



BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

DELOITTE & TOUCHE INC.

2001 ANNUAL GEOTECHNICAL EVALUATION AND INSTRUMENT REVIEW

VOLUME 1 OF 2

VARIOUS FACILITIES AT FARO MINE, YUKON

FINAL

PROJECT NO.: 0257-005-04
DATE: FEBRUARY, 2002

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Project No. 0257-005-04
February 27, 2002

Ms. Shannon Glenn
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BCE Place, 181 Bay Street
Toronto, ON M5J 2V1

Re: 2001 Annual Geotechnical Evaluation and Instrument Review
Various Mine Waste Facilities at Faro Mine, Yukon

Dear Ms. Glenn:

Please find attached our report on the Annual Geotechnical Evaluation of various mine waste facilities at Faro Mine. In addition to the one copy forwarded to you, one copy has been forwarded to Mr. Dana Haggart in Faro, one to Mr. Eric Denholm in Yellowknife and six copies (including one unbound copy) to Mr. Dennis Lu of Gartner Lee Ltd. in Whitehorse for use in the Annual Water Licence report.

If there are any questions regarding this report, or require any other services, please contact the undersigned at your convenience.

Yours truly,
BGC Engineering Inc.
per:

James W. Cassie, M.Sc., P.Eng.
Specialist Geotechnical Engineer

encl.: Final report
JWC/sf

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LIMITATIONS OF REPORT

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1.0 INTRODUCTION

1.1 Scope of Services

BGC Engineering Inc. (BGC) provided a proposal (No. 01-040) for the annual geotechnical inspection and instrumentation review work at Faro Mine, dated April 13, 2001, to Mr. Doug Sedgwick of Deloitte & Touche Inc. (interim Receiver for Anvil Range Mining Corporation). The scope of work detailed in that proposal comprised the following:

- a) Field geotechnical inspection, review of relevant instrumentation data and preparation of maintenance recommendations concerning the following structures:
 - Down Valley Tailings Facility components comprising:
 - ◊ Cross Valley Dam and emergency spillway
 - ◊ Intermediate Dam and emergency spillway
 - ◊ Rose Creek Diversion Channel dike top, top of backslope and toe of slope
 - ◊ North Valley Wall Interceptor Ditch
 - North-Fork Rose Creek flow-through rock drain;
 - Faro Creek Diversion Channel above the Faro Pit; and
 - the Fresh Water Supply (FWS) Dam and spillway.
- b) Synthesis and interpretation of field instrumentation data (collected by Deloitte staff).
- e) Preparation of a two-volume report divided as follows: Volume 1 to provide interpretation and recommendations resulting from the instrumentation data and field inspection and Volume 2 to provide a compendium of all relevant instrumentation data and plots.

In addition to the annual inspection and performance assessment work, BGC was also responsible for the preparation of a 3-hour training seminar for site staff. The objective of this seminar was to provide site staff with an introduction to geotechnical, hydrotechnical and dam safety issues so they could understand the importance of their site monitoring work.

Authorization to proceed with the work was provided in a letter dated May 28, 2001 by Mr. Doug Sedgwick.

1.2 General Background Relating to Inspection and Instrumentation

Golder Geotechnical Consultants (1980) provided the design recommendations for the Down Valley Tailings Disposal Project. Following the subsequent construction of the facilities, an extensive geotechnical monitoring program was initiated in December, 1981 that is continuing to-date. As a result, Golder Associates was responsible for the annual inspection and instrumentation review of the Down Valley Tailings project since that time. Since 2000, BGC has conducted the annual inspection and instrumentation data assessment duties.

The report, provided herein, prepared by BGC, presents an assessment of the monitoring data collected in 2001. Monitoring data, from piezometers, slope inclinometers, thermistors and seepage weirs, is collected by the Deloitte staff at site. The data is forwarded to BGC for review and inclusion in this report. In addition to reviewing the instrumentation data, a visual inspection of the various facilities was also undertaken by BGC. This report compiles and reviews the two components in order to assess the physical performance of the structures reviewed herein.

The Down Valley Tailings Project and FWS Dam - The Down Valley Tailings Project comprises three major components; the Rose Creek Diversion Canal, the Intermediate Dam and the Cross Valley Dam, as shown in Figures 1 and 2. This report also documents an evaluation of the FWS Dam, which is located on South Fork of Rose Creek, upstream from the Down Valley Tailings Project. Instrumentation locations for the Down Valley Tailings Project and for the FWS Dam are shown on Figures 1, 2 and 4, respectively.

North-Fork Rose Creek Flow-Through Causeway - The causeway was built of waste rock during 1987. The causeway was advanced by dumping waste from causeway grade to provide a zone of preferentially larger particles in the lower portion of the fill. This zone conveys creek flows through the structure, the driving head being provided by some ponding of water on the upstream side of the causeway. Golder Associates (1988) provided an early assessment of the performance of the rock drain. Inspections have concentrated on hydraulic performance of the causeway. Pond level and creek flow data accumulated by the operator were analyzed for the 1992 report and an expression was developed the prediction of head pond level for high rates of flow. **No pond level data has been obtained since 1992.** ? *visited no staff gauges pic's monthly*

Faro Creek Diversion Channel and East Wall of Faro Pit - Mining began at the Faro Pit in 1969. Faro Creek was diverted around the top of the Faro Pit through the construction of a diversion channel. The stability of the east wall of the Faro pit has been a concern throughout the lifetime of the pit operation. A number of structural discontinuities within the east pit wall, coupled with seepage from the Faro Creek diversion channel along the top of this pit wall, contribute to the slope instability that has occurred along this pit wall. A visual inspection along the diversion channel was initiated beginning last year to assess the concern that instability of the East Pit Wall could lead to the potential loss of the diversion channel.

1.3 Additional Work on the FWS Dam

The FWS Dam was designed and constructed in 1969 by H.A. Simons International Ltd., supported by the geotechnical consulting company of Ripley, Klohn and Leonoff Ltd. Immediately after construction, a small toe berm was placed due to concerns regarding seepage and related cracking at the toe. Following a stability assessment by Golder Associates in 1989, another toe berm lift, including toe drainage measures, was placed for enhancement of the downstream face stability.

The purpose of the dam was to retain a reservoir of fresh water that the mine processing operation would use through the winter period. Since that time, the water source requirements for the mill have changed and any required processing water could be obtained from the Faro pit. Hence, if the Faro Mine were reopened in the future, the processing operation would not need the reservoir currently retained behind the dam. Therefore, it's role is redundant. When the dam retains water, there still exists potential risks with the dam and monitoring, inspection and maintenance of the dam requires significant expenditures.

It must be noted that the FWS Dam exists above the Down Valley tailings containment area (that includes the two major dams and a diversion channel) for the Faro Mine. Any catastrophic release of water from the upstream reservoir would remobilize the tailings deposit, breach the two major downstream dams and release significant amounts of non-compliant water into the environment.

In May, 2001, BGC undertook a qualitative risk assessment (termed a Failure Modes and Effects Analysis or an FMEA) of the FWS Dam and the other dams and structures in the downstream Down Valley. The first draft of the summary report was submitted to Deloitte in June, 2001 and is referenced as BGC 2001a. Within that assessment, and noting the system boundaries and the assumptions made, the highest risk identified within all the structures reviewed was the low-level pipe. In addition, it was recommended that a Dam Safety Review (DSR), compliant with the guidelines of the Canadian Dam Association (CDA), be undertaken on the FWS Dam.

BGC also undertook an assessment of the physical stability of the FWS Dam that was submitted in draft in September 2001 and is summarized under BGC 2001b. This evaluation based on limited information and the assumptions noted therein, attempted to determine the Factors of Safety for both sides of the dam, in comparison to the guidelines provided by the CDA. In summary, the current configuration of the dam meets most of the required Factor of Safety criteria for static conditions, dependent upon the soil properties assumed. Alternatively, the dam did not meet some of the Factor of Safety criteria for seismic loading, assuming a peak ground acceleration (PGA) value of 0.13g. It also reviewed the Factor of Safety for various breached cases on the FWS Dam. Again, a DSR was recommended, including an assessment of the low-level pipe, along with a more detailed assessment of the PGA values to be used for pseudo-static analyses.

A diving inspection of the low level pipe within the FWS Dam was undertaken between September 17 and 21, 2001. The inspection included a visual inspection of the pipe interior, along with measurements of the pipe wall thickness, which has been significantly reduced from its original thickness. In addition, a significant bend in the pipe was observed. A copy of the inspection report produced by Diving Dynamics is provided in Appendix III.

Northwest Hydraulic Consultants Ltd. (NHC) 2001 undertook a review of the hydrology of the Faro site, in relation to the current sizing of the spillway on the FWS Dam and the downstream Diversion Channel. In brief summary, the following points summarize their assessment:

- The 100-, 200- and 500-year return period snowmelt flood events within the FWS Dam reservoir amount to 39, 49 and 63 m³/s.
- The current spillway configuration within the FWS Dam can discharge 94 m³/s to a level equivalent to the top of the silty core in the dam.
- Minor attenuation of the 100- to 500-year snowmelt flood peaks occur due to the reservoir.
- The PMF value amounts to 550 m³/s and the FWS Dam would be overtopped if this extreme flood event were to occur.
- The flow capacity of the Rose Creek Diversion Channel was computed to be 160 m³/s at the bankful depth of 3.4 m. This exceeds the estimated 500-year flood peak of 145 m³/s for the downstream end of the channel section.
- PMF at the downstream end of the Diversion Channel amounts to 1680 m³/s, far in excess of its current capacity.

Following that, NHC (2002) also undertook dam break analyses. Within these analyses, the "sunny day" piping event was postulated to occur along the low-level pipe for two different cases; i) the status quo dam with the reservoir level at 1096 m elevation and ii) the lowered configuration with the reservoir at elevation 1090 m, approximately 6 m lower than the first case. It should be noted that the reservoir volume at 1096 amounts to approximately 5.7 million m³ of water. With the reservoir at 1090 m, the water volume is reduced by approximately 40%. The model formulates a breach occurring at the dam and generates an outflow hydrograph from the dam. The flood is then routed along the topography of the downstream valley and an assessment of the outflow flooding can then be made. The following table provides a summary of the two cases:

Comparison of Results for Two Dam Break Cases

Parameter	Status Quo Dam with Pond at 1096 m	Lowered Case with Pond at 1090 m
Peak outflow quantity from breach (m ³ /s) at the FWS Dam (relation to PMF size)	3,200 (approximately 6 times the PMF size for this dam)	1,800 (approximately 3 times the PMF size for this dam)
Depth of flood water above tailings deposit (m)	2 to 3	1.5
Discharge water velocity (m/s)	>3	2.5
Fate of downstream Intermediate and Cross Valley Dams	Washed away	Washed away

Since a water velocity of approximately 0.4 m/s is required to erode fine sand particles, it can be seen that the flood wave would erode and displace the tailings in the Down Valley. Given the abilities of the model, coupled with the likely breach of the two downstream dams, it is not possible to estimate the amount of tailings erosion and/or the far downstream distribution of these eroded tailings. Based on the results of the dam break analyses, there would appear to be little difference in the resulting failure consequence from the two cases, noting the sensitivity of the model and the assumptions made therein. The flood wave in both cases is significantly larger than the PMF sizing and as a result, extensive downstream damage would occur in both cases.

To summarize the previous work undertaken, a Rational Summary Memo, dated January 7, 2002 was prepared and forwarded to Deloitte and DIAND. This memo outlines the chronology of events, summarizes the information and evaluations made to that date and provides rationale for the proposed lowering of the FWS Dam reservoir by 6 m. It is expected that this reservoir lowering will occur in the Fall 2002 or early Winter 2002/03.

2.0 2001 MONITORING PROGRAM

2.1 Introduction

Historically, the monitoring program has been comprised of a specific schedule for reading the instrumentation, depending on the type of instrument, its location and the performance trend indicated by the accumulated data. As performance of the works became better demonstrated over time, the frequency of readings was reduced for reasons of economy or irrelevance of additional data, or because the installations became non-functional. Conversely, there have been some instances where instrumentation and visual observation justified more frequent readings and installation of additional instrumentation. A recommended instrumentation monitoring schedule for 2001 was provided as Figure 23 in the 2000 Annual Geotechnical Evaluation and Instrumentation Review produced by BGC.

Instruments in the Canal Dike, Canal Dike Backslope, Spoil Piles and Intermediate Dam were monitored in May, June, August, and September 2001, as requested.

Instruments in the Cross Valley Dam were monitored once in June and September. In October, the Cross Valley Pond was lowered to accommodate tailings excavation activities scheduled for Fall and early Winter 2001. In response to the lowering of the pond, instrumentation readings were taken on a daily to weekly basis between October 16th and December 26th to aid in assessing the effects of the drawdown of the pond on the stability of the upstream face of the Cross Valley Dam.

Instruments in the FWS Dam were monitored once in June and September 2001. Concern was raised about the low level pipe beneath the dam in September 2001, after an inspection of the pipe was conducted by Diving Dynamics (Appendix III). Drawdown of the reservoir behind the FWS Dam commenced in October to lower the water pressure acting on the low level pipe.

Drawdown activities were continued throughout the remainder of the year in preparation for the possible construction of a new spillway. In order to assess the effects of the drawdown on the stability of the upstream face of the dam, the monitoring frequency of the instruments at the FWS Dam was increased to 3 times weekly. This monitoring frequency was continued for the remainder of 2001 and into 2002.

The settlement observation casings have not been monitored since 1981 because it had been found shortly after their installation in 1981 that the interpreted data was not dependable.

Deloitte staff at the mine site performed all of the instrument monitoring activities. The data was forwarded to BGC staff that reduced and plotted the instrumentation data. Further details of the instrumentation-monitoring program are provided in Section 3.0.

As a complement to the instrumentation data obtained, various components of the Faro Mine were visually inspected during the period August 27th to August 30th, 2001. In addition, second and third visits were also held in early to mid-October. Details of the visual inspection are discussed in Section 4.0.

2.2 2001 Water Management

Water pumped from the Faro pit enters into the northeast corner of the pond (retained by the Intermediate Dam) via a pre-existing ditch adjacent to the mill area. The water level then rises behind the Intermediate Dam until it reaches the level of the spillway, whereby it flows down to the polishing pond behind the Cross Valley Dam. Decant siphons can also be used to convey the water over the Intermediate Dam. Water from the polishing pond is then discharged to the environment over the Cross Valley Dam, generally by siphon pipes.

Table 1 and associated graphs provide a summary of the Intermediate and Cross Valley pond water levels throughout the year; this water level information will be useful for interpretation of the instrumentation response in the following sections. It should be noted that pond elevations in Table 1 are reported with respect to mean sea level (msl), which is approximately 33.3 m below the Down Valley Project Datum (dvpd). The graphs of water levels are shown with respect to mean sea level (msl). The Intermediate pond level ranged from approximately 1047.85 m (amsl) in August to 1047.30 m (amsl) on September 21 when the water level fell below the monitored staff gauge. The Cross Valley pond fluctuated from a high of 1031.31 m (amsl) in July and August down to a low of 1030.51 m (amsl) on October 15 when the water level fell below the monitored staff gauge. The 2001 retained water level in the Intermediate pond are generally similar to those in 2000 up to August 12 and 13. However, the water level in the Intermediate pond fell below the 2000 levels during the rest of the monitoring period. The Cross Valley pond levels recorded in 2001 fluctuated less than the water levels measured in 2000. However, the 2001 water levels remained near the highest levels recorded in 2000 throughout the monitoring period. As will be reviewed in Section 2.3, total precipitation in 2001 was 101 mm less than the total precipitation that occurred in 2000.

2.3 Climatic Information

Yearly climatic conditions significantly affect the performance of water retaining and water conveying earth structures. Table 3 provides a summary, on a month-by-month basis, of the total precipitation at the Faro airport, from 1978 to 2001. At the bottom of the table, the minimum, mean and maximum monthly precipitation values are also provided. The year 2001 was judged by BGC to be a below average year; the total annual precipitation was 268 mm, as compared to the mean value of 304 mm.

The high amounts of precipitation in August and September 2000 should be noted, as this precipitation did impact the various structures in 2001. Anecdotal information from site notes that snow fell in approximately mid-September 2000 and hence, there was limited chance for the saturated ground (from the previous six weeks of precipitation) to drain and dry out. As a result, the saturated ground became frozen and then began thawing in May and June of 2000.

3.0 HISTORICAL RECORD AND 2001 MONITORING RESULTS

3.1 Down Valley Project Diversion Canal

3.1.1 Canal Dike

Piezometers - Readings of the Canal Dike piezometers for 2001 were obtained in June and September. Tabulated data and plotted records are presented in Appendix III and summarised in Table 4. Piezometric levels recorded by the piezometers installed along the Canal Dike in 2001 were typical of readings obtained in previous years. Details regarding the 2001 readings are discussed below.

Over the period of records, the water level in the tailings pond retained by the Intermediate Dam has been raised several times; its current Full Supply Level (F.S.L.) is 1080.25 m (dvpd). The Diversion Canal crest elevation opposite the south abutment of the Intermediate Dam is approximately 1085.2 m (dvpd) and the invert of the 0.6 m deep pilot channel is at approximately 1081.2 m (dvpd). Fall flows typically just inundate the bench adjacent to the pilot channel, suggesting a diversion channel water surface elevation of about 1081.9 to 1082.0 m (dvpd), i.e., an elevation approximately two metres above the level of the tailings pond at the Intermediate Dam. The gradient of the Diversion Canal is 0.19% and the tails beach limit is about 1100 m upstream of the Intermediate Dam.

Based on the above discussion, the difference in elevation between the surface of the water in the Diversion Canal and the base level (water or tailings) upstream of the Intermediate Dam ranges from about 2 m at the Intermediate Dam to approximately 4 m at the beach limit. Upstream of the beach limit the difference in elevation is about 4 m. For these conditions and a uniform head loss between the Diversion Canal and the tailings pond, piezometric levels recorded by piezometers installed in the Canal Dike should range from about 1081.5 m just upstream of the Intermediate Dam, to about 1083.5 m at the limit of the tailings beach. In fact, the observed piezometric levels are generally lower than expected. Exceptions to that general relationship were noted in piezometers 88-7 and 88-11 where higher than expected piezometric levels were measured in the shallow (approximately 8 m depth) tips. However, those levels have dropped significantly (4.7 m in the shallow tip at 88-11) since the readings taken in September 2000. The high levels observed in 2000 were likely related to the exceptionally high precipitation that occurred in August and September 2000, to the melting of ice-rich permafrost and lagging drainage or poor data associated with frozen piezometer tips. All the double piezometers, except for CD-15, indicate a downward hydraulic gradient. The upward gradient at CD-15 may be a result of one malfunctioning tip or it may be due to thawing permafrost indicated by the thermistor at CD-15.

Some of the deep piezometers at locations CD-19, CD-21, and 88-11 continue to indicate piezometric pressures that are 3 to 7 m lower than the elevation of the adjacent tailings pond in spite of their locations being between 300 m and 600 m upstream of the Intermediate Dam.

Downstream of the Intermediate Dam, CD-26 at Station 2+600, indicates essentially free drainage at depth. The lower piezometer, although some 70 m southwest of the pond shoreline, indicates a water level approximately 11 m above the elevation of the polishing pond.

Only the shallow piezometer at CD-13 (Station 1+350) indicates any significant increase in pore pressures. An increase in the piezometric elevation of 0.8 m was recorded from readings taken during the same time period last year.

Thermal Regime - Readings from thermistors in 2001 were obtained one to three times during the monitoring period depending on the installation. Tabulated data appearing in Appendix III and summarised in Table 5.

A general warming trend in the foundations along the canal dike has occurred since thermistors have been installed (although the ground temperatures appeared to have stabilized over the past few years). Trend interruptions that have been recorded likely reflect variations such as the timing of the readings or annual climatic effects. The warming has consumed virtually all of the permafrost that was initially present. As expected, the installation at site CD-21 indicates a fully thawed profile occurred in 2001, with no remaining permafrost. The thermistor string at site CD-15 indicate some cold ground remains. These locations with a slower warming trend are inferred by BGC to be representative of areas with greater amounts of excess ice in the soil. Relatively more settlement would be expected at those locations as the excess ice melts. This has been verified by the observation of settlement in the area of the canal dike near installation CD-21.

As can be seen from the data summary in Table 5, the following locations indicate thawing of the subsurface soil that has not been fully completed.

- Thermistor location CD-15 at Station 1+530 exhibits subzero temperatures from 2.5 to 3.5 m depth although the data may be a result of dysfunctional thermistor tips. Also of note is the subzero temperatures recorded at a depth of 10 m indicating a cooling of soil temperature;
- The thermistors at locations 88-7 at Station 2+115 and 88-11 at Station 2+160 indicate that no warming of ground temperatures has occurred below 6 m since initiation of monitoring in 1988. Since warming of ground temperatures has occurred at every other location, it was determined that the thermistors at this location must be malfunctioning and are not indicative of actual conditions.
- A thermistor string was installed in borehole BGC01-02 to replace the malfunctioning installation at 88-11. Unfortunately, not enough data has been collected to date , to interpret the subsurface conditions.

Ground Movements – Readings in 2001 were obtained from the slope inclinometers installed between Station 0+990 and 2+160 along the Canal Dike. Data was collected from the inclinometers in May and September. Plots of cumulative and incremental deflection are presented in Appendix III. Interpretations of those plots are summarised in Table 6. Generally the data indicates that slow, downslope movement is occurring locally in response to differential melting of permafrost with excess ice. The data from the slope inclinometers installed along the Canal Dike are discussed below.

