ROSE CREEK TAILINGS FACILITY, FARO MINE

Intermediate Dam Spillway - PMF Flood Handling

#25

Prepared for

Deloitte & Touche Inc.

On behalf of

Faro Mine Closure Planning Office

Klohn Crippen Berger

M09237A06

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Klohn Crippen Berger

April 11, 2008

Deloitte & Touche Inc.
79 Wellington Street West, Suite 1900
PO Box 29 TD Centre
Toronto, Ontario
M5K 1B9

Mr. Doug Sedgwick

Dear Mr. Sedgwick:

Rose Creek Tailings Facility, Faro Mine
Intermediate Dam Spillway - PMF Flood Handling

We are pleased to submit our report on the field investigation and Phase 2 preliminary design to route the PMF through a new Intermediate Dam spillway at Rose Creek Tailings Facility at the Faro Mine. The optimum configuration of the new works would be a 20 metre wide spillway on the right abutment and a raise in the Intermediate Dam from Elev. 1049.4 to Elev. 1058.8 metres.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Bryan D Watts

Bryan D. Watts, P. Eng.
Project Manager

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EXECUTIVE SUMMARY

This report presents a preliminary design for passing the Probable Maximum Flood through the Intermediate Tailings area via a new spillway in rock on the right abutment of the Intermediate Dam. This is an alternative to passing the PMF through an upgraded Rose Creek Diversion Channel (RCDC) on the south side of the Rose Creek valley. The Probable Maximum Flood (PMF) has been estimated by Water Management Consultants (2006) which is based on a Probable Maximum Flood by Taylor (2005a). This preliminary design is part of the overall closure design effort for the mine.

The primary impediment to passing the flood through the tailings is the low capacity of the existing spillway in sand and gravel at the Intermediate Dam. Only a spillway in rock sized to pass the PMF is sufficiently reliable to pass the flood in perpetuity. An investigation program demonstrated that rock was within the invert of a spillway cut and, thus, this flood routing alternative is feasible. The upper few metres of the rock is highly fractured, sometimes to gravel sizes, so further investigations are needed to determine the extent of this upper weathered zone.

Other site modifications necessary to pass the PMF include:

- Breach of the Cross Valley Dam, removal of the sludge/sediments in the polishing pond, and reinstatement of Rose Creek and its tributary within the polishing pond (not included in the cost estimate);
- An upgrade of the RCDC from its upstream end to the fuse plug to carry the PMF flow;
- Replacement of the RCDC overflow berm with a fuse plug such that it fails at the 500-year flood level in the RCDC;
- Leveling the tailings in the Intermediate Impoundment and placing a 1.5 to 2 m waste rock and soil (glacial till) cover on the tailings;

- Construction of flow distribution swales in the Intermediate Impoundment;
- Construction of a spillway on the right abutment of the Intermediate Dam to carry the PMF; and
- Raising the Intermediate Dam and the RCDC dyke to allow adequate freeboard during passage of the PMF through the impoundment.

If the Intermediate Dam were left at its present crest elevation, a very large spillway cut would be necessary to pass the PMF because of the small storage capacity of the dam. Thus, we examined the effects of increased storage by raising the Intermediate Dam and the RCDC dyke on spillway dimensions in terms of costs. These costs estimates were sufficiently accurate to make comparisons but not to estimate actual costs for the alternative. This comparative cost estimate shows that a 20 m wide spillway at the invert together with raising the Intermediate Dam crest to Elev. 1058.8 m and the RCDC to a minimum crest Elev. of 1058.6 m was the lowest cost option.

Using project unit costs, the total estimated cost for this PMF flood handling alternative is $90 M, excluding GST. This includes $19M of indirect costs and a contingency of $15M. Without indirect costs and contingency, the estimated costs are approximately $56M of which about $36M is for the tailings blanket costs. The direct spillway costs are estimated to be about $10M.

This cost estimate is based on information available to date and is only our opinion of probable cost for budgetary purposes. Actual cost depends on many factors which can change with time, including site and market conditions at the time of construction. Construction costs are very high at this time in Western Canada and the north. They may escalate in future if the current market conditions persist.

Our work has been done in the absence of a comprehensive understanding of the closure options being considered by the Planning Office. This has not been a detriment to the execution of the work but, rather, there may be economies which can be realized or our work may precipitate consideration of other issues. For instance, the tailings cover recommended will have to be integrated or made part of a dry cover to prevent acid mine drainage if that option is being considered. Also, removal of the Polishing Pond at the toe of Intermediate Dam will increase the seepage gradient through the foundation soils which may affect predictions of contaminant migration. These and all other similar issues are for others to consider.

This is a preliminary design to establish feasibility and to estimate costs so that this flood handling option can be compared to other alternatives. In order for construction to be tendered, detailed design will have to proceed. Detailed design would included a thorough investigation of depth to rock on the right abutment of the Intermediate Dam, delineation of borrow areas, integration of the design with the overall closure plan, and re-estimation of the costs at the time of construction, among other issues.

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1. INTRODUCTION

1.1 General

This report presents a preliminary design for passage of the Probable Maximum Flood (PMF) through the tailings impoundment at the Rose Creek Tailings Facility. This design is Phase 2 of a two phase design which started in July 2007 to assess the feasibility of passing flood waters over the tailings from the Rose Creek Diversion Channel (RCDC) through a new spillway on the Intermediate Dam. The Phase 1 report was issued on September 7, 2007. The Phase 2 work was authorized by Deloitte&Touche letter of September 21, 2007 based on our proposal of September 10, 2007. The basic conclusion in our Phase 1 report was that the flood waters could be passed over the tailings downstream of the Secondary Dam provided that a spillway could be founded in rock on the right or north abutment of the Intermediate Dam.

This report presents a preliminary design of the spillway together with Intermediate Dam raising to achieve capacity and storage to pass the PMF. This report also documents the field investigations that show rock is present near surface on the right abutment of the Intermediate Dam. This work is done within the context of the overall site closure design being done by others. None of the recommendations in this report have been tested against other requirements for the closure design for the tailings. In and of itself the design presented in this report is feasible. Coordination with other closure design elements for the tailings impoundment should proceed during detailed design.

1.2 Project Setting

As shown in Figure 1.1, uncontaminated water from the North and South forks of Rose Creek is diverted around the tailings impoundment through the Rose Creek Diversion Channel (RCDC) on the south side of the valley. The present configuration of the RCDC can pass only the 1 in 500 flood around the tailings. Larger flows will spill on to the

Intermediate tailings, overwhelm the small spillway on the Intermediate Dam, breach the Intermediate Dam, and breach the Cross Valley Dam. Expanding the capacity of the RCDC to pass the PMF has been assessed by others. This PMF flood routing option competes with the RCDC expansion. The preferred scheme will be selected by others.

The Original Impoundment, the Secondary Impoundment and the Intermediate Impoundment store tailings, and the Cross Valley Pond serves as a polishing pond for treated mine effluent from the Faro Pit. The existing dam and dyke crest elevations are shown in Table 1.1. All elevations referred to in this report are above mean sea level.

Table 1.1 Existing Dam and Dyke Crest Elevations

Structure	Crest Elevation
Original Dyke	Contained behind Secondary Impoundment
Secondary Dam	El. 1062 m
Intermediate Dam	El. 1049.4 m
Cross Valley Dam	El. 1033.5 m
Rose Creek Diversion Channel Dyke	El. 1060.5 m at RCDC Overflow Berm El. 1053 m at Intermediate Dam El. 1047 m at Cross Valley Dam

The RCDC begins near the confluence of the North and South Forks of Rose Creek, and ends at the original Rose Creek channel approximately 800 m downstream of the Cross Valley Dam. The RCDC follows a flat gradient from its upstream end to the Cross Valley Dam, and then it drops relatively steeply down to Rose Creek below the Cross Valley Dam. The Secondary Dam East Limb separates the RCDC from the Secondary Impoundment, and an earth dyke separates the RCDC from the Intermediate Impoundment and the Cross Valley Pond. The RCDC also has an overflow berm near the upstream end of the Intermediate Impoundment. On the north side of the valley, the

North Slope Diversion Ditch intercepts runoff from the slope and diverts it into the polishing pond downstream of the Intermediate Dam.

1.3 Scope of Work

The work by nhc (2006) concluded that a 1:500 year flood event could pass through the RCDC, and that larger floods would spill into the Intermediate Impoundment. Nhc (2006) also set out the improvements required to upgrade the RCDC to carry the PMF. Both evaluations used the PMF estimates by Water Management Consultants (WMC). We accept the PMF estimate by WMC as the basis for the design flows through the tailings impoundment.

Our scope is to include a cost estimate for the work. Unit costs have been provided by SRK Consultants Ltd. The flood routing option described in this report also assumes that the Cross Valley Dam will be breached and be able to pass the PMF through the breach. This allows the new spillway to exit into the former polishing pond. The costs for breach of the Cross Valley Dam, the removal and disposal of the sludge/sediments from the Cross Valley Pond and the re-establishment of the Rose Creek channel between the Cross Valley Dam and the Intermediate dam are not included in our cost estimate.

The results of the field investigation to determine the depth to rock on the right abutment of the Intermediate Dam are presented in Section 2 of this report. The estimated PMF values, the results of flood routing through the Intermediate Impoundment, and the preliminary design for the facilities required to handle PMF are presented in Section 3. Section 4 presents the cost estimates.

2. DEPTH TO ROCK ON NORTH ABUTMENT OF INTERMEDIATE DAM

As stated earlier the feasibility of passing flood waters over the tailings impoundment depends on being able to pass the floods past the Intermediate Dam. A spillway that is required to pass floods *in perpetuity* should be founded in rock with minimal use of concrete that might have to be repaired. Because there is a rock outcrop on a road near the right abutment, a field program was completed to investigate whether rock might be within the depth profile of a spillway.

The site visits and drilling program was started and completed in September 2007. Mr. Arvind Dalpatram, P. Eng., of KCBL visited the tailings facilities with Mr. Glen Craig of Anvil Range Mining Corporation on September 24. Mr. Chris Kowalchuk, GIT, of KCBL supervised the geotechnical drilling and test pitting on the right abutment of the Intermediate Dam between 24 and 28 September. He also examined the right and left abutments of the dam for presence of bedrock outcrops. The drill hole and test pit logs, and photographs pertinent to the drilling and test pitting program, are presented in Appendix I. Photographs of the general site are presented in Appendix II.

Four holes were drilled on the right abutment of the Intermediate Dam using a truck mounted air rotary percussion rig operated by Carbon Mountain Drilling. A D6 Cat dozer was used to level and prepare drill pads, and to cut into the hillslope where bedrock was suspected to be close to the surface. The drill holes were numbered chronologically from DHKC07-1 to DHKC07-4 (Table 2.1 and Figure 2.1). A 6" tricone bit was drilled inside PQ casing through overburden. Once bedrock was reached, an HQ single barrel core tube was used to obtain 2.5" (HQ) diameter core. Each hole was drilled at least 3 m into rock. Core recovery was not good, varying between 10 and 50%. Future drilling to determine rock quality should use a triple tube core barrel.

A Cat 345 excavator, with a downward boom reach of 5.5 m, was used to dig four test pits. The test pits were numbered chronologically (TPKC07-1 to TPKC07- 4) as shown in Table 2.1 and Figure 2.1. One road cut in bedrock was logged at site 07SE28-1.

Table 2.1 Drill Hole and Test Pit Locations, and Depth to Bedrock

ID #	Easting	Northing	Ground Elevation (m)	Depth to Bedrock (m)
DHKC07-1	580,866	6,914,333	1,073	9.27
DHKC07-2	580,882	6,914,414	1,084	0
DHKC07-3	580,791	6,914,313	1,053	5.1
DHKC07-4	580,966	6,914,201	1,055	10.5
TPKC07-1	580,862	6,914,394	1,078	3.2
TPKC07-2	580,734	6,914,430	1,070	1.9
TPKC07-3	580,975	6,914,199	1,056	>5.5
TPKC07-4	580,996	6,914,227	1,061	>5
07SE28-1	581,906	6,914,189	1,109	0

Coordinates and elevations provided by Yukon Engineering Services Inc.

Bedrock encountered on the right abutment is a dark grey, very closely foliated, medium strong schist with quartz veins from 10 to 30 mm thick. Foliation dips at 25 to 27° towards 191 to 203°, which is downslope towards the tailings impoundment. Bedrock was found to be between 0 and 11 m below the surface, with the depth to bedrock increasing towards the impoundment. In most test holes and test pits, the upper 2 metres, at least, of the rock is broken down to gravel size particles.

The low core recovery and very low RQD of the rock is due, in part, to the interaction of the relatively primitive coring techniques with the foliation. Better coring techniques would improve core recovery but the upper few metres of highly fractured rock would still yield low RQD values. It is very common for large changes in rock quality and rock depth over short distances in these terrains. However, the presence of shallow rock demonstrates that a spillway can be founded on the right abutment but dental concrete or equivalent measures might be necessary on the base and sides of the spillway. This rock is far from ideal and will require more design and construction care than desirable. Test trenching along the entire alignment and at right angles will be necessary for preparation of detailed design.

We also expect the stability of the rock on one side of the spillway cut to be less than the other because of the orientation of the foliation. The durability of the rock will also have to be assessed. Future evaluations should include high quality drilling, trenching, and testing.

Bedrock is exposed along the south side slope of the RCDC on the left abutment of the Intermediate Dam and along the RCDC further upstream. The bedrock on the left abutment is schist similar to that found on the right abutment. The foliation on the left abutment appears to be oriented as it is on the right abutment.

3. DESIGN

3.1 WMC PMF Estimate

The recommended 24-hour Probable Maximum Flood (PMF) values for the Rose Creek Diversion are as follows (WMC, 2006):

• Upper end of Rose Creek Diversion Channel	674 m^3/s
• Lower end of Rose Creek Diversion Channel	692 m^3/s

This PMF estimate includes the flood that would pass through the Rose Creek Diversion Channel which collects runoff from the North Fork of Rose Creek, the South Fork of Rose Creek, and the south slope above the Rose Creek Diversion Channel. These catchments are designated as A, B and C, respectively, in Figure 3.1. The PMF estimate does not, by definition, include the runoff from the catchment along the north slope of the Intermediate Impoundment, which is designated as catchment D in Figure 3.1. This north slope runoff will discharge into the tailings impoundment so has to be included with the flood waters that pass by the Intermediate Dam.

WMC (2006) indicates the total catchment at the lower end of the Rose Creek Diversion Channel (i.e., catchments A+B+C) to be 217.3 km^2. We estimate the catchment of the north slope of the Intermediate Impoundment (catchment D) to be about 12 km^2. This catchment area assumes that the North Slope Diversion Ditch has failed or has been decommissioned before or during the flood. For the present purposes, we have estimated the PMF value for catchment D to be 38 m^3/s by proportional area. Hence total PMF for catchments A+B+C+D would be about 730 m^3/s.

3.2 Design Concept

The proposed design concept for passage of the PMF through the Intermediate Pond is illustrated in Figures 3.3 to 3.6. The proposed flood handling works would include the following:

- Breach of the Cross Valley Dam, removal of the sludge/sediments in the polishing pond, and reinstatement of Rose Creek and its tributary within the polishing pond;
- Replacement of the RCDC overflow berm with a fuse plug such that it fails at the 500-year flood level in the RCDC;
- An upgrade of the RCDC from its upstream end to the fuse plug to carry the PMF flow;
- Leveling the tailings in the Intermediate Impoundment and placing a 1.5 to 2 m waste rock and soil (glacial till) cover on the tailings;
- Construction of flow distribution swales in the Intermediate Impoundment;
- Construction of a spillway on the right abutment of the Intermediate Dam to carry the PMF; and
- Raising the Intermediate Dam and the RCDC dyke to provide adequate freeboard during passage of the PMF through the impoundment.

This report describes the upgrade of the RCDC from its upstream end to the fuse plug. Nhc (2006) indicated that improvements are also required at the upstream end of the RCDC and along the North Fork Rose Creek. These proposed improvements are discussed in detail in the nhc report and are not part of our scope.

We recommend leveling or grading of the tailings where practicable to reduce velocities and therefore erosion of tailings during flooding. Based on available pond topography and bathymetry, it is estimated that the tailings in the Intermediate Impoundment could be leveled to an average elevation of approximately 1048.5 m. Placement of a 2 m waste rock and soil cover over the leveled tailings would result in an average soil cover elevation of 1050.5m.

Our work is partly based on the bathymetric survey for the Cross Valley Pond and the Intermediate Impoundment, which was completed in 2004, and is presented in Appendix III.

These recommendations are based only on flood velocity reduction requirements and are not meant to replace cover recommendations by others to reduce acid generation in the tailings. We expect that the design of the final tailings cover will be done by others to accommodate these and other requirements.

3.3 Flood Routing

The capacity of the existing Rose Creek Diversion Channel is estimated to be a 500-year flood, which is 135 m^3/s (nhc, 2006). The following three scenarios have been considered for routing the PMF through the Intermediate Impoundment:

- Scenario A

  Up to 135 m^3/s flows through the RCDC, and flows above 135 m^3/s pass through the Intermediate Impoundment. This assumes that the RCDC is fully functional up to its estimated capacity.

- Scenario B

  The initial portion of the PMF hydrograph up to 135 m^3/s flows through the RCDC, and the rest flows through the Intermediate Impoundment. This assumes that the RCDC fails as soon as the PMF flow reaches 135 m^3/s.

- Scenario C

  The entire PMF passes through the Intermediate Impoundment. This is the worst case scenario and it assumes that the RCDC has failed prior to the PMF event.

The PMF hydrographs for the three scenarios are shown in Figure 3.2. These hydrographs were routed through the Intermediate Impoundment using our in-house flood routing spreadsheet. In order to determine the optimum combination of spillway size and dam raising, the flood routing was carried out with various spillway widths ranging from 15 to 100 m.

The results of the flood routing are summarized in Tables 3.1 to 3.3. Scenario A results in the lowest pond inflows, outflows and water levels because a significant portion of the PMF (135 m^3/s) is assumed to be carried by the RCDC throughout the PMF event. Scenarios B and C result in higher pond inflows, outflows and water levels. The results for Scenario B are almost the same as those for Scenario C because only a small portion of the PMF is assumed to be carried by the RCDC in Scenario B. As expected, the larger the spillway size the larger the discharge through the spillway and the lower the resulting pond water level. All three scenarios indicate that the PMF level will be higher than the crest of the existing Intermediate Dam (El. 1049.4 m) and that the dam needs to be raised if the PMF is to be routed through the impoundment.

