE BC TM 11 DATA SET (082K.063 & 063), CONTOURS 20 METERS. PROJECTION: UTM NAD83 - ZONE 11
 2. THINGS DAM BASE TOPOGRAPHY SUPPLIED BY FORTTWO METALS INC., NOV. 2008.

NOT FOR CONSTRUCTION



	PROJECT MAX MOLYBDENUM MINE TAILINGS STORAGE FACILITY DAM BREACH AND INUNDATION STUDY
	TITLE NORTHWEST DAM FLOOD INUNDATION MAPPING
SCALE AS SHOWN	PROJECT No. M09508A07
	FIG. No. 1



Forty Two Metals Inc

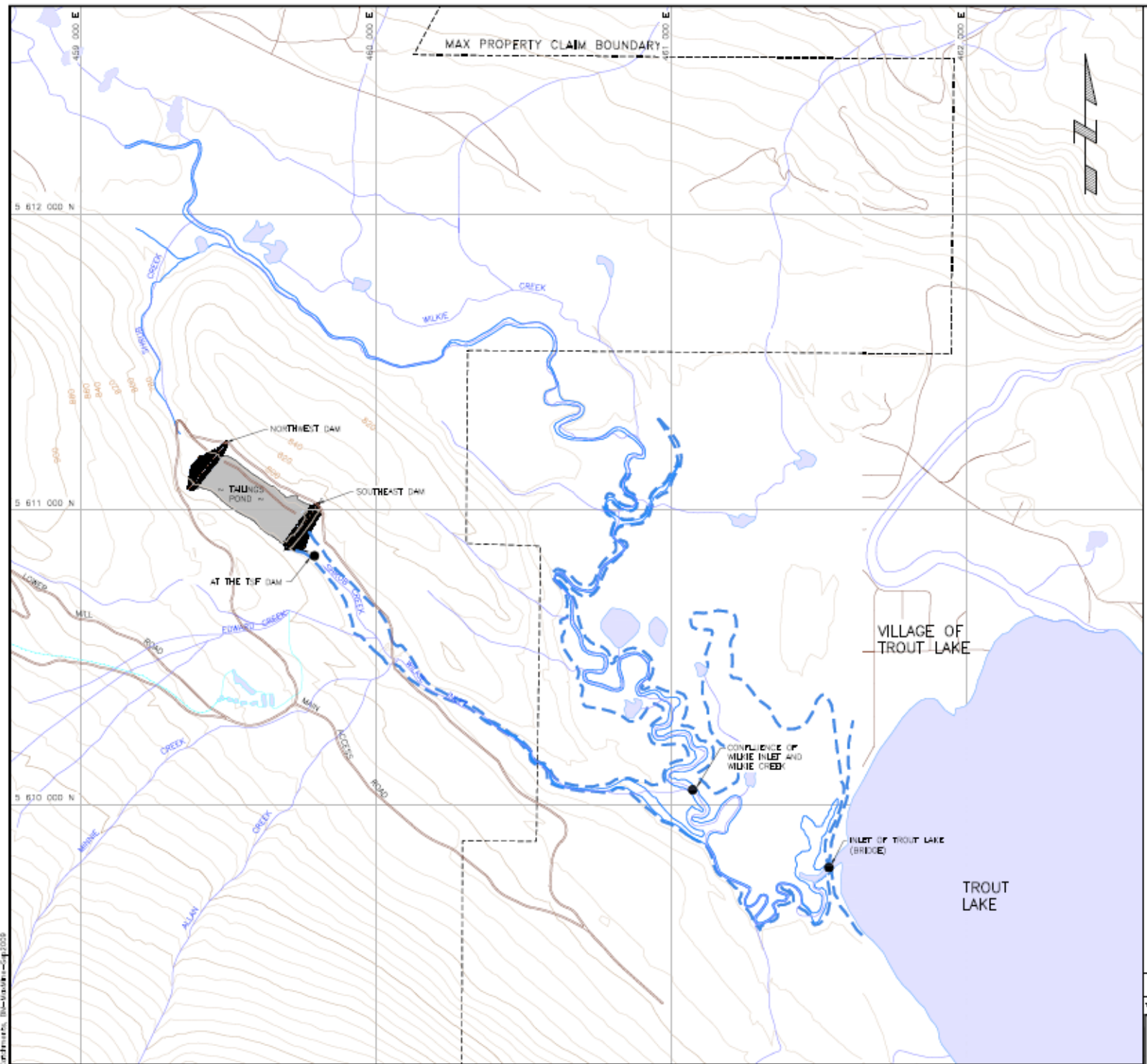
Third Party Review of DSI Report

Northwest Dam Inundation Map

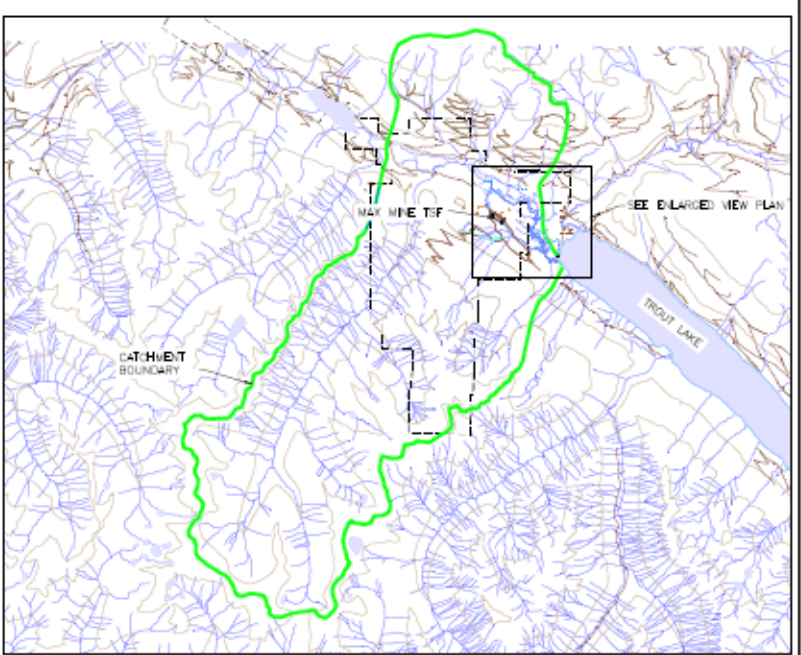
Job No: 1CF011.000
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MAX Molybdenum Mine

Date: Nov 2014
 Approved: CS
 Figure: 1



PLAN
SCALE A



LOCATION AND CATCHMENT PLAN
SCALE B

LEGEND

- DAM BREACH INUNDATION EXTENT (SUNNY-DAY DAM FAILURE)
- NATURAL CREEK FLOW
- CATCHMENT BOUNDARY
- ROAD
- STREAMS
- POINTS OF INTEREST

NOTES:

1. BASIC DATA INCLUDING TOPOGRAPHIC CONTOURS, RIVERS AND LAND COVER IS DERIVED FROM THE BC TRIM II DATA SET (DSR.063 & 063). CONTOURS: 20 METERS. PROJECTION: UTM NAD83 - ZONE 11
2. TAILINGS DAM BASE TOPOGRAPHY SUPPLIED BY FORTY TWO METALS INC., NOV. 2008.

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Title: 14-16-57
 Date: 15/27/2014
 User: T...
 Path: ...
 Name: ...

	Party Two Metals Inc. 600-125 Main Street St. Vancouver, B.C. V6B 6L5 Tel: 604.684.2300 Fax: 604.684.2300 www.partytwo.com	PROJECT MAX MOLYBDENUM MINE TAILINGS STORAGE FACILITY DAM BREACH AND INUNDATION STUDY
		TITLE SOUTHEAST DAM FLOOD INUNDATION MAPPING
SCALE AS SHOWN	PROJECT No. M09508A07	FIG. No. 2

	Forty Two Metals Inc	Third Party Review of DSI Report		
		Southeast Dam Inundation Map		
Job No: 1CF011.000 Filename: Figures_1CF011_000_CS_20141201	MAX Molybdenum Mine	Date: Nov 2014	Approved: CS	Figure: 2

Appendix A – Notification of Chief Inspector’s Orders



August 18, 2014

Notification of Chief Inspector's Orders

Tailings Dams – Independent Review of Dam Safety and Consequence Classification