The following inclinometers have shown negligible movements since 1996:

- CD-10 at Station 0+990;
- CD-15 at Station 1+530;
- BH91-CD-1 at Station 1+767;
- CD-19 at Station 1+900;
- CD-21 at Station 2+100; and,
- BH94CD-1 at Station 2+313.

The Canal Dike is settling in the vicinity of Station 2+100 based on the distinctive shape of the deflection versus depth curves for data recently obtained from CD- 21.

At 88-10 (Station 2+160), the inclinometer probe would not go past a depth of 5 m during two monitoring attempts in 2001. That depth corresponds to a zone of movement that was reported in the 1999 and 2000 monitoring reports. An inclinometer, designated 88-10/BGC-01, was installed in 2001 to replace 88-10 and to monitor future displacements along the movement zone. Only one set of data has been collected for that instrument to date.

It should be noted that longitudinal cracks have been observed at edge of the Canal Dike crest in the vicinity of 88-10, and settlement was observed during the 2001 inspection. One possible cause of the ongoing deformation is continued thawing of the subsurface soils, as indicated in the thermistors.

From study of the above data, it is concluded that, in general, the canal dike slope indicators continue to show negligible movements. Significant movement occurred at the location of 88-10 in 2000 resulting in deformation of the slope inclinometer casing rendering it inoperable. The degradation of permafrost below pond level and behind the reservoir wall is likely responsible for the movements being observed.

3.1.2 Spoil Piles

The construction waste (spoil) piles downslope of the canal dike were initially monitored because of the potential for sudden slope failure into the tailings pond. The spoil piles could have potentially failed during thawing of the loosely-placed, frozen materials. However, during the course of tailings deposition, the likelihood of that occurrence has diminished because of the toe support provided by the raised level of the tailings. That support is considered effective along the toe of the spoil piles, except for the area extending a short distance upstream from the Intermediate Dam (Station 1+900 to Station 2+500). In that area, two thermistor strings and one slope indicator were monitored in 2001. In addition to the instrument installations noted above, the spoil pile overlooking the south abutment of the Cross Valley Dam is also instrumented for subsurface movement and thermal fluctuation. Instrumentation data is discussed below:

Thermal Regime - Tabulated data is presented in Appendix III and summarised in Table 7. Readings for 2001 were obtained in June and September for SP-3 and SP-5, while data was collected from SP-2 in June only. The readings taken at location SP-2 are invalid for the following reasons. The readings were reported as "noisy" by monitoring personnel. In addition, the graph of the data indicates that ground temperatures have dropped approximately 4 degrees between 2.3 m and 6.3 m depths. A cooling trend of that magnitude and over a one year time period has not been recorded by any of the instruments installed at the Down Valley Tailings Containment Facility. The data collected in June from location SP-3 shows a similar 4 degree cooling trend as well. Therefore those readings may also be invalid. However, the September 2001 readings indicate that the spoil pile and the upper 6.5 m of the soil beneath it remain thawed. Data from Thermistor SP-5 indicates a slight (0.25 m) decrease to the depth of permafrost since the September 2000 readings. Referring to original data, the depth of spoil over natural ground at SP-2, SP-3, and SP-5 is 7.5, 3.5, and 5.5 m, respectively.

Ground Movements - The plots of the slope inclinometer data are included in Appendix III and summarised in Table 8.

In previous years, movement was observed at instrument SP-2 (Station 1+530) at a depth of approximately 7.5 m. In 2000, it was noted that the casing was blocked at a depth of 7.5 m. Attempts were made to monitor the instrument in 2001, but again the probe would not go past a depth of 7.5 m. It is concluded from this information, it is likely that the inclinometer casing has been deformed at a depth of 7.5 m as a result of the slope movements.

Data collected from instrument SP-3 (Station 1+900) indicates that settlement has been occurring in that area since 1999. As discussed above, the spoil pile and upper 6.5 m of the foundation soil is thawed at this location.

At SP-5 (Station 2+950), situated above the south abutment of the Cross Valley Dam, no movement at depth has been recorded since 1996. However, approximately 30 mm of displacement was recorded in the upper 2 m since September 2000.

3.1.3 Canal Backslope

Piezometers - A review of the 1995 data indicated that, except for location BS-5, a downward trend in backslope pore pressures had developed and continued and the slope was determined to be essentially drained. The low pore pressures within the slope are thought to benefit general stability and as a result, no further piezometer readings have been made since 1995.

Thermal Regime - Ten thermistor strings are present in the Diversion Canal Back Slope. Six of those installations previously recorded permafrost and four recorded thawed profiles. BS-10 was the only thermistor monitored in 2001, although BS11 was also requested. Readings were obtained in July and August of 2001. Tabulated data for BS-10 is located in Appendix III and is summarised in Table 9. Jim was with me on the backslope and he knows about BS-11. Rusted on cap. Re and the rest we read.

The conclusion reached from a previous review of the thermistor data was that a substantial thickness of natural soils behind the gravel-mantled backslope (thermal liner) are now thawed (4.5 m based on the data from Thermistor BS-10) along the Canal Backslope. As such, the possibility of excess pore pressures and possible instabilities related to insufficient drainage during thaw of ice-rich permafrost is diminished. In BS-10 the permafrost thawed from 4 to 4.5 m below ground surface between 1999 and 2001. However, a cooling trend has occurred below that depth since 1998.

repeat
of pg
11
Thermal
Regime

Ground Movement - Five slope indicators have been installed in the canal dike backslope, but only three of those were monitored in June and September 2001. However, the top of the casing of Inclinometer BS-18 was broken and no readings were obtained from that installation.

Plotted data for these installations is provided in Appendix III and summarised in Table 10. From a review of these data, only negligible movement has occurred since September 1999. There may have been movement occurring in BS-10 (Station 1+900) at the depth of 9.5 m until 1999. Given that thermal equilibrium has generally been reached in the canal backslope, little potential for future movement exists.

3.2 Down Valley Project - Cross Valley Dam

The Cross Valley Dam was constructed with a crest elevation of 1065.8 m (dvpd), a top of core elevation at 1064.8 m (dvpd) and a main spillway entrance elevation of 1063.5 m (dvpd). The Cross Valley Dam site was instrumented before construction. Additional instrumentation was installed after construction was complete and in 1988, a number of thermistors were installed in the crest of the dam. Data for the monitored instruments at the Cross Valley Dam are discussed below.

Piezometer Readings – Piezometers installed in the vicinity of the Cross Valley Dam embankment consist of pneumatic and standpipe piezometers. Two foundation sections are instrumented from as much as 20 m upstream of centreline to 7 m downstream of centreline. As well, 5 locations on centreline are instrumented; tips range in position from about 11 m below crest to about 13 m below the bottom of the cut-off trench. Finally, it is noted that the embankment core is attached to an upstream blanket of core-type glacial till material which extends 30 m upstream of centreline. This blanket is connected with a secondary blanket of 'second-rate' glacial till material which is 60 m wide. The function of these blankets is to reduce the hydraulic gradient in the mixed alluvial strata present beneath the dam.

Plots of the data collected in 2001 are presented in Appendix III and summarised in Table 11. Readings were taken from the Cross Valley Dam piezometers on a near daily basis from October 16, 2001 until the end of the year. This increased monitoring frequency was carried out to monitor the piezometric levels as the polishing pond was lowered. As previously noted, the Cross Valley Pond elevations recorded during 2001 were generally consistent with the highest levels recorded in 2000.

On the basis of the data available, the following general observations can be made:

- The piezometric levels at centreline below the embankment are typically at about 1048 m to 1050 m.
- At CVDC-7, an upward hydraulic gradient is indicated by the shallow and deep piezometers, situated at elevations 1040.1 and 1035.2, respectively.
- At CVDC-9, piezometer tips situated at elevations 1040 and 1053 respectively, indicate an upward hydraulic gradient.
- The piezometer at location CVDT-1, located at the toe of the dam, continued to indicate a piezometric surface approximately 0.3 m below the surface.
- The piezometer at locations CVDT-2, located at the toe of the dam, indicated a slight decrease in piezometric elevation between 2000 and 2001.

The shallow depth of the phreatic surface near the toe of the dam is to be expected. The readings reviewed herein indicated that the dam is performing in an acceptable manner.

Seepage - Seepage emerging at the toe of the Cross Valley Dam is collected by a granular toe drain which was constructed in 1991. Seepage rate is normally measured by observing three tributary V-notch weirs and a combined flow weir. Each of the tributaries collects seepage from a discrete portion of the toe drain. The seepage rate is also influenced by some water derived from the spillway/decant area recharge downstream of the core section of the dam. Hence, the north weir is measuring a combination of foundation seepage sources as has been reported in 1995, 1996 and 2000.

The 2001 data and the historic summary of weir flows are presented in Tables 12 and 13. Figure 3 presents both rate data for Weir X-13 together with the year-by-year trend in mean annual seepage rate. The Weir X13 quantity should equal the combined flow volumes of X11, X12 and W3. The difference between the calculated combined flow rates and the flow rate is presented in Table 13. A possible contributing factor to that discrepancy is seepage from the pervious spillway foundation materials during periods of Cross Valley Dam spillway discharge is recorded at Weir X11.

The average 2001 flow rate at Weir X13 is 48 L/s, which is slightly less than the 48.65 L/s. recorded in 2000. The 2001 flow rates continue the trend of decreasing flow rates displayed on Figure 3. This phenomena may be reflective of changes within the granular toe drain (e.g. clogging) but no real rise in toe piezometric levels has been detected to date.

Thermal Regime – Data from thermistor strings CVDC-6, CVDC-11 and 88-4-4 was collected in June, September or October 2001. The data is presented graphically and in tabular formats in Appendix III and summarized in Table 14.

Thermistor string CVDC-6 was installed from the dam crest to provide temperature data from the lower section of the embankment and the local permafrost beneath it. Reading of the thermistor indicated that the no permafrost remained within 29 m of surface by December 1981, probably due to seepage-related heating. The 2001 readings are consistent with the 2000 readings which indicate a slight cooling trend at depth. A temperature of -0.12 degrees was recorded at 29 m depth. Readings taken on October 16, 2001 are likely invalid due to monitoring equipment failure.

Installation CVDC-11 was also installed from the crest of the dam. The upper 3 m of the thermistor string is in embankment material and the lower 12 m is in abutment foundation material. Initially, all of the natural material was permafrost but the entire monitored soil profile had thawed by about 1986. The 2001 readings are consistent with previous readings of this installation. The data suggests winter frost penetration extends to an approximate depth of 6 m. The data also indicates that temperatures at depth remain above freezing. The thermistor tip at 9 m depth is malfunctioning. The loss of permafrost and the subsequent warming was expected, primarily because of the heating influence of the reservoir.

The zone immediately below the crest was instrumented in 1988 for research reasons related to longitudinal cracking of the crest. The installations, BH-88-4 and BH-88-5, are positioned at approximately the one-third point of the 500 m crest length, south of the spillway. Data collected from BH-88-4 in the spring between 1998 and 2001 indicates that winter frost penetration extends to a depth of approximately 4 m. The cooling trend in the Cross Valley Dam fill discussed in the 2000 annual report by BGC appears to have ceased. The thermistor installation at BH-88-5 was not read in 2001.

3.3 Down Valley Project - Intermediate Dam

The Intermediate Dam currently has a crest elevation of 1081.7 m (dvpd); initial construction in 1980 was to only 1068.8 metres. The dam was raised as follows in response to tailings storage requirements using the downstream method:

- To elevation 1073.0 in the summer of 1988 (spillway crest at 1071.5);
- To elevation 1078.0 in the summer of 1989 (spillway crest at 1076.5); and
- To elevation 1081.7 in the summer of 1991 (spillway crest at 1080.0).

Tailings were always discharged from the upstream end of the basin during mine operation, hence a water pond was always present immediately upstream of the dam. The water level downstream of the dam is typically at Elevation 1063.5 m, as controlled by the spillway crest of the Cross Valley Dam, or lower, if siphoning/pumping over the Cross Valley Dam spillway is practised. The elevation of the Intermediate Dam foundation is approximately 1050.0 m in the original bed of Rose Creek near the south side of the valley. Therefore, the maximum height of the Intermediate Dam is approximately 31.7 metres.

The original construction phase and first raising (1988) had the emergency spillway at the south abutment; it was moved to the opposite end of the dam during 1989 construction, and rebuilt in 1991 when the dam was raised to its present elevation. As a consequence of this general construction activity, all of the pre-construction and post-construction geotechnical performance instruments have been destroyed, some replacements have been made and new instruments have been installed where required.

Original instrumentation included piezometers (standpipe and pneumatic types) and one string of thermistors. The piezometers monitored pore pressure conditions in the embankment, and in the foundation. The thermistor string was installed in the permafrost of the south abutment. Current instrumentation consists of five piezometers. Two sets of instruments are located in the south abutment, and the remainder are positioned at depth downstream of the core. Since 1995, no reading has been taken from the BH 88-3 piezometer located in the south abutment.

Piezometers - Plotted data for piezometers installed at the Intermediate Dam are presented in Appendix III and summarised in Table 15. Readings for 2001 were obtained in June and September. The measured Intermediate Pond elevation ranged from a high of 1081.2 m (dvpd) in August to less than 1080.6 m (dvpd) in October. Measurement of the pond level ceased at that time because the water level fell below the level of the monitored staff gauge.

The 2001 data for BH91-ID-3 generally follows the trend of declining variation in piezometric levels recorded by the deep dip that have occurred since the 1999 readings. The shallow tip indicates drained conditions exist in the upper 7 m of the dam. The deep piezometer tip indicates fluctuation but generally lower water levels values than the shallow tip. BGC infers that the piezometer data reflects abutment conditions dominated by drainage from upslope, not the level of the tailings pond upstream of the dam. That inference is supported by the sudden increase in piezometric level of 2 m recorded by both tips in June 1992, which would be coincident with the spring freshet in the adjacent diversion channel. Therefore, the decline in piezometric pressure recorded by BH91-ID-3 may be related to better drainage associated with ongoing loss of permafrost in the abutment downstream of the dam. It should be noted that no seepage was observed this year at the toe of the south abutment, where historically, seepage generally occurs.

Piezometers BH91-ID-4, ID-5, ID-6 and ID-7 were installed from the berm along the downstream toe a short time before the dam was raised in the summer of 1991. Measurements from these piezometers indicate notable changes in pore pressures during 2001, as summarised below:

- Piezometric data collected from the shallow and deep piezometers at ID-4 (Station 0+567) indicate less variability in the measured pore pressures in 2001 when compared to historic variations. Relatively consistent levels were recorded in 2001.

- ID-5 and ID-6 are at Station 0+625 and 0+630, respectively, but ID-6 is about 20 m upstream of ID-5. The data for ID-5 indicates that both pneumatic leads are leaking because, since September 1992, interpreted water levels have been very consistent at 25 to 30 m below the polishing pond level. ID-6, with tips at approximately the same elevations as those for ID-5, has registered an upward gradient, thus demonstrating the influence of the tailings pond upstream of the Intermediate Dam. The 2001 readings for ID-6, as for ID-4, indicate less variability in the measured pore pressures in 2001 when compared to historic variations.
- Location ID-7 is south of the above-discussed installations and has only one tip; it is situated at about the same elevation as the shallow tips for the other installations (about 7 m depth). The data trend for ID-7 is similar to ID-6, however the piezometric levels at ID-7 are about 2.0 m higher. Disregarding the low reading when the polishing pond was drawn down in the fall of 1997, the recorded piezometric levels are quite consistent at about 1 to 2 m above downstream pond full supply level. The readings taken from ID-7 in 2001 continue the trend displayed by the piezometers discussed above, with less variability in the measured pore pressures in 2001 when compared to historic variations.

As part of their mine closure study, Robertson GeoConsultants Inc., installed 8 monitoring wells into 4 sites in the crest and downstream berm of the Intermediate Dam. Water level readings from these monitoring wells are included in Appendix VI. The readings collected in the Fall of 2001 are 0.22 m to 0.12 m higher than those collected during the fall of 2000. This continues the increasing trend in observed pore pressures observed in 1999 and 2000.

Thermal Regime - Thermistor readings in the south abutment area of interest were last taken in 1991. None were taken during 1992 for the south abutment installation because the thermistor had been destroyed. In the prior years, readings had indicated that the ground was thawed to the full depth of the instrumentation and hence, the absence of additional data is not viewed as critical by BGC.

3.4 FWS Dam

Instrument readings were carried out more frequently in 2001 than in past years in order to monitor subsurface conditions in the dam as the reservoir level was lowered. As mentioned in Section 1.3, the water level was lowered in anticipation of the reservoir lowering project. A geodetic survey was conducted in 2001 as part of a project to analyse the stability of the dam during reservoir lowering (BGC, 2001b). The crest of the FWS Dam is at a nominal elevation of 1099.3 m asl based on the geodetic survey. The reservoir level ranged from 1096 m asl in September to 1092.9 m asl on December 31.

Piezometers - The embankment and its downstream toe area contain a number of piezometers installed for the purpose of monitoring pore pressures. Plotted data is presented in Appendix III and summarised in Table 16.

Piezometers installed from the crest of the dam are numbered BH85-4, BH85-5 and BH88-15 and are discussed below.

Piezometer BH85-4 showed a 0.6 m drop in the piezometric elevation in response to lowering of the reservoir during the monitoring period (June 6 to December 31, 2001). The slotted section of the standpipe is located within the core of the dam, approximately 9.6 m below the crest. Readings in 2001 ranged from a low of 1091.50 m asl recorded on December 26 to a high reading of 1092.27 m asl on October 29.

The piezometric elevation indicated by the piezometer at BH85-5 fluctuated between a low elevation of 1088.59 m asl, measured on December 26 and 31, to a high of 1089.56 m asl, measured on October 16. The piezometric pressure dropped 0.86 m in response to reservoir lowering during the monitoring period. The tip of piezometer BH85-5 is embedded in the core or random fill zone of the dam approximately 11.4 m below crest level.

Installation BH88-15 has tips at three levels; 4.5 m, 12.9 m, and 19.6 m below crest level. The shallow tip is likely located in the core of the dam, the intermediate tip is likely embedded in the core or random fill zone of the dam and the deep tip is likely located in the foundation of the dam. The piezometric level in the shallow tip dropped by 0.68 m, the intermediate tip recorded no change while the deep tip piezometric pressure dropped by 1.54 m in response to reservoir lowering during the monitoring period. It appears that the intermediate tip may not be functional.

Piezometers installed from the downstream toe berm are numbered BH85-2, BH85-3, and BH88-16 and are discussed below.

The readings taken from BH85-2 during 2001 indicate that relatively high piezometric pressures are present at that location. Piezometric elevation varied from a high of 1083.97 m asl on November 6 to a low of 1085.13 m asl on November 12. The piezometric level measured at BH85-2 dropped by 1.03 m during the monitoring period in response to reservoir lowering.

BH88-16 indicates, as in all previous years, that an upward gradient exists between the toe berm and the foundation material based on the piezometric elevations recorded at the deep and shallow tips in 2001. The shallow tip recorded no change, while the deep tip indicated a 0.84 m drop in the piezometric level in response to lowering of the pond.

The readings from BH85-3 showed little variation over the year. No change was noted in response to the reservoir lowering.

Installation BH85-1 is near the seepage collection trench at the toe of the rock fill berm. For the years between 1995 and 1997, the well was flowing as an artesian well, which is typical according to data presented in Table 16. The piezometric elevation was within 0.1 m of the ground surface at the end of the 2001 monitoring period. The water in the standpipe has been frozen since November 12th, 2001, therefore, readings taken after this date can be considered invalid.

Thermal Regime - The plot of the thermistor data collected from the FWS Dam is presented in Appendix III and summarised in Table 17. One crest area thermistor (BH85-5) with sensors to 8.1 m depth has been used to observe core zone temperature since 1989. The interest in temperature was derived from the need to research cracking that was occurring along the crest of the dam, as was also observed for the Cross Valley Dam crest.

The thermistor string was installed and first read in 1989, but subsequent readings were not taken until May 1994. After that time readings were taken once or twice every year. The May 1994 readings indicated that the core was frozen to at least 3.7 m below crest during the winter of 1993-94. The May 1998 and 1999 readings were relatively consistent, showing that the winter's frost penetrated to a depth of approximately 4 m. The June 2000 readings indicated a reduction in the depth of winter frost penetration to 3.1 m below ground surface. Readings taken in June 2001 indicated that the depth of winter frost penetration increased approximately 0.4 m to 3.5 m depth.

Seepage Monitoring - A counterweight berm was installed along the downstream toe of the dam in 1989. The berm was constructed with a preferentially pervious lower section to allow drainage of artesian seepage. A ditch was constructed to collect the seepage water and two weirs were installed along a the ditch to measure seepage water flow rates. No data is available for 1993, 1994, or 1995 and little for 1996 and 1997. Measurements of water levels were made utilising staff gauges at the two weirs up to three times a month in 2001 by site personnel. Water levels at the staff gauges are presented in Table 2 and are summarised below:

- "Lower" seepage collection weir – The readings fluctuated between a low of 0.16 m, measured on April 10 and June 21, to a high of 0.18 m measured on May 21 and June 1. That range varied less than the range of measurements recorded in 2000, however the average measured water level was the same in both years.
- "Valvehouse" seepage collection weir – The staff gauge readings fluctuated between a low of 0.25 m, measured on September 14, to a high value of 0.46 m measured on November 1. The average measured water level in 2001 was slightly greater than the 2000 average measured water level.
- South abutment seepage observations – none provided by site personnel.