Scenario A is based on the assumption that the RCDC will be fully functional up to its estimated capacity during the entire PMF event. Because assuming the RCDC is fully functional during such a large flood event cannot be relied upon, Scenario A is not recommended for design. Since the flood routing results for Scenarios B and C are similar, we have used Scenario C to carry forward the preliminary design.

Table 3.1 PMF Routing for Scenario A

Top of Tailings Cover (m)	Spillway Control Elevation (m)	Spillway Bottom Width (m)	Peak Inflow to Pond (m^3/s)	Peak Outflow from Pond (m^3/s)	Max. Pond Water Elevation (m)
1050.5	1050.5	15	595	388	1056.9
		20	595	418	1056.4
		25	595	444	1055.9
		40	595	485	1055.0
		75	595	538	1053.9
		100	595	553	1053.4

Table 3.2 PMF Routing for Scenario B

Top of Tailings Cover (m)	Spillway Control Elevation (m)	Spillway Bottom Width (m)	Peak Inflow to Pond (m^3/s)	Peak Outflow from Pond (m^3/s)	Max. Pond Water Elevation (m)
1050.5	1050.5	15	730	554	1058.3
		20	730	584	1057.5
		25	730	605	1056.9
		40	730	644	1055.7
		75	730	686	1054.4
		100	730	693	1053.8

Table 3.3 PMF Routing for Scenario C

Top of Tailings Cover (m)	Spillway Control Elevation (m)	Spillway Bottom Width (m)	Peak Inflow to Pond (m^3/s)	Peak Outflow from Pond (m^3/s)	Max. Pond Water Elevation (m)
1050.5	1050.5	15	730	559	1058.3
		20	730	588	1057.6
		25	730	607	1057.0
		40	730	645	1055.7
		75	730	686	1054.4
		100	730	694	1053.8

3.4 Intermediate Dam and RCDC Dyke Raise

The existing Intermediate Dam crest is at El. 1049.4 m, and the existing RCDC dyke crest varies from 1060.5 m at the overflow berm to 1053 m at the Intermediate Dam. Routing of the PMF through the Intermediate Impoundment (Tables 3.1 to 3.3) indicate that the flood levels will be much higher than the existing dam and the RCDC dyke, therefore both the Intermediate Dam and the RCDC dyke need to be raised in order to contain the flood waters and to provide adequate freeboard.

To establish freeboard at the dam for the PMF, wave effects have been estimated. The maximum hourly wind speed recorded at the Faro Airport (Station no. 2100517) is 50 km/hr (31 miles/hour). For estimating the wind set-up and wave run-up for the Intermediate Dam, a conservative wind speed of 60 miles/hour has been used which results in a wind set-up plus wave run-up of about 0.4 m. Given that the wind set-up and wave run-up are estimated to be 0.4 m and that the Intermediate Dam is assigned a High to Very High Consequence category, a minimum freeboard allowance of 1.0 m is recommended to the top of the dam and the top of the RCDC dyke. Flood routing results indicate that the pond water level would remain within 1 m of the peak flood level for about 6 to 10 hours. Therefore, the flood freeboard would remain at 1 m for only a short time, and would increase to more than 1 m as the flood level in the pond drops. The required dam and dyke elevations are shown in Tables 3.4 and 3.5, respectively, for various assumed spillway widths. Typical sections of the raised Intermediate Dam and the RCDC dyke, based on the optimum combination of the Intermediate Dam spillway size, and the dam and RCDC dyke raises discussed in Section 4, are shown in Figures 3.4 and 3.5. Crest elevations do not include any measures to protect the impervious core against frost damage.

Table 3.4 Intermediate Dam Crest Elevations for Scenario C

Spillway Bottom Width (m)	Max. PMF Flood Elevation (m)	Freeboard to top of Dam Core (m)	Elevation of Top of Dam Core (m)	Dam Crest Elevation* (m)
15	1058.3	1.0	1059.3	1059.5
20	1057.6	1.0	1058.6	1058.8
25	1057.0	1.0	1058.0	1058.2
40	1055.7	1.0	1056.7	1056.9
75	1054.4	1.0	1055.4	1055.6
100	1053.8	1.0	1054.8	1055.0

* Dam crest elevation includes 0.2 m of gravel road surfacing on top of the dam core.

Table 3.5 RCDC Dyke Crest Elevations for Scenario C

Spillway Bottom Width (m)	Max. PMF Flood Elevation (m)	Freeboard (m)	Dyke Crest Elevation (m)
15	1058.3	1.0	1059.3
20	1057.6	1.0	1058.6
25	1057.0	1.0	1058.0
40	1055.7	1.0	1056.7
75	1054.4	1.0	1055.4
100	1053.8	1.0	1054.8

3.5 RCDC and Fuse Plug

Currently, the RCDC can pass the 500-year flood (135m^3/s). No change in the RCDC downstream of the fuse plug is proposed since flows in excess of the 500–year flood are to be routed through the Intermediate Impoundment. However, an upgrade of the RCDC upstream of the fuse plug is required such that it can carry the full PMF flows. A typical upgraded cross section of the RCDC is shown on Figure 3.4. Figure 3.4 shows a 20 m wide RCDC channel. The channel width required to carry the PMF through this reach is only 15 m but a 20 m wide channel is proposed to allow for potential blockages. A 20 m wide channel will provide approximately 17% extra flow area and 22% extra discharge capacity. An alternative to widening the channel to account for blockages would be to encroach onto the channel freeboard. This is not desirable since the higher water level will result in larger flow depth along the toe of the Secondary Dam East Limb.

The top of the existing RCDC overflow berm is at El. 1058 m, and we understand that it may also contain some large rock. The estimated 500–year water level in the RCDC near the overflow berm is at El. 1059.5 m, therefore the top of the proposed fuse plug needs to be set at this level such that it fails at the 500-year flood flow. A proposed cross section of the fuse plug is shown in Figure 3.5. Since the existing overflow berm may contain some large rock, it should be removed in its entirety.

Once the flood water depth in the RCDC overtops the fuse plug, the fuse plug should begin to erode. As the plug erodes, the flow into the Intermediate Impoundment will increase. The division of flow into the downstream RCDC channel and the inlet channel to the Intermediate Impoundment depends on the channel and fuse plug geometry. The peak PMF flow in the RCDC at the fuse plug is estimated to be about 680 m^3/s. Assuming that the fuse plug erodes to the bottom of the RCDC channel, approximately 80 m^3/s will flow through the RCDC downstream and the remaining 600 m^3/s will flow into the Intermediate Pond. Higher flows can be maintained in the RCDC channel by constructing a concrete sill in the fuse plug such that the plug does not erode to the bottom of the RCDC channel. The construction of such a concrete sill has not been investigated at this preliminary design stage. Regardless of whether or not a concrete sill is incorporated into the fuse plug, the plug would have to be reconstructed once it fails at the 500-year flood level.

3.6 Intermediate Tailings Pond

As indicated in Section 3.2, it is estimated that the tailings in the Intermediate Impoundment could be leveled to an average elevation of approximately 1048.5 m. A 1.5 to 2 m thick waste rock and soil cover should be placed over the tailings to prevent mobilization of the tailings during passage of flood through the impoundment. The waste rock would be placed over the tailings and the soil (glacial till) cover would be placed over the waste rock. With a 2 m thick cover, the average elevation of the top of the cover will be 1050.5 m. In order to provide some positive drainage of the cover, the tailings in the impoundment would need to be graded such that the top of the cover is at El. 1049.5 m near the spillway and El. 1051.75 m at the downstream end of the inlet channel. This will result in a grade of about 0.15% for the cover. Such a flat gradient should keep the flood flow velocities over the cover relatively low as well as allow the water to quickly pond over the cover as the flood waters come through the fuse plug.

In order to distribute the flood waters throughout the impoundment before the water ponds over the entire impoundment, distribution swales should be constructed as shown in Figures 3.3 and 3.4. These swales will be excavated in the tailings and covered with 2 m waste rock and soil such that the finished swales are 1 m deep with 10H:1V side slopes, as shown in Figure 3.4. At a channel gradient of 0.15%, each swale will have a full flow capacity of 10 m^3/s at a velocity of 0.9 m/s which is an acceptable velocity for glacial till like material without any erosion protection.

The inlet channel to the Intermediate Impoundment is relatively narrow near the fuse plug (Figure 3.3). The channel gradually widens to 250 m approximately 700 m downstream of the plug. This 700 metres of the inlet channel will be re-graded to match the top of the tailings cover at its downstream end and the bottom elevation of the RCDC at the fuse plug. Flow velocities in the inlet channel, particularly near the fuse plug, will be high. The entire 700 m of the inlet channel will be lined with riprap to provide erosion protection.

The construction work in the impoundment will require careful scheduling. Some of the work, such as re-grading the tailings and placement of the waste rock cover may have to be carried out during the winter while the tailings are frozen or partially frozen.

3.7 Intermediate Dam Spillway

Figures 3.3 and 3.4 show the proposed alignment and section of the Intermediate Dam spillway. The spillway will discharge into a tributary of Rose Creek downstream of the Intermediate Dam, as shown. The spillway will be located such that the maximum PMF flow depth is within bedrock. The bedrock encountered at the site has significant foliation, with dips at 25 to 27° towards the impoundment. Therefore, for preliminary design we have assumed channel side slopes of 1H:1V for excavation in bedrock and have provided 5 m wide benches at 10 m intervals. The bedrock cuts will also require rock support, which have been assumed to be on a 1 m x 1 m grid pattern. Channel side slopes in overburden will be 2.5H:1V.

3.8 Secondary Dam

The top of the existing Secondary Dam is approximately at El.1062 m. The PMF level in the RCDC, flowing parallel to the Secondary Dam East Limb, is estimated to be El.1060.9 m at the upstream end of the RCDC and El.1057.6 m near the fuse plug. This leaves a flood freeboard of 1.1 m to 4.4 m, which is considered to be adequate.

3.9 Cross Valley Dam and Pond

The Cross Valley Pond needs to be drained, and the sludge and sediments which may have accumulated over the years need to be removed to allow construction of the Intermediate Dam raise. The sludge and sediments would have to be disposed of at an appropriate disposal site. For the purpose of preliminary design it has been assumed that the Cross Valley Dam is breached, and that the Rose Creek channel and its tributary between the Cross Valley Dam and the Intermediate Dam are restored.

Materials removed from the Cross Valley Dam could be used for the Intermediate Dam raise, however temporary stock piling of some of the removed materials may be required while the foundation for dam raise is being prepared.

4. COST ESTIMATES

4.1 Comparative Costs for Selection of Spillway Width

Project costs are dependent on the width of the spillway and the required dam raise. A larger spillway will require larger excavation, greater amounts of rock supports, and more riprap. On the other hand, a smaller spillway, while requiring less excavation, rock support and riprap, will require a higher Intermediate Dam and RCDC dyke. A preliminary estimate of comparative costs was prepared in order to determine the optimum combination of spillway width and dam and dyke raises. The estimates included costs for spillway channel excavation, rock supports and riprap, and the costs for the dam and dyke raises. Items which are common to all options, such as the breach of the Cross Valley Dam, replacement of the RCDC overflow berm with a fuse plug, the upgrade of the RCDC upstream of the fuse plug, the re-grading of the tailings and the placement of the waste rock and soil cover, etc., were excluded from the comparative costs. Further details of the comparative cost estimates can be found in Appendix IV.

Figure 3.7 shows a plot of the comparative cost for various spillway widths. As the plot indicates, a spillway width of 15 m to 20 m appears to be the least cost option. A spillway width of 20 m has been selected for preliminary design. In this case, the Intermediate Dam and the RCDC dyke would be raised to El. 1058.8 m and El. 1058.6 m, respectively. The comparative costs, the spillway size, and the dam and dyke raises should be confirmed during detailed design.

4.2 Cost Estimate for Proposed Flood Handling Works

The cost estimate for the proposed works to pass the PMF through the Intermediate Impoundment is summarized in Table 4.1 below. A detailed breakdown of these costs is presented in Appendix V. These costs are based on a 20 m wide spillway on the right abutment of the Intermediate Dam.

The costs for breach of the Cross Valley Dam, the removal and disposal of the sludge/sediments from the Cross Valley Pond, the re-establishment of the Rose Creek channel and its tributary within the Cross Valley Pond, and the improvement of the North Fork Rose Creek channel upstream of the RCDC are not included in our cost estimate.

Table 4.1 Estimated Costs

Item	Estimated Cost
Intermediate Dam raise	$ 6 800 000
Intermediate Dam spillway	$ 9 400 000
Intermediate Impoundment tailings re-grading and cover	$ 35 700 000
RCDC Dyke raise	$ 1 200 000
RCDC upgrade upstream of fuse plug	$ 2 300 000
RCDC fuse plug	$ 60 000
Sub-total	$ 55 500 000
Indirect Costs at 35 %	$ 19 400 000
Contingency at 20 %	$ 15 000 000
TOTAL (excluding GST)	$ 90 000 000

The cost estimate is based on information available to date and is our opinion of probable cost for budgetary purposes. Actual cost depends on many factors which can change with time, including site and market conditions at the time of construction. SRK provided the project unit costs for the above estimate. This cost estimate can be used to compare one alternative against another for the purposes of deciding which alternative is best for the project. However, this cost estimate cannot be used as a reliable means for raising funds to execute the project. These estimated costs can change significantly with time. To obtain more reliable costs, detailed design will have to be completed.

It is interesting to note that the 64% ($36M/$56M) of the estimated costs, before contingency and indirect costs, are for the construction of the Intermediate Tailings blanket. Our work has been done in the absence of a real understanding of the closure options being considered by the Planning Office. This has not been a detriment to the execution of the work but, rather, there may be economies which can be realized in other parts of the project or our work may precipitate consideration of other issues. For instance, the recommended tailings cover will have to be integrated or made part of a dry cover to reduce acid mine drainage if that option is being considered. Also, removal of the Polishing Pond at the toe of Intermediate Dam will increase the seepage gradient through the foundation soils which may affect predictions of contaminant migration. These and all other similar issues are for others to consider.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Steven Catania, E.I.T.
Water Resources Engineer

PROFESSIONAL
PROVINCE OF
A. DALPATRAM
BRITISH COLUMBIA
ENGINEER

Arvind Dalpatram, P.Eng.
Senior Civil Engineer

REFERENCES

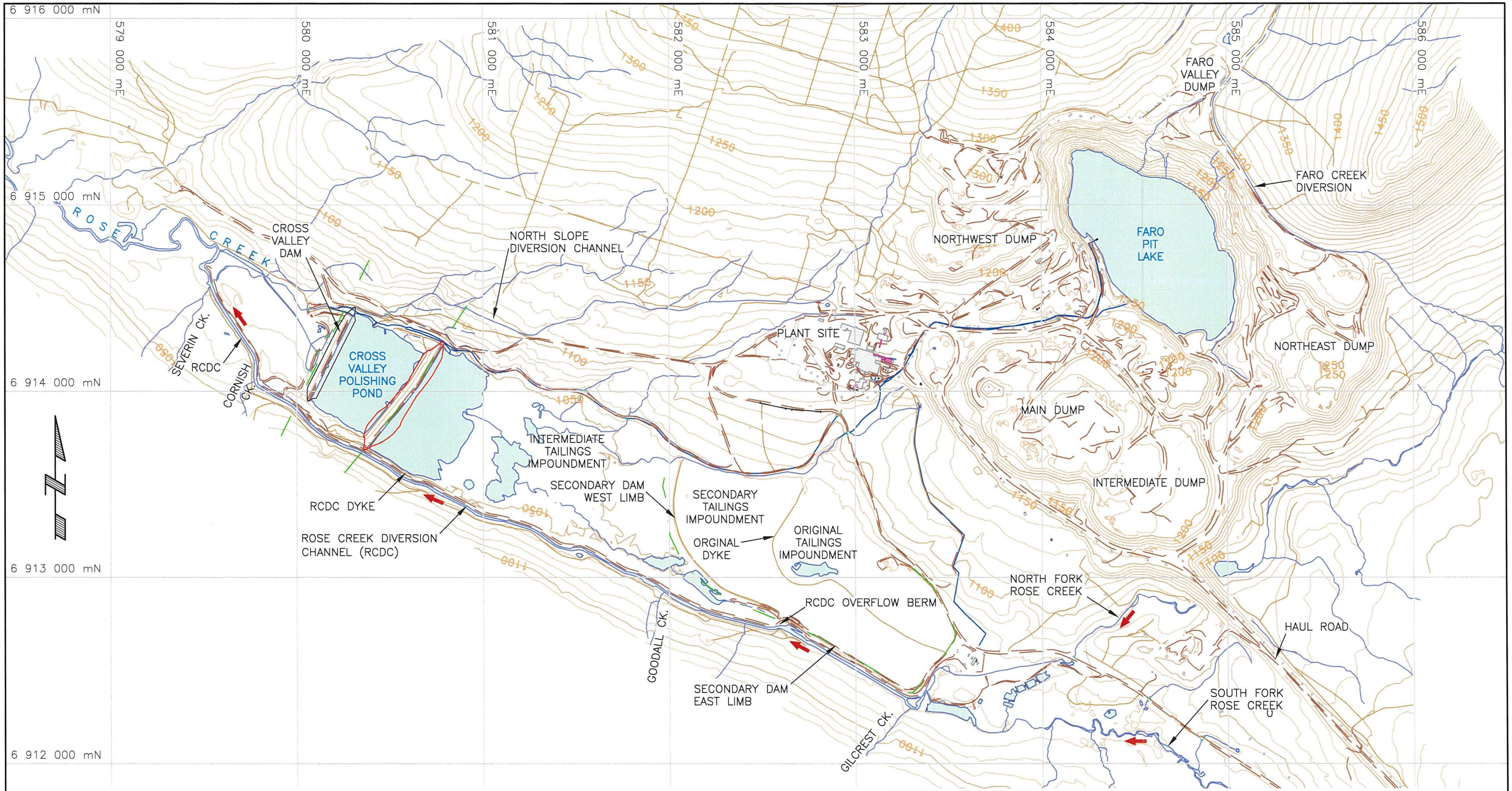
Klohn Crippen Berger Ltd. (2007). "Rose Creek Facility, Faro Mine – Phase 1 Concepts for Passing the PMF over the Intermediate Impoundment", 7 September.

Northwest Hydraulics Consultants Ltd. (nhc) (2006). "Rose Creek Diversion Channel – Hydrotechnical Closure Design – Draft Report," November.

Taylor (2005a). An Analysis of Probable Maximum Precipitation for the Faro Mine Site, Yukon. Report to the Faro Mine Closure Planning Office/

Water Management Consultants (WMC) (2006). "Faro Mine - Rose Creek Probable Maximum Flood." 5 May.