As Chief Inspector of Mines, it is my responsibility to ensure that tailings dams in British Columbia are being designed, constructed, and operated in a safe manner. In light of the recent tailings dam failure at the Mount Polley mine on August 4, 2014, I am issuing the following orders for the purpose of reviewing the safety of tailings impoundment structures at mines throughout the province to establish where improvements may be required.

Owners, agents or managers responsible for tailings dams are being issued these orders pursuant to Section 18 of the *Mines Act*:

Orders:

Dam Safety Inspection and Independent Third Party Review of Dam Safety Inspection

1. You are required to conduct a Dam Safety Inspection (DSI) by December 1, 2014. The DSI must cover all dam structures for all tailings storage facilities on your mine site. The DSI must be conducted by a qualified professional engineer consistent with the BC Ministry of Energy and Mines Guidelines for Dam Safety Inspections.
[http://www.empr.gov.bc.ca/Mining/Permitting-Reclamation/Geotech/Documents/Guidelines_for_Annual_Dam_Safety_Inspections\(RevisedAug2013\).pdf](http://www.empr.gov.bc.ca/Mining/Permitting-Reclamation/Geotech/Documents/Guidelines_for_Annual_Dam_Safety_Inspections(RevisedAug2013).pdf)
2. The mine manager must have the DSI reviewed by an independent qualified third party professional engineer from a firm that has not been associated with the tailings dam. The Independent Third Party Review of the DSI must also include a review of the dam consequence classification.
3. Both the DSI and the Independent Third Party Review of the DSI must be sealed by the qualified licensed professional engineers who conducted the work.
4. Any recommendations made in the DSI or the Independent Third Party Review of the DSI must be summarized in an accompanying letter from the Mine Manager to the Chief Inspector outlining the commitments for completing the recommended work along with a schedule for implementing the recommended work.
5. The DSI, Independent Review of the DSI, and the mine manager's letter to the Chief Inspector must be submitted to the Chief Inspector by December 1, 2014.