*Optimized
with
many
changes*

*We do this any changes would be recorded & reported.
unless no change
forward data end
of year*

4.0 FIELD INSPECTION AND SUMMARY NOTES

Mr. J. Cassie, P.Eng., of BGC visited the Faro Mine site from the period August 27 to 30, 2001 and inspected the following facilities:

- Selected components of the Down Valley Tailings Project,
- The FWS Dam,
- The North Fork of Rose Creek flow-through rock drain causeway, and
- The Faro Creek Diversion Channel situated over the east wall of the Faro pit.

clarify
As recommended in last year's inspection report, no visual inspection of the waste dumps overlooking North Fork Rose Creek was done. *YES we DO THIS, not recorded unless changes are observed.*

As for previous visits, the facilities were inspected during a walking tour and a camera and Dictaphone were used to record conditions and observations. The photographs, along with recorded observations, are compiled into a Field Record Summary that is kept in the files of BGC. The observations made during the site visit are summarized within this section of the report.

The purpose of the 2001 site inspection was to examine the facilities in detail for evidence of deficient performance and possible maintenance, to provide a basis for possible adjustment to the frequency of monitoring and to review points of immediate concern and maintenance with site representatives. At the conclusion of the inspection, a Field Memo was prepared that outlined the status of the various structures inspected, highlight items of concern and items requiring immediate attention, such having been observed during the subject inspection. The Field Memo is attached in Appendix I. The contents of this memo were reviewed with Mr. Dana Haggar before Mr. Cassie left site.

At the time of the inspection visit, water was just flowing over the concrete sill level at the FWS Dam, just as it had been observed during last years visit. At the Intermediate Dam, some water was being conveyed over the spillway and lime was being mixed in the spillway. The water level was estimated at approximately 1.3 m below the physical crest, slightly higher than the level observed during the previous year's inspection. Water was being conveyed over the Cross Valley Dam by siphoning and the retained pond level was estimated to be the same as during the 2000 inspection.

It should also be noted that Mr. Cassie returned to site on October 4 and 5, 2001, specifically to observe the conditions on the FWS Dam following the diver's inspection visit. In addition, Mr. Cassie also visited the site on October 12, 2001 as he was working on another mining project in the general area. A summary memo on Mr. Cassie's October visits are provided in Appendix II while Appendix III contains the inspection report prepared by Diving Dynamics.

4.1 Down Valley Tailings Project

The Diversion Canal, the North Valley Wall Interceptor Ditch, the Cross Valley Dam and the Intermediate Dam were all inspected. No inspection was undertaken of the Original or the Second Tailings Embankments, situated near the upstream end of the tailings containment area.

4.1.1 Diversion Canal

Mr Dana Haggar accompanied Mr. Cassie during the visual inspection of the canal backslope.

Canal Dike - The dike crest and immediate uphill slope were inspected by walking. The principal reason for this inspection historically has been to examine the dike for surface cracking, such being in response to deterioration of foundation permafrost. However, each time the dike crest is graded to remove ruts and ridges for better traffic conditions, the cracks are also obliterated. Minor potholes and undulations were noted at approximately Stations 1+200, 1+400 and 1+800. In addition, cracking and settlement were observed on the crest between Stations 2+050 and 2+100, in an area where cracking has been historically noted. It should also be noted that slope inclinometer (SI) 88-10 at Station 2+200 sheared off at a depth of 5 to 5.5 m. A new SI was installed within the area in August but data to-date indicates little on-going movement so far.

Hence, it appears that settlement for the majority of the dike has generally been completed, except within an area bounded approximately by Station 2+050 to 2+250. It remains important to continue with the program of visual and instrument observations until it is clearly apparent that thaw-related deformations are complete. *ON-GOING.*

Toe-of-Slope Area - This area was inspected by walking the shoreline from the Cross Valley Dam east to the Diversion Dam. The objectives of the inspection were to identify seepage occurrences and areas of possible slope instability insofar as they may provide an indication of concern for the integrity of the canal.

From a point approximately 200 m east of the Cross Valley Dam (canal Station 2+700) up to the toe of the Intermediate Dam, approximately 15 seepage discharge points were noted in 2000 with an estimated total quantity of 30 l/min. This year, approximately 8 to 10 seepage points were noted. As noted earlier, the rainfall amounts for August and September 2000 were several times higher than typical and this may be the basis of the yearly difference. In addition to these seepage points, the access road fill situated just below the south abutment has numerous tension cracks resulting from the oversteepened nature of the material.

Again, some longitudinal toe cracking was observed intermittently between Stations 2+100 and 2+400. Extensive toe cracking was noted in 2002 at Station 2+100. The cracking is partially related to some previous toe erosion that had occurred at this location. The toe cracking in this area is indicative of on-going deformation of the dike that is still occurring.

No evidence of seepage emerging at the toe or of seepage emerging onto the tailings shoreline was observed except from the tails-filled Borrow Pit I, situated at approximate Station 1+350. Seepage has always emerged into that area. The emergence points have always been in the same locations and the rate of seepage has been relatively steady.

No other areas of seepage emergence were seen between the Borrow Pit I site and the Diversion Canal Dam, except into the channel downstream of the Diversion Canal Dam. The conclusion of the inspection was that the slopes and the area between the canal dike toe and the tailings / water's edge are in good condition, thus posing no field-evident danger to the integrity of the diversion canal or dike. **Monitoring should continue on a regular basis between 2+000 to 2+400, where deformations of the dike appear to be continuing and between 2+500 and 2+700 where seepage continues to be observed.** D O P E

Complete **Canal Backslope and Thermal Liner** – A small slide occurred in the backslope, right at the entrance to the Diversion Canal. In addition, extensive new cracking was observed at the old slide area located at approximately 2+000. These movements likely reflect the saturated nature of the materials, following the extreme precipitation of August and September 2000. Repairs were recommended for both locations.

No new erosion gullies have appeared to form in the face of the thermal liner recently and these are generally armoured and pseudo-stable. The largest of the erosional gullies exist at the following locations; 7+50, 1+600, 1+950, 2+080, three near 2+100 and 2+200. In addition, smaller gullies exist at 0+200, 0+550, 1+000, 1+630, 1+690, 2+900 and 3+020. All the gullies appear to be the result of redirected runoff from upslope, but generally, no active erosion appears to be occurring.

As previously recommended, it would be beneficial to protect the above-described gullies with blast rock. Redirection of surface water flow over the backslope edge has proven to be an unfortunate consequence of such repairs being done from the top of the backslope. In consequence, it is recommended that consideration be given to armouring the gullies before spring break-up, but only by gaining access from the ice level in the canal. **The feasibility of the work should be determined by a trial at one gully location.**

It is suggested that well-graded blast rock having a 300 to 500 mm maximum particle size be used for the test. Several front-end loader scoops of the material could be dumped from the canal dike crest as far toward the canal ice surface as possible. Taking care not to damage the riprapped slope, a tracked loader could then transfer the material to the gully and distribute it up the feature, leaving a concave shape to the finished section. If the approach proves workable, the program could either be continued immediately or plans could be made to tackle the rest of the gullies a year later. No material should be left on the ice surface because it will disrupt the normal flow in the diversion canal.

Aside from the conditions noted above, the backslope is considered to be in satisfactory condition.

Clarify
Weir Cascades – The weir cascades were considered to be in good condition although, at some locations, one or more of the central boulders of some weirs have been displaced downstream. This generally occurs in the first few weirs at the upstream end because the materials of construction for these were of slightly smaller size than for the rest of the weirs. The consequence is that some of these weir crests are becoming relatively ill-defined compared with those downstream. Using photo comparisons, the remainder of the weirs have shown relatively little change from year to year and, except for some accumulated debris, they appear to be functioning well. Finally, and as has been recommended by previous reports, the last weir of the downstream cascade would benefit from repair because some of the flow is going around the corner of the weir. (FWD) *Done repairs to be made?*

4.1.2 North Valley Wall Interceptor Ditch

Agree
The walking inspection of the ditch indicated no significant changes to its configuration. As illustrated by Figure 9, the two culverts placed under the haul road have an estimated discharge capacity of 4 to 8 m³/s. This estimated value is still well below the design requirements of 17.7 m³/s (Hydrocon 1980). As a result, either larger sized culverts should be installed or the adjacent road sections should be shaped to ensure a safe failure of the culvert when a large flood occurs.

consider this year
The channel leading from the culverts discussed above is illustrated in Figure 9. As noted previously, this channel should be designed to carry up 17.7 m³/s plus an allowance for 0.5 m of freeboard. Based on some visual estimates of the current channel grade and configuration, it is likely that the current channel could convey this design discharge quantity. But, it is recommended that a detailed survey be undertaken at this area to confirm channel grade and dimensions. In addition, the survey could determine if the right hand access road crest (shown in Figure 9) is too high.

Except for the undersized culverts and the channel configuration at the outfall section, the inspection indicates that the interceptor ditch system is capable of conveying routine small flows without difficulty.

4.1.3 Cross Valley Dam

At the time of the inspection, the upstream pond was approximately 3 to 3.2 m lower than the physical crest of the dam, the same condition as observed last year during the inspection. As a result, the retained water level was lower than the inlet elevation for the spillway as shown in Figure 12 and water was being conveyed through a siphon pipe.

Spillway – The inlet to both the spillway and pilot channel were in satisfactory condition, based on the visual inspection.

At the bottom of the spillway discharge, below the confluence with the outfall section flow, the combined flow travels through two culverts situated under the access road to the toe of the dam. Some minor sloughing of the rip rap protection around these two culverts has occurred.

Dam Crest - As has been described by previous reports, the crest of the dam has undergone some episodes of centreline-parallel cracking for which the crack width appears to be sensitive to the time of inspection and the severity of the previous winter. They have been interpreted to be the consequence of frost heave ice lensing within the upper part of the core. For this reason, two thermistor strings were installed to several metres below crest in 1988. This data has tended to confirm the belief that they are the result of ice lens formation.

Cracking on the crest appears to be continuing. The settlement trough adjacent to the cracks appears slightly more pronounced this year than last. It should be noted that new cracks were observed by site staff in 2000.

Upstream and Downstream Slopes - Both the upstream riprap and the downstream slopes are considered to be in good condition. Some minor erosion of the rip rap has occurred on the upstream side riprap, approximately 2 m lower than the physical crest. Numerous small erosional gullies are formed on the downstream face but no significant concerns with them are noted at the current time.

Downstream Toe Area Seepage - The surface of the berm placed during 1991 remains dry, as shown in Figure 14. Visually, the rate of flow in the seepage collector ditches appeared equal to previous years.

This year
The roadway culvert (X12) draining the south end of the berm drainage system is still choked with sand and gravel at its inlet end, and to some extent at its outlet end. *Had cleaned last year but on-going.*

4.1.4 Intermediate Dam

At the time of the inspection, a small amount of water was being discharged into the spillway and the upstream pond level was slightly higher than during last year's inspection.

Emergency Spillway - The spillway is illustrated by the various photographs in Figure 15. A small soil berm had been placed across the entrance, almost completely blocking the entrance to the spillway. This practice is not recommended since it can surcharge pore pressures within the dam. Siphons pipes were being used to convey pond water into the spillway. Lime mixing and discharge was being undertaken within the spillway. Inspection of the entrance to the emergency spillway did not identify any disturbance or repair work to be undertaken. It is possible that after removal of the small soil berm, some disturbance of the spillway may result and this should be prevented.

clay
The spillway invert and boulder array, below the entrance area, has been previously noted as disturbed and needs to be reinstated to prevent unnecessary and possibly severe damage to the spillway, should it be required to carry its design flow. Removal of the crossing ramps is also recommended for the same reason. Neither the spillway retaining dike or the crest of the Intermediate Dam should be used to gain access to the south end of the dam for servicing of water treatment facilities or to work on the siphons.

Crest - The crest of the dam is in generally good condition with some additional cracking noted towards the north end of the crest, as shown in Figure 16. These cracks are likely a result of the saturation effects of the precipitation that fell in 2000. In addition, some minor longitudinal cracking was noted on both the upstream and the downstream edges of the crest. A small settled area was noted on the crest edge, almost directly at the south abutment of the dam.

Upstream and Downstream Slopes - The upstream riprap is in good condition, except for some minor cracking at the crest near the south end. Several small slumps and some significant erosional gullies formed on the downstream side during the year (see Figures 17 and 18). Most of the small slumps appear to have been caused by thawing (in June 2001) of saturated material, caused by extreme precipitation in August/September 2000. Some of these small slumps resulted in the deposition of material towards or at the toe of the dam.

Site staff installed numerous stakes into the downstream face, following initiation of some of the sloughs in June 2001. Yukon Engineering Services measured the distances between these stakes as a potential method for monitoring the movements. Although the actual movement data was never forwarded to BGC for review, discussions with site staff indicated that the downslope movements subsided after a short initial period.

Seepage - Seepage has been observed on the toe berm, at the south abutment, in all years since 1995 except 1999. In 2000, seven seepage discharge points were noted at the southern abutment. During this year's inspection, no signs of seepage were noted at the south abutment toe, although recent vehicular traffic at the toe may have blinded off seepage paths in the short term.

No seepage was observed along the toe berm further to the north or at the junction of the embankment with the spillway bank at the north end of the dam.

4.2 FWS Dam

4.2.1 Spillway and Channel

The spillway structure and outfall channel appeared to be in good condition, as shown in Figure 19. The stop-log guides were removed previously, and hence, it is not currently possible to surcharge the dam above the concrete invert level. Based on survey information collected by Yukon Engineering Services in October 2001, the geodetic elevation of this concrete sill is 1096.09 m.

500 ?
The culverts used for the site access crossing at the downstream end of the spillway channel are estimated to have a total discharge capacity of approximately 20 m³/s. NHC (2000) notes that the 100- and 500-year flood events for this dam amounts to 39 m³/s and 63 m³/s, respectively, while the currently configured spillway can discharge 94 m³/s. As such, for flood events even smaller than a 1 in 100-year event, the culvert crossing will be washed out. When the culverts and roads are washed out, it would eliminate convenient access to the dam crest and valve house. As such, either properly-sized culverts need to be installed for the crossing or alternatively, a contingency plan for emergency access should be formulated.

In addition, the two culverts at the road crossing are eroding the embankment supporting the road and the culverts. Site personnel have installed cables to assist with the supporting the free ends of the culverts, but this measure is a temporary fix. Additional fill and erosion protection will need to be placed beneath the culverts at some time in the future, but it is expected that some form of fisheries approval may be required to place material within the waterway.

4.2.2 Embankment Crest, Riprap and Slopes

The crest has a history of cracking along its upstream side, generally related to frost action in the silty core materials and to high pond levels when the stop-logs were installed. Golder Associates undertook a test pit investigation program of the crest. Golder (1994) presented the results of the investigation together with recommendations for repair of the crest, if so required.

The photos in Figure 20 provide some examples of the weathered cracking traces and existing cracks. Based on subtle differences from previous years photos, combined with disturbances to the spray painted lines, there is some slight movement still on-going. This additional cracking is still likely related to the extreme rainfall that occurred in August and September 2000 that resulted in the thawing of saturated ground in June, 2001

The riprap on the upstream side is in satisfactory condition.

Following the diving inspection of late September, a "sinkhole" was observed supposedly in the crest of the dam, proximal to the expected location of the low level pipe. Mr. Jim Cassie was mobilized to site and his observations of October 4th and 5th are summarized in the memo located in Appendix II. To summarize briefly, no visual signs of settlement or deformation were observed on the crest or the slopes adjacent to the pipe crossing area. The "sinkhole" proved to be a test pit previously excavated by Golder Associates that had rutted slightly from the vehicle traffic on the crest.

4.2.3 Seepage

Three to four distinct seepage discharge points were observed on the upstream side of the valve house, all of which were described going back to 1995. Judging by photos of the total seepage volume at the east corner of the valve house, the seepage quantity is judged to be equal to last year's amount. As has been discussed in previous inspection reports, the seepage flow emerging from around the valve house is substantial and appears to correlate with reservoir water levels to some extent.

Following the diving inspection of late September, and the complete closure of the valve on the low level pipe, the amount of seepage emerging from around the valve house reduced significantly. Even after the valve was reopened on October 4th, the seepage amount remained constant at the lower value.

As has been noted previously, the low level pipe was inspected in late September including both visual inspection and ultrasonic measurement of the pipe wall thickness. A summary of the diving report is provided in Appendix III but approximately 45% of the original pipe wall thickness has been lost since installation. More disconcerting was the observation, confirmed by depth measurements, that a 1.5 m bend (over a total distance of 20 m) exists in the pipe within the middle portion of the dam. The summary memo in Appendix II provides an interpretation of these results that appears to indicate that the bend was likely installed during construction. As outlined in the summary memo, there still remain some potential risks with the low level pipe. In addition, the role of this dam is redundant at site and it appears to provide only minor flood attenuation (NHC 2000). Hence, design preparations are underway for a proposed lowering of the reservoir level (first phase) followed by some form of low level pipe removal or rehabilitation (second phase).

The collector ditch situated along the downstream edge of the toe berm was working effectively to collect seepage from the drainage layer beneath the berm.

4.3 North Fork Rose Creek Flow-Through Causeway

The flow-through rock drain, which is some 65 m high on the downstream side, was observed during the site inspection. The discharge area was observed to be flowing clear water from the downstream side. Both the width of the this discharge area, along with flow velocity of the water, indicated a higher quantity of flow than that observed last year during the inspection. No evidence of distress in the slope above, nor ravelling of the toe of the slope was observed. On this basis, it appeared that the downstream portion of the causeway section was functioning as intended, and that its performance was not deteriorating.

The head pond level observed in 2001 was lower than the level observed in 2000. This observed decrease is likely related to the extreme amount of precipitation that fell in 2000 that resulted in increased pond levels. Some woody debris was still remaining on the upstream face above the observed level of the headpond. On the basis of the observations described above, it is concluded that hydraulic performance continues to be good.

4.4 Waste Rock Dumps

No formal inspection of the waste dumps was undertaken this year. During the drive to the Faro Pit, several 1.5 m deep test pits were observed along the dump crest edge, adjacent to the access road that leads up to the Faro Creek Diversion channel (the pits are located some 300 m south of the diversion channel at the estimated mine grid co-ordinates of 85,000 N and 21,600 E). These pits should be backfilled to prevent any water collection and infiltration into the adjacent slope. *only record if changes observed.*

4.5 Faro Creek Diversion Channel

The Faro Creek diversion channel is situated on top of the east wall of the Faro pit. The channel transmits creek water, which previously flowed directly through the pit area, over to the North Fork Rose Creek, where it flows through the Vangorda causeway rock drain. BGC's annual inspection report for 2000 provided a synthesis of some relevant information relative to the Faro pit wall, hydrogeological conditions and the relationship with the creek diversion channel.

A visual inspection was made on the diversion channel, in association with the top portion of the east pit wall. The observed conditions were relatively unchanged from last year, as summarized below:

- The distance from the backscarp of the east pit wall to the diversion channel varies from approximately 25 to 75 m. It is difficult to make an exact and/or accurate determination of retrogression, given the lack of definable measurement points.
- The diversion channel initially (upper portion) is a 4 to 6 m deep channel cut down into native materials. An access road berm is situated on the downstream side of the channel. Some blue geomembrane liner is installed in the channel bottom but it is completely ripped and torn. As a result, this liner is completely ineffective in cutting off any seepage into the underlying overburden materials.
- The channel section becomes shallower (less than 2 m) where the half section metal culvert (a flume) becomes apparent in the channel bottom. A number of the joints in the flume are open and hence, some water is travelling along the outside of the flume section. As such, this flume liner is also ineffective in cutting off any seepage.
- At the point where the flume section begins, a small longitudinal ditch is also cut on the downhill side of the access road berm. It appears that the purpose of this ditch is hopefully to intercept any seepage from the diversion channel proper and then drain it longitudinally parallel to the access road.
- No signs of cracking, settlement or deformation were observed within the diversion channel section, on the crest of the access road berm or in the downhill interceptor ditch. It is unlikely that any signs would be observed, given the relatively large separation distance from the pit wall back scarp noted earlier.

In summary, the diversion channel has been for a number of years now, and is currently, ineffective in cutting off seepage from the surface run-off. As a result, it is likely that the phreatic conditions within that wall are high and on the increase, given that no active mining and/or depressurization is currently on-going. This condition will act as a destabilizing force, leading to potential movement and/or failure of this pitwall. On the other hand, the slowly increasing level of the water in the pit will act as a buttressing effect of the slide mass and hence, this will be a stabilizing force. Ravelling and retrogression of the slide back scarps will likely continue as deformation and creep of the slide mass continues. This ravelling will occur at such a rate that several years may be required before the back scarps impinge upon the diversion channel. Hence, some visual monitoring of the back scarp status and potential cracking within the diversion channel should be implemented such that early indications of diversion channel deformation can be identified. In addition, a contingency plan should be developed for the eventuality of losing the diversion channel.

Catastrophic failure of the east wall is a possibility, but it is not possible to comment on any effect on the diversion channel since very limited information on the controlling structures is currently known. It is likely that diversion channel seepage travels laterally on the overburden/bedrock contact, draining out onto the pit wall where one of the major faults or structures outcrops. Longitudinal drainage trenches on the benches above any fault outcrop may be beneficial in reducing the recharge potential into this structure. If the pore pressure can be reduced, then the stability of the pit wall will be enhanced and hence, the potential for further movement will be reduced. Additional investigative and design work would be required before these trenches could be installed.

If the Faro Creek diversion channel is lost due to pit instability, then all the Faro Creek flow must be accommodated within the existing pit capacity. The filling could only proceed up to the level where water would flow over the topographic high point into the adjacent B2 pit (currently covered with waste dumps). Groundwater within the B2 pit currently is acidic and interceptor wells are used to extract this water before it reaches the surface water in the North Fork of Rose Creek. One possible contingency option would be to install the previously planned Plug Dam, which was planned to separate the water from the Faro pit from the adjacent B2 pit. In this way, additional water could be retained within the Faro Pit, if a failure of the diversion channel were to occur. Alternative options for management of the Faro Creek water should also be evaluated as part of the contingency planning process.

