



BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

DELOITTE AND TOUCHE INC.

ANVIL RANGE PROPERTY, YT

**EMERGENCY PREPAREDNESS PLAN FOR
SELECTED DAMS AND WATER DIVERSION
STRUCTURES**

**FINAL
COPY #7**

PROJECT NO.: 0257-018-02
DATE: OCTOBER 20, 2003

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**Re: Final Report - Emergency Preparedness Plan For Selected Dams
and Water Diversion Structures, Anvil Range Property, YT**

Dear Doug:

Please find attached one bound copy and one digital version on CD of the above captioned report. This version has incorporated comments received from Deloitte and Touche, Dana Haggart at site, Peter Healey of SRK and Eric Denholm of Gartner Lee on the draft version previously released on September 22, 2003. Digital versions have also been forwarded to Eric Denholm and Peter Healey for their information.

Should you have any questions or comments, please do not hesitate to contact me at the number listed above.

Yours truly,
BGC Engineering Inc.
per:

Holger Hartmaier, M.Eng., P.Eng
Senior Geotechnical Engineer

encl. Final report

HHH/sf



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LIMITATIONS OF REPORT

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1.0 INTRODUCTION

1.1 Background and Study Objective

A recent dam safety review by Klohn Crippen Consultants Ltd. (Klohn Crippen 2002) identified the need for an Emergency Preparedness Plan (EPP) for the dams on the Anvil Range property, located near Faro, YT as shown on Figure 1. Section 10.1 of that review noted that the "...EPP should focus on the potential dam breach of the Intermediate Dam, which is considered the key structure for the tailings impoundment area." In addition, Klohn's review stated "Adoption of a single EPP for the entire Anvil Range property is appropriate, provided the reasonably worst case (emphasis by BGC) conditions are identified." CDA (1999) also notes that an EPP is recommended for certain categories of dams under current Canadian dam safety guidelines. The purpose of the EPP is to describe the arrangements in place to respond to potential or actual dam breaks. As such, BGC Engineering Inc. (BGC) was retained to undertake the preparation of an EPP for the Anvil Range property.

Klohn Crippen (2002) reviewed the safety of four dams located on the Anvil Range property, as summarized below:

- Fresh Water Supply (FWS) Dam located on Rose Creek.
- Intermediate Dam located proximal to the Rose Creek Diversion Channel (RCDC).
- Cross Valley Dam located immediately downstream from the Intermediate Dam.
- Little Creek Dam located on the Vangorda Plateau, just below the Vangorda rock dump.

The locations of these four dams are shown on Figures 2 and 3.

It should be noted that there are several other dams, water retention ponds and dikes on the Anvil Range property, including the following;

- The headworks collection dam at the inlet to the Vangorda Creek Diversion Flume (VCDF).
- The Water Treatment Plant clarification pond embankment.
- The Sheep Pad Sediment Pond embankment below the Grum overburden dump.

None of these noted structures are considered within the assessment scope of the EPP provided herein.

With regards to the four dams reviewed under Klohn Crippen (2002), the FWS Dam will be breached beginning in November 2003, subject to regulatory approvals. Therefore, the EPP provided herein will cover preparedness planning for the other three dams, with special focus on the Intermediate Dam. This preparedness planning work will be complemented by a review of failure modes and response plans for the two main pit diversion channels, the Faro Creek Diversion Channel (FCDC) and the VCDF.

Deloitte and Touche Inc. (Deloitte), in their capacity as Interim Receiver for Anvil Range Mining Corporation (ARMC), is currently progressing with the development of an Emergency Response Plan (ERP) for the Anvil Range Property that will include elements such as spills and other environmental concerns. That ERP will serve to compliment the EPP provided herein for selected dams and diversion channels. In addition with the development of the EPP for dams, an Operations, Maintenance and Surveillance (OMS) Manual is also under preparation by BGC (under separate cover) for the four dams initially listed. This manual will provide information that is relevant to both operations and to response planning.

1.2 Scope of Work and Authorization to Proceed

BGC provided a proposal on August 8, 2003 to Deloitte that included the following scope of work:

- Task 1: Prepare list of emergency incidents relevant to three major dams, (not including the FWS Dam and with a focus on the Intermediate Dam) and two diversion channels:
 - Develop criteria on definition of incident level (e.g. Emergency versus Failure).
 - Prioritize emergency failure modes based on risk assessment work done to-date by BGC (Down Valley FMEA), SRK (site risk assessments) and Klohn Crippen (dam safety reviews).
 - Consider both structural and forest fires within the potential emergencies reviewed.
 - Prepare a list of failure modes and incident levels.
- Task 2: Prepare emergency identification and action plans for identified failure modes.
- Task 3: Prepare notification plan for identified failure modes; consistent with any existing response plans for site.
- Task 4: Prepare summary list of required mobile equipment, operators, supplies and materials for implementation of the action plan for the emergency modes identified.
- Task 5: Prepare and submit draft report, summarizing the information and assumptions used, the emergency failure modes identified and recommendations for further work. Prepare final report based on comments received from Deloitte.

As introduced above, Steffen Robertson & Kirsten (Canada) Inc. (SRK) provided technical input to BGC with respect to the various dams and potential failure modes. SRK has provided consulting services on both the Vangorda Plateau and Faro Mine sites for several years.

Authorization to proceed with the preparation of the EPP was provided in a letter dated August 11, 2003 from Deloitte.

2.0 IDENTIFICATION OF EMERGENCY MODES AND PRIORITIZATION

2.1 Work Done To-Date

BGC (2001) undertook a qualitative risk assessment of the Down Valley tailings area where three major dams are situated. The risk assessment approach used was a Failure Modes and Effects Analysis (FMEA) as a means to prioritize potential risks within the Down Valley in a systematic manner. Table 2 from that report outlines 48 generic failure modes for dams while Table 4 outlines failure modes for diversion channels. For each element, such as an individual dam, each potential failure mode was subjectively ranked for likelihood of occurrence (scale from negligible to very high) and potential consequences (from very low to very high). All of these risk categories are then summarized with regards to the overall system.

A draft ERP is currently being prepared for Deloitte by Gartner Lee Limited (Gartner Lee) for the entire Anvil Range Mining Complex (ARMC) (Deloitte, 2003). This document provides a course of action for any potential accidental release of untreated water or hazardous/toxic substance, tailings release, system failure or medical emergency. The ERP provides the necessary information needed in responding to environment, health and safety incidents, including identification of the emergency situation, initial responses, action steps and reporting requirements. Sections of the ERP cover the cases of uncontrolled fresh water releases and uncontrolled untreated water releases.

Klohn Crippen (2002) recommended updating the ARMC ERP to include an EPP for the dams to identify the response by site staff to a potential dam breach alert. Their review also recommended that the EPP provide a description of the flood inundation and downstream impact of hazards created by flood damage. Although no detailed flood inundation studies have been undertaken for the Anvil Range Property, the following sections outline the dam break assessment work done to date.

Northwest Hydraulic Consultants Ltd. (2002) considered the preliminary routing of an extreme flood due to a breach of the FWS Dam. From that assessment, and based on the assumptions provided therein, a peak discharge of approximately 3,200 m³/s (with a 6 m high flood wave) would result from a full reservoir breaching the FWS Dam. Approximately 2,300 m³/s of discharge would reach the spillway at the Intermediate Dam, far in excess of its design capacity of approximately 100 m³/s. Both of the downstream dams "would be overtopped and probably fail." Flow velocities across the tailings area would be "...high and more than sufficient to erode and transport the silt and fine sands..." and as a result, the tailings are expected to "...be transported in suspension very far downstream." No detailed flood inundation mapping was undertaken within that work though.

SRK (2002) undertook another assessment of the risks and consequences resulting from a failure of the FWS Dam. "Sunny day" conditions with piping and breaching under flood conditions (including the PMF) were the primary failure modes considered. For a breach of the full reservoir behind the FWS Dam, overtopping and breaching of both the Intermediate and Cross Valley Dams were predicted for a PMF event. The flood wave downstream of the Cross Valley Dam was simulated and the following results are extracted from Table 3.5 of that report:

Table 1 DAMBRK Results Downstream of the Cross Valley Dam (after SRK 2002)

Location	Peak Flow (m ³ /s)	Max. Water Surface Elevation (m, NGVD)	Max. Velocity (m/s)	Flow Top Width (m)	Max Channel Depth (m)
Anvil Creek Jct. (Catchment 18)	1504	835.6	8.94	63.47	3.52
Pelly River Jct (Catchment 20)	1104	665.0	4.24	173.7	2.44

As stated in SRK (2003b), the September 2002 report provided the following conclusions:

"Breaches of the Intermediate Dam were always predicted to result in a breach of the Cross Valley Dam, with a resulting release of 1.2 to 4.0 million m³ of tailings, and zinc concentrations of several milligrams per litre as far downriver as Pelly Crossing. In addition to the downstream environmental impacts, the cleanup associated with such an event would be in the tens of millions of dollars. ... Clearly, a breach of the Intermediate Dam would lead to very severe consequences by any standard."

Due to discussions about the inputs and assumptions used within SRK (2002), the risk assessment work was revised in SRK (2003b) and the previous work of 2002 was superseded. The most important input parameter changed was the reservoir capacity of the FWS Dam. The reservoir was reduced to 4.06 million m³ of water, rather than the value of 5.6 million m³ previously used in error. Dambreak modelling was again undertaken for "sunny day" breaches of the FWS Dam, PMF flows into the FWS Dam reservoir and PMF conditions with the FWS Dam removed. From the results, several patterns resulted, as summarized below:

- "First, all breaches of the Intermediate Dam also result in breaches of the Cross Valley Dam."
- "...PMF conditions are predicted to result in a breach of the Intermediate and the Cross Valley Dams in all cases."
- "...floods will continue to pose a risk to the Intermediate and Cross Valley Dams even if the FWSD is completely removed."

Although dam breach studies have been completed, no detailed flood inundation mapping of the downstream area has been undertaken. At the current time, there is no significant infrastructure or inhabited areas situated downstream from the Cross Valley Dam down to the reaches of the Pelly River. It should also be noted that no dam break assessment for the Little Creek Dam has ever been undertaken.

Gartner Lee (2003) assessed the consequences of a complete breach of the Faro Creek, Rose Creek and Vangorda Creek diversions. Various timeframes for reaction to prevent consequences from a complete breach were summarized. The examples provided estimates of the time to overflow for various levels of inflow and outflow (pumping). These estimates provide guidance to mine staff on the amount of time available to repair a breach or a channel overtopping event under various flow and pumping scenarios.

With respect to the FCDC, a complete breach could be the result of failure of the northeast Faro Pit wall. The consequence of this failure could be the filling of the Faro Pit with water if pumping could not be undertaken at a rate to match the inflow. Ultimately the excess water in the pit would reach the overflow into the Zone 2 Pit and subsequently, into the North Fork of Rose Creek. This would represent an uncontrolled release of non-compliant water into the environment. For "normal" flows ($0.155 \text{ m}^3/\text{s}$) and a pumping rate of $0.28 \text{ m}^3/\text{s}$, there is no chance of overflow. For the 7-day PMF flow ($7.44 \text{ m}^3/\text{s}$), the time for overflow was 13 days for pumping rates of 0.28 and $0.56 \text{ m}^3/\text{s}$. For "freshet" level flows ($0.28 \text{ m}^3/\text{s}$) and a pumping rate of $0.28 \text{ m}^3/\text{s}$, the time for overflow is about 3 years. These times assumed an initial pit water level at elevation 3862 ft. mine datum.

A complete breach of the Vangorda Creek diversion could result from the failure of the north pit wall. Non-compliant water could be released into the environment when pit water levels exceed elevation 1122.5 m asl, versus the maximum desired operating elevation of 1092 m asl. Based on the current pumping rate of $0.12 \text{ m}^3/\text{s}$, the time for overflow ranges from 4 days for the 7-day PMF (flow of $10.2 \text{ m}^3/\text{s}$) to 7 days for inflows of 50 % of 7-day PMF ($5.1 \text{ m}^3/\text{s}$).

2.2 Failure Modes Meeting

As noted in Section 1.1, "a single EPP for the entire Anvil Range property is appropriate, provided the reasonably worst case conditions are identified". Klohn Crippen (2002) states that potential problems that may threaten dams include the following:

- Slumping or cracking of the dams;
- Springs, seeps or boggy areas;
- Abnormal flows from the drainage areas;
- Abnormal instrumentation readings;
- Surcharging of the spillways/overtopping due to PMF conditions; and
- Earthquake events.

In order to compile a list of "reasonably worst case" failure modes, a one-day meeting was held on August 25, 2003 with SRK in Vancouver to define the failure modes, based on previous site experience with the various structures and from formal risk assessments such as BGC (2001), SRK (2002) and SRK (2003b). Participants in the meeting were Messrs. Peter Healey, P.Eng. and Cam Scott, P.Eng. of SRK and Messrs. Holger Hartmaier, P.Eng. and Jim Cassie, P.Eng., of BGC. An agenda for that meeting is provided in Appendix I.

From that meeting and the discussions held, Table 2 provides a summary of failure modes identified as "reasonably worst case (RWC)" for each of the three dams under consideration:

Table 2 Summary of RWC Failure Modes for Dams

Dam	Reasonably Worst Case Failure Modes
Intermediate Dam	<ul style="list-style-type: none"> • Overtopping due to floods (spillway designed for 1:500 year event), blockages and failure of the Second Tailings Embankment. • Static instability including surface sloughing, pore pressure changes and frost effects. • Seismic instability including overall stability and liquefaction. • Piping.
Cross Valley Dam	<ul style="list-style-type: none"> • Overtopping due to floods (spillway designed for 1:500 year event), blockages and failure of the Intermediate Dam. • Static instability including surface sloughing, pore pressure changes and frost effects. • Seismic instability including overall stability and liquefaction. • Piping.
Little Creek Dam	<ul style="list-style-type: none"> • Overtopping due to floods (emergency spillway designed for 1:200 year event) or pumping system failure (meant to keep pond down). • Static instability including surface sloughing, pore pressure changes and frost effects. • Seismic instability including overall stability and liquefaction. • Piping.

