Klohn Crippen Berger

October 19, 2009

SRK Consulting
2200-1066 West Hasting Street
Vancouver, British Columbia
Canada V6E 3X2

Mr. Cam Scott, P.Eng.

Dear Mr. Scott:

Rose Creek Tailings Facility, Faro Mine
Intermediate Dam – Dam Raise and Spillway Options Review

1. INTRODUCTION

This report presents a conceptual design for passage of the Probable Maximum Flood (PFM) through the tailings impoundment at the Rose Creek Tailings Facility without raising the Intermediate Dam. The design presented herein is a variant of the design presented in the April 2008 report "Intermediate Dam Spillway – PMF Flood Handling", prepared by Klohn Crippen Berger for Deloitte & Touche Inc. (KCBL, 2008). The 2008 report presented a conceptual design for passing the PMF by effecting several changes to the tailings impoundment, including: re-grading the tailings surface and installing an engineered tailings cover of waste rock and till; constructing flow distribution swales in the impoundment; constructing a 20 m wide spillway on the right abutment of the Intermediate Dam; and, raising the Intermediate Dam and the Rose Creek Diversion Channel dyke by 9.4 m.

We understand that some of the project stakeholders have indicated that they would prefer a scheme that does not require raising of the Intermediate Dam or requires a minimal dam raise. Therefore SRK requested KCBL to review two alternative designs as follows:

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Option 1 – No Dam Raise

- Assume that no raise of the Intermediate Dam occurs; the spillway invert would be lowered and the tailings would be sloped to this invert at some low grade.
- Determine how much the invert of the spillway would have to be lowered in order to pass the design flood with a spillway width of 30 m or less.

Option 2 – Small Dam Raise

- Using the same conditions as Option 1, but including a modest 2 m to 3 m dam raise, determine the optimal spillway invert elevation and tailings grade to pass the design flood with a spillway width of 30 m or less.

Review of Option 2 was to be undertaken only if Option 1 was found to be not viable. Preliminary review by KCBL indicated that Option 1 was viable, albeit with some issues/concerns. Following discussions with SRK, it was decided that Option 2 was not to be investigated.

2. FLOOD ROUTING RESULTS FOR NO INTERMEDIATE DAM RAISE

A site plan showing the general arrangement of the existing tailings storage facility is presented in Figure 1. The proposed works under Option 1 are illustrated in Figures 2 and 3, and described below. Several variant conditions for Option 1 were considered, and the following were adopted for further analysis:

- No Intermediate Dam raise. Dam crest remains at El. 1,049.4 m;
- Slope of re-graded tailings surface = 0.7%;
- Spillway width = 30 m;
- Invert of the spillway channel at the spillway entrance = El. 1,041.8 m. This is 7.6 m below the existing Intermediate Dam crest; and
- Inflow Design Flood (IDF) corresponds to Scenario C as presented in KCBL 2008. Under Scenario C, the entire PMF is assumed to pass through the Intermediate Impoundment. This is the worst case scenario for

passage of the flood since it assumes that the Rose Creek Diversion Channel has failed prior to the PMF event.

The results of the flood routing through the Intermediate Impoundment, based on the above conditions, are presented in Table 2.1.

Table 2.1 Flood Routing Summary for Intermediate Impoundment

DESCRIPTION	VALUE
Inflow Design Flood	PMF Scenario C (KCBL, 2008)
Peak PMF inflow to impoundment	730 m^3/s
Peak PMF outflow via spillway	695 m^3/s
Existing dam crest level	El. 1,049.4 m
Maximum PMF pond level	El. 1,048.4 m
Spillway invert level at entrance	El.1,041.8 m
PMF freeboard to dam crest	1.0 m
PMF pond rise above spillway invert	6.6 m

The invert of the spillway channel at the spillway entrance was set at El. 1,041.8 m by trial and error to provide a flood freeboard of 1.0 m. The results of the flood routing analyses indicate that there will be very little attenuation of the flood as it passes through the impoundment. The peak flood inflow of 730 m^3/s reduces by only a small amount to an outflow of 695 m^3/s, primarily because the impoundment has relatively little storage with which to buffer the flood flows.