4.6 Training Seminar

As noted earlier, a training seminar on geotechnical, hydrotechnical and dam safety issues was provided to the site staff on the evening of August 29, 2001. The attendees included the following four staff members:

- Ms. Rhonda Carr
- Mr. Dana Haggart

- Mr. Craig McKinnon
- Mr. Mike Bryson

A summary document of the information reviewed was also provided to site.

5.0 PHYSICAL WORKS MAINTENANCE REQUIREMENTS SUMMARY

The following sections provides a point-form summary of the maintenance and repair recommendations presented in Section 4.0, as well as those presented in the Field Memo of Appendix I and the Summary Memo of Appendix II. In addition, some recommendations regarding monitoring and surveying requirements are also provided.

5.1 Down Valley Project

5.1.1 Diversion Canal

It is important that the crest of the Diversion Canal dike be dressed each September after the annual inspection to close areas where cracks have developed. The purpose of this treatment is to prevent ingress of surface run-off water that may be concentrated in the settled areas, perhaps to enter local cracks to the disadvantage of stability. Blading should be used to accomplish this work. Care must be taken not to disturb the existing instrumentation that has been installed to monitor performance of the dike. No other blading should be done through the year.

- Minor potholes on the crest of the Canal Dike need to be graded to prevent water from ponding.
- Settlement of the dike crest was noted approximately 50 m west of Instrument CD-20, resulting in the discharge of surface water onto the downstream face. Backfilling and grading required to correct this settled area.
- Seepage continues to occur along the toe of the backslope, between the Intermediate Dam and the spoil piles, located east of the Cross Valley Dam.
- A small new slide has been formed in the backslope, right at the entrance to the Diversion Canal. As such, the slide mass should also be graded to prevent the further infiltration of run-off water which would tend to exacerbate the problem.
- New cracking and the formation of a small head-scarp have occurred adjacent to the old slide mass at approximate Station 2+000 on the backslope. This slide should be repaired to prevent the further infiltration of run-off water into the slide mass. It is likely that access for this repair work can only be affected when ice is formed in the channel section.
- Repair the final weir in the Weir section of the canal where flow is escaping around the south side of the weir.

5.1.2 North Valley Wall Interceptor Ditch

- The capacity of the two culverts running under the main access road at the outfall section are likely not capable of handing the design flood quantity of 17.7 m³/s.

5.1.3 Cross Valley Dam

- Cracking on the crest appears to be continuing. The crest should be graded properly to cover over the cracks and to properly drain any surface water off.
- Clean out the intake and discharge ends of the culvert located at the south side of the toe berm access road.
- An attempt should be made to repair the piezometer CVDP-3.

Costs
who -

Core was going to
Six during drilling

5.1.4 Intermediate Dam

- Cracking on the crest appears to be continuing. The crest should be graded properly to cover over the cracks and to properly drain any surface water off the crest.
- It appears the sloughing of the surficial material on the downstream face of this dam has occurred resulting from the thawing of saturated surficial materials. Minor settlement of the downstream edge of the crest, along with some crest edge cracking was observed. In addition, a number of significant erosional gullies have formed on the face, resulting in the formation a two to three debris cones of the downstream face. As such, some backfilling of the significant erosional gullies should be undertaken to ensure that additional run-off does not erode deeper into the face. In addition, all significant accumulations of debris and slough (that would interrupt any proper drainage on the face) should be removed and/or properly graded.

5.2 FWS Dam

- Cracking on the crest appears to be continuing. In accordance with the recommendations provided last year, the cracks should be cleaned out and a mixture of sand and bentonite be placed into the cracks. In addition, any settlement within previously excavated testpits should also be backfilled. The crest should be properly graded to drain any surface water to the upstream side.
- The V-notch weir, downstream from the gatehouse, needs to be repaired as water is escaping around the weir.
- The two culverts within the road crossing berm need to be upgraded for the expected design flood volume or a contingency plan for emergency site access needs to be formulated, given that the culverts and the roads will be washed away.
- The discharge end of the two large culverts below the spillway discharge is causing erosion underneath the access road embankment. As such, some form of repair and armouring work needs to be planned since fisheries authorization will be required for work within the waterway.

For
Discussion

5.3 Faro Creek Diversion Channel

- Ravelling of the pit slope adjacent to the Faro Creek diversion channel appears to be ongoing. Monitoring should be undertaken to determine if the ravelling and resulting deformation impacts the channel section in any manner.

5.4 Instrumentation

Two new instruments were installed in 2001 on the canal dike to replace one inclinometer that has sheared off (88-10) and to replace one thermistor that appears to not be working properly (88-11). The two new instruments are located in that section of the canal dike that is still underlain by permafrost and is still settling in response to thawing permafrost. The installation letter report is provided in Appendix IV.

For Discussion

All instrumentation (whether operational or not), should be inspected for surficial settlement around the instrumentation casing and/or standing water. If either of these two features is observed, the casing needs to be backfilled with bentonite chips in order to prevent the infiltration of any surface water along the casing. The bentonite chips should be piled up around the casing so that all surface water is directed away from the casing.

At the current time, only a portion of the total number of instruments within the various structures are actually monitored, as summarised below:

Structure	Total Number of Instruments ^{1,2}	Number of Instruments Still Monitored
Canal Dike	32	10
Back Slope of Canal	11	3
Spoil Pile	3	3
Cross Valley Dam	28	11
Intermediate Dam	26	12
Fresh Water Supply Dam	10	10
1980 Tailings Dam	12	0
Totals	122	49

¹ Source is Figures 1,2 and 4

² Includes only slope inclinometer, piezometer and thermistor installations and does not consider instruments installed to monitor settlement.

As such, only 44% of the installed instrumentation within the tailings containment area is currently being monitored. This fact may be because the data is not required, redundant, or the instrument has been destroyed or is malfunctioning.

Any conduit situated within a water retention structure may become a potential seepage path and hence, a liability over the long term. Hence, a three-phased approach regarding dam instrumentation should be undertaken this year, as noted below:

1. A desk top review of the purpose and current status of all instruments should be done. In addition, review the instrumentation installation methods, if possible, to evaluate if any voids and/or openings may exist adjacent to or within the instruments.
2. Following this, a field survey of the current location and condition should be done to determine if any instrumentation can be rehabilitated, or if it should be abandoned.

3. If any instruments are to be abandoned, ensure that suitable protocols for abandonment (e.g. removal of surface casing and grouting of any open holes) have been followed or undertake this work to ensure proper abandonment.

As part of this instrumentation review, and given the current closure status of the mine, consideration should be given to installing dataloggers for automatic and continuous reading of critical instrumentation. This would include some critical piezometers within each of the three dams, along with water level readings within each of the three retained ponds. More accurate, continuous data can be collected in this way, and over several years, becomes cost-effective since only two trips per year are required to retrieve the data. Alternatively, numerous technologies currently exist to upload the data (daily, weekly, monthly) to a receiver in Faro so that continuous, remote monitoring of these structures is possible. As a result, BGC would be able to monitor critical aspects of the dams performance from their operation in Calgary, reducing reading and data reduction errors and costs over some time period.

5.5 Emergency Response Planning

During Mr. Cassie's site visit on October 4th and 5th, he was asked to review the appropriate sections of an Emergency Response Plan that is kept on-site. Canadian Dam Safety Guidelines notes that an Emergency Preparedness Plan (EPP), also referred to as an Emergency Action Plan (EAP), is required for any dam whose failure could be expected to result in a loss of life as well as for any dam for which advanced warning would reduce upstream or downstream damages. Mr. Cassie's review indicated that the current plan on site was too brief to be any real assistance during an emergency. Hence, as noted in the summary memo in Appendix II, a more detailed EPP should be prepared and reviewed with site personnel.

6.0 ANNUAL REVIEWS AND ROUTINE INSPECTION

6.1 Annual Reviews

As has been noted in previous annual reports, the performance monitoring and annual inspections of facilities has served as a basis for:

- a) judging current performance of the facilities;
- b) providing some forewarning of any trends towards potentially troublesome performance;
- c) adjusting the frequency of observation of instrumentation;
- d) recommending the installation of additional instrumentation; and
- e) undertaking maintenance work.

In keeping with the important nature of these facilities, and the inherent value of keeping a comprehensive performance record, it remains prudent to continue with the data acquisition. The collection of current data is of both immediate and ongoing value, to review such data in relation to the existing database and to visually inspect the works on an annual basis for evidence of deteriorating or deficient performance.

The annual inspection in 2002 should again be done in late August or early September, in keeping with the schedules held for previous inspections, and for the advantage of consistency of conditions. It is recommended that the annual inspection of the Faro waste dumps be undertaken again in 2003 to see if any changes are occurring. If any extreme precipitation or seismic event occurs before then, an inspection should be completed.

6.2 Dam Safety Reviews

Canadian Dam Safety Guidelines note that Dam Safety Reviews (DSR's) should be undertaken on a period varying from 5 years for "Very High Consequence" dams to 10 years for "Low Consequence" and "Very Low Consequence" dams. To the knowledge of BGC, no DSR's have ever been undertaken on any of the Cross Valley, Intermediate or Fresh Water Supply Dams. In addition, a DSR is also recommended when either a design criteria modification or decommissioning of a dam is proposed, which may occur as closure planning is initiated for the Faro mine site. As such, consideration should be given to undertaking DSR's for all three dams, compliant with Section 2.0 of the Canadian Dam Safety Guidelines.

6.3 Routine Inspections by On-Site Personnel

6.3.1 Down Valley Project

In addition to the basic monitoring schedule outlined in Figure 23, it is important that a responsible and routinely available person (that has been appropriately trained) visit the key structures for inspection purposes as described below, and that a log of the visits and observations be maintained:

1. To inspect, on a monthly basis, the 400 m reach of the Diversion Canal dike crest immediately upstream of the Intermediate Dam for evidence of cracking;
2. To view on a monthly basis, the opposite side of the Diversion Canal from the driving dike (particularly the 50 m long segment about 500 m upstream of the Intermediate Dam), looking for change to the top profile of the gravelly backslope, possible narrowing of the flow channel, and other changes which might be attributed to sloughing of the backslope;
3. To inspect in June, just after spring runoff is completed, the top of the thermal liner on the backslope of the Diversion Canal at the location of the somewhat-sloughed area situated about 500 m upstream of the Intermediate Dam; such inspection to determine if new (sharp-edged) cracking has developed. While there, the inspector should redirect surface drainage to keep it from ponding along the backside of the thermal liner crest, and to keep it from unnecessarily entering crest area cracks. This inspection requires some walking, and hence, the inspector should carry a hand shovel to direct surface flow. BGC should be advised of any evidence that movement has occurred in the area.
4. To inspect, weekly, the Cross Valley Dam's downstream toe berm culverts for consistency of flow rate.

5. To note and record the water levels weekly in the Intermediate Dam pond and the polishing pond. Consideration should be given to automating this task through the installation of pore pressure transducers and dataloggers so that continuous data may be collected.
6. To inspect weekly, the abutments of the Cross Valley Dam and the Intermediate Dam for evidence of changing conditions (sloughing of the embankment fill and/or the adjacent slopes), for evidence of active crest cracking and for evidence of changing seepage rates (especially the south abutment toe seepage at the Intermediate Dam) and locations.

Any change in condition that is noted as a consequence of this program of routine inspection must be brought immediately to the attention of the inspector's superiors. BGC must also be notified so that the condition can be evaluated in light of the database and prior performance history of the structures, and to provide any necessary geotechnical advice related to the concerns at hand. Pictures of the changed condition should be taken and also forwarded to BGC.

6.3.2 FWS Dam

In addition to the basic monitoring schedule outlined in Figure 23, it is important that a responsible and routinely available person (that has been suitably trained) make weekly visits to the dam for inspection purposes described below and that a log of the visits and observations be maintained:

1. To note and record the water level in the reservoir, relative to the concrete spillway level. Consideration should be given to automating this task through the installation of a pore pressure transducer and a datalogger so that continuous data may be collected.
2. To inspect the abutments of the FWS Dam for evidence of changing conditions (sloughing of the embankment fill and/or the adjacent slopes), for evidence of active crest cracking (e.g., spray paint lines) and for evidence of changing seepage rates and locations.
3. To inspect the valve house area at the FWS Dam for evidence of seepage (and any signs of included sediment) and to quantify that amount of seepage.
4. To inspect and record the amount of seepage (V-notch weir) occurring within the seepage collection trench at the toe of the dam. An elevation correlation of the notch bottom to the pond staff gauge will need to be developed.
5. To inspect and record the amount of seepage (V-notch weir) occurring the channel on the downstream side of the valve house. An elevation correlation of the notch bottom to the pond staff gauge will need to be developed.

This data should be forwarded to BGC on a weekly basis such that the dam's performance under changing pond conditions can be closely monitored.

Any change in condition that is noted as a consequence of this program of routine inspection must be brought immediately to the attention of the inspector's superiors. BGC must also be notified so that the condition can be evaluated in light of the database and prior performance history of the structures, and to provide any necessary geotechnical advice related to the concerns at hand. Pictures of the changed condition should be taken and also forwarded to BGC.

6.3.3 North Fork Rose Creek Flow-Through Rock Drain

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It is important that monthly, a responsible and routinely available person (that has been suitably trained) check the level of the headpond at the North Fork Rose Creek causeway (Vangorda Causeway) to be assured that its relative level generally reflects the relative quantity of flow in the creek at the Faro Mine road crossing downstream. A photo should be taken for record purposes. Alternatively, an automated datalogger could be installed.

Any change in condition that is noted as a consequence of this program of routine inspection must be brought immediately to the attention of the inspector's superiors. BGC must also be notified so that the condition can be evaluated in light of the data base and prior performance history of the structures, and to provide any necessary geotechnical advice related to the concerns at hand.

6.3.4 Faro Creek Diversion Channel

Visual inspection of the channel sections for cracks should be undertaken in the months of April, May, June and September. Any signs of deformation should be forwarded to BGC for comment.

Date routinely.

7.0 ONGOING DATA ACQUISITION

7.1 Introduction

The frequency of readings of the instrumentation has been greatly reduced from the initial practice of quarterly observations because confidence in the performance of the project has been substantiated by accumulated data. However, some unfortunate interruptions in data gathering have occurred while Faro Mine has been inoperative, or otherwise manned with a skeleton staff.

It should be noted that all thermistor and piezometric data collected by Deloitte staff should be immediately plotted and forwarded to BGC for review. All slope inclinometer data should be forwarded to BGC for input, plotting and interpretation.

7.2 Down Valley Project

A recommended observation schedule for 2002 is shown in Figure 22. Instruments which have been excluded from the 2002 requirement fall in areas for which acceptable conditions have been solidly demonstrated, where total thawing has occurred in the case of thermistors, and the like. This has also been the basis from which the frequency of observation has gradually been reduced over the period since the Down Valley Project was constructed in 1980/81.

It is recommended that the monitoring program be as detailed by Figure 22. Piezometer 91-ID3 should be read monthly after May, in combination with visual seepage observations, to assess the increasing seepage quantity trend.

7.3 FWS Dam

It is recommended that the monitoring program be as detailed by Figure 22. It is particularly important that the weirs and valve house seepage be monitored on a weekly basis during ice-free conditions.

7.4 North Fork Rose Creek Causeway

Headpond water level observations for both the causeway and the road culvert downstream should be observed on a monthly basis. Data during periods of high flow is particularly important and, as a minimum, the headpond should be viewed weekly in the late afternoon for the period from about April 15th until June 30th. In addition, it is recommended that an electronic continuous automatic recording and data storage device be used to obtain water level data for the head pond and upstream of the road culvert. Data accumulated by such apparatus can be conveniently down-loaded to a lap top computer. The advantage of such a system is that virtually continuous data is obtained, that the data can be graphed and compared readily, and that a comparative data base is then available for evaluation of year-by-year performance.

The upstream and downstream faces of the Vangorda Causeway should also be inspected monthly for any signs of instability or sloughing.

8.0 CLOSURE

This report summarizes the physical conditions as observed by BGC and the instrumentation results and as collected by Deloitte staff on various mine waste facilities and structures at Faro Mine. Thank you for the opportunity to be of service to Deloitte & Touche and Faro Mine. Should you have any questions on this report, please contact BGC at your convenience.

Respectfully submitted,
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Per:



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TABLES

Table 1
Summary of Cross Valley and Intermediate Pond Levels

DATE	Cross Valley Staff Gauge	Intermediate Dam Staff Gauge	Cross Valley Pond Elevation (m amsl)	Intermediate Dam Pond Elevation (m amsl)
16-Jan-01	0.58		1031.09	
23-May-01	0.499		1031.009	
26-May-01		0.44		1047.74
28-May-01		0.44		1047.74
29-May-01		0.43		1047.73
31-May-01		0.4		1047.70
1-Jun-01		0.4		1047.70
2-Jun-01		0.39		1047.69
3-Jun-01		0.39		1047.69
5-Jun-01		0.36		1047.66
6-Jun-01	0.22	0.36	1030.73	1047.66
7-Jun-01	0.26	0.36	1030.77	1047.66
8-Jun-01	0.3	0.36	1030.81	1047.66
9-Jun-01	0.32	0.36	1030.83	1047.66
10-Jun-01	0.35	0.36	1030.86	1047.66
11-Jun-01	0.38	0.36	1030.89	1047.66
12-Jun-01	0.41	0.36	1030.92	1047.66
13-Jun-01	0.445	0.34	1030.955	1047.64
14-Jun-01	0.45	0.34	1030.96	1047.64
15-Jun-01	0.29	0.34	1030.8	1047.64
16-Jun-01	0.24	0.33	1030.75	1047.63
17-Jun-01	0.27	0.35	1030.78	1047.65
18-Jun-01	0.29	0.34	1030.8	1047.64
19-Jun-01	0.3	0.32	1030.81	1047.62
20-Jun-01	0.31	0.31	1030.82	1047.61
21-Jun-01	0.32	0.3	1030.83	1047.60
22-Jun-01	0.33	0.3	1030.84	1047.60
23-Jun-01	0.33	0.3	1030.84	1047.60
24-Jun-01	0.31	0.29	1030.82	1047.59
25-Jun-01	0.01	0.28	1030.52	1047.58
26-Jun-01	0.02	0.28	1030.53	1047.58
27-Jun-01	0.04	0.28	1030.55	1047.58
28-Jun-01	0.1	0.27	1030.61	1047.57
29-Jun-01	0.2	0.27	1030.71	1047.57
30-Jun-01	0.29	0.27	1030.8	1047.57
1-Jul-01	0.39	0.27	1030.9	1047.57
2-Jul-01	0.43	0.28	1030.94	1047.58
3-Jul-01	0.47	0.28	1030.98	1047.58
4-Jul-01	0.5	0.28	1031.01	1047.58
5-Jul-01	0.54	0.26	1031.05	1047.56
6-Jul-01	0.54	0.26	1031.05	1047.56
7-Jul-01	0.6	0.28	1031.11	1047.58
8-Jul-01	0.67	0.31	1031.18	1047.61
9-Jul-01	0.67	0.33	1031.18	1047.63
10-Jul-01	0.65	0.35	1031.16	1047.65
11-Jul-01	0.66	0.36	1031.17	1047.66
12-Jul-01	0.65	0.37	1031.16	1047.67
13-Jul-01	0.64	0.36	1031.15	1047.66
14-Jul-01	0.63	0.36	1031.14	1047.66
15-Jul-01	0.62	0.35	1031.13	1047.65
16-Jul-01	0.62	0.36	1031.13	1047.66
17-Jul-01	0.69	0.35	1031.2	1047.65
18-Jul-01	0.69	0.35	1031.2	1047.65
19-Jul-01	0.67	0.34	1031.18	1047.64
20-Jul-01	0.74	0.33	1031.25	1047.63
21-Jul-01	0.8	0.32	1031.31	1047.62
22-Jul-01	0.79	0.32	1031.3	1047.62
23-Jul-01		0.31		1047.61
7/23/01 7:00	0.67		1031.18	
7/23/01 19:00	0.54		1031.05	
24-Jul-01		0.3		1047.60
7/24/01 6:30	0.47		1030.98	
7/24/01 18:55	0.37		1030.88	
25-Jul-01	0.36	0.31	1030.87	1047.61
26-Jul-01	0.34	0.32	1030.85	1047.62
27-Jul-01	0.34	0.36	1030.85	1047.66

