Primary Alternatives for Closure of Anvil Range Mining Complex

DRAFT

Prepared for

Faro Mine Closure Planning Office

Prepared by

SRK Consulting
Engineers and Scientists

December 2005

Primary Alternatives for Closure of Anvil Range Mining Complex

DRAFT

Faro Mine Closure Planning Office

SRK Consulting (Canada) Inc.
Suite 800, 1066 West Hastings Street
Vancouver, B.C. V6E 3X2

Tel: 604.681.4196 Fax: 604.687.5532
E-mail: vancouver@srk.com Web site: www.srk.com

SRK Project Number 1CD003.065

December 2005

Table of Contents

List of Tables

List of Figures

List of Attachments

1 Introduction

This document describes the primary alternatives for the closure of the Anvil Range Mining Complex. It is intended for two uses. The first use will be to provide basic information on each of the primary alternatives to the group of people who will assess the residual technical risks associated with each alternative. The second use will be to provide a basis for presenting the alternatives, and their associated risks and costs, to the Faro Mine Closure Oversight Committee.

The remainder of the document presents:

- An overview of the process leading up to this report, and the expected process for finalizing and presenting the results;
- A presentation of three primary alternatives for closure of the Faro Tailings area, two primary alternatives for the Faro Mine area, and two primary alternatives for the Vangorda/Grum Mine area;
- Initial assessments of the primary alternatives (with a section on residual technical risks that remains to be completed); and
- Attachments providing detailed analyses, risk assessments, and cost estimates.

2 Overview of Process

Closure planning for the Anvil Range Mining Complex has a long history. The first comprehensive closure plan, known as the Integrated Closure and Abandonment Plan (ICAP), was produced for the site operator in 1996. It was reviewed by regulatory agencies and other interested parties but never approved or revised.

The Interim Receiver initiated a review of the ICAP in 2002, as part of the application for a new Water License. It was clear that there were several parts of the ICAP that could no longer be implemented, and other parts that would not meet approval of the broader range of stakeholders that are now involved in the project. The Interim Receiver therefore initiated a series of technical workshops to initiate development of new closure plan.

Over the period April 2002 to January 2004, there were a total of four technical workshops. Attendees at the workshops have included representatives of the Type II Mines Office, First Nations, the town of Faro, Yukon regulatory agencies, Environment Canada, the Department of Fisheries and Oceans, and specialist consultants in several of the key technical disciplines. In general, each workshop began with a presentation of the current state of knowledge of the site, including updates on recent technical studies. Participants in each technical workshop then developed lists of methods that could be used to close various parts of the site. The methods were then reviewed and the uncertainties preventing selection of preferred methods were identified. Studies to resolve the critical uncertainties were then designed. Over the years 2003-2005, the Interim Receiver, working together with DIAND, commissioned approximately ?? of these studies, with a total value of over $???????.

In addition to the technical workshops and studies, efforts were underway to consult with interested stakeholders to determine their principal objectives for the project. One formal workshop was held as part of that process, in July 2004, and additional meetings were held with each group of stakeholders.

In January 2005, a final technical workshop was held. Mr. Tony Keen, who had been leading the stakeholder consultation process, presented a summary of the objectives expressed by the various stakeholder groups. Technical specialists then presented the results of the investigations that they had carried out in 2004.

Subsequent to the January 2005 workshop, SRK was asked to initiate a review of the available closure alternatives, to provide a basis for the project's Oversight Committee to select preferred options. The "primary alternatives" project, as it came to be called, was initiated in February 2005. The first step was to select groups of methods to represent the range of options that were still under consideration. SRK completed an initial list of methods and then circulated it to other project participants representing the Type II Mines Office, the Faro Mine Closure Planning Office, and the Ross River and Selkirk First Nations. The list of methods was heavily modified based on feedback

from the other participants. A number of critical uncertainties were also identified, and the project team worked to resolve these over the period March – June 2005.

Other commitments, in particular to field studies, then delayed the project for several months. In October 2005, with the appointment of a Director for the Faro Mine Closure Planning Office, the project regained momentum. In November and early December, the results of the earlier studies were reviewed by a small team consisting of SRK and FMCPO staff, and a complete set of sketches and cost estimates for each of the primary alternatives was prepared. Results from studies of post-closure water quality, ecological risk and human health risk became available, and these were integrated into the analysis of each alternative.

At the time of writing, a set of primary alternatives have been defined, and the water quality, ecological risks, human health risks and costs associated with each have been estimated. The remainder of this report presents those items. For ease of reference, the primary alternatives are listed in Table 2.1.

One significant gap remains, namely the assessment of residual technical risks, i.e. the risks of failure, malfunction, degradation or additional cost, associated with each alternative. The intention is that a series of meetings will be held in early January 2006 to work through each of the primary alternatives and define these residual technical risks. Those meetings will be attended by technical specialists from the FMCPO, the Type II team, First Nations, and SRK.

Finally, once the residual risks have been defined, a complete package will be developed for presentation to the project Oversight Committee. The presentation package will include summary descriptions of each alternative, as well as the associated implications for water quality, ecological risk, human health risk, residual technical risk, and cost. The Oversight Committee will then use that package as a basis for selecting a single set of preferred alternatives that can be taken forward into the final closure plan.

The relationship of this project to other ongoing projects is worth noting. More detailed studies of components of the primary alternatives are still underway at the time of writing. The latest information available from such projects has been brought into this work, but the ongoing work will undoubtedly result in further modification of the alternatives presented herein. Future studies, up to and including final design and implementation, will result in additional modifications. However, after lengthy consideration, it is the opinion of SRK and the FMCPO that the current state of technical knowledge is sufficient to support the definition of the primary alternatives and to provide the technical information needed to support the selection of a single set of preferred alternatives.

Table 2.1: Primary Alternatives

Faro Mine Area
1. Flow-Through Pit
2. Upgrade Faro Creek Diversion
Rose Creek Tailings
1. Stabilize in Place
2. Complete Relocation
3. Partial Relocation
Vangorda/Grum Mine Area
1. Backfill Vangorda Pit
2. Stabilize in Place

3 Primary Alternatives for Faro Mine Area

3.1 Faro Mine Area Alternative 1 – Flow-Through Pit

The "Flow-Through Pit" alternative for the Faro Mine area is illustrated in Figure 3.1. The following paragraphs summarize the major activities in each portion of the site. Further detail can be found in the "Construction Details and Cost Estimate" sheets found in Appendix A.

The Faro Pit will be used for passive treatment by seasonal phosphate addition. A plug dam will be constructed to elevation 1170 m. A berm will be constructed around the rim of the pit to prevent inadvertent access.

Faro Creek will be routed into the pit via an HDPE-lined ditch cut through or around the Faro Valley Dump. The ditch will include a rip-rapped overflow point, from which the water will cascade into the pit lake. Water will leave the Pit Lake via a set of siphons or pumps installed in a cut through the waste rock and mill areas. The base of the excavation will have a maximum elevation of 1168 m so that any excess water will spill before exceeding the Plug Dam freeboard limit.

Water will be pumped by a well from the Zone II pit and discharged to the Faro Pit lake. Outwash material at the toe of the slope below the Zone II pit will be excavated and placed on the Intermediate Dump.

The oxide fines and low grade ore stockpiles will be consolidated and covered with a very low infiltration covers, herein assumed to be a combination geomembrane and soil cover, consisting of a bedding layer, HDPE geomembrane, and 1.0 m of lightly compacted till. A variant with similar cost and water quality implications is to add lime to neutralize the acidity in the oxide fines and low grade ore materials, and relocate them to a location below the water level in the Faro Pit.

The ETA tailings will be relocated to the tailings impoundment or to the Faro Pit if the remainder of the Rose Creek tailings are re-located there.

Waste rock slopes will be regraded to 3H:1V. A low infiltration cover consisting of 0.5 m of compacted till overlain by 1.5 m of uncompacted till will be placed on the sulphide cell. The remainder of the waste rock piles will be covered with 0.5 m of lightly compacted till. Runoff control ditches will be constructed on the cover. All surface will be seeded and fertilized.

Groundwater collection systems will be installed below the Zone II Pit and in the S-well area. Where necessary, the north fork of Rose Creek will be routed into a constructed and lined channel, to facilitate collection of contaminated groundwater from the base of the valley. The ditch will be continued through the rock and, if necessary, below the S-wells.

A groundwater collection system will also be installed in the ETA area. All collected groundwater will be pumped to the Faro Pit.

Unnecessary roads will be scarified, seeded and fertilized. All buildings will be demolished and disposed in an unlined landfill area in the waste rock. Hydrocarbon-contaminated soils will be excavated and bio-remediated.

Post-closure requirements for the "Flow-Through Pit" alternative include:

- Year-round pumping of contaminated groundwater and seepage to the Faro Pit;
- Seasonal addition of phosphate to the Faro Pit lake;
- Seasonal discharge of water from the Faro Pit lake, via siphon, to a ditch leading to Rose Creek;
- Monitoring of water quality in the Faro Pit, in and around each of the groundwater collection systems, and in Rose Creek above and below the site;
- Annual inspections of all earthworks;
- Intensive maintenance of covers and ditches for a period of five years after closure, and limited bi-annual maintenance thereafter with additional repairs after extreme events.

With the maintenance exception noted above, all of the above activities are expected to continue to be required for several hundred years.

3.2 Faro Mine Area Alternative 2 – Upgrade Faro Creek Diversion

The "Upgrade Faro Creek Diversion" alternative for the Faro Mine area is illustrated in Figure 3.2. The following paragraphs summarize the major activities in each portion of the site. Further detail can be found in the "Construction Details and Cost Estimate" sheets found in Appendix A.

A water treatment plant will constructed to treat the Faro Pit water, which will be discharged into Rose Creek. A berm will be constructed around the rim of the pit to prevent inadvertent access.

Faro Creek will be diverted to the east of the pit via an geosynthetic clay lined channel. The east interceptor will be constructed upstream of the present Faro Creek diversion and discharge into the present diversion north of the Northeast Waste Rock Dump before flowing into North Fork Rose Creek. The channel includes a thermal blanket consisting of granular fill to prevent permafrost degradation on the uphill cut slope. An optional extension of the channel on the west side of the Faro Creek Valley is included to collect additional runoff.

Water will be pumped by a well from the Zone II pit and discharged to the Faro Pit Lake. Outwash material at the toe of the slope below the Zone II pit will be excavated and placed on the Intermediate Dump.

The oxide fines and low grade ore stockpiles will be consolidated and covered with a combination geomembrane and soil cover, consisting of a bedding layer, HDPE geomembrane, and 1.0 m of

lightly compacted till. A variant with similar cost and water quality implications is to add lime to neutralize the acidity in the oxide fines and low grade ore materials, and relocate them to a location below the water level in the Faro Pit.

The ETA tailings will be relocated to the tailings impoundment or to the Faro Pit if the remainder of the Rose Creek tailings are re-located there.

Waste rock slopes will be regraded to 3H:1V. A low infiltration cover consisting of 0.5 m of compacted till overlain by 1.5 m of uncompacted till will be placed on the sulphide cell. The remainder of the waste rock piles will be covered with 0.5 m of lightly compacted till. Runoff control ditches will be constructed on the cover. All surfaces will be seeded and fertilized.

Groundwater collection systems will be installed below the Zone II Pit and in the S-well area. Where necessary, the north fork of Rose Creek will be routed into a constructed and lined channel, to facilitate collection of contaminated groundwater from the base of the valley. The ditch will be continued through the rock and, if necessary, below the S-wells.

Unnecessary roads will be scarified, seeded and fertilized. All buildings will be demolished and disposed in an unlined landfill area in the waste rock. Hydrocarbon-contaminated soils will be excavated and bio-remediated.

Post-closure requirements for the “Upgrade Faro Creek Diversion” alternative include:

- Year-round pumping of contaminated groundwater and seepage to the water treatment plant with storage of seasonal excess flow in the Faro Pit;
- Year-round operation and maintenance of the water treatment plant;
- Periodic disposal of water treatment sludge in constructed cells;
- Monitoring of water quality in the Faro Pit, in and around each of the groundwater collection systems, and in Rose Creek above and below the site;
- Annual inspections of all earthworks;
- Intensive maintenance of covers and ditches for a period of five years after closure, and limited bi-annual maintenance thereafter with additional repairs after extreme events.

With the maintenance exception noted above, all of the above activities are expected to continue to be required for several hundred years.

4 Primary Alternatives for Rose Creek Tailings

4.1 Tailings Alternative 1 – Stabilize In Place

The "Stabilize In Place" alternative for the Rose Creek Tailings is illustrated in Figure 4.1. The following paragraphs summarize the major activities in each portion of the site. Further detail can be found in the "Construction Details and Cost Estimate" sheets found in Appendix A.

The Cross-Valley Dam will be removed. The impounded sludge will be excavated and hauled to a sludge containment cell and contaminated soils will be removed to the mill area. The Intermediate Dam will be stabilized against foundation liquefaction through ground densification with vibro-replacement stone columns and/or the construction of a buttress. The East Limb of the Secondary Dam will be stabilized through ground densification with vibro-replacement stone columns.

The Intermediate and Secondary Tailing Impoundments will be covered with a low-infiltration cover consisting of 0.5 m of waste rock overlain by 1.5 m of lightly compacted till. The tailings covers will be seeded and fertilized.

The Rose Creek Diversion Channel will be upgraded to the PMF by deepening and widening the channel along its current alignment. The alignment will be re-routed to enter Rose Creek downstream of the Intermediate Dam where the channel is cut through bedrock. The North Fork Rock Drain will be breached with the material hauled to the Faro Waste Dump or used as tailing cover material.

Groundwater collection systems will be installed below or along the alignment of the Cross-Valley Dam. The collected groundwater will be pumped to a water treatment plant and treated.

Post-closure requirements for the "Stabilize In Place" alternative include:

- Year-round pumping of contaminated groundwater and seepage to the water treatment plant;
- Year-round operation and maintenance of the water treatment plant;
- Periodic disposal of water treatment sludge in constructed cells;
- Monitoring of water quality in and around the groundwater collection system, and in Rose Creek above and below the site;
- Annual inspections of all earthworks;
- Intensive maintenance of covers and ditches for a period of five years after closure, and limited bi-annual maintenance thereafter with additional repairs after extreme events.

With the maintenance exception noted above, all of the above activities are expected to continue to be required for several hundred years.

4.2 Tailings Alternative 2 – Complete Relocation

The "Complete Relocation" alternative for the Rose Creek Tailings is illustrated in Figure 4.2. The following paragraphs summarize the major activities in each portion of the site. Further detail can be found in the "Construction Details and Cost Estimate" sheets found in Appendix A.

All dams will be kept in place to control water and sediment during tailings monitoring. The dams will be breached after basin cleanup is completed.

The Intermediate and Secondary Tailings will be pumped to the Faro Pit. The tailings will be hydraulically monitored along excavated trenches to a collection sump and pumped. Lime is added to the slurry during pumping. Excess water is treated through a HDS system in a new treatment plant and discharged. The remaining contaminated material in the impoundments will be removed by truck and shovel to the Faro Pit. The impoundments will be graded for drainage and all surfaces will be seeded and fertilized.

The Rose Creek Diversion Channel will be maintained during the period of tailings relocation and groundwater cleanup. Fish habitat along the thalweg of the valley will be enhanced by installing riffles and excavating pools. The Rose Creek Diversion will be breached into the thalweg once the basin cleanup is completed. Willows will be planted along the restored stream channel and seeded and fertilized. The Rose Creek Diversion channel will then be regraded to create stable slops and be breached where streams enter the channel from the south. The North Fork Rock Drain will be breached with the material hauled to the Faro Waste Dump.

A groundwater collection system will be installed below the Cross-Valley Dam. The collected groundwater will be pumped to a water treatment plant. An adaptive medium-term groundwater collection system consisting of multiple shallow extraction and monitoring wells will be implemented where necessary along Rose Creek.

Post-closure requirements for the "Complete Relocation" alternative include:

- Year-round pumping of contaminated groundwater and seepage to the water treatment plant for an estimated period of twenty years;
- Year-round operation and maintenance of the water treatment plant for the same period;
- Monitoring of water quality in and around the groundwater collection system for twenty year, and in Rose Creek above and below the site for several hundred years;
- Relocation or installation of additional extraction and monitoring wells during the twenty year period;
- Annual inspections of all earthworks for twenty years.

4.3 Tailings Alternative 3 – Partial Relocation

The "Partial Relocation" alternative for the Rose Creek Tailings is illustrated in Figure 4.3. The following paragraphs summarize the major activities in each portion of the site. Further detail can be found in the "Construction Details and Cost Estimate" sheets found in Appendix A.

The Cross-Valley Dam will be removed. The impounded sludge will be excavated and hauled to a sludge containment cell and contaminated soils will be removed to the mill area. The Intermediate Dam will be kept in place to control water and sediment during tailings monitoring and breached after basin cleanup is completed. The east and west limbs of the Secondary Dam will be stabilized through ground densification with vibro-replacement stone columns. A compacted toe berm will also be constructed along the west limb.

The Intermediate Tailings will be pumped to the Faro Pit. The tailings will be hydraulically monitored along excavated trenches to a collection sump and pumped. Lime is added to the slurry during pumping. Excess water is treated through a HDS system in a new treatment plant and discharged. The remaining contaminated material in the intermediate impoundment will be removed by truck and shovel to the Faro Pit. The impoundment will be graded for drainage and all surfaces will be seeded and fertilized.

The Secondary Tailing Impoundment will be covered with a low-infiltration cover consisting of 0.5m of waste rock overlain by 1.0m of lightly compacted till. The tailings cover will be seeded and fertilized.

The upper portion of the Rose Creek Diversion Channel will be upgraded to the PMF by deepening and widening the channel along its current alignment. The alignment will be re-routed to enter Rose Creek downstream of the Secondary Dam once the basin cleanup is completed. Fish habitat along the thalweg of the Intermediate Impoundment will be enhanced by installing riffles and excavating pools. Willows will be planted along the restored stream channel and seeded and fertilized. The lower portion of the Rose Creek Diversion channel will then be regraded to create stable slops and be breached where streams enter the channel from the south. The North Fork Rock Drain will be breached with the material hauled to the Faro Waste Dump or used as tailing cover material.

An adaptive medium-term groundwater collection system consisting of multiple shallow extraction and monitoring wells will be implemented where necessary along the restored Rose Creek Valley. For the purposes of the cost estimate, it is assumed that a groundwater collection system will be installed below the Cross Valley Dam. A system of seepage and groundwater collection will also be constructed along the toe of the Secondary Dam. The collected groundwater and seepage will be pumped to a water treatment plant.

Post-closure requirements for the "Partial Relocation" alternative include:

- Year-round pumping of contaminated groundwater and seepage to the water treatment plant;
- Year-round operation and maintenance of the water treatment plant;

- Periodic disposal of water treatment sludge in constructed cells;
- Monitoring of water quality in and around the groundwater collection system, and in Rose Creek above and below the site;
- Relocation or installation of additional extraction and monitoring wells;
- Annual inspections of all earthworks;
- Intensive maintenance of ditches for a period of five years after closure, and limited bi-annual maintenance thereafter with additional repairs after extreme events.

With the maintenance exception noted above, all of the above activities are expected to continue to be required for several hundred years.

5 Primary Alternatives for Vangorda/Grum Mine Area

5.1 Vangorda/Grum Alternative 1 – Backfill Vangorda Pit

The "Backfill Vangorda Pit" alternative for the Vangorda Mine area is illustrated in Figure 5.1. The following paragraphs summarize the major activities in each portion of the site. Further detail can be found in the "Construction Details and Cost Estimate" sheets found in Appendix A.

Water from the Vangorda Pit will be pumped and treated at the present water treatment plant. The pit will then be backfilled with material from the Vangorda Water Rock Dump, the ore transfer pad the high sulphide area west of the pit. Lime will be added to the acidic material during the backfill. The backfilled pit will be graded to direct runoff to runoff control ditches. A low infiltration cover consisting of 0.5m of compacted till overlain by 1.5m of uncompacted till will be placed over the area. All surfaces will be seeded and fertilized.

Vangorda Creek will be routed over the backfilled pit via a constructed channel. The creek will include a series of rip rapped drop sections and will be designed to include no artificial materials.

The footprint of the Vangorda Waste Rock Dump, after the completion of the relocation of materials to the Vangorda Pit will be graded to ensure runoff, seeded and fertilized. Little Creek Dam will be breached.

The Grum Pit will be used for passive treatment by seasonal phosphate addition. The Grum Interceptor Ditch will be routed into the pit. The ditch will include a rip-rapped overflow point, from which the water will cascade into the pit lake. A rock drain structure will be constructed at the mouth of the outlet channel at the slot cut on the south end of the pit. The outlet channel will be excavated to a elevation of 1230, at the Grum Pit Lake and will discharge either into Vangorda Creek Tributary B or directly along its previous channel. In the latter case, waste rock will be excavated as needed to establish a drainage path. A berm will be constructed around the rim of the pit to prevent inadvertent access.

The Grum Dump waste rock slopes will be regraded to 3H:1V. A low infiltration cover consisting of 0.5 m of compacted till overlain by 1.5 m of uncompacted till will be placed on the sulphide cell. The remainder of the waste rock piles will be covered with 0.5 m of lightly compacted till. Runoff control ditches will be constructed on the cover. All surfaces will be seeded and fertilized.

The Overburden Dump slopes will be regraded to 3H:1V, seeded and fertilized.

The Ore Transfer Pad, after the completion of the relocation of acidic materials to the Vangorda Pit, will be graded to ensure runoff as well as seeded and fertilized.

A groundwater collection system will be installed below the Grum Waste Dump. A contingency groundwater collection system maybe required at the backfilled Vangorda Pit. All collected groundwater will be pumped to the Grum Pit.

Unnecessary roads will be scarified, seeded and fertilized. All buildings will be demolished and disposed in an unlined landfill area in the waste rock. Hydrocarbon contaminated soils located around mine maintenance areas will be excavated and remediated in the bioremediation cell. The existing bioremediation cell and sludge pond will be covered. All dams and existing settling ponds will be breached.

Post-closure requirements for the "Backfill Vangorda Pit" alternative include:

- Year-round pumping of contaminated groundwater and seepage to the Grum Pit;
- Seasonal addition of phosphate to the Grum Pit lake;
- Monitoring of water quality in the Grum Pit, in and around the groundwater collection systems, and in Vangorda Creek above and below the site;
- Annual inspections of all earthworks;
- Intensive maintenance of covers and ditches for a period of five years after closure, and limited bi-annual maintenance thereafter with additional repairs after extreme events.

5.2 Vangorda/Grum Alternative 2 – Stabilize In Place

The "Stabilize In Place" alternative for the Vangorda Mine area is illustrated in Figure 5.2. The following paragraphs summarize the major activities in each portion of the site. Further detail can be found in the "Construction Details and Cost Estimate" sheets found in Appendix A.

A water treatment plant will constructed to treat the Vangorda Pit water, which will be discharged into Vangorda Creek. A berm will be constructed around the rim of the pit to prevent inadvertent access. The waste rock piles located to the southeast of the Vangorda Pit will be regraded to 3H:1V. The waste rock piles will be covered with 0.5m of lightly compacted till, seeded and fertilized.

The Vangorda Waste Dump will be regraded to 3H:1V. The dump will be covered with a low infiltration cover consisting of 0.5 m of compacted till overlain by 1.5 m of uncompacted till. Runoff control ditches will be constructed on the cover. All surfaces will be seeded and fertilized.

Vangorda Creek will be routed north of the pit along the present Vangorda Creek Diversion. The channel will be widened and deepened as well as have a minor realignment. A plunge pool will be constructed at the bottom of the diversion to disperse energy before discharging into Vangorda Creek. The Dixon Creek Diversion will be upgraded.

The Grum Pit will be used for passive treatment by seasonal phosphate addition. The Grum Interceptor Ditch will be routed into the pit. The ditch will include a rip-rapped overflow point, from which the water will cascade into the pit lake. A rock drain structure will be constructed at the

mouth of the outlet channel at the slot cut on the south end of the pit. The outlet channel will be excavated to a elevation of 1230, at the Grum Pit Lake and will discharge either into Vangorda Creek Tributary B or directly along its previous channel. In the latter case, waste rock will be excavated as needed to establish a drainage path. A berm will be constructed around the rim of the pit to prevent inadvertent access.

The Grum Dump waste rock slopes will be regraded to 3H:1V. A low infiltration cover consisting of 0.5 m of compacted till overlain by 1.5 m of uncompacted till will be placed on the sulphide cell. The remainder of the waste rock piles will be covered with 0.5 m of lightly compacted till. Runoff control ditches will be constructed on the cover. All surfaces will be seeded and fertilized.

The Overburden Dump slopes will be regraded to 3H:1V, seeded and fertilized.

Acidic materials from the Ore Transfer Pad will be relocated to the sulphide cell area at the Grum Dump. The pad will be graded to ensure runoff, covered with 0.5m of lightly compacted till as well as seeded and fertilized.

A groundwater collection system will be installed below the Grum Waste Dump. A contingency groundwater collection system maybe required at the backfilled Vangorda Pit. All collected groundwater will be pumped to the water treatment plant.

Unnecessary roads will be scarified, seeded and fertilized. All buildings will be demolished and disposed in an unlined landfill area in the waste rock. Hydrocarbon contaminated soils located around mine maintenance areas will be excavated and remediated in the bioremediation cell. The existing bioremediation cell and sludge pond will be covered. All dams and existing settling ponds except for Little Creek Dam will be breached.

Post-closure requirements for the “Stabilize In Place” alternative include:

- Year-round pumping of contaminated groundwater and seepage to the water treatment plant;
- Year-round operation and maintenance of the water treatment plant;
- Periodic disposal of water treatment sludge in constructed cells;
- Seasonal addition of phosphate to the Grum Pit lake;
- Monitoring of water quality in the Grum Pit, in and around the groundwater collection systems, and in Vangorda Creek above and below the site;
- Annual inspections of all earthworks;
- Intensive maintenance of covers and ditches for a period of five years after closure, and limited bi-annual maintenance thereafter with additional repairs after extreme events.

With the maintenance exception noted above, all of the above activities are expected to continue to be required for several hundred years.

6 Assessments of Primary Alternatives

6.1 Protection of Water Quality

The site water and load balance developed in the summer of 2005 was used to estimate contaminant concentrations in receiving water under each of the primary alternatives. The calculations were completed for silver, aluminium, arsenic, cadmium, cobalt, copper, iron, manganese, nickel, lead sulphate and zinc. Monthly estimates of concentrations at X2 , X14, the mouth of Rose Creek, the mouth of Anvil Creek, as well as at V27 and V8, were developed for each contaminant. A complete set of outputs is included in Attachment B.

In order to complete the estimates, it was necessary to quantify the expected performance of several of the closure measures proposed. Table 6.1 summarizes the assumptions, and further details are provided in Attachment B. The major assumptions have been tested through sensitivity analyses, the results of which are presented in Attachment C.

Table 6.2 provides a summary of estimated contaminant concentrations at X14 in Rose Creek (just downstream of the mine and tailings areas), under the Base Case performance assumptions for all combinations of the Faro Mine Area and Rose Creek Tailings primary alternatives.

Table 6.3 provides a summary of estimated contaminant concentrations in Vangorda Creek under each of the Vangorda/Grum primary alternatives.