The re-graded solids surface contours in the impoundment are shown in Figure 2. Figure 2 also shows flow distribution swales. The swales will be 2 m wide trapezoidal channels with 10H:1V side slopes similar to those described in KCBL 2008. The purpose of the swales is to distribute the flood flows across the impoundment as the flood inflow increases. For the flood passage scheme proposed in KCBL 2008, which included a 9.4 m dam raise, the water level in the impoundment was expected to rise quickly such that the tailings surface is flooded and no erosion protection for the tailings is required. Under Option 1, since the spillway channel is located at a low level relative to the impoundment surface, a protective water pond will not form and erosion protection for the tailings surface is required. A 300 mm thick lining of d_{50} = 100 mm riprap over the tailings surface and the flow distribution swales will provide the required erosion protection.

Figures 2 and 3 show the proposed spillway alignment and the assumed channel cross-section. The spillway is shown as starting at the Intermediate Dam and discharging into Rose Creek downstream of the Cross Valley Dam. Previous design (KCBL, 2008)

assumed that the Cross Valley Dam is to be decommissioned and breached, therefore the spillway was shown as discharging into the creek at the Cross Valley Pond. If the Cross Valley Dam is to be breached then the spillway length for the design presented herein could be shortened by discharging into the creek at the Cross Valley Pond, similar to the 2008 design. Our 2007 site investigation (KCBL, 2008) indicated that the bedrock on the right abutment of the Intermediate Dam is of relatively poor quality. Unless good quality rock is encountered at the proposed level of the spillway channel, substantial channel erosion protection (such as riprap or concrete lining) and rock support works will likely be required. Further investigations are required to ascertain the quality of bedrock at depth along the proposed spillway channel alignment.

3. ESTIMATED CONSTRUCTION QUANTITIES

Re-grading the tailings would require excavating tailings from the eastern section of the impoundment, and filling the supernatant pond adjacent to the Intermediate Dam. The estimated tailings excavation and fill quantities are shown in Table 3.1. These quantities are based on taking tailings from the higher areas in the impoundment to fill the supernatant pond. They do not account for the extra fill space required by the tailings closure cover or the riprap. The mass balance indicates that there will be a tailings surplus of approximately 26,000 m^3 if the tailings surface is re-graded at 0.7%. Placement of a closure cover and erosion protection riprap will increase the surplus material quantity. As details of the closure cover are not known at this time, we have not investigated methods to balance the excavation and fill quantities. Options for balancing the quantities include incorporating the riprap into the closure cover, changing the re-graded tailings surface slope, raising the Intermediate Dam, disposing of excess material(s) elsewhere, or a combination of any of the above. The amount by which the dam has to be raised will depend on the thickness of the closure cover. For example, if the closure cover thickness is 1.3 m and if the riprap for erosion protection is included within this thickness then the dam raise will be in the order of 1.3 m. Further investigation is required to balance the excavation and fill quantities.

Table 3.1 Estimated Quantities with Tailings Slope at 0.7%

ITEM	QUANTITY
Tailings excavation for re-grading tailings surface	560,000 m^3
Tailings needed to fill supernatant pond	534,000 m^3
Surplus tailings (assuming no bulking)	26,000 m^3
Riprap (d_{50} = 100 mm) to cover re-graded tailings surface and swales	270,000 m^3
Spillway excavation	507,000 m^3

4. COMPARISON WITH PREVIOUS DESIGN

A number of issues and concerns have been identified for Option 1 in comparison with the design presented in the 2008 report:

- The lower spillway level proposed under Option 1 will lead to drainage of poor quality pore water from the tailings to the environment downstream of the Intermediate Dam.
- Since the proposed scheme under Option 1 does not flood the impoundment with a protective pond during passage of the flood, erosion protection is required for the tailings and/or closure cover surface.
- Although the proposed tailings slope of 0.7% is relatively flat, liquefaction of the tailings by a large earthquake will disrupt the tailings surface. In the event of a disruption of the tailings closure cover or erosion protection, the tailings may erode and migrate downstream via the spillway during rainfall, snowmelt and other flow events.
- The lower spillway level requires more excavation than the spillway associated with the 9.4 m dam raise proposed in the 2008 report. If competent rock does not exist along the spillway excavation, substantial channel erosion protection and rock support will be required along the spillway.

The above issues and concerns need to be taken into consideration in the decision making process.