Table 1
Summary of Cross Valley and Intermediate Pond Levels

DATE	Cross Valley Staff Gauge	Intermediate Dam Staff Gauge	Cross Valley Pond Elevation (m amsl)	Intermediate Dam Pond Elevation (m amsl)
28-Jul-01	0.41	0.39	1030.92	1047.69
29-Jul-01	0.41	0.39	1030.92	1047.69
30-Jul-01	0.41	0.42	1030.92	1047.72
31-Jul-01	0.4	0.43	1030.91	1047.73
1-Aug-01	0.4	0.44	1030.91	1047.74
2-Aug-01	0.4	0.46	1030.91	1047.76
3-Aug-01	0.44	0.46	1030.95	1047.76
4-Aug-01	0.56	0.46	1031.07	1047.76
5-Aug-01	0.63	0.48	1031.14	1047.78
6-Aug-01	0.63	0.49	1031.14	1047.79
7-Aug-01	0.7	0.5	1031.21	1047.80
8-Aug-01	0.7	0.5	1031.21	1047.80
9-Aug-01	0.69	0.52	1031.2	1047.82
10-Aug-01	0.63	0.53	1031.14	1047.83
11-Aug-01	0.47	0.54	1030.98	1047.84
12-Aug-01	0.39	0.55	1030.9	1047.85
13-Aug-01	0.44	0.55	1030.95	1047.85
14-Aug-01	0.58	0.53	1031.09	1047.83
15-Aug-01	0.72	0.51	1031.23	1047.81
16-Aug-01	0.72	0.49	1031.23	1047.79
17-Aug-01		0.46		1047.76
8/17/01 6:30	0.8		1031.31	
8/17/01 13:30	0.77		1031.28	
18-Aug-01		0.44		1047.74
19-Aug-01		0.45		1047.75
20-Aug-01	0.53	0.43	1031.04	1047.73
21-Aug-01	0.44	0.41	1030.95	1047.71
22-Aug-01	0.51	0.38	1031.02	1047.68
23-Aug-01	0.62	0.36	1031.13	1047.66
24-Aug-01	0.7	0.34	1031.21	1047.64
25-Aug-01	0.56	0.32	1031.07	1047.62
26-Aug-01	0.44	0.31	1030.95	1047.61
27-Aug-01	0.34	0.29	1030.85	1047.59
28-Aug-01	0.42	0.27	1030.93	1047.57
29-Aug-01	0.6	0.26	1031.11	1047.56
30-Aug-01	0.52	0.24	1031.03	1047.54
31-Aug-01	0.6	0.22	1031.11	1047.52
1-Sep-01	0.69	0.2	1031.2	1047.50
2-Sep-01	0.52	0.2	1031.03	1047.50
3-Sep-01	0.39	0.18	1030.9	1047.48
4-Sep-01	0.55	0.15	1031.06	1047.45
5-Sep-01	0.68	0.13	1031.19	1047.43
6-Sep-01	0.6	0.12	1031.11	1047.42
7-Sep-01	0.52	0.1	1031.03	1047.40
8-Sep-01	0.58	0.1	1031.09	1047.40
9-Sep-01	0.68	0.08	1031.19	1047.38
10-Sep-01	0.73	0.08	1031.24	1047.38
11-Sep-01	0.68	0.09	1031.19	1047.39
12-Sep-01	0.69	0.09	1031.2	1047.39
13-Sep-01	0.71	0.1	1031.22	1047.40
14-Sep-01	0.74	0.11	1031.25	1047.41
15-Sep-01		0.1		1047.40
9/15/01 6:45	0.49		1031	
9/15/01 20:00	0.36		1030.87	
16-Sep-01	0.29	0.09	1030.8	1047.39
17-Sep-01	0.34	0.07	1030.85	1047.37
18-Sep-01	0.48	0.05	1030.99	1047.35
19-Sep-01	0.61	0.04	1031.12	1047.34
20-Sep-01	0.48	0.02	1030.99	1047.32
21-Sep-01	0.31	0	1030.82	1047.30
22-Sep-01	0.15		1030.66	
23-Sep-01	0.34		1030.85	
24-Sep-01	0.48		1030.99	
25-Sep-01	0.59		1031.1	
26-Sep-01	0.45		1030.96	
27-Sep-01	0.36		1030.87	

Table 1
Summary of Cross Valley and Intermediate Pond Levels

DATE	Cross Valley Staff Gauge	Intermediate Dam Staff Gauge	Cross Valley Pond Elevation (m amsl)	Intermediate Dam Pond Elevation (m amsl)
28-Sep-01	0.48		1030.99	
29-Sep-01	0.56		1031.07	
30-Sep-01	0.64		1031.15	
1-Oct-01	0.69		1031.2	
2-Oct-01	0.56		1031.07	
3-Oct-01	0.41		1030.92	
4-Oct-01	0.32		1030.83	
5-Oct-01	0.27		1030.78	
6-Oct-01	0.31		1030.82	
7-Oct-01	0.45		1030.96	
8-Oct-01	0.34		1030.85	
9-Oct-01	0.14		1030.65	
10-Oct-01	0.12		1030.63	
11-Oct-01	0.24		1030.75	
12-Oct-01	0.38		1030.89	
13-Oct-01	0.28		1030.79	
14-Oct-01	0.14		1030.65	
15-Oct-01	0		1030.51	
16-Oct-01	0		1030.51	
17-Oct-01	0		1030.51	

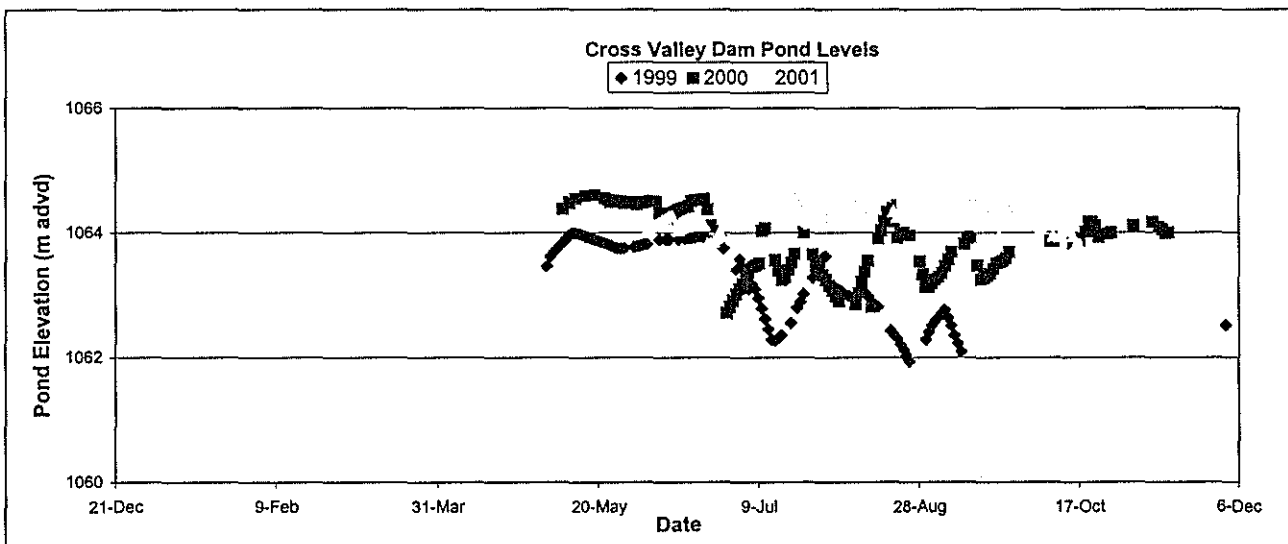
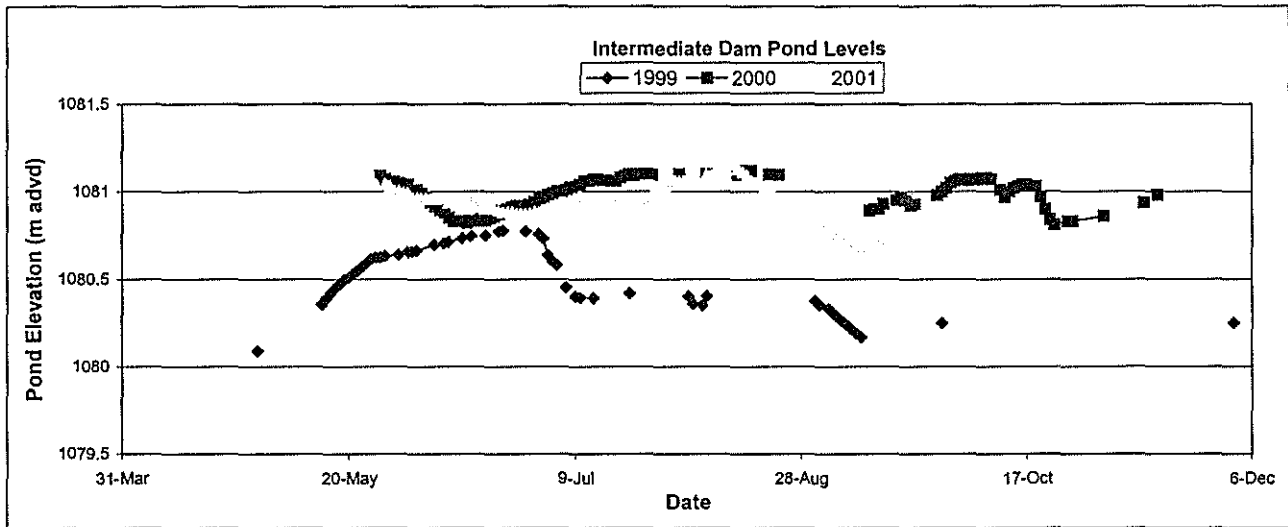


Table 2
2002 FRESH WATER SUPPLY DAM WEIR STAFF GAUGE READINGS

Date	Lower Seep Weir Staff Gauge (m)	ValveHouse Weir Staff Gauge (m)
12-Jan-01		0.31 (73.27 LPS)
23-Jan-01		0.37 (170.60 LPS)
10-Apr-01	0.16	0.38
21-May-01	0.18	0.380
1-Jun-01	0.180	0.390
4-Jun-01	0.170	0.390
21-Jun-01	0.160	0.380
25-Jun-01	0.17	0.38 (155.6 LPS)
1-Jul-01	0.160	0.45
18-Jul-01	0.170	0.45
25-Jul-01		0.45 (246.2 LPS)
6-Aug-01	0.170	0.450
27-Aug-01		0.32 (75.75 LPS)
14-Sep-01	0.170	0.250
1-Nov-01	0.17 (1 LPS)	0.46 (252.6 LPS)

all data provided by Anvil Range Mining Corp. (Interim Receivership)
log of physical inspections not reported here

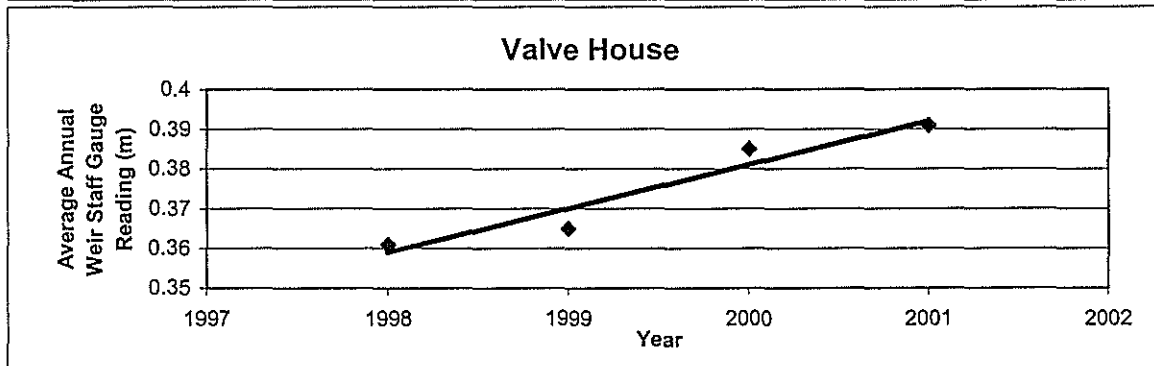
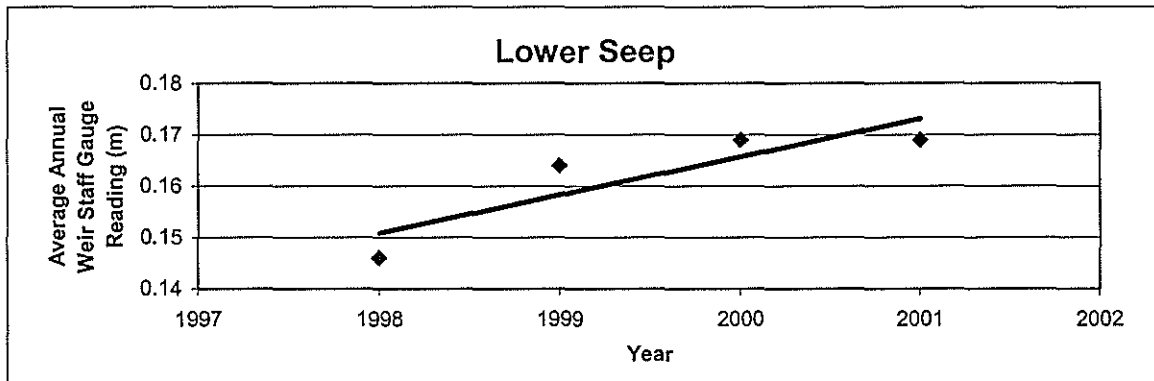


TABLE 3
TOTAL MONTHLY PRECIPITATION (mm) AT FARO AIRPORT, YUKON

Year	Jan	Feb.	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total (mm)
1978	0.4	miss.	trace	4.1	11.6	27.0	38.1	41.6	7.8	32.4	20.2	19.0	202.2
1979	8.9	18.3	20.2	6.7	10.5	68.2	55.4	13.8	13.4	11.6	12.4	34.4	273.8
1980	19.7	2.4	11.7	12.5	10.5	11.1	95.4	33.2	46.7	miss.	21.3	13.3	277.8
1981	6.5	23.1	4.0	4.5	7.8	42.8	41.3	22.5	41.9	21.5	17.0	5.4	238.3
1982	10.2	18.0	9.5	4.1	18.2	14.3	58.3	47.3	47.2	42.3	11.8	13.6	294.8
1983	35.7	6.6	9.8	2.2	20.6	55.6	49.1	65.8	21.2	16.3	11.4	3.9	298.2
1984	27.6	24.1	5.9	2.4	38.8	49.0	16.6	64.9	5.5	10.8	10.7	22.5	278.8
1985	22.5	24.8	2.2	13.8	17.2	28.1	62.6	80.8	46.3	20.0	22.2	26.1	366.6
1986	8.4	4.7	34.6	12.9	35.1	12.8	81.8	77.4	44.4	22.7	15.9	5.6	356.3
1987	3.1	14.0	2.8	10	40.1	50.8	92.4	63.5	30.2	26.6	17.8	6.2	357.5
1988	7.0	10.4	17.2	8.2	38.0	37.3	97.2	25.5	43.8	29.0	17.9	16.5	348.0
1989	19.8	3.6	19.8	2.0	17.9	41.0	51.7	16.9	30.8	46.3	39.8	13.8	303.4
1990	14.4	25.8	5.0	7.0	23.4	45.4	30.0	64.4	66.2	22.7	25.4	24.8	354.5
1991	17.2	22.6	16.6	2.8	22.4	30.2	115.4	33.0	48.2	49.6	43.4	40.0	441.4
1992	22.8	24.6	7.6	15.8	14.4	11.4	66.1	34.4	47.8	13.8	18.8	13.0	290.5
1993	22.2	15.0	1.6	6.0	76.7	48.6	50.2	56.0	50.8	35.7	miss.	miss.	362.8
1994	20.2	8.4	11.4	5.0	39.8	24.2	19.6	25.2	45.6	41.6	24.4	8.0	273.4
1995	8.4	7.8	18.4	5.2	10.9	33.9	73.4	63.4	28.8	12.2	22.3	15.4	300.1
1996	10.2	9.1	27.1	7.2	13.4	20.0	64.4	70.8	52.7	34.8	3.5	5.9	319.1
1997	6.6	8.7	1.4	14	16.5	39.3	86.4	33.2	trace	25.2	6.4	12.4	250.1
1998	7.0	2.8	4.8	4.2	14.4	29.6	19.2	24.2	23.4	24.0	4.6	8.2	166.4
1999	24.4	10.0	15.4	1.8	44.4	64.8	42.0	33.8	27.0	22.4	12.8	21.6	320.4
2000	12.2	2.0	trace	6.0	9.6	39.6	48.1	116.2	102.2	8.6	19.4	5.8	369.7
2001	7.4	3.0	4.0	14.6	30.8	35	58.4	14.2	44.6	28.6	12.2	15.4	268.2
Max	35.7	25.8	34.6	15.8	76.7	68.2	115.4	116.2	102.2	49.6	43.4	40.0	
Year	1983	1990	1986	1992	1993	1979	1991	2000	2000	1991	1991	1991	
Mean	14.3	12.1	10.5	7.2	24.3	35.8	58.9	46.8	38.2	24.9	17.2	14.6	304.7
Min	0.4	2.0	trace	1.8	7.8	11.1	16.6	13.8	trace	8.6	3.5	3.9	
Year	1978	2000	1978	1999	1981	1980	1984	1979	1997	2000	1996	1983	
St.Dev	8.8	8.4	8.9	4.5	16.1	15.9	26.2	25.6	20.5	11.6	9.6	9.5	

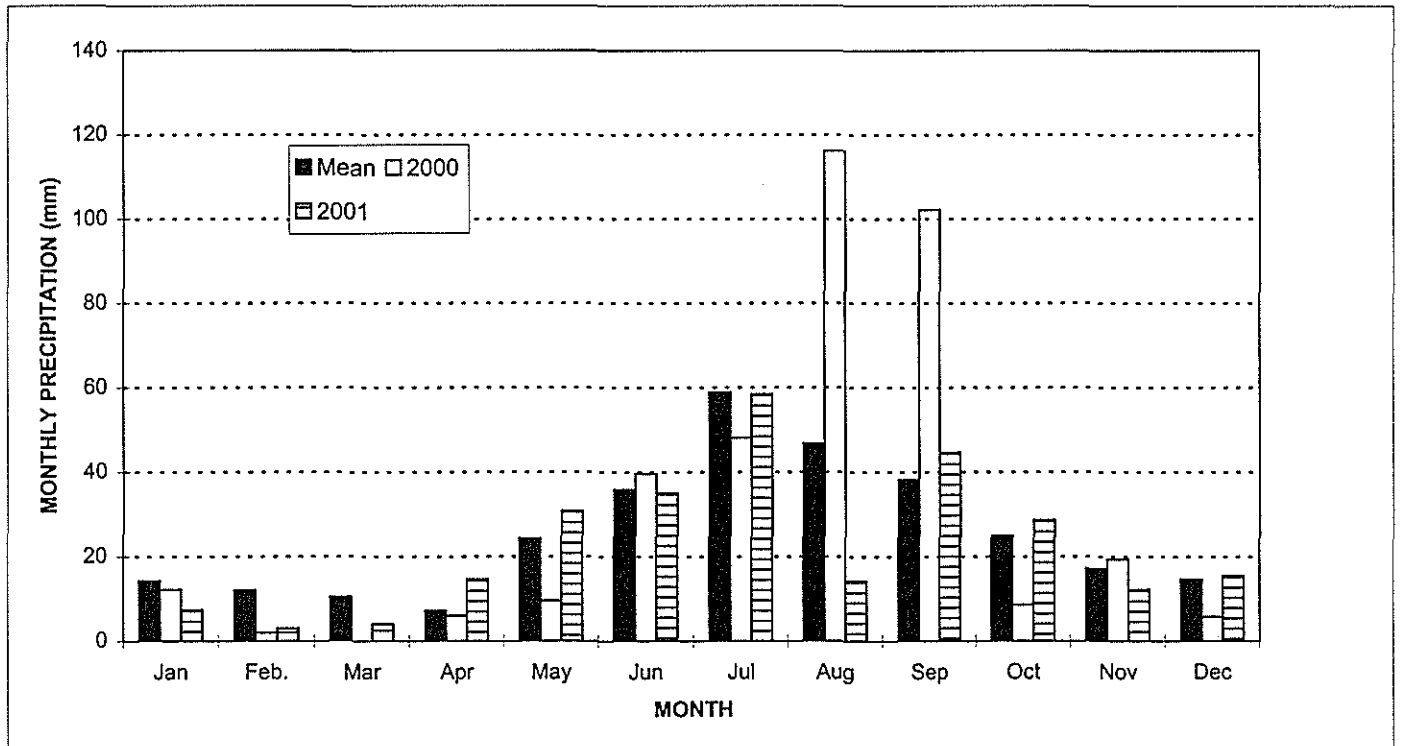


Table 4 Canal Dyke - Piezometers

Installation	Date Installed	Standpipe (S) or Pneumatic (P)	# of Readings in 2001	Ground Elevation (m advpd)	Tip Elev. (m)	Historic Low Reading/ Date	Historic High Reading/ Date	2001 Low Reading/ Date (Compared to 2000 Low)	2001 High Reading/ Date (Compared to 2000 High)	Comments
CD-13	1981	P	2	1087.6	1081.00/ 1077.00	1081.28/ May 1, 1982, 1079.87/ May 1, 1982	1083.94/ Jun 14, 2000 and Jun 8, 2001, 1083.37/ Jun 14, 2000	1083.10/ Sep 19 (-0.56), 1082.53/ Sep 19 (-0.56)	1083.94/ June 6 (0.00), 1083.16/ June 6 (-0.21)	Slight downward gradient
CD-15	1981	P	2	1087	1080.40/ 1075.60	1080.40 (dry)/ Nov 1, 1981, Dec 1, 1981 and Sep 19, 2001, 1075.61/ Dec 1, 1981	1083.55/ Oct 1, 1985, 1083.27/ Sep 19, 2000	1080.40 (dry)/ Sep 19 (- 0.35), 1079.73/ June 6 (- 2.80)	1080.82/ Jun 6 (0.00), 1081.20/ Sep 19 (-1.33)	Upward gradient
CD-19	1981	P	2	1086.3	1081.00/ 1077.30	1081.35/ May 1, 1982, 1077.30/ Sep 1, 1981	1091.43/ Jun 1, 1992, 1083.39/ Jun 1, 1992	1083.10/ June 6 (-0.35), 1077.36/ Sept 19(-0.43)	1083.66/ Sep 19 (+0.07), 1077.72/ June 6 (-0.14)	Downward gradient, likely free drainage at depth
CD-21	1981	P	2	1085.9	1079.80/ 1074.30	1080.22/ Apr 1, 1991, 1074.58/ Nov 1, 1988 and May 1, 1982 to Sep 1, 1983	1084.56/ Jun 1, 1992, 1079.81/ Jun 1, 1992	1082.29/ June 6 (-0.31), 1075.07/ June 6 (0.00)	1082.39/ Sept 19 (-0.42), 1075.21/ Sept 19 (+0.07)	Downward gradient, likely free drainage at depth
CD-26	1981	P	2	1085.5	1080.50/ 1074.30	1080.50/ Sep 1, 1995, 1074.30/ Sep 1, 1995	1082.11/ Jul 1, 1988, 1075.91/ Jul 1, 1988	1080.55/ Sep 19 (-0.30), 1075.00/ Sept 19 and June 6 (+0.14)	1080.92/ June 6 (-0.14), 1075.00/ June 6, Sept 19 (-0.14)	Downward gradient, likely free drainage at depth
BH88-7	1988	P	2	1086.3	1078.60/ 1071.40	1079.09/ Oct 1, 1988, 1071.54/Mar 1, 1989	1094.63/ Aug 7, 1998, 1081.48/ Jun 1, 1992	1089.17/ Sept 19 (-3.36), 1077.35/ June 6 (-0.45)	1090.15/ June 6 (-2.59), 1077.6/ Sept 19 (-0.50)	Downward gradient, shallow tip readings indicate artesian pressures.
BH88-11	1988	P	2	1086.2	1078.90/ 1072.30	1079.53/ Oct 1, 1988, 1073.00/ Jun 6, 2001 and Oct 1, 1988	1088.74/ Sep 11, 1999, 1080.39/ Jun 1, 1992	1081.49/ Sept 19 (-4.69), 1073.00/ June 6 (-3.71)	1081.98/ June 6 (-4.41), 1073.98/ Sept 19 (-2.73)	Downward gradient. Significant decrease in recorded pore pressures since 2000.