Table 3 provides a similar assessment for the two main diversion channels under consideration:

Table 3 Summary of RWC Failure Modes for Channels

Dam	Reasonably Worst Case Failure Modes
Faro Creek Diversion Channel	<ul style="list-style-type: none"> • Overtopping due to floods or ice/snow blockage. • Slope instability above the channel leading to deformation and/or blockage of the channel. • Instability (including complete failure) of proximal pit wall leading to leakage and/or blockage of the channel. • Leakage from the channel to nearby pit wall, possibly leading to piping in the dike.
Vangorda Creek Diversion Flume	<ul style="list-style-type: none"> • Overtopping due to floods (designed for 1:100 year event) or ice/snow blockage. • Blockage of the upstream headworks collection dam leading to dam breach. • Slope instability above the channel leading to deformation and/or blockage of the channel. • Instability (including complete failure) of proximal pit wall leading to leakage and/or blockage of the channel. • Leakage from the channel to nearby pit wall, possibly leading to piping in the dike. • Failure of the piping system and drop box below the channel.

Emergency identification and response plans for each of the failure modes noted in these two tables are outlined in Sections 2.4 and 3.

In addition to the emergency events noted in Tables 2 and 3, numerous other incidents and events are possible that do not necessarily constitute an emergency and these include the following:

- Abnormal piezometer reading; i.e. high pore pressure reading.
- Abnormal thermistor reading; i.e. warm temperature reading.
- Abnormal slope inclinometer reading; i.e. blocked SI casing or large movement indicated.
- Cracks and sloughs resulting from frost action and freeze-thaw cycles.
- Rip rap erosion and/or displacement from water flow and/or ice action.
- Erosional gullies formed from run-off.

Events such as these are important for the various dams and channels but responses to such events will be provided within the OMS Manual (to be provided under separate cover).

2.3 Criteria for Incident Levels

Incidents may be categorized into those that threaten the safety of the dams and the channels and those that do not. Incidents that threaten the safety of the dams and the channels are the focus of this EPP. Potential incidents can be classified into three levels of action:

- Alert Level.
- Emergency Level.
- Failure Level.

Further explanation of each of these categories is provided in the following sections.

Alert Level:

The alert level is the first or lowest level of action for a given incident. This level of action is assigned to typical operations and maintenance conditions and is dealt with under the OMS manual. No external (off mine-site) notification is required. Response to incidents is done internally under the protocols provided in the OMS Manual. Typical incidents that may be observed at the alert level may include the following:

- seasonal frost cracking at the crest of a dam,
- minor seepage,
- piezometric response to changing reservoir levels,
- minor erosion gullies due to runoff, and
- spillway flowing at design capacity with no erosion.

The OMS manual provides guidelines and protocols for prompting action in dealing with these "routine" incidents and system failures that can be easily and quickly corrected or repaired. Some of these incidents, if ignored, may develop into emergency situations that must be dealt with outside of the normal scope of OMS activities. The OMS Manual identifies the "trigger levels" or thresholds at which the EPP plan is put into action.

Emergency Level

The emergency level is the first level of potential danger to dam and channel safety to be assigned to an unusual event or condition, which would result in an immediate and significant threat to the safety of the structure and would therefore involve activation of the EPP. The EPP addresses emergency situations that require actions outside the normal scope of OMS activities to correct. External communication, according to the notification procedure outlined in the site-wide ERP for the Anvil Range property (Deloitte, 2003), is required to mobilize the resources and response required to eliminate the threat to the structure. Immediate action would be required to plan and execute remedial action and repairs. The required remedial measures and actions should be initiated and completed in sufficient time to eliminate the immediate threat, or prevent it from getting worse.

The incident level may be downgraded from emergency to alert level or upgraded to failure level, depending on the change in conditions at the structure or as new information or analysis becomes available.

Failure Level

At failure level, the incident has progressed to the point where failure of the structure is imminent. A failure level incident would require immediate notification of any downstream area by means of the general and local warning systems. The failure level response should be implemented immediately upon verification of the conditions that a dam is failing or about to fail, or as a precautionary measure when there is uncertainty whether the dam may fail, but there is a significant probability that it will.

Any emergency repair measure that has some potential to avert, delay or retard the rate of failure should be initiated. In addition, measures for post-failure monitoring and assessment should be initiated.

2.4 Failure Modes and Associated Incident Levels

Based on the risk assessment work, and the failure modes meeting of August 25th, the following failure modes are reviewed in more detail in the following sections:

- Dam Overtopping.
- Dam Embankment Instability.
- Piping.
- Seismic Instability and Large Earthquake Events.
- Channel Overtopping.
- Channel Slope Instability.

The following sections outline the identification and appropriate details for each failure and criteria for determination of the incident level. As context for the identification of emergency incidents, a person discovering an incident must be reminded to ensure their own personal safety. Make sure not to endanger yourself by remaining in a potentially dangerous situation. If safe to do so, ensure that others do not become endangered as well.

2.4.1 Dam Overtopping

2.4.1.1 Identification

Water enters the reservoir exceeding the capacity of the spillway or reservoir storage and flows over the top of the dam. This may be due to an extreme flood event, blockage of the spillway, failure of a perimeter by-pass system or external creek diversion, failure of a beaver dam or a landslide generated wave. In some cases, the reservoir operating levels may have become exceeded due to poor operational control, resulting in reduced storage capacity. Wave action under reduced freeboard conditions may result also in overtopping and erosion. System failure of a mine water reclaim system due to mechanical problems, power outage, pipeline rupture or sinking of pump barge may also lead to a hazardous rise in water levels.

An extreme precipitation event or extreme snowfall accompanied by rapid melting or a combination of both will usually result in a rapid rise in pond levels, which may exceed design capacities. If these conditions exist or are in the forecast, visual inspection of all reservoir levels and assessment of snowpack depth and density or rainfall amount should be conducted to assess pond capacity.

2.4.1.2 Incident Levels

Alert Level:

- Reservoir level is at normal operating level (see OMS Manual for dam specific reservoir data) and starts to rise to maximum operating level.

Emergency Level:

- Reservoir level begins to rise above maximum operating level. Sufficient freeboard exists to top of water retaining element of dam (impervious liner or core) to prevent overtopping. Overtopping may occur if pond levels are not reduced.

Failure Level:

- Reservoir levels have reached the top of the dam's water retaining element. Depending on the design of the crest of the dam, there may be additional freeboard between the top of the impervious core or liner and the crest of the dam. However, overtopping is imminent if water levels continue to rise and erosion of the crest occurs.

2.4.2 Dam Embankment Instability

2.4.2.1 Identification

Appearance of tension cracks on the crest or downstream face of dam, development of a headscarp with vertical or horizontal displacement or both and bulging of the dam face. Visual inspection of the dam crest and both faces and toe areas is the best method of detection as the zone of failure may not be covered by instrumentation installed in the dam. Changes in pore pressures may also be indicative of instability. A significant warming trend in thermistor readings may signal that some type of instability is occurring within the dam. A significant change in the seepage quality at weir monitoring locations may also be a concern.

Embankment instability may occur following a rapid drop in reservoir water levels, an earthquake event, an extreme precipitation or rapid snowmelt event or a significant change in operating practices. These events should trigger an immediate visual inspection of the embankment.

2.4.2.2 Incident Levels

Alert Level:

- Appearance of new cracks or the opening of existing cracks in crest or faces of dam. Significant warming trend in thermistors, increasing pore pressures in piezometers or high one-time reading from a single piezometer.

Emergency Level:

- New cracks continue to grow in length and width, and the displacement increases. Thermistor data continues to show warming trend (or increasing extent), piezometric levels continue to rise, other instruments in dam begin to show these effects indicating a growing condition. Headscarp is located on downstream face of dam. Toe bulges are noted.

Failure Level:

- Continued and accelerating displacements and development of new cracks. Head scarp reaches dam crest or breaches upstream side of dam. All instabilities on upstream face of dam are considered potential failure level conditions.

2.4.3 Piping

2.4.3.1 Identification

Seepage water, which is visibly coloured by suspended sediment, typically occurring at localized exit points on the downstream face or toe in excessive or abnormal quantities. Due to the high seepage gradient, a cavity or "pipe" develops at the location of the exit point, which gradually progresses in an upstream direction along the seepage path. As it progresses, the rate of seepage and amount of transported sediment will increase, potentially leading to a breach of the dam.

Therefore, visual inspection of the entire dam, noting the location of seepage points and water quality on a regular basis is crucial to establishing a baseline by which abnormal conditions, that may develop over time and are associated with piping, can be recognized. Any seepage showing turbidity or suspended sediment should not be ignored.

2.4.3.2 Incident Levels

Alert Level:

- Small quantities of clear seepage water flowing from the toe or abutment of a dam may be considered normal, but should be recorded as part of the regular visual inspections being carried out. The location and seepage quantities, preferably measured by a weir or by the time required to fill a container of known volume should be monitored. Changes in the location, rate of flow may be related to reservoir levels, precipitation, snowmelt or thawing of ground ice. May be associated with warming trend in thermistors.

Emergency Level:

- Any change from clear seepage to seepage containing suspended sediment or turbidity.
- Development of surface depressions or sinkholes on upstream face of dam or base of reservoir upstream of dam. These may be visible if the water is clear and not too deep, or may become apparent if reservoir levels have been lowered.
- Development of "boils" or cavities on downstream side of dam or in foundation downstream of dam, which remain relatively stable or in equilibrium with flow.
- Significant changes in pore pressures from adjacent piezometers may be noted.

Failure Level:

- Progressive or rapid development or enlargement of boils or soil cavities, leading to uncontrolled seepage flows increasing in flow rate and amount of transported sediment.
- May be associated with slope instabilities due to erosion of materials by high gradient seepage flow.
- Formation of settlement troughs between reservoir and seepage points.

- Entire reservoir may be discharged through pipe cavity, without breaching of dam, or pipe may progress upgradient with increasing erosion leading to dam breach and release of remaining reservoir due to dam failure.

2.4.4 Seismic Instability and Large Earthquake Events

2.4.4.1 Identification

Any seismic event that is felt by the on-site staff warrants an immediate visual inspection of all significant water-retaining structures. The Natural Resources Canada (NRCAN) Pacific Geoscience Centre (PGC), located in Sidney, B.C., and operated by the Geological Survey of Canada (GSC), monitors earthquake activity around the world and includes virtually real-time information on earthquake activity in western Canada. This information is available on their website at www.pgc.nrcan.gc.ca/seismo. Site staff can obtain information updates regarding distant events as well as reporting local events.

2.4.4.2 Incident Levels

Alert Level:

- Site staff should inspect all dams after a seismic event has been felt at the site, regardless of the size of the event. Pore pressure readings should be taken on all piezometers. Information may be obtained from the PGC website given above regarding recent seismic events in western and northern Canada and Alaska.

Emergency Level:

- Following a seismic event, visual inspection reveals the presence of new cracks, settlement of the dam crest, increased seepage flow from existing seepage points or development of new zones of seepage or both. Any deformation of the dam or adjacent abutments and foundation areas or signs of damage to appurtenant structures is considered to be an emergency level incident requiring immediate attention.

Failure Level:

- Under severe seismic shaking, deformations may compromise the water retention capability of the dam. Deformations may take place during the period of shaking or shortly thereafter. The crest may settle below reservoir operating level, resulting in overtopping. Cracking of the impervious core or liner may lead to uncontrolled release of water from the reservoir. Liquefaction of the foundation may affect the stability of the entire dam and abutments. Liquefaction of tailings stored behind a dam may impose an increased load on the dam, leading to embankment instability. Signs of embankment instability in the form of headscarps, increasing deformations on cracks, ongoing settlement, development of a toe bulge and increased seepage (typically muddy) may be observed.

2.4.5 Channel Overtopping

2.4.5.1 Identification

Channel overtopping occurs when the water level in the channel exceeds the level of the banks, either due to flood events larger than design values or due to blockage of the channel. This may occur wherever the diversion channel is oriented parallel to the contours of a slope, as is the case adjacent to the Faro and Vangorda Pits. The resulting spill of water from the diversion channel may enter the pit and become non-compliant due to the ambient levels of metals contamination and overall pit water quality. As a result, additional quantities of water must be treated before they can be released into the environment. In a worst case scenario, the overtopping event could continue to fill the pits until the capacity of the pit is exceeded and non-compliant water begins to be released from the pit.

It is understood that hydrological studies will be carried out for the Faro and Vangorda Diversion Channels. These studies will provide updated regional hydrological assessments, on-site meteorological observations and channel flow measurements. Until these studies have been completed, visual appraisal of the depth and velocity of flow at various points in the channel are required over a given period of time to assess the potential for overtopping. Capacity curves for the Faro and Vangorda Pits are currently available to estimate the time required to fill the pit under various flow scenarios (as reported in Gartner Lee, 2003).

2.4.5.2 Incident Levels

Alert Level:

- Normal channel flow conditions. Water levels below the lowest bank level. No active erosion of channel bed or sides. Note that the Vangorda Creek Diversion Channel consists of a corrugated metal half-pipe flume, within an excavated channel bed. In this case, flow is usually within the flume and the buried pipe, but the design allows higher flows to occur within the flume and proximal excavated channel.

Emergency Level:

- As flow levels rise and velocities increase, there is greater potential for erosion of the channel bed and sides as the design hydraulic capacity of the channel is reached. Although overtopping has not yet occurred, continued erosion at low points may result in breaching of the channel. If water levels continue to rise, overtopping will occur.

Failure Level:

- The banks containing the diversion flow are breached or overtopped. The amount of flow out of the channel may range from relatively minor overbank spillage to complete loss of the channel and the downhill retention. Minor overbank spillage may cause erosion into the bank and increase in volume, even if channel water levels remain constant, potentially leading to a complete breach situation.

2.4.6 Channel Slope Instability

2.4.6.1 Identification

Instability may occur within the channel banks, the slopes above the channel and the slopes below the channel (pit slopes). Instability may occur in rock or soil materials. In general, rock slope instability is governed by the presence of discontinuities, which are oriented to permit movement towards the open channel cut. Where the diversion channel is located along the rim of an excavated open pit, the stability of the channel is dependent on the rock mass forming the pit walls. Rockfalls from the slopes above the channel may partially block the channel. If the size of the rock is large enough to remain stable under the ambient flow in the channel, the blockage will remain and degrade channel capacity. Large rockfalls or slides may completely block the channel, and may lead to overtopping upstream of the blockage.

Soil slope instability usually occurs in the form of mudflows, rotational, block or retrogressive slides. In most cases, the source of these instabilities will be from the overburden overlying bedrock on the slopes above the channel. It should be noted that a portion of the Faro Creek Diversion Channel passes through overburden, which forms a portion of the channel sides adjacent to the Faro Pit, a recognized area of concern, which has undergone previous attempts at remediation. Small soil slumps into the channel may be washed away, resulting in only temporary impairment of channel capacity. Larger slides may completely block a channel, leading very quickly to an overtopping situation upstream of the slide.