Although some of the water quality results shown in Table 6.2 and 6.3 may be acceptable, the work on site specific water quality objectives has not yet progressed to the state where such a determination can be made. Additional runs of the water and load balance were therefore completed, with changes to the performance assumptions, to identify the levels needed to bring the March zinc concentrations within the level of the (hardness dependent) B.C. criteria of 0.24 mg/L. Table 6.4 summarizes the results.

Table 6.1: Performance Assumptions in Base Case Water and Load Balance

Covers	**Infiltration**
Rudimentary covers on Faro waste rock	20% of MAP
Low infiltration covers on Faro sulphide cells	5% of MAP
Very low infiltration covers on Faro LGO and Oxide fines	0.5% of MAP
Waste rock and till covers on Rose Creek Tailings	10% of MAP
Rudimentary covers on Grum Dump and Ore Transfer Pad	20% of MAP
Low infiltration cover on Grum Sulphide Cell	5% of MAP
Low infiltration cover on Vangorda Dump and Oxide Fines	5% of MAP
Groundwater collection systems	**Seepage Load Escaping Capture**
Faro Mine Area below Zone II Pit	10%
Faro Mine Area near S-Wells	10%
Faro Mine Area below ETA	2%
Tailings Area	2%
Vangorda/Grum Waste Dumps	10%
Backfilled Vangorda Pit	2%
Treatment effectiveness	**Assumption**
Bio-remediation in Faro Pit lake	Zinc removal of 37 tonnes per year
Lime addition during tailings relocation	No contaminants from relocated tailings
Lime addition to Vangorda Pit backfill	No contaminants from relocated tailings

Table 6.2: Summary of Base Case Water Quality Predictions for Faro Mine and Tailings Primary Alternatives

Primary Alternatives[1]				Contaminant Concentrations at X14[2] (mg/L)								
				Future 1 ARD Sources[3]			Future 2 ARD Sources[4]			Future 3 ARD Sources[5]		
Mine Area		Tailings Area		As	Cu	Zn	As	Cu	Zn	As	Cu	Zn
1	Flow-Through Pit	1	Stabilize In Place	0.003	0.015	0.55	0.003	0.023	0.85	0.25	1.6	57.3
1	Flow-Through Pit	2	Complete Relocation	0.002	0.013	0.37	0.003	0.017	0.56	0.25	1.6	56.6
1	Flow-Through Pit	3	Partial Relocation	0.002	0.014	0.54	0.003	0.020	0.81	0.25	1.6	57.2
2	Upgrade Faro Ck Diversion	1	Stabilize In Place	0.003	0.012	0.27	0.003	0.017	0.46	0.016	0.11	3.6
2	Upgrade Faro Ck Diversion	2	Complete Relocation	0.002	0.010	0.09	0.002	0.011	0.16	0.015	0.09	2.9
2	Upgrade Faro Ck Diversion	3	Partial Relocation	0.002	0.011	0.26	0.003	0.015	0.41	0.015	0.11	3.5

Notes:
1. See Table 6.1 and Attachment B for assumptions used in Base Case water and load balance calculations.
2. Water and load balance estimates were on a monthly basis. The concentrations shown are for March, which is the worst month in all cases.
3. Based on "Current Average" predictions of source chemistry. Represents most likely future case.
4. Based on "Current Maximum" predictions of source chemistry. Represents possible future case if ARD is allowed to develop.
5. Based on "Future Maximum" predictions of source chemistry. Represents pessimistic worst case.

Table 6.3: Summary of Water Quality Predictions for Vangorda/Grum Primary Alternatives

Primary Alternatives[1]		Water Quality Location	Contaminant Concentrations (mg/L)								
			Future 1 ARD Sources[3]			Future 2 ARD Sources[4]			Future 3 ARD Sources[5]		
			As	Cu	Zn	As	Cu	Zn	As	Cu	Zn
1	Backfill Vangorda Pit	V27	0.004	0.008	0.070	0.004	0.012[b]	0.091[a]	0.006	0.019	8.2
1	Backfill Vangorda Pit	V8	0.002	0.007	0.034	0.002	0.0077[b]	0.029	0.003	0.058	2.3
2	Stabilize In Place	V27	0.005	0.008	0.27	0.005	0.018	0.68[a]	0.005	0.046	1.8[a]
2	Stabilize In Place	V8	0.027	0.007	0.14	0.007	0.013	0.30	0.0027	0.021	0.65[a]

Notes:
1. See Table 6.1 and Attachment B for assumptions used in water and load balance calculations.
2. Water and load balance estimates were on a monthly basis. The concentrations shown are for the worst month, which is March in all cases except:
   a. April
   b. May, June and July
3. Based on "Current Average" predictions of source chemistry. Represents most likely future case.
4. Based on "Current Maximum" predictions of source chemistry. Represents possible future case if ARD is allowed to develop.
5. Based on "Future Maximum" predictions of source chemistry. Represents pessimistic worst case.

Table 6.4: Maximum Seepage Escape to meet BC Zinc Criterion of 0.24 mg/L at X14

Primary Alternatives[1]				Maximum Allowable Escape of Seepage Load[2]								
				Future 1 ARD Sources[3]			Future 2 ARD Sources[4]			Future 3 ARD Sources[5]		
Mine Area		Tailings Area		Waste Rock	ETA	Tailings	Waste Rock	ETA	Tailings	Waste Rock	ETA	Tailings
1	Flow-Through Pit	1	Stabilize In Place				<5%	<1%	<1%			
1	Flow-Through Pit	2	Complete Relocation				5%	<1%	n/a			
1	Flow-Through Pit	3	Partial Relocation				<5%	<1%	<1%			
2	Upgrade Faro Ck Diversion	1	Stabilize In Place				5	1	1			
2	Upgrade Faro Ck Diversion	2	Complete Relocation				10	5	n/a			
2	Upgrade Faro Ck Diversion	3	Partial Relocation				5	~1	~1			

Notes:
1. See Table 6.1 and Attachment B for assumptions used in Base Case water and load balance calculations.
2. "Seepage escape" values showing in Table 6.1 were adjusted upwards or downwards until the March zinc concentrations at X14 fell were 0.24 mg/L.
3. Based on "Current Average" predictions of source chemistry. Represents most likely future case.
4. Based on "Current Maximum" predictions of source chemistry. Represents possible future case if ARD is allowed to develop.
5. Based on "Future Maximum" predictions of source chemistry. Represents pessimistic worst case.

6.2 Protection of Ecological Health

SENES Consultants Ltd. have completed a draft assessment of ecological and human health risks. The main report from that draft is included as Attachment D.

The primary conclusions from the ecological portion of the risk assessment are as follows:

- Estimated concentrations of zinc in Rose Creek and Anvil Creek exceed the toxicity benchmarks for bottom feeder and predatory fish (0.06 and 0.25 mg/L respectively). The exceedances in Rose Creek and Anvil Creek increase substantially, and estimated concentrations of zinc in Vangorda Creek also exceed the toxicity benchmarks, when the worst case source chemistry (Future 3) is assumed.
- Estimated concentrations of copper in Rose Creek and Anvil Creek exceed the toxicity benchmarks for fish (0.004 mg/L). The exceedances increase and extend also to Vangorda Creek when the worst case source chemistry (Future 3) is assumed.
- Estimated concentrations of zinc under the worst case water chemistry (Future 3) also lead to exceedances of the threshold zinc intake for ducks and mink living in Rose Creek and mink living in Vangorda Creek.

6.3 Protection of Human Health

The primary conclusions from the human health portion of the risk assessment are as follows:

- Individual who camp in the Rose Creek area are at risk of health effects due to intake of arsenic.
- The primary pathways of arsenic intake are terrestrial, i.e. ingestion of soil and vegetation.
- Although the estimated health risks from arsenic exceed the “essentially negligible” level used as a screening criteria, they remain within the range of risks associated with typical arsenic intakes among the broader Canadian population.

6.4 Implementation Risks

To be completed

6.5 Residual Risks

To be completed in January 2006

7 Estimated Costs

Attachment A presents an estimate of the direct capital costs (excluding water treatment) associated with each primary alternative. Allowances for indirect capital costs, which have not been carefully estimated, are also included. Table 7.1 provides a summary of the capital costs for each alternative.

Attachment E presents estimates of water treatment costs for each of the primary alternatives. Water treatment capital and operating costs are included. The net present value of the water treatment costs, estimated using a net rate of 3%, are summarized in Table 7.2.

Table 7.3 provides summary estimates of capital costs and water treatment NPV costs for each of the combinations for which water quality estimates were provided in Chapter 6.

Table 7.4 shows the estimated total costs of various combination of the Faro Mine Area and Rose creek tailings primary alternatives. The estimates in Tables 7.1 through 7.3 include arbitrary contingencies of 20%. Such contingencies are necessary for budgeting, but they can be confusing for the evaluation of alternatives. Table 7.4 therefore also includes a column showing the estimates without contingencies.

Table 7.5 summarizes the Vangorda/Grum estimates with and without the 20% contingency.

Costs for monitoring, inspection, maintenance and repair are not yet included in these estimates.

Costs associated with the yet to be defined implementation and residual risks are also not included.

Table 7.1: Estimated Capital Costs for Each Primary Alternative

Primary Alternative	Direct Capital	Indirect Capital	Total Capital
Faro Mine Area			
Flow-through Faro Pit	$36,600,000	$18,300,000	$54,900,000
Upgrade Faro Ck Diversion	$45,500,000	$22,600,000	$68,000,000
Rose Creek Tailings			
Stabilization in place	$52,000,000	$25,700,000	$77,800,000
Complete Relocation	$213,200,000	$82,600,000	$295,800,000
Partial Relocation	$130,900,000	$50,900,000	$181,800,000
Vangorda/Grum			
Vangorda Pit Backfill	$77,500,000	$30,300,000	$107,800,000
Stabilize Current Situation	$33,900,000	$16,900,000	$50,900,000

Table 7.2: Estimated NPV Water Treatment Costs for Each Primary Alternative

Primary Alternative	Capital	Annual	NPV Total
Faro Mine Area			
Flow-through Faro Pit	$0	$200,000	$6,600,000
Upgrade Faro Ck Diversion	$3,590,000	$570,000	$22,500,000
Rose Creek Tailings			
Stabilization in place	$6,198,000	$1,192,000	$45,800,000
Complete Relocation	$4,015,000	$693,000	$17,300,000
Partial Relocation	$4,666,000	$942,000	$35,981,000
Vangorda/Grum			
Vangorda Pit Backfill	$0	$200,000	$6,600,000
Stabilize Current Situation	$2,746,000	$435,000	$17,100,000

Table 7.3: Summary Cost Estimates for Primary Alternatives and Combinations

Primary Alternative	Total Capital	Water Treatment NPV Total	Total NPV
Faro Mine Area			
Flow-through Faro Pit	$54,900,000	$6,600,000	$61,600,000
Upgrade Faro Ck Diversion	$68,000,000	$22,500,000	$90,600,000
Rose Creek Tailings			
Stabilization in place	$77,800,000	$45,800,000	$123,600,000
Complete Relocation	$295,800,000	$17,300,000	$313,100,000
Partial Relocation	$181,800,000	$35,981,000	$217,800,000
Vangorda/Grum			
Vangorda Pit Backfill	$107,800,000	$6,600,000	$114,400,000
Stabilize Current Situation	$50,900,000	$17,100,000	$68,000,000

Table 7.4: Summary Cost Estimates for Faro Mine & Tailings Combinations

Combination	With 20% Contingency	No Contingency
Flow-through pit + Complete tailings relocation	$374,700,000	$312,200,000
Flow-through pit + Stabilize tailings in place	$185,200,000	$154,300,000
Flow-through pit + Partial tailings relocation	$279,300,000	$232,800,000
Upgraded Faro Ck. diversion + Complete tailings relocation	$403,700,000	$336,400,000
Upgraded Faro Ck. diversion + Stabilize tailings in place	$214,200,000	$178,500,000
Upgraded Faro Ck. diversion + Partial tailings relocation	$308,300,000	$256,900,000

Table 7.5: Summary Cost Estimates for Vangorda/Grum

Combination	With 20% Contingency	No Contingency
Backfill Vangorda Pit	$114,400,000	$95,400,000
Stabilize Current Situation	$68,000,000	$56,700,000

Figures

Attachment A
Construction Details and Cost Estimate

Option 1: Vangorda Pit Backfilling

Contract Code	Work Area Code	Item	Task	Sub-task	Estimate Type	Activity	Task	Quantity	Unit	Unit Cost	Activity Total	Subtotals	Source / Comments
CLOSURE COSTS - DIRECT CAPITAL													
Vangorda Pit													1CD003.48_VangordaBackfill
Water Management												$322,000	
	1	1	1	1	610	Pump and treat Vangorda Pit Water	Pump to existing treatment plant	2,300,000	m3	$0.14	$322,000		(115mg/L Zn)
Pit Ramp												$23,012	
	1	2	1	1	430	Upgrade ramp for 777 traffic	LHD (locally) waste rock above present waterline	1,908	m3	$8.37	$15,970		
	1	2	1	2	430		Grading Ramp	24,000	m2	$0.29	$7,042		
Backfill Pit												$52,912,612	
	1	3	1	1	430	Backfill Pit	Load, Haul and Place Baritic and Oxide Fines	286,000	m3	$4.08	$1,166,880		
	1	3	1	2	430		Load, Haul and Place high sulphide area west of the dump ramp	1,300,000	m3	$4.08	$5,304,000		
	1	3	1	3	430		Load, Haul and Place ore transfer pad material	1,500,000	m3	Included in Ore Transfer Pad Costs			
	1	3	1	4	430		Load, Haul and Place Main Waste Rock Dump	8,787,000	m3	$4.08	$35,850,960		
	1	3	1	5	430		Load, Haul and Place till from base of Waste Rock Dump	504,150	m3	$4.08	$2,056,932		
	1	3	2	1	510	Lime Addition	Lime Addition (waste rock)	12,548	tonnes	$320.00	$4,015,360		
	1	3	2	2	510		Lime Addition (Baritic and Oxide Fines)	4,089	tonnes	$320.00	$1,308,480		
	1	3	2	3	010		Survey requirements (grid for testing)	12,840	hrs	$125.00	$1,605,000		
	1	3	2	4	010		Material testing (to verify lime addition dosage)	12,840	hrs	$125.00	$1,605,000		
Regrade waste for drainage												$68,778	
	1	4	1	1	430	Regrade	Shape to send runoff to ditches	150	hrs	$459.10	$68,778		
Cover with Low Infiltration Cover												$1,779,000	
	1	5	1	1	430	Place Low Infiltration Cover	Load, Haul, Place Compacted Till (0.5m)	150,000	m3	$4.08	$612,000		
	1	5	1	2	430		Load, haul, place loose till (1.0m)	300,000	m3	$3.89	$1,167,000		
Revegetate												$135,000	
	1	6	1	1	610	Vegetate WR Dumps	Seeding	300,000	m2	$0.40	$120,000		
	1	6	1	2	610		Fertilization	300,000	m2	$0.05	$15,000		
Safety Berms												$65,271	
	1	7	1	1	430	Construct access road	Clear access road area	1,281	m2	$1.40	$1,796		
	1	7	1	2	220		Construct Access road	427	m	$12.00	$5,124		
	1	7	2	1	430	Place berm materials	Load, haul, dump berm material	4,150	m3	$10.31	$42,787		
	1	7	2	2	430		Shape Material into berm	830	m	$18.75	$15,564		
Subtotal Direct Costs - Vangorda Pit												**$55,305,673**	
Vangorda Dump													1CD003.48_VangordaBackfill
Little Creek Dam												$121,125	
	2	1	1	1	430	Breach dam	Load, Haul and Dump locally	22,266	m3	$5.44	$121,125		VanWasteDumpTillBerm.xls
Revegetate												$226,868	
	2	2	1	1	610	Revegetate Dump Footprint	Seeding	504,150	m2	$0.40	$201,660		
	2	2	1	2	610		Fertilization	504,150	m2	$0.05	$25,208		
Subtotal Direct Costs - Vangorda Dump												**$347,993**	
Vangorda Creek Diversion													1CD003.48_VangordaBackfill
Vangorda Creek												$549,980	
	3	1	1	1	430	Excavate Channel	5m wide, 2:1 side slopes	26,815	m3	$3.69	$98,889		
	3	1	2	1	430	Place HDPE Liner	Supply and place HDPE Liner	6,226	m2	$21.57	$134,254		(or bitumen?)
	3	1	3	1	430	Place Bedding Layer	Produce and stockpile locally	1,868	m3	$7.73	$14,438		
	3	1	3	2	430		Load, haul, dump to Vangorda Stockpile Area	1,868	m3	$2.78	$5,192		
	3	1	3	3	430		Load , haul, place and compact	1,868	m3	$5.35	$9,992		
	3	1	4	1	430	Place Riprap	Rip-Rap: Drill, blast and stockpile	5,520	m3	$23.86	$131,678		Some rip-rap needs to belarge to disperse energy at bottom of channel
	3	1	4	2	430		Rip-Rap: Screen and stockpile	5,520	m3	$15.46	$85,339		
	3	1	4	3	430		Rip-Rap: Load, haul, dump to Vangorda Stockpile Area	5,520	m3	$2.68	$14,792		
	3	1	4	4	430		Rip-Rap: Load, haul and dump	5,520	m3	$5.35	$29,530		
	3	1	4	5	430		Rip-Rap: Place and secure	5,520	m3	$4.69	$25,875		
Subtotal Direct Costs - Vangorda Creek Diversion												**$549,980**	
Grum Pit													1CD003.46_PitLakesTreat
Water Treatment													
	4	1	1	1	610	Biological treatment	Operational cost of fertilizer application						
Safety Berms												$226,465	
	4	2	1	1	430	Construct access road	Clear access road area	3,750	m2	$1.40	$5,259		
	4	2	1	2	220		Construct Access road	1,250	m	$12.00	$15,000		
	4	2	2	1	430	Place berm materials	Load, haul, dump berm material	20,000	m3	$6.56	$131,200		
	4	2	2	2	430		Shape Material into berm	4,000	m	$18.75	$75,006		
Subtotal Direct Costs - Grum Pit												**$226,465**	
Grum Interceptor Ditch													1CD003.46_PitLakesTreat
Route into Grum Pit												$102,655	assumed channel from vangorda creek diversion (1CD003.15
	5	1	1	1	430	Access Road	Clear access road area	600	m2	$1.40	$841		
	5	1	1	2	220		Construct Access road	200	m	$12.00	$2,400		
	5	1	2	1	430	Headworks dam	Load, Haul, Dump, Place and Compact Till	24	m3	$9.57	$230		
	5	1	3	1	430	Excavate Channel	Excavate diversion channel (soils)	2,017	m3	$3.69	$7,438		
	5	1	3	2	430		Excavate diversion channel (bedrock)	362	m3	$23.33	$8,435		
	5	1	4	1	430	Place bedding layer	Produce and stockpile locally	623	m3	$7.73	$4,813		
	5	1	4	2	430		Load, haul, dump to Grum Stockpile Area	623	m3	$2.78	$1,731		
	5	1	4	3	430		Load , haul, place and compact	623	m3	$11.28	$7,023		
	5	1	5	1	430	Place Rip-Rap	Rip-Rap: Drill, blast and stockpile	1,212	m3	$23.86	$28,924		

	5	1	5	2	430		Rip-Rap: Screen and stockpile	1,212	m3	$15.46	$18,745	
	5	1	5	3	430		Rip-Rap: Load, haul, dump to Grum Stockpile Area	1,212	m3	$2.78	$3,370	
	5	1	5	4	430		Rip-Rap: Load, haul and dump	1,212	m3	$10.74	$13,021	
	5	1	5	5	430		Rip-Rap: Place and secure	1,212	m3	$4.69	$5,684	
Rock Drain												$24,312
	5	2	6	1	430	Rock Drain at start of slot cut	Rip-Rap: Drill, blast and stockpile	469	m3	$23.86	$11,183	
	5	2	6	2	430		Rip-Rap: Screen and stockpile	469	m3	$15.46	$7,247	
	5	2	6	3	430		Rip-Rap: Load, haul, dump to Grum Stockpile Area	469	m3	$2.78	$1,303	
	5	2	6	4	430		Rip-Rap: Load, haul and dump	469	m3	$5.08	$2,381	
	5	2	6	5	430		Rip-Rap: Place and secure	469	m3	$4.69	$2,197	
Route out of Pit via slot cu												$233,203
	5	3	1	1	430	Access Road	Clear access road area	150	m2	$1.40	$210	
	5	3	1	2	220		Construct Access road	50	m	$12.00	$600	
	5	3	2	1	430	Excavate Channel	Excavate diversion channel (soils)	9,222	m3	$3.69	$34,010	
	5	3	3	1	430	Place Bedding layer	Produce and stockpile locally	1,736	m3	$7.73	$13,422	
	5	3	3	2	430		Load, haul, dump to Grum Stockpile Area	1,736	m3	$2.78	$4,827	
	5	3	3	3	430		Load , haul, place and compact	1,736	m3	$4.54	$7,883	
	5	3	4	1	430	Place Rip-Rap	Rip-Rap: Drill, blast and stockpile	3,375	m3	$23.86	$80,519	
	5	3	4	2	430		Rip-Rap: Screen and stockpile	3,375	m3	$15.46	$52,183	
	5	3	4	3	430		Rip-Rap: Load, haul, dump to Grum Stockpile Area	3,375	m3	$2.78	$9,383	
	5	3	4	4	430		Rip-Rap: Load, haul and dump	3,375	m3	$4.25	$14,344	
	5	3	4	5	430		Rip-Rap: Place and secure	3,375	m3	$4.69	$15,822	
Subtotal Direct Costs - Grum Interceptor Ditch												**$360,171**
Grum Dump												
Reslope Dump												$629,554
	6	1	1	1	430	Regrade	Flattened Surfaces	337	hrs	$459.10	$154,872	
	6	1	1	2	430		Flatten Bubble Dump Surfaces	296	hrs	$459.10	$136,123	
	6	1	1	3	430		Regrade Slopes	737	hrs	$459.10	$338,559	
Sulphide Cell												$2,415,801
	6	2	1	1	430	Low Infiltration Cover	Load, haul, place compacted till (0.5m)	98,725	m3	$6.26	$618,019	
	6	2	1	2	430		Load, haul, place loose till (1.5m)	296,175	m3	$6.07	$1,797,782	
Waste Rock Cover												$5,211,854
	6	3	1	1	430	Place Rudimentary Cover	Load, haul, place loose till (0.5m)	858,625	m3	$6.07	$5,211,854	
Rock Drains												$141,664
	6	4	1	1	430	Install rock drains (runoff management)	Excavate channel for rock drains	3,500	m3	$3.69	$12,907	
	6	4	1	2	430		Rip-Rap: Drill, blast and stockpile	2,604	m3	$23.86	$62,123	
	6	4	1	3	430		Rip-Rap: Screen and stockpile	2,604	m3	$15.46	$40,261	
	6	4	1	4	430		Rip-Rap: Load, haul, dump to Grum Stockpile Area	2,604	m3	$2.78	$7,239	
	6	4	1	5	430		Load Haul and Dump Rip-Rap	2,604	m3	$2.66	$6,927	
	6	4	1	6	430		Place and secure Rip-Rap	2,604	m3	$4.69	$12,207	
Sediment Control Ditches												$103,016
	6	5	1	1	430	Sediment Control Ditch	Excavation of Ditch	3,490	m3	$3.69	$12,870	
	6	5	1	2	430		Supply and place geotextile	5,175	m2	$4.41	$22,830	
	6	5	1	3	430		Rip-Rap: Drill, blast and stockpile	1,215	m3	$23.86	$28,982	
	6	5	1	4	430		Rip-Rap: Screen and stockpile	1,215	m3	$15.46	$18,783	
	6	5	1	5	430		Rip-Rap: Load, haul, dump to Moose Pond Stockpile	1,215	m3	$4.06	$4,932	
	6	5	1	6	430		Load Haul and Dump Rip-Rap	1,215	m3	$2.66	$3,232	
	6	5	1	7	430		Place and secure Rip-Rap	1,215	m3	$4.69	$5,695	
	6	5	2	1	430	Sedimentation Basin	Excavate sedimentation basin	1,117	m3	$3.69	$4,119	
	6	5	2	2	430		Rip-Rap: Drill, blast and stockpile	31	m3	$23.86	$740	
	6	5	2	3	430		Rip-Rap: Screen and stockpile	31	m3	$15.46	$479	
	6	5	2	4	430		Rip-Rap: Load, haul, dump to Moose Pond Stockpile	31	m3	$4.06	$126	
	6	5	2	5	430		Load Haul and Dump Rip-Rap	31	m3	$2.66	$82	
	6	5	2	6	430		Place and secure Rip-Rap	31	m3	$4.69	$145	
Revegetate												$672,188
	6	6	1	1	610	Revegetate WR Dumps	Seeding	1,493,750	m2	$0.40	$597,500	
	6	6	1	2	610		Fertilization	1,493,750	m2	$0.05	$74,688	
Subtotal Direct Costs - Grum Dump												**$9,174,076**
Overburden Dump												
Roads												$157,851
	7	1	1	1	430	Widen Roads for 777 traffic	Excavate overburden material	22,500	m3	$6.82	$153,450	
	7	1	1	2	430		Grade Road	15,000	m2	$0.29	$4,401	
Reslope Dump												$196,478
	7	2	1	1	430	Regrade	Flattened Surfaces	77	hrs	$459.10	$35,426	
	7	2	1	2	430		Regrade Slopes	351	hrs	$459.10	$161,051	
Revegetate												$229,613
	7	3	1	1	610	Revegetate WR Dumps	Seeding	510,250	m2	$0.40	$204,100	
	7	3	1	2	610		Fertilization	510,250	m2	$0.05	$25,513	
Subtotal Direct Costs - Overburden Dump												**$583,942**
Ore Transfer Pad												
Relocate to Vangorda Pit												$9,210,000
	8	1	1	1	430	Relocate to Vangorda Pit	Load, Haul and Place and compact material	1,500,000	m3	$6.14	$9,210,000	
Reslope Pad for drainage												$52,161
	8	2	1	1	430	Regrade	Flattened Surfaces	52	hrs	$459.10	$23,827	
	8	2	1	2	430		Regrade Slopes	62	hrs	$459.10	$28,335	
Rudementary Cover												$391,082