Note: Bold values correspond to deep tip readings

Table 5 Canal Dyke - Thermistors							
Installation	Date Installed	Length of String (m)	# of Readings in 2001	Historical Minimum Depth of Permafrost (m below surface)	Depth to Permafrost 2000 (depth below ground surface (m))	Depth to Permafrost 2001 (depth below ground surface (m))	Comments
CD-15	1981	10	2	9.5 (2001)	9.5	9.5	The data indicating subzero ground temperatures recorded at 3 m depth may be spurious. May readings indicate winter frost penetration to a depth of 4.5 m. Cooling trend indicated at depth.
CD-21	1981	13	3	3.0 (1982)	Not Observed within 13.0 m of ground surface.	Not Observed within 13.0 m of ground surface.	As expected, a completely thawed profile was present in 2001.
BH 88-7	1988	15	1	6.0	6.0	6.0	Very little warming occurring at depth, June readings indicate winter frost penetration results in a completely subzero profile below 3 m. Absence of warming casts doubt on accuracy of data and functioning performance of the instrument.
BH88-11	1988	14	1	5.75	5.75	5.75	Very little warming occurring at depth, June readings indicate winter frost penetration results in a completely subzero profile below 3 m. Absence of warming casts doubt on accuracy of data and functioning performance of the instrument. A thermister string was installed in borehole BGC01-02 to replace this installation.
BGC01-02	2001	14	3	N/A	N/A	N/A	Currently not enough data to interpret.

Table 6 Canal Dyke - Slope Inclinometers				
Installation	Date Installed	Length of Casing (m)	# of Readings in 2001	Comments
CD-10	1981	10	2	Negligible movement since 1996.
CD-15	1981	10	2	Negligible movement since 1996.
91CD-1	1991	11	2	Negligible movement since 1997.
CD-19	1988	10	2	Negligible movement since 1998. Some movement has been detected in readings recorded prior to 1998. This movement has been attributed to settlement of the dike and settlement of the SI casing in the borehole.
CD-21	1981	10	2	Negligible movement since 1998. Some movement has been detected in readings recorded prior to 1998. This movement has been attributed to settlement of the dike and settlement of the SI casing in the borehole. Indications of settlement have been observed at surface during the annual inspection since 1991.
88-10/BGC-01	2001	14	3	Installed to replace SI BH88-10. That SI was sheared off between 5 and 5.5 m depth in 2000. No movement has been recorded by this instrument since installation, but only one data set has been collected.
94CD-1	1994	14	2	Negligible movement since 1996

Table 7 Spoil Pile - Thermistors

Installation	Date Installed	Length of String (m)	# of Readings in 2001	Historical Minimum depth to Permafrost (m below ground surface)	Depth to Permafrost 2000 (m below surface)	Depth to Permafrost 2001 (m below surface)	Comments
SP-2	1981	9	1	1.3 (1981)	none	unknown	Readings taken on June 26, 2001 were recorded as "noisy". Therefore the data is invalid. Many tips not working or giving spurious data.
SP-3	1981	10	2	2.1 (1981)	none	none	Several tips not working.
SP-5	1981	10	2	2.1 (1981)	5.75	5.5	Thermal conditions slightly colder in Sept 2001 compared to Sept 2000

Table 8 Spoil Pile - Slope Inclinometers

Installation	Date Installed	Length of Casing (m)	# of Readings in 2001	Comments
SP-2	1981	10	2	Casing deformed at 7.5 m below surface.
SP-3	1981	10	1	Approximately 50 mm of displacement appears to have occurred since 1999. Displacement was likely related to settlement of soil profile and/ or the SI casing.
SP-5	1981	10	2	No movement at depth has been recorded since 1996, approximately 30 mm of cumulative displacement appears to have occurred in the upper 2 m since Sep 2000.

Table 9 Canal Backslope Thermistors

Installation	Date Installed	Length of String (m)	# of Readings in 2000	Minimum Depth to Permafrost (m below ground surface)	Depth to Permafrost 1999 (m below surface)	Depth to Permafrost 2001 (m below surface)	Comments
BS-10	1981	10	2	surface (1981)	4	5	Geothermal conditions observed in Dec. 99 and Aug. 01 appear to be similar. Readings taken on July 13, 2001 were reported as "noisy". Therefore the data is regarded as invalid for that date.

Table 10 Back Slope - Slope Inclinedometers				
Installation	Date Installed	Length of Casing (m)	# of Readings in 2001	Comments
BS-9	1981	10.5	1	Negligible movement since 1997.
BS-10	1981	10.5	1	Possible movement zone at 9.5 m depth. Approximately 10 mm cumulative deflection occurred up to 1999. Negligible movement has occurred since that time.
BS-18	1981	10.5	0	Top of SI casing was damaged in 2001. Negligible movement was recorded between 1997 and 2000.

Table 11 Cross Valley Dam - Piezometers

Installation	Date Installed	Standpipe (S) or Pneumatic (P)	# of Readings In 2001	Ground Elevation (m)	Tip Elev. (m)	Historic Low Reading/ Date	Historic High Reading/ Date	2001 Low Reading/ Date (Compared to 2000 Low)	2001 High Reading/ Date (Compared to 2000 High)	Comments
CVDC-4	1981	S	32	1065.5	1040.2/ 1032	1048.92/ Apr 1, 1984	1051.25/ Jun 1, 1992	1050.8/ Oct 22, 25 and 29 (-0.10)	1050.96/ Sep 14 (-0.09)	Shallow Piezo blocked 7.6 m below top of pipe.
CVDC-7	1981	S	32	1065.7	1040.1/ 1035.2	1047.51/ Apr 1, 1984, 1049.57/ Apr 1, 1984	1048.60/ Sep 1, 1992, 1051.51 June 1, 1992	1047.92/ Dec 26 (-0.22), 1050.30/Dec 26 (+0.14)	1048.13/ Sep 14 (-0.15), 1050.80 Sep 14 (-0.20)	Upward gradient.
CVDC-9	1981	S	32	1065.6	1040/ 1033	1052.21/ Aug 1, 1983, 1053.48/ Jun 1, 1984	1057.04/ Aug 1, 1982, 1057.91/ Jun 1, 1992	1053.2/ Dec 26 (-0.89), 1055.32/ Dec 26 (-1.19)	1054.17/ Sep 14 (-0.29), 1056.22/ Jun 10 (-0.74)	Slight upward gradient.
CVDP-3	1982	P	20	1063	1047.01	1047.29/ Sep 1, 1992	1050.37/ May 1, 1991	1049.18/ Oct 29, Nov 5 and Nov 6 (-0.15)	1049.53 Oct 6 (0.00)	Currently broken, may be able to fix in spring.
CVDP-6	1982	P	30	1063	1046.67	1049.29/ May 27, 1998	1051.29/ Sep 1, 1992	1049.75/ Dec 15 (-0.21)	1050.1/ Jun 10, Sep 14 and Nov 30 (-0.21)	2001 low related to reservoir lowering activities in December 2001.
CVDT-1	unknown	S	32	1050.0	1040.2	1049.43/ May 31, 1994	1050.63/ Jun 3, 1999	1049.69 (Frozen) (+0.03)	1049.73/ Sep 14 (-0.06)	Readings post October 2001 questionable due to water in standpipe freezing.
CVDT-2	unknown	S	32	1051.8	1038.5	1048.34/ Dec 26, 2001	1048.79/ Oct 6, 1999	1048.34/ Dec 26 (-0.28)	1048.61/ Sep 14 (-0.18)	2001 low related to reservoir lowering activities in December 2001.
BH94CVDC-1	1994	S	32	1065.5	1052.7	1055.21/ May 7, 1997	1056.88/ Sep 1, 1995	1055.55/ Dec 19 (-0.27)	1056.12/ Sep 14 (-0.24)	2001 low related to reservoir lowering activities in December 2001.

Note: Bold values correspond to deep tip readings

Table 12 2001 Cross Valley Dam Weir Flows

DATE	X13 (comb.) FLOW* (Lps)	X11 (North) FLOW** (Lps)	X12 (South) FLOW*** (Lps)	W3 (Central) FLOW** (Lps)	X13-(X11+X12+W3) FLOW (Lps)
13-Jan-01	35	24	1	12	-2
10-Feb-01	35	24	1	12	-2
1-Mar-01	47	22	1	10	14
10-Mar-01	47	22	1	10	14
15-Mar-01	49	22	1	10	16
27-Mar-01	49	22	1	10	16
5-Apr-01	48	22	1	10	15
11-Apr-01	48	22	1	10	15
16-Apr-01	49	22	1	10	16
23-Apr-01	49	22	1	10	16
30-Apr-01	49	22	1	10	16
8-May-01	49	22	1	10	16
14-May-01	48	22	1	10	15
23-May-01	48	22	1	10	15
30-May-01	48	22	1	10	15
8-Jun-01	49	22	1	11	16
14-Jun-01	49	22	1	11	16
17-Jun-01	49	22	1	11	16
21-Jun-01	49	22	1	11	16
29-Jun-01	49	22	1	11	16
6-Jul-01	49	24	1	12	12
14-Jul-01	49	24	1	12	12
20-Jul-01	49	24	1	12	12
27-Jul-01	49	24	1	12	12
31-Jul-01	49	24	1	12	12
6-Aug-01	49	24	1	12	12
14-Aug-01	49	24	1	12	12
21-Aug-01	49	24	1	12	12
27-Aug-01	49	24	1	12	12
4-Sep-01	49	24	1	12	12
12-Sep-01	49	24	1	12	12
17-Sep-01	49	24	1	12	12
24-Sep-01	49	24	1	12	12
1-Oct-01	49	24	1	12	12
10-Oct-01	49	24	1	12	12
15-Oct-01	49	24	1	12	12
23-Oct-01	47	24	1	11	11
30-Oct-01	47	24	1	11	11
7-Nov-01	47	24	1	11	11
13-Nov-01	47	24	1	11	11
22-Nov-01	47	24	1	11	11
27-Nov-01	47	24	1	11	11
8-Dec-01	47	24	1	11	11
14-Dec-01	47	24	1	11	11
20-Dec-01	47	24	1	11	11
28-Dec-01	47	24	1	11	11

* flows calculated from stage-discharge curve and occassional spot measurements.
 **flows calculated from standard V-Notch weir formula applied to staff gauge readings.
 ***flow estimated by by bucket/timer method.
 The difference of flow at X13 less (X11+X12+W3) is unaccounted for.

2001 Cross Valley Dam Seepage Weir Flows

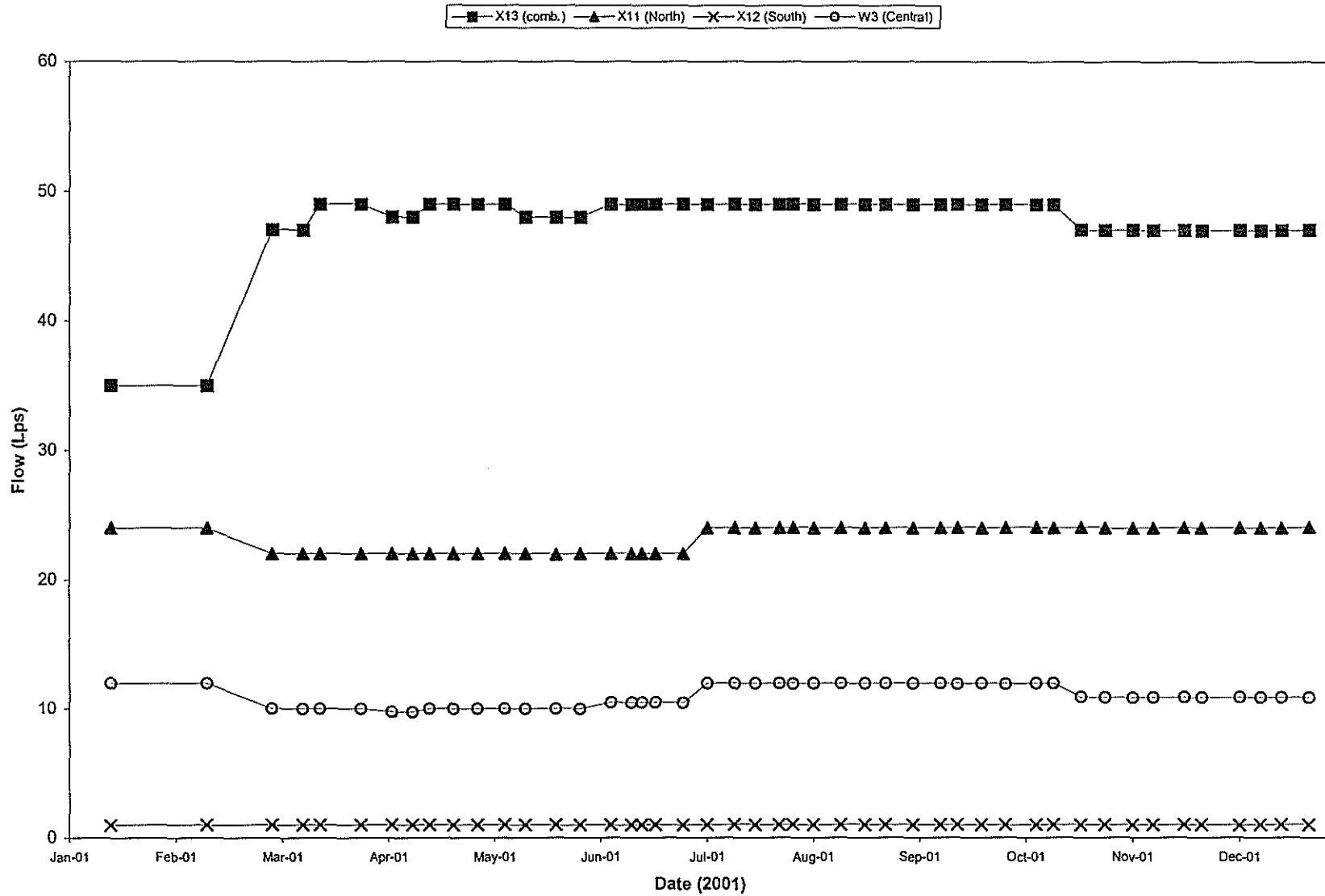


Table 13
CROSS VALLEY DAM SEEPAGE FLOWS - WEIR X13 (1982 - 2001)

YEAR	MEAN POND ELEVATION (m asl)	MINIMUM FLOW RATE (month recorded) (L/s)	MAXIMUM FLOW RATE (month recorded) (L/s)	AVERAGE YEARLY FLOW RATE (L/s)
1982	1058.55	75.9 (Sept)	277.6 (June)	115.3
1984	1059.85	67.8 (Oct)	84.9 (Dec)	76.3
1985	1061.99	83.9 (Sept - Dec)	113.6 (Jul)	93.2
1986	1063.2	79.8 (May)	113.2 (Sept)	93.8
1987	~1063.2	77.0 (May)	106.1 (Aug - Sept)	94.4
1988	~1063.2	78.9 (Jun)	110.4 (Aug)	95.5
1989	~1063.2	72.3 (Mar)	97.9 (Aug)	85.7
1990	~1063.2	64.9 (Mar)	102.9 (Sept)	82.8
1991	~1063.2	66.6 (Oct)	91.0 (Jun)	81.6
1992	N/A	53.8 (Nov)	90.8	68.4
1995	1063.5	29.1 (Dec)	52.8 (Jun)	50.2
1996	1062.2(Sept)	15.8 (Apr)	58.3 (Sep)	34.8
1997	N/A	30.0 (Apr)	109.9 (Sep)	28.6
1998	1062.8	49.0 (Dec)	119.0 (Sep)	52.7
1999	1063	44.0 (Feb and Sep)	82.0 (July)	53.58
2000	1063.8	35.0 (Nov 18)	78.0 (June 26)	48.65
2001		35.0 (Jan and Feb)	49 (Jun to Sep)	48

- Notes:
1. For locations of weirs see Figure 1.
 2. Flows for 1983, 1984 and 1985 based on records for period June to December
 3. High flow through Weir 3 in June, 1982 due to siphon discharge above weir.
 4. Weir 3 was replaced by X13 as a consequence of the seepage filter construction conducted in the summer of 1991.
 5. Drainage from west of south abutment road crossed to berm drainage collector during 1995 and perhaps in 1996; therefore some readings may higher than expected.

Table 14 Cross Valley Dam - Thermistors							
Installation	Date Installed	Length of String (m)	# of Readings in 2001	Historical Minimum Depth to Permafrost (m below ground surface)	Depth to Permafrost 2000 (m below ground surface)	Depth to Permafrost 2001 (m below ground surface)	Comments
CVDC-6	1981	29	4	none	none	none	Thawed profile, Temp = -0.12 degrees at 29 m depth Oct. 2001, bad tip at 21 m depth. The slight cooling trend occurring at depth and noted in the 2000 annual report continued in 2001. Readings taken on Oct. 16, 2001 were likely invalid.
CVDC-11	1981	15	3	2.9 (1981)	none	none	Winter frost penetration to 6 m, similar to 2000. Thawed profile, Temp = 3.57 degrees at 15 m depth Sept 2001, bad tip at 9 m depth.
88-4-4T	1988	4	3	none	none	none	Depth of winter frost = 4 m, similar to 2000.

Table 15 Intermediate Dam - Piezometers

Installation	Date Installed	Standpipe (S) or Pneumatic (P)	# of Readings in 2001	Ground Elevation (m)	Tip Elev. (m)	Historic Low Reading/ Date	Historic High Reading/ Date	2001 Low Reading/ Date (Compared to 2000)	2001 High Reading/ Date (Compared to 2000)	Comments
91-ID3	1991	P	2	1085.45	1078.45/ 1070.25	1078.45/ Sep 1, 1995, Dec 16, 1998 and Sep 9, 2000, 1074.66/ Dec 16, 1998	1080.86/ Jun 1, 1992, 1079.67/ Jun 1, 1992	1078.46/ Sep 20 (+0.007), 1075.99/ Sep 20 (-0.91)	1078.52/ Jun 10 (+0.06), 1077.46 Jun 10 (-0.08)	Downward gradient. Upper 7 m drained, continues trend since 1998 of becoming less variable over the year.
91-ID4	1991	P	2	1064.1	1056.52/ 1049.38	1060.93/ May 7, 1997, 1060.72/ Sep 16, 1999	1066.88/ Jun 1, 1992, 1064.15/ Sep 1, 1992	1063.17/ Jun 10 (-0.21), 1062.05/ Jun 10 (-0.07)	1063.31/ Sep 20 (-0.56), 1062.12/ Sep 20 (-0.63)	Downward gradient, continues trend of becoming less variable over the year.
91-ID5	1991	P	1	1064	1056.60/ 1049.38					Both tips are leaking making the instrument inoperable.
91-ID6	1991	P	2	1064.2	1057.10/ 1049.20	1059.13/ May 7, 1997, 1061.52/ Sep 16, 1999	1064.04/ Jun 1, 1992, 1067.26/ Jun 1, 1992	1061.86/ Jun 10 (0.00), 1062.85/ Jun 10 (-0.14)	1062.00/ Sep 20 (-0.49), 1062.99/ Sep 20 (-0.497)	Upward gradient, continues trend of becoming less variable over the year.
91-ID7	1991	P	2	1065.75	1058.25	1061.82/ May 7, 1997	1067.50/ Feb 1, 1992	1063.92/ Sep 20 (+0.42)	1063.99/ Jun 10 (-0.49)	Continues trend of becoming less variable over the year.
94-IDC-1	1993	S	2	unknown						Has recorded dry well since initial monitoring in 1994, 2000 monitoring noted the bottom of the casing to be wet.
P96-1,2,3 and 4	1996	S	2 to 3	1049 m at crest, 1031.5 m at toe	various					Fall 2000 levels 0.5 m to 0.8 m higher than Fall 1999 readings, likely related to higher pond levels.