Overburden instability may occur relatively rapidly (mudflows) or slowly depending on a wide variety of influencing factors. In general, slope stability decreases during periods of high ground water, such as during the spring melt, or during periods of sustained precipitation. Inspection of slopes must be done regularly to identify cracks, scarps, slope bulging toe bulging or other signs of deformation that indicate instability.

2.4.6.2 Incident Levels

Alert Level:

- Routine maintenance of the slopes above the channel should be carried out to scale and remove loose rock and overburden that may slide or fall into the channel. Where a catch-bench is located adjacent to the diversion channel, periodic removal of accumulated soil and rock debris should be carried out to prevent material from reaching the channel.

Emergency Level:

- Periodic visual inspection has revealed the presence of cracks or other evidence of deformation in the slopes above the channel, or in the bank between the channel and an adjacent slope or excavation. A minor slide has partially blocked the channel, but no overtopping is expected to occur.

Failure Level:

- Relatively rapid development of surface instability, which threatens to completely block the channel or result in a breach in the channel sides. Note that excessive deformation of the slope below the channel may result in cracks that intercept the channel, resulting in leakage from the channel.

2.4.7 Other Failure Modes

As summarized in Tables 2 and 3, additional failure modes were identified for the Intermediate Dam and Vangorda Creek Diversion, including the following;

- Failure of Second Tailings Embankment.
- Blockage of headworks collection dam.
- Failure of piping system and drop box below the Vangorda Creek Diversion Flume.

Identification of these failure modes and associated incident levels is covered in Section 2.4. The corresponding emergency and failure response plans are described in Section 3.

2.4.8 Fire

The identification and response plans for fires are reviewed in their entirety under Section 3.7.

3.0 EMERGENCY AND FAILURE RESPONSE PLANS

The identification of incident levels that lead to implementation of the EPP are described in the previous section. This section describes the response actions that will be required by on-site staff to carry out emergency operations and repairs for each of the failure modes. Potential constraints on action plan implementation are discussed in Section 4. The required notification plans referred to in this section are described in detail in Section 5. The equipment, operators, supplies and materials required for implementation of the response plan are listed in Section 6. Some of the response actions involve obtaining and placing rock and soil materials. Figures 5, 6 and 7 show the locations of soil and rock borrow areas within the mine site area. It is recommended that these various sources be verified in terms of quality and quantity of materials so that the site is aware of the sources that can be used in the event of an emergency. There may be a need to establish stockpiles of some materials in areas close to the dams.

3.1 Dam Overtopping

Emergency Level

- Execute Emergency Notification Plan.
- Lower pond levels with siphons, pumps or both. Spill reporting will be required if water quality is non-compliant.
- Attempt to increase spillway capacity by clearing out accumulated debris, widening existing spillway or cutting a new notch, with rockfill protection, through an abutment area to preserve integrity of embankment.
- Maintain 24-hour/day vigilance of pond levels until levels are restored to below maximum operating levels as defined in OMS Manual for this structure.
- Visually inspect dam for erosion or deformation.
- Repair affected areas as recommended by Geotechnical Consultant.

Failure Level

- Execute Failure Notification Plan.
- Lower pond levels with pumps, siphons or both. Spill reporting will be required if water quality is non-compliant.
- Continue attempts to increase spillway capacity by clearing out accumulated debris, widening existing spillway or cutting a new notch, with rockfill protection, through an abutment area to preserve integrity of embankment.
- Maintain 24-hour/day vigilance of pond levels, until water levels are restored to below maximum operating levels as defined in OMS Manual for this structure.
- Visually inspect dam for erosion and deformation damage.
- Repair affected areas of dam as per recommendations of Geotechnical Consultant.

3.2 Dam Embankment Instability

Emergency Level

- Execute Emergency Notification Plan.
- Lower pond levels using siphons, pumps or both. Spill reporting will be required if water quality is non-compliant.
- Initiate daily inspections and readings of all instruments, or as required by the Geotechnical Consultant.
- Undertake remedial repairs as recommended by Geotechnical Consultant. Likely response will be construction of a stabilizing berm at the toe of the dam. Preparations should begin to haul rockfill.

Failure Level

- Execute Failure Notification Plan.
- Lower pond levels using siphons, pumps or both. Spill reporting will be required if water quality is non-compliant.
- Initiate hourly readings on all instruments, where it is safe to do so or as recommended by the Geotechnical Consultant.
- Maintain 24-hour/day vigilance of structure as directed by Geotechnical Consultant.
- Undertake remedial construction as recommended by Geotechnical Consultant. Likely response will be construction of a stabilizing berm at the toe of the dam. Preparations should begin to haul rockfill.

3.3 Piping

Emergency Level

- Execute Emergency Notification Plan.
- Lower reservoir level with pumps, siphons or both. Spill reporting will be required if water quality is non-compliant.
- For an isolated, relatively low head seep, construct a sand bag dike enclosure around the zone of seepage to contain the flow and reduce the head difference.
- Initiate daily readings of all instrumentation or as directed by Geotechnical Consultant.
- Construct inverted filter (sand and rockfill) on the seepage area at the toe as directed by Geotechnical Consultant.
- Dump impervious fill (till) into any sinkholes observed on the upstream side that are in the reservoir.
- Repair or construct upstream impervious liner as directed by Geotechnical Consultant.
- Maintain 24-hour/day vigilance of dam until remedial repairs have been completed.

Failure Level

- Execute Failure Notification Plan.
- Lower reservoir level with pumps, siphons or both. Spill reporting will be required if water quality is non-compliant.
- Dump rockfill or waste rock from nearest dump across downstream toe, covering the zone of seepage to a depth equal to at least one-half the maximum depth of the water in the reservoir.
- Initiate hourly readings of all instrumentation where safe to do so and as directed by the Geotechnical Consultant.
- Undertake remedial repairs as recommended by Geotechnical Consultant.
- Maintain 24-hour/day vigilance of dam until remedial repairs are completed.

3.4 Seismicity Instability and Large Earthquake Events

Emergency Level

- Execute Emergency Notification Plan.
- Conduct visual inspection of dam and report to Geotechnical Consultant.
- Initiate daily reading of all instrumentation.
- Undertake remedial repairs as recommended by post-event inspection by Geotechnical Consultant.

Failure Level

- Execute Failure Notification Plan.
- Lower reservoir levels using pumps, siphons or both. Spill reporting will be required if water quality is non-compliant.
- Conduct visual inspection of dam and report to Geotechnical Consultant.
- Initiate hourly reading of instrumentation where it is safe to do so, and as directed by the Geotechnical Consultant.
- Undertake remedial repairs based on post-event inspection by Geotechnical Consultant.

3.5 Channel Overtopping

Emergency Level

- Execute Emergency Notification Plan.
- Place crushed rock, rockfill or gravel into areas of erosion and low bank areas to maintain freeboard.
- If overtopping due to channel blockage, attempt to remove obstruction. Consider possible diversion of channel flow to allow construction to proceed.
- Maintain on-going, visual inspection of pit water levels and begin planning for emergency operation of pit dewatering system. If pumping is initiated, monitor flow rates.
- Consider potential options for excavating a controlled breach to reduce flows in channel temporarily, especially if excess water can be maintained in a compliant state.

Failure Level

- Execute Failure Notification Plan.
- Execute controlled breach or continue to place rockfill into overflow area to reduce quantities of water being discharged.
- If overtopping due to channel blockage, attempt to remove obstruction. Consider possible diversion of channel flow to allow construction to proceed.
- Maintain continuous (24/7) watch over channel condition.
- Maintain on-going, visual inspection of pit water levels and begin planning for emergency operation of pit dewatering system. If pumping is initiated, monitor flow rates.
- Geotechnical Consultant to conduct inspection and recommend repairs.

3.6 Channel Slope Instability

Emergency Level

- Execute Emergency Notification Plan.
- Check safety of remaining slopes and channel before entering and undertaking remedial work.
- Consider temporary diversion of channel flow to allow construction access.
- Remove debris from channel and stabilize the area around the failed slope by flattening slope, cutting ditches to improve drainage.
- Place rockfill as required to prevent further erosion and undercutting in critical areas.
- Overall pit wall instability could affect the channel section. Likely that a temporary diversion of channel flow would be required. Contact Geotechnical Consultant for directions on stabilizing options.
- Maintain daily visual inspection of conditions along channel.
- Maintain on-going, visual inspection of pit water levels and begin planning for emergency operation of pit dewatering system. If pumping is initiated, monitor flow rates.

Failure Level

- Execute Failure Notification Plan.
- Ensure personal safety and the safety of adjacent critical structures.
- Consider options for controlled breach to prevent overtopping if channel becomes blocked.
- Contact Geotechnical Consultant for advice regarding immediate stabilization options, which involve removal of unstable materials or placing rockfill to stabilize the downstream retention dike.
- Excavate failed material from channel to restore channel capacity.
- Geotechnical Consultant to conduct inspection and recommend repairs.
- Maintain on-going, visual inspection of pit water levels and begin planning for emergency operation of pit dewatering system. If pumping is initiated, monitor flow rates.

3.7 Fires

The identification of fire events will be self-evident (e.g. flames, smoke, etc.) when observed in site buildings or property. Forests fires that are moving towards the Anvil Range property may be noticed by site staff or by external forces such as YTG staff. The potential external interaction of fire events separates fires from other emergency related events.

It should also be noted that third-party forces involved with fire fighting may require that their own emergency response protocols be followed.

3.7.1 Structural Fire

- Upon identification of any signs of a fire, ensure the safety of yourself and individuals located in the immediate area of the fire.
- Use fire extinguishers to fight fire and remove flammable sources, if safe to do so.
- Evacuate the area of concern, if safe to do so.
- Notify Site Security and they will contact the Anvil Range Site Manager.
- Site Security to respond with any First Aid and Medical issues.
- Appropriately trained staff will mobilize site fire truck to assist with fire suppression.
- The Site Manager will contact the Town of Faro Fire Department for assistance, if necessary.
- Review potential hazards (e.g., flammable material and resulting air quality) and implications (e.g., loss of site power and pumping capacity) resulting from fire.
- Evacuate general area if potential hazards exist.
- Continue with fire suppression efforts, if appropriate to do so.
- Contact Environmental Consultant to review potential hazards and monitoring requirements.
- Assess implications of the fire on site activities, and particularly, environmental protection activities and initiate temporary measures to ensure continuation of these activities, where necessary.

3.7.2 Forest Fire

Since April 1, 2003, the Protective Services Branch of the Department of Community Services of YTG has assumed responsibility for the Forest Fire Management Program from the federal government under the terms of the Devolution Transfer Agreement. The Fire Management Program is responsible for managing Yukon forest fires and enforcing the Government of Yukon's Forest Fire Protection Act. Reporting of wildfires should be done through the FIRE HOTLINE AT 1-888-798-FIRE (3473).

When reporting a wildfire, the following information is important for fire crews to locate and suppress the fire (Yukon, Department of Community Services):

- Fire Size- how big is the fire? The size of the house, a football field, a campfire?
- Location of the fire- is it close to a road, a community, a remote area?
- Fuel- what is burning? Trees, grass, brush, other?
- Is anyone fighting the fire? Neighbours, passers by, fire crews?
- What colour is the smoke? White, grey, black?
- What is threatened by the fire? Lives, homes, buildings, campgrounds, structures, etc.?
- Is the fire burning on top of a hill, side of a hill, on flat ground?

Yukon government fire crews are located throughout the territory. Locally, one crew is located in Ross River and another crew is located in Carmacks. In addition, First Nation fire crews are also stationed at these locations, as well as one crew at Pelly Crossing.

If a forest fire is detected by on-site staff, either on the mine site or adjacent to the site, they should initially ensure their own personal safety and those individuals in the immediate area. After that initial step, the following steps are provided:

- Evacuate the area of concern, if safe to do so.
- Notify Site Security who will contact the Anvil Range Site Manager and the YTG forest fire reporting line, if appropriate to do so. Within the YTG fire response measures, the Town of Faro Fire Department may be contacted to assist with fire fighting.
- If there is a forest fire in the area of the mine, an alert or an evacuation notice may be issued by the Territorial Government.
- If no evacuation notice has occurred and the fire is quickly advancing towards the mine site, the Mine Manager can issue an evacuation notice to the on-site staff, if he/she deems it necessary.
- Forest fires have the potential to interrupt site access roads, powerlines and communications lines. The implications of forest fires on site activities, and particularly, environmental protection activities should be reviewed in detail. Initiate temporary measures to ensure continuation of these activities, where necessary.

4.0 POTENTIAL CONSTRAINTS ON RESPONSE PLAN IMPLEMENTATION

4.1 Access Roads

Primary access to the mine site from the Town of Faro is by a 23 km long road leading to the main gate at the mill and office area, which is controlled when scheduled activities are underway at the mine site. Site security staff mans the main gate. Procedures are in place to log in all persons entering the mill and mining area. These procedures include receiving management (Interim Receiver) authorization, sign-in and waiver requirements and having the required personal safety equipment for the intended areas and activities. These procedures will remain in place through 2008 (Gartner Lee, 2003), with amendments as required from time to time to control access into the mine site and to minimize risks to the public and worker safety.

The Interim Receiver has maintained the main access road since 1998 to allow summer and winter access to a standard for the safe passage of heavy loads, such as float trucks used to move heavy equipment. Maintenance activities have included localized resurfacing, grading, patching, steaming culverts and snow clearing. These activities are expected to continue through to 2008 in accordance with activities at the mine site (Gartner Lee, 2003). Winter snow clearing may not be required during the winter, or a portion thereof, when no activities are underway or planned at the mine site (Gartner Lee, 2003).

Access by road is possible to all dams from the main gate area. Figure 1 shows a plan of the site access roads for the entire Anvil Range property. Road access from the main gate to the Vangorda Plateau mine site is via the 13 km long heavy haul road. This road must be maintained to the same standard as the mine access road from Faro to ensure safe passage of heavy loads on float trucks. Road access from the Town of Faro to the Vangorda Plateau mine site has been blocked since 1998, except for brief periods when special protocols were implemented to allow direct access for contractor work (Gartner Lee, 2003). Access will be similarly restricted through to 2008 (Gartner Lee, 2003).

Other access roads that will remain blocked to public vehicular traffic through to 2008 include the Blind Creek road to the Vangorda Plateau mine site and the fuel truck ramp to the heavy haul road (Gartner Lee, 2003). The ATV crossing of the haul road will be maintained as accessible in order to allow First Nations and recreational access to the land upslope of the haul road.