	8	3	1	1	430	Place Rudimentary Cover	Load, haul, place loose till (0.5m)	73,650	m3	$5.31	$391,082	
Sediment Control Ditches												$7,534
	8	4	1	1	430	Sediment Control Ditch	Excavation of Ditch	1,791	m3	$3.69	$6,605	
	8	4	2	1	430	Sedimentation Basin	Excavate sedimentation basin	252	m3	$3.69	$929	
Revegetate												$57,827
	8	5	1	1	610	Revegetate	Seeding	128,504	m2	$0.40	$51,402	
	8	5	1	2	610		Fertilization	128,504	m2	$0.05	$6,425	
Subtotal Direct Costs - Ore Transfer Pad												**$9,718,604**
Grum Dump Groundwater Collection to Holding Pond												$149,872
	9	1	1	1	430	Access Road	Clear access road area	1,950	m2	$1.40	$2,735	
	9	1	1	1	430		Construct Access road	650	m	$12.00	$7,800	
	9	1	2	1	430	Groundwater Wells	Drill Well	7	ea.	$1,906.43	$13,345	no prelliminary design done.
	9	1	2	2	500		Install 4" PVC Well	140	m	$100.00	$14,000	
	9	1	2	3	500		Install Pump in well	7	ea.	$2,629.00	$18,403	
	9	1	2	4	500		Supply Power	1,242	m	$2.53	$3,142	
	9	1	3	1	430	Piping System	Excavate Piping Trench	7,452	m3	$2.50	$18,632	
	9	1	3	2	510		Supply and place 150mm PVC pipe	1,242	m	$15.50	$19,251	
	9	1	3	3	510		Supply and install heat trace through piping	1,242	m	$7.87	$9,775	
	9	1	3	4	430		Bedding: Produce and stockpile (screen)	484	m3	$7.73	$3,745	
	9	1	3	5	430		Bedding: Load, haul, place	484	m3	$5.28	$2,558	
	9	1	3	6	430		Backfill and compact ditches	7,452	m3	$4.90	$36,488	
Grum Dump Groundwater Holding Pond												$23,104
	9	2	1	1	430	Excavate pond	Excavate Holding Pond	563	m3	$3.69	$2,074	
	9	2	2	1	430	Place Liner	Supply and place HDPE Liner	435	m2	$21.57	$9,390	
	9	2	3	1	430	Place bedding layer	Bedding Material: Produce and stockpile (screen)	201	m3	$7.73	$1,551	
	9	2	3	2	430		Bedding Material: Load, haul, place and compact	201	m3	$7.18	$1,440	
	9	2	4	1	500	Place pump	Supply and place pump	1	ea.	$1,878.00	$1,878	
	9	2	4	2	500		Build and install housing for primary pump	1	ea.	$5,000.00	$5,000	
	9	2	4	3	500		Provide power to pumping system	700	m	$2.53	$1,771	
Groundwater Collection System to Grum Pit												$231,690
	9	3	1	1	430	Piping System	Excavate Piping Trench	17,160	m3	$3.69	$63,282	
	9	3	1	2	510		Supply and place 150mm PVC pipe	2,860	m	$15.50	$44,330	
	9	3	1	3	510		Supply and install heat trace through piping	2,860	m	$7.87	$22,508	
	9	3	1	4	500		Supply and place Air valves	1	ea.	$295.00	$295	
	9	3	1	5	500		Supply and place Drains (blow-offs)	1	ea.	$620.00	$620	
	9	3	1	6	430		Bedding: Produce and stockpile (screen)	1,115	m3	$7.73	$8,623	
	9	3	1	7	430		Bedding: Load, haul, place	1,115	m3	$7.18	$8,009	
	9	3	1	8	430		Backfill and compact ditches	17,160	m3	$4.90	$84,023	
Vangorda Pit Groundwater (Contingency												$114,930
	9	4	1	1	430	Groundwater Wells	Drill Well	3	ea.	$1,906.43	$5,719	no prelliminary design done.
	9	4	1	2	500		Install 4" PVC Well	270	m	$100.00	$27,000	
	9	4	1	3	500		Install Pump in well	3	ea.	$2,629.00	$7,887	
	9	4	1	4	500		Supply Power	300	m	$2.53	$759	
	9	4	2	1	430	Piping System	Excavate Piping Trench	5,400	m3	$3.69	$19,914	
	9	4	2	2	500		Supply and place 150mm PVC pipe	900	m	$15.50	$13,950	
	9	4	2	3	510		Supply and install heat trace through piping	900	m	$7.87	$7,083	
	9	4	2	4	430		Bedding: Produce and stockpile (screen)	351	m3	$7.73	$2,713	
	9	4	2	5	430		Bedding: Load, haul, dump to Vangorda Stockpile Area	351	m3	$2.78	$976	
	9	4	2	6	430		Bedding: Load, haul, place	351	m3	$5.32	$1,867	
	9	4	2	8	500		Supply and place Drains (blow-offs)	1	ea.	$620.00	$620	
	9	4	2	9	430		Backfill and compact ditches	5,400	m3	$4.90	$26,441	
Vangorda Pit Groundwater Holding Pond (Contingency												$21,746
	9	5	1	1	430	Excavate pond	Excavate Holding Pond	563	m3	$3.69	$2,074	
	9	5	2	1	430	Place Liner	Supply and place HDPE Liner	435	m2	$21.57	$9,390	
	9	5	3	1	430	Place bedding layer	Bedding: Produce and stockpile (screen)	201	m3	$7.73	$1,551	
	9	5	3	2	430		Bedding: Load, haul, dump to Vangorda Stockpile Area	201	m3	$2.78	$558	
	9	5	3	3	430		Bedding: Load, haul, place and compact	201	m3	$5.32	$1,067	
	9	5	4	1	500	Place pump	Install Primary pump	1	ea.	$1,878.00	$1,878	
	9	5	4	2	500		Build and install housing for primary pump	1	ea.	$5,000.00	$5,000	
	9	5	4	3	500		Provide power to pumping system	90	m	$2.53	$228	
Subtotal Direct Costs - Groundwater												**$541,342**
Miscellaneous												
Buildings												$102,840
	10	1	1	1	220	Building Demolition	Demolish and stockpile building material	6,902	m3	$4.94	$34,096	
	10	1	1	2	430		LHD building material to Grum toe to be regraded over	6,902	m3	$9.96	$68,744	
Sludge Pond												$97,800
	10	2	1	1	430	Cover Sludge Pond	Load, Haul, Place Till	30,000	m3	$3.26	$97,800	
Existing Bioremediation Cell												$2,244
	10	3	1	1	430	Cover Existing Bioremediation Cell	Doze material	1,600	m2	$1.40	$2,244	
Dams												$5,440
	10	4	1	1	430	Breach all Dams (2)	Excavate, haul and dump locally	1,000	m2	$5.44	$5,440	
WTP Settling Pond												$8,111
	10	5	1	1	430	Breach WTP Settling Pond	Excavate, haul and dump locally	1,491	m3	$5.44	$8,111	
Contaminated soils												$37,350
	10	6	1	1	600	Remove Contaminated soils	Excavate, haul and place contaminated soils in bio-remediation cell	3,750	m3	$9.96	$37,350	
Bioremediation Cell												$56,856
	10	7	1	1	430	Construct Bioremediation Cell	Excavate and create berms for use as the bioremediation cell	8,000	m3	$2.50	$20,002	

10	7	1	2	430		Place HDPE Liner for remediation Cell	1,600	m2	$21.57	$34,504		
10	7	1	3	430		Bedding: Load, haul, place (use local overburden material)	480	m3	$4.90	$2,350		
Roads											$25,607	
10	8	1	1	430	Reclaim unnecessary roads	Remove culverts and breach stream crossing	3,920	m3	$3.69	$14,456		
10	8	1	2	430		Scarify road surfaces	15,000	m2	$0.29	$4,401		
10	8	1	3	610		Seed and fertilize	15,000	m2	$0.45	$6,750		
Borrow Sources											$286,894	
10	9	1	1	600	Develop Borrow Sources	Clear and grub	3,000	m2	$2.08	$6,253		
10	9	1	2	600		Construct Haul Road	1,000	m	$200.00	$200,000		
10	9	2	1	600	Decommission Borrow Sources	Regrade Borrow source slopes	10	hrs	$459.10	$4,591		
10	9	2	2	610		Revegetate - Seeding	169,000	m2	$0.40	$67,600		
10	9	2	3	610		Revegetate - Fertilizer	169,000	m2	$0.05	$8,450		
Subtotal Direct Costs - Miscellaneous											**$623,142**	
Subtotal Direct Costs												
						Subtotal direct costs					**$77,431,386**	
CLOSURE COSTS - INDIRECT												
100	100	1	1		Project Management	2.5% of direct costs	$ 77,431,386	x	2.5%		$1,935,785	
100	100	2	1		Field Supervision	(included in major tasks)					$0	
100	100	3	1		Contractor profit and home office overhead	10% of direct costs	$ 77,431,386	x	10.0%		$7,743,139	
100	100	4	1		Insurance	0.5% of direct costs	$ 77,431,386	x	0.5%		$387,157	
100	100	5	1		Bonding	0.5% of direct costs	$ 77,431,386	x	0.5%		$387,157	
100	100	6	1		Field Engineering and QA	15% of direct costs	$ 77,431,386	x	15.0%		$11,614,708	
100	100	7	1		Mob - Demob		1	lump	$500,000		$500,000	
100	100	8	1		Living out allowances	(included in heavy equipment costs)					$0	
100	100	9	1		Taxes	7% of taxable direct and indirect costs	$ 84,513,054	x	7.0%		$5,915,914	
Subtotal Indirect Costs												
						Subtotal indirect costs					**$28,483,859**	
CLOSURE COSTS - CONTINGENCY												
						Contingency	20% of direct costs	$77,431,386	x	20.0%	**$15,486,277**	
CLOSURE COSTS - TOTAL												
						Total direct and indirect costs					**$121,401,522**	

Option 2: Stabilize Current Situation

Contract Code	Work Area Code	Item	Task	Sub-task	Estimate Type	Activity	Task	Quantity	Unit	Unit Cost	Activity Total	Subtotals	Source / Comments
CLOSURE COSTS - DIRECT CAPITAL													
Vangorda Pit													
Water Management													
	1	1	1	1	600	Construct Water Treatment Plant							(preliminary construction cost esti. $4,670,000)
Safety Berm												$ 439,591	
	1	2	1	1	430	Construct access road	Clear (grub access road)	4,350	m	$2.08	$ 9,067		
	1	2	1	2	430		Construct Access road	1,450	m	$12.00	$ 17,400		
	1	2	2	1	430	Place berm materials	LHD Material (Haul road material?)	15,000	m3	$8.79	$ 131,850		
	1	2	2	2	430		Shape Material into berm	15,000	m3	$18.75	$ 281,274		
Vangorda Pit Waste Rock Piles												$ 313,835	
	1	3	1	1	430	Regrade	Regrade Flattened Surfaces	13	hrs	$459.10	$ 5,970		
	1	3	1	2	430		Regrade Flat Bubble Dump Surfaces	10	hrs	$459.10	$ 4,424		
	1	3	1	3	430		Regrade Slopes (3:1)	28	hrs	$459.10	$ 12,718		
	1	3	2	1	430	Place Rudimentary Cover	Load, haul, place loose till (0.5m)	64,823	m3	$3.66	$ 237,252		
	1	3	3	1	610	Revegetate	Seeding	118,825	m2	$0.40	$ 47,530		
	1	3	3	2	610		Fertilization	118,825	m2	$0.05	$ 5,941		
Subtotal Direct Costs - Vangorda Pit												**$ 753,426**	
Vangorda Dump													
Reslope Dump												$ 339,522	
	2	1	1	1	430	Regrade	Flattened Surfaces	40	hrs	$459.10	$ 18,180		
	2	1	1	2	430		Flat Bubble Dump Surfaces	102	hrs	$459.10	$ 46,806		
	2	1	1	3	430		Regrade Slopes (3:1)	598	hrs	$459.10	$ 274,536		
Waste Rock Cover												$ 5,889,150	
	2	2	1	1	430	Low Infiltration Cover	Load, haul, place compacted till (0.5m)	320,063	m3	$6.26	$ 2,003,591		
	2	2	1	2	430		Load, haul, place loose till (1.0m)	640,125	m3	$6.07	$ 3,885,559		
Rock Drains												$ 56,141	
	2	3	1	1	430	Install rock drains (runoff management)	Excavate channel for rock drains	1,313	Bm3	$3.69	$4,840		
	2	3	1	2	430		Rip-Rap: Drill, blast and stockpile	977	Bm3	$23.86	$23,296		
	2	3	1	3	430		Rip-Rap: Screen and stockpile	977	Bm3	$15.46	$15,098		
	2	3	1	4	430		Rip-Rap: Load, haul, dump to Vangorda Stockpile Area	977	Bm3	$2.68	$2,617		
	2	3	1	5	430		Load Haul and Dump Rip-Rap	977	Bm3	$5.85	$5,713		
	2	3	1	6	430		Place and secure Rip-Rap	977	Bm3	$4.69	$4,578		
Sediment Control Ditches												$ 1,438	
	2	4	1	1	430	Vangorda Dump Sediment Control Ditch	Upgrade present Vangorda seepage collection ditch	390	Bm3	$3.69	$ 1,438		
Revegetate												$ 226,868	
	2	5	1	1	610	Revegetate	Seeding	504,150	m2	$0.40	$ 201,660		
	2	5	1	2	610		Fertilization	504,150	m2	$0.05	$ 25,208		
Subtotal Direct Costs - Vangorda Dump												**$ 6,513,119**	
Vangorda Creek													1CD003.15_ Vangorda Creek Diversion
Relocate North of Pit												$ 1,288,695	
	3	1	1	1	430	Excavate Channel	Rock Excavation: drill, blast, muck, load and haul 1 km	19,346	m3	$23.33	$ 451,282		
	3	1	1	2	430		Soil Excavation: load, haul and dump locally	78,061	m3	$3.69	$ 287,872		
	3	1	2	1	430	Place Till	Till: Load, haul, place and compact	290	m3	$13.28	$ 3,855		
	3	1	3	1	430	Place Bedding layer	Bedding: Produce and stockpile	3,194	m3	$7.73	$ 24,692		
	3	1	3	2	430		Bedding: Load, haul, dump to Vangorda Stockpile Area	3,194	m3	$2.78	$ 8,880		
	3	1	3	3	430		Bedding: load , haul, place and compact	3,194	m3	$4.62	$ 14,757		
	3	1	4	1	430	Place Rip-Rap	Rip-Rap: Drill, blast and stockpile	9,694	m3	$23.86	$ 231,265		
	3	1	4	2	430		Rip-Rap: Screen and stockpile	9,694	m3	$15.46	$ 149,881		
	3	1	4	3	430		Rip-Rap: Load, haul, dump to Vangorda Stockpile Area	9,694	m3	$2.68	$ 25,980		
	3	1	4	4	430		Rip-Rap: Load, haul and dump	9,694	m3	$4.62	$ 44,786		
	3	1	4	5	430		Rip-Rap: Place and secure	9,694	m3	$4.69	$ 45,444		
Plunge Pool												$ 57,011	
	3	2	1	1	430	Excavate Pool	Plunge Pool Excavation	2,700	m3	$2.50	$ 6,751		
	3	2	2	1	430	Place Bedding Layer	Bedding: Produce and stockpile locally	270	m3	$7.73	$ 2,087		
	3	2	2	2	430		Bedding: Load, haul, dump to Vangorda Stockpile Area	270	m3	$2.78	$ 751		
	3	2	2	3	430		Bedding: Load, haul, place and compact	270	m3	$4.62	$ 1,247		
	3	2	3	1	430	Place Rip-Rap	Rip-Rap: Drill, blast and stockpile	900	m3	$23.86	$ 21,471		
	3	2	3	2	430		Rip-Rap: Screen and stockpile	900	m3	$15.46	$ 13,915		
	3	2	3	3	430		Rip-Rap: Load, haul, dump to Vangorda Stockpile Area	900	m3	$2.68	$ 2,412		
	3	2	3	4	430		Rip-Rap: Load, haul and dump	900	m3	$4.62	$ 4,158		
	3	2	3	5	430		Rip-Rap: Place and secure	900	m3	$4.69	$ 4,219		
Diversion to Dixon Creek												$ 207,602	
	3	3	1	1		Dixon Crk Diversion	Upgrade existing diversion to Dixon creek	56,295	Bm3	$3.69	$ 207,602		
Subtotal Direct Costs - Vangorda Creek												**$ 1,553,308**	
Grum Pit													1CD003.46_PitLakesTreat
Water Management													
	4	1	1	1	610	Biological treatment	Operational cost of fertilizer application						
Safety Berm												$ 526,491	
	4	2	1	1	430	Construct access road	Access Road: clearing and grubbing	3,750	m	$1.40	$ 5,259		
	4	2	1	2	220		Access Road: construction	1,250	m	$12.00	$ 15,000		
	4	2	2	1	430	Place berm materials	LHD Material (Haul road material?)	20,000	m3	$6.56	$ 131,200		

	4	2	2	2	430		Shape Material into berm	20,000	m3	$18.75	$ 375,032		
Subtotal Direct Costs - Grum Pit												**$ 526,491**	
Grum Interceptor Ditch													1CD003.46_PitLakesTreat
Route into Grum Pit												$102,655	assumed channel from vangorda creek diversion (1CD003.15
	5	1	1	1	430	Access Road	Access Road: clearing and grubbing	600	m2	$1.40	$841		
	5	1	1	2	220		Access Road: construction	200	m	$12.00	$2,400		
	5	1	2	1	430	Headworks dam	Construct Earth Dam at Headworks (LHD Till)	24	Bm3	$9.57	$230		
	5	1	3	1	430	Excavate Channel	Excavate diversion channel (soils)	2,017	Bm3	$3.69	$7,438		
	5	1	3	2	430		Excavate diversion channel (bedrock)	362	Bm3	$23.33	$8,435		
	5	1	4	1	430	Place bedding layer	Bedding: Produce and stockpile locally	623	Bm3	$7.73	$4,813		
	5	1	4	2	430		Bedding: Load, haul, dump to Grum Stockpile Area	623	Bm3	$2.78	$1,731		
	5	1	4	3	430		Bedding: load , haul, place and compact	623	Bm3	$11.28	$7,023		
	5	1	5	1	430	Place Rip-Rap	Rip-Rap: Drill, blast and stockpile	1,212	Bm3	$23.86	$28,924		
	5	1	5	2	430		Rip-Rap: Screen and stockpile	1,212	Bm3	$15.46	$18,745		
	5	1	5	3	430		Rip-Rap: Load, haul, dump to Grum Stockpile Area	1,212	Bm3	$2.78	$3,370		
	5	1	5	4	430		Rip-Rap: Load, haul and dump	1,212	Bm3	$10.74	$13,021		
	5	1	5	5	430		Rip-Rap: Place and secure	1,212	Bm3	$4.69	$5,684		
Rock Drain												$24,312	
	5	2	6	1	430	Rock Drain at start of slot cut	Rip-Rap: Drill, blast and stockpile	469	Bm3	$23.86	$11,183		
	5	2	6	2	430		Rip-Rap: Screen and stockpile	469	Bm3	$15.46	$7,247		
	5	2	6	3	430		Rip-Rap: Load, haul, dump to Grum Stockpile Area	469	Bm3	$2.78	$1,303		
	5	2	6	4	430		Rip-Rap: Load, haul and dump	469	Bm3	$5.08	$2,381		
	5	2	6	5	430		Rip-Rap: Place and secure	469	Bm3	$4.69	$2,197		
Route out of Pit via slot cu												$233,203	
	5	3	1	1	430	Access Road	Access Road: clearing and grubbing	150	m2	$1.40	$210		
	5	3	1	2	220		Access Road: construction	50	m	$12.00	$600		
	5	3	2	1	430	Excavate Channel	Excavate diversion channel (soils)	9,222	Bm3	$3.69	$34,010		
	5	3	3	1	430	Place bedding layer	Bedding: Produce and stockpile locally	1,736	Bm3	$7.73	$13,422		
	5	3	3	2	430		Bedding: Load, haul, dump to Grum Stockpile Area	1,736	Bm3	$2.78	$4,827		
	5	3	3	3	430		Bedding: load , haul, place and compact	1,736	Bm3	$4.54	$7,883		
	5	3	4	1	430	Place Rip-Rap	Rip-Rap: Drill, blast and stockpile	3,375	Bm3	$23.86	$80,519		
	5	3	4	2	430		Rip-Rap: Screen and stockpile	3,375	Bm3	$15.46	$52,183		
	5	3	4	3	430		Rip-Rap: Load, haul, dump to Grum Stockpile Area	3,375	Bm3	$2.78	$9,383		
	5	3	4	4	430		Rip-Rap: Load, haul and dump	3,375	Bm3	$4.25	$14,344		
	5	3	4	5	430		Rip-Rap: Place and secure	3,375	Bm3	$4.69	$15,822		
Subtotal Direct Costs - Grum Interceptor Ditch												**$360,171**	
Grum Dump													
Reslope Dump												$629,554	
	6	1	1	1	430	Regrade	Flattened Surfaces	337	hrs	$459.10	$154,872		
	6	1	1	2	430		Flatten Bubble Dump Surfaces	296	hrs	$459.10	$136,123		
	6	1	1	3	430		Regrade Slopes	737	hrs	$459.10	$338,559		
Sulphide Cell												$2,415,801	
	6	2	1	1	430	Low Infiltration Cover	Load, haul, place compacted till (0.5m)	98,725	Bm3	$6.26	$618,019		
	6	2	1	2	430		Load, haul, place loose till (1.5m)	296,175	Bm3	$6.07	$1,797,782		
Waste Rock Cover												$5,211,854	
	6	3	1	1	430	Place Rudimentary Cover	Load, haul, place loose till (0.5m)	858,625	Bm3	$6.07	$5,211,854		
Rock Drains												$141,664	
	6	4	1	1	430	Install rock drains (runoff management)	Excavate channel for rock drains	3,500	Bm3	$3.69	$12,907		
	6	4	1	2	430		Rip-Rap: Drill, blast and stockpile	2,604	Bm3	$23.86	$62,123		
	6	4	1	3	430		Rip-Rap: Screen and stockpile	2,604	Bm3	$15.46	$40,261		
	6	4	1	4	430		Rip-Rap: Load, haul, dump to Grum Stockpile Area	2,604	Bm3	$2.78	$7,239		
	6	4	1	5	430		Load Haul and Dump Rip-Rap	2,604	Bm3	$2.66	$6,927		
	6	4	1	6	430		Place and secure Rip-Rap	2,604	Bm3	$4.69	$12,207		
Sediment Control Ditches												$103,016	
	6	5	1	1	430	Sediment Control Ditch	Excavation of Ditch	3,490	Bm3	$3.69	$12,870		
	6	5	1	2	520		Supply and place geotextile	5,175	m2	$4.41	$22,830		
	6	5	1	3	430		Rip-Rap: Drill, blast and stockpile	1,215	Bm3	$23.86	$28,982		
	6	5	1	4	430		Rip-Rap: Screen and stockpile	1,215	Bm3	$15.46	$18,783		
	6	5	1	5	430		Rip-Rap: Load, haul, dump to Moose Pond Stockpile	1,215	Bm3	$4.06	$4,932		
	6	5	1	6	430		Load Haul and Dump Rip-Rap	1,215	Bm3	$2.66	$3,232		
	6	5	1	7	430		Place and secure Rip-Rap	1,215	Bm3	$4.69	$5,695		
	6	5	2	1	430	Sedimentation Basin	Excavate sedimentation basin	1,117	Bm3	$3.69	$4,119		
	6	5	2	2	430		Rip-Rap: Drill, blast and stockpile	31	Bm3	$23.86	$740		
	6	5	2	3	430		Rip-Rap: Screen and stockpile	31	Bm3	$15.46	$479		
	6	5	2	4	430		Rip-Rap: Load, haul, dump to Moose Pond Stockpile	31	Bm3	$4.06	$126		
	6	5	2	5	430		Load Haul and Dump Rip-Rap	31	Bm3	$2.66	$82		
	6	5	2	6	430		Place and secure Rip-Rap	31	Bm3	$4.69	$145		
Revegetate												$672,188	
	6	6	1	1	610	Revegetate WR Dumps	Seeding	1,493,750	m2	$0.40	$597,500		
	6	6	1	2	610		Fertilization	1,493,750	m2	$0.05	$74,688		
Subtotal Direct Costs - Grum Dump												**$9,174,076**	
Overburden Dump													
Roads												$157,851	
	7	1	1	1	430	Widen Roads for 777 traffic	Excavate overburden material	22,500	Bm3	$6.82	$153,450		
	7	1	1	2	430		Grade Road	15,000	m2	$0.29	$4,401		
Reslope Dump												$196,478	

	7	2	1	1	430	Regrade	Flattened Surfaces	77	hrs	$459.10	$35,426	
	7	2	1	2	430		Regrade Slopes	351	hrs	$459.10	$161,051	
Revegetate												$229,613
	7	3	1	1	610	Revegetate WR Dumps	Seeding	510,250	m2	$0.40	$204,100	
	7	3	1	2	610		Fertilization	510,250	m2	$0.05	$25,513	
Subtotal Direct Costs - Overburden Dump												**$583,942**
Ore Transfer Pad												
Relocate to Vangorda Pit												#REF!
Reslope Pad for drainage												$52,161
	8	2	1	1	430	Regrade	Flattened Surfaces	52	hrs	$459.10	$23,827	
	8	2	1	2	430		Regrade Slopes	62	hrs	$459.10	$28,335	
Rudementary Cover												$391,082
	8	3	1	1	430	Place Rudimentary Cover	Load, haul, place loose till (0.5m)	73,650	Bm3	$5.31	$391,082	
Sediment Control Ditches												$7,534
	8	4	1	1	430	Sediment Control Ditch	Excavation of Ditch	1,791	Bm3	$3.69	$6,605	
	8	4	2	1	430	Sedimentation Basin	Excavate sedimentation basin	252	Bm3	$3.69	$929	
Revegetate												$57,827
	8	5	1	1	610	Revegetate	Seeding	128,504	m2	$0.40	$51,402	
	8	5	1	2	610		Fertilization	128,504	m2	$0.05	$6,425	
Subtotal Direct Costs - Ore Transfer Pad												**#REF!**
Groundwater												1CD003.37 Grum Seepage Collection
Grum Dump Groundwater Collection to Holding Pond												$149,872
	9	1	1	1	430	Access Road	Clear access road area	1,950	m2	$1.40	$2,735	
	9	1	1	1	430		Construct Access road	650	m	$12.00	$7,800	
	9	1	2	1	430	Groundwater Wells	Drill Well	7	ea.	$1,906.43	$13,345	no prelliminary design done.
	9	1	2	2	500		Install 4" PVC Well	140	m	$100.00	$14,000	
	9	1	2	3	500		Install Pump in well	7	ea.	$2,629.00	$18,403	
	9	1	2	4	500		Supply Power	1,242	m	$2.53	$3,142	
	9	1	3	1	430	Piping System	Excavate Piping Trench	7,452	m3	$2.50	$18,632	
	9	1	3	2	510		Supply and place 150mm PVC pipe	1,242	m	$15.50	$19,251	
	9	1	3	3	510		Supply and install heat trace through piping	1,242	m	$7.87	$9,775	
	9	1	3	4	430		Bedding: Produce and stockpile (screen)	484	m3	$7.73	$3,745	
	9	1	3	5	430		Bedding: Load, haul, place	484	m3	$5.28	$2,558	
	9	1	3	6	430		Backfill and compact ditches	7,452	m3	$4.90	$36,488	
Grum Dump Groundwater Holding Pond												$23,104
	9	2	1	1	430	Excavate pond	Excavate Holding Pond	563	m3	$3.69	$2,074	
	9	2	2	1	430	Place Liner	Supply and place HDPE Liner	435	m2	$21.57	$9,390	
	9	2	3	1	430	Place bedding layer	Bedding Material: Produce and stockpile (screen)	201	m3	$7.73	$1,551	
	9	2	3	2	430		Bedding Material: Load, haul, place and compact	201	m3	$7.18	$1,440	
	9	2	4	1	500	Place pump	Supply and place pump	1	ea.	$1,878.00	$1,878	
	9	2	4	2	500		Build and install housing for primary pump	1	ea.	$5,000.00	$5,000	
	9	2	4	3	500		Provide power to pumping system	700	m	$2.53	$1,771	
Groundwater Collection System to Vangorda Pit												$102,101
	9	3	1	1	430	Piping System	Excavate Piping Trench	7,524	Bm3	$3.69	$27,747	
	9	3	1	2	510		Supply and place 150mm PVC pipe	1,254	m	$15.50	$19,437	
	9	3	1	3	510		Supply and install heat trace through piping	1,254	m	$7.87	$9,869	
	9	3	1	4	500		Supply and place Air valves	1	ea.	$295.00	$295	
	9	3	1	5	500		Supply and place Drains (blow-offs)	1	ea.	$620.00	$620	
	9	3	1	6	430		Bedding: Produce and stockpile (screen)	489	Bm3	$7.73	$3,781	
	9	3	1	7	430		Bedding: Load, haul, place	489	Bm3	$7.18	$3,511	
	9	3	1	8	430		Backfill ditches	7,524	Bm3	$4.90	$36,841	
Vangorda Dump Seepage Toe Drain												$514,148
	9	4	1	1	430	Excavate Ditch	Excavation of Ditch	7,980	Bm3	$3.69	$ 29,428	
	9	4	2	1	430	Place Rip-Rap	Rip-Rap: Drill, blast and stockpile	7,980	Bm3	$23.86	$ 190,376	
	9	4	2	2	430		Rip-Rap: Screen and stockpile	7,980	Bm3	$15.46	$ 123,380	
	9	4	2	3	430		Rip-Rap: Load, haul, dump to Vangorda Stockpile Area	7,980	Bm3	$2.68	$ 21,386	
	9	4	2	4	430		Rip-Rap: Load, haul and dump	7,980	Bm3	$5.85	$ 46,683	
	9	4	3	1	430	Collection Sump	Excavate sump for manholes	32	Bm3	$3.69	$ 118	
	9	4	3	2	500		Supply and place Precast concrete manhole	1	ea.	$1,863.00	$ 1,863	
	9	4	3	3	500		Supply and place pump	1	ea.	$1,503.00	$ 1,503	
	9	4	3	4	500		Provide power to pumping system	1,000	m	$2.53	$ 2,530	est
	9	4	4	1	430	Piping System (to Vangorda Pit)	Excavate Piping Trench	7,200	Bm3	$3.69	$ 26,552	
	9	4	4	2	520		Supply and place 150mm PVC insulated pipe	1,200	m	$15.50	$ 18,600	
	9	4	4	3	510		Supply and install heat trace through piping	1,200	m	$7.87	$ 9,444	
	9	4	4	4	430		Bedding: Produce and stockpile (screen)	468	Bm3	$7.73	$ 3,618	
	9	4	4	5	430		Bedding: Load, haul, dump to Vangorda Stockpile Area	468	Bm3	$2.78	$ 1,301	
	9	4	4	6	430		Bedding: Load, haul, place	468	Bm3	$4.51	$ 2,111	
	9	4	4	7	430		Backfill ditches	7,200	Bm3	$4.90	$ 35,254	
Subtotal Direct Costs - Groundwater												**$789,226**
Miscellaneous												
Buildings												$102,840
	10	1	1	1	220	Building Demolition	Demolish and stockpile building material	6,902	m3	$4.94	$34,096	
	10	1	1	2	430		LHD building material to Grum toe to be regraded over	6,902	m3	$9.96	$68,744	
Sludge Pond												$97,800
	10	2	1	1	430	Cover Sludge Pond	Load, Haul, Place Till	30,000	Bm3	$3.26	$97,800	
Existing Bioremediation Cell												$2,244