Note: Bold values correspond to deep piezometer tips

Table 16 Fresh Water Supply Dam - Piezometers

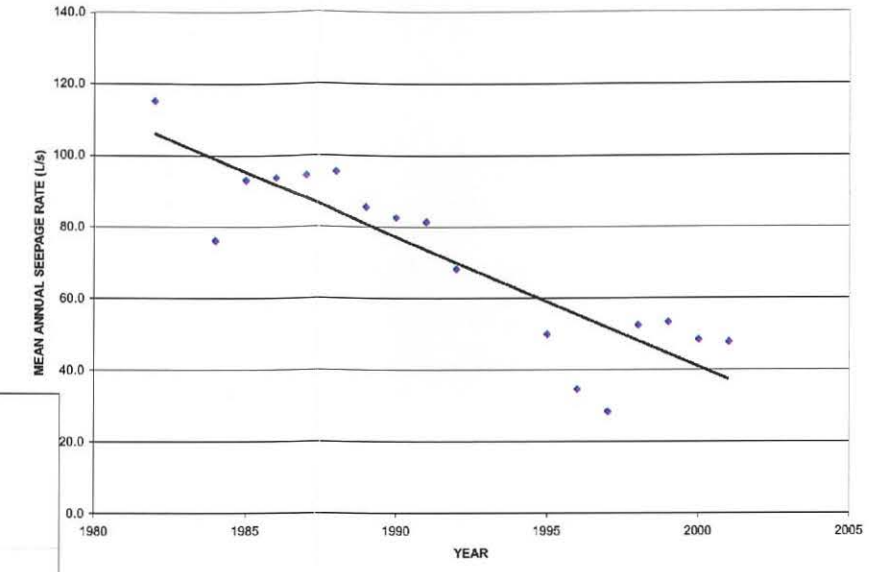
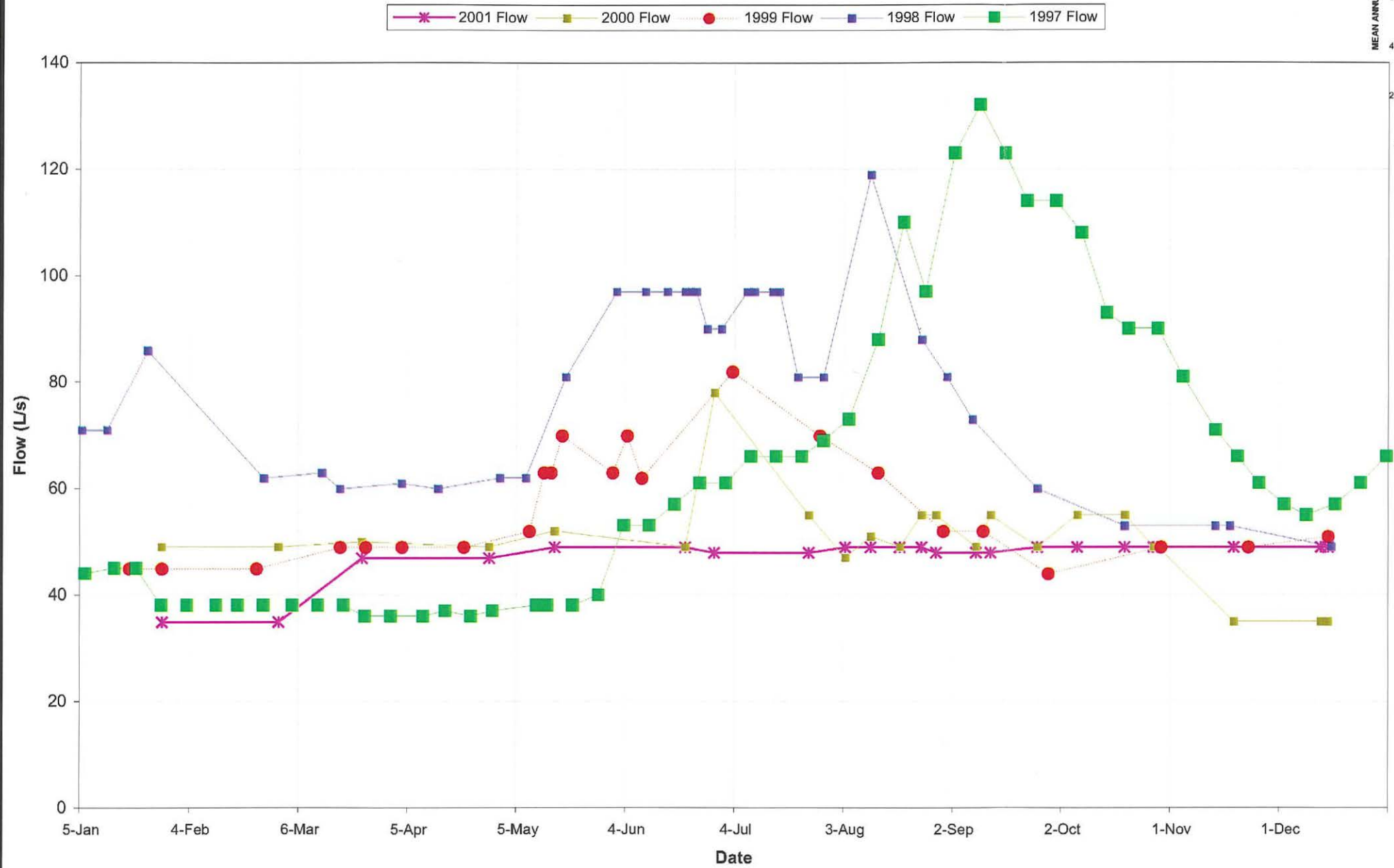
Installation	Date Installed	Standpipe (S) or Pneumatic (P)	# of Readings In 2001	Ground Elevation (m)	Tip Elev. (m)	Historic Low Reading/ Date	Historic High Reading/ Date	2001 Low Reading/ Date (Compared to 2000)	2001 High Reading/ Date (Compared to 2000)	Comments
BH85-1	1985	H	30	1079.32 (based on 2001 survey)	1072.04	1076.33/ June 8, 2000	1081.42 (Artesian pore pressure) Sep 85, Oct 87, Oct 88, Aug 89, May 90, Jun 90, Jul 90 Jun 91 and Sep 91	1078.08/ June 6 (+1.75)	1079.186/ Nov 12 to Dec 28 (-0.154)	The piezometric elevation is within 0.1 m of ground surface.
BH85-2	1985	H	30	1086.674 (after 1989 berm construction)	1078.75	1082.54/ Oct 1, 1987	1085.36/ Sept 1, 1992	1083.965/ Nov 6 (-0.045)	1085.13/ Nov 12 (-0.18)	Piezometric elevation dropped by 1.03 m in response to lowering of the pond.
BH85-3	1985	H	30	1087.802 (after 1989 berm construction)	1083.68	1085.01/ Mar 1, 1990	1086.13/ Jul 1, 1990	1085.446/ Nov 6 (-0.384)	1085.97/ Jun 6 (+0.01)	Little variation over the year. No change in piezometric levels in response to lowering of the pond.
BH85-4	1985	H	30	1099.347 (based on 2001 survey)	1089.2	1090.92/ May 7, 1997	1092.99/ Dec 3, 1996	1091.50/ Dec 26 (-0.54)	1092.27/ Oct 29 (-0.64)	Piezometric elevation dropped 0.6 m in response to lowering of the pond.
BH85-5	1985	H	30	1099.217 (based on 2001 survey)	1087.31	1087.93/ May 7, 1997	1093.28/ Jun 1, 1991	1088.59/ Dec 26 and Dec 31 (-0.09)	1089.56/ Oct 16 (-0.80)	Piezometric elevation dropped 0.68 m in response to lowering of the pond.
BH85-6	1985	H	30	1087.164 (after 1989 berm construction)	1078.26	1083.88/ Oct 1, 1988	1085.35/ Sept 28, 2000	1084.32/ Sep 14 (-0.57)	1085.219/ Oct 9 (-0.131)	Piezometric elevation dropped 0.22 m in response to lowering of the pond.
BH88-15	1988	P	30	1099.42 (based on 2001 survey)	1094.20/ 1087.00/ 1079.30	1094.21/ Dec 3 to Dec 28, 2001 1087.00/ Sep 1, 1995 1087.46/ Dec 1, 1990	1098.44/ Jun 1, 1992 1090.64/ Jun 1, 1992 1094.11/ Jun 1, 1992	1094.21/ Dec 3 to Dec 28 (-0.69) 1087.035/ Dec 26 (-0.315) 1089.73/ Dec 28 to Dec 31 (-1.33)	1096.37/ Sept 14 (-0.35) 1087.63/ Sep 14 (0.00) 1091.417/ Sep 25 (0.00)	Downward gradient within the dam. High pore pressures continue to exist within foundation. Shallow tip recorded a 0.68 m drop in piezometric level, intermediate tip recorded no change and the deep tip recorded a 1.54 m drop in piezometric level in response to lowering of the pond.
BH88-16	1988	P	30	1089.61	1079.40/ 1074.80	1083.03/ May 27, 1998 1085.72/ Mar 1, 1990	1085.56/ Jun 1, 1992 1089.36/ Jun 1, 1992	1083.04/ Nov 5 and 6 (-0.14) 1085.93/ Dec 31 (-0.98)	1083.39/ Sep 25, Dec 14 and Dec 17 (0.00) 1087.12/ Jun 10 (+0.07)	Upward gradient within berm and foundation. Shallow tip recorded no change while the deep tip recorded a 0.84 m drop in piezometric level in response to lowering of the pond.

Table 17 Fresh Water Supply Dam - Thermistors

Installation	Date Installed	Length of String (m)	# of Readings in 2001	Permafrost Interval 2000 (m below surface)	Permafrost Interval 2001 (m below surface)	Comments
BH 85-5	1985	8	9	none	none	Depth of winter frost penetration was 3.5 m.

FIGURES

ANNUAL FLOW AT X13 (L/s)



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SCALE: N/A
 DATE: Feb. 2002
 DRAWN: GKC
 DESIGNED: GKC
 CHECKED: JWC
 APPROVED: JWC



CLIENT: **Deloitte & Touche**

PROJECT: 2001 Annual Geotechnical Performance Evaluation

TITLE: Annual Seepage Flows at Weir X13

PROJECT No. 0257-005-04

FIGURE No. Figure 3
 REV. 0.

REV.	DATE	REVISION	DRAWN	CHECKED	APPROVED

CLIENT:

Deloitte & Touche

LEGEND:

 PIEZOMETER

NOTE:

1. SURVEY COMPLETED BY YUKON ENGINEERING SERVICES 2001 & 2002
2. ELEVATIONS ARE GEODETIC
3. CONTOUR INTERVAL = .5m
4. COORDINATES ARE UTM NAD83 DERIVED FROM 72Y237 LOCATED ALONG THE CAMPBELL HIGHWAY

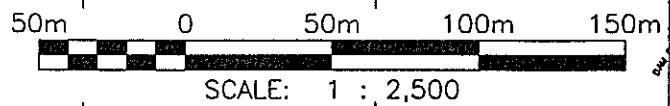
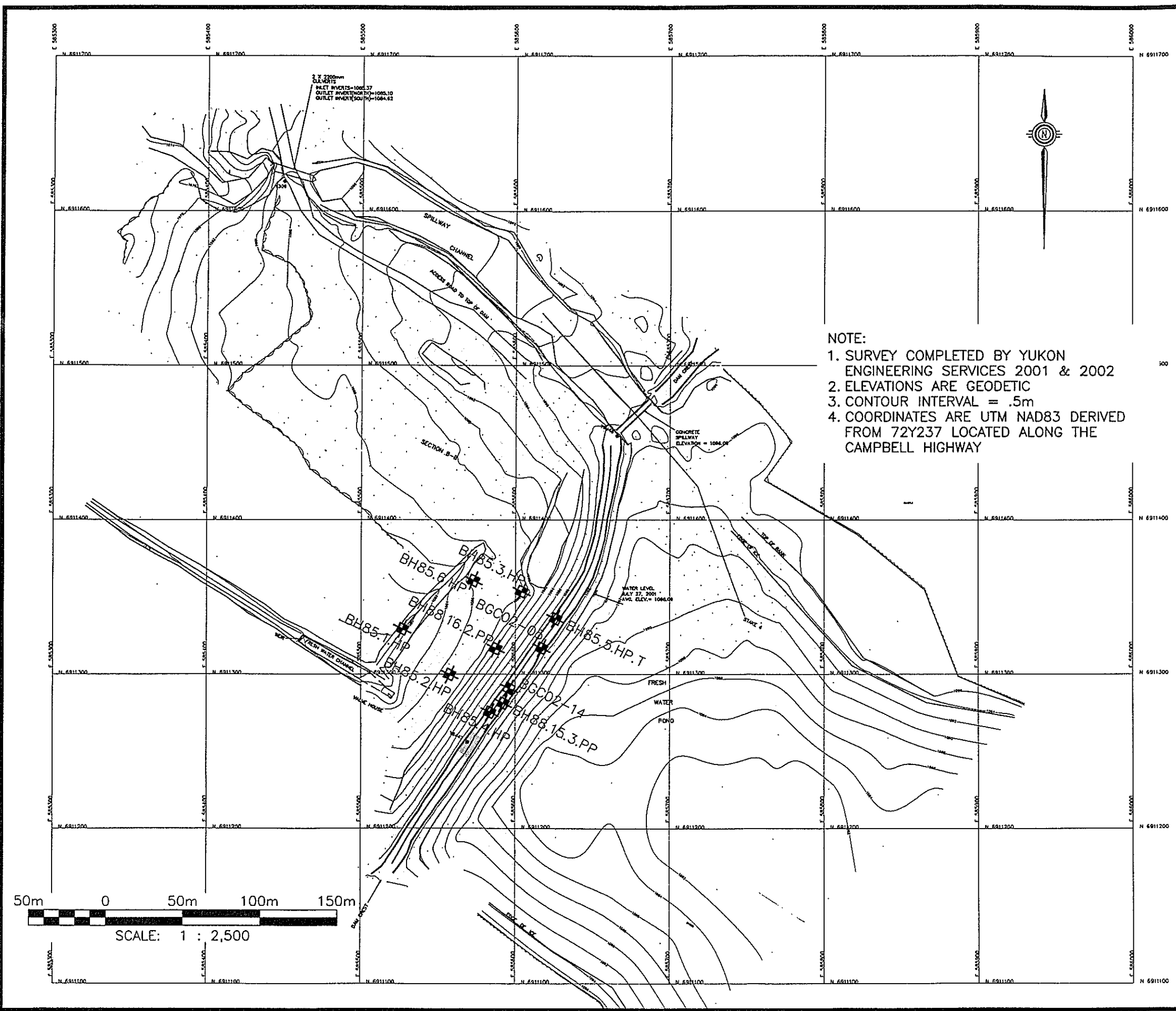
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REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED

SCALE:	AS SHOWN
DATE:	FEBRUARY 2002
DRAWN:	GEJ
DESIGNED:	GC
CHECKED:	JWC
APPROVED:	JWC

PROJECT ANNUAL GEOTECHNICAL INSPECTION OF FARO MINE		
TITLE FRESH WATER SUPPLY DAM SITE PLAN		
PROJECT No. 0257-005-04	DWG. No. FIGURE 4	REV. 0

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
BGC Calgary, AB Phone: (403) 250 5185

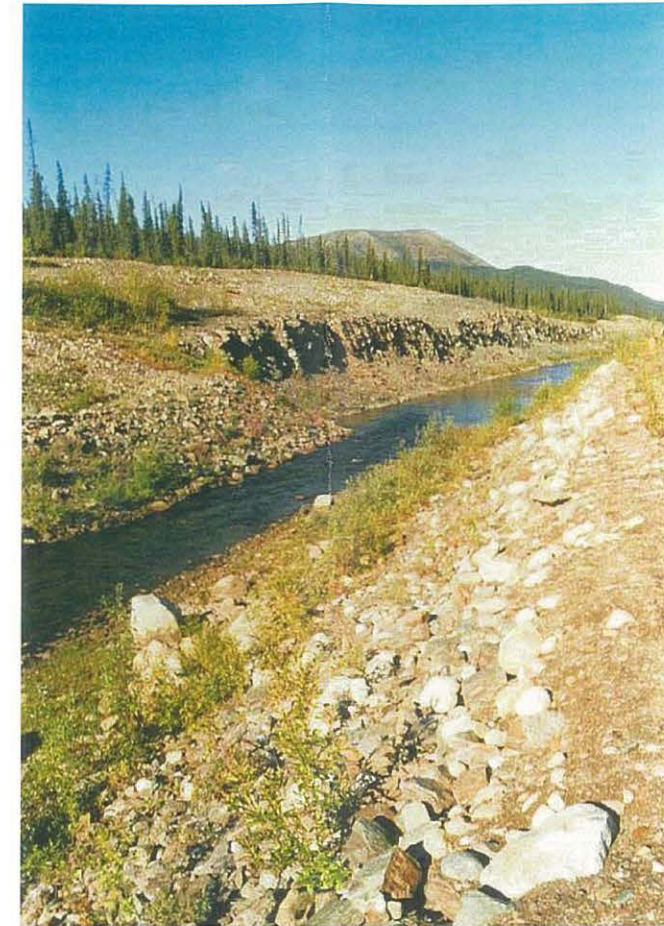




Area of settlement on the crest of the canal dike approximately 50 m west of CD-20. Magnitude of settlement estimated at 0.4m to 0.5 m.



Crest of canal dike looking west as seen from installation CD-18. Note the undulations in the crest.



View of the invert and side slopes of the canal dike.

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SCALE: N/A
 DATE: Feb. 2002
 DRAWN: GKC
 DESIGNED: GKC
 CHECKED: JWC
 APPROVED: JWC

BGC ENGINEERING INC.
 AN APPLIED EARTH SCIENCES COMPANY
 Calgary, AB Phone (403) 250-5185

PROJECT 2001 Annual Geotechnical Inspection of Various Facilities at Faro Mine

TITLE Diversion Canal Dike Inspection Photos

CLIENT: **Deloitte & Touche**

PROJECT No. 0257-005-04

FIGURE No. Figure 5

REV. 0.

REV.	DATE	REVISION	DRAWN	CHECKED	APPROVED



Above:
Transverse crack in crest of canal dike near installation CD-21.

Below:
A slight pot hole depression and some standing water situated approximately 50 m west of CD-13.



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DRAWN: GKC	APPROVED: JWC



PROJECT: 2001 Annual Geotechnical Inspection of Various Facilities at Faro Mine

TITLE: Diversion Canal Dike Inspection Photos

CLIENT: **Deloitte & Touche**

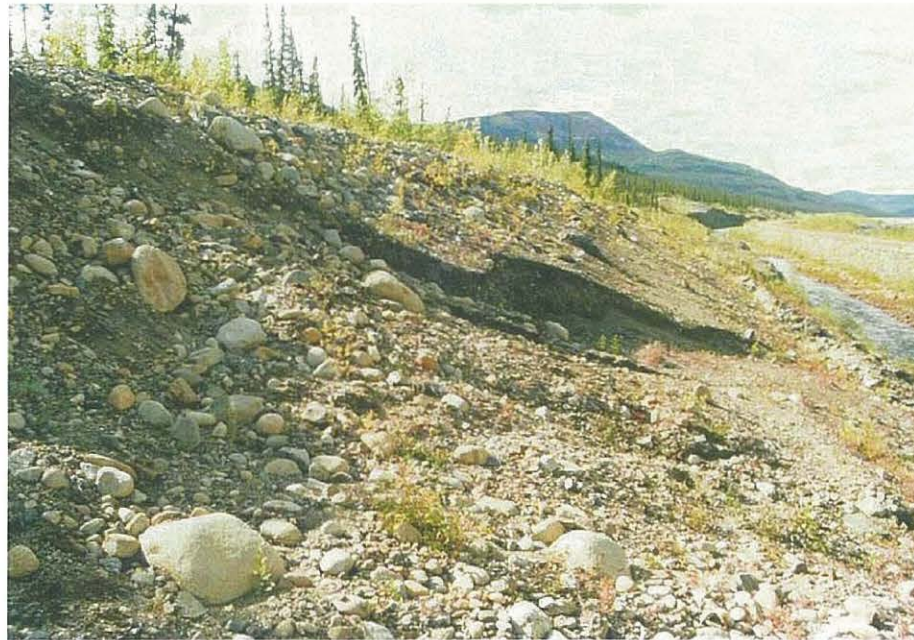
PROJECT No. 0257-005-04	DWG No. Figure 6	REV. 0.
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**Frontal view of failure in canal dike back slope.
Located at the entrance to the diversion canal.**



**View of the face of the back slope of the canal dike.
Note the surficial erosion of the face.
Location is proximal to the old slide area at 2+000.**



**Cross sectional view of failure in canal dike back slope.
Located at the entrance to the diversion canal.**

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SCALE: N/A
 DATE: Feb. 2002
 DRAWN: GKC
 DESIGNED: GKC
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PROJECT 2001 Annual Geotechnical Inspection of Various Facilities at Faro Mine

TITLE Diversion Canal Back Slope Inspection Photos

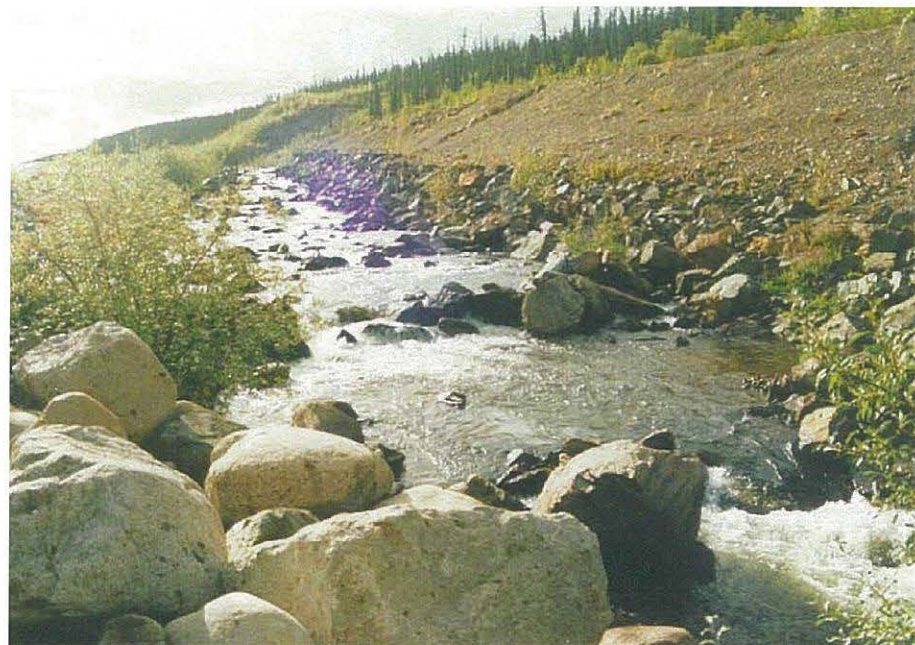


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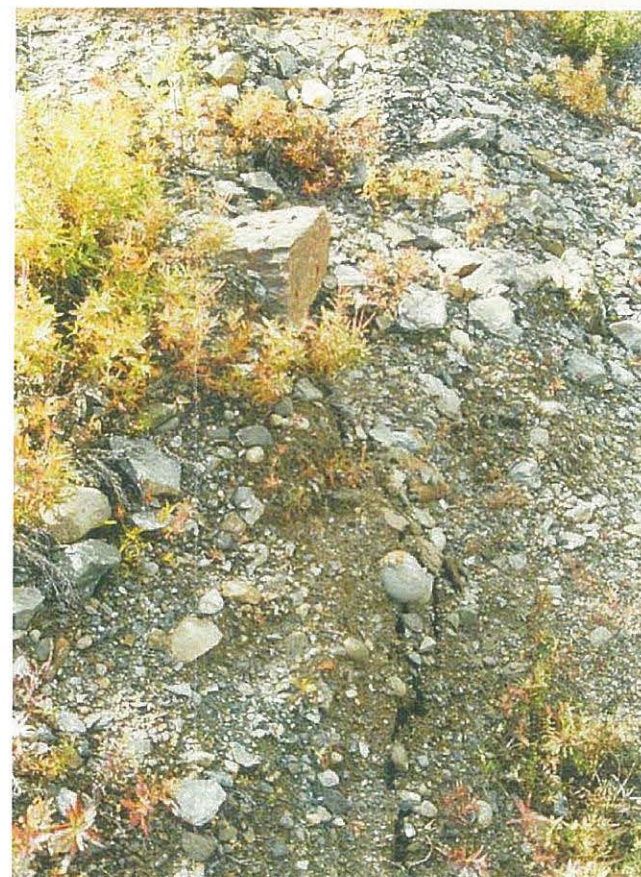
FIGURE No. Figure 7

REV. 0.