FIGURES



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 11 APRIL, 2008

SCALE
0 1 km

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CLIENT
DELOITTE & TOUCHE INC.
ANVIL RANGE MINING COMPLEX

Klohn Crippen Berger

PROJECT
ROSE CREEK TAILINGS FACILITY
INTERMEDIATE DAM SPILLWAY – PMF FLOOD HANDLING

TITLE
GENERAL SITE ARRANGEMENT

PROJECT No.
M09237 A06

FIG. No.
1.1

KCB-R-MLB

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Date: 4/8/2008
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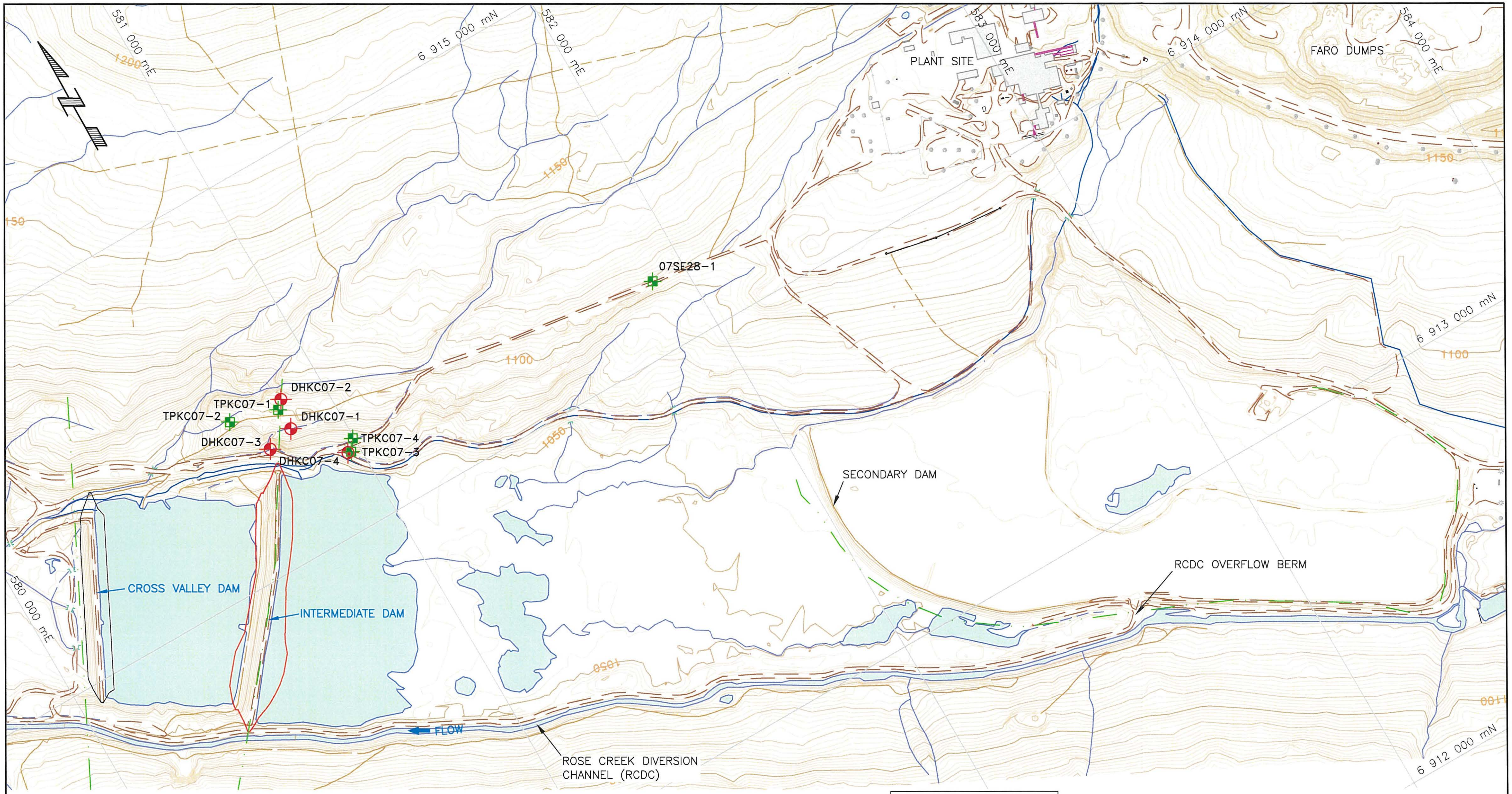
Xrefs: BM-RoseCreek-Aug2004



LEGEND

DHKC07-1	KLOHN CRIPPEN BERGER DRILL HOLE
TPKC07-1	KLOHN CRIPPEN BERGER TEST PIT

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 2M.

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SCALE
0 500 m

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DELOITTE & TOUCHE INC.
ANVIL RANGE MINING COMPLEX

Klohn Crippen Berger

PROJECT
ROSE CREEK TAILINGS FACILITY
INTERMEDIATE DAM SPILLWAY – PMF FLOOD HANDLING

TITLE
2007 DRILL HOLES AND TEST PITS
LOCATION PLAN

PROJECT No.
M09237 A06

FIG. No.
2.1

KCB-R-MLB

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Date: 4/8/2008
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Xrefs: BM-RoseCreek-Aug2004

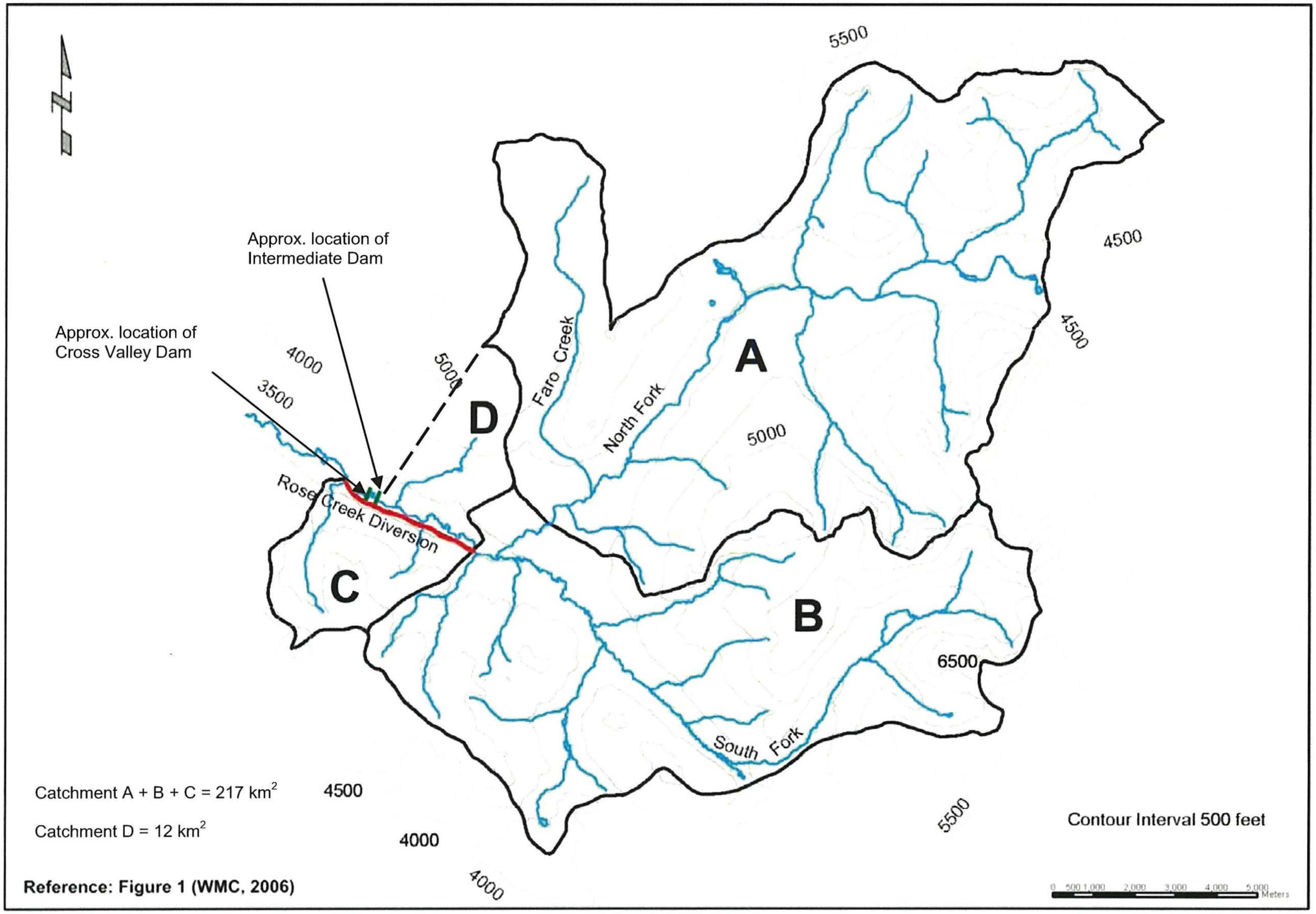


Figure 3.1 Rose Creek Watershed Catchment Boundaries

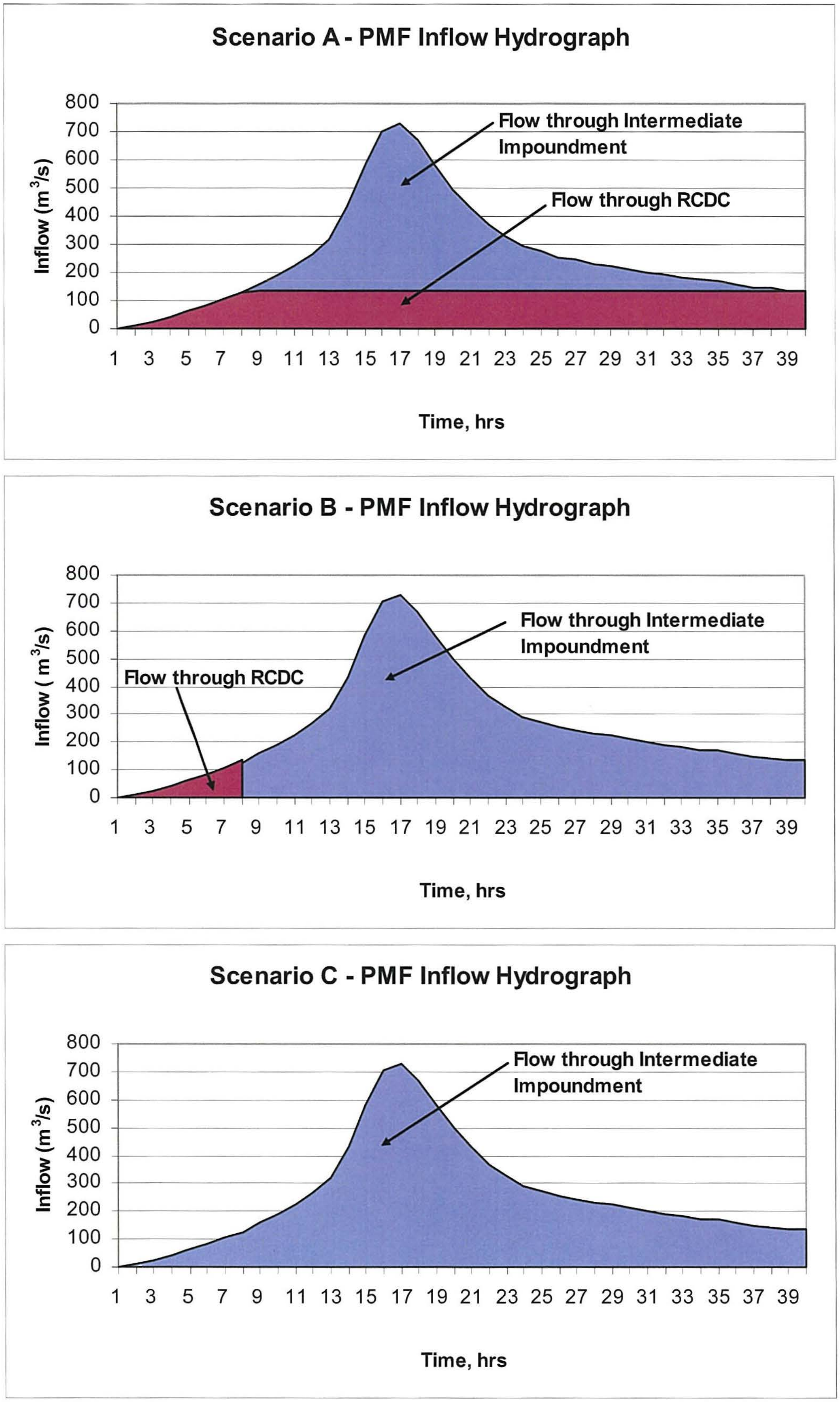
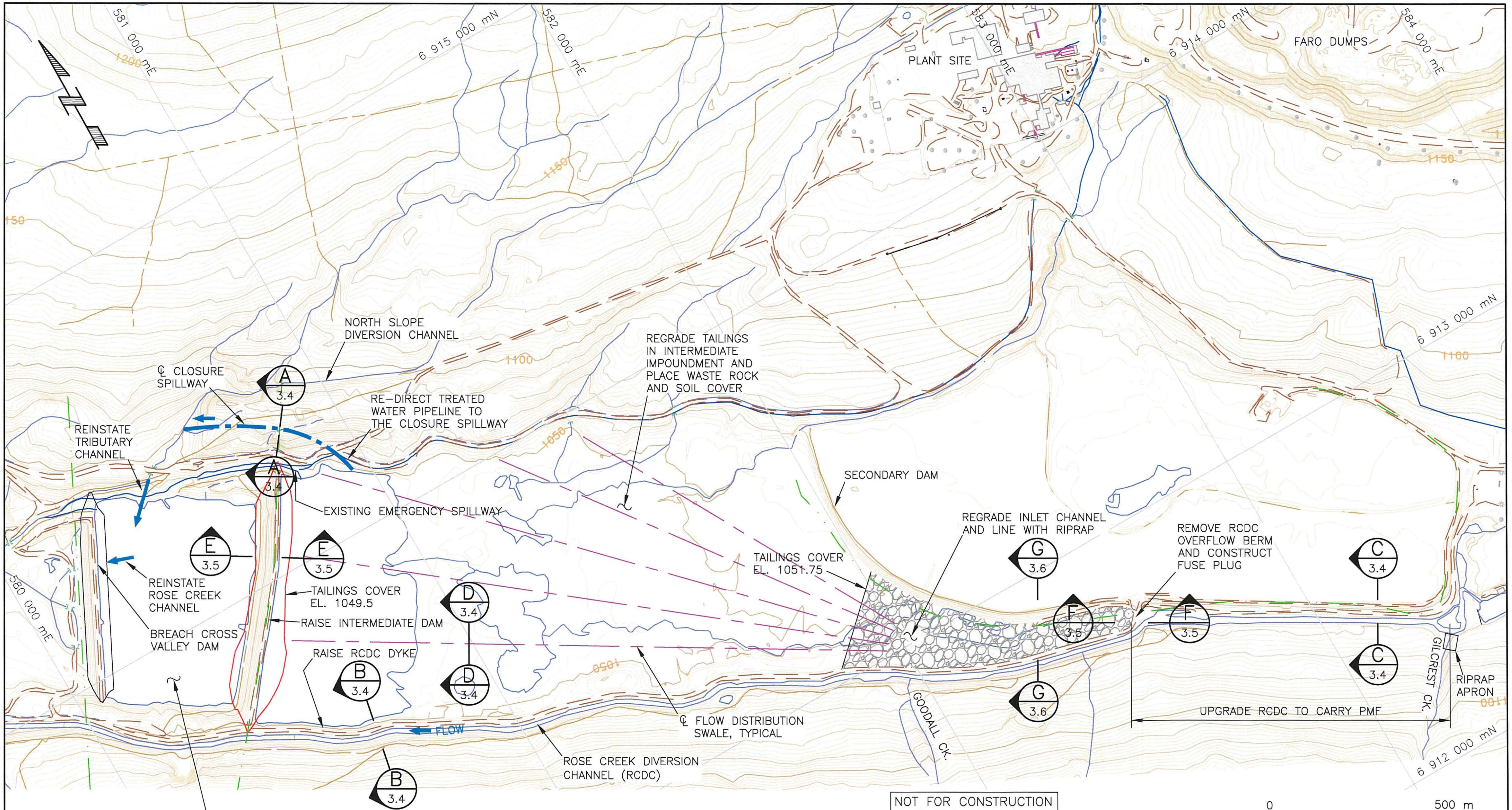


Figure 3.2 PMF Hydrographs



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.