	10	3	1	1	430	Cover Existing Bioremediation Cell	Doze material	1,600	m2	$1.40	$2,244	
Dams												$5,440
	10	4	1	1	430	Breach all Dams (except Little Creek Dam)	Excavate, haul and dump locally	1,000	m2	$5.44	$5,440	
WTP Settling Pond												$8,111
	10	5	1	1	430	Breach WTP Settling Pond	Excavate, haul and dump locally	1,491	m3	$5.44	$8,111	
Contaminated soils												$37,350
	10	6	1	1	600	Remove Contaminated soils	Excavate, haul and place contaminated soils in bio-remediation cell	3,750	m3	$9.96	$37,350	
Bioremediation Cell												$56,856
	10	7	1	1	430	Construct Bioremediation Cell	Excavate and create berms for use as the bioremediation cell	8,000	m3	$2.50	$20,002	
	10	7	1	2	430		Place HDPE Liner for remediation Cell	1,600	m2	$21.57	$34,504	
	10	7	1	3	430		Bedding: Load, haul, place (use local overburden material)	480	m3	$4.90	$2,350	
Roads												$25,607
	10	8	1	1	430	Reclaim unnecessary roads	Remove culverts and breach stream crossing	3,920	m3	$3.69	$14,456	
	10	8	1	2	430		Scarify road surfaces	15,000	m2	$0.29	$4,401	
	10	8	1	3	610		Seed and fertilize	15,000	m2	$0.45	$6,750	
Borrow Sources												$286,894
	10	9	1	1	600	Develop Borrow Sources	Clear ang grub	3,000	m2	$2.08	$6,253	
	10	9	1	2	600		Construct Haul roads	1,000	m	$200.00	$200,000	
	10	9	2	1	600	Decommission Borrow Sources	Regrade Borrow source slopes	10	hrs	$459.10	$4,591	
	10	9	2	2	610		Revegetate - Seeding	169,000	m2	$0.40	$67,600	
	10	9	2	3	610		Revegetate - Fertilizer	169,000	m2	$0.05	$8,450	
Subtotal Direct Costs - Miscellaneous												**$623,142**
Subtotal Direct Costs												
							Subtotal direct costs					**#REF!**
CLOSURE COSTS - INDIRECT												
	100	100	1	1		Project Management	2.5% of direct costs	#REF!	x	2.5%		#REF!
	100	100	2	1		Field Supervision	(included in major tasks)					$0
	100	100	3	1		Contractor profit and home office overhead	10% of direct costs	#REF!	x	10.0%		#REF!
	100	100	4	1		Insurance	0.5% of direct costs	#REF!	x	0.5%		#REF!
	100	100	5	1		Bonding	0.5% of direct costs	#REF!	x	0.5%		#REF!
	100	100	6	1		Field Engineering and QA	15% of direct costs	#REF!	x	15.0%		#REF!
	100	100	7	1		Mob - Demob		1	lump	$500,000		$500,000
	100	100	8	1		Living out allowances	(included in heavy equipment costs)					$0
	100	100	9	1		Taxes	7% of taxable direct and indirect costs	#REF!	x	7.0%		#REF!
Subtotal Indirect Costs												
							Subtotal indirect costs					**#REF!**
CLOSURE COSTS - CONTINGENCY												
							Contingency	20% of direct costs	#REF!	x	20.0%	**#REF!**
CLOSURE COSTS - TOTAL												
							Total direct and indirect costs					**#REF!**

Contract Code	Work Area Code	Item	Task	Sub-task	Estimate Type	Activity	Task	Quantity	Unit	Unit Cost	Activity Total	Subtotals	Source / Comments
CLOSURE COSTS - DIRECT CAPITAL													
Faro Pit													**1CD003.046**
Water Treatment													
	1	1	1	1	610	Biological treatment	Operate water treatment system						
Construct Plug Dam												$2,343,251	
	1	2	1	1	430	Foundation Preparation	Bulk stripping- Excavate, load, haul, dump overburden	3700	m3	$7.56	$27,972		1CD003.052 (BGC) (SRK Library - BKG-254)
	1	2	1	2	430		Rock Excavation: core trench rock	4500	m3	$23.33	$104,971		
	1	2	1	4	430		Foudation preparation	1600	m2	$40.00	$64,000		
	1	2	1	5	600		Relocate Zone II Pit Pump well discharge pipe	1	LS	$10,000	$10,000		
	1	2	1	6	520		Foundation/Abutment Grouting - Drilling of Grout Holes	4664	m	$225.00	$1,049,400		
	1	2	1	7	430		Foundation/Abutment Grouting - Water Pressure Testing	350	hrs	$300.00	$105,000		
	1	2	1	8	600		Foundation/Abutment Grouting - Setting packers	1400	ea.	$20.00	$28,000		
	1	2	1	9	600		Foundation/Abutment Grouting - Cement	200000	kg	$0.50	$100,000		
	1	2	2	1	430	Place core material	Load, haul, dump, Till to Stockpile B	16540	m3	$3.81	$63,017		
	1	2	2	2	430		Load, haul, dump, compact Impervious Core Material (Till)	16540	m3	$6.63	$109,660		
	1	2	3	1	430	Place filter material	Produce and screen Fine Filter Material	5740	m3	$7.73	$44,374		
	1	2	3	2	430		Excavate, load, haul, dump, compact Fine Filter Material	5740	m3	$5.26	$30,192		
	1	2	3	3	430		Produce and screen Coarse Filter Material	5130	m3		$0		
	1	2	3	4	430		Excavate, load, haul, dump, compact Coarse Filter Material	5130	m3	$5.26	$26,984		
	1	2	4	1	430	Place rockfill	Excavate, load, haul, dump, compact Rockfill Material	48,500	m3	$11.68	$566,480		
	1	2	5	1	430	Compliance testing	Compliance testing - to confirm uncontaminated material used	105.6	hrs	$125.00	$13,200		1 Inspector over material placement duration.
Safety Berm												$485,077	
	1	3	1	1	430	Construct access road	Clear access road area	600	m2	$1.40	$841		
	1	3	1	2	220		Construct Access road	200	m	$12.00	$2,400		
	1	3	2	1	430	Place berm materials	Load, haul, dump berm material	22,000	m3	$3.15	$69,300		
	1	3	2	2	430		Shape Material into berm	22,000	m3	$18.75	$412,535		
Subtotal Direct Costs - Faro Pit												**$2,828,327**	
Faro Creek													
Route into Faro Pit (East & West Channel)												$566,653	
	2	1	1	1	430	Construct access road	Clear access road area	1,800	m2	$1.40	$2,524		
	2	1	1	2	430		Construct Access road	600	m	$12.00	$7,200		
	2	1	1	1	430	Headworks dam	Load, Haul Dump Till to Stockpile A	54	m3	$5.14	$278		
	2	1	1	2	430		Load, haul, dump, place and compact till at headworks	54	m3	$6.42	$347		
	2	1	2	1	430	Excavate Channel	Soil Excavation: load, haul and dump locally	6,614	m3	$3.69	$24,392		
	2	1	2	2	430		Rock excavation: Drill, blast, muck, load haul dump	4,863	m3	$23.33	$113,432		
	2	1	3	1	430	Place HDPE Liner	Supply and place HDPE Liner	3,142	m2	$21.57	$67,757		
	2	1	4	1	430	Place bedding layer	Produce and stockpile (screen)	3,992	m3	$7.73	$30,864		
	2	1	4	2	430		Load, Haul Dump bedding material to Stockpile A	3,992	m3	$5.14	$20,521		
	2	1	4	3	430		Load, Haul, Place and Compact	3,992	m3	$5.38	$21,479		
	2	1	5	1	430	Place Rip-Rap	Rip-Rap: Screen and stockpile	9,726	m3	$15.46	$150,374		
	2	1	5	2	430		Load Haul and Dump Rip-Rap	9,726	m3	$8.42	$81,892		
	2	1	5	3	430		Place and secure Rip-Rap	9,726	m3	$4.69	$45,594		
Rip rap protection at pit inlet												$17,141	
	2	2	1	1	430	Place Rip-Rap	Rip-Rap: Screen and stockpile	600	m3	$15.46	$9,277		
	2	2	1	2	430		Load Haul and Dump Rip-Rap	600	m3	$8.42	$5,052		
	2	2	1	3	430		Place and secure Rip-Rap	600	m3	$4.69	$2,813		
Route out of Pit												$2,377,094	
	2	3	1	1	430	Excavate Channel	Bulk Excavate Soil/Waste Rock (dump locally)	277,181	m3	$3.69	$1,022,181		
	2	3	1	2	430		Rock excavation: Drill, blast, muck, load haul dump	5,584	m3	$23.33	$130,250		
	2	3	2	1	430	Place HDPE Liner	Supply and place HDPE Liner	12,089	m2	$21.57	$260,700		
	2	3	3	1	430	Place bedding layer	Produce and stockpile (screen) bedding layer	17,569	m3	$7.73	$135,818		
	2	3	3	2	430		Load, Haul, Place and Compact bedding layer	17,569	m3	$5.30	$93,115		
	2	3	4	1	430	Place Rip-Rap	Rip-Rap: Screen and stockpile	29,402	m3	$15.46	$454,583		
	2	3	4	2	430		Load Haul and Dump Rip-Rap	29,402	m3	$3.15	$92,615		
	2	3	4	3	430		Place and secure Rip-Rap	29,402	m3	$4.69	$137,832		
	2	3	5	1		Syphon	Supply and install Syphon - allowance	1	ls	$50,000	$50,000		
Upgrade North Wall Interceptor												$292,357	
	2	4	1	1	430	Excavate Channel	Soil Excavation: load, haul and dump locally	7,500	m3	$3.69	$27,658		assume same upgrade as Improved Creek
	2	4	2	1	430	Place Rip-Rap	Rip-Rap: Screen and stockpile	10,800	m3	$15.46	$166,981		option
	2	4	2	2	430		Load Haul and Dump Rip-Rap	10,800	m3	$4.36	$47,088		
	2	4	2	3	430		Place and secure Rip-Rap	10,800	m3	$4.69	$50,629		
Subtotal Direct Costs - Faro Creek												**$3,253,245**	
Zone II Pit													
Outwash material												$266,462	
	3	1	1	1		Relocate to Intermediate Dump	Load, Haul, Dump Outwash Material	76,350	m3	$3.49	$266,462		
Water Management												$76,579	
	3	2	1	1	430	Groundwater Wells	Drill Well	1	ea.	$1,906.43	$1,906		Pump and treat Zone II Pit water
	3	2	1	2	500		Install 4" PVC Well	90	ea.	$100.00	$9,000		
	3	2	1	3	500		Install Pump in well	1	ea.	$2,629.00	$2,629		
	3	2	1	4	500		Supply Power	2,200	m	$2.53	$5,566		
	3	2	2	1	430	Piping system	Excavate Piping Trench	4,200	m3	$3.69	$15,489		
	3	2	2	2	510		Supply and place 150mm PVC pipe	700	m	$15.50	$10,850		
	3	2	2	3	510		Supply and install heat trace through piping	700	m	$7.87	$5,509		
	3	2	2	4	430		Produce and stockpile (screen) bedding layer	273	m3	$7.73	$2,110		
	3	2	2	5	430		Load, haul, place and compact bedding layer	273	m3	$7.47	$2,039		

3	2	2	8	500		Supply and place Air valves	1	ea.	$295.00	$295	
3	2	2	7	500		Supply and place Drains (blow-offs)	1	ea.	$620.00	$620	
3	2	2	8	430		Backfill ditches	4,200	m3	$4.90	$20,565	
Subtotal Direct Costs - Zone II Pit											**$343,040**
Oxide Fines / LGSP											
Consolidate oxide fines											$3,246,855
4	1	1	1	430	Relocate to Low Grade Stockpile C	Load, Haul, Place and Compact Oxide Materials	683,549	m3	$4.75	$3,246,855	
Low Grade Stockpile "A"											$1,119,787
4	2	1	1	430	Regrade	Flattened Surfaces	7	hrs	$459.10	$3,122	
4	2	1	2	430		Regrade Slopes	15	hrs	$459.10	$7,110	
4	2	2	1	430	Place HDPE Cover	Bedding Layer - Produce and Stockpile	10,842	m3	$7.73	$83,813	
4	2	2	2	430		Bedding Layer - Load, Haul, Place (0.3m)	10,842	m3	$5.26	$57,027	
4	2	2	3	430		Supply and place HDPE Liner	36,139	m2	$21.57	$779,343	
4	2	2	4	430		Load, haul, place loose till (1.0m)	36,139	Bm3	$4.79	$173,105	
4	2	3	1	610	Revegetate	Seeding	36,150	m2	$0.40	$14,460	
4	2	3	2	610		Fertilization	36,150	m2	$0.05	$1,808	
Low Grade Stockpile "C"											$3,775,598
4	3	1	1	430	Regrade	Flattened Surfaces	27	hrs	$459.10	$12,327	
4	3	1	2	430		Regrade Slopes	46	hrs	$459.10	$21,175	
4	3	2	1	430	Place HDPE Cover	Bedding Layer - Produce and Stockpile	54,770	m3	$7.73	$423,408	
4	3	2	2	430		Bedding Layer - Load, Haul, Place (0.3m)	54,770	m3	$5.26	$288,092	
4	3	2	3	430		Supply and place HDPE Liner	109,541	m2	$21.57	$2,362,267	
4	3	2	4	430		Load, haul, place loose till (1.0m)	109,541	m3	$4.79	$524,700	
4	3	3	1	430	Rock Drains	Excavate channel for rock drains	610	m3	$3.69	$2,250	
4	3	3	2	430		Rip-Rap: Screen and stockpile	454	m3	$15.46	$7,017	
4	3	3	3	430		Load Haul and Dump Rip-Rap	454	m3	$4.44	$2,015	
4	3	3	4	430		Place and secure Rip-Rap	454	m3	$4.69	$2,128	
4	3	4	1	430	Surface Runoff Collection	Excavation of ditch	4,280	m3	$3.69	$15,783	
4	3	4	2	430		Supply and place geotextile	6,347	m2	$4.41	$27,998	
4	3	4	3	430		Rip-Rap: Screen and stockpile	1,490	m3	$15.46	$23,035	
4	3	4	4	430		Load Haul and Dump Rip-Rap	1,490	m3	$4.78	$7,122	
4	3	4	5	430		Place and secure Rip-Rap	1,490	m3	$4.69	$6,984	
4	3	5	1	610	Revegetate	Seeding	109,550	m2	$0.40	$43,820	
4	3	5	2	610		Fertilization	109,550	m2	$0.05	$5,478	
Subtotal Direct Costs - Oxide Fines											**$8,142,240**
ETA Tailings											
Pump Tailings to Faro Pit											$0
5	1	1	1		Hydraulic monitoring system	Purchase and install hydraulic monitors		ea.		$0	
5	1	1	2			Install Power Supply		ls		$0	
5	1	1	3			Excavate trenches to sump		m3		$0	
5	1	2	1		Collection Sumps	Purchase sump pumps and piping		ea.		$0	
5	1	2	2			Construct collection sump		m3		$0	
5	1	2	3			Install sump pumps and piping		ea.		$0	
5	1	3	1		Booster Station	Install power supply		ls		$0	
5	1	3	2			Purchase booster station		ea.		$0	
5	1	3	3			Construct booster station		ls		$0	
5	1	4	1		Piping System	Purchase pressure pipe to crest		m		$0	
5	1	4	2			Purchase gravity pipe to pit		m		$0	
5	1	4	3			Install Pipeline		ls		$0	
5	1	4	4			Purchase and install return water pipe		m		$0	
5	1	5	1		Lime addition System	Construct Lime addition System		ls		$0	
5	1	5	2			Procure and install lime addition system		ls		$0	
5	1	6	1		Tailings Relocation Operation	Operate hydraulic monitoring system				$0	
5	1	6	2			Operate sump pumping system				$0	
5	1	6	3			Operate booster pumping system				$0	
5	1	6	4			Purchase lime and operate lime addition system				$0	
5	1	6	5			System decommissioning and removal				$0	
Subtotal Direct Costs - ETA											**$0**
Waste Rock											
Reslope Waste Rock											$3,988,137
6	1	1	1	430	Regrade	Flattened Surfaces	557	hrs	$459.10	$255,551	
6	1	1	2	430		Flatten Bubble Dump Surfaces	773	hrs	$459.10	$355,075	
6	1	1	3	430		Regrade Slopes	7,357	hrs	$459.10	$3,377,510	
Sulphide Cell											$2,148,775
6	2	1	1	430	Low Infiltration Cover	Load, haul, place compacted till (0.5m) (South cells)	86,823	m3	$5.78	$501,839	
6	2	1	2	430		Load, haul, place loose till (1.5m) (South cells)	260,470	m3	$5.57	$1,450,818	
6	2	1	3	430		Load, haul, place compacted till (0.5m) (East cell)	8,720	m3	$5.78	$50,403	
6	2	1	4	430		Load, haul, place loose till (1.5m) (East cell)	26,161	m3	$5.57	$145,715	
Waste Rock Cover											$9,887,713
6	3	1	1	430	Place Rudimentary Cover	Load, haul, place loose till (0.5m)	1,775,173	m3	$5.57	$9,887,713	
Rock Drains											$97,278
6	4	1	1	430	Intall rock drains (runoff management)	Excavate channel for rock drains	4,375	m3	$3.69	$16,134	
6	4	1	2	430		Rip-Rap: Screen and stockpile	3,255	m3	$15.46	$50,326	
6	4	1	3	430		Load Haul and Dump Rip-Rap	3,255	m3	$4.78	$15,559	
6	4	1	4	430		Place and secure Rip-Rap	3,255	m3	$4.69	$15,259	
Sediment Control Ditches											$572,788
6	5	1	1	430	Construct access road	Clear access road area	9,195	m2	$1.40	$12,895	
6	5	1	2	430		Construct Access road	3,065	m	$12.00	$36,780	
6	5	2	1	430	SE, SW Sediment Ditches	Excavation of Ditch	14,841	m3	$3.69	$54,732	
6	5	2	3	430		Rip-Rap: Screen and stockpile	5,166	m3	$15.46	$79,880	

	6	5	2	4	430		Load Haul and Dump Rip-Rap	5,166	m3	$7.61	$39,317	
	6	5	2	5	430		Place and secure Rip-Rap	5,166	m3	$4.69	$24,220	
	6	5	3	1	430	NW Sediment Ditch	Excavation of Ditch	4,276	m3	$3.69	$15,769	
	6	5	3	2	430		Supply and place geotextile	6,341	m2	$4.41	$27,973	
	6	5	3	3	430		Rip-Rap: Screen and stockpile	1,489	m3	$15.46	$23,014	
	6	5	3	4	430		Load Haul and Dump Rip-Rap	1,489	m3	$3.44	$5,121	
	6	5	3	5	430		Place and secure Rip-Rap	1,489	m3	$4.69	$6,978	
	6	5	4	1	430	Faro Crk. Out Sediment Ditch	Excavation of Ditch	11,045	m3	$3.69	$40,731	
	6	5	4	2	430		Supply and place geotextile	16,379	m2	$4.41	$72,254	
	6	5	4	3	430		Rip-Rap: Screen and stockpile	3,845	m3	$15.46	$59,445	
	6	5	4	4	430		Load Haul and Dump Rip-Rap	3,845	m3	$3.15	$12,111	
	6	5	4	5	430		Place and secure Rip-Rap	3,845	m3	$4.69	$18,024	
	6	5	5	1	430	SE, SW Sediment Basin	Excavate sedimentation basin	5,184	m3	$3.69	$19,117	
	6	5	5	2	430		Rip-Rap: Screen and stockpile	104	m3	$15.46	$1,608	
	6	5	5	3	430		Load Haul and Dump Rip-Rap	104	m3	$7.61	$791	
	6	5	5	4	430		Place and secure Rip-Rap	104	m3	$4.69	$488	
	6	5	6	1	430	Faro Crk. Out Sediment Basin	Excavate sedimentation basin	5,184	m3	$3.69	$19,117	
	6	5	6	2	430		Rip-Rap: Screen and stockpile	104	m3	$15.46	$1,608	
	6	5	6	3	430		Load Haul and Dump Rip-Rap	104	m3	$3.15	$328	
	6	5	6	4	430		Place and secure Rip-Rap	104	m3	$4.69	$488	
Revegetate												$1,999,980
	6	6	1	1	610	Revegitate WR Dumps	Seeding	4,444,400	m2	$0.40	$1,777,760	
	6	6	1	2	610		Fertilization	4,444,400	m2	$0.05	$222,220	
Subtotal Direct Costs - Waste Rock												**$18,694,671**
Groundwater												
Upgrade North Fork Rose Creek												$1,551,887
	7	1	1	1	430	Construct access road	Clear access road area	6,600	m2	$1.40	$9,256	
	7	1	1	2	430		Construct Access road	2,200	m	$12.00	$26,400	
	7	1	2	1	430	Contruct Channel	Load, Haul, Dump granular material along channel thalwag.	16,500	m3	$7.52	$124,080	
	7	1	2	2	430		Load, Haul, Dump till to create channel berms	26,782	m3	$7.52	$201,401	
	7	1	3	1	430	Place HDPE Liner	Supply and place HDPE Liner	32,502	m2	$21.57	$700,910	
	7	1	4	1	430	Place bedding layer	Produce and stockpile (screen) bedding layer	9,751	m3	$7.73	$75,381	
	7	1	4	2	430		Load, haul, place and compact bedding layer	9,751	m3	$7.52	$73,328	
	7	1	5	1	430	Place Rip-Rap	Rip-Rap: Screen and stockpile	12,289	m3	$15.46	$190,003	
	7	1	5	2	430		Load Haul and Dump Rip-Rap	12,289	m3	$7.61	$93,519	
	7	1	5	3	430		Place and secure Rip-Rap	12,289	m3	$4.69	$57,610	
North Fork Rose Creek Detention Pond												$11,002
	7	2	1	1	430	Excavate Basin	Excavate sedimentation basin	2,592	m3	$3.69	$9,559	
	7	2	2	1	430	Place Rip-Rap	Rip-Rap: Screen and stockpile	52	m3	$15.46	$804	
	7	2	2	2	430		Load Haul and Dump Rip-Rap	52	m3	$7.61	$396	
	7	2	2	3	430		Place and secure Rip-Rap	52	m3	$4.69	$244	
North Fork Rose Creek Collection System (to Pit)												$181,444
	7	3	1	1	430	Place Manholes	Excavate sump for manholes	32	m3	$3.69	$118	
	7	3	1	2	500		Supply and place Precast concrete manhole	1	ea.	$1,863.00	$1,863	
	7	3	1	3	500		Install Primary pump	1	ea.	$1,503.00	$1,503	
	7	3	1	4	500		Provide power to pumping system	400	m	$2.53	$1,012	
	7	3	2	1	430	Groundwater Wells	Drill Well	3	ea.	$1,906.43	$5,719	
	7	3	2	2	500		Install 4" PVC Well	60	m	$100.00	$6,000	
	7	3	2	3	500		Install Pump in well	3	ea.	$2,629.00	$7,887	
	7	3	2	4	500		Supply Power	400	m	$2.53	$1,012	
	7	3	3	1	430	Piping system	Excavate Piping Trench	11,400	m3	$3.69	$42,041	
	7	3	3	2	510		Supply and place 150mm PVC pipe	1,900	m	$15.50	$29,450	
	7	3	3	3	510		Supply and install heat trace through piping	1,900	m	$7.87	$14,953	
	7	3	3	4	500		Supply and place Air valves	2	ea.	$295.00	$590	
	7	3	3	5	500		Supply and place Drains (blow-offs)	1	ea.	$620.00	$620	
	7	3	3	6	430		Produce and stockpile (screen) bedding layer	741	m3	$7.73	$5,728	
	7	3	3	7	430		Load, haul, place and compact bedding layer	741	m3	$9.62	$7,128	
	7	3	3	8	430		Backfill ditches	11,400	m3	$4.90	$55,820	
ETA Colletion System (to Pit)												$207,061
	7	4	1	1	430	Place Manholes	Excavate sump for manholes	32	m3	$3.69	$118	
	7	4	1	2	500		Supply and place Precast concrete manhole	1	ea.	$1,863.00	$1,863	
	7	4	1	3	500		Install Primary pump	1	ea.	$1,503.00	$1,503	
	7	4	1	4	500		Provide power to pumping system	300	m	$2.53	$759	
	7	4	2	1	500	Install Wells	Drill Well	3	ea.	$1,906.43	$5,719	
	7	4	2	2	500		Install 4" PVC Well	60	m	$100.00	$6,000	
	7	4	2	3	500		Install Pump in well	3	ea.	$2,629.00	$7,887	
	7	4	2	4	500		Supply Power	300	m	$2.53	$759	
	7	4	3	1	430	Piping system	Excavate Piping Trench	13,200	m3	$3.69	$48,679	
	7	4	3	2	510		Supply and place 150mm PVC pipe	2,200	m	$15.50	$34,100	
	7	4	3	3	510		Supply and install heat trace through piping	2,200	m	$7.87	$17,314	
	7	4	3	4	500		Supply and place Air valves	2	ea.	$295.00	$590	
	7	4	3	5	500		Supply and place Drains (blow-offs)	1	ea.	$620.00	$620	
	7	4	3	6	430		Produce and stockpile (screen) bedding layer	858	m3	$7.73	$6,633	
	7	4	3	7	430		Load, haul, place and compact bedding layer	858	m3	$11.52	$9,884	
	7	4	3	8	430		Backfill ditches	13,200	m3	$4.90	$64,633	
Subtotal Direct Costs - Groundwater												**$1,951,394**
Miscellaneous												
Roads												$16,066
	8	1	1	1	430	Reclaim unnecssary roads	Remove culverts and breach stream crossing	2,240	m3	$3.69	$8,260.60	
	8	1	1	2	430		Scarify road surfaces	10,500	m2	$0.29	$3,080.84	