Access to the north crest of the Intermediate Dam is obtained by driving down and across the Intermediate Dam spillway and then up the retention dike of the downstream side of the spillway. As a result, during a flood event, access will not be possible from this side of the valley. Access to both the toe and the crest of this dam is also possible from top of the canal dike (of the RCDC) along two access roads downstream of the south abutment. The access road to the crest of the south abutment was recently constructed as required for grading of the crest and the downstream face.

During a flood event, similar access constraints exist for the Cross Valley Dam. The crest is accessed from the toe area and access to the toe exists from the north side but across the bottom portion of the spillway discharge (that passes through two culverts). If the spillway discharge is too high, and the culverts have been eroded, access to the toe would have to occur from the south side along the RCDC access road/dike crest. It should be noted that there is no direct access to the south abutment crest from the RCDC dike crest.

Access to the Little Creek Dam occurs from the main access road traveling to the Vangorda Pit. The access road is the crest of the dam and the access could be compromised if the crest is unstable or being overtopped. Access is also possible along the east and south sides of the Vangorda rock dump onto the south abutment of the dam.

Access to the FCDC is generally from one direction only; proximal to the Faro Northeast rock dumps and then west along the dike crest on the downstream side of the diversion channel. Access for heavy equipment only is also possible from the north via the Northwest rock dumps and old exploration roads that pass around the north site of the main pit to the upstream end of the FCDC. This access is currently not normally passable by light vehicles.

Access to the VCDF exists from two directions; both of which are both commonly used and of good quality. The "bottom end" is accessed from the main haul road and then uphill along the western side of the Vangorda Pit along the dike crest access road. The "top end" is accessed via the Water Treatment Plant / Grum Interceptor Ditch access road that crosses Vangorda Creek via the headworks collection dam.

In the summer, roads are passable by 2-wheel drive vehicles. During the winter, roads must be maintained by ploughing to permit vehicle access. Four-wheel drive vehicles are required in the winter due to drifting snow that may cover portions of the road, even after ploughing.

The critical period for most dams is in the spring, when snowmelt in combination with rainfall has the potential to create extreme flood conditions. During this period, access roads may be at risk of washing out, due to erosion, culvert failure or exceedance of culvert capacity. Culvert capacity may become diminished due to icing, snow or blockage by debris.

Loss of road access is a serious concern, since it will delay or prevent inspection of dam and channel facilities and the repair of any damage that has occurred. Under the site wide ERP, the contingency plan that is already in place includes the following (Gartner Lee 2003):

- Park a grader or plow truck in the Town of Faro during winter periods when the road is not being cleared regularly.
- Use snowmobiles in the winter when the snow is not ploughed from all roads.
- Maintain a grader, plow truck, front-end loader and gravel truck on-site or maintain contact with off-site contractors for emergency provision of road repair services.
- Aggressively steam ice from culverts and clear ice from roadside ditches through the winter and spring as required to maintain flow and prevent road washout.
- Maintain contact with the YTG highways maintenance department as regards joint monitoring, maintenance and repairs to the access roads.

4.2 Power and Communications

4.2.1 Power

The Faro site is connected to the Whitehorse-Aishihik-Faro Grid via a 38 kV power line, as shown on Figure 2. Transformers are located at the Faro Mill, which steps down the power for on-site distribution. A standby diesel generator is available to provide emergency power supply. The Vangorda Plateau site is connected to the Faro Mill by a 27 kV overhead power line, as shown on Figure 3. This line feeds a 4160-volt distribution system for the Grum and Vangorda Mine site, which is mounted on single log poles. A distribution of 4167-volt lines feeds power to various substations around the site where temporary ground lines are used to connect to equipment (Gartner Lee, 2003)

A general loss of power could occur at the mine site if the Whitehorse-Aishihik-Faro hydroelectric power grid were to fail as a result of a local or regional disruption or accident. In this event, all site operations would shut down except those that are powered by a portable on-site generator such as the Intermediate Pond lime treatment system and the Little Creek Dam pump (Gartner Lee, 2003). The major project equipment that would be shut down in this event includes the following (Gartner Lee, 2003):

- Main Pit pumping;
- Zone 2 Pit pumping;
- Vangorda Pit pumping;
- Mill water treatment system;
- Grum/Vangorda water treatment plant.

Previous experience has demonstrated that the regional power supplier has restored power quickly. The contingency plan at the site provides for two alternate power sources in the event of an imminent environmental emergency:

- The Town of Faro diesel generator.
- The on-site EMD emergency generator.

The contingency plan requires that in the case of a general loss of power, the following steps be followed (Gartner Lee, 2003):

- Conduct an operational check of equipment status such that equipment is configured appropriately for restart.
- Contact regional power supplier to confirm status and ascertain restart timeframe.
- Arrange with regional power supplier to re-instate power to the mine from the Town of Faro diesel generator if an environmental emergency was imminent.
- Maintain on-site emergency generator that can be utilized in an environmental emergency situation.

4.2.2 Communications

The mine site is connected by telephone to the Town of Faro and to the public phone system. The "Guest House" in the Town of Faro is also equipped with an operable fax machine and telephone. A state-of-the-art telephone system is scheduled for installation at the mine site in 2003 (Gartner Lee, 2003). This phone would work in the event of a power outage only at the point of connection to the telephone line (next to Dana Hagggar's office, 2nd Floor of the guardhouse). The other phones would rely on site power to work.

Senior site managers carry portable satellite phones to maintain communications in the event of a loss of telephone lines. Staff that are undertaking inspections and remote activities carry radios that can contact the Guard House, when so staffed. Alternatively, satellite phones can be used to call Faro directly.

4.3 Darkness

During the winter, the length of daylight hours at the mine site may be less than 6 hours. During the summer, daylight may extend for 24 hours, with a minimal light equivalent to twilight conditions for a short period.

The darkness factor increases the difficulty in responding to emergency events during the winter, when combined with the potential for extreme cold and snow conditions characteristic of the regional climate. Available outside lighting sources will be extremely limited, especially at the dam sites, being restricted to that provided by vehicles and portable flashlights or generator supported floodlights. As noted in Table 4, portable light-plants may be required to support response plans. It is understood that there are three portable light-plants at the site:

- One is on wheels and can be towed as required.
- One is set up at the guardhouse.
- A man-portable unit that can be packed around.

The site security area, Norcan shop area and fuel stations are lit during emergencies. Depending on the emergency, additional areas can be activated.

4.4 Snow Cover

During the winter, snow cover on access roads and dams and structures will severely hamper emergency response. A cleared roadway is required before heavy equipment can be transported on a float trucks, as discussed above in Section 4.1. In an emergency, access by mine staff can be made with snowmobiles or possibly helicopters (if available) to provide preliminary assessment of conditions and to initiate appropriate emergency response measures, including notification of stakeholders.

In general, site activities will be limited during the winter due to the logistical constraints associated with snow cover and maintenance of access. Winter activities such as the excavation of frozen material from borrow sources may be very difficult if the moisture levels are high. Extensive depths of snow cover actually insulate the subsurface and may assist with the prevention of hard, frozen conditions.

Winter is also a time when the risk to dam structures is low, due to reduced water levels, channel flows and frozen conditions. The most critical period is the spring, when snow storms may coincide with high water levels during the break up period. The contingency measures listed in Section 4.1 above should be followed or augmented to suit specific structures that may be at risk.

5.0 NOTIFICATION PLAN

5.1 Emergency Level vs. Failure Level

Activation of the EPP will be done when incident levels for any of the potential failure modes reach the emergency level condition, as described in Section 2.4. The site-wide ERP (Deloitte, 2003) provides the notification responsibilities for any emergency incident. The ERP procedure defines the lines of communication between the mine site staff and Interim Receiver and the notification of outside agencies and stakeholders by the Interim Receiver.

The main distinction between the Emergency Level and Failure Level notification procedures is the degree of involvement of outside agencies. Figure 4 is a decision-based illustration of the steps in the notification plan from the perspective of the first on-scene individual. The decision path format provides a guide for notification for the following incident levels:

- Observation of an incident at the Emergency Level.
- Observation of an incident at the Emergency Level, which progresses to the Failure Level.
- Observation of an incident at the Failure Level.

For all incident levels, the first response is to ensure personal safety and the safety of others. This may require erecting barricades, warning indicators or posting guards to prevent or control access while notifying the Anvil Range Site Manager.

For an Emergency Level incident, notification is primarily internal, within the mine site and the Interim Receiver, except when non-compliant water must be released. Releases of non-compliant water require reporting to the Yukon Spill Line. Implement the Emergency Response Plan(s) for the appropriate failure mode(s) as outlined in Section 3.

If the incident progresses from the Emergency Level to the Failure Level, external notification of all downstream interests and external emergency response organizations is required by the Anvil Range Site Manager, who will also contact the Interim Receiver. The Interim Receiver will notify relevant stakeholders as required by the ERP notification procedure.

If the incident is immediately recognized as a Failure Level condition, the initial observer should notify the Site Manager, who will then assess and implement notification of all downstream interests and external emergency response organizations (fire, police, medical) so that they can initiate their own emergency response plans to deal with the situation as soon as possible. The Site Manager will then contact the Interim Receiver, who in turn will contact the appropriate external agencies. The Site Manager will then contact the Technical Consultant and implement the Failure Response Plan(s) outlined in Section 3.

5.2 Contacts

Appendix II provides the contact list compiled at the mine site. The following are the key contacts for notification when the EPP is implemented:

5.2.1 Internal Site Staff and Deloitte and Touche Inc. (Interim Receiver)

Anvil Range Staff

Site Security	(867) 994-2315 Ext. 105
Dana Haggar	(867) 994-2315 (w) (867) 994-2647 (h)
Mike Bryson	(867) 994-2315 (w) (867) 994-2579 (h)
Rhonda Haggar	(867) 994-2315 (w) (867) 994-2647 (h)
Craig McKinnon	(867) 994-2315 (w) (867) 994-2500 (h)

Deloitte and Touche Inc. (Interim Receiver)

Wes Treleavan	(416) 601-4482 (w)
Alternate Contact #1- Doug Sedgwick	(416) 643-8034 (w) (416) 236-9193 (h)
Alternate Contact #2- Greg Stevens	(403) 267-1724 (w)
Alternate Contact #3- Valerie Chort	(416) 601-6147 (w)

5.2.2 Emergency Response Agencies

Faro Fire Department	(867) 994-2222
Faro Nursing Station	(867) 994-2157 or (867) 994-4444
Faro RCMP	(867) 994-2677 or (867) 994-5555
Faro Ambulance Service	(867) 994-2673 or (867) 994-4444
Faro Municipal Airport	(867) 994-2791
YTG Report a Fire Line	(888) 798-FIRE (3473)

5.2.3 Key Technical Consultants

Geotechnical (Faro)	Jim Cassie	BGC	(403) 250-5185 Ext. 103 (w) (403) 240-0089 (h) (403) 651-2464 (c)
Geotechnical (Faro) - Alternate	Gerry Ferris	BGC	(403) 250-5185 Ext. 101 (w) (403) 228-1077 (h) (403) 815-6513 (h)
Geotechnical (Vangorda and Grum)	Peter Healey	SRK	(604) 601-8420 (w) (604) 985-6751 (h) (604) 619-6753 (c)
Geotechnical (Vangorda and Grum) – Alternate	Cam Scott	SRK	(604) 601-8425 (w) (604) 267-1166 (h)
Environmental	Eric Denholm	Gartner Lee	(867) 873-5808 Ext. 22 (w) (867) 669-7855 (h) (867) 444-1256 (c)
Environmental - Alternate	Forest Pearson	Gartner Lee	(867) 633-6474 Ext 23 (w)

5.2.4 Regulators

YTG 24 Hour Spill Report Hotline	(867) 667-7244
Yukon Health and Safety Board 24 Hour Emergency Line	(867) 667-5450
Chief Mine Inspector	(867) 667-5450
DIAND Chief Water Inspector	(867) 667-3217
YTG Type II Management Team	(867) 667-3360

6.0 RESPONSE PLAN RESOURCES

For the various response plans reviewed herein, manpower, mobile equipment, supplies and support will be required on site. The following section therefore outlines the mobile equipment that is available at the Anvil Range Property, and from other sources in the proximal area. In addition, a suggested list of materials and supplies is also provided so that site staff can determine their existing on-site inventory and to determine if additional supplies are required.

At the current time, the following mobile equipment is located at the Anvil Range site:

- Earth Moving
 - Cat 16G grader;
 - Cat D9 dozer;
 - Cat 235 excavator;
 - Link-Belt 460LX excavator;
 - Volvo L220E loader;
 - Case 4WD 580SM extendable backhoe loader;
 - Two highway-rated dump trucks and
 - Heavy equipment float and tractor.
- Lifting
 - P&H 115 ton mobile crane;
 - P&H 40 ton mobile crane;
 - Cat forklift;
 - Kalmar forklift;
 - Kenworth tandem-axle Hiab crane truck and
 - Single axle Hiab crane truck.
- Generators
 - Cat 285 kW diesel genset;
 - Cummins/Onan 300 kW diesel genset and
 - Various small portable gasoline generators.
- Miscellaneous equipment
 - Two trailer mounted Enviro-fuel tanks;
 - Two 4WD ATV's;
 - Two snowmobiles;
 - Two medical response vehicles;
 - Fire truck;
 - Various 4WD light trucks;
 - Various flat deck utility trailers;
 - Gorman/Rupp Duetz diesel water pump;
 - Four 30 hp Flyte electric water pumps;
 - Various small pumps;
 - Hand held radios and
 - Radio-telephones.

At the current time, the only shortcoming with this equipment inventory would be the lack of a compactor (e.g. vibrator drum-roller) that would be required for the compaction of various lifts of any backfill placed.

Site staff should be familiar with the equipment since they use it on a regular basis. It is assumed that all of this equipment is properly maintained and "certified" for use, as in the case of cranes. It is also assumed that operators for this equipment are located in the Town of Faro, although contacting staff may be problematic at short notice and during weekends and holidays. Cranes require the use of certified operators, which may not be immediately available following an emergency incident. A contact list for operators and staff should be maintained and included within the site ERP document. A partial list of site staff is provided in Appendix II.

The Town of Faro and the YTG road maintenance yard have additional equipment such as graders, water truck, 966 loaders, compactors and various dump trucks. A more specific inventory of these resources should be made and included in this document at a later time.

Local contractors in the Faro-Ross River area and other Yukon based contractors can provide a variety of equipment to supplement the mine equipment on site. Since contractors' capabilities may change with time and new contractors may come into the area, site staff should undertake at least an annual review of local contractors capabilities and inspect the equipment in their yards. This document does not endorse use of any of the particular contractors named below or limit the selection to those listed. The names given below are given for reference only, and should be verified on a regular basis.