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SCALE 0 500 m

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Klohn Crippen Berger

PROJECT
ROSE CREEK TAILINGS FACILITY
INTERMEDIATE DAM SPILLWAY – PMF FLOOD HANDLING

TITLE
PROPOSED FLOOD HANDLING WORKS
PLAN

PROJECT No. M09237 A06
FIG. No. 3.3

KCB-R-MLB

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Date: 4/8/2008
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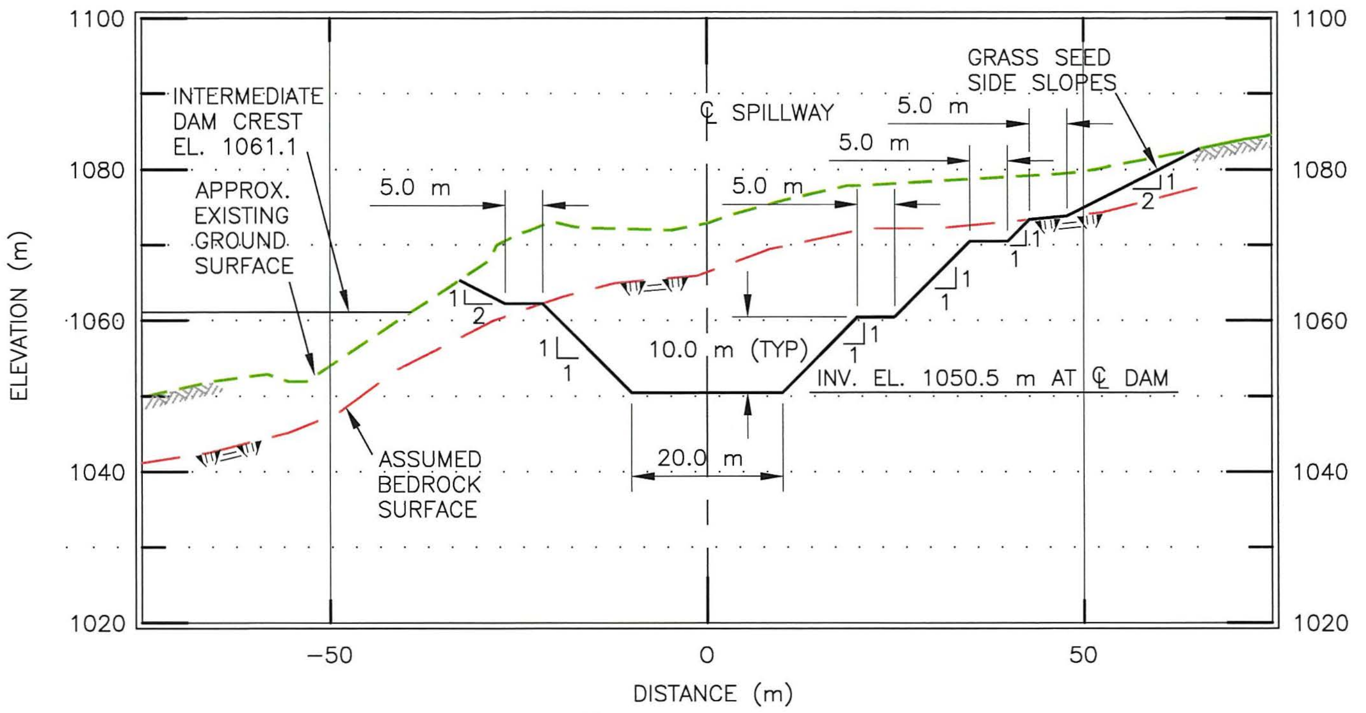
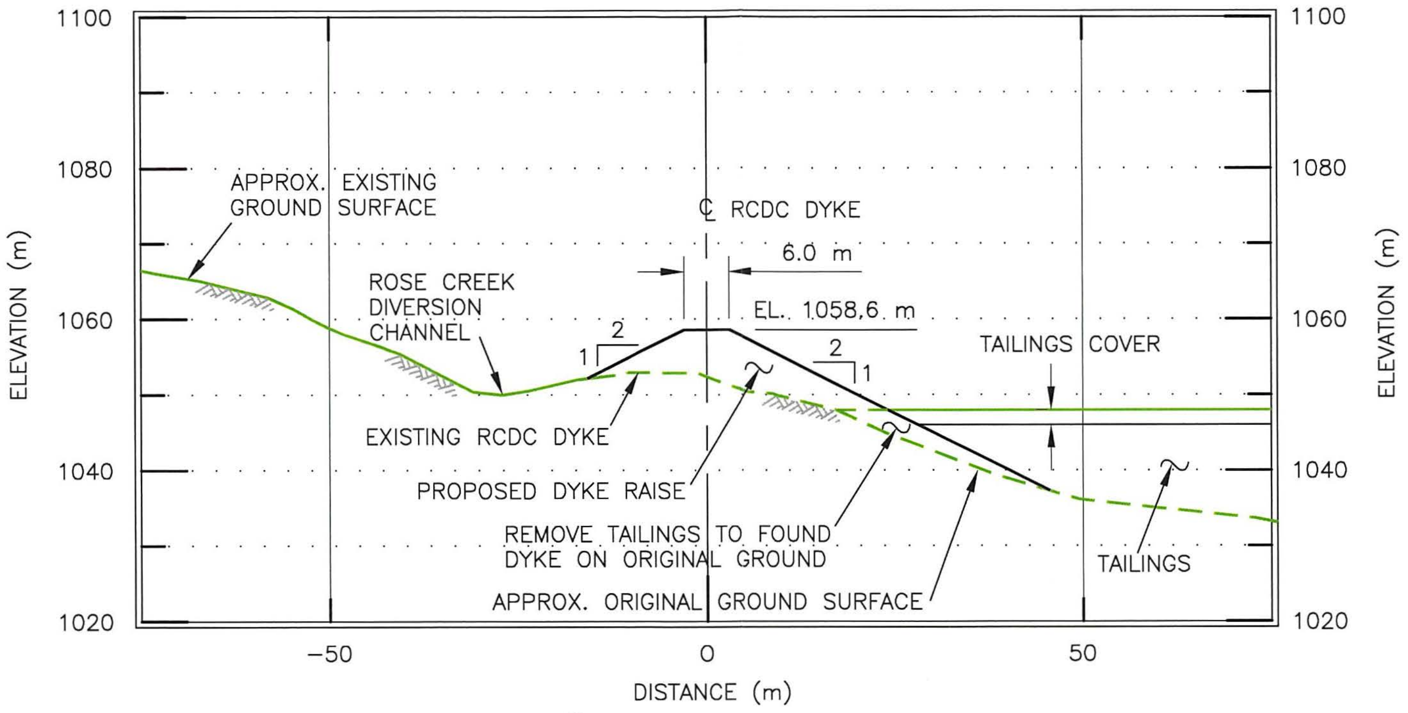
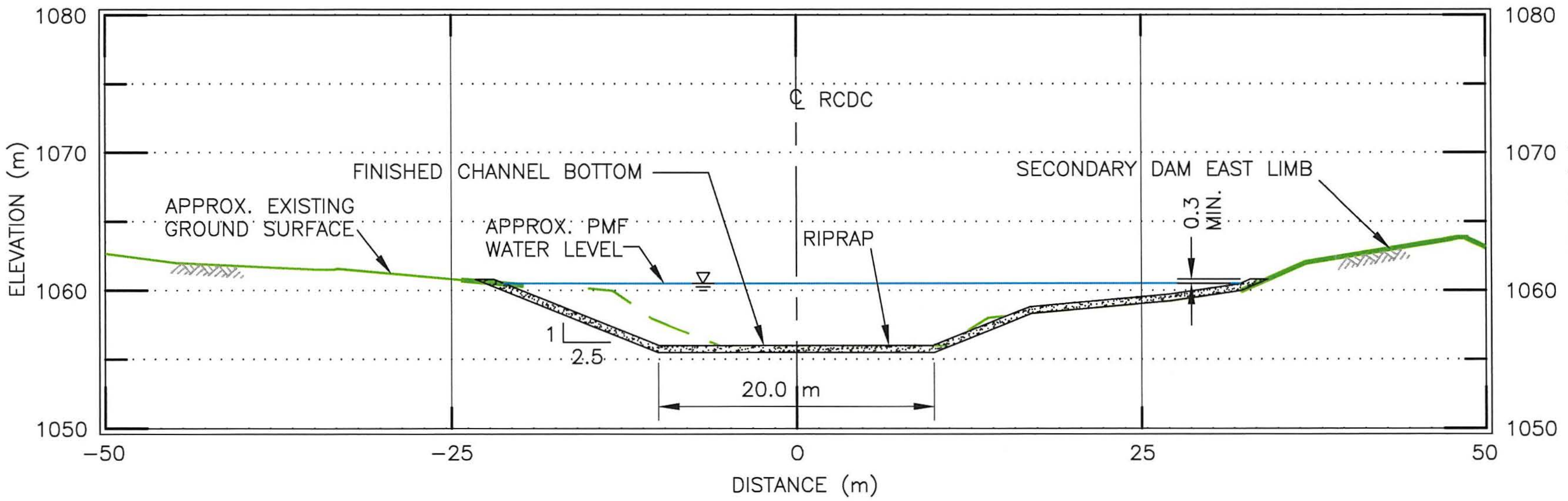
Xrefs: BM-RoseCreek-Aug2004



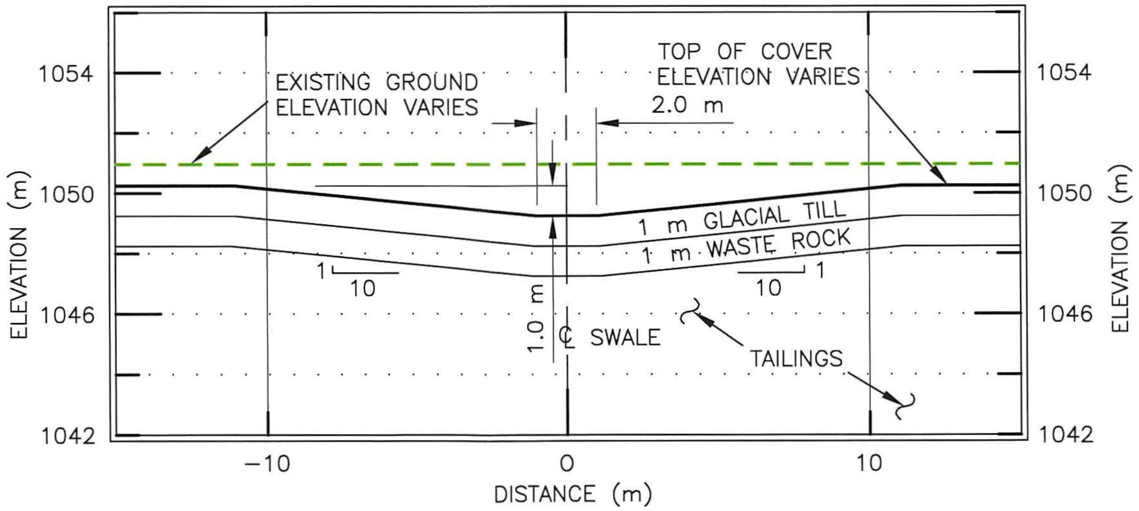
SECTION (A/3.3) CLOSURE SPILLWAY
SCALE A



TYPICAL SECTION (B/3.3) OF RCDC U/S OF INTERMEDIATE DAM
SCALE A



RCDC TYPICAL SECTION (C/3.3) UPSTREAM OF FUSE FLUG
SCALE B



TYPICAL SECTION (D/3.3) FLOW DISTRIBUTION SWALE
SCALE C

SCALE A: 0 40 m
SCALE B: 0 20 m
SCALE C: 0 10 m

LEGEND

RCDC	ROSE CREEK DIVERSION CHANNEL

NOTES:

1. RCDC DYKE RAISE SHOWN IS BASED ON A 20 m WIDE SPILLWAY.
2. ALL ELEVATIONS ARE ABOVE MEAN SEA LEVEL.

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PROJECT
ROSE CREEK TAILINGS FACILITY
INTERMEDIATE DAM SPILLWAY – PMF FLOOD HANDLING

TITLE
PROPOSED FLOOD HANDLING WORKS
SECTIONS AND DETAILS
SHEET 1 OF 3

PROJECT No. M09237 A06
FIG. No. 3.4

KCB-R-MLB

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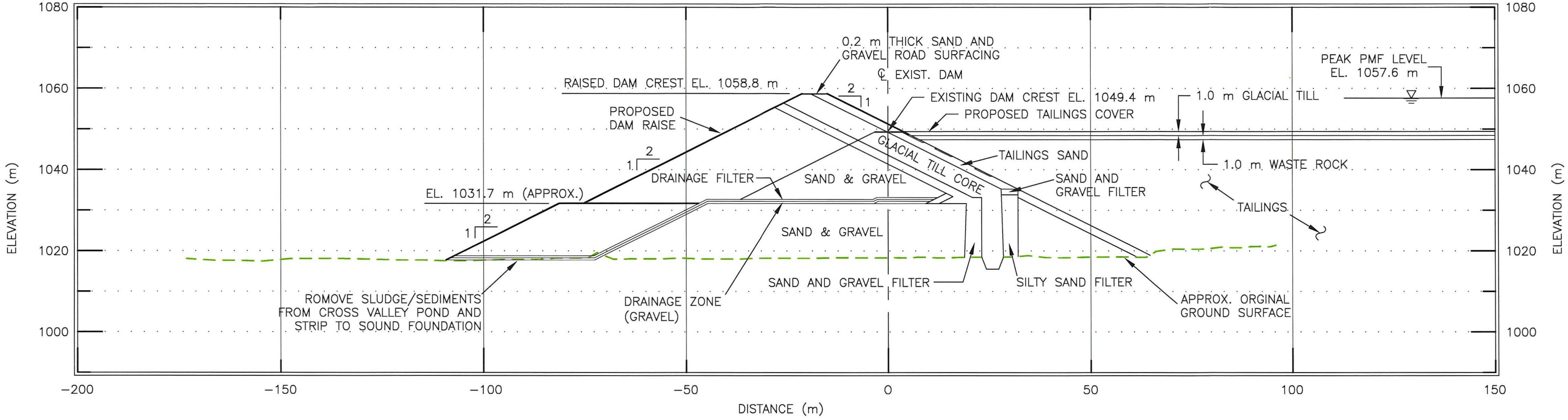
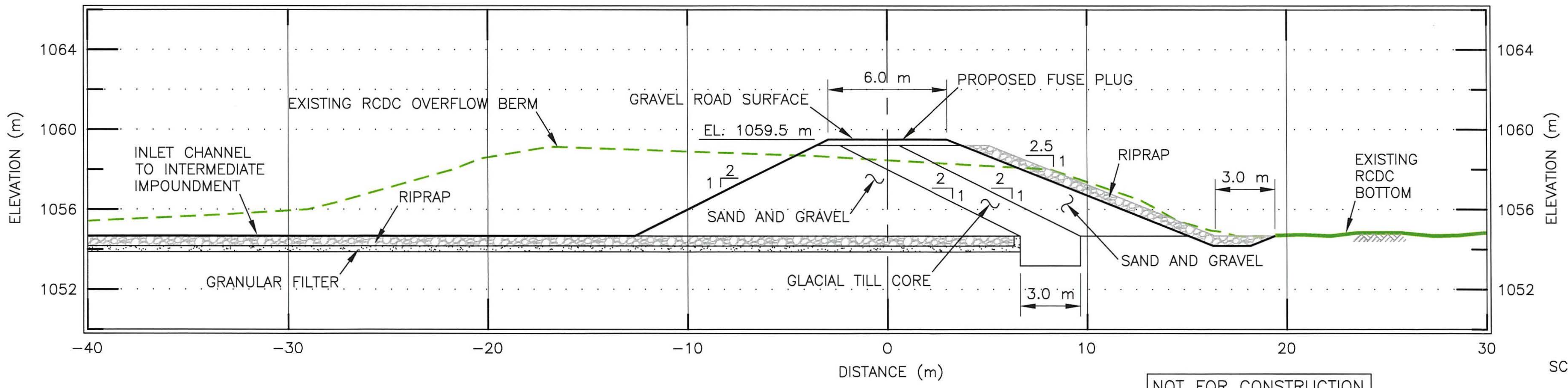
Xrefs: BM-RoseCreek-Aug2004



SECTION (E / 3.3) INTERMEDIATE DAM RAISE

SCALE A



SECTION (F / 3.3) RCDC FUSE PLUG

SCALE B

LEGEND

RCDC	ROSE CREEK DIVERSION CHANNEL

NOTES:

1. INTERMEDIATE DAM RAISE SHOWN IS BASED ON A 20 m WIDE SPILLWAY.
2. ALL ELEVATIONS ARE ABOVE MEAN SEA LEVEL.

SCALE A 0 40 m

SCALE B 0 10 m

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ROSE CREEK TAILINGS FACILITY
INTERMEDIATE DAM SPILLWAY – PMF FLOOD HANDLING

TITLE
PROPOSED FLOOD HANDLING WORKS
SECTIONS AND DETAILS
SHEET 2 OF 3

PROJECT No. M09237 A06

FIG. No. 3.5

KCB-R-MLB

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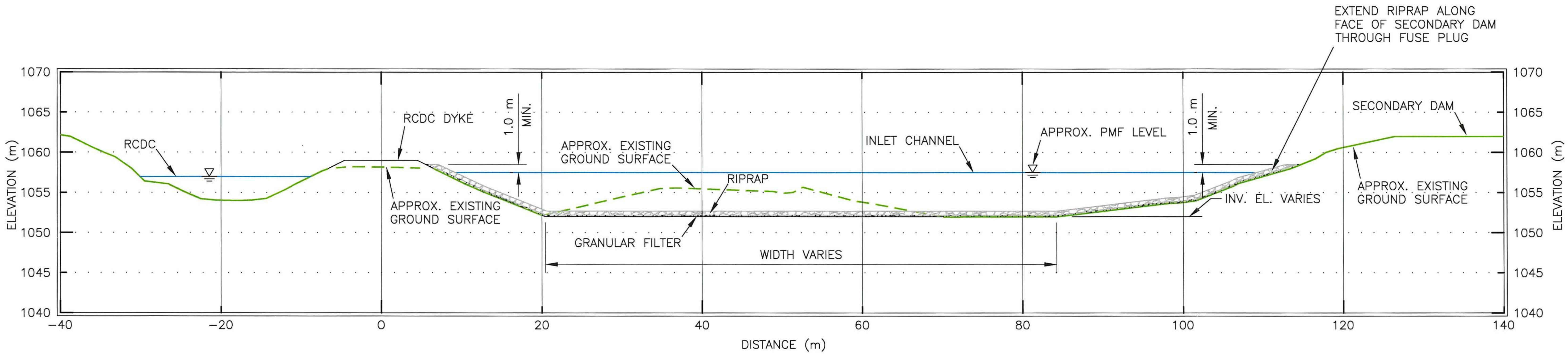
Xrefs: BM-RoseCreek-Aug2004



SECTION G 3.3 INTERMEDIATE IMPOUNDMENT INLET CHANNEL

LEGEND

RCDC	ROSE CREEK DIVERSION CHANNEL

NOTES:

1. ALL ELEVATIONS ARE ABOVE MEAN SEA LEVEL.

NOT FOR CONSTRUCTION

TO BE READ WITH KLOHN CRIPPEN BERGER REPORT DATED 11 APRIL, 2008

SCALE 0 20 m

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PROJECT
ROSE CREEK TAILINGS FACILITY
INTERMEDIATE DAM SPILLWAY – PMF FLOOD HANDLING