8	1	1	2	610		Seed and fertilize	10,500	m2		$0.45	$4,725.00	
Buildings												$840,360
8	2	1	1	220	Building Demolition	Demolish and stockpile building material	56,400	m3		$4.94	$278,616	
8	2	1	2	430		LHD building material to Faro WR Dump toe to be regraded ove	56,400	m3		$9.96	$561,744	
Borrow Sources												$387,585
8	3	1	1	600	Develop Borrow Sources	Clear (grub access road)	1,500	m2		$2.08	$3,126	
8	3	1	2	600		Construct Access road	500	m		$200.00	$100,000	
8	3	2	1	600	Decommission Borrow Sources	Regrade Borrow source slopes	11	hrs		$459.10	$5,009	
8	3	2	2	610		Revegetate - Seeding	621,000	m2		$0.40	$248,400	
8	3	2	3	610		Revegetate - Fertilizer	621,000	m2		$0.05	$31,050	
Subtotal Direct Costs - Miscellaneous												**$1,244,012**
Subtotal Direct Costs												
						Subtotal direct costs						**$36,456,929**
CLOSURE COSTS - INDIRECT												
100	100	1	1		Project Management	2.5% of direct costs	$ 36,456,929		x	2.5%		$911,423
100	100	2	1		Field Supervision	(included in major tasks)						$0
100	100	3	1		Contractor profit and home office overhead	10% of direct costs	$ 36,456,929		x	10.0%		$3,645,693
100	100	4	1		Insurance	0.5% of direct costs	$ 36,456,929		x	0.5%		$182,285
100	100	5	1		Bonding	0.5% of direct costs	$ 36,456,929		x	0.5%		$182,285
100	100	6	1		Field Engineering and QA	15% of direct costs	$ 36,456,929		x	15.0%		$5,468,539
100	100	7	1		Mob - Demob		1	lump		$500,000		$500,000
100	100	8	1		Living out allowances	(included in heavy equipment costs)						$0
100	100	9	1		Taxes	7% of taxable direct and indirect costs	$ 40,055,768		x	7.0%		$2,803,904
Subtotal Indirect Costs												
						Subtotal indirect costs						**$13,694,129**
CLOSURE COSTS - CONTINGENCY												
						Contingency	20% of direct costs		$36,456,929	x	20.0%	**$7,291,386**
CLOSURE COSTS - TOTAL												
						Total direct and indirect costs						**$57,442,443**

Contract Code	Work Area Code	Item	Task	Sub-task	Estimate Type	Activity	Task	Quantity	Unit	Unit Cost	Activity Total	Subtotals	Source / Comments
CLOSURE COSTS - DIRECT CAPITAL													
Faro Pit													
Water Treatment												$191,632	
	1	1	1	1	600	Construct Plant							
	1	1	3	1	430	Place Pipeline	Excavation of Ditch	15,000	m3	$3.69	$55,317		
	1	1	3	2	500		Supply and place pump	1	ea.	$1,878.00	$1,878		
	1	1	3	3	500		Build and install housing for primary pump	1	ea.	$5,000.00	$5,000		
	1	1	3	4	500		Provide power to pumping system	100	m	$2.53	$253		
	1	1	3	5	500		Supply and place Air valves	1	ea.	$295.00	$295		
	1	1	3	6	510		Supply and place 150 mm PVC Pipe	2,500	m	$15.50	$38,750		
	1	1	3	8	430		Produce and stockpile (screen) bedding layer	975	m3	$7.73	$7,537		
	1	1	3	9	430		Load, Haul, Place bedding layer	975	m3	$9.39	$9,155		
	1	1	3	10	430		Backfill ditches	15,000	m3	$4.90	$73,447		
Safety Berm												$508,953	
	1	2	1	1	430	Construct access road	Clear (grub access road)	600	m2	$1.40	$841		
	1	2	1	2	430		Construct Access road	200	m	$12.00	$2,400		
	1	2	2	1	430	Place berm materials	LHD Material	22,000	m3	$5.94	$130,680		
	1	2	2	2	430		Shape Material into berm	20,000	m3	$18.75	$375,032		
Subtotal Direct Costs - Faro Pit												**$700,585**	
Faro Creek													Golder report (Feb. 2004)
Construct East Interceptor												$4,501,753	
	2	1	1	1	430	Excavate Channel	Clear and Grub	135,000	m2	$2.08	$281,377		2700m * 50m avg
	2	1	1	2	430		Excavate channel	230,000	m3	$3.69	$848,187		
	2	1	2	1	430	Construct access road	Construct Access road	3,057	m	$12.00	$36,684		
	2	1	3	1	430	Place Thermal Blanket	Produce and stockpile Granular Fill	81,000	m3	$7.73	$626,179		2700m * 20m avg. * 1.5m
	2	1	3	2	430		Load, Haul and Dump Granular Fill to Stockpile A	81,000	m3	$5.66	$458,460		
	2	1	3	3	430		Load, Haul, Place and compact Granular Fillon uphill cut slope	81,000	m3	$7.16	$579,960		
	2	1	4	1	430	Place GCL	Supply and Place GCL	27,000	m2	$24.80	$669,469		2700m * 10m avg.
	2	1	5	1	430	Place bedding layer	Produce and stockpile (screen)	8,100	m3	$7.73	$62,618		
	2	1	5	2	430		Load Haul and Dump bedding to Stockpile A	8,100	m3	$5.66	$45,846		
	2	1	5	3	430		Load, Haul, Place and Compact bedding layer	8,100	m3	$7.16	$57,996		
	2	1	6	1	430	Place Rip-Rap	Rip-Rap: Screen and stockpile	29,402	m3	$15.46	$454,583		2700m * 10m avg. * 0.25m
	2	1	6	2	430		Load Haul, Dump Rip-Rap	29,402	m3	$8.25	$242,563		
	2	1	6	3	430		Place and secure Rip-Rap	29,402	m3	$4.69	$137,832		
Optional Extension across west of Faro Valley												$634,296	
	2	2	1	1	430	Excavate Channel	Clear and Grub	20,300	m2	$2.08	$42,311		
	2	2	1	2	430		Excavate channel in soil	93,076	m3	$3.69	$343,241		
	2	2	2	1	430	Construct access road	Construct Access road	2,100	m	$12.00	$25,200		
	2	2	3	1	430	Place bedding layer	Produce and stockpile (screen)	4,263	m3	$7.73	$32,956		
	2	2	3	2	430		Load Haul and Dump bedding to Stockpile A	4,263	m3	$5.66	$24,129		
	2	2	3	3	430		Load, Haul, Place and Compact bedding layer	4,263	m3	$10.69	$45,571		
	2	2	4	1	430	Place Rip-Rap	Rip-Rap: Screen and stockpile	3,553	m3	$15.46	$54,926		
	2	2	4	2	430		Load Haul and Dump Rip-Rap	3,553	m3	$13.88	$49,309		
	2	2	4	3	430		Place and secure Rip-Rap	3,553	m3	$4.69	$16,654		
Subtotal Direct Costs - Faro Creek												**$5,136,049**	
Zone II Pit													
Outwash material												$266,462	
	3	1	1	1		Relocate to Intermediate Dump	Load, Haul, Dump Outwash Material	76,350	m3	$3.49	$266,462		
Water Management												$76,579	
	3	2	1	1	430	Groundwater Wells	Drill Well	1	ea.	$1,906.43	$1,906		Pump and treat Zone II Pit water
	3	2	1	2	500		Install 4" PVC Well	90	ea.	$100.00	$9,000		
	3	2	1	3	500		Install Pump in well	1	ea.	$2,629.00	$2,629		
	3	2	1	4	500		Supply Power	2,200	m	$2.53	$5,566		
	3	2	2	1	430	Piping system	Excavate Piping Trench	4,200	m3	$3.69	$15,489		
	3	2	2	2	510		Supply and place 150mm PVC pipe	700	m	$15.50	$10,850		
	3	2	2	3	510		Supply and install heat trace through piping	700	m	$7.87	$5,509		
	3	2	2	4	430		Produce and stockpile (screen) bedding layer	273	m3	$7.73	$2,110		
	3	2	2	5	430		Load, haul, place and compact bedding layer	273	m3	$7.47	$2,039		
	3	2	2	6	500		Supply and place Air valves	1	ea.	$295.00	$295		
	3	2	2	7	500		Supply and place Drains (blow-offs)	1	ea.	$620.00	$620		
	3	2	2	8	430		Backfill ditches	4,200	m3	$4.90	$20,565		
Subtotal Direct Costs - Zone II Pit												**$343,040**	
Oxide Fines / LGSP													
Consolidate oxide fines												$3,246,855	
	4	1	1	1	430	Relocate to Low Grade Stockpile C	Load, Haul, Place and Compact Oxide Materials	683,549	m3	$4.75	$3,246,855		
Low Grade Stockpile "A"												$1,119,787	
	4	2	1	1	430	Regrade	Flattened Surfaces	7	hrs	$459.10	$3,122		
	4	2	1	2	430		Regrade Slopes	15	hrs	$459.10	$7,110		
	4	2	2	1	430	Place HDPE Cover	Bedding Layer - Produce and Stockpile	10,842	m3	$7.73	$83,813		
	4	2	2	2	430		Bedding Layer - Load, Haul, Place (0.3m)	10,842	m3	$5.26	$57,027		
	4	2	2	3	430		Supply and place HDPE Liner	36,139	m2	$21.57	$779,343		
	4	2	2	4	430		Load, haul, place loose till (1.0m)	36,139	Bm3	$4.79	$173,105		
	4	2	3	1	610	Revegetate	Seeding	36,150	m2	$0.40	$14,460		
	4	2	3	2	610		Fertilization	36,150	m2	$0.05	$1,808		
Low Grade Stockpile "C"												$3,775,598	
	4	3	1	1	430	Regrade	Flattened Surfaces	27	hrs	$459.10	$12,327		
	4	3	1	2	430		Regrade Slopes	46	hrs	$459.10	$21,175		
	4	3	2	1	430	Place HDPE Cover	Bedding Layer - Produce and Stockpile	54,770	m3	$7.73	$423,408		
	4	3	2	2	430		Bedding Layer - Load, Haul, Place (0.3m)	54,770	m3	$5.26	$288,092		

	4	3	2	3	430		Supply and place HDPE Liner	109,541	m2	$21.57	$2,362,267
	4	3	2	4	430		Load, haul, place loose till (1.0m)	109,541	m3	$4.79	$524,700
	4	3	3	1	430	Rock Drains	Excavate channel for rock drains	610	m3	$3.69	$2,250
	4	3	3	2	430		Rip-Rap: Screen and stockpile	454	m3	$15.46	$7,017
	4	3	3	3	430		Load Haul and Dump Rip-Rap	454	m3	$4.44	$2,015
	4	3	3	4	430		Place and secure Rip-Rap	454	m3	$4.69	$2,128
	4	3	4	1	430	Surface Runoff Collection	Excavation of ditch	4,280	m3	$3.69	$15,783
	4	3	4	2	430		Supply and place geotextile	6,347	m2	$4.41	$27,998
	4	3	4	3	430		Rip-Rap: Screen and stockpile	1,490	m3	$15.46	$23,035
	4	3	4	4	430		Load Haul and Dump Rip-Rap	1,490	m3	$4.78	$7,122
	4	3	4	5	430		Place and secure Rip-Rap	1,490	m3	$4.69	$6,984
	4	3	5	1	610	Revegetate	Seeding	109,550	m2	$0.40	$43,820
	4	3	5	2	610		Fertilization	109,550	m2	$0.05	$5,478
Subtotal Direct Costs - Oxide Fines											**$8,142,240**
ETA Tailings											
Pump Tailings to Faro Pit											$0
	5	1	1	1		Hydraulic monitoring system	Purchase and install hydraulic monitors		ea.	$0	
	5	1	1	2			Install Power Supply		ls	$0	
	5	1	1	3			Excavate trenches to sump		m3	$0	
	5	1	2	1		Collection Sumps	Purchase sump pumps and piping		ea.	$0	
	5	1	2	2			Construct collection sump		m3	$0	
	5	1	2	3			Install sump pumps and piping		ea.	$0	
	5	1	3	1		Booster Station	Install power supply		ls	$0	
	5	1	3	2			Purchase booster station		ea.	$0	
	5	1	3	3			Construct booster station		ls	$0	
	5	1	4	1		Piping System	Purchase pressure pipe to crest		m	$0	
	5	1	4	2			Purchase gravity pipe to pit		m	$0	
	5	1	4	3			Install Pipeline		ls	$0	
	5	1	4	4			Purchase and install return water pipe		m	$0	
	5	1	5	1		Lime addition System	Construct Lime addition System		ls	$0	
	5	1	5	2			Procure and install lime addition system		ls	$0	
	5	1	6	1		Tailings Relocation Operation	Operate hydraulic monitoring system			$0	
	5	1	6	2			Operate sump pumping system			$0	
	5	1	6	3			Operate booster pumping system			$0	
	5	1	6	4			Purchase lime and operate lime addition system			$0	
	5	1	6	5			System decommissioning and removal			$0	
Subtotal Direct Costs - ETA											**$0**
Waste Rock											
Reslope Waste Rock											$3,988,137
	6	1	1	1	430	Regrade	Flattened Surfaces	557	hrs	$459.10	$255,551
	6	1	1	2	430		Flatten Bubble Dump Surfaces	773	hrs	$459.10	$355,075
	6	1	1	3	430		Regrade Slopes	7,357	hrs	$459.10	$3,377,510
Sulphide Cell											$2,148,775
	6	2	1	1	430	Low Infiltration Cover	Load, haul, place compacted till (0.5m) (South cells)	86,823	m3	$5.78	$501,839
	6	2	1	2	430		Load, haul, place loose till (1.5m) (South cells)	260,470	m3	$5.57	$1,450,818
	6	2	1	3	430		Load, haul, place compacted till (0.5m) (East cell)	8,720	m3	$5.78	$50,403
	6	2	1	4	430		Load, haul, place loose till (1.5m) (East cell)	26,161	m3	$5.57	$145,715
Waste Rock Cover											$9,887,713
	6	3	1	1	430	Place Rudimentary Cover	Load, haul, place loose till (0.5m)	1,775,173	m3	$5.57	$9,887,713
Rock Drains											$97,278
	6	4	1	1	430	Intall rock drains (runoff management)	Excavate channel for rock drains	4,375	m3	$3.69	$16,134
	6	4	1	2	430		Rip-Rap: Screen and stockpile	3,255	m3	$15.46	$50,326
	6	4	1	3	430		Load Haul and Dump Rip-Rap	3,255	m3	$4.78	$15,559
	6	4	1	4	430		Place and secure Rip-Rap	3,255	m3	$4.69	$15,259
Sediment Control Ditches											$669,391
	6	5	1	1	430	Construct access road	Clear access road area	9,195	m2	$1.40	$12,895
	6	5	1	2	430		Construct Access road	3,065	m	$12.00	$36,780
	6	5	2	1	430	SE, SW Sediment Ditches	Excavation of Ditch	14,841	m3	$3.69	$54,732
	6	5	2	2	430		Supply and place geotextile	22,010	m2	$4.41	$97,091
	6	5	2	3	430		Rip-Rap: Screen and stockpile	5,166	m3	$15.46	$79,880
	6	5	2	4	430		Load Haul and Dump Rip-Rap	5,166	m3	$7.61	$39,317
	6	5	2	5	430		Place and secure Rip-Rap	5,166	m3	$4.69	$24,220
	6	5	3	1	430	NW Sediment Ditch	Excavation of Ditch	4,276	m3	$3.69	$15,769
	6	5	3	2	430		Supply and place geotextile	6,341	m2	$4.41	$27,973
	6	5	3	3	430		Rip-Rap: Screen and stockpile	1,489	m3	$15.46	$23,014
	6	5	3	4	430		Load Haul and Dump Rip-Rap	1,489	m3	$3.44	$5,121
	6	5	3	5	430		Place and secure Rip-Rap	1,489	m3	$4.69	$6,978
	6	5	4	1	430	Faro Crk. Out Sediment Ditch	Excavation of Ditch	11,045	m3	$3.69	$40,731
	6	5	4	2	430		Supply and place geotextile	16,379	m2	$4.41	$72,254
	6	5	4	3	430		Rip-Rap: Screen and stockpile	3,845	m3	$15.46	$59,445
	6	5	4	4	430		Load Haul and Dump Rip-Rap	3,845	m3	$3.15	$12,111
	6	5	4	5	430		Place and secure Rip-Rap	3,845	m3	$4.69	$18,024
	6	5	5	1	430	SE, SW Sediment Basin	Excavate sedimentation basin	5,184	m3	$3.69	$19,117
	6	5	5	2	430		Rip-Rap: Screen and stockpile	104	m3	$15.46	$1,608
	6	5	5	3	430		Load Haul and Dump Rip-Rap	104	m3	$7.61	$791
	6	5	6	1	430	Faro Crk. Out Sediment Basin	Excavate sedimentation basin	5,184	m3	$3.69	$19,117
	6	5	6	2	430		Rip-Rap: Screen and stockpile	104	m3	$15.46	$1,608
	6	5	6	3	430		Load Haul and Dump Rip-Rap	104	m3	$3.15	$328
	6	5	6	4	430		Place and secure Rip-Rap	104	m3	$4.69	$488
Revegetate											$1,999,980
	6	6	1	1	610	Revegitate WR Dumps	Seeding	4,444,400	m2	$0.40	$1,777,760
	6	6	1	2	610		Fertilization	4,444,400	m2	$0.05	$222,220
Subtotal Direct Costs - Waste Rock											**$18,791,274**
Groundwater											$1,551,887

7	1	1	1	430	Construct access road	Clear access road area	6,600	m2	$1.40	$9,256	
7	1	1	2	430		Construct Access road	2,200	m	$12.00	$26,400	
7	1	2	1	430	Contruct Channel	Load, Haul, Dump granular material along channel thalwag.	16,500	m3	$7.52	$124,080	
7	1	2	2	430		Load, Haul, Dump till to create channel berms	26,782	m3	$7.52	$201,401	
7	1	3	1	430	Place HDPE Liner	Supply and place HDPE Liner	32,502	m2	$21.57	$700,910	
7	1	4	1	430	Place bedding layer	Produce and stockpile (screen) bedding layer	9,751	m3	$7.73	$75,381	
7	1	4	2	430		Load, haul, place and compact bedding layer	9,751	m3	$7.52	$73,328	
7	1	5	1	430	Place Rip-Rap	Rip-Rap: Screen and stockpile	12,289	m3	$15.46	$190,003	
7	1	5	2	430		Load Haul and Dump Rip-Rap	12,289	m3	$7.61	$93,519	
7	1	5	3	430		Place and secure Rip-Rap	12,289	m3	$4.69	$57,610	
North Fork Rose Creek Detention Pond											$11,002
7	2	1	1	430	Excavate Basin	Excavate sedimentation basin	2,592	m3	$3.69	$9,559	
7	2	2	1	430	Place Rip-Rap	Rip-Rap: Screen and stockpile	52	m3	$15.46	$804	
7	2	2	2	430		Load Haul and Dump Rip-Rap	52	m3	$7.61	$396	
7	2	2	3	430		Place and secure Rip-Rap	52	m3	$4.69	$244	
North Fork Rose Creek Collection System (to Plant)											$17,428
7	3	1	1	430	Place Manholes	Excavate sump for manholes	32	m3	$3.69	$118	
7	3	1	2	500		Supply and place Precast concrete manhole	1	ea.	$1,863.00	$1,863	
7	3	1	3	500		Install Primary pump	1	ea.	$1,503.00	$1,503	
7	3	1	4	500		Provide power to pumping system	400	m	$2.53	$1,012	
7	3	2	1	430	Groundwater Wells	Drill Well	3	ea.	$1,906.43	$5,719	
7	3	2	2	500		Install 4" PVC Well	60	m	$100.00	$6,000	
7	3	2	3	500		Install Pump in well	3	ea.	$2,629.00	$7,887	
7	3	2	4	500		Supply Power	400	m	$2.53	$1,012	
7	3	3	1	430	Piping system	Excavate Piping Trench	1,080	m3	$3.69	$3,983	
7	3	3	2	510		Supply and place 150mm PVC pipe	180	m	$15.50	$2,790	
7	3	3	3	510		Supply and install heat trace through piping	180	m	$7.87	$1,417	
7	3	3	4	430		Produce and stockpile (screen) bedding layer	70	m3	$7.73	$543	
7	3	3	5	430		Load, haul, place and compact bedding layer	70	m3	$9.62	$675	
7	3	3	6	430		Backfill ditches	1,080	m3	$4.90	$5,288	
7	3	3	7	500		Provide power to pumping system	1,080	m	$2.53	$2,732	
ETA Colletion System (to Plant)											$182,907
7	4	1	1	430	Place Manholes	Excavate sump for manholes	32	m3	$3.69	$118	
7	4	1	2	500		Supply and place Precast concrete manhole	1	ea.	$1,863.00	$1,863	
7	4	1	3	500		Install Primary pump	1	ea.	$1,503.00	$1,503	
7	4	1	4	500		Provide power to pumping system	300	m	$2.53	$759	
7	4	2	1	500	Install Wells	Drill Well	3	ea.	$1,906.43	$5,719	
7	4	2	2	500		Install 4" PVC Well	60	m	$100.00	$6,000	
7	4	2	3	500		Install Pump in well	3	ea.	$2,629.00	$7,887	
7	4	2	4	500		Supply Power	300	m	$2.53	$759	
7	4	3	1	430	Piping system	Excavate Piping Trench	11,100	m3	$3.69	$40,934	
7	4	3	2	510		Supply and place 150mm PVC insulated pipe	1,850	m	$15.50	$28,675	
7	4	3	3	510		Supply and install heat trace through piping	1,850	m	$7.87	$14,560	
7	4	3	4	500		Supply and place Air valves	2	ea.	$295.00	$590	
7	4	3	5	500		Supply and place Drains (blow-offs)	1	ea.	$620.00	$620	
7	4	3	6	430		Produce and stockpile (screen) bedding layer	722	m3	$7.73	$5,578	
7	4	3	7	430		Load, haul, place and compact bedding layer	722	m3	$11.52	$8,312	
7	4	3	8	430		Backfill ditches	11,100	m3	$4.90	$54,351	
7	4	3	9	500		Provide power to pumping system	1,850	m	$2.53	$4,681	
Subtotal Direct Costs - Groundwater											**$1,763,224**
Miscellaneous											
Roads											$16,066
8	1	1	1	430	Reclaim unnecssary roads	Remove culverts and breach stream crossing	2,240	m3	$3.69	$8,260.60	
8	1	1	2	430		Scarify road surfaces	10,500	m2	$0.29	$3,080.84	
8	1	1	3	610		Seed and fertilize	10,500	m2	$0.45	$4,725.00	
Buildings											$840,360
8	2	1	1	220	Building Demolition	Demolish and stockpile building material	56,400	m3	$4.94	$278,616	
8	2	1	2	430		LHD building material to Faro WR Dump toe to be regraded over	56,400	m3	$9.96	$561,744	
Borrow Sources											$387,585
8	3	1	1	600	Develop Borrow Sources	Clear and grub	1,500	m2	$2.08	$3,126	
8	3	1	2	600		Construct Haul road	500	m	$200.00	$100,000	
8	3	2	1	600	Decommission Borrow Sources	Regrade Borrow source slopes	11	hrs	$459.10	$5,009	
8	3	2	2	610		Revegetate - Seeding	621,000	m2	$0.40	$248,400	
8	3	2	3	610		Revegetate - Fertilizer	621,000	m2	$0.05	$31,050	
Subtotal Direct Costs - Miscellaneous											**$1,244,012**
Subtotal Direct Costs											
					Subtotal direct costs						**$36,120,425**
CLOSURE COSTS - INDIRECT											
100	100	1	1		Project Management	2.5% of direct costs	$ 36,120,425	x	2.5%		$903,011
100	100	2	1		Field Supervision	(included in major tasks)					$0
100	100	3	1		Contractor profit and home office overhe	10% of direct costs	$ 36,120,425	x	10.0%		$3,612,043
100	100	4	1		Insurance	0.5% of direct costs	$ 36,120,425	x	0.5%		$180,602
100	100	5	1		Bonding	0.5% of direct costs	$ 36,120,425	x	0.5%		$180,602
100	100	6	1		Field Engineering and QA	15% of direct costs	$ 36,120,425	x	15.0%		$5,418,064
100	100	7	1		Mob - Demob		1	lump	$500,000		$500,000
100	100	8	1		Living out allowances	(included in heavy equipment costs)					$0
100	100	9	1		Taxes	7% of taxable direct and indirect costs	$ 39,690,661	x	7.0%		$2,778,346
Subtotal Indirect Costs											
					Subtotal indirect costs						**$13,572,667**
CLOSURE COSTS - CONTINGENCY											
					Contingency	20% of direct costs	$36,120,425	x	20.0%		**$7,224,085**
CLOSURE COSTS - TOTAL											
					Total direct and indirect costs						**$56,917,178**