Two contractors in Ross River are potentially able to supply the following equipment:

1. Clifford McLeod Contracting, Phone 867-969-2364

- 1985&88 Western Star dump trucks;
- Cat 966C loader;
- Cat 225 excavator;
- Cat D6D dozer;
- Grader - size unknown; and
- Other miscellaneous light-duty mobile equipment.

2. Tim Moon Construction, Phone 867-969-2519

- Three Cat 235 excavators (or equivalent);
- Cat D8 and D6 dozers;
- Cat 14G grader;
- Cat 966 loader (or equivalent); and
- Other miscellaneous light-duty mobile equipment.

In addition to these two local contractors, there are two major contractors in the Yukon Territory that have worked extensively at Faro Mine and have extensive suites of mining and heavy hauling equipment. These two contractors include the following:

1. Golden Hill Ventures Ltd
Whitehorse, YT Y1A 3V7
Phone: 867-668-7807
Fax: 867-668-7762

2. Pelly Construction Ltd.
Whitehorse, YT Y1A 2T7
Phone: 867-667-6161

Each of the contractors may have some equipment within the Faro regional area and they should be contacted if response plans dictate the need for their resources, which may include operators for the equipment.

For all equipment, fuel and oil will be required for their operation. It is assumed that an appropriate amount of both is located on site and that additional required amounts can be moved from the Town of Faro.

In addition to mobile equipment and operators, equipment, materials and supplies will be required to implement the various response plans reviewed earlier. Table 4 outlines some of the potential requirements:

Table 4 Potential Equipment, Materials and Supplies for Emergency Response

Article	Purpose	Commentary / Location
Rip rap	Repair of eroded areas and protection of channels and dam faces.	<p>Cobbles and boulders exist in the granular borrow areas, as below:</p> <ul style="list-style-type: none">• east of BXL explosive plant near NFRC diversion,• west of the Cross Valley Dam and• east of the NFRC Rock Drain on the south side of the causeway. <p>A stockpile of angular riprap is located at the toe of the FWS Dam. Old rockfill quarries located on the south side of the RCDC. Rip rap fragments are located in the quarry area on the far south side of the Grum rock dump. Extensive amounts</p>

Article	Purpose	Commentary / Location
		of rip rap would be problematic. Large fragments from the rock dumps could be possibly used, but material may be acid-generating. Figures 5, 6 and 7 provide more detailed information.
Rockfill and general fill	Backfill for settled areas. Construction of access roads, pads, dikes and buttress berms.	As noted above. Borrow pits also located along the mine site access road coming from the Town of Faro. Large amounts of till located on the Vangorda Plateau with accessible amounts overlooking the Vangorda Pit slopes. Figures 5, 6 and 7 provide more detailed information.
Sand	Required for bedding and covering of liners. May be required for filters and drainage layers.	Granular borrow areas as noted above. Significant granular deposits located just above the north abutment of the Intermediate Dam. If critical, tailings could also be used but metals leaching and ARD concerns would result. Figures 5, 6 and 7 provide more detailed information.
Geotextile	Required for separation and/or filtration for filters and drainage layers.	Relatively heavy-duty non-woven geotextile would likely be required for separation purposes. 10 rolls of inventory currently at site.
Geocomposite liner (GCL)	Required to control seepage by reducing seepage input and leakage from channels.	GCL products are named Bentofix and Bentomat and are installed with overlapping seams only. Powdered bentonite required for seam overlaps. 12 rolls of Bentomat currently at site.
Siphon pipes	Required to lower pond levels rapidly when so needed.	Various lengths of 8, 16, 20 and 24-inch plastic pipe located on site. Starting siphon pipes requires valves or cranes to fill the pipe ends. In addition, small suction pumps and pipe tie-in locations required to evacuate trapped air.

Article	Purpose	Commentary / Location
Light plants	Required to assist night time operations and operations during winter time periods	Three light plants at site, one of which is dedicated to the guardhouse, one is mounted on wheels for towing and the other is man-portable.
Pumps	Required to handle and transfer water and to remove air from siphon pipes.	Various types and sizes of pumps will be required. Pumps will need to be portable and hence gasoline or diesel driven may be the most useful, dependent upon electrical services in the area.

As introduced in Section 4.4, frozen material with higher moisture levels (e.g., till and sand versus riprap) will be difficult to excavate from borrow pits. Consideration should be given to developing stockpiles of material that would allow some drainage to occur, hopefully preventing hard, frozen conditions. If rainfall occurs immediately preceding snowfall and freeze-up, even stockpiles may be frozen solid. Figures 5, 6 and 7 show the location of rock and soil borrow sites in the mine site area.

For several of the noted materials and equipment, site staff should undertake an inventory of the current quantities and conditions. If additional quantities are required, then they should be sourced, delivered and stored appropriately at site.

7.0 RECOMMENDATIONS FOR ADDITIONAL WORK

7.1 Site Staff Training on EPP Content

Copies of the EPP must be distributed to appropriate site staff and representatives of the agencies listed in the notification plan. Each copy should be registered so that any updates or amendments of the EPP can be forwarded to each holder, and acknowledged by the recipients. A list of all the holders of the EPP should appear in each copy. The telephone numbers and names of contact persons should be updated on a regular basis; at least annually as noted by CDA, (1999). The EPP should be bound in a 3-ring binder so that revised pages can be replaced as required.

Training is necessary to ensure that all mine site personnel as well as individuals involved in the EPP are thoroughly familiar with all the elements of the EPP, the availability of equipment and their responsibilities and duties. Mine site staff that may have limited geotechnical and dam experience, should be trained in identification of problems, evaluation and selection of appropriate remedial measures for all incident levels. The training needs to cover all levels of responsibility, beginning with on-site observations through to site management and Interim Receiver personnel. Training should cover a sufficient number of people to ensure adequate coverage at all times (CDA, 1999). The training seminar can be put on CD for the training of new staff.

Training should include representatives of the local emergency response agencies (fire, police, medical etc.) and the Town of Faro, so that they are aware of the EPP details and their role and needs for coordination with the mine personnel.

The training relative to the EPP provided herein should be coordinated with the site-wide ERP currently under preparation.

7.2 Site Drill for Emergency Response

An important component of the EPP is testing the plan through site drills to ensure that the contents of the document and the training of the individuals and involved parties are adequate (CDA, 1999). Initially, testing can be done as a table-top exercise to review the identification and initial response to various incident levels. Larger scale simulations should include notification of external emergency response agencies and regulators and full-scale emergency simulations including multiple failure events. The purpose of these simulations is to identify problems with communications, resources and logistics so that deficiencies in the EPP can be improved. An important component in the simulation drills is to give the site staff the experience and confidence with respect to dealing with emergencies and having a good understanding of the time involved in responding to various incidents.

7.3 Additional Technical and Element Content Relative to EPP

As noted in Section 1.1, there are several other dams and water retention ponds and dikes on the Anvil Range property that have not been included in this EPP as noted below:

- The headworks collection dam at the inlet to the Vangorda Creek Diversion Flume (VCDF).
- The Water Treatment Plant clarification pond embankment.
- The Sheep Pad Sediment Pond embankment below the Grum overburden dump.

The dam safety review carried out by Klohn Crippen (Klohn Crippen, 2002) included a review of the site-wide ERP and recommended that an EPP be prepared for response to potential or actual dam breaks. The present EPP addresses the dams on the property deemed to have the highest consequence of failure, but should eventually include all water retention structures on the property. An assessment of the potential failure modes for the above structures should be carried out so that the any new mechanisms are included in the EPP. Site staff will have to be aware of the emergency identification and associated incident levels for each of these structures.

A key recommendation of the 2002 dam safety review was the need to undertake flood inundation mapping for a potential breach of the Intermediate Dam. As outlined in Section 2.1, dam breach studies have been completed for the FWS (Northwest Hydraulics, 2002; SRK, 2002) but no detailed flood inundation mapping was undertaken with respect to these studies. The dams in the Vangorda Creek drainage basin are all upstream of the Town of Faro, and the dam safety report recommended inundation mapping downstream of these structures, as well.

Additional recommendations made in the dam safety review that will have impacts on the EPP include:

- Completion of certain maintenance items recommended such as repairs to surface erosion on the downstream face of the Intermediate Dam, and infilling and re-grading of cracks of the crests of the dams in the Down Valley area.
- Assess the capacity of the North Fork Rose Creek rock drain under the Vangorda Mine Road.
- Assess the capacity of the main Rose Creek diversion channel to pass high flood flows (see Section 7.4).
- Assess capacity of the emergency spillway at the Intermediate Dam (see Section 7.4).

Some additional items to be considered by the mine site staff and the Interim Receiver with respect to the EPP are:

- The need for some type of warning system to alert downstream users (visitors, hunters, etc.) in the event of a potential dam breach or uncontrolled release of water/tailings.
- Further consideration regarding the stockpiling of supplies and materials, particularly the types, quantities and locations.

- A more detailed description of the site communications system and backup communications system(s).
- Identifying alternative means of accessing the site under various conditions (foot, helicopter, snowmobile, etc.).
- Additional sources of emergency power and lighting.

7.4 Additional Hydrotechnical Analyses

Studies are proposed or have been commissioned to improve the understanding of the regional hydrology and to assess the hydraulic capacity of the Rose Creek Diversion Channel, downstream of the FWS Dam. Regional hydrology data is required to confirm the operating levels and freeboard requirements for all water retention structures under various flood scenarios. Many of the dams have been classified as Very High Consequence (CDA, 1999) structures due to the potential for extreme environmental damages. The Inflow Design Flood (IDF) for these structures is the Probable Maximum Flood (PMF). Currently, the Rose Creek Diversion Channel and the Intermediate Dam Spillway have been sized for flood events less than the PMF (Klohn Crippen, 2002). A PMF review is to be done for the Rose Creek Diversion.

Hydrological design criteria are under review for both the Faro and Vangorda diversion channels. These studies will include flow measurements in the creeks, collection of meteorological data, regional hydrological analysis and correlation to major rainfall events occurring within the study period. The 1:200 to PMF flood values will be determined.

Any relevant information from these studies should be transferred to the EPP, as appropriate.

7.5 Borrow Materials

As outlined in Section 3, some of the response measures will require placing various types of fill materials such as till, sand and gravel, crushed rock and rockfill. Figures 5, 6 and 7 show the locations of various soils and rock borrow areas around the mine site area. It is recommended that these sources be checked and inventoried in terms of quantities and quality of materials be prepared. An assessment should be made to determine the need for creating stockpiles of various materials close to dams, so that they will be readily available in case of an emergency. Consideration needs to be given to ensuring that the material is thermally protected from becoming frozen and remains in a dry or drained condition at all times.

8.0 CLOSURE

This EPP has been prepared for the Intermediate, Cross Valley and Little Creek Dams and the two main pit diversion channels at Faro and Vangorda. As part of the process for completing our terms of reference, BGC has received comments on the draft EPP from Deloitte and Touche, site management and SRK. These comments have been included in this version of the document. This EPP was written concurrently with the site-wide ERP, under coordination by Eric Denholm of Gartner Lee. Comments on the draft EPP were received from Gartner Lee and include items that ensure the two documents are consistent. Nevertheless, this EPP should be considered to be a "living document" that must be constantly reviewed and updated to reflect current site conditions and information.

We trust that this information meets with your requirements at this time. Please do not hesitate to contact the undersigned if you have any questions or require additional information.

Respectfully submitted,
BGC Engineering Inc.
Per:

Holger Hartmaier, M.Eng., P.Eng. (AB)
Senior Geotechnical Engineer

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

REFERENCES

BGC Engineering Inc. 2001. Qualitative Risk Assessment of the Down Valley Tailings Area, Faro Mine, Yukon. Report submitted to Deloitte and Touche Inc., Project No. 0257-004, November 2001.

Canadian Dam Association 1999. Dam Safety Guidelines. Published by CDA, twelve sections, January 1999.

Deloitte and Touche Inc., 2003. Draft Emergency Response Plan (ERP). In preparation by Mr. Eric Denholm of Gartner Lee Limited.

Gartner Lee Limited 2003. 2004-2008 Water Licence Renewal Application Report, Anvil Range Mining Corporation (Interim Receivership), Prepared May 2003.

Klohn Crippen Consultants Ltd. 2002. Anvil Range Property, 2002 Dam Safety Reviews. Report submitted to Deloitte and Touche Inc., Project No. 3003.01.510, December 5, 2002.

Northwest Hydraulic Consultants Ltd. 2002. Faro Mine Site – Preliminary Routing of Extreme Floods Through the FWSD and the Potential of Dam Break. Report submitted to BGC Engineering Inc., January 8, 2002.

Steffen Robertson and Kirsten (Canada) Inc. 2002. Risk Assessment of the Fresh Water Supply Dam, Faro Mine, Yukon Territory. Report submitted to Deloitte and Touche Inc., Project No. 1CD003.14, September 2002.

Steffen Robertson and Kirsten (Canada) Inc. 2003a. Phase 2 Borrow Source Survey, Faro Mine, Yukon Territory. Report submitted to Deloitte and Touche Inc., Project No. 1CD003.12, April 2003.

Steffen Robertson and Kirsten (Canada) Inc. 2003b. Revised Risk Assessment of the Faro Fresh Water Supply Dam, Faro Mine, Yukon. Report submitted to Deloitte and Touche Inc., Project No. 1CD003.17, June 2003.

APPENDIX I – AUGUST 25 MEETING AGENDA



AGENDA
RISK ASSESSMENT & FAILURE MODE REVIEW MEETING
ANVIL RANGE PROPERTY, YT
AUGUST 25, 2003

Attendees: Peter Healey and Cam Scott – SRK
Holger Hartmaier and Jim Cassie – BGC

1. Study Objective

Provide technical input into OMS manual and failure mode input (level and mode) into Emergency Preparedness Plan (EPP) for the following five structures:

- Cross Valley Dam.
- Intermediate Dam.
- Little Creek Dam.
- Faro Creek Diversion Channel (and by extension, the Faro open pit).
- Vangorda Creek Diversion Channel (and by extension, the Vangorda open pit).

It should be noted that the FWS Dam should not be considered in detail since it will be removed this November.

The approved budget from Deloitte contains fees and disbursements for SRK. Assuming that SRK invoice for project costs will be forwarded to BGC for information (budget tracking) only.