.../2

Ministry of
Energy and Mines

Health, Safety and
Permitting Branch

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Emergency Preparedness and Response Plan and Dam Break Inundation Study

6. All tailings dams that have a failure consequence classification of high, very high or extreme (and taking into account any change in dam classification resulting from the Independent Third Party Review of the DSI under Orders 1 through 5), must have an Emergency Preparedness and Response Plan (EPRP) and a Dam Break Inundation Study.
7. The EPRP and Dam Break Inundation Study must be completed and tested consistent with the Canadian Dam Association, Dam Safety Guidelines (CDA Guidelines). If the tailings facility already has an existing EPRP, it must be reviewed and updated for consistency with the CDA Guidelines and with current standards of engineering practice.
8. The Dam Break Inundation Study must be prepared by a qualified licensed professional engineer. The EPRP must be informed by the Dam Break Inundation Study with input from the qualified licensed professional engineer.
9. The Dam Break Inundation Study, the EPRP, and a summary of the EPRP test including any identified gaps and lessons learned from the EPRP test, must be submitted to the Chief Inspector by December 1, 2014.

The Ministry of Energy and Mines will be placing reliance on the seal of the qualified professionals undertaking the above work. In addition, all submitted reports and reviews that are submitted to satisfy these orders will be subject to additional review by Ministry of Energy and Mines geotechnical engineers and/or their consultants. As well, in the interest of transparency and the public interest, all submitted documents related to these orders will be made available to the public.

Sincerely,

A handwritten signature in black ink, appearing to read 'Al Hoffman', with a stylized flourish at the end.

Al Hoffman, P.Eng.
Chief Inspector of Mines

Appendix B – Guidelines for Annual Dam Safety Inspection Reports



Ministry of Energy & Mines

GUIDELINES FOR ANNUAL DAM SAFETY INSPECTION REPORTS

Reference:

Health, Safety and Reclamation Code for Mines in British Columbia (Code) Section 10.5.3: *The manager shall submit an annual dam safety inspection report prepared by a professional engineer on the operation, maintenance and surveillance of the tailings and water management facilities and associated dams to the chief inspector.*

This Code reference applies to every operating and closed mine in BC.

The report shall provide the following information:

1. Executive Summary
 - (a) Classification of the dam(s) in terms of Consequence of Failure in accordance with Table 2-1 of the CDA Dam Safety Guidelines (2007).
 - (b) Significant changes in instrumentation and/or visual monitoring records.
 - (c) Significant changes to dam stability and/or surface water control.
 - (d) For major impoundments, as defined in Part 10 of the Code, a current Operation, Maintenance and Surveillance (OMS) Manual is required. The annual report shall indicate the latest revision date of the OMS manual.
 - (e) For tailings dams classified as High, Very High, or Extreme Consequence, an Emergency Preparedness Plan (EPP) is required. The annual report shall indicate the latest revision date of the EPP document.
 - (f) Scheduled date for the next formal Dam Safety Review in accordance with Table 5-1 of the CDA Dam Safety Guidelines (2007). Formal Dam Safety Reviews are required every 5 to 10 years (depending on consequence classification) and differ from annual dam safety inspections. The requirements for Dam Safety Reviews are included in Section 5 of the CDA Dam Safety Guidelines. Dam Safety Reviews may be conducted by the Engineer of Record with third party review, or by an independent third party with involvement of the Engineer of Record.

2. Summary of past years' construction (if any) with a description of any problems and stabilization.
3. Plan and representative cross sections.
4. Site photographs.
5. Review of climate data.
6. Water balance review.
7. Freeboard and storage availability (in excess of the design flood).
8. Water discharge system, volumes, and quality.
9. Seepage occurrence and water quality.
10. Surface water control and surface erosion.
11. Instrumentation review including:
 - (a) Phreatic surfaces and piezometric data.
 - (b) Settlement.
 - (c) Lateral movement.

The report shall be submitted by a qualified geotechnical engineer registered as a Professional Engineer (P.Eng.) in British Columbia. The professional engineer will be deemed the Engineer of Record for the facility unless another engineer is identified within the Dam Safety Inspection report as having this responsibility.