Option 1: Stabilization

Contract Code	Work Area Code	Item	Task	Sub-task	Estimate Type	Task	Activity	Quantity	Unit	Unit Cost	Activity Total	Subtotals	Source / Comments
CLOSURE COSTS - DIRECT CAPITAL													
Dams													
Cross Valley Dam												$2,309,667	
	1	1	1	1		Remove Pond	Pump Pond water to discharge	1	ls	$50,000	$50,000.00		
	1	1	2	1		Remove Impounded Sludge	Excavate and create berms for use as sludge cell ontop of tailings	1,445	m3	$3.69	$5,328.83		
	1	1	2	2			Load, haul and place sludge material	1,600	m3	$7.46	$11,936		1CD003.45_SludgeManagement
	1	1	3	1		Remove Contaminated Soil	Excavate, load, haul and place contaminated soils to mill area	322,650	m3	$4.81	$1,551,947		
	1	1	4	1		Prepare spoil area	Clear and Grub	5,000	m2	$2.08	$10,421		
	1	1	4	2			prepare access roads	200	m	$12.00	$2,400		
	1	1	5	1		Remove Dam	Excavate, load, haul and place dam material not used for Int. Dam toe bern	87,588	m3	$3.75	$328,455		
	1	1	6	1		Create Channel	Excavate channel	3900	m3	$3.69	$14,382		
	1	1	6	2			Supply and place geotextile Liner	1300	m2	$4.41	$5,735		
	1	1	6	3			Bedding Layer: Screen and stockpile	500	m3	$7.73	$3,865		
	1	1	6	4			Bedding Layer: Load, haul, dump and place	500	m3	$5.78	$2,890		
	1	1	6	5			Rip-Rap: Drill, blast and stockpile	4600	m3	$23.86	$109,740		
	1	1	6	6			Rip-Rap: Screen and stockpile	4600	m3	$15.46	$71,122		
	1	1	6	7			Load Haul and Dump Rip-Rap	4600	m3	$5.03	$23,138		
	1	1	6	8			Place and secure Rip-Rap	4600	m3	$4.69	$21,564		
	1	1	7	1		Revegetate Dam footprint and impoundment	Seed and fertilize	214,983	m2	$0.45	$96,742		
Intermediate Dam												$3,080,492	1CD003.59_Rose_Creek_Dam_Upgrades
	1	2	1	1		Ground Densification	Gravel: supply and stockpile locally	6,493	m3	$7.73	$50,191.89		
	1	2	1	2			Gravel: load , haul, place (3km)	6,493	m3	$6.24	$40,513.98		
	1	2	1	2			Drill vibro-replacement stone columns	74,400	m3	$25.00	$1,860,000.00		
	1	2	1	2			Verification testing	1	ls	$50,000	$50,000.00		
	1	2	2	1		Construct Berm at Toe	Excavate, load, haul and place Material From Cross Valley Dam	247,500	m3	$3.75	$928,125		
	1	2	3	1		Install pond level control	Install pumping system to manage pond levels	1	ls	$5,000.00	$5,000.00		
	1	2	3	2			Modify spillway - lower or add stop logs	1	ls	$2,500.00	$2,500.00		
	1	2	4	1		Construct channel - spillway to Rose Cr.	Excavate and create berms	8,030	m3	$3.69	$29,612.79		
	1	2	4	2			Bedding Layer: Screen and stockpile	1,452	m3	$7.73	$11,224.60		
	1	2	4	3			Bedding Layer: Load, haul, dump and place	1,452	m3	$5.78	$8,392.39		
	1	2	4	4			Rip-Rap: Drill, blast and stockpile	1,936	m3	$23.86	$46,185.42		
	1	2	4	5			Rip-Rap: Screen and stockpile	1,936	m3	$15.46	$29,932.26		
	1	2	4	6			Load Haul and Dump Rip-Rap	1,936	m3	$5.03	$9,737.88		
	1	2	4	7			Place and secure Rip-Rap	1,936	m3	$4.69	$9,075.59		
Secondary Dam												$750,826	
	1	3	1	1		Ground Densification (East Limb)	Gravel: supply and stockpile locally	2,339	m3	$7.73	$18,079.87		
	1	3	1	2			Gravel: load , haul, place (3km)	2,339	m3	$5.45	$12,746.14		
	1	3	1	3			Drill vibro-replacement stone columns	26,800	m3	$25.00	$670,000.00		
	1	3	1	4			Verification testing	1	ls	$50,000	$50,000.00		
Subtotal Direct Costs - Dams												**$6,140,984**	
Tailings													
Intermediate Tailings												$20,810,996	
	2	1	1	1		Densify Tailings	Gravel: supply and stockpile locally	6,938	m3	$7.73	$53,632.46		
	2	1	1	2			Gravel: load , haul, place (3km)	6,938	m3	$6.24	$43,291.15		
	2	1	1	3			Drill vibro-replacement stone columns	79,500	m3	$25.00	$1,987,500.00		
	2	1	1	4			Verification testing	1	ls	$50,000	$50,000.00		
	2	1	2	1		Dewater	Pump pond water to Faro Pit or water treatment facility	1	ls	$50,000	$50,000.00		
	2	1	3	1		Upgrade Roads	Upgrade road from tailings area to waste rock source	1,350	m	$200.00	$270,000.00		
	2	1	3	2			Construct new acccess road where necessary	1,000	m	$12.00	$12,000.00		
	2	1	4	1		Cover Tailings	Load, haul, and place waste rock	504,665	m3	$5.03	$2,538,464.95		
	2	1	4	2			Load, haul, and place Till	1,009,330	m3	$15.21	$15,351,909.30		
	2	1	5	1		Revegetate till-covered areas	Seed	1,009,330	m2	$0.40	$403,732		
	2	1	5	2			Fertilize	1,009,330	m2	$0.05	$50,467		
Secondary Tailings												$6,628,768	
	2	2	1	1		Upgrade Roads	Upgrade road from tailings area to waste rock source	935	m	$200.00	$187,000.00		
	2	2	1	2			Construct new acccess road where necessary	1,000	m	$12.00	$12,000.00		
	2	2	2	1		Cover Tailings	Load, haul, and place waste rock	187,075	m3	$5.03	$940,987.25		
	2	2	2	2			Load, haul, and place Till	374,150	m3	$14.22	$5,320,413.00		
	2	2	3	1		Revegetate till-covered areas	Seed	374,150	m2	$0.40	$149,660.00		
	2	2	3	2			Fertilize	374,150	m2	$0.05	$18,707.50		
Subtotal Direct Costs - Tailings												**$27,439,764**	
Rose Creek Diversion Channel													
Upgrade to PMF (475m3/s)												$15,808,865	
	3	1	1	1		Clear and Grub	Dozer: D10R/N	78,250	m2	$2.08	$163,094.63		
	3	1	2	1		Excavate Channel	Bulk excavate soil (dump locally)	795,719	m3	$3.69	$2,934,428.66		
	3	1	2	2			Rock excavation: Drill, blast, muck, load haul dump (locally)	337,301	m3	$23.33	$7,868,203.56		
	3	1	3	1		Place bedding Layer	Bedding: Produce and stockpile	46,703	m3	$7.73	$361,042.21		
	3	1	3	2			Bedding: load , haul, place and compact	46,703	m3	$11.65	$544,089.95		
	3	1	4	1		Place HDPE Liner	Supply and place HDPE Liner	46,311	m3	$21.57	$998,703.33		
	3	1	5	1		Place Rip-Rap	Rip-Rap: Screen and stockpile (from locally blasted material)	54,939	m3	$15.46	$849,422.87		
	3	1	5	2			Load, haul, dump and place Rip-Rap	54,939	m3	$38.04	$2,089,879.56		

Contract Code	Work Area Code	Item	Task	Sub-task	Estimate Type	Task	Activity	Quantity	Unit	Unit Cost	Activity Total	Subtotals	Source / Comments
North Fork Rock Drain												$2,182,829	
	3	2	1	1		Construct Ramp up to haul road	Excavate and doze WR material	22,500	m3	$6.82	$153,450.00		
	3	2	1	2			Grade Road	15,000	m2	$0.29	$4,401.20		
	3	2	2	1		Breach Drain	Excavate, load, haul and place breach material in Faro WR Dump	462,357	m3	$4.16	$1,923,403.73		
	3	2	3	1		Create Channel	Excavate channel	6,104	m3	$3.69	$22,510.15		
	3	2	3	2			Supply and place geotextile	3,924	m2	$4.41	$17,310.02		
	3	2	3	3			Bedding Layer: Screen and stockpile	1,177	m3	$7.73	$9,100.46		
	3	2	3	4			Bedding Layer: Load, haul, dump and place	1,177	m3	$3.75	$4,414.50		
	3	2	3	6			Rip-Rap: Screen and stockpile (from NFRD)	1,962	m3	$15.46	$30,334.87		
	3	2	3	7			Load Haul and Dump Rip-Rap	1,962	m3	$3.69	$7,235.40		
	3	2	3	8			Place and secure Rip-Rap	1,962	m3	$4.69	$9,197.66		
	3	2	4	1		Revegetate disturbed areas	Seed and Fertilize	3270	m2	$0.45	$1,471.50		
Subtotal Direct Costs - Rose Creek Diversion Channel												**$17,991,694**	
Groundwater Collection													
Collect groundwater below CVD												$467,767	
	4	1	1	1		Place Manhole	Excavate sump for manholes	32	m3	$3.69	$118		
	4	1	1	2			Supply and place Precast concrete manhole	1	ea.	$1,863.00	$1,863		
	4	1	1	3			Install Primary pump	1	ea.	$1,503.00	$1,503		
	4	1	1	4			Provide power to pumping system	3,000	m	$2.53	$7,590		
	4	1	2	1		Groundwater Wells	Drill Well	7	ea.	$1,906.43	$13,345		
	4	1	2	2			Install 4" PVC Well	140	m	$100.00	$14,000		
	4	1	2	3			Install Pump in well	7	ea.	$2,629.00	$18,403		
	4	1	2	4			Supply Power	3,000	m	$2.53	$7,590		
	4	1	3	1		Piping system	Excavate Piping Trench	30,000	m3	$3.69	$110,633		
	4	1	3	2			Supply and place 150mm PVC pipe	5,000	m	$15.50	$77,500		
	4	1	3	3			Supply and install heat trace through piping	5,000	m	$7.87	$39,350		
	4	1	3	4			Produce and stockpile (screen) bedding layer	1,950	m3	$7.73	$15,075		
	4	1	3	5			Load, haul, place and compact bedding layer	1,950	m3	$7.13	$13,904		
	4	1	3	6			Backfill ditches	30,000	m3	$4.90	$146,893		
Subtotal Direct Costs - Groundwater Collection												**$467,767**	
Miscellaneous													
Reclaim unnecssary roads												$4,460	
	6	1	1	1		Reclaim unnecssary roads	Scarify road surfaces	6,000	m2	$0.29	$1,760.48		
	6	1	1	2			Seed and fertilize	6,000	m2	$0.45	$2,700.00		
Subtotal Direct Costs - Miscellaneous												**$4,460**	
Subtotal Direct Costs													
						Subtotal direct costs						**$52,044,670**	
CLOSURE COSTS - INDIRECT													
	100	100	1	1		Project Management	2.5% of direct costs	$ 52,044,670	x	2.5%		$1,301,117	
	100	100	2	1		Field Supervision	(included in major tasks)					$0	
	100	100	3	1		Contractor profit and home office overhead	10% of direct costs	$ 52,044,670	x	10.0%		$5,204,467	
	100	100	4	1		Insurance	0.5% of direct costs	$ 52,044,670	x	0.5%		$260,223	
	100	100	5	1		Bonding	0.5% of direct costs	$ 52,044,670	x	0.5%		$260,223	
	100	100	6	1		Field Engineering and QA	15% of direct costs	$ 52,044,670	x	15.0%		$7,806,700	
	100	100	7	1		Mob - Demob		1	lump	$500,000		$500,000	
	100	100	8	1		Living out allowances	(included in heavy equipment costs)					$0	
	100	100	9	1		Taxes	7% of taxable direct and indirect costs	$ 56,968,467	x	7.0%		$3,987,793	
Subtotal Indirect Costs													
						Subtotal indirect costs						**$19,320,524**	
CLOSURE COSTS - CONTINGENCY													
						Contingency	20% of direct costs	$52,044,670	x	20.0%		**$10,408,934**	
CLOSURE COSTS - TOTAL													
						Total direct and indirect costs						**$81,774,128**	

Option 2: Complete Relocation

Contract Code	Work Area Code	Item	Task	Sub-task	Estimate Type	Task	Activity	Quantity	Unit	Unit Cost	Activity Total	Subtotals	Source / Comments
CLOSURE COSTS - DIRECT CAPITAL													
Dams													
Cross Valley Dam												$2,249,544	
	1	1	1	1		Remove Pond	Pump Pond water to discharge	1	ls	$50,000	$50,000.00		
	1	1	2	1		Remove Impounded Sludge	Excavate and create berms for use as sludge cell ontop of tailings	1,445	m3	$3.69	$5,328.83		
	1	1	2	2			Load, haul and place sludge material	1,600	m3	$7.46	$11,936		1CD003.45_SludgeManagement
	1	1	3	1		Remove Contaminated Soil	Excavate, load, haul and place contaminated soils to mill area	322,650	m3	$4.81	$1,551,947		
	1	1	4	1		Prepare spoil area	Clear and Grub	1,000	m2	$2.08	$2,084		
	1	1	4	2			Prepare access roads	200	m	$12.00	$2,400		
	1	1	5	1		Breach Dam	Excavate, load, haul and place breach material	72,500	m3	$3.75	$271,875		
	1	1	6	1		Create Channel	Excavate channel	5200	m3	$3.69	$19,176		
	1	1	6	2			Supply and place geotextile	1300	m2	$4.41	$5,735		
	1	1	6	3			Bedding Layer: Screen and stockpile	500	m3	$7.73	$3,865		
	1	1	6	4			Bedding Layer: Load, haul, dump and place	500	m3	$5.78	$2,890		
	1	1	6	5			Rip-Rap: Drill, blast and stockpile	4600	m3	$23.86	$109,740		
	1	1	6	6			Rip-Rap: Screen and stockpile	4600	m3	$15.46	$71,122		
	1	1	6	7			Load Haul and Dump Rip-Rap	4600	m3	$5.03	$23,138		
	1	1	6	8			Place and secure Rip-Rap	4600	m3	$4.69	$21,564		
	1	1	7	1		Revegetate Dam footprint and impoundment	Seed and fertilize	214,983	m2	$0.45	$96,742		
Breach Intermediate Dam												$538,255	
	1	2	1	1		Prepare Soil Area	Clear and Grub	1000	m2	$2.08	$2,084.28		
	1	2	1	2			Prepare access roads	300	m	$12.00	$3,600.00		
	1	2	2	1		Breach Dam	Excavate, load, haul and dump breach material	72,500	m3	$3.75	$271,875.00		
	1	2	3	1		Create Channel	Excavate channel	5,200	m3	$3.69	$19,176.40		
	1	2	3	2			Supply and place geotextile	1,300	m2	$4.41	$5,734.72		
	1	2	3	3			Bedding Layer: Screen and stockpile	500	m3	$7.73	$3,865.30		
	1	2	3	4			Bedding Layer: Load, haul, dump and place	500	m3	$5.78	$2,890.00		
	1	2	3	5			Rip-Rap: Drill, blast and stockpile	4,600	m3	$23.86	$109,740.36		
	1	2	3	6			Rip-Rap: Screen and stockpile	4,600	m3	$15.46	$71,121.52		
	1	2	3	7			Load Haul and Dump Rip-Rap	4,600	m3	$5.03	$23,138.00		
	1	2	3	8			Place and secure Rip-Rap	4,600	m3	$4.69	$21,564.34		
	1	2	4	1		Revegetate disturbed areas	Seed and Fertilize breach slopes	7700	m2	$0.45	$3,465.00		
Breach Secondary Dam												$550,485	
	1	3	1	1		Prepare Soil Area	Clear and Grub	1000	m2	$2.08	$2,084.28		
	1	3	1	2			Prepare access roads	500	m	$12.00	$6,000.00		
	1	3	2	1		Breach Dam	Excavate, load, haul and dump breach material	72,500	m3	$3.75	$271,875.00		
	1	3	3	1		Create Channel	Excavate channel	5,200	m3	$3.69	$19,176.40		
	1	3	3	2			Supply and place geotextile	1,300	m2	$4.41	$5,734.72		
	1	3	3	3			Bedding Layer: Screen and stockpile	500	m3	$7.73	$3,865.30		
	1	3	3	4			Bedding Layer: Load, haul, dump and place	500	m3	$6.12	$3,060.00		
	1	3	3	5			Rip-Rap: Drill, blast and stockpile	4,600	m3	$23.86	$109,740.36		
	1	3	3	6			Rip-Rap: Screen and stockpile	4,600	m3	$15.46	$71,121.52		
	1	3	3	7			Load Haul and Dump Rip-Rap	4,600	m3	$7.13	$32,798.00		
	1	3	3	8			Place and secure Rip-Rap	4,600	m3	$4.69	$21,564.34		
	1	3	4	1		Revegetate disturbed areas	Seed and Fertilize breach slopes	7700	m2	$0.45	$3,465.00		
Breach Original Dam												$552,367	
	1	3	1	1		Prepare Soil Area	Clear and Grub	1000	m2	$2.08	$2,084.28		
	1	3	1	2			Prepare access roads	540	m	$12.00	$6,480.00		
	1	3	2	1		Breach Dam	Excavate, load, haul and dump breach material	72,500	m3	$3.75	$271,875.00		
	1	3	3	1		Create Channel	Excavate channel	5,200	m3	$3.69	$19,176.40		
	1	3	3	2			Supply and place geotextile	1,300	m2	$4.41	$5,734.72		
	1	3	3	3			Bedding Layer: Screen and stockpile	500	m3	$7.73	$3,865.30		
	1	3	3	4			Bedding Layer: Load, haul, dump and place	500	m3	$6.90	$3,450.00		
	1	3	3	5			Rip-Rap: Drill, blast and stockpile	4,600	m3	$23.86	$109,740.36		
	1	3	3	6			Rip-Rap: Screen and stockpile	4,600	m3	$15.46	$71,121.52		
	1	3	3	7			Load Haul and Dump Rip-Rap	4,600	m3	$7.35	$33,810.00		
	1	3	3	8			Place and secure Rip-Rap	4,600	m3	$4.69	$21,564.34		
	1	3	4	1		Revegetate disturbed areas	Seed and Fertilize breach slopes	7700	m2	$0.45	$3,465.00		
Subtotal Direct Costs - Dams												**$3,890,650**	
Tailings													
Pump Intermediate Tailings to Faro Pit												$213,749,195	
	2	1	1	1		Hydraulic monitoring system	Pumps: Supply and intall Vertical Turbine Pump	3	ea.	$100,000	$300,000.00		
	2	1	1	2			Pipelines: Supply and Install piping system	1	ls	$1,763,669	$1,763,669.29		1CD003.041
	2	1	1	3			Hydraulic Monitors: Supply and Install	1	ls	$1,255,000	$1,255,000.00		
	2	1	1	4			Mobile Equipment: Purchase	1	ls	$1,020,000	$1,020,000.00		
	2	1	1	5			Supply Power	1	ls	$100,000	$100,000.00		
	2	1	2	1		Slurry Pumping System	Pumps and Support: Supply and Install	1	ls	$1,793,000	$1,793,000.00		
	2	1	2	2			Pipelines: Supply and Install	1	ls	$3,299,200	$3,299,199.69		
	2	1	2	3			Supply Power	1	ls	$500,000	$500,000.00		
	2	1	3	1		Lime addition system	Procure and install lime addition system - Allowance	1	ls	$300,000.00	$300,000.00		
	2	1	4	1		Tailings relocation operation	Operate hydraulic monitoring system	12.5	yrs	$3,016,641	$37,708,013.94		
	2	1	4	2			Operate slurry pumping system	12.5	yrs	$2,416,824	$30,210,299.53		
	2	1	4	4			Purchase Lime and operate lime addition system	478,723	tonnes Ca(OH)	$282.00	$135,000,013		Need new estimates of lime requirements from JTC/DDS
	2	1	4	5			System decommissioning and removal	1	ls	$500,000	$500,000.00		
Excavate comtaminated material to Faro Pit												$14,504,088	

2	2	1	1	Truck contaminated soils to Faro Pit	Construct local access roads	3500	m	$12.00	$42,000.00		
2	2	1	2		Load, haul, dump remaining contaminated material to Faro Pit	2,766,960	m3	$5.08	$14,056,156.80		
2	2	1	3		Regrade stripped areas for drainage	1,383,480	m2	$0.29	$405,931.08		Use remaining dam materials for fill where necessary
Revegetate										$622,566	
2	3	1	1	Revegetate disturbed areas	Seed	1,383,480	m2	$0.40	$553,392.00		
2	3	1	2		Fertilize	1,383,480	m2	$0.05	$69,174.00		
Subtotal Direct Costs - Tailings										**$228,875,849**	
Rose Creek											
Restore Rose Creek										$0	
3	1	1	1	Maintain RCDC	Maintain RCDC during period of tailings relocation and groundwater cleanup	1	ls	$0.00	$0.00		
3	1	2	1	Redirect flow into thalweg	Breach RCDC at Original Dam				$0.00		
3	1	2	2		Breach diversion where stream enter from south				$0.00		
3	1	2	3		Regrade channel and dykes to create stable slopes				$0.00		
3	1	3	1	Fish habitat enhancement	Install riffles along restored channel				$0.00		
3	1	3	2		Excavate pools		m3	$3.69	$0.00		
3	1	4	1	Reclamation	Plant willows along restored stream channel		m2		$0.00		
3	1	4	2		Seed and fertilize		m2	$0.45	$0.00		
North Fork Rock Drain										$2,182,829	
3	2	1	1	Construct Ramp up to haul road	Excavate and doze WR material	22,500	m3	$6.82	$153,450.00		
3	2	1	2		Grade Road	15,000	m2	$0.29	$4,401.20		
3	2	2	1	Breach Drain	Excavate, load, haul and place breach material in Faro WR Dump	462,357	m3	$4.16	$1,923,403.73		
3	2	3	1	Create Channel	Excavate channel	6,104	m3	$3.69	$22,510.15		
3	2	3	2		Supply and place geotextile	3,924	m2	$4.41	$17,310.02		
3	2	3	3		Bedding Layer: Screen and stockpile	1,177	m3	$7.73	$9,100.46		
3	2	3	4		Bedding Layer: Load, haul, dump and place	1,177	m3	$3.75	$4,414.50		
3	2	3	6		Rip-Rap: Screen and stockpile (from NFRD)	1,962	m3	$15.46	$30,334.87		
3	2	3	7		Load Haul and Dump Rip-Rap	1,962	m3	$3.69	$7,235.40		
3	2	3	8		Place and secure Rip-Rap	1,962	m3	$4.69	$9,197.66		
3	2	4	1	Revegetate disturbed areas	Seed and Fertilize	3270	m2	$0.45	$1,471.50		
Subtotal Direct Costs - Rose Creek										**$2,182,829**	
Groundwater											
Collect groundwater below CVD										$467,767	
4	1	1	1	Place Manhole	Excavate sump for manholes	32	m3	$3.69	$118		
4	1	1	2		Supply and place Precast concrete manhole	1	ea.	$1,863.00	$1,863		
4	1	1	3		Install Primary pump	1	ea.	$1,503.00	$1,503		
4	1	1	4		Provide power to pumping system	3,000	m	$2.53	$7,590		
4	1	2	1	Groundwater Wells	Drill Well	7	ea.	$1,906.43	$13,345		
4	1	2	2		Install 4" PVC Well	140	m	$100.00	$14,000		
4	1	2	3		Install Pump in well	7	ea.	$2,629.00	$18,403		
4	1	2	4		Supply Power	3,000	m	$2.53	$7,590		
4	1	3	1	Piping system	Excavate Piping Trench	30,000	m3	$3.69	$110,633		
4	1	3	2		Supply and place 150mm PVC pipe	5,000	m	$15.50	$77,500		
4	1	3	3		Supply and install heat trace through piping	5,000	m	$7.87	$39,350		
4	1	3	4		Produce and stockpile (screen) bedding layer	1,950	m3	$7.73	$15,075		
4	1	3	5		Load, haul, place and compact bedding layer	1,950	m3	$7.13	$13,904		
4	1	3	6		Backfill ditches	30,000	m3	$4.90	$146,893		
Adaptive Management										$0	
4	2	1	1	Adaptive management Phase 1	Install multiple shallow extraction and monitoring wells				$0.00		Assume first 3 years after footprint cleanup
4	2	1	2		Operate seasonal groudwater extraction				$0.00		
4	2	1	3		Treatment extracted water in mine area treatment plant				$0.00		
4	2	2	1	Adaptive management Phase 2	Relocate or install additional extraction and monitoring wells				$0.00		Assume years 4-10 after footprint cleanup
4	2	2	2		Operate seasonal groudwater extraction				$0.00		
4	2	2	3		Treatment extracted water in mine area treatment plant				$0.00		
4	2	3	1	Adaptive management Phase 3	Relocate or install additional extraction and monitoring wells				$0.00		Assume years 11-20 after footprint cleanup
4	2	3	2		Operate seasonal groudwater extraction				$0.00		
4	2	3	3		Treatment extracted water in mine area treatment plant				$0.00		
Subtotal Direct Costs - Groundwater Collection										**$467,767**	
Miscellaneous											
Reclaim unnecssary roads										$4,460	
6	1	1	1	Reclaim unnecssary roads	Scarify road surfaces	6,000	m2	$0.29	$1,760.48		
6	1	1	2		Seed and fertilize	6,000	m2	$0.45	$2,700.00		
Subtotal Direct Costs - Miscellaneous										**$4,460**	
Subtotal Direct Costs											
				Subtotal direct costs						**$235,421,556**	
CLOSURE COSTS - INDIRECT											
100	100	1	1	Project Management	2.5% of direct costs	$ 235,421,556		x	2.5%	$5,885,539	
100	100	2	1	Field Supervision	(included in major tasks)					$0	
100	100	3	1	Contractor profit and home office overhead	10% of direct costs	$ 235,421,556		x	10.0%	$23,542,156	
100	100	4	1	Insurance	0.5% of direct costs	$ 235,421,556		x	0.5%	$1,177,108	
100	100	5	1	Bonding	0.5% of direct costs	$ 235,421,556		x	0.5%	$1,177,108	
100	100	6	1	Field Engineering and QA	15% of direct costs	$ 235,421,556		x	15.0%	$35,313,233	
100	100	7	1	Mob - Demob		1		lump	$500,000	$500,000	
100	100	8	1	Living out allowances	(included in heavy equipment costs)					$0	
100	100	9	1	Taxes	7% of taxable direct and indirect costs	$ 255,932,389		x	7.0%	$17,915,267	
Subtotal Indirect Costs											
				Subtotal indirect costs						**$85,510,411**	
CLOSURE COSTS - CONTINGENCY											
				Contingency	20% of direct costs	$235,421,556		x	20.0%	**$47,084,311**	
CLOSURE COSTS - TOTAL											