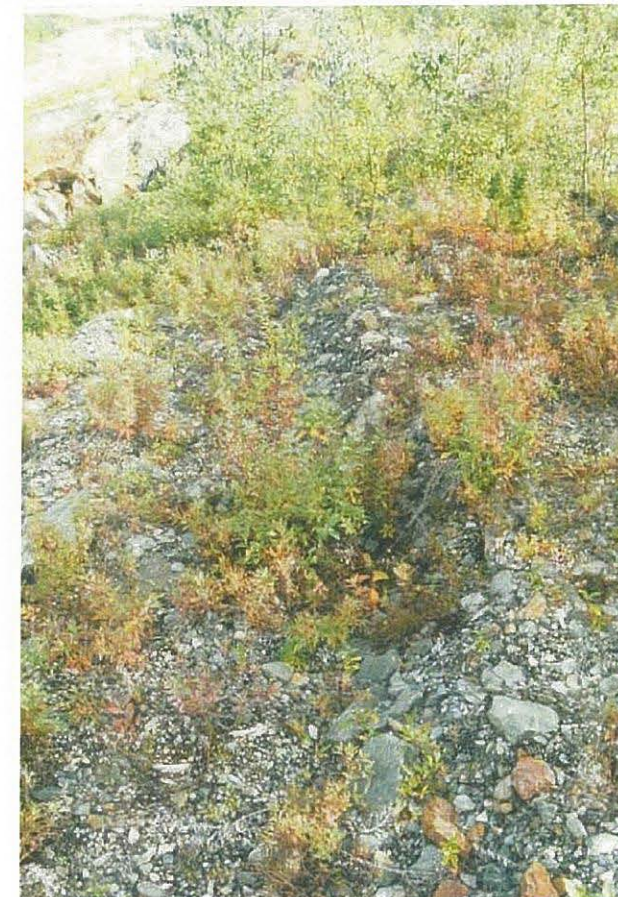
REV.	DATE	REVISION	DRAWN	CHECKED	APPROVED



**View of diversion canal and face of the back slope of the canal dike.
Note that the rip rap appears to be in good
condition in the bottom of the canal.**



**View of tension crack that has
developed in the back slope of the canal dike.**



**View of a tension crack in the back slope
of the canal dike.**

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CLIENT: **Deloitte & Touche**

PROJECT: 2001 Annual Geotechnical Inspection of Various Facilities at Faro Mine

TITLE: Diversion Canal Dike Back Slope Inspection Photos

PROJECT No. 0257-005-04

FIGURE No. Figure 8

REV. 0.

REV.	DATE	REVISION	DRAWN	CHECKED	APPROVED



View of outlet side of culverts used to pass water beneath the access road to the Cross Valley Dam which crosses the channel. Note the disturbance to the protective rip rap.



View looking downstream at the channel outflow section adjacent to the Cross Valley Dam. Note the apparent equal elevation of the top of the road on the left and right side of the channel.



View of the discharge coming down the channel below the Cross Valley Dam.



View of the downstream end of the two culverts which run under the main access road and drain into the outfall section of the North Valley Interceptor Ditch.

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 TITLE: North Valley Wall Interceptor Ditch Inspection Photos

CLIENT: **Deloitte & Touche**

PROJECT No. 0257-005-04

FIGURE No. Figure 9

REV. 0.

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View of Faro Pit. Note failing area in upper right portion of photo.



View of Faro Pit. Note failing area in upper right portion of photo.



View from top of failing area of pit.

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 TITLE: Faro Pit Inspection Photos

CLIENT: **Deloitte & Touche**

PROJECT No. 0257-005-04

FIGURE No. Figure 10

REV. 0.

REV.	DATE	REVISION	DRAWN	CHECKED	APPROVED



**View of the Faro Creek Diversion Channel above the Faro Pit.
Note the poor state of the blue channel liner.**



**View of the Faro Creek Diversion Channel.
Note the state of the half culvert channel liner.**



View of the Faro Creek Diversion Channel.

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 TITLE: Faro Creek Diversion Channel Inspection Photos

CLIENT: **Deloitte & Touche**

PROJECT No. 0257-005-04

FIGURE No. Figure 11

REV. 0.

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View of entrance to spillway of the Cross Valley Dam.



View of the pilot channel adjacent to the Cross Valley Dam Spillway.



View of the bottom of the emergency spillway of the Cross Valley Dam.



View of the exposed portion of the upstream face of the Cross Valley Dam.

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PROJECT No. 0257-005-04

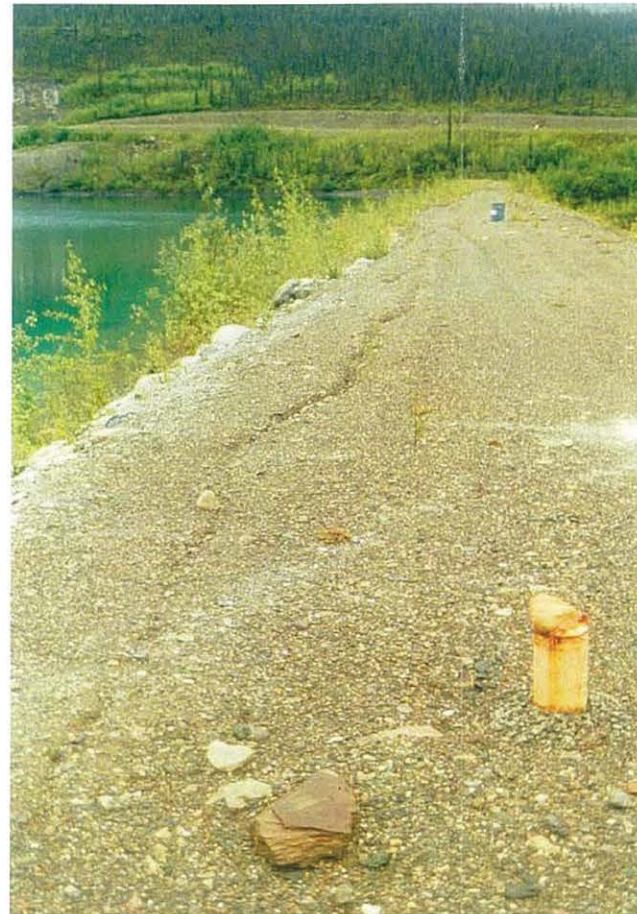
FIGURE No. Figure 12

REV. 0.

REV.	DATE	REVISION	DRAWN	CHECKED	APPROVED



View of settlement trough in crest of Cross Valley Dam.



View of settlement trough in crest of Cross Valley Dam near thermistor 88-5.



View of crest of Cross Valley Dam looking towards the south abutment.

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 TITLE: Cross Valley Dam Inspection Photos



PROJECT No. 0257-005-04

FIGURE No. Figure 13

REV. 0.

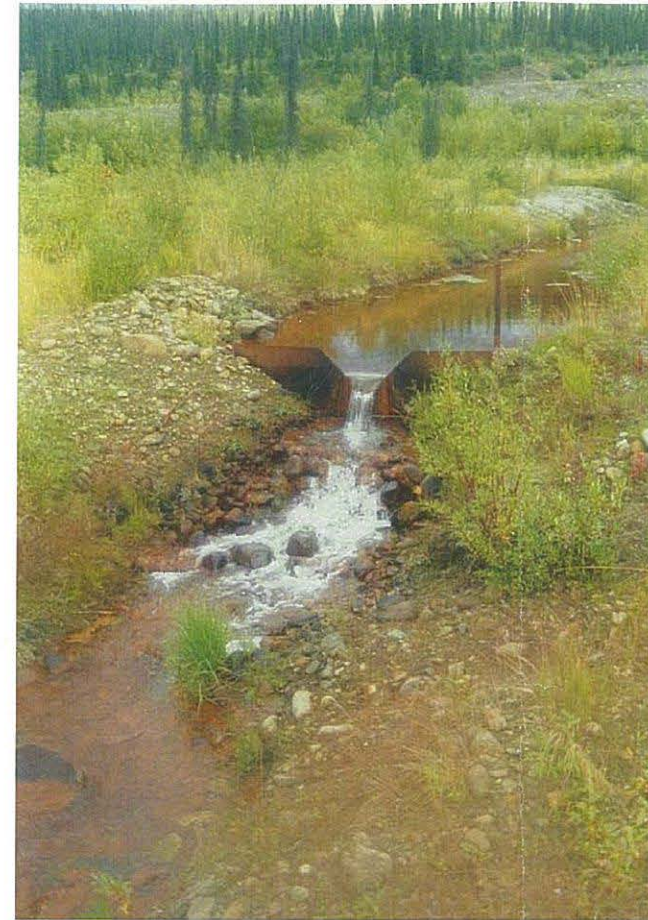
REV.	DATE	REVISION	DRAWN	CHECKED	APPROVED



Downstream face of Cross Valley Dam looking towards the south abutment.



Downstream face of Cross Valley Dam looking towards the south abutment.



View of the flow emerging from the V notch weir in the seepage collection trench at the toe of the Cross Valley Dam.

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FIGURE No. Figure 14

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Small berm at entrance of the Intermediate Dam spillway.



Intermediate Dam Pond staff gauge.

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TITLE:

Intermediate Dam Inspection Photos

CLIENT:

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PROJECT No.

0257-005-04

DWG No.

Figure 15

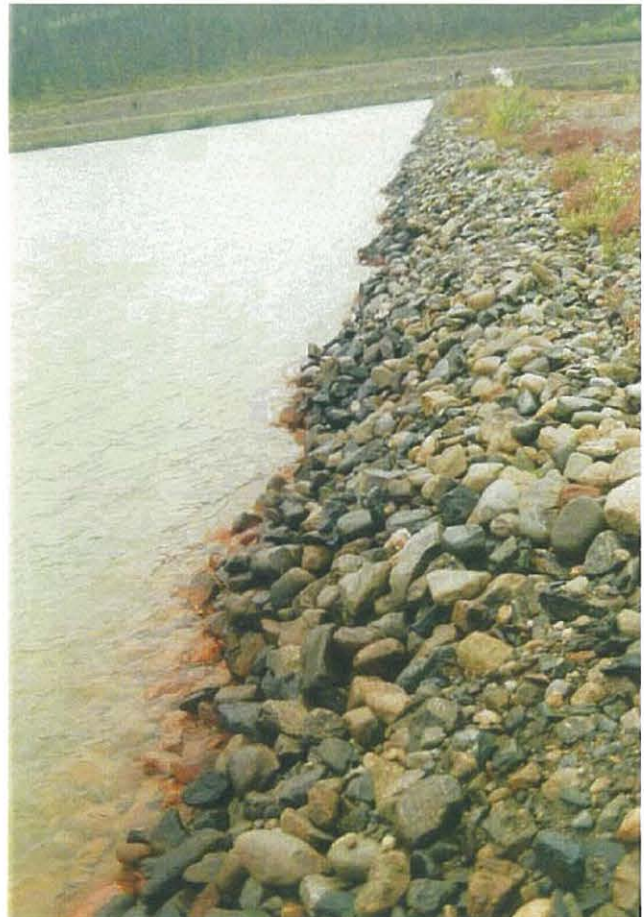
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Above:
Tension crack near centreline
of Intermediate Dam.

Below:
View of rip rap on upstream face
of Intermediate Dam.



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Various Facilities at Faro Mine

TITLE:

Intermediate Dam Inspection Photos

CLIENT:

**Deloitte
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PROJECT No.

0257-005-04

DWG No.

Figure 16

REV.

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View of a bulge on the face of the Intermediate Dam.



Downstream face of the Intermediate Dam.



Debris cone at the base of an erosional rill located on the downstream face of the Intermediate Dam.

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TITLE Intermediate Dam Inspection Photos

PROJECT No. 0257-005-04

FIGURE No. Figure 17

REV. 0.

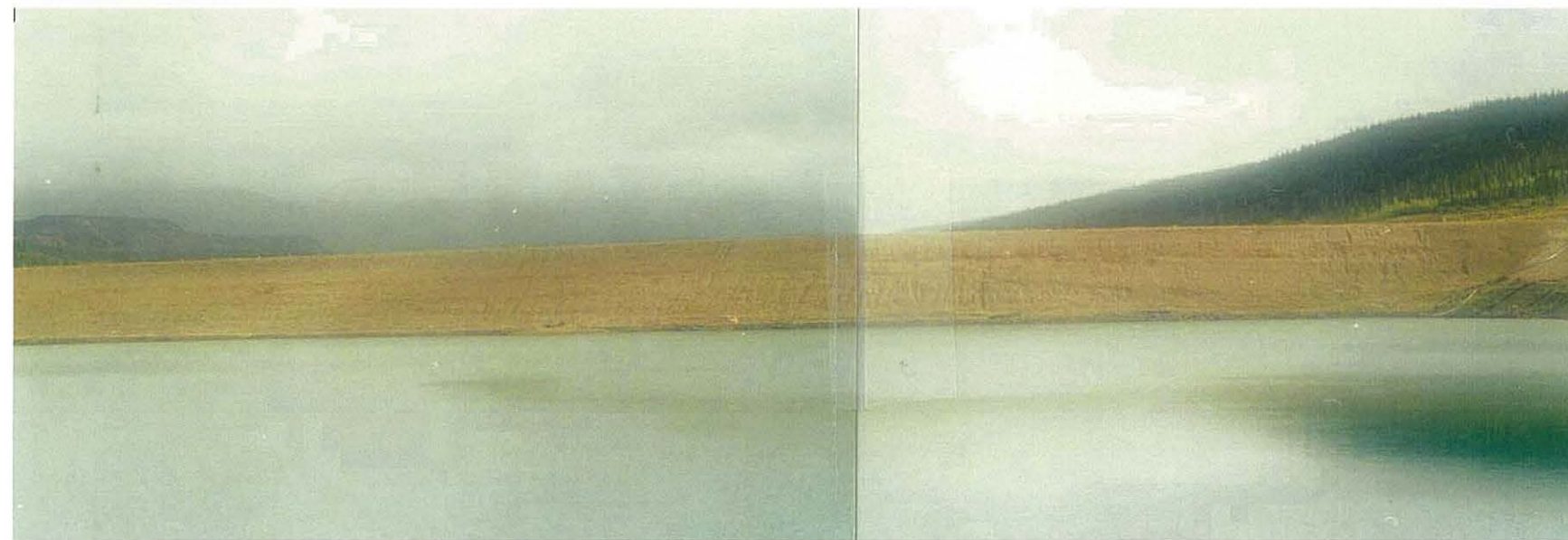
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View of downstream face of the Intermediate Dam.



View of standing water and wet softened area at the toe of the Intermediate Dam.



View of the downstream face of the Intermediate Dam. Note the erosional rills on the face of the dam.

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TITLE Intermediate Dam Inspection Photos

PROJECT No. 0257-005-04

FIGURE No. Figure 18

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View of the spillway of the FWSD.



View of the upstream face of the FWSD.

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TITLE:

Fresh Water Supply Dam Inspection Photos

CLIENT:

Deloitte & Touche

PROJECT No.

0257-005-04

DWG No.

Figure 19

REV.

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Left:
View of the cracking on the crest of the FWSD.
Approximate location is near installation 85-5.



Right
View of the FWSD reservoir.
Note the location of the buoy in the reservoir indicating the intake of the Low Level Pipe.

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TITLE:
 Fresh Water Supply Dam Inspection Photos

CLIENT: **Deloitte & Touche**

PROJECT No. 0257-005-04	DWG No. Figure 20	REV. 0.
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Seepage weir at the toe of the rock-fill berm at the FWSD. Note the location of installation 85-1 in the distance.



A seepage weir situated near the north limit of the collection trench.



View of seepage collection trench at installation 85-1. Note seepage in trench.



View of seepage weir in channel downstream of valve house. Note seepage flowing around side of weir.

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PROJECT No. 0257-005-04


FIGURE No. Figure 21

REV. 0.

REV.	DATE	REVISION	DRAWN	CHECKED	APPROVED

2002 INSTRUMENTATION READINGS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	02	02	02	02	02	02	02	02	02	02	02	02
1. Diversion Canal												
THERMISTORS												
- Canal Dyke: CD-15, CD-21, BGC01-02					***	***			***			
- Spoil Pile: SP-3,5					***	***			***			
- Backslope: BS-10					***	***			***			
SLOPE INDICATORS					If blocked in May, attempt to read in June.							
- Canal Dyke:												
BGC01-01					***		***		***			
CD-21, BH94CD-1, BH91-CD1					***				***			
CD-10, CD-15, CD-19					***				***			
- Spoil Pile: SP3, SP-5					***				***			
PIEZOMETERS												
- Canal Dyke CD-13, 15, 19, 21, 26, 88-7, 11					***				***			
- Backslope BS-5					***	***			***			
2. Cross Valley Dam												
THERMISTORS - BH88-4, 5, CVDC-6, CVDC-11					***				***			
PIEZOMETERS : CVDC-4, 7, 9, 11 CVDT-1, 2 CVDP-3*, 6					***				***			
WEIR FLOWS : X-11, X-12, W3 (monthly)	***	***	***	***	***	***	***	***	***	***	***	***
WEIR FLOWS : X-13	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly
POLISHING POND WATER LEVEL (or automate with datalogger)	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly
3. Intermediate Dam												
PIEZOMETERS : ID3, 4, 5, 6, 7					***				***			
91-ID3 (with seepage observations near abutment)					***	***		***	***			
96-1, 2, 3, 4, in combination with toe seepage observations.					***		***		***			
RETAINED POND WATER LEVEL (or automate with datalogger)	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly
4. Fresh Water Supply Dam												
THERMISTOR - BH85-5					***	***			***			
PIEZOMETERS : 85-1, 2, 3, 4, 5, 6, 88-15, 16, BGC02-04, 14					***	***			***			
VALVE HOUSE SEEPAGE AMOUNTS	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly
FRESH WATER CHANNEL (Below Valve House) FLOW QUANTITY	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly
TOE BERM SEEPAGE WEIR FLOWS	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly
RESERVOIR WATER LEVEL (or automate with datalogger)	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly	weekly
NOTES:												
* Try to fix CVDP-3 in spring. This may require a digital photo to be taken and passed to BGC personnel.												

He is asking for B-11 in report pg. 11 although monitor sheet requires BS-10 only thermistors slope indicators requiring B-5 only.

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				DATE: Feb. 2002			TITLE 2002 Monitoring Schedule		
				DRAWN: GKC		CLIENT: Deloitte & Touche	PROJECT No. 0257-005-04		
				DESIGNED: GKC			FIGURE No. Figure 22		
				CHECKED: JWC			REV. 0.		
				APPROVED: JWC					
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