TITLE
PROPOSED FLOOD HANDLING WORKS
SECTIONS AND DETAILS
SHEET 3 OF 3

PROJECT No. M09237 A06
FIG. No. 3.6

KCB-R-MLB

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Date: 4/8/2008
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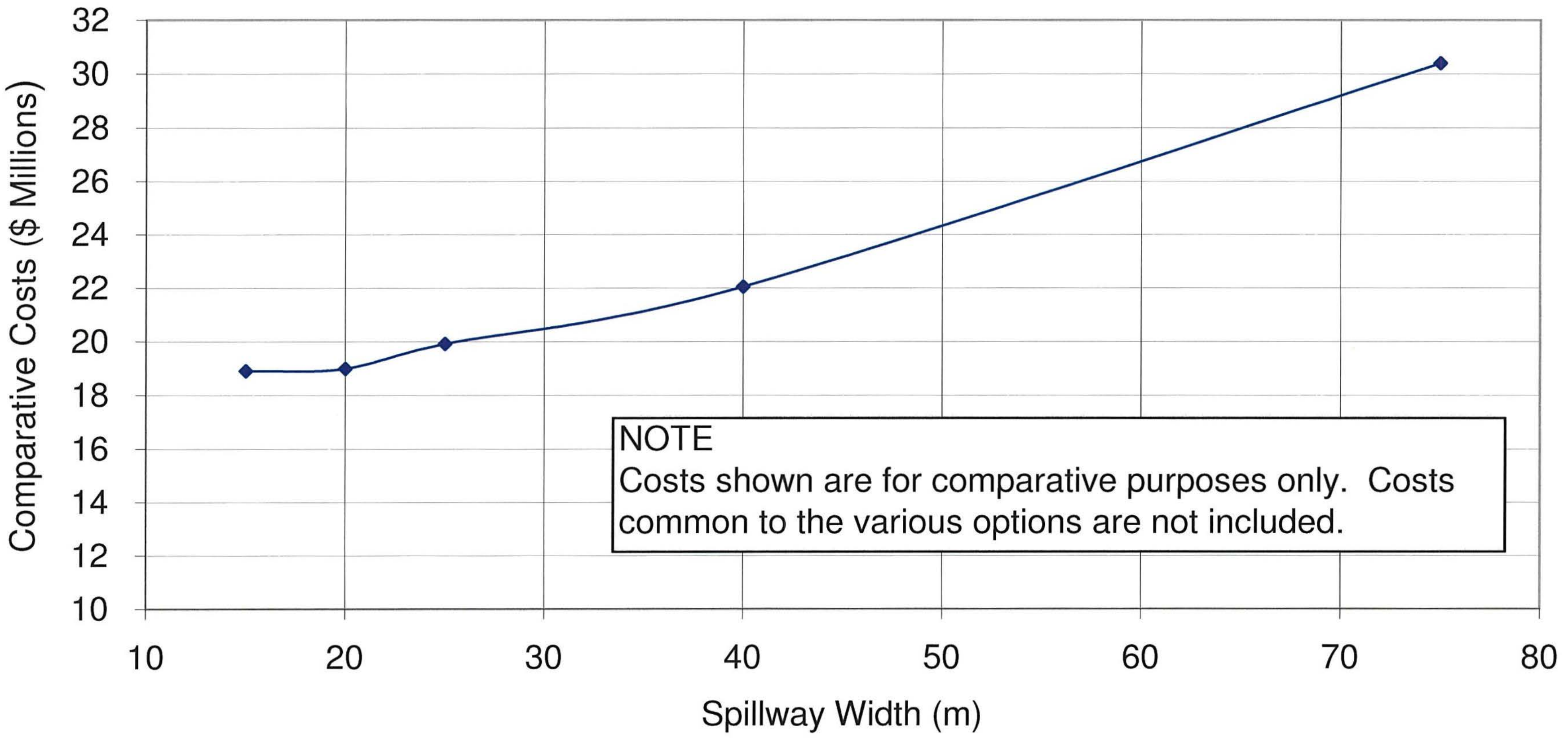
Xrefs: BM-RoseCreek-Aug2004

Rose Creek Tailings Facility
Intermediate Dam Spillway - PMF Flood Handling

Figure 3.7
Intermediate Dam
Spillway Width vs. Comparative Cost



NOTE
Costs shown are for comparative purposes only. Costs common to the various options are not included.

APPENDIX I

Drill Hole Logs, Test Pit Logs and Photographs

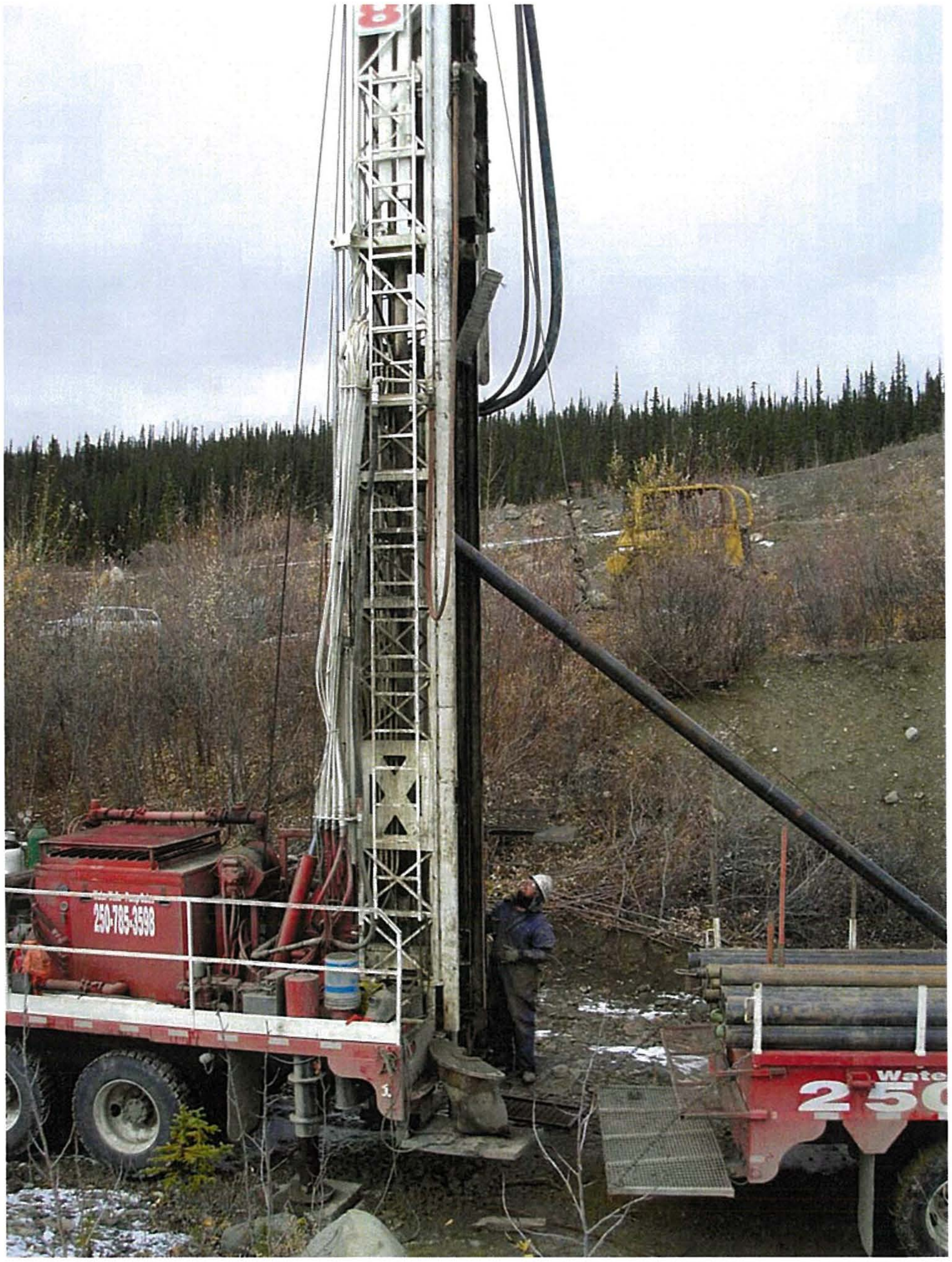


Photo I-1 **Truck mounted drill rig at DHKC07-1. A 6" casing is being hoisted into position. Note the outcrop of silty gravel on the right.**

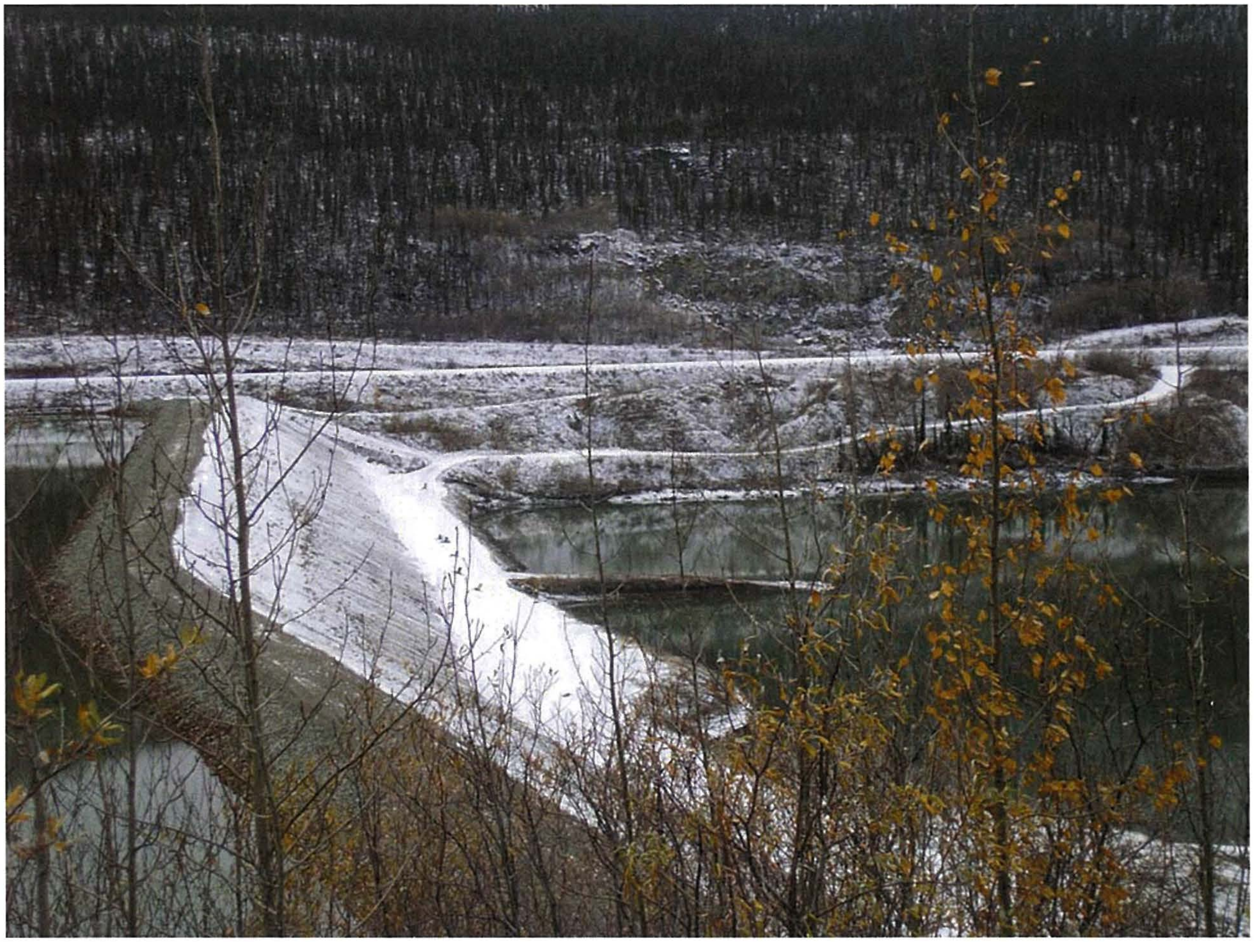


Photo I-2 View towards the intermediate dam from DHKC07-1.

Photo I-3 **Sand and gravel chip sample from tri-cone drilling at about 4 m depth at DHKC07-1.**

Photo I-4 **View from DHKC07-2 towards DHKC07-1 with the intermediate dam visible in the mist.**

Photo I-5 **Foliated schist bedrock in a dozer cut at DHKC07-2.**

PhotoI-6 **DHKC07-3 and the intermediate dam. Bedrock is at 5.1 m depth in DHKC07-3. Note the 4 m high roadcut of sand and gravel on the right.**

Photo I-7 DHKC07-3 is on the extreme left, where bedrock is 5.1 m below surface. A 4 m high roadcut of sand and gravel is in the centre.

Photo I-8 Excavator is digging TPKC07-3, which is adjacent to DHKC07-4. Bedrock is at 10.5 m depth in DHKC07-4.

Photo I-9 TPKC07-1 exposed schist bedrock at 3.2 m below surface.

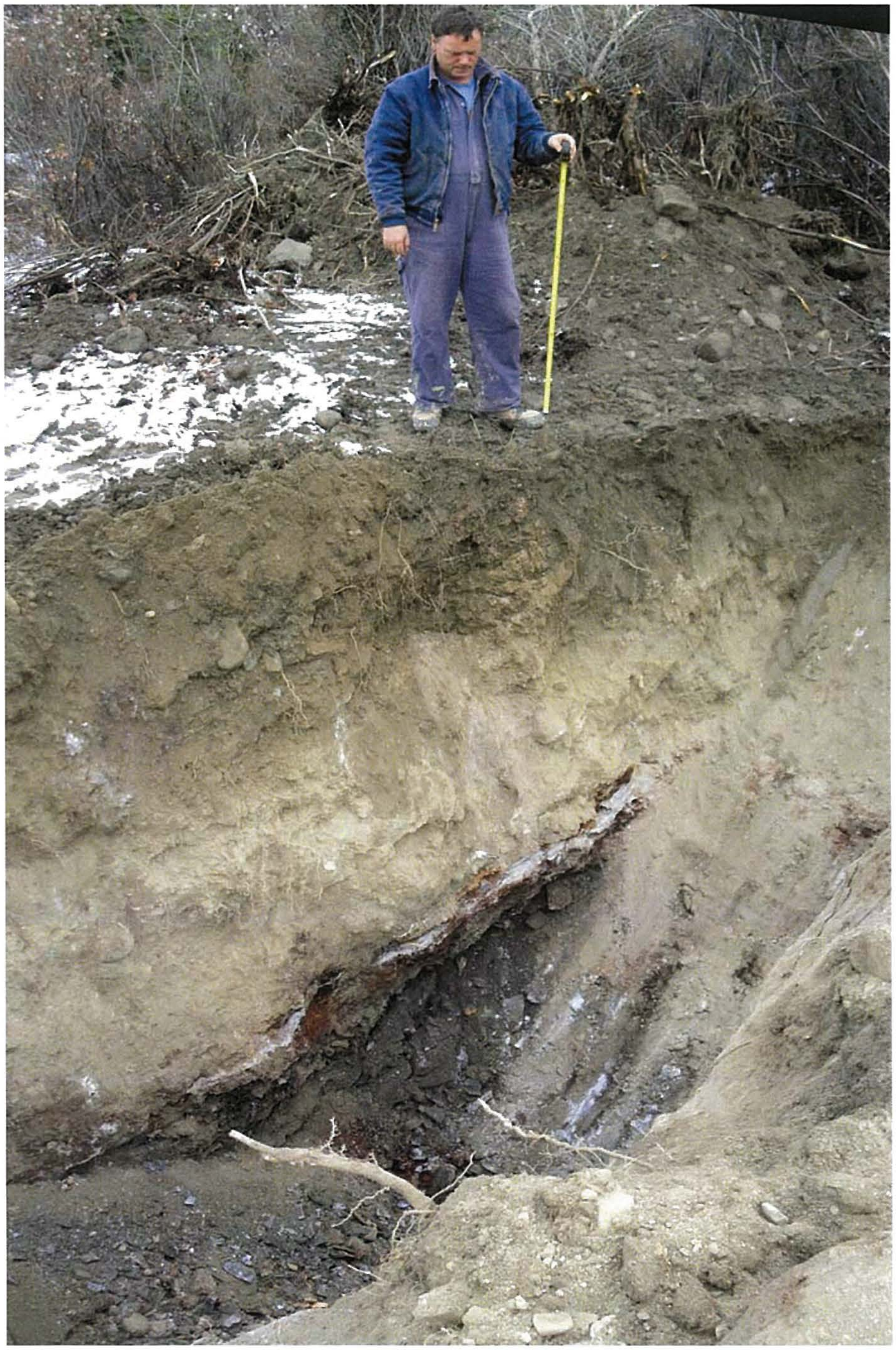


Photo I-10 **TPKC07-2 exposed schist bedrock at 1.9 m below surface. Note the darker disturbed material at the top of the test pit.**

Buried soil horizon.

Photo I-11 **TPKC07-3 exposed 3.5 m of fill, with sand and gravel underlying to at least 5.5 m depth. Note the thin black buried soil layer at 3.5 m depth.**

Photo I-12 **TPKC07-4 exposes at least 5 m of silty gravelly sand with trace organics.**

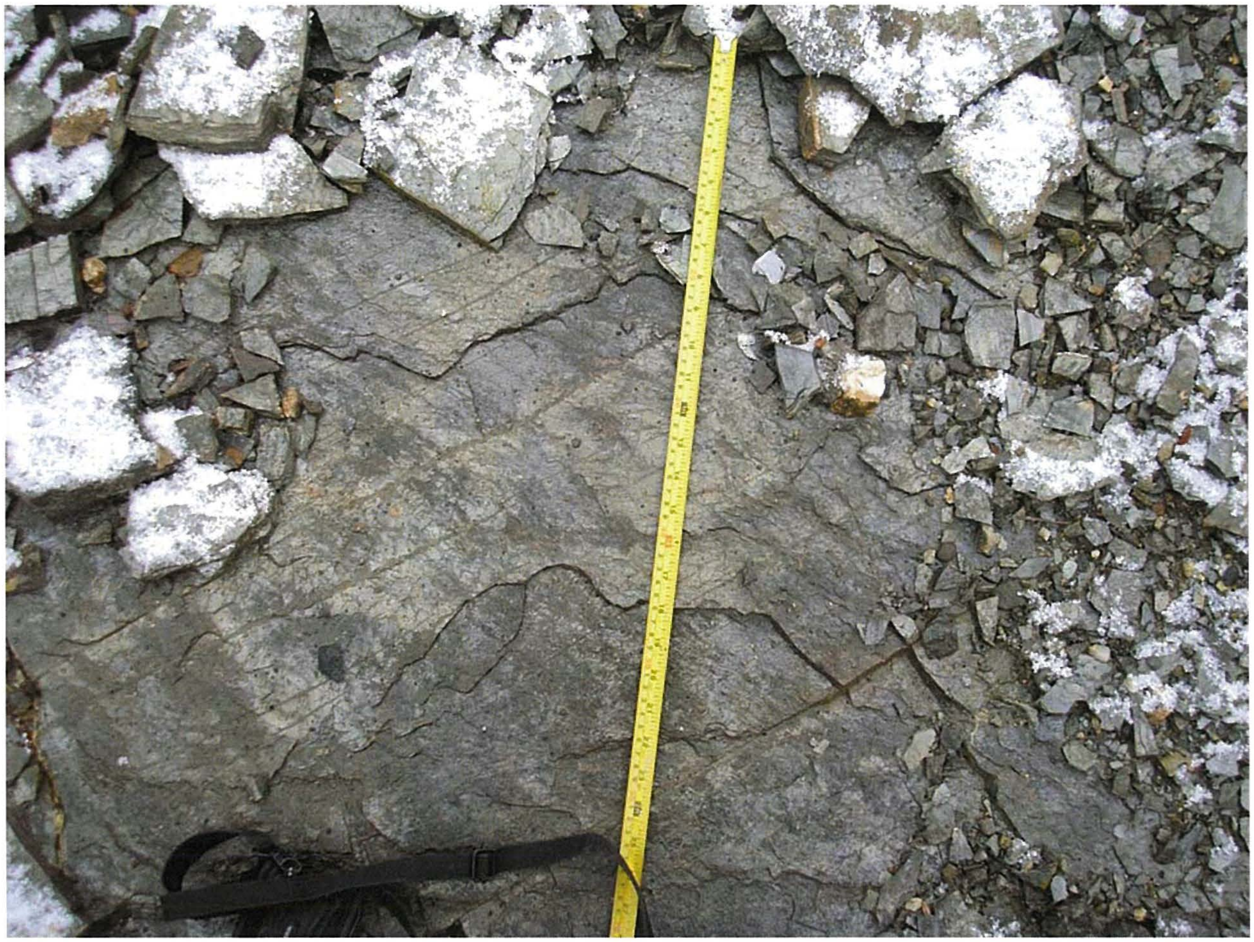


Photo I-13 **The smooth, planar surface of foliation in the schist bedrock in a roadcut at 07SE28-1. Foliation spacing is 2 to 10 mm.**

Photo I-14 **Closely foliated schist with minor folding in a roadcut at 07SE28-1. The light material is quartz.**

Photo I-15 Core from 9.34 to 14.78 m in DHKC07-1.