2. Alert Levels

Need to define alert levels indicative of potential incidents that require assessment and response. The level categories need to be simple and straightforward for ease of use. Do not want categories to under-rate importance of identified incidents. Possible categories include the following:

- Alert Level – minor atypical conditions noted (e.g. high pore pressure reading from piezometer, spillway flowing at maximum design flow level, with no failure).
- Emergency Level – significant atypical condition noted (e.g. slump on the downstream face).
- Failure Level – imminent failures conditions observed (e.g. piping at toe coupled with crest sinkhole).

Q: Are three categories too many?

Q: What is the level of training required/expected for operators (i.e. recognition of potential problems)?

3. Overview of Background Data Available

- Flood data and reservoir storage curves.
- As-built information
- Previous inspection/performance/assessment data
- Existing Instrumentation/monitoring programs

4. Summary of Individual Dam/Diversion Channel Specifics

- Layout/general arrangement
- Unique site conditions
- Access/power/facilities/appurtenant structures
- Relevant studies-dam break, stability analysis
- Potential failure modes- see copy of generic list
- Threat levels

5. Information Gaps Identified**6. Summary****7. Action Items**

- Report and drawing copies from SRK.
- Reading and review time from Peter Healey.

APPENDIX II – MINE SITE PHONE LIST

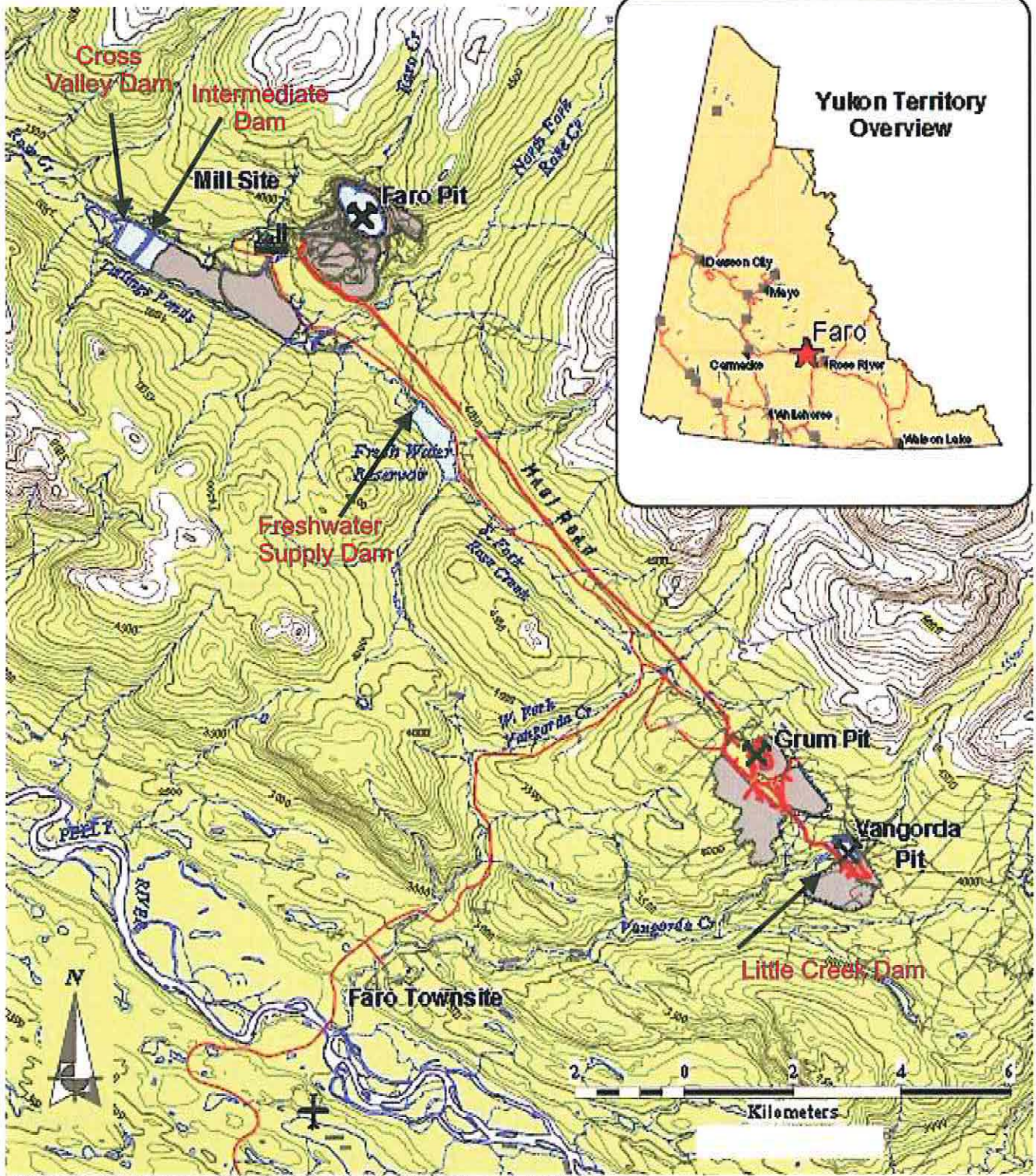


LOCAL EMPLOYEE TELEPHONE CONTACT LIST				MAIN TELEPHONE LISTING		REVISED: 30 September, 2003	
LAST NAME	FIRST NAME	TELEPHONE NUMBER	ALTERNATIVE NUMBER	ANVIL RANGE MINING CORPORATION TELEPHONE DIRECTORY	TELEPHONE NUMBER	FAX NUMBER	
ANDERSON	Ralph	994-2022		NUMBER - ONE	(867) 994-2315	(867) 994-2378	
BENOIT	Amos	994-2672		NUMBER - TWO	(867) 994-2319	(867) 994-2378	
BORK	Kathy	994-2047		NUMBER - THREE	(867) 994-2348	(867) 994-2378	
BOYLE	Lester	994-2069		NUMBER - FOUR	(867) 994-2352	(867) 994-2378	
BRANNER	Karie	994-2341		NUMBER - FIVE	(867) 994-2600	(867) 994-2378	
BRYSON	Michael	994-2579	Fax: 994-2805				
CHEATER	Robert	994-2001		ANVIL RANGE MINING CORPORATION EXTENSION NUMBERS	EXTENSION NUMBER		
DUIVENVOORDEN	Dan	994-3111					
EBERLEIN	Wolfgang	994-3007	L.S. 2M-4583	DANA HAGGAR	EXT. 101		
FORBES	Doc	994-2307		MICHAEL BRYSON	EXT. 102		
FREAKE	Neil	994-3413		JEFF IRVINE	EXT. 103		
HACKET	Leo	994-2337		SUPERVISORS OFFICE	EXT. 104		
HAGGAR	Dana	994-2647	Fax: 994-3349	SECURITY - MAIN GATE	EXT. 105		
HAGGAR	Rhonda	994-3328		LABORATORY - RHONDA & CRAIG	EXT. 106		
IRVINE	Jeff	994-2017		MEDICAL - FIRST AID ROOM	EXT. 107		
JOHB	Lloyd	994-3447					
JONES	Ray	994-3155		EMERGENCY RESPONSE TELEPHONE NUMBERS	TELEPHONE NUMBER	EMERGENCY NUMBER	
LaFLEUR	Robert	994-3249					
McKinnon	Craig	994-2500		AMBULANCE SERVICE - FARO	(867) 994-2673	(867) 994-4444	
McGIVERN	Rory	994-2484		FIRE DEPARTMENT - FARO	(867) 994-2222		
MEERS	Darcy	994-3301		MAINTENANCE SHOP - FARO	(867) 994-2758		
MEERS	Harold	994-2232		MUNICIPAL AIRPORT - FARO	(867) 994-2791		
MEERS	Ronnie	994-2379		NURSING STATION - FARO	(867) 994-2157	(867) 994-4444	
MILLER	Adam	994-3310		POISON CONTROL	(800) 267-1373		
NEYELE	Ron	994-2080		WHITEHORSE HOSPITAL	(867) 393-8700		
NICKSON	John	994-3293		YUKON ENERGY - FARO	(867) 994-3013		
PARDY	Bernice	994-2234	L.S. 2M-0830	YUKON ENERGY - GUY MORGAN	(867) 393-5366		
PARDY	Harry	994-2234	L.S. 2M-0830	YUKON ENERGY - SCC WHITEHORSE	(867) 393-5355		
POWER	Bill	994-2168		(RCMP) POLICE STATION - FARO	(867) 994-2677	(867) 994-5555	
RAYMOND	Bob	994-2204					
ROGERS	Bob	994-2735		DELOITTE & TOUCHE CALGARY OFFICE	TELEPHONE NUMBER	FAX NUMBER	
SALO	John	994-2021					
SUNDIN	Lorraine	994-2341		GREG STEVENS	(403) 267-1724	(403) 263-2390	
WESCHE	BJ	994-2129		RICK ANDERSON	(403) 267-1734	(403) 263-2390	
WILKINSON	Chris	994-3289		SUE OUELLETTE	(403) 267-0580	(404) 263-2390	
WILKINSON	Elizabeth	994-3289					
WILKINSON	Richard	994-3257		ANVIL RANGE MINING CORPORATION GUEST HOUSES	TELEPHONE NUMBER	FAX NUMBER	
				282 DAWSON DRIVE - HOUSE # 1	(867) 994-2459	(867) 994-3483	
				638 YATES STREET - HOUSE # 2	(867) 994-2058		



FIGURES





Note: Base map figure provided by Gartner Lee Limited.

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SCALE:	As Shown	DESIGNED:	KFM
DATE:	September 2003	CHECKED:	HHH
DRAWN:	SLF	APPROVED:	JWC

CLIENT: **Deloitte & Touche**

PROJECT: **Anvil Range EPP for Dams & Water Diversion Structures**

BGC

BGC Engineering Inc.
AN APPLIED EARTH SCIENCES COMPANY

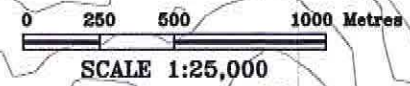
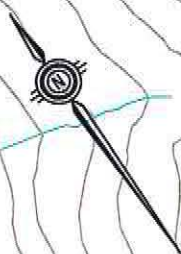
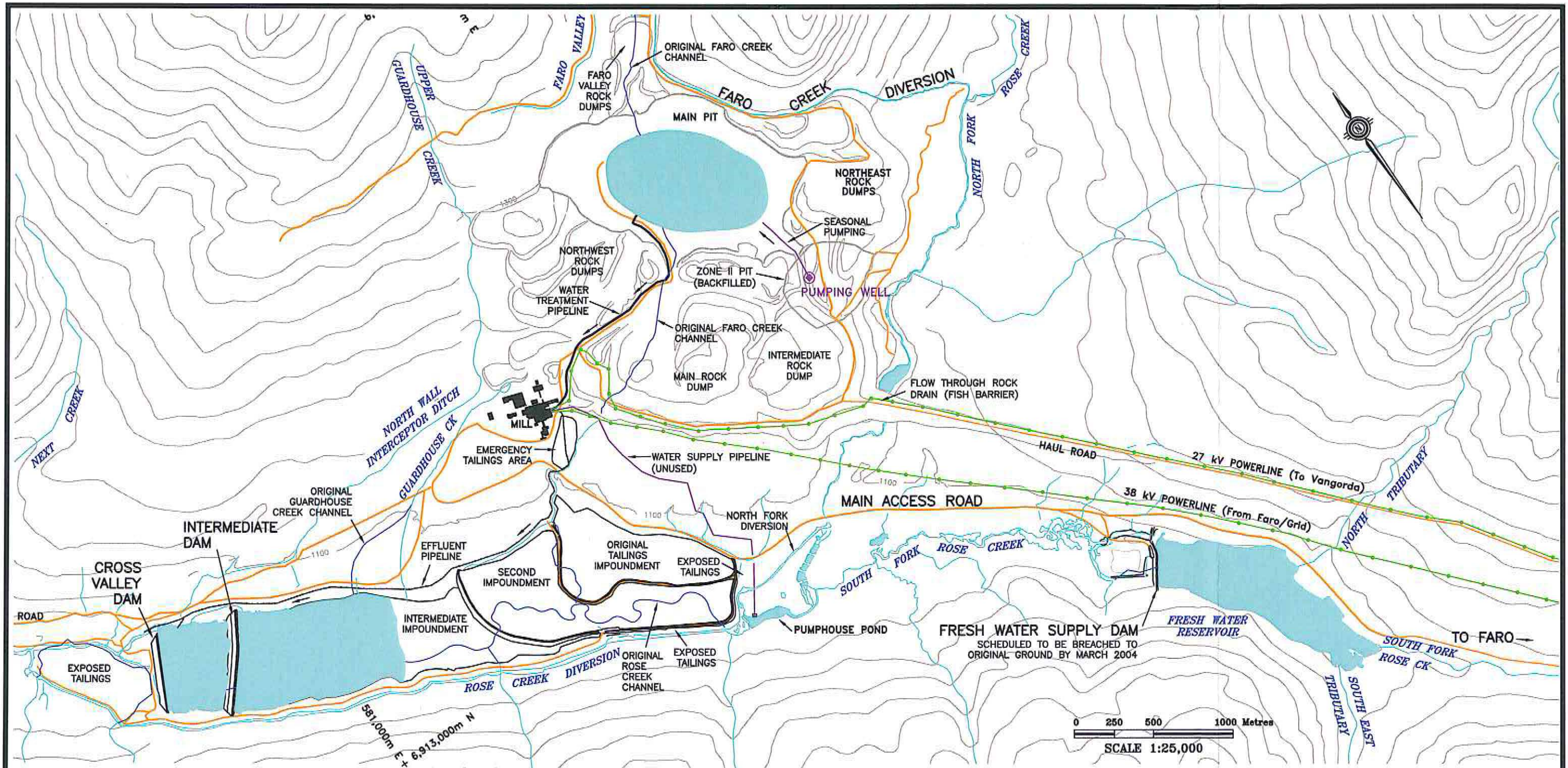
Calgary, Alberta. Phone: (403) 250-5185

TITLE: **Site Location Plan**

PROJECT No. **0257-018-02**

Figure number
Figure 1

REV.
0



CLIENT: **Deloitte & Touche**

NOTE: BASE MAP FIGURE PROVIDED BY GARTNER LEE LTD.