Option 3: Partial Relocation

CLOSURE COSTS - DIRECT CAPITAL

Contract Code	Work Area Code	Item	Task	Sub-task	Estimate Type	Task	Activity	Quantity	Unit	Unit Cost	Activity Total	Subtotals	Source / Comments
CLOSURE COSTS - DIRECT CAPITAL													
Dams													
Cross Valley Dam												$2,244,749	
	1	1	1	1		Remove Pond	Pump Pond water to discharge	1	ls	$50,000	$50,000.00		
	1	1	2	1		Remove Impounded Sludge	Excavate and create berms for use as sludge cell ontop of tailings	1,445	m3	$3.69	$5,328.83		
	1	1	2	2			Load, haul and place sludge material	1,600	m3	$7.46	$11,936		1CD003.45_SludgeManagement
	1	1	3	1		Remove Contaminated Soil	Excavate, load, haul and place contaminated soils to mill area	322,650	m3	$4.81	$1,551,947		
	1	1	4	1		Prepare spoil area	Clear and Grub	1,000	m2	$2.08	$2,084		
	1	1	4	2			prepare access roads	200	m	$12.00	$2,400		
	1	1	5	1		Breach Dam	Excavate, load, haul and place breach material	72,500	m3	$3.75	$271,875		
	1	1	6	1		Create Channel	Excavate channel	3900	m3	$3.69	$14,382		
	1	1	6	2			Supply and place geotextile Liner	1300	m2	$4.41	$5,735		
	1	1	6	3			Bedding Layer: Screen and stockpile	500	m3	$7.73	$3,865		
	1	1	6	4			Bedding Layer: Load, haul, dump and place	500	m3	$5.78	$2,890		
	1	1	6	5			Rip-Rap: Drill, blast and stockpile	4600	m3	$23.86	$109,740		
	1	1	6	6			Rip-Rap: Screen and stockpile	4600	m3	$15.46	$71,122		
	1	1	6	7			Load Haul and Dump Rip-Rap	4600	m3	$5.03	$23,138		
	1	1	6	8			Place and secure Rip-Rap	4600	m3	$4.69	$21,564		
	1	1	7	1		Revegetate Dam footprint and impoundment	Seed and fertilize	214,983	m2	$0.45	$96,742		
Breach Intermediate Dam												$538,255	
	1	2	1	1		Prepare Soil Area	Clear and Grub	1000	m2	$2.08	$2,084.28		
	1	2	1	2			Prepare access roads	300	m	$12.00	$3,600.00		
	1	2	2	1		Breach Dam	Excavate, load, haul and dump breach material	72,500	m3	$3.75	$271,875.00		
	1	2	3	1		Create Channel	Excavate channel	5,200	m3	$3.69	$19,176.40		
	1	2	3	2			Supply and place geotextile Liner	1,300	m2	$4.41	$5,734.72		
	1	2	3	3			Bedding Layer: Screen and stockpile	500	m3	$7.73	$3,865.30		
	1	2	3	4			Bedding Layer: Load, haul, dump and place	500	m3	$5.78	$2,890.00		
	1	2	3	5			Rip-Rap: Drill, blast and stockpile	4,600	m3	$23.86	$109,740.36		
	1	2	3	6			Rip-Rap: Screen and stockpile	4,600	m3	$15.46	$71,121.52		
	1	2	3	7			Load Haul and Dump Rip-Rap	4,600	m3	$5.03	$23,138.00		
	1	2	3	8			Place and secure Rip-Rap	4,600	m3	$4.69	$21,564.34		
	1	2	4	1		Revegetate disturbed areas	Seed and Fertilize breach slopes	7700	m2	$0.45	$3,465.00		
Secondary Dam												$6,212,005	
	1	3	1	1		Ground Densification (East Limb)	Gravel: supply and stockpile locally	2,339	m3	$7.73	$18,079.87		
	1	3	1	2			Gravel: load , haul, place (3km)	2,339	m3	$5.45	$12,746.14		
	1	3	1	3			Drill vibro-replacement stone columns	26,800	m3	$25.00	$670,000.00		
	1	3	1	4			Verification testing	1	ls	$50,000	$50,000.00		
	1	3	2	1		Ground Densification (West Limb)	Construct Workpad	88,075	m3	$6.82	$600,671.50		
	1	3	2	2			Gravel: supply and stockpile locally	15,963	m3	$7.73	$123,405.25		
	1	3	2	3			Gravel: load , haul, place (3km)	15,963	m3	$7.14	$113,977.37		
	1	3	2	4			Drill vibro-replacement stone columns	182,925	m3	$25.00	$4,573,125.00		
	1	3	2	5			Verification testing	1	ls	$50,000	$50,000.00		
Subtotal Direct Costs - Dams												**$8,995,010**	
Tailings													
Pump Intermediate Tailings to Faro Pit												$95,626,993	
	2	1	1	1		Hydraulic monitoring system	Pumps: Supply and intall Vertical Turbine Pump	3	ea.	$100,000	$300,000.00		
	2	1	1	2			Pipelines: Supply and Install piping system	1	ls	$1,763,669	$1,763,669.29		1CD003.041
	2	1	1	3			Hydraulic Monitors: Supply and Install	1	ls	$1,255,000	$1,255,000.00		
	2	1	1	4			Mobile Equipment: Purchase	1	ls	$1,020,000	$1,020,000.00		
	2	1	1	5			Supply Power	1	ls	$100,000	$100,000.00		
	2	1	2	1		Slurry Pumping System	Pumps and Support: Supply and Install	1	ls	$1,793,000	$1,793,000.00		
	2	1	2	2			Pipelines: Supply and Install	1	ls	$3,299,200	$3,299,199.69		
	2	1	2	3			Supply Power	1	ls	$500,000	$500,000.00		
	2	1	4	4			Purchase Lime and operate lime addition system	201,568	tonnes Ca(OH)	$282.00	$56,842,106		
	2	1	4	1		Tailings relocation operation	Operate hydraulic monitoring system	5.2	yrs	$3,016,641	$15,686,533.80		
	2	1	4	2			Operate slurry pumping system	5.2	yrs	$2,416,824	$12,567,484.60		
	2	1	4	4			Purchase Lime and operate lime addition system	5.2	yrs		$0.00		
	2	1	4	5			System decommissioning and removal	1	ls	$500,000.00	$500,000.00		
Excavate comtaminated material to Faro Pit												$10,574,943	
	2	2	1	1		Truck contaminated soils to Faro Pit	Construct local access roads	2000	m	$12.00	$24,000.00		
	2	2	1	2			Load, haul, dump remaining contaminated material to Faro Pit	2,018,660	m3	$5.08	$10,254,792.80		
	2	2	1	3			Regrade stripped areas for drainage	1,009,330	m2	$0.29	$296,150.59		Use remaining dam materials for fill where necessary
Revegetate Intermediate Tailings												$454,199	
	2	3	1	1		Revegetate disturbed areas	Seed	1,009,330	m2	$0.40	$403,732.00		
	2	3	1	2			Fertilize	1,009,330	m2	$0.05	$50,466.50		
Secondary Tailings Cover												$6,628,768	
	2	4	1	1		Upgrade Roads	Upgrade road from tailings area to waste rock source	935	m	$200.00	$187,000.00		
	2	4	1	2			Construct new acccess road where necessary	1,000	m	$12.00	$12,000.00		
	2	4	2	1		Cover Tailings	Load, haul, and place waste rock	187,075	m3	$5.03	$940,987.25		
	2	4	2	2			Load, haul, and place Till	374,150	m3	$14.22	$5,320,413.00		
	2	4	3	1		Revegetate till-covered areas	Seed	374,150	m2	$0.40	$149,660.00		
	2	4	3	2			Fertilize	374,150	m2	$0.05	$18,707.50		
Subtotal Direct Costs - Tailings												**$113,284,903**	
Rose Creek													
Upgrade Upstream portion to PMF (475m3/s)												$6,165,322	

3	1	1	1	Clear and Grub	Dozer: D10R/N	25,000	m2	$2.08	$52,106.91		
3	1	2	1	Excavate Channel	Bulk excavate soil (dump locally)	143,721	m3	$3.69	$530,009.99		
3	1	2	2		Rock excavation: Drill, blast, muck, load haul dump (locally)	110,900	m3	$23.33	$2,586,958.76		
3	1	3	1	Place bedding Layer	Bedding: Produce and stockpile	24,421	m3	$7.73	$188,788.98		
3	1	3	2		Bedding: load , haul, place and compact	24,421	m3	$11.65	$284,504.65		
3	1	4	1	Place HDPE Liner	Supply and place HDPE Liner	46,311	m3	$21.57	$998,703.33		
3	1	5	1	Place Rip-Rap	Rip-Rap: Screen and stockpile (from locally blasted material)	28,490	m3	$15.46	$440,489.59		
3	1	5	2		Load, haul, dump and place Rip-Rap	28,490	m3	$38.04	$1,083,759.60		
Restore Lower Portion Rose Creek										$0	
3	1	2	1	Maintain entire RCDC	Maintain RCDC during period of tailings relocation and groundwater cleanup	1	ls	$0.00	$0.00		
3	1	3	1	Redirect flow into thalweg	Breach RCDC downstream of Secondary Dam				$0.00		
3	1	3	2		Breach diversion where stream enter from south				$0.00		
3	1	3	3		Regrade channel and dykes to create stable slopes				$0.00		
3	1	4	1	Fish habitat enhancement	Install riffles along restored channel				$0.00		
3	1	4	2		Excavate pools				$0.00		
3	1	5	1	Reclamation	Plant willows along restored stream channel				$0.00		
North Fork Rock Drain										$2,182,829	
3	2	1	1	Construct Ramp up to haul road	Excavate and doze WR material	22,500	m3	$6.82	$153,450.00		
3	2	1	2		Grade Road	15,000	m2	$0.29	$4,401.20		
3	2	2	1	Breach Drain	Excavate, load, haul and place breach material in Faro WR Dump	462,357	m3	$4.16	$1,923,403.73		
3	2	3	1	Create Channel	Excavate channel	6,104	m3	$3.69	$22,510.15		
3	2	3	2		Supply and place geotextile	3,924	m2	$4.41	$17,310.02		
3	2	3	3		Bedding Layer: Screen and stockpile	1,177	m3	$7.73	$9,100.46		
3	2	3	4		Bedding Layer: Load, haul, dump and place	1,177	m3	$3.75	$4,414.50		
3	2	3	6		Rip-Rap: Screen and stockpile (from NFRD)	1,962	m3	$15.46	$30,334.87		
3	2	3	7		Load Haul and Dump Rip-Rap	1,962	m3	$3.69	$7,235.40		
3	2	3	8		Place and secure Rip-Rap	1,962	m3	$4.69	$9,197.66		
3	2	4	1	Revegetate disturbed areas	Seed and Fertilize	3270	m2	$0.45	$1,471.50		
Subtotal Direct Costs - Rose Creek										**$8,348,151**	
Groundwater											
Collect groundwater below Secondary Dam										$264,720	
4	1	1	1	Place Manhole	Excavate sump for manholes	32	m3	$3.69	$118		
4	1	1	2		Supply and place Precast concrete manhole	1	ea.	$1,863.00	$1,863		
4	1	1	3		Install Primary pump	1	ea.	$1,503.00	$1,503		
4	1	1	4		Provide power to pumping system	2,666	m	$2.53	$6,745		
4	1	2	1	Groundwater Wells	Drill Well	5	ea.	$1,906.43	$9,532		
4	1	2	2		Install 4" PVC Well	100	m	$100.00	$10,000		
4	1	2	3		Install Pump in well	5	ea.	$2,629.00	$13,145		
4	1	2	4		Supply Power	2,666	m	$2.53	$6,745		
4	1	3	1	Piping system	Excavate Piping Trench	15,996	m3	$3.69	$58,990		
4	1	3	2		Supply and place 150mm PVC pipe	2,666	m	$15.50	$41,323		
4	1	3	3		Supply and install heat trace through piping	2,666	m	$7.87	$20,981		
4	1	3	4		Produce and stockpile (screen) bedding layer	1,040	m3	$7.73	$8,038		
4	1	3	5		Load, haul, place and compact bedding layer	1,040	m3	$7.13	$7,413		
4	1	3	6		Backfill ditches	15,996	m3	$4.90	$78,324		
Adaptive Management										$0	
4	2	1	1	Adaptive management Phase 1	Install multiple shallow extraction and monitoring wells				$0.00		Assume first 3 years after footprint cleanup
4	2	1	2		Operate seasonal groudwater extraction				$0.00		
4	2	1	3		Treatment extracted water in mine area treatment plant				$0.00		
4	2	2	1	Adaptive management Phase 2	Relocate or install additional extraction and monitoring wells				$0.00		Assume years 4-10 after footprint cleanup
4	2	2	2		Operate seasonal groudwater extraction				$0.00		
4	2	2	3		Treatment extracted water in mine area treatment plant				$0.00		
4	2	3	1	Adaptive management Phase 3	Relocate or install additional extraction and monitoring wells				$0.00		Assume years 11-20 after footprint cleanup
4	2	3	2		Operate seasonal groudwater extraction				$0.00		
4	2	3	3		Treatment extracted water in mine area treatment plant				$0.00		
Subtotal Direct Costs - Groundwater										**$264,720**	
Miscellaneous											
Reclaim unnecssary roads										$4,460	
6	1	1	1	Reclaim unnecssary roads	Scarify road surfaces	6,000	m2	$0.29	$1,760.48		
6	1	1	2		Seed and fertilize	6,000	m2	$0.45	$2,700.00		
Subtotal Direct Costs - Miscellaneous										**$4,460**	
Subtotal Direct Costs											
				Subtotal direct costs						**$130,897,244**	
CLOSURE COSTS - INDIRECT											
100	100	1	1	Project Management	2.5% of direct costs	$ 130,897,244		x	2.5%	$3,272,431	
100	100	2	1	Field Supervision	(included in major tasks)					$0	
100	100	3	1	Contractor profit and home office overhead	10% of direct costs	$ 130,897,244		x	10.0%	$13,089,724	
100	100	4	1	Insurance	0.5% of direct costs	$ 130,897,244		x	0.5%	$654,486	
100	100	5	1	Bonding	0.5% of direct costs	$ 130,897,244		x	0.5%	$654,486	
100	100	6	1	Field Engineering and QA	15% of direct costs	$ 130,897,244		x	15.0%	$19,634,587	
100	100	7	1	Mob - Demob		1		lump	$500,000	$500,000	
100	100	8	1	Living out allowances	(included in heavy equipment costs)					$0	
100	100	9	1	Taxes	7% of taxable direct and indirect costs	$ 142,523,509		x	7.0%	$9,976,646	
Subtotal Indirect Costs											
				Subtotal indirect costs						**$47,782,360**	
CLOSURE COSTS - CONTINGENCY											
				Contingency	20% of direct costs	$130,897,244		x	20.0%	**$26,179,449**	
CLOSURE COSTS - TOTAL											
				Total direct and indirect costs						**$204,859,053**	

Attachment B

Water and Load Balance Calculations – Primary Alternatives

Primary Alternative Base Case Runs

Component	Variants	Method	Orig Footprint (ha)	Increase (%)	Resloped / Final Footprint Area (ha)	MAP (mm)	MAR (mm)	Infiltration (mm or % of MAP)	Collection Efficiency
Faro Mine Area									
FM01 Flow-through Faro Pit									
Faro Creek		direct into pit			1549		341		
Faro Valley Dumps	Cover in Situ	Rudimentary Cover, seepage to pit	18.0	8%	19.5	400	341	20%	100%
Low Grade Ore / Oxide Fines	Consolidate and cover	Very Low Infil Cover; seepage to pit	6.8	8%	7.4	400	341	0.5%	100%
Sulphide Cells		Low Infil Cover; seepage collection	20.4	0%	20.4	400	341	5%	90%
Waste Rock Dumps		Rudimentary Cover, seepage to pit	281.3	8%	303.8	400	341	20%	90%
Zone II Pit	Pump to Faro Pit	Rudimentary Cover, seepage to pit	23.0	0%	23.0	400	341	20%	90%
Emergency Tailings Area		Relocate to pit Lime amended							98%
Faro Pit	Biological treatment	Flow-through			1720	400	341		100%
Treatment Plant	Zone II Variant	Lime treatment - contingency							
FM02 Improved Faro Creek Diversion									
Faro Creek		Reroute to the west			1549	400	341		
Faro Valley Dumps	Cover in Situ	Rudimentary Cover, seepage to pit	18.0	8%	19.5	400	341	20%	100%
Low Grade Ore / Oxide Fines	Consolidate and cover	Very Low Infil Cover; seepage collection	6.8	8%	7.4	400	341	0.5%	90%
Sulphide Cells		Low Infil Cover; seepage collection	20.4	1%	20.7	400	341	5%	90%
Waste Rock Dumps		Rudimentary Cover, seepage to pit	281.3	8%	303.8	400	341	20%	90%
Zone II Pit	Pump to Faro Pit	Rudimentary Cover, seepage to pit	23.0	1%	23.3	400	341	20%	90%
Emergency Tailings Area		Relocate to pit Lime amended							98%
Faro Pit	Seepage Storage	Isolated pit			171		341		100%
Treatment Plant	U/S of RC Tailings Deposit	Lime treatment of Seepage							

Primary Alternative Base Case Runs

Component	Variants	Method	Orig Footprint (ha)	Increase (%)	Resloped / Final Footprint Area (ha)	MAP (mm)	MAR (mm)	Infiltration (mm or % of MAP)	Collection Efficiency
Rose Creek Tailings									
RCT01 Stabilize Current Situation									
Original Tailings		Waste Rock and Til Cover - 40 mm infiltration			38.6	400	341	45%	98%
Secondary Tailings		Waste Rock and Til Cover - 40 mm infiltration			57	400	341	45%	98%
Intermediate Tailings		Waste Rock and Til Cover - 40 mm infiltration			76.8	400	341	45%	98%
Lime Treatment	U/S of RC Tailings Deposit								
RCT02 Complete Tailings Relocation									
Original Tailings		Lime amend & relocate		Contaminated groundwater only					
Secondary Tailings		Lime amend & relocate							
Intermediate Tailings		Lime amend & relocate							
Lime Treatment	U/S of RC Tailings Deposit								
RCT03 Partial Tailings Relocation									
Original Tailings		Waste Rock and Til Cover - 40 mm infiltration			38.6	400	341	45%	98%
Secondary Tailings		Waste Rock and Til Cover - 40 mm infiltration			57	400	341	45%	98%
Intermediate Tailings		Lime amend & relocate - separate treatment system							
Lime Treatment	U/S of RC Tailings Deposit								

Primary Alternative Base Case Runs

Component	Variants	Method	Orig Footprint (ha)	Increase (%)	Resloped / Final Footprint Area (ha)	MAP (mm)	MAR (mm)	Infiltration (mm or % of MAP)	Collection Efficiency
Vangorda / Grum Mine Area									
VG01 Vangorda Pit Backfill									
Grum Pit		Biological treatment			150		270		100%
Ore Transfer Pad		Rudimentary Cover, seepage to Grum pit	12.9	8%	13.8	450	270	20%	90%
Grum Waste Dump		Rudimentary Cover, seepage to Grum pit	128.1	3%	132.1	450	270	20%	90%
Sulphide Cell		Low Infil Cover; seepage to Grum	21.2	1%	21.5	450	270	5%	90%
Vangorda Creek		Flow across pit							
Vangorda Pit		Backfilled with lime added; low infiltration cover; seepage to Grum			60	380	362	5%	98%
Vangorda Waste Dump		Backfilled							
Oxide fines		Backfilled							
VG02 Stabilize Current Situation									
Grum Pit		Biological treatment			150		341		100%
Ore Transfer Pad		Rudimentary Cover; seepge to Grum pit	12.9	8%	13.8	400	341	20%	90%
Grum Waste Dump		Rudimentary Cover; seepge to Grum pit	128.1	3%	132.1	400	341	20%	90%
Sulphide Cell		Low Infil Cover; seepage collected	21.2	1%	21.5	400	341	5%	90%
Vangorda Creek		Diverted around pit							
Vangorda Pit		Pump and treat			60	380	362	5%	100%
Vangorda Waste Dump		Low Infil Cover; seepage collection	50.415	8%	54.4	400	341	5%	90%
Oxide fines		Low Infil Cover; seepage collection	4.18	1%	4.2	400	341	5%	90%
Water Treatment		HDS at Vangorda Pit							

Summary of water quality estimates at X14 for combinations of alternatives

"Future 1" Chemistry

Mine Area Alternative	Tailings Alternative	Ag	Al	As	Ca	Cd	Cl	Co	Cu	Fe	K	Mg	Mn	Na	Ni	Pb	SO4	Zn
1 Flow-Through Pit	1 Stabilize In Place	0.00	0.05	0.003	3.582	0.002	0.004	0.002	0.015	0.68	3.32	1.06	0.03	7.45	0.01	0.01	50.12	0.55
1 Flow-Through Pit	2 Complete Relocation	0.00	0.05	0.002	9.384	0.002	0.004	0.002	0.013	0.58	2.08	2.33	0.03	4.71	0.01	0.01	49.65	0.37
1 Flow-Through Pit	3 Partial Relocation	0.00	0.05	0.002	7.499	0.002	0.004	0.002	0.014	0.61	2.27	1.92	0.03	5.14	0.01	0.01	41.59	0.54
2 Upgrade Faro Creek Diversion	1 Stabilize In Place	0.00	0.04	0.003	8.889	0.003	0.002	0.003	0.012	0.61	4.47	6.12	0.03	10.01	0.01	0.01	89.47	0.27
2 Upgrade Faro Creek Diversion	2 Complete Relocation	0.00	0.04	0.002	14.691	0.002	0.002	0.002	0.010	0.51	3.23	7.39	0.03	7.27	0.01	0.01	89.00	0.09
2 Upgrade Faro Creek Diversion	3 Partial Relocation	0.00	0.04	0.002	12.807	0.002	0.002	0.002	0.011	0.55	3.42	6.98	0.03	7.69	0.01	0.01	80.95	0.26

"Future 2" Chemistry

Mine Area Alternative	Tailings Alternative	Ag	Al	As	Ca	Cd	Cl	Co	Cu	Fe	K	Mg	Mn	Na	Ni	Pb	SO4	Zn
1 Flow-Through Pit	1 Stabilize In Place	0.00	0.08	0.003	4.638	0.003	0.015	0.003	0.023	1.07	3.34	1.67	0.07	7.57	0.01	0.01	69.78	0.85
1 Flow-Through Pit	2 Complete Relocation	0.00	0.07	0.003	9.691	0.002	0.015	0.002	0.017	0.73	2.09	2.76	0.06	4.83	0.01	0.01	52.73	0.56
1 Flow-Through Pit	3 Partial Relocation	0.00	0.08	0.003	8.376	0.002	0.015	0.002	0.020	0.95	2.29	2.49	0.06	5.25	0.01	0.01	58.36	0.81
2 Upgrade Faro Creek Diversion	1 Stabilize In Place	0.00	0.06	0.003	13.655	0.003	0.006	0.003	0.017	0.90	4.47	11.95	0.04	10.06	0.01	0.01	142.56	0.46
2 Upgrade Faro Creek Diversion	2 Complete Relocation	0.00	0.05	0.002	18.7078	0.0021	0.0056	0.0023	0.011	0.56	3.23	13.03	0.04	7.32	0.01	0.01	125.51	0.16
2 Upgrade Faro Creek Diversion	3 Partial Relocation	0.00	0.06	0.003	17.393	0.002	0.006	0.003	0.015	0.78	3.43	12.76	0.04	7.75	0.01	0.01	131.14	0.41

"Future 3" Chemistry

Mine Area Alternative	Tailings Alternative	Ag	Al	As	Ca	Cd	Cl	Co	Cu	Fe	K	Mg	Mn	Na	Ni	Pb	SO4	Zn
1 Flow-Through Pit	1 Stabilize In Place	0.00	4.33	0.25	15.171	0.080	2.896	0.092	1.6	57.43	3.97	19.20	7.84	8.60	0.08	0.03	496.87	57.3
1 Flow-Through Pit	2 Complete Relocation	0.00	4.24	0.25	15.615	0.079	2.896	0.090	1.6	55.58	2.73	19.15	7.82	5.86	0.08	0.03	355.95	56.6
1 Flow-Through Pit	3 Partial Relocation	0.00	4.31	0.25	17.699	0.080	2.896	0.091	1.6	56.91	2.92	19.71	7.84	6.28	0.08	0.03	451.13	57.2
2 Upgrade Faro Creek Diversion	1 Stabilize In Place	0.00	0.34	0.016	19.888	0.007	0.143	0.008	0.11	5.12	4.50	27.57	0.43	10.06	0.02	0.01	511.50	3.6
2 Upgrade Faro Creek Diversion	2 Complete Relocation	0.00	0.25	0.015	20.331	0.006	0.143	0.007	0.09	3.26	3.25	27.52	0.41	7.32	0.01	0.01	370.58	2.9
2 Upgrade Faro Creek Diversion	3 Partial Relocation	0.00	0.32	0.015	22.415	0.006	0.143	0.007	0.11	4.60	3.45	28.08	0.42	7.74	0.01	0.01	465.76	3.5

Mine Area Flow-through Pit + Tailings Stabilize in Place

Summary Water Quality		Bkgd	0.0010	0.0050	0.0011	0.0017	0.0256
Conditions	**FUTURE 1**	CCME	0.005	0.002	0.025	0.001	0.03

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0010	0.0048	0.0011	0.0016	0.0418
Feb	403	0.0010	0.0048	0.0011	0.0016	0.0457
Mar	407	0.0010	0.0048	0.0012	0.0016	0.0513
Apr	784	0.0010	0.0050	0.0012	0.0017	0.0443
May	6991	0.0010	0.0049	0.0011	0.0017	0.0278
Jun	7191	0.0010	0.0049	0.0011	0.0017	0.0283
Jul	5013	0.0010	0.0049	0.0011	0.0017	0.0289
Aug	3506	0.0010	0.0049	0.0011	0.0017	0.0288
Sep	4720	0.0010	0.0049	0.0011	0.0017	0.0281
Oct	2460	0.0010	0.0048	0.0011	0.0016	0.0292
Nov	1115	0.0010	0.0048	0.0011	0.0016	0.0340
Dec	821	0.0010	0.0049	0.0011	0.0017	0.0379
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0024	0.0112	0.0082	0.0082	0.4177
Feb	912	0.0027	0.0131	0.0098	0.0097	0.4909
Mar	981	0.0028	0.0151	0.0105	0.0102	0.5452
Apr	1784	0.0021	0.0115	0.0062	0.0063	0.3506
May	14480	0.0011	0.0059	0.0017	0.0022	0.1602
Jun	14796	0.0015	0.0059	0.0040	0.0045	0.2589
Jul	10302	0.0017	0.0061	0.0053	0.0057	0.0771
Aug	7268	0.0020	0.0063	0.0067	0.0071	0.0863
Sep	9748	0.0017	0.0060	0.0053	0.0058	0.0722
Oct	5108	0.0013	0.0067	0.0028	0.0032	0.1683
Nov	2303	0.0017	0.0081	0.0047	0.0050	0.2587
Dec	1705	0.0020	0.0092	0.0060	0.0063	0.3230
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0020	0.0095	0.0064	0.0065	0.3038
Feb	1230	0.0022	0.0110	0.0076	0.0076	0.3594
Mar	1301	0.0024	0.0125	0.0081	0.0081	0.4039
Apr	2402	0.0018	0.0098	0.0048	0.0050	0.2605
May	19992	0.0011	0.0056	0.0015	0.0021	0.1211
Jun	20466	0.0014	0.0056	0.0032	0.0037	0.1954
Jul	14254	0.0015	0.0058	0.0041	0.0046	0.0633
Aug	10032	0.0017	0.0060	0.0053	0.0057	0.0704
Sep	13469	0.0015	0.0057	0.0042	0.0047	0.0597
Oct	7047	0.0012	0.0062	0.0023	0.0028	0.1271
Nov	3181	0.0015	0.0073	0.0037	0.0041	0.1907
Dec	2352	0.0017	0.0080	0.0047	0.0050	0.2350
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0014	0.0067	0.0031	0.0035	0.1228
Feb	3272	0.0015	0.0072	0.0035	0.0039	0.1443
Mar	3362	0.0015	0.0078	0.0037	0.0041	0.1633
Apr	6375	0.0013	0.0067	0.0025	0.0029	0.1100
May	55468	0.0010	0.0052	0.0013	0.0018	0.0588
Jun	56957	0.0011	0.0052	0.0019	0.0024	0.0873
Jul	39693	0.0012	0.0053	0.0022	0.0028	0.0394
Aug	27824	0.0013	0.0054	0.0027	0.0032	0.0423
Sep	37419	0.0012	0.0053	0.0022	0.0028	0.0381
Oct	19528	0.0011	0.0054	0.0015	0.0021	0.0612
Nov	8835	0.0012	0.0058	0.0020	0.0026	0.0830
Dec	6515	0.0013	0.0061	0.0024	0.0029	0.0979
Total	269678					