**Photo I-16	Core from 14.78 to 17.76 m in DHKC07-1.**

Photo I-17 Core from 0 to 3.8 m in DHKC07-2.

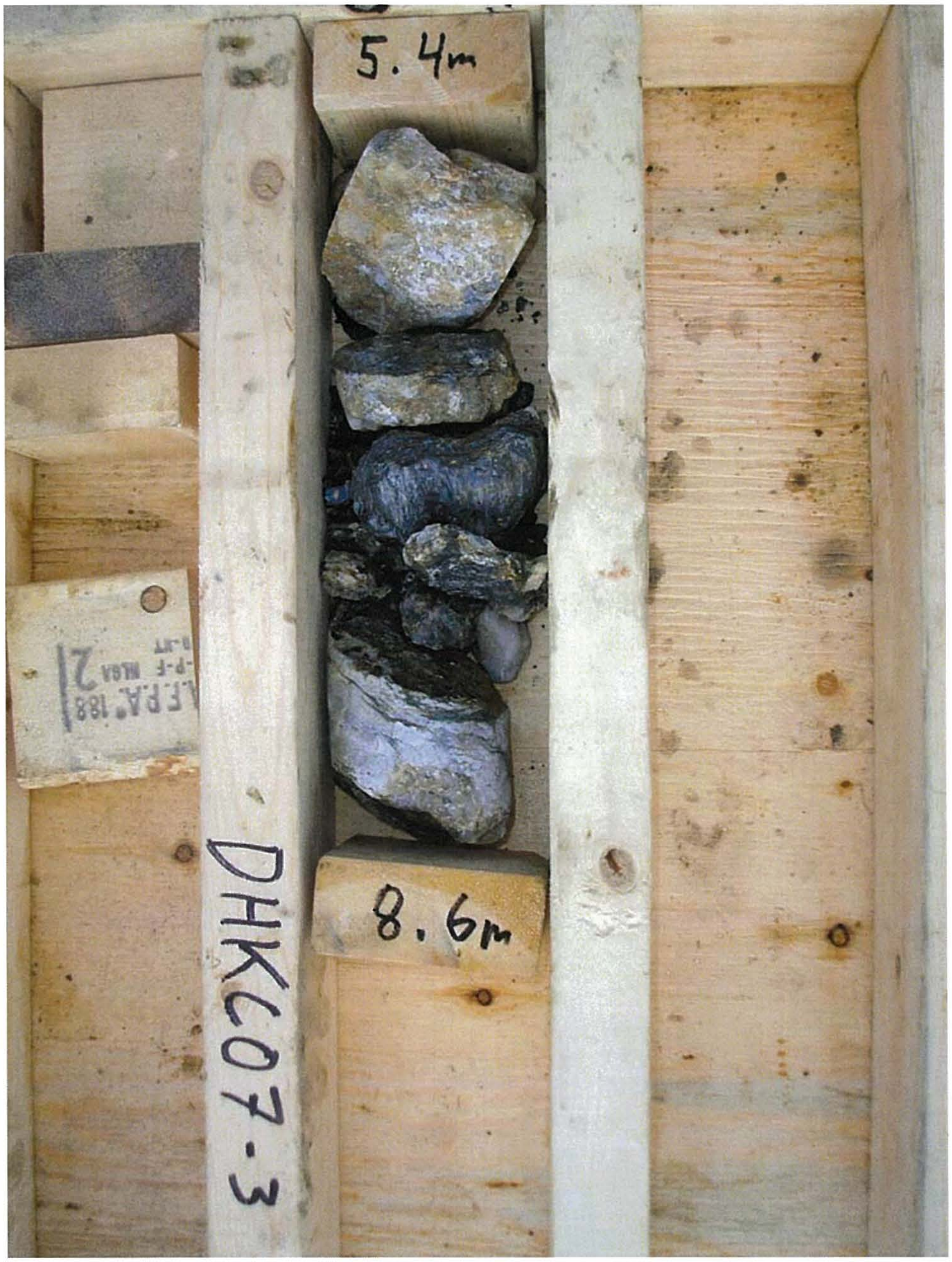
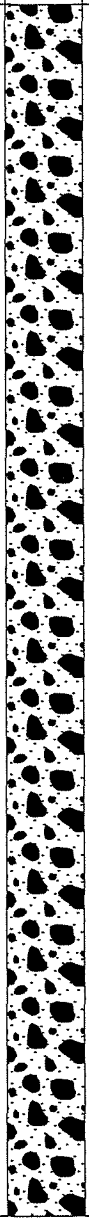
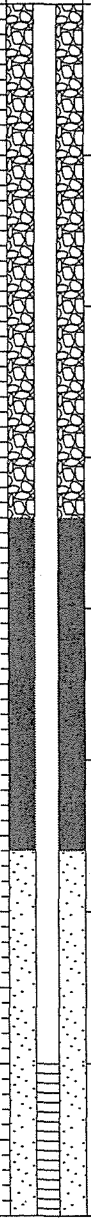


Photo I-18 Core from 5.4 to 8.6 m in DHKC07-3.

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DHKC07-1(P)

CLIENT: Deloitte & Touche Inc.	PROJECT NO.: M09237A06
PROJECT: Rose Creek Diversion Review	DATE HOLE STARTED: 09/24/2007 FINISHED: 09/26/2007
LOCATION: Intermediate Dam - Right Abutment	DATUM: NAD 27 masl
DIRECTION AZIMUTH: DIP (from horiz): 90	TOP OF PIPE ELEVATION: 1072.946 m
CO-ORDINATES: E 580865.798m N 6914332.664m	GROUND ELEVATION: 1073.476 m
MANUFACTURER'S DRILL DESIGNATION:	TOTAL DEPTH OF HOLE: 17.76 m
DRILLING CONTRACTOR: Carbon Mountain Drilling	DRILLING METHOD SOIL: Tricone Air Rotary ROCK: HQ Core
LOGGED BY: C Kowalchuk	DRILLING FLUID: Air and Water CASED TO: 9.27m
CHECKED BY: S Warner	HOLE DIA.: 157mm cased, 154mm uncased

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA SEE BOTTOM OF FORM FOR CODES	ROCK STRENGTH BASED ON POINT LOAD TEST (MPa) (a)=axial; (d)=diametrical	ROCK HARDNESS 1 2 3 4 5	RECOVERY DATA CORE RECOVERY % 25 50 75	RECOVERY DATA R.Q.D. % 25 50 75
0–8		GRAVEL AND SAND (GW-SW). Fine to coarse gravel, fine to coarse sand, no fines, some boulders, well graded, max. particle size up to boulders, light brown, schist and medium grained intrusive lithologies. (Glaciofluvial)							

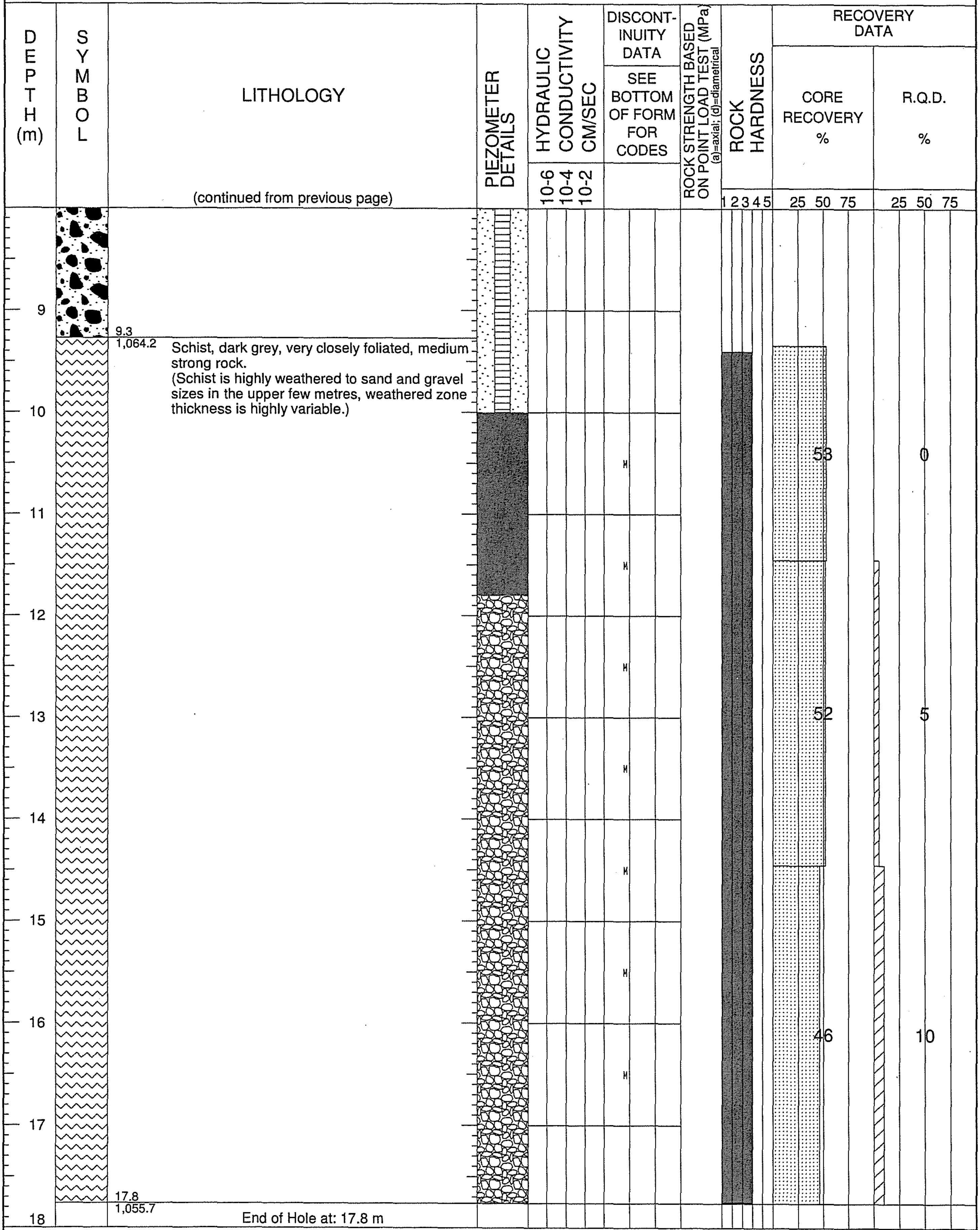
DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▨ CORE LOSS ⁚ FRACTURED/BROKEN CORE DIP ANGLES MEASURED WITH RESPECT TO HORIZONTAL

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DHKC07-1(P)

(continued from previous page)



Schist, dark grey, very closely foliated, medium strong rock.
(Schist is highly weathered to sand and gravel sizes in the upper few metres, weathered zone thickness is highly variable.)

End of Hole at: 17.8 m

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▨ CORE LOSS ░ FRACTURED/BROKEN CORE DIP ANGLES MEASURED WITH RESPECT TO HORIZONTAL

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DHKC07-2

CLIENT: Deloitte & Touche Inc.	PROJECT NO.: M09237A06
PROJECT: Rose Creek Diversion Review	DATE HOLE STARTED: 09/26/2007 FINISHED: 09/26/2007
LOCATION: Intermediate Dam - Right Abutment	DATUM: NAD 27 masl
DIRECTION AZIMUTH: DIP (from horiz): 90	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 580882.305m N 6914414.224m	GROUND ELEVATION: 1084.309 m
MANUFACTURER'S DRILL DESIGNATION:	TOTAL DEPTH OF HOLE: 3.8 m
DRILLING CONTRACTOR: Carbon Mountain Drilling	DRILLING METHOD SOIL: Tricone Air Rotary ROCK: HQ Core
LOGGED BY: C Kowalchuk	DRILLING FLUID: Air and Water CASED TO: 0m
CHECKED BY: S Warner	HOLE DIA.: 154mm uncased

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA SEE BOTTOM OF FORM FOR CODES	ROCK STRENGTH BASED ON POINT LOAD TEST (MPa) (a)=axial; (d)=diametrical	ROCK HARDNESS 1 2 3 4 5	RECOVERY DATA CORE RECOVERY % 25 50 75	RECOVERY DATA R.Q.D. % 25 50 75
0–3.8		Schist, dark grey, very closely foliated, medium strong rock, quartz veins up to 20 mm thick. Foliation dips toward 191 at 27. (Schist is highly weathered to sand and gravel sizes in the upper few metres, weathered zone thickness is highly variable.)						6	0
								50	0
3.8 1,080.5		End of Hole at: 3.8 m							

Depth scale: 1 2 3 4 5 6 7 8

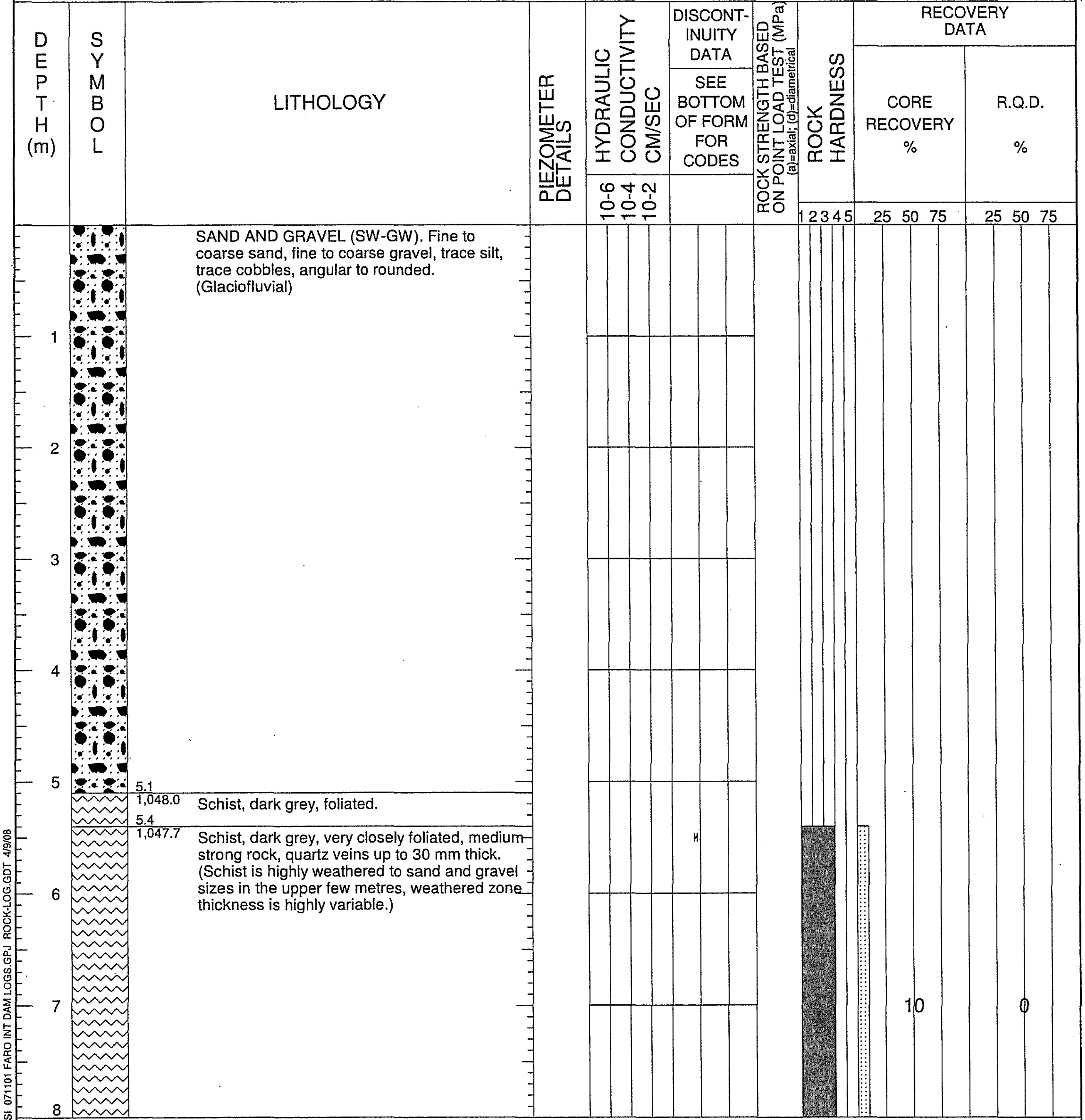
DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▨ CORE LOSS ⁘ FRACTURED/BROKEN CORE DIP ANGLES MEASURED WITH RESPECT TO HORIZONTAL

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DHKC07-3

CLIENT: Deloitte & Touche Inc.	PROJECT NO.: M09237A06
PROJECT: Rose Creek Diversion Review	DATE HOLE STARTED: 09/27/2007 FINISHED: 09/27/2007
LOCATION: Intermediate Dam - Right Abutment	DATUM: NAD 27 masl
DIRECTION AZIMUTH: DIP (from horiz): 90	TOP OF PIPE ELEVATION: 1052.396 m
CO-ORDINATES: E 580790.55m N 6914312.893m	GROUND ELEVATION: 1053.126 m
MANUFACTURER'S DRILL DESIGNATION:	TOTAL DEPTH OF HOLE: 8.6 m
DRILLING CONTRACTOR: Carbon Mountain Drilling	DRILLING METHOD SOIL: Tricone Air Rotary ROCK: HQ Core
LOGGED BY: C Kowalchuk	DRILLING FLUID: Air and Water CASED TO: 5.3m
CHECKED BY: S Warner	HOLE DIA.: 157mm cased, 154mm uncased



SAND AND GRAVEL (SW-GW). Fine to coarse sand, fine to coarse gravel, trace silt, trace cobbles, angular to rounded. (Glaciofluvial)

5.1 / 1,048.0 Schist, dark grey, foliated.