LEGEND:

	ROADS		SURFACE WATER
	EXISTING SURFACE DRAINAGE		
	PRE-MINE DRAINAGE		
	EFFLUENT PIPELINE		
	PIPELINE		
	WATER TREATMENT PIPELINE		
	POWERLINE		

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED

SCALE:	AS SHOWN
DATE:	OCTOBER 2003
DRAWN:	GEJ
DESIGNED:	KM
CHECKED:	HHH/JWC
APPROVED:	JWC

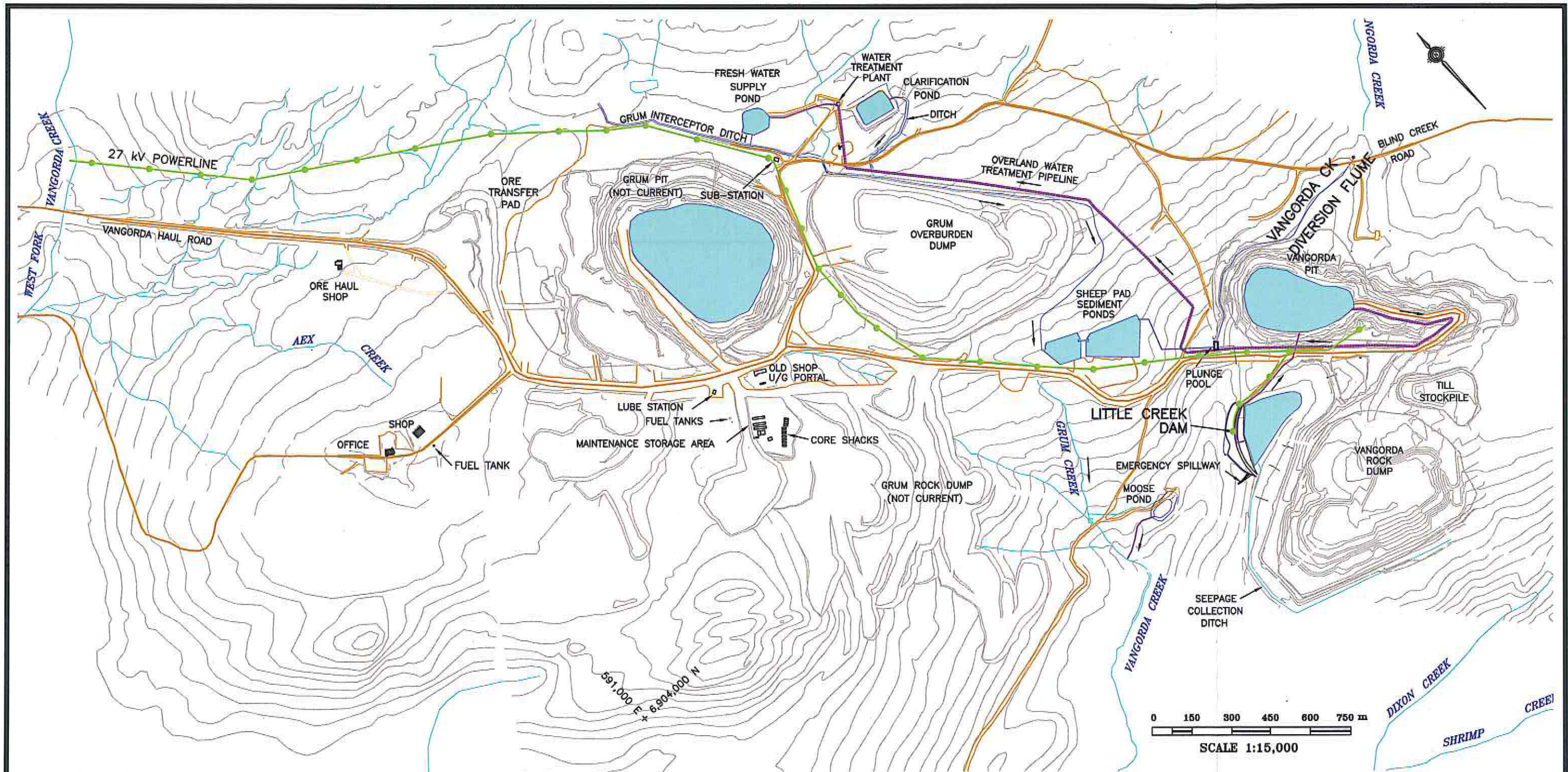
PROJECT: ANVIL RANGE EPP FOR DAMS & WATER DIVERSION STRUCTURES		
TITLE: FARO MINE SITE OVERVIEW		
PROJECT No. 0257-018-02	FIGURE No. 2	REV. 0

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY

BGC Calgary, AB Phone: (403) 250 5185

0257-018-02 001 FIGURE1.dwg

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CLIENT: **Deloitte & Touche**

NOTE: BASE MAP FIGURE PROVIDED BY GARTNER LEE LTD.

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LEGEND:

	ROADS		WATER TREATMENT PIPELINE
	EXISTING SURFACE DRAINAGE		SURFACE WATER
	PRE-MINE DRAINAGE		
	EFFLUENT PIPELINE		
	PIPELINE		
	POWERLINE		

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED

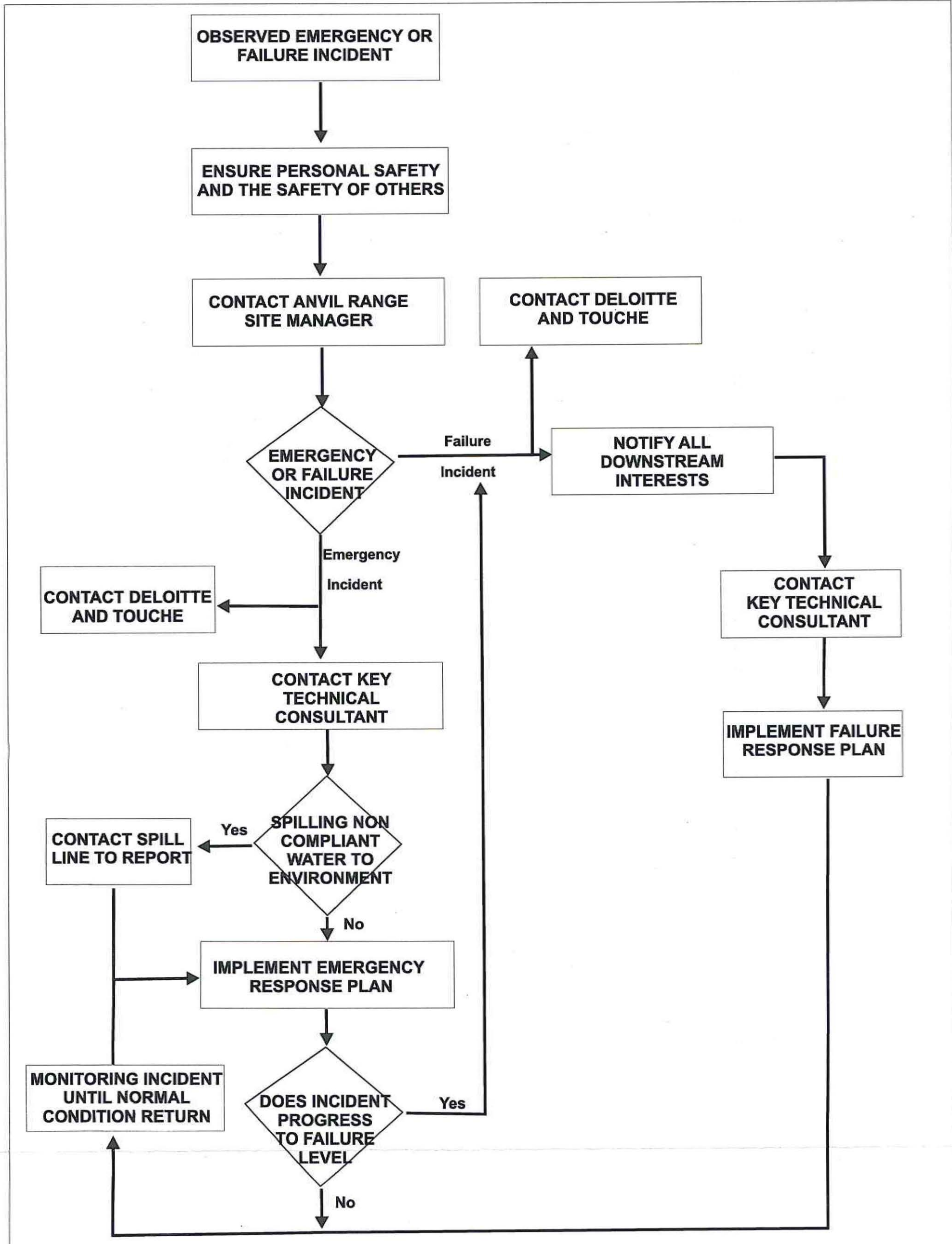
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DATE:	OCTOBER 2003
DRAWN:	GEJ
DESIGNED:	KM
CHECKED:	HHH/JWC
APPROVED:	JWC

PROJECT:	ANVIL RANGE EPP FOR DAMS & WATER DIVERSION STRUCTURES	
TITLE:	VANGORDA PLATEAU MINE SITE OVERVIEW	
PROJECT No.	FIGURE No.	REV.
0257-018-02	3	0

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0257-018-02 001 FARO OVERVIEW.dwg



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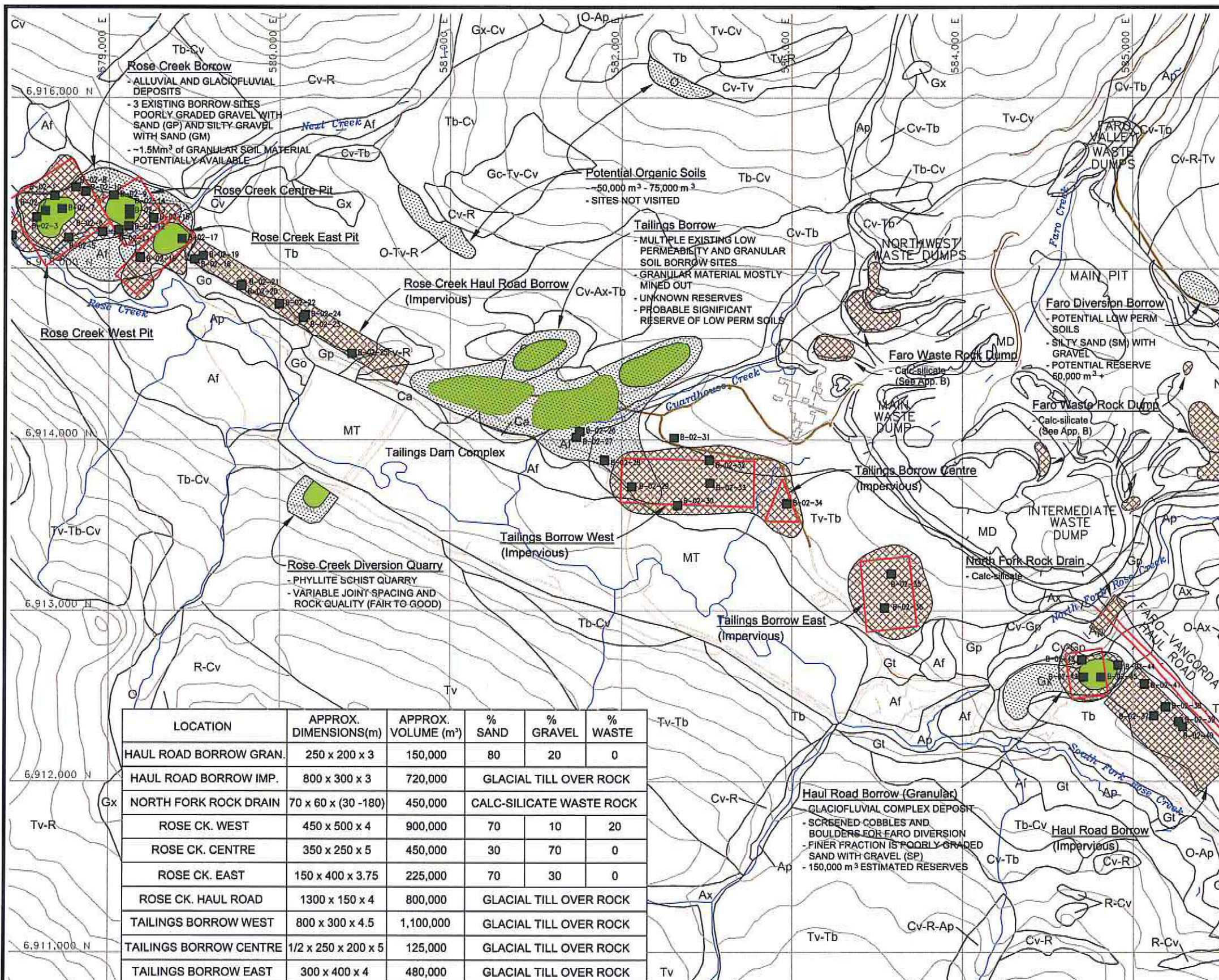
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DATE:	September 2003	CHECKED:	HHH
DRAWN:	SLF	APPROVED:	JWC

CLIENT: **Deloitte & Touche**

PROJECT: **Anvil Range EPP for Dams & Water Diversion Structures**

BGC Engineering Inc.
AN APPLIED EARTH SCIENCES COMPANY
Calgary, Alberta. Phone: (403) 250-5185

TITLE: Decision Path for Site Personnel		
PROJECT No.	DWG. No.	REV.
0257-018-02	Figure 4	0



LEGEND (from Bond, 1999)

- QUATERNARY**
HOLOCENE
MINE DISTURBANCE
 MD - mine disturbance; consisting of an open-pit and stripped till and bedrock accumulations. Bedrock and surficial sediments exposed in open-pit.
MINE TAILINGS
 MT - mine tailings; consisting of sand, silt and some clay.
ORGANIC DEPOSITS
 O - organics; consisting of woody sedge peat, variable thickness. White River ash accumulations are commonly associated with poorly drained peaty areas.
ALLUVIAL DEPOSITS
 Ap - alluvial plain; silt, sand and pebbles with reworked cobbles and boulders occurring as bars, overbank floodplain deposits, 0 - 10 m thick; floodplain subject to periodic floods. Small valley alluvial plains may not be mapped at this scale.
 Ap (active) - alluvial plain; area of Pelly River floodplain that has been recently active.
 At - alluvial terrace; silt, sand, and pebbles with reworked cobbles and boulders occurring as low terrace deposits, 0 - 10 m thick.
 Af - alluvial fan; coarse sand, pebbles, cobbles and mudflow deposits, up to or >10 m thick. Appear as vegetated, often peat covered, landforms developed during post-glacial sedimentation.
 Ax - complexes of Ap and Af undivided. Common when a stream is unconfined and also in narrow valleys where side-entry alluvial fans cannot be differentiated from an alluvial plain.
PLEISTOCENE AND HOLOCENE (UNDIVIDED)
COLLUVIAL DEPOSITS
 Cv - colluvium veneer; conforms to bedrock topography, <1 m thick.
 Ca - colluvium apron; coalescing colluvial fans at the base of a slope, >1 m thick.
 Cz - mass wasting; includes slumping, debris slides and rockfalls. Slumping and rockfalls are common on Mt. Mye.
LATE PLEISTOCENE (WISCONSINAN) - McCONNELL GLACIATION
GLACIOLACUSTRINE DEPOSITS
 Lb - glaciolacustrine blanket; 1- 40 m thick.
GLACIOFLUVIAL DEPOSITS
 Gp - glaciofluvial plain; 3 - 10 m thick.
 Gt - glaciofluvial terrace; <10 m thick.
 Gx - glaciofluvial complex; 1 - 30 m thick, composed of deposits of outwash, glaciolacustrine and minor till deposited in an ice contact environment. Hummocky topography is associated with this depositional setting. Crevasse fillings were mapped in the upper part of Vangorda Creek valley.
GLACIAL DEPOSITS
 Tv - till veneer; conforms to underlying topography, <1 m thick.
 Tb - till blanket; gently to moderately sloping plain controlled by bedrock or underlying surficial deposits, >1 m thick.
 Tx - till complex; till blanket or veneer composed of meltout till and minor ice contact glaciofluvial deposits.