This is a draft report only and we solicit your review and comments within 1 week of submission. Upon issue of the final report we request that all draft reports be destroyed or returned to Klohn Crippen Berger Ltd. This draft report should not be relied upon as a final document for design and/or construction.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Arvind Dalpatram, P.Eng.
Project Manager

Attachments:
Figure 1 Existing General Site Arrangement
Figure 2 Option 1 – Proposed Flood Handling Works – Plan
Figure 3 Option 1 – Spillway Plan and Typical Section

6 916 000 mN
6 915 000 mN
6 914 000 mN
6 913 000 mN
6 912 000 mN
579 000 mE
580 000 mE
581 000 mE
582 000 mE
583 000 mE
584 000 mE
585 000 mE
586 000 mE
ROSE CREEK
CROSS VALLEY DAM
CLOSURE SPILLWAY
NORTH SLOPE DIVERSION CHANNEL
SEVERIN CK.
RCDC
CORNISH CK.
CROSS VALLEY POLISHING POND
RCDC DYKE
ROSE CREEK DIVERSION CHANNEL (RCDC)
INTERMEDIATE TAILINGS IMPOUNDMENT
SECONDARY DAM WEST LIMB
SECONDARY TAILINGS IMPOUNDMENT
ORGINAL DYKE
ORIGINAL TAILINGS IMPOUNDMENT
GOODALL CK.
SECONDARY DAM EAST LIMB
RCDC OVERFLOW BERM
GILCREST CK.
PLANT SITE
FARO VALLEY DUMP
FARO CREEK DIVERSION
NORTHWEST DUMP
FARO PIT LAKE
NORTHEAST DUMP
MAIN DUMP
INTERMEDIATE DUMP
NORTH FORK ROSE CREEK
HAUL ROAD
SOUTH FORK ROSE CREEK
1400
1350
1300
1250
1200
1150
1100
1050
1000
1450
1500
1550

LEGEND

CURRENT FLOOD ROUTING AROUND TAILINGS IMPOUNDMENT

REFERENCE DRAWING : SRK CONSULTING, ICD003.65, FIGURE A, AUGUST 2006.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED _____

0 1 km

SCALE

CLIENT

SRK Consulting
Engineers and Scientists

Klohn Crippen Berger

PROJECT

ROSE CREEK TAILINGS FACILITY
INTERMEDIATE DAM SPILLWAY – OPTIONS REVIEW

TITLE

EXISTING GENERAL SITE ARRANGEMENT

PROJECT No. M09237 A07

FIG. No. 1

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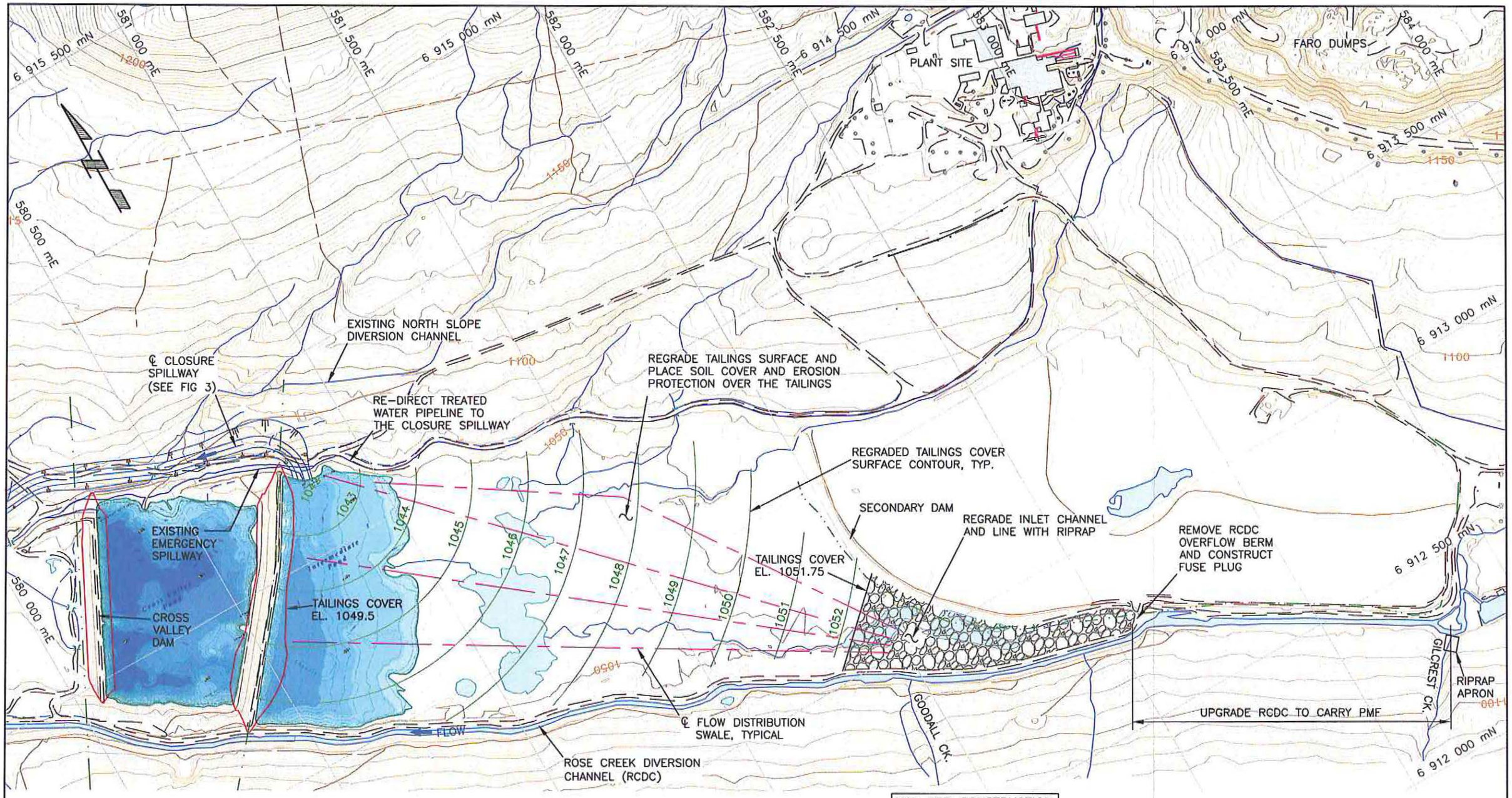
Xrefs: Bill-RoseCreek-Aug2004



NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED _____

0 500 m

SCALE

NOTES:

1. BASE PLAN TAKEN FROM 2003 FARO SITE PLAN1_VER2000.DWG PROVIDED BY SRK.
2. ELEVATIONS ARE ABOVE MEAN SEA LEVEL.
3. CONTOUR INTERVAL IS 2 m.

CLIENT: SRK Consulting — Engineers and Scientists

Klohn Crippen Berger

PROJECT: ROSE CREEK TAILINGS FACILITY
INTERMEDIATE DAM SPILLWAY – OPTIONS REVIEW

TITLE: OPTION 1
PROPOSED FLOOD HANDLING WORKS PLAN

PROJECT No. M09237 A07

FIG. No. 2

RCB-R-163

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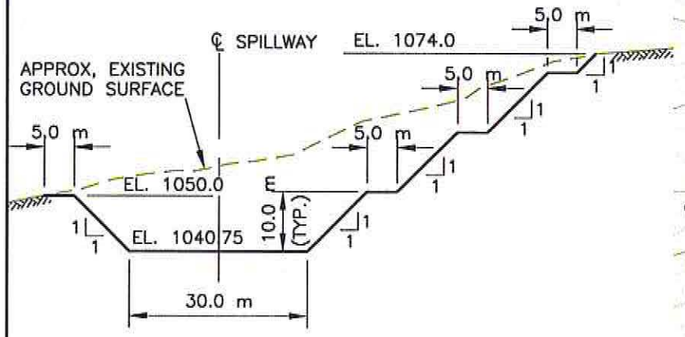

SECTION A SPILLWAY CROSS SECTION
SCALE NTS

SPILLWAY GRADE AND ELEVATION		
WORKING POINT #	CHANNEL BOTTOM ELEVATION (m)	APPROX. CHANNEL SLOPE (%)
INLET	1042.0	
		1.0
WP 1	1039.5	
		0.5
WP 2	1037.0	
		0.5
WP 3	1035.75	
		0.5
WP 4	1035.5	
		13.2
WP 5	1007.0	
		4.0
WP 6	1001.0	

PLAN LAYOUT

LEGEND

- DHKC07-1 — KLOHN CRIPPEN BERGER DRILL HOLE (2007)
- TPKC07-1 — KLOHN CRIPPEN BERGER TEST PIT (2007)

NOTES:

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3. CONTOUR INTERVAL IS 2M.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED _____

SCALE 0 250 m

CLIENT: SRK Consulting Engineers and Scientists

Klohn Crippen Berger

PROJECT: ROSE CREEK TAILINGS FACILITY
INTERMEDIATE DAM SPILLWAY – OPTIONS REVIEW

TITLE: 0
OPTION 1
SPILLWAY PLAN AND TYPICAL SECTION

PROJECT No. M09237 A07

FIG. No. 3

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