5.4 / 1,047.7 Schist, dark grey, very closely foliated, medium strong rock, quartz veins up to 30 mm thick. (Schist is highly weathered to sand and gravel sizes in the upper few metres, weathered zone thickness is highly variable.)

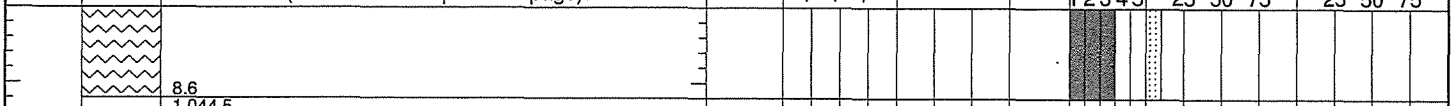
DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▨ CORE LOSS ⁙ FRACTURED/BROKEN CORE DIP ANGLES MEASURED WITH RESPECT TO HORIZONTAL

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DHKC07-3

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC	DISCONTINUITY DATA SEE BOTTOM OF FORM FOR CODES	ROCK STRENGTH BASED ON POINT LOAD TEST (MPa) (a)=axial; (d)=diametrical	ROCK HARDNESS	RECOVERY DATA CORE RECOVERY %	RECOVERY DATA R.Q.D. %
		(continued from previous page)		10-6 10-4 10-2			1 2 3 4 5	25 50 75	25 50 75



8.6
1,044.5

End of Hole at: 8.6 m

9
10
11
12
13
14
15
16
17
18

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▨ CORE LOSS ⠿ FRACTURED/BROKEN CORE DIP ANGLES MEASURED WITH RESPECT TO HORIZONTAL

KCBL_ROCK-SI 071101 FARO INT DAM LOGS.GPJ ROCK-LOG.GDT 4/9/08

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DHKC07-4

CLIENT: Deloitte & Touche Inc.	PROJECT NO.: M09237A06
PROJECT: Rose Creek Diversion Review	DATE HOLE STARTED: 09/28/2007 FINISHED: 09/28/2007
LOCATION: Intermediate Dam - Right Abutment	DATUM: NAD 27 masl
DIRECTION AZIMUTH: DIP (from horiz): 90	TOP OF PIPE ELEVATION: m
CO-ORDINATES: E 580966.045m N 6914200.737m	GROUND ELEVATION: 1055.064 m
MANUFACTURER'S DRILL DESIGNATION:	TOTAL DEPTH OF HOLE: 13.5 m
DRILLING CONTRACTOR: Carbon Mountain Drilling	DRILLING METHOD SOIL: Tricone Air Rotary ROCK: Tricone Air Ro
LOGGED BY: C Kowalchuk	DRILLING FLUID: Air and Water CASED TO: 10.6m
CHECKED BY: S Warner	HOLE DIA.: 157mm cased, 154mm uncased

DEPTH (m)	SYMBOL	LITHOLOGY	PIEZOMETER DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA SEE BOTTOM OF FORM FOR CODES	ROCK STRENGTH BASED ON POINT LOAD TEST (MPa) (a)=axial; (d)=diametrical	ROCK HARDNESS 1 2 3 4 5	RECOVERY DATA CORE RECOVERY % 25 50 75	RECOVERY DATA R.Q.D. % 25 50 75
		SAND AND GRAVEL (SW-GW). Fine to coarse sand, fine to coarse gravel, trace silt, trace cobbles, medium grained igneous and schist lithologies. (Fill)							
4.0 1,051.1		SILT (ML) and clay, trace pebbles, black to dark grey, trace organics. (Buried soil)							
5.0 1,050.1		GRAVEL AND SAND (GW-SW). Fine to coarse gravel, fine to coarse sand, trace silt, trace cobbles, medium grained igneous and schist lithologies. (Glaciofluvial)							

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▨ CORE LOSS ⁘ FRACTURED/BROKEN CORE DIP ANGLES MEASURED WITH RESPECT TO HORIZONTAL

Klohn Crippen Berger

GEOLOGIC LOG OF DRILL HOLE NO.: DHKC07-4

DEPTH (m)	SYMBOL	LITHOLOGY (continued from previous page)	PIEZOMETER DETAILS	HYDRAULIC CONDUCTIVITY CM/SEC 10-6 10-4 10-2	DISCONTINUITY DATA SEE BOTTOM OF FORM FOR CODES	ROCK STRENGTH BASED ON POINT LOAD TEST (MPa) (a)=axial; (d)=diametrical	ROCK HARDNESS 1 2 3 4 5	RECOVERY DATA CORE RECOVERY % 25 50 75	RECOVERY DATA R.Q.D. % 25 50 75
9									
10									
		10.5 1,044.6 Schist, dark grey, very closely foliated, medium strong rock. (Schist is highly weathered to sand and gravel sizes in the upper few metres, weathered zone thickness is highly variable.)							
11									
12									
13									
		13.5 1,041.6 End of Hole at: 13.5 m							
14									
15									
16									
17									
18									

DISCONTINUITY CODES: B: BEDDING D: DRILL BRK F: FAULT G: GNEISS'TY J: JOINT M: SCHIST'TY S: SHEAR T: TENSION CRK

▨ CORE LOSS ░ FRACTURED/BROKEN CORE DIP ANGLES MEASURED WITH RESPECT TO HORIZONTAL

TEST PIT LOG

Su - kPa
20 60 100 140 180

VANE FIELD LAB
PEAK ◆ ■
REMOLD ◇ □
▲ UC/2
△ P.PEN/2
★ % FINES
W_P% W% W_L%
× — — — — ○ — — — — ×
20 40 60 80

DEPTH (m) | SAMPLE TYPE | SAMPLE No. | SYMBOL | INSTRUMENT DETAILS

STARTED: 09/28/2007 **FINISHED:** 09/28/2007
EXCAVATOR TYPE: Road Cut Exposure
GROUND ELEV. (m): 1107.5
COORDINATES (m): N 6914189 E 581906

DESCRIPTION OF MATERIALS

Schist, dark grey, very closely foliated, medium strong rock, slightly weathered, quartz veins up to 50 mm thick, trace folded areas of low grade gneiss.

Foliation dipping towards 203 at 25.
Spacing 30 to 70 mm.
Persistence >3 m.
No fill.
Aperture 0 to 0.5 mm, average 0.1 mm.
Smooth, planar.

Joint set 1 dipping towards 343 at 55.
Spacing 60 to 80 mm.
Persistence 1 m.
Fill Ca and Qtz.
Aperture 0.5 to 1.5 mm.
Smooth, undulating.

Joint set 2 dipping towards 228 at 27.
Spacing 1 m.
Persistence 1.5 m.
Fill Ca and Qtz.
Aperture 1 to 2 mm.
Rough, irregular.

2.00
1105.5

End of Hole at 2.00 m

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0

KCBL_TEST_PIT-SI 071101 FARO TEST PIT LOGS.GPJ KC_DATA.GDT 4/9/08

Klohn Crippen Berger

PROJECT NO.: M09237A06
PROJECT: Rose Creek Diversion Review
LOCATION: Faro, Yukon
LOGGED BY: CK **CHECKED BY:**
SHEET 1 **OF** 1 **HOLE NO.:** 07SE28-1

TEST PIT LOG

STARTED: 09/27/2007 **FINISHED:** 09/27/2007

EXCAVATOR TYPE: Cat 345 Excavator

GROUND ELEV. (m): 1078.4

COORDINATES (m): N 6914393.569 E 580861.934

Su - kPa

20 60 100 140 180

VANE	FIELD	LAB	
PEAK	◆	■	▲ UC/2
REMOLD	◇	□	△ P.PEN/2

★ % FINES

$W_P\%$ W% $W_L\%$

× — — — — ○ — — — — ×

20 40 60 80

DEPTH (m)	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
0.0 – 3.20				SAND AND GRAVEL (SW-GW). Fine to coarse sand, fine to coarse gravel, some cobbles, some silt, trace clay, light brown, max. particle size up to boulders, subround to subangular, moist, compact.	
3.20 1075.2				Schist, dark brown, highly weathered and broken up, very closely foliated, medium strong rock.	
3.40 1075.0				End of Hole at 3.40 m Refusal on hard rock.	

DEPTH (m) scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0

Klohn Crippen Berger

PROJECT NO.: M09237A06

PROJECT: Rose Creek Diversion Review

LOCATION: Faro, Yukon

LOGGED BY: CK **CHECKED BY:**

SHEET 1 **OF** 1 **HOLE NO.:** TPKC07-1

KCBL_TEST_PIT-SI 071101 FARO TEST PIT LOGS.GPJ KC_DATA.GDT 4/9/08

TEST PIT LOG

STARTED: 09/27/2007 **FINISHED:** 09/27/2007
EXCAVATOR TYPE: Cat 345 Excavator
GROUND ELEV. (m): 1070.2
COORDINATES (m): N 6914429.553 E 580733.574

Su - kPa
20 60 100 140 180
VANE FIELD LAB
PEAK ◆ ■
REMOLD ◇ □
▲ UC/2
△ P.PEN/2
★ % FINES
W_P% W% W_L%
× — — — — o — — — — ×
20 40 60 80

DEPTH (m)	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
0.5				SAND AND GRAVEL (SW-GW). Fine to coarse sand, fine to coarse gravel, trace silt, trace cobbles, max. particle size up to cobbles, angular to subrounded, dry. (Fill). 0.70	
1.0 1.5				1069.5 SAND AND GRAVEL (SW-GW). Fine to coarse sand, fine to coarse gravel, trace cobbles, trace boulders, trace silt, max. particle size boulders, angular to subrounded, distinct tephra layers 3cm thick. (Original ground). 1.90	
2.0 2.5				1068.3 Schist, dark brown, highly weathered and broken up, very closely foliated, medium strong rock. 2.80	
3.0 3.5 4.0 4.5 5.0				1067.4 End of Hole at 2.80 m Refusal on hard rock.	

KCBL_TEST_PIT-SI 071101 FARO TEST PIT LOGS.GPJ KC_DATA.GDT 4/9/08

Klohn Crippen Berger

PROJECT NO.: M09237A06
PROJECT: Rose Creek Diversion Review
LOCATION: Faro, Yukon
LOGGED BY: CK **CHECKED BY:**
SHEET 1 **OF** 1 **HOLE NO.:** TPKC07-2

TEST PIT LOG

STARTED: 09/27/2007 **FINISHED:** 09/27/2007

EXCAVATOR TYPE: Cat 345 Excavator

GROUND ELEV. (m): 1055.9

COORDINATES (m): N 6914198.691 E 580974.796

Su - kPa: 20 60 100 140 180

VANE	FIELD	LAB	
PEAK	◆	■	▲ UC/2
REMOLD	◇	□	△ P.PEN/2

★ % FINES

W_P% W% W_L%

× — — — — ○ — — — — ×

20 40 60 80

DEPTH (m)	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
0.0				SAND AND GRAVEL (SW-GW). Fine to coarse sand, fine to coarse gravel, some cobbles, trace boulders, trace silt, trace organics, max. particle size up to cobbles, subangular, dry, compact. (Fill)	
3.50 1052.4				SAND AND GRAVEL (SW-GW). Fine to coarse sand, fine to coarse gravel, some cobbles, trace silt, trace organics, max. particle size up to cobbles, subrounded to subangular, dry, compact. (Original ground)	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0

Continued Next Page

Klohn Crippen Berger

PROJECT NO.: M09237A06

PROJECT: Rose Creek Diversion Review

LOCATION: Faro, Yukon

LOGGED BY: CK **CHECKED BY:**

SHEET 1 **OF** 2 **HOLE NO.:** TPKC07-3

TEST PIT LOG

STARTED: 09/27/2007 **FINISHED:** 09/27/2007
EXCAVATOR TYPE: Cat 345 Excavator
GROUND ELEV. (m): 1055.9
COORDINATES (m): N 6914198.691 E 580974.796

Su - kPa
20 60 100 140 180

VANE	FIELD	LAB	
PEAK	◆	■	▲ UC/2
REMOLD	◇	□	△ P.PEN/2

★ % FINES

W_P% W% W_L%
× — — — ○ — — — ×
20 40 60 80

DEPTH (m)	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
5.5			▨	5.50 1050.4	
				End of Hole at 5.50 m Max. boom reach.	
6.0					
6.5					
7.0					
7.5					
8.0					
8.5					
9.0					
9.5					
10.0					

KCBL_TEST_PIT-SI 071101 FARO TEST PIT LOGS.GPJ KC_DATA.GDT 4/9/08

Klohn Crippen Berger

PROJECT NO.: M09237A06
PROJECT: Rose Creek Diversion Review
LOCATION: Faro, Yukon
LOGGED BY: CK **CHECKED BY:**
SHEET 2 **OF** 2 **HOLE NO.:** TPKC07-3

TEST PIT LOG

STARTED: 09/27/2007 **FINISHED:** 09/27/2007

EXCAVATOR TYPE: Cat 345 Excavator

GROUND ELEV. (m): 1061.1

COORDINATES (m): N 6914227.36 E 580996.364

Su - kPa: 20 60 100 140 180

VANE	FIELD	LAB	
PEAK	◆	■	▲ UC/2
REMOLD	◇	□	△ P.PEN/2

★ % FINES

W_P% × — — — — ○ — — — — × W_L%, W%: 20 40 60 80

DEPTH (m)	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
0.0–5.0			▨	SAND (SM). Fine to coarse sand. Silty, fine to coarse gravelly, some cobbles, trace boulders, trace organics, max. particle size up to small boulders, dry, loose.	
5.0				5.00	

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0

Continued Next Page

Klohn Crippen Berger

PROJECT NO.: M09237A06

PROJECT: Rose Creek Diversion Review

LOCATION: Faro, Yukon

LOGGED BY: CK **CHECKED BY:**

SHEET 1 **OF** 2 **HOLE NO.:** TPKC07-4

TEST PIT LOG

Su - kPa
20 60 100 140 180

VANE	FIELD	LAB
PEAK	◆	■
REMOLD	◇	□

▲ UC/2
△ P.PEN/2

★ % FINES

W_P% W% W_L%
× – – – – ○ – – – – ×
20 40 60 80

STARTED: 09/27/2007 **FINISHED:** 09/27/2007
EXCAVATOR TYPE: Cat 345 Excavator
GROUND ELEV. (m): 1061.1
COORDINATES (m): N 6914227.36 E 580996.364

DEPTH (m)	SAMPLE TYPE	SAMPLE No.	SYMBOL	DESCRIPTION OF MATERIALS	INSTRUMENT DETAILS
				1056.1 End of Hole at 5.00 m Max. boom reach.	
5.5					
6.0					
6.5					
7.0					
7.5					
8.0					
8.5					
9.0					
9.5					
10.0					

Klohn Crippen Berger

PROJECT NO.: M09237A06
PROJECT: Rose Creek Diversion Review
LOCATION: Faro, Yukon
LOGGED BY: CK **CHECKED BY:**
SHEET 2 **OF** 2 **HOLE NO.:** TPKC07-4

KCBL_TEST_PIT-SI 071101 FARO TEST PIT LOGS.GPJ KC_DATA.GDT 4/9/08

APPENDIX II

Site Photographs

Photo II-1 **Intermediate Dam and Impoundment as seen from right abutment. RCDC in background.**

Photo II-2 **Cross Valley Dam and Pond as seen from right abutment. Intermediate Dam on left.**

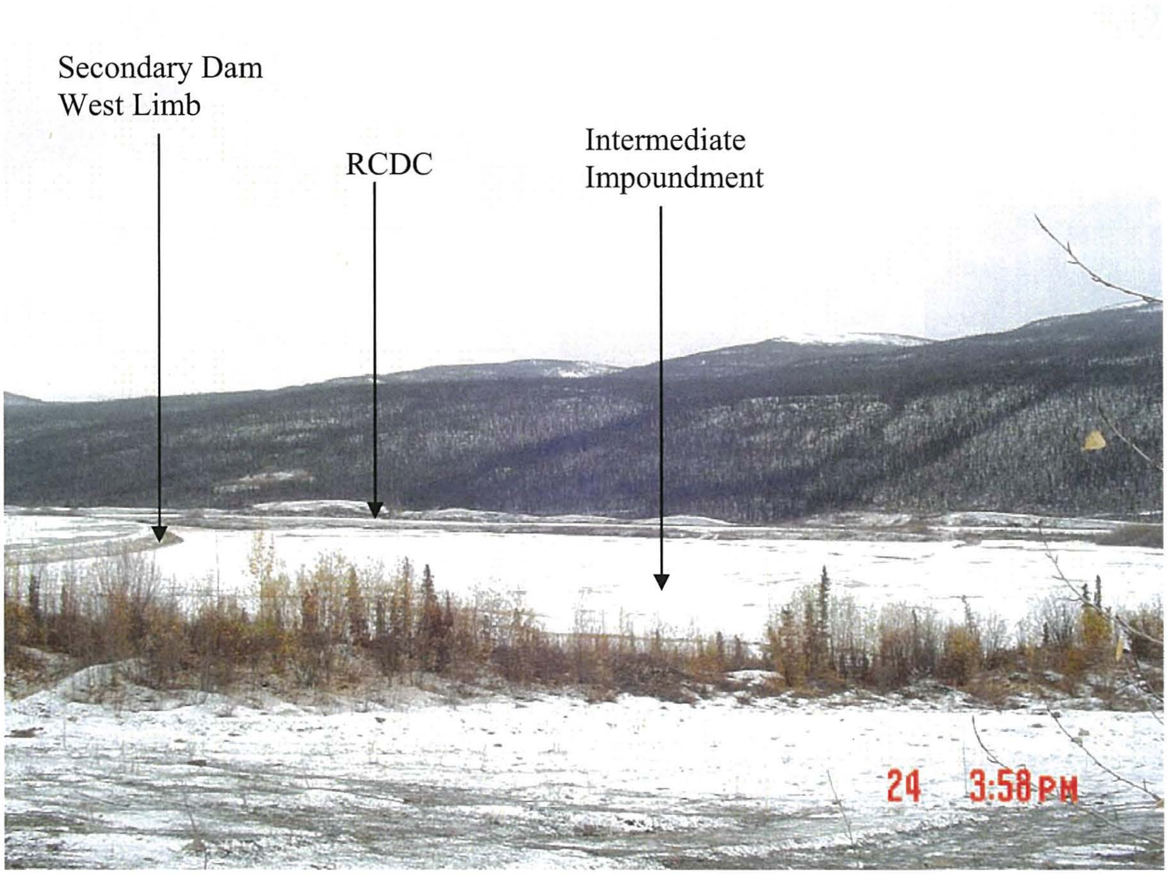


Photo II-3 **Secondary Dam, Intermediate Impoundment, and RCDC as seen from north slope.**