- LOWER CAMBRIAN TO CRETACEOUS**
BEDROCK
 R - bedrock; common on plateau summits and ridges on Mt. Mye and Sheep Mountain.

- EXISTING QUARRY OR BORROW
 - POTENTIAL QUARRY OR BORROW
 - AREA IDENTIFIED IN PHASE 1 (TOO THIN OR UNTESTED)
 - MINE INFRASTRUCTURE
 - EXISTING ACCESS ROAD
 - PHASE 2 BORROW TEST PIT
- B-02-40

REFERENCES
 ORIGINAL MAP : SRK (2003) FIGURE 2
 BOND, J.D. (OPEN FILE 1999-10)
 SURFICIAL GEOLOGY MAP AND TILL GEOCHEMISTRY OF MOUNT MYE (105K/3&6 W), CENTRAL YUKON TERRITORY

LOCATION	APPROX. DIMENSIONS(m)	APPROX. VOLUME (m ³)	% SAND	% GRAVEL	% WASTE
HAUL ROAD BORROW GRAN.	250 x 200 x 3	150,000	80	20	0
HAUL ROAD BORROW IMP.	800 x 300 x 3	720,000	GLACIAL TILL OVER ROCK		
NORTH FORK ROCK DRAIN	70 x 60 x (30 -180)	450,000	CALC-SILICATE WASTE ROCK		
ROSE CK. WEST	450 x 500 x 4	900,000	70	10	20
ROSE CK. CENTRE	350 x 250 x 5	450,000	30	70	0
ROSE CK. EAST	150 x 400 x 3.75	225,000	70	30	0
ROSE CK. HAUL ROAD	1300 x 150 x 4	800,000	GLACIAL TILL OVER ROCK		
TAILINGS BORROW WEST	800 x 300 x 4.5	1,100,000	GLACIAL TILL OVER ROCK		
TAILINGS BORROW CENTRE	1/2 x 250 x 200 x 5	125,000	GLACIAL TILL OVER ROCK		
TAILINGS BORROW EAST	300 x 400 x 4	480,000	GLACIAL TILL OVER ROCK		

Haul Road Borrow (Granular)
 GLACIOFLUVIAL COMPLEX DEPOSIT
 - SCREENED COBBLES AND BOULDERS FOR FARO DIVERSION
 - FINER FRACTION IS POORLY GRADED SAND WITH GRAVEL (SP)
 - 150,000 m³ ESTIMATED RESERVES

0 500 1000
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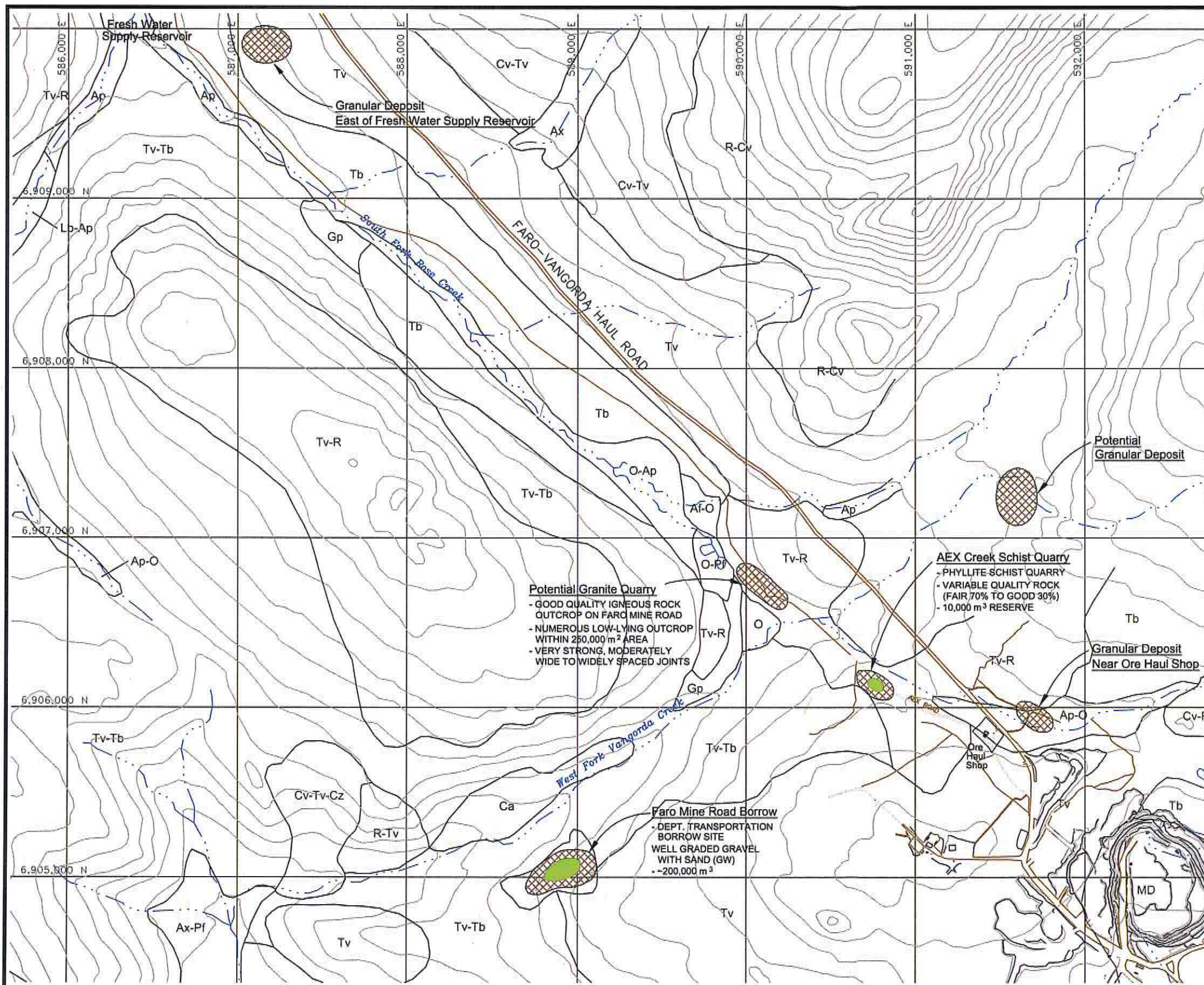
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SCALE: AS SHOWN
 DATE: OCTOBER 2003
 DRAWN: WKL
 DESIGNED:
 CHECKED: HHH/JWC
 APPROVED: JWC

FARO MINE SITE

TITLE		
SURFICIAL GEOLOGY		
SOIL AND ROCK BORROW LOCATIONS		
PROJECT No.	FIGURE No.	REV.
0257-018-02	5	0



LEGEND (from Bond, 1999)

QUATERNARY

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- EXISTING QUARRY OR BORROW
- POTENTIAL QUARRY OR BORROW
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- MINE INFRASTRUCTURE
- EXISTING ACCESS ROAD
- PHASE 2 BORROW TEST PIT

REFERENCES

- ORIGINAL MAP : SRK (2003) FIGURE 4
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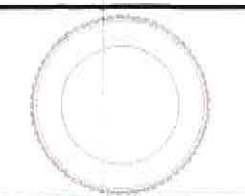
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Deloitte & Touche

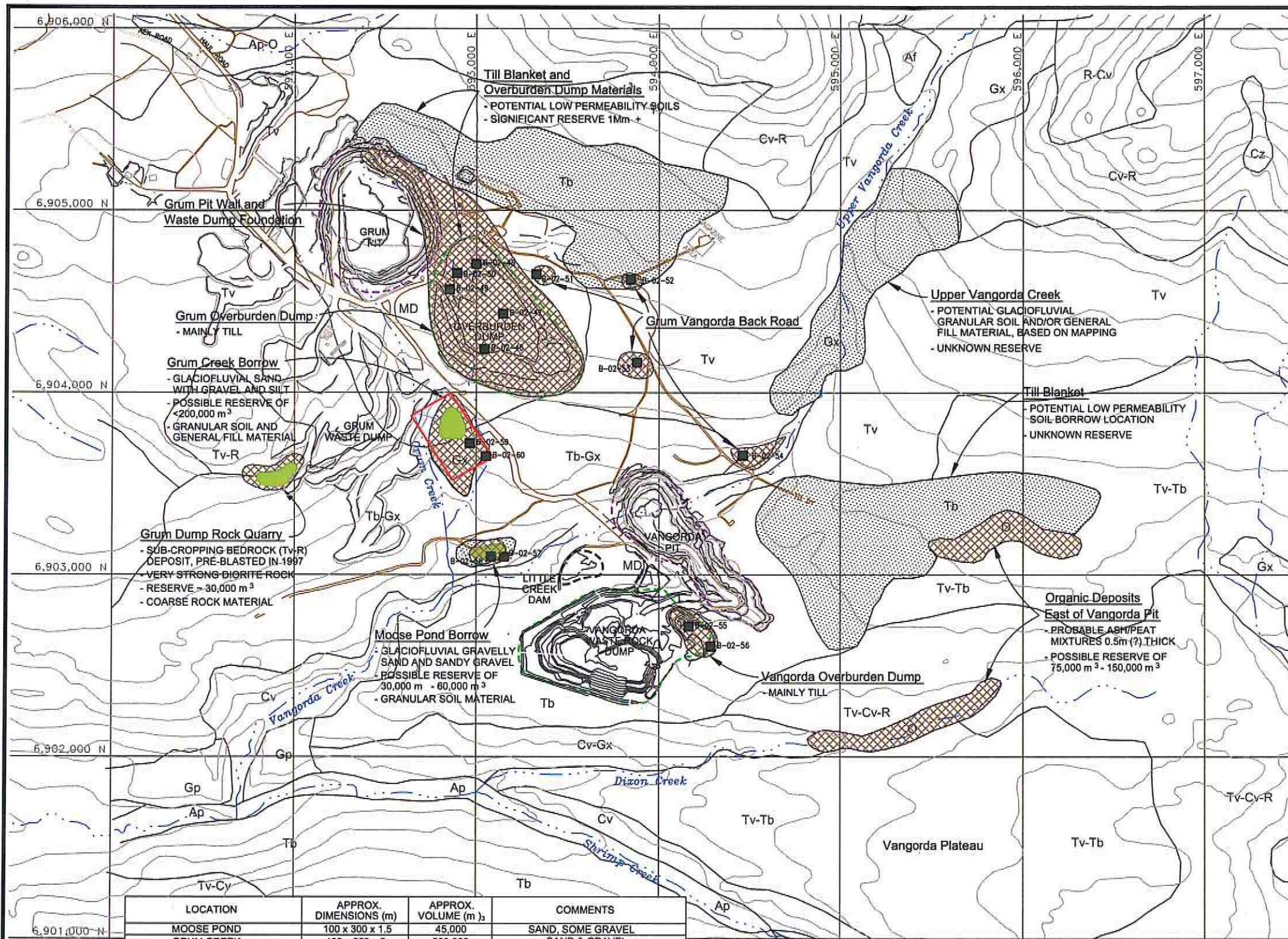
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SCALE:	AS SHOWN
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APPROVED:	JWC



FARO - VANGORDA HAUL ROAD		
TITLE SURFICIAL GEOLOGY SOIL AND ROCK BORROW LOCATIONS		
PROJECT No.	FIGURE No.	REV.
0257-018-02	6	0



LEGEND (from Bond, 1999)

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- MINE INFRASTRUCTURE
- EXISTING ACCESS ROAD
- PHASE 2 BORROW TEST PIT

REFERENCES

ORIGINAL MAP : SRK (2003) FIGURE 3

BOND, J.D. (OPEN FILE 1999-10)

SURFICIAL GEOLOGY MAP AND TILL GEOCHEMISTRY OF MOUNT MYE (105K/3&6 W), CENTRAL YUKON TERRITORY

LOCATION	APPROX. DIMENSIONS (m)	APPROX. VOLUME (m ³)	COMMENTS
MOOSE POND	100 x 300 x 1.5	45,000	SAND, SOME GRAVEL
GRUM CREEK	400 x 250 x 2	<200,000	SAND & GRAVEL
GRUM, VANGORDA BACK ROAD	#51	100 x 100 x 1	SAND & GRAVEL
	#52	60 x 100 x 2.5	
	#53	200 x 100 x <1	
	#54	1/2 x 400 x 300 x 1	
VANGORDA OVB DUMP	200 x 200 x 10	400,000	GLACIAL TILL
GRUM OVERBURDEN DUMP	1000 x 700 x 12	8,000,000	GLACIAL TILL
ORGANIC DEPOSITS EAST OF VANGORDA PIT	800 x 150 x .5 1100 x 150 x .5	150,000	PEAT

0 500 1000
1:25,000 METRIC



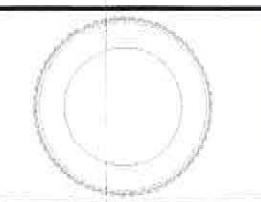
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FARO - VANGORDA HAUL ROAD		
TITLE: SURFICIAL GEOLOGY SOIL AND ROCK BORROW LOCATIONS		
PROJECT No.	FIGURE No.	REV.
0257-018-02	7	0