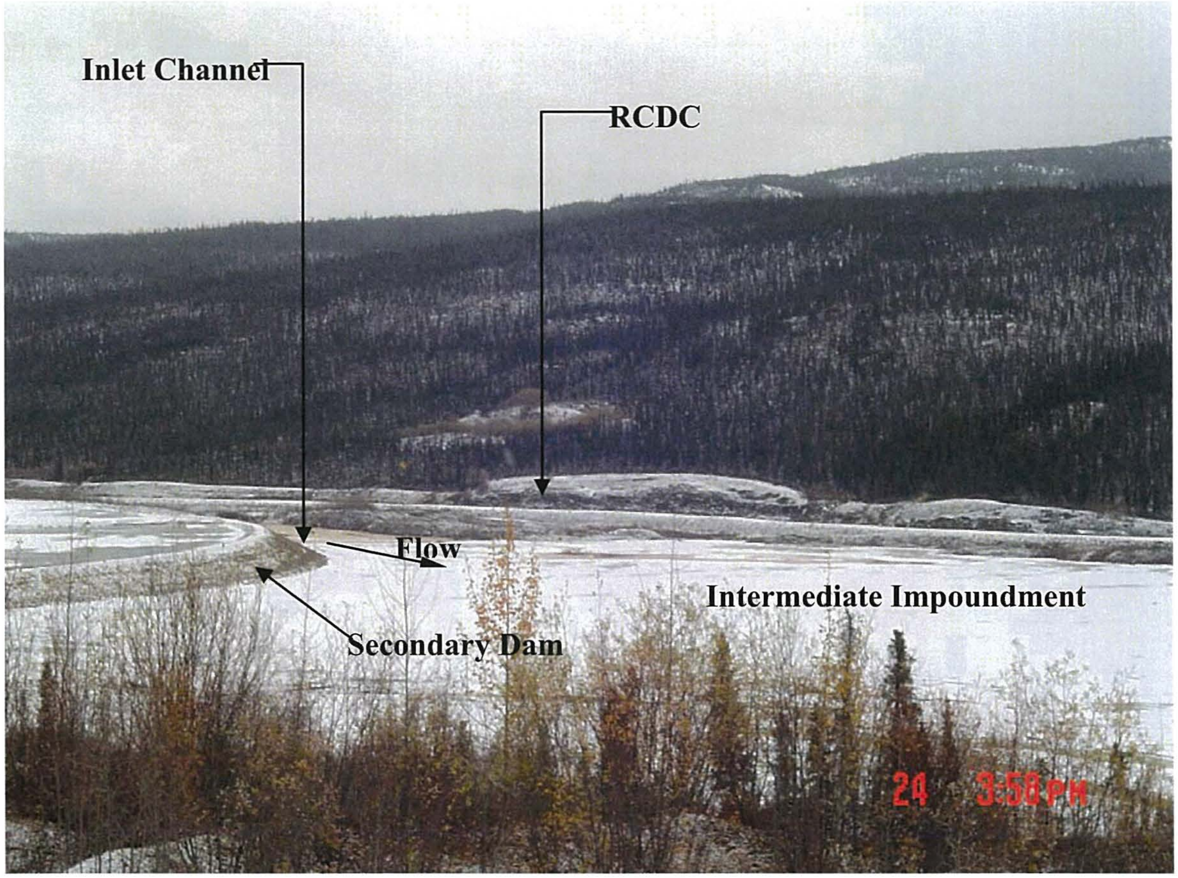


Photo II-4 Inlet channel to Intermediate Impoundment as seen from north slope.

Photo II-5 **Inlet of Existing Intermediate Dam spillway channel, looking upstream into impoundment. Note treated water effluent line across spillway channel.**

Photo II-6 Intermediate Dam Spillway channel, looking downstream.

Photo II-7 RCDC at Intermediate Dam, looking downstream.

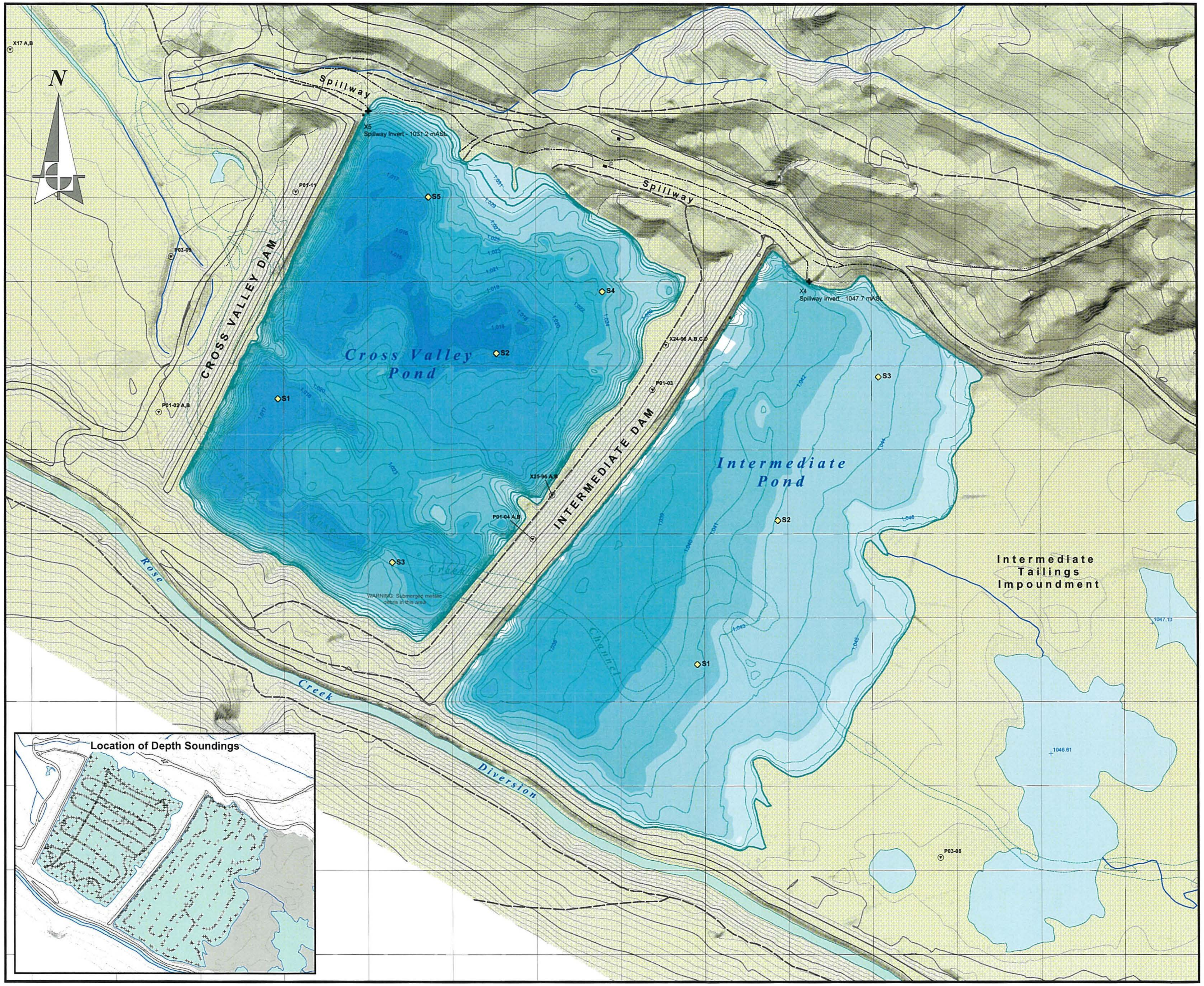
Photo II-8 RCDC at Intermediate Dam, looking upstream.

Photo II-9 RCDC overflow berm as seen from Secondary Dam East Limb.

Photo II-10 **RCDC Upstream of overflow berm, looking downstream from Secondary Dam East Limb.**

APPENDIX III

Pond Bathymetry



Topographic Features:

- Surface Contour (2m)
- Index Contour (10 m)
- Roadway
- Small Road
- Pipeline
- ■ Building
- Streams
- Rivers / Ponds
- ⦿ Monitoring Well
- ◇ Bottom Sediment Sample Location

Bathymetry:

Water depth below Full Supply Level:
- Intermediate Pond FSL = 1047.7 m ASL
- Cross Valley Pond FSL = 1031.2 m ASL

Land
0
2.5 m
5.0 m
7.5 m
12.5 m
15.0 m
17.5 m

Pond Bottom Elevation
1 m contour interval

Notes:

- Base map from Orthoshop, 2003. Scale 1:20,000. Based on August 2003 aerial photography.
- Pond perimeter elevation from 2003 mapping. Intermediate Pond perimeter used 1047.26 m ASL; Cross Valley Pond perimeter elevation used 1030.84 m ASL.
- Bathymetric survey completed on September 27, 2004 using Garmin GPSMAP 230 Chartplotter/Depth Sounder.
- Pond elevations at time of survey:
  Intermediate Pond 1046.655 m ASL
  Cross Valley Pond 1029.030 m ASL
- Horizontal accuracy typically +/- 4 m
  Depth accuracy +/- 0.1 m
  Overall volumetric accuracy <5% error

SCALE 50 0 50 100 15
Meters
1:3,000

Projection: UTM NAD27 Zone 8
Contour Interval: 2 m

Reviewed By: LG
Prepared By: FKP
Date Issued: Oct 18, 2004
Project No.: 40-721
File Name: 40721-F1.WOR
Revision: 0

Deloitte & Touche

Project: Management Options for the Intermediate Pon
Location: Anvil Range Mine Site
Client: Deloitte & Touche Inc.

Faro Tailings Ponds
Bathymetry

Gartner Lee

Figure No.
1

APPENDIX IV

Comparative Cost Estimates

Intermediate Dam
Spillway Width vs. Comparative Costs

15m Wide Spillway

Item	Estimated Quantity	Unit	Assumed Unit Cost	Cost
Intermediate Dam				
Dam Fill	708,000	m3	$10	$7,080,000
Dam Riprap	13,400	m3	$55	$737,000
			Subtotal	**$7,817,000**
Intermediate Dam Spillway				
Overburden Excavation	187,400	m3	$6	$1,124,400
Bedrock Excavation	167,500	m3	$25	$4,187,500
Rock Support	15,300	m2	$210	$3,213,000
Spillway Riprap	9,000	m3	$70	$630,000
			Subtotal	**$9,154,900**
Rose Creek Diversion Dyke				
Dyke Fill	193,000	m3	$10	$1,930,000
			Subtotal	**$1,930,000**
			TOTAL	**$18,901,900**

NOTE: Costs shown are for comparative purposes only. Costs common to all options are not been included.

20m Wide Spillway

Item	Estimated Quantity	Unit	Assumed Unit Cost	Cost
Intermediate Dam				
Dam Fill	649,200	m3	$10	$6,492,000
Dam Riprap	12,400	m3	$55	$682,000
			Subtotal	**$7,174,000**
Intermediate Dam Spillway				
Overburden Excavation	205,600	m3	$6	$1,233,600
Bedrock Excavation	203,600	m3	$25	$5,090,000
Rock Support	15,600	m2	$210	$3,276,000
Spillway Riprap	9,100	m3	$70	$637,000
			Subtotal	**$10,236,600**
Rose Creek Diversion Dyke				
Dyke Fill	157,800	m3	$10	$1,578,000
			Subtotal	**$1,578,000**
			TOTAL	**$18,988,600**

NOTE: Costs shown are for comparative purposes only. Costs common to all options are not been included.

25m Wide Spillway

Item	Estimated Quantity	Unit	Assumed Unit Cost	Cost
Intermediate Dam				
Dam Fill	600,200	m3	$10	$6,002,000
Dam Riprap	11,500	m3	$55	$632,500
			Subtotal	**$6,634,500**
Intermediate Dam Spillway				
Overburden Excavation	213,100	m3	$6	$1,278,600
Bedrock Excavation	270,100	m3	$25	$6,752,500
Rock Support	15,700	m2	$210	$3,297,000
Spillway Riprap	9,400	m3	$70	$658,000
			Subtotal	**$11,986,100**
Rose Creek Diversion Dyke				
Dyke Fill	130,000	m3	$10	$1,300,000
			Subtotal	**$1,300,000**
			TOTAL	**$19,920,600**

NOTE: Costs shown are for comparative purposes only. Costs common to all options are not been included.

40m Wide Spillway

Item	Estimated Quantity	Unit	Assumed Unit Cost	Cost
Intermediate Dam				
Dam Fill	498,600	m3	$10	$4,986,000
Dam Riprap	9,600	m3	$55	$528,000
			Subtotal	**$5,514,000**
Intermediate Dam Spillway				
Overburden Excavation	319,800	m3	$6	$1,918,800
Bedrock Excavation	377,800	m3	$25	$9,445,000
Rock Support	19,000	m2	$210	$3,990,000
Spillway Riprap	6,400	m3	$70	$448,000
			Subtotal	**$15,801,800**
Rose Creek Diversion Dyke				
Dyke Fill	74,400	m3	$10	$744,000
			Subtotal	**$744,000**
			TOTAL	**$22,059,800**

NOTE: Costs shown are for comparative purposes only. Costs common to all options are not been included.

75m Wide Spillway

Item	Estimated Quantity	Unit	Assumed Unit Cost	Cost
Intermediate Dam				
Dam Fill	402,400	m3	$10	$4,024,000
Dam Riprap	7,000	m3	$55	$385,000
			Subtotal	**$4,409,000**
Intermediate Dam Spillway				
Overburden Excavation	463,300	m3	$6	$2,779,800
Bedrock Excavation	744,400	m3	$25	$18,610,000
Rock Support	19,400	m2	$210	$4,074,000
Spillway Riprap	7,500	m3	$70	$525,000
			Subtotal	**$25,988,800**
Rose Creek Diversion Dyke				
Dyke Fill	-	m3	$10	$0
			Subtotal	**$0**
			TOTAL	**$30,397,800**

NOTE: Costs shown are for comparative purposes only. Costs common to all options are not been included.

APPENDIX V

Construction Cost Estimate

Rose Creek Tailings Facility
Intermediate Dam Spillway - PMF Flood Handling

Estimated Quantities and Costs for Selected Scheme

ITEM	DESCRIPTION	Estimated Quantity	Unit	Unit Cost	Cost	Total
100	**Raise Intermediate Dam**					
101	Foundation Preparation	30,400	m^2	$42.93	$1,305,072	
102	Common dam fill	720,000	m^3	$5.88	$4,233,600	
103	Impervious glacial till core fill	63,000	m^3	$6.65	$418,950	
104	Drainage gravel and filter	60,800	m^3	$8.80	$535,040	
105	Riprap on upstream face - Class 10 (d_{50} = 200 mm)	6,300	m^3	$40.31	$253,953	
106	Granular filter under riprap	3,150	m^3	$8.80	$27,720	$6,774,000
200	**Intermediate Dam Spillway**					
201	Overburden excavation	220,000	m^3	$4.35	$957,000	
202	Bedrock excavation	275,000	m^3	$18.29	$5,029,750	
203	Rock Support	19,000	m^2	$156.00	$2,964,000	
204	Riprap Class 250 (d_{50} = 600 mm)	8,900	m^3	$46.17	$410,913	
205	Granular filter under riprap	4,450	m^3	$8.80	$39,160	$9,401,000
300	**Intermediate Impoundment**					
401	Regrade tailings (includes construction of distribution swales)	1,400,000	m^3	$4.35	$6,090,000	
402	Place waste rock cover over tailings (1m thick)	1,100,000	m^3	$8.40	$9,240,000	
403	Place glacial till cover over tailings (1m thick)	1,100,000	m^3	$16.86	$18,546,000	
404	Riprap inlet channel at upstream end of impoundment					
	Class 10 (d_{50} = 200mm)	39,000	m^3	$40.31	$1,572,090	
	Class 25 (d_{50} = 300mm)	2,100	m^3	$40.31	$84,651	
405	Granular filter under riprap	20,400	m^3	$10.51	$214,404	$35,747,000
400	**Raise Rose Ck Diversion Dyke between Intermediate Dam and Fuse Plug**					
201	Foundation preparation for dyke raise	12,000	m^2	$42.93	$515,160	
202	Dyke fill	100,000	m^3	$6.77	$677,000	$1,192,000
500	**Upgrade Rose Creek Diversion Channel Upstream of Fuse Plug**					
101	Channel excavation	91,400	m^3	$4.35	$397,590	
102	Riprap Class 100 (d_{50} = 450 mm)	45,600	m^3	$40.31	$1,838,136	
103	Granular filter under riprap	10,100	m^3	$10.51	$106,151	$2,342,000
600	**Remove RCDC Dyke Overflow Berm and Construct Fuse Plug**					
601	Remove existing overflow berm	1	LS	$3,000	$3,000	
602	Sand and gravel fill	3,300	m^3	$5.26	$17,358	
603	Glacial till (core)	700	m^3	$6.77	$4,739	
604	Gravel (road surface)	100	m^3	$10.51	$1,051	
605	Riprap Class 100 (d_{50} = 450 mm)	700	m^3	$40.31	$28,217	
606	Granular filter under riprap	150	m^3	$10.51	$1,577	$56,000
					Subtotal	$55,512,000
700	**Indirects and Contingency**					
	35% Indirect Costs					$19,429,000
	20% Contingency					$14,988,000
					TOTAL (excluding GST)	$89,929,000

NOTES
1. Quantities shown are based on:
   20m wide Intermediate Dam Spillway
   Intermediate Dam raised to EL. 1058.8m
   RCDC dyke raised to EL. 1058.6m
2. Estimate does not include costs for breaching the Cross Valley Dam, the removal and disposal of.the sludge/sediments from the Cross Valley Pond, the re-establishment of the Rose Creek channel in the Cross Valley Pond area, or the improvement of the North Fork Rose Creek channel upstream of the RCDC.
3. Unit costs, and contingency allowance supplied by SRK.

Klohn Crippen Berger