Mine Area Flow-through Pit + Tailings Stabilize in Place
Summary Tables
Conditions FUTURE 2

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0010	0.0055	0.0015	0.0018	0.1158
Feb	403	0.0011	0.0057	0.0016	0.0019	0.1369
Mar	407	0.0011	0.0060	0.0018	0.0019	0.1655
Apr	784	0.0011	0.0058	0.0016	0.0019	0.1239
May	6991	0.0010	0.0050	0.0012	0.0017	0.0384
Jun	7191	0.0010	0.0050	0.0012	0.0017	0.0415
Jul	5013	0.0010	0.0051	0.0012	0.0017	0.0450
Aug	3506	0.0010	0.0050	0.0012	0.0017	0.0456
Sep	4720	0.0010	0.0050	0.0012	0.0017	0.0410
Oct	2460	0.0010	0.0050	0.0012	0.0017	0.0481
Nov	1115	0.0010	0.0052	0.0013	0.0017	0.0744
Dec	821	0.0010	0.0054	0.0014	0.0018	0.0936
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0028	0.0162	0.0089	0.0086	0.6210
Feb	912	0.0031	0.0195	0.0106	0.0100	0.7458
Mar	981	0.0033	0.0228	0.0114	0.0107	0.8516
Apr	1784	0.0024	0.0165	0.0068	0.0066	0.5529
May	14480	0.0012	0.0065	0.0018	0.0023	0.1881
Jun	14796	0.0013	0.0154	0.0038	0.0033	0.8772
Jul	10302	0.0014	0.0156	0.0041	0.0036	0.6884
Aug	7268	0.0014	0.0160	0.0045	0.0040	0.6982
Sep	9748	0.0014	0.0159	0.0042	0.0037	0.7059
Oct	5108	0.0015	0.0172	0.0049	0.0043	0.8234
Nov	2303	0.0020	0.0201	0.0070	0.0062	0.9812
Dec	1705	0.0024	0.0221	0.0086	0.0076	1.0922
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0023	0.0131	0.0068	0.0068	0.4484
Feb	1230	0.0025	0.0155	0.0081	0.0079	0.5426
Mar	1301	0.0027	0.0181	0.0088	0.0084	0.6270
Apr	2402	0.0020	0.0134	0.0053	0.0053	0.4067
May	19992	0.0011	0.0061	0.0016	0.0021	0.1409
Jun	20466	0.0012	0.0125	0.0031	0.0029	0.6432
Jul	14254	0.0013	0.0127	0.0033	0.0031	0.5060
Aug	10032	0.0013	0.0130	0.0036	0.0034	0.5142
Sep	13469	0.0013	0.0129	0.0033	0.0031	0.5195
Oct	7047	0.0014	0.0138	0.0039	0.0036	0.6041
Nov	3181	0.0017	0.0159	0.0054	0.0050	0.7147
Dec	2352	0.0020	0.0173	0.0066	0.0060	0.7903
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0015	0.0079	0.0032	0.0036	0.1736
Feb	3272	0.0016	0.0088	0.0037	0.0040	0.2096
Mar	3362	0.0016	0.0098	0.0040	0.0042	0.2446
Apr	6375	0.0014	0.0080	0.0026	0.0030	0.1625
May	55468	0.0010	0.0054	0.0013	0.0018	0.0658
Jun	56957	0.0011	0.0077	0.0018	0.0021	0.2487
Jul	39693	0.0011	0.0078	0.0019	0.0022	0.1989
Aug	27824	0.0011	0.0079	0.0020	0.0023	0.2026
Sep	37419	0.0011	0.0079	0.0019	0.0022	0.2043
Oct	19528	0.0011	0.0082	0.0021	0.0024	0.2345
Nov	8835	0.0013	0.0089	0.0027	0.0029	0.2722
Dec	6515	0.0014	0.0094	0.0031	0.0033	0.2967
Total	269678					

Mine Area Flow-through Pit + Tailings Stabilize in Place
Summary Tables
Conditions FUTURE 3

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.1389	0.8515	0.0417	0.0138	32.2562
Feb	403	0.1706	1.0460	0.0510	0.0166	39.6618
Mar	407	0.2127	1.3044	0.0634	0.0204	49.4961
Apr	784	0.1494	0.9157	0.0448	0.0148	34.6955
May	6991	0.0210	0.1276	0.0070	0.0034	4.6957
Jun	7191	0.0259	0.1576	0.0084	0.0039	5.8362
Jul	5013	0.0312	0.1902	0.0100	0.0043	7.0796
Aug	3506	0.0326	0.1990	0.0104	0.0044	7.4151
Sep	4720	0.0253	0.1543	0.0082	0.0038	5.7124
Oct	2460	0.0365	0.2229	0.0115	0.0048	8.3259
Nov	1115	0.0768	0.4701	0.0234	0.0083	17.7377
Dec	821	0.1052	0.6447	0.0318	0.0109	24.3824
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.1832	1.1424	0.0614	0.0243	41.3070
Feb	912	0.2173	1.3592	0.0730	0.0288	49.1043
Mar	981	0.2535	1.5886	0.0843	0.0326	57.3437
Apr	1784	0.1790	1.1191	0.0582	0.0220	40.3769
May	14480	0.0263	0.1634	0.0091	0.0045	5.8542
Jun	14796	0.0405	0.2571	0.0143	0.0063	9.6184
Jul	10302	0.0466	0.2953	0.0164	0.0070	10.8040
Aug	7268	0.0480	0.3051	0.0171	0.0075	11.1377
Sep	9748	0.0402	0.2563	0.0146	0.0065	9.3933
Oct	5108	0.0533	0.3389	0.0192	0.0084	12.4306
Nov	2303	0.1026	0.6454	0.0355	0.0145	23.5751
Dec	1705	0.1398	0.8759	0.0478	0.0191	31.9604
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.1289	0.8038	0.0437	0.0178	29.0079
Feb	1230	0.1546	0.9668	0.0524	0.0212	34.8690
Mar	1301	0.1838	1.1520	0.0615	0.0242	41.5318
Apr	2402	0.1294	0.8088	0.0424	0.0164	29.1363
May	19992	0.0189	0.1171	0.0068	0.0037	4.1515
Jun	20466	0.0296	0.1877	0.0107	0.0050	6.9789
Jul	14254	0.0340	0.2152	0.0122	0.0056	7.8294
Aug	10032	0.0351	0.2226	0.0127	0.0059	8.0829
Sep	13469	0.0295	0.1872	0.0109	0.0052	6.8191
Oct	7047	0.0390	0.2473	0.0143	0.0066	9.0292
Nov	3181	0.0744	0.4674	0.0260	0.0110	17.0273
Dec	2352	0.1006	0.6301	0.0347	0.0143	22.9418
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0448	0.2790	0.0159	0.0074	9.9606
Feb	3272	0.0546	0.3407	0.0192	0.0087	12.1812
Mar	3362	0.0669	0.4185	0.0230	0.0099	14.9810
Apr	6375	0.0470	0.2929	0.0159	0.0070	10.4489
May	55468	0.0072	0.0439	0.0031	0.0024	1.4582
Jun	56957	0.0113	0.0709	0.0046	0.0029	2.5350
Jul	39693	0.0129	0.0807	0.0051	0.0031	2.8366
Aug	27824	0.0133	0.0836	0.0053	0.0032	2.9351
Sep	37419	0.0113	0.0708	0.0046	0.0030	2.4794
Oct	19528	0.0147	0.0927	0.0059	0.0035	3.2823
Nov	8835	0.0273	0.1708	0.0100	0.0051	6.1205
Dec	6515	0.0363	0.2269	0.0131	0.0062	8.1591
Total	269678					

Mine Area Flow-through Pit + Tailings Complete Relocation

Summary Water Quality		Bkgd	0.0010	0.0050	0.0011	0.0017	0.0256
Conditions	**FUTURE 1**	CCME	0.005	0.002	0.025	0.001	0.03

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0011	0.0051	0.0012	0.0017	0.0433
Feb	403	0.0011	0.0051	0.0012	0.0017	0.0474
Mar	407	0.0011	0.0051	0.0012	0.0017	0.0530
Apr	784	0.0011	0.0051	0.0012	0.0017	0.0447
May	6991	0.0010	0.0049	0.0011	0.0017	0.0278
Jun	7191	0.0010	0.0049	0.0011	0.0017	0.0282
Jul	5013	0.0010	0.0049	0.0011	0.0017	0.0288
Aug	3506	0.0010	0.0049	0.0011	0.0017	0.0289
Sep	4720	0.0010	0.0049	0.0011	0.0017	0.0280
Oct	2460	0.0010	0.0048	0.0011	0.0016	0.0291
Nov	1115	0.0010	0.0048	0.0011	0.0016	0.0339
Dec	821	0.0010	0.0048	0.0011	0.0016	0.0377
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0019	0.0100	0.0051	0.0052	0.3141
Feb	912	0.0021	0.0115	0.0060	0.0060	0.3486
Mar	981	0.0022	0.0130	0.0063	0.0062	0.3671
Apr	1784	0.0017	0.0101	0.0038	0.0040	0.2442
May	14480	0.0011	0.0057	0.0014	0.0020	0.1460
Jun	14796	0.0015	0.0057	0.0037	0.0042	0.2455
Jul	10302	0.0017	0.0058	0.0048	0.0053	0.0604
Aug	7268	0.0019	0.0060	0.0062	0.0066	0.0616
Sep	9748	0.0017	0.0057	0.0049	0.0054	0.0544
Oct	5108	0.0012	0.0063	0.0020	0.0024	0.1364
Nov	2303	0.0014	0.0074	0.0030	0.0033	0.2072
Dec	1705	0.0016	0.0083	0.0037	0.0040	0.2592
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0016	0.0086	0.0040	0.0042	0.2273
Feb	1230	0.0018	0.0097	0.0047	0.0048	0.2538
Mar	1301	0.0018	0.0108	0.0049	0.0050	0.2714
Apr	2402	0.0015	0.0087	0.0031	0.0034	0.1827
May	19992	0.0011	0.0055	0.0013	0.0019	0.1108
Jun	20466	0.0013	0.0055	0.0030	0.0035	0.1856
Jul	14254	0.0015	0.0056	0.0039	0.0043	0.0512
Aug	10032	0.0017	0.0057	0.0049	0.0053	0.0525
Sep	13469	0.0015	0.0055	0.0039	0.0044	0.0469
Oct	7047	0.0011	0.0059	0.0017	0.0022	0.1040
Nov	3181	0.0013	0.0067	0.0025	0.0029	0.1531
Dec	2352	0.0015	0.0073	0.0030	0.0034	0.1883
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0012	0.0063	0.0021	0.0026	0.0943
Feb	3272	0.0013	0.0067	0.0024	0.0028	0.1046
Mar	3362	0.0013	0.0071	0.0025	0.0029	0.1133
Apr	6375	0.0012	0.0063	0.0018	0.0023	0.0814
May	55468	0.0010	0.0052	0.0012	0.0018	0.0551
Jun	56957	0.0011	0.0052	0.0018	0.0024	0.0838
Jul	39693	0.0012	0.0052	0.0021	0.0027	0.0351
Aug	27824	0.0012	0.0053	0.0025	0.0031	0.0358
Sep	37419	0.0012	0.0052	0.0021	0.0027	0.0335
Oct	19528	0.0010	0.0053	0.0013	0.0019	0.0528
Nov	8835	0.0011	0.0056	0.0016	0.0021	0.0693
Dec	6515	0.0012	0.0058	0.0018	0.0023	0.0807
Total	269678					

Mine Area Flow-through Pit + Tailings Complete Relocation
Summary Tables
Conditions **FUTURE 2**

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0011	0.0058	0.0016	0.0019	0.1173
Feb	403	0.0011	0.0060	0.0017	0.0020	0.1386
Mar	407	0.0012	0.0063	0.0018	0.0020	0.1672
Apr	784	0.0011	0.0059	0.0016	0.0019	0.1243
May	6991	0.0010	0.0050	0.0012	0.0017	0.0384
Jun	7191	0.0010	0.0050	0.0012	0.0017	0.0414
Jul	5013	0.0010	0.0051	0.0012	0.0017	0.0449
Aug	3506	0.0010	0.0051	0.0012	0.0017	0.0458
Sep	4720	0.0010	0.0050	0.0012	0.0017	0.0410
Oct	2460	0.0010	0.0050	0.0012	0.0017	0.0480
Nov	1115	0.0010	0.0052	0.0013	0.0017	0.0743
Dec	821	0.0010	0.0054	0.0014	0.0018	0.0934
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0022	0.0129	0.0057	0.0055	0.4497
Feb	912	0.0025	0.0149	0.0067	0.0063	0.5101
Mar	981	0.0026	0.0170	0.0072	0.0066	0.5564
Apr	1784	0.0020	0.0129	0.0044	0.0043	0.3768
May	14480	0.0011	0.0060	0.0015	0.0020	0.1647
Jun	14796	0.0013	0.0149	0.0035	0.0031	0.8550
Jul	10302	0.0013	0.0150	0.0037	0.0032	0.6608
Aug	7268	0.0013	0.0152	0.0039	0.0035	0.6573
Sep	9748	0.0013	0.0152	0.0038	0.0033	0.6766
Oct	5108	0.0014	0.0161	0.0041	0.0035	0.7707
Nov	2303	0.0017	0.0183	0.0053	0.0045	0.8965
Dec	1705	0.0020	0.0199	0.0063	0.0053	0.9876
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0019	0.0106	0.0044	0.0045	0.3220
Feb	1230	0.0020	0.0121	0.0052	0.0051	0.3677
Mar	1301	0.0022	0.0137	0.0056	0.0053	0.4075
Apr	2402	0.0017	0.0107	0.0035	0.0036	0.2779
May	19992	0.0011	0.0057	0.0014	0.0019	0.1240
Jun	20466	0.0012	0.0122	0.0029	0.0027	0.6271
Jul	14254	0.0012	0.0123	0.0030	0.0028	0.4860
Aug	10032	0.0013	0.0124	0.0032	0.0030	0.4845
Sep	13469	0.0012	0.0124	0.0030	0.0029	0.4983
Oct	7047	0.0013	0.0130	0.0033	0.0030	0.5659
Nov	3181	0.0015	0.0146	0.0042	0.0038	0.6529
Dec	2352	0.0017	0.0157	0.0048	0.0043	0.7136
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0013	0.0070	0.0023	0.0027	0.1265
Feb	3272	0.0014	0.0075	0.0026	0.0029	0.1439
Mar	3362	0.0014	0.0082	0.0027	0.0030	0.1618
Apr	6375	0.0013	0.0070	0.0020	0.0024	0.1153
May	55468	0.0010	0.0053	0.0012	0.0018	0.0597
Jun	56957	0.0011	0.0076	0.0017	0.0021	0.2429
Jul	39693	0.0011	0.0076	0.0018	0.0021	0.1918
Aug	27824	0.0011	0.0077	0.0018	0.0022	0.1918
Sep	37419	0.0011	0.0077	0.0018	0.0021	0.1966
Oct	19528	0.0011	0.0079	0.0019	0.0022	0.2207
Nov	8835	0.0012	0.0084	0.0022	0.0024	0.2496
Dec	6515	0.0012	0.0088	0.0025	0.0027	0.2684
Total	269678					

Mine Area Flow-through Pit + Tailings Complete Relocation
Summary Tables
Conditions **FUTURE 3**

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.1390	0.8518	0.0417	0.0139	32.2577
Feb	403	0.1707	1.0463	0.0511	0.0167	39.6635
Mar	407	0.2128	1.3047	0.0635	0.0205	49.4978
Apr	784	0.1494	0.9158	0.0448	0.0149	34.6959
May	6991	0.0210	0.1276	0.0070	0.0034	4.6957
Jun	7191	0.0259	0.1576	0.0084	0.0039	5.8361
Jul	5013	0.0312	0.1902	0.0100	0.0043	7.0795
Aug	3506	0.0326	0.1990	0.0104	0.0045	7.4153
Sep	4720	0.0253	0.1543	0.0082	0.0038	5.7123
Oct	2460	0.0365	0.2229	0.0115	0.0048	8.3258
Nov	1115	0.0768	0.4701	0.0234	0.0083	17.7376
Dec	821	0.1052	0.6447	0.0317	0.0109	24.3823
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.1825	1.1261	0.0581	0.0212	40.8918
Feb	912	0.2165	1.3368	0.0689	0.0250	48.5322
Mar	981	0.2525	1.5604	0.0798	0.0284	56.6265
Apr	1784	0.1784	1.1021	0.0557	0.0197	39.9496
May	14480	0.0262	0.1611	0.0088	0.0042	5.7973
Jun	14796	0.0404	0.2549	0.0140	0.0060	9.5645
Jul	10302	0.0465	0.2927	0.0160	0.0066	10.7372
Aug	7268	0.0479	0.3012	0.0165	0.0069	11.0382
Sep	9748	0.0401	0.2534	0.0141	0.0061	9.3223
Oct	5108	0.0531	0.3338	0.0184	0.0076	12.3031
Nov	2303	0.1022	0.6372	0.0337	0.0129	23.3707
Dec	1705	0.1393	0.8659	0.0453	0.0168	31.7085
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.1284	0.7918	0.0412	0.0155	28.7015
Feb	1230	0.1539	0.9501	0.0493	0.0183	34.4449
Mar	1301	0.1831	1.1310	0.0581	0.0211	40.9988
Apr	2402	0.1290	0.7964	0.0405	0.0147	28.8237
May	19992	0.0189	0.1155	0.0066	0.0035	4.1103
Jun	20466	0.0296	0.1862	0.0105	0.0048	6.9398
Jul	14254	0.0340	0.2133	0.0119	0.0053	7.7811
Aug	10032	0.0350	0.2198	0.0123	0.0055	8.0108
Sep	13469	0.0294	0.1852	0.0106	0.0049	6.7677
Oct	7047	0.0388	0.2436	0.0136	0.0060	8.9367
Nov	3181	0.0741	0.4614	0.0247	0.0098	16.8780
Dec	2352	0.1002	0.6227	0.0329	0.0126	22.7571
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0446	0.2745	0.0149	0.0065	9.8467
Feb	3272	0.0543	0.3345	0.0180	0.0076	12.0220
Mar	3362	0.0666	0.4105	0.0217	0.0087	14.7801
Apr	6375	0.0468	0.2883	0.0152	0.0064	10.3343
May	55468	0.0072	0.0433	0.0030	0.0023	1.4434
Jun	56957	0.0113	0.0704	0.0045	0.0028	2.5209
Jul	39693	0.0129	0.0800	0.0050	0.0030	2.8192
Aug	27824	0.0133	0.0825	0.0051	0.0031	2.9090
Sep	37419	0.0113	0.0701	0.0045	0.0029	2.4609
Oct	19528	0.0147	0.0913	0.0056	0.0033	3.2488
Nov	8835	0.0272	0.1686	0.0096	0.0046	6.0660
Dec	6515	0.0362	0.2242	0.0124	0.0056	8.0911
Total	269678					

Mine Area Flow-through Pit + Tailings Partial Relocation

Summary Water Quality		Bkgd	0.0010	0.0050	0.0011	0.0017	0.0256
Conditions	**FUTURE 1**	CCME	0.005	0.002	0.025	0.001	0.03

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0010	0.0048	0.0011	0.0016	0.0416
Feb	403	0.0010	0.0047	0.0011	0.0016	0.0455
Mar	407	0.0010	0.0048	0.0012	0.0016	0.0511
Apr	784	0.0010	0.0050	0.0012	0.0017	0.0440
May	6991	0.0010	0.0049	0.0011	0.0017	0.0277
Jun	7191	0.0010	0.0049	0.0011	0.0017	0.0282
Jul	5013	0.0010	0.0049	0.0011	0.0017	0.0288
Aug	3506	0.0010	0.0049	0.0011	0.0017	0.0289
Sep	4720	0.0010	0.0049	0.0011	0.0017	0.0280
Oct	2460	0.0010	0.0048	0.0011	0.0016	0.0290
Nov	1115	0.0010	0.0048	0.0011	0.0016	0.0338
Dec	821	0.0010	0.0048	0.0011	0.0016	0.0376
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0020	0.0104	0.0056	0.0057	0.4147
Feb	912	0.0021	0.0119	0.0066	0.0066	0.4874
Mar	981	0.0023	0.0136	0.0070	0.0069	0.5415
Apr	1784	0.0018	0.0106	0.0043	0.0045	0.3484
May	14480	0.0011	0.0057	0.0015	0.0020	0.1600
Jun	14796	0.0015	0.0058	0.0038	0.0043	0.2586
Jul	10302	0.0017	0.0059	0.0049	0.0054	0.0767
Aug	7268	0.0019	0.0062	0.0063	0.0067	0.0861
Sep	9748	0.0017	0.0058	0.0050	0.0055	0.0718
Oct	5108	0.0012	0.0065	0.0022	0.0026	0.1675
Nov	2303	0.0015	0.0077	0.0034	0.0037	0.2571
Dec	1705	0.0017	0.0087	0.0043	0.0045	0.3208
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0017	0.0089	0.0044	0.0047	0.3016
Feb	1230	0.0018	0.0101	0.0052	0.0053	0.3567
Mar	1301	0.0019	0.0114	0.0055	0.0056	0.4011
Apr	2402	0.0016	0.0091	0.0035	0.0037	0.2589
May	19992	0.0011	0.0055	0.0014	0.0019	0.1209
Jun	20466	0.0014	0.0055	0.0031	0.0036	0.1952
Jul	14254	0.0015	0.0057	0.0039	0.0044	0.0630
Aug	10032	0.0017	0.0059	0.0050	0.0054	0.0703
Sep	13469	0.0015	0.0056	0.0040	0.0045	0.0594
Oct	7047	0.0012	0.0061	0.0019	0.0024	0.1266
Nov	3181	0.0014	0.0070	0.0027	0.0032	0.1895
Dec	2352	0.0015	0.0076	0.0034	0.0038	0.2335
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0013	0.0064	0.0023	0.0028	0.1220
Feb	3272	0.0013	0.0069	0.0026	0.0031	0.1433
Mar	3362	0.0013	0.0074	0.0028	0.0032	0.1622
Apr	6375	0.0012	0.0065	0.0020	0.0024	0.1094
May	55468	0.0010	0.0052	0.0012	0.0018	0.0588
Jun	56957	0.0011	0.0052	0.0018	0.0024	0.0872
Jul	39693	0.0012	0.0052	0.0021	0.0027	0.0393
Aug	27824	0.0013	0.0053	0.0026	0.0031	0.0422
Sep	37419	0.0012	0.0052	0.0022	0.0027	0.0380
Oct	19528	0.0011	0.0054	0.0014	0.0019	0.0610
Nov	8835	0.0011	0.0057	0.0017	0.0022	0.0826
Dec	6515	0.0012	0.0059	0.0019	0.0025	0.0973
Total	269678					

Mine Area Flow-through Pit + Tailings Partial Relocation
Summary Tables
Conditions FUTURE 2

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0010	0.0055	0.0015	0.0018	0.1156
Feb	403	0.0010	0.0056	0.0016	0.0018	0.1366
Mar	407	0.0011	0.0059	0.0018	0.0019	0.1653
Apr	784	0.0011	0.0058	0.0016	0.0019	0.1237
May	6991	0.0010	0.0050	0.0011	0.0017	0.0383
Jun	7191	0.0010	0.0050	0.0012	0.0017	0.0414
Jul	5013	0.0010	0.0051	0.0012	0.0017	0.0448
Aug	3506	0.0010	0.0050	0.0012	0.0017	0.0457
Sep	4720	0.0010	0.0050	0.0012	0.0017	0.0409
Oct	2460	0.0010	0.0050	0.0012	0.0017	0.0479
Nov	1115	0.0010	0.0052	0.0013	0.0017	0.0742
Dec	821	0.0010	0.0054	0.0014	0.0018	0.0934
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0023	0.0148	0.0063	0.0060	0.5933
Feb	912	0.0026	0.0176	0.0074	0.0069	0.7083
Mar	981	0.0028	0.0204	0.0080	0.0073	0.8053
Apr	1784	0.0021	0.0151	0.0050	0.0048	0.5253
May	14480	0.0011	0.0063	0.0016	0.0021	0.1845
Jun	14796	0.0013	0.0152	0.0036	0.0031	0.8737
Jul	10302	0.0013	0.0154	0.0038	0.0033	0.6840
Aug	7268	0.0014	0.0157	0.0041	0.0036	0.6922
Sep	9748	0.0013	0.0156	0.0039	0.0034	0.7013
Oct	5108	0.0014	0.0168	0.0043	0.0037	0.8151
Nov	2303	0.0018	0.0194	0.0057	0.0049	0.9676
Dec	1705	0.0021	0.0213	0.0068	0.0058	1.0752
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0019	0.0121	0.0049	0.0049	0.4280
Feb	1230	0.0021	0.0141	0.0058	0.0056	0.5147
Mar	1301	0.0023	0.0163	0.0062	0.0059	0.5925
Apr	2402	0.0018	0.0123	0.0039	0.0039	0.3865
May	19992	0.0011	0.0060	0.0014	0.0020	0.1383
Jun	20466	0.0012	0.0124	0.0029	0.0027	0.6407
Jul	14254	0.0012	0.0125	0.0031	0.0029	0.5028
Aug	10032	0.0013	0.0128	0.0033	0.0031	0.5098
Sep	13469	0.0012	0.0127	0.0031	0.0029	0.5161
Oct	7047	0.0013	0.0135	0.0034	0.0032	0.5981
Nov	3181	0.0016	0.0154	0.0045	0.0040	0.7048
Dec	2352	0.0018	0.0167	0.0053	0.0047	0.7778
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0013	0.0075	0.0025	0.0029	0.1659
Feb	3272	0.0014	0.0083	0.0028	0.0032	0.1991
Mar	3362	0.0015	0.0092	0.0030	0.0033	0.2315
Apr	6375	0.0013	0.0077	0.0021	0.0025	0.1551
May	55468	0.0010	0.0053	0.0012	0.0018	0.0649
Jun	56957	0.0011	0.0077	0.0017	0.0021	0.2478
Jul	39693	0.0011	0.0077	0.0018	0.0021	0.1978
Aug	27824	0.0011	0.0078	0.0019	0.0022	0.2009
Sep	37419	0.0011	0.0078	0.0018	0.0021	0.2031
Oct	19528	0.0011	0.0081	0.0019	0.0022	0.2323
Nov	8835	0.0012	0.0087	0.0023	0.0026	0.2685
Dec	6515	0.0013	0.0092	0.0026	0.0028	0.2921
Total	269678					

Mine Area Flow-through Pit + Tailings Partial Relocation
Summary Tables
Conditions FUTURE 3

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.1389	0.8514	0.0417	0.0138	32.2560
Feb	403	0.1706	1.0459	0.0510	0.0166	39.6616
Mar	407	0.2127	1.3043	0.0634	0.0204	49.4959
Apr	784	0.1494	0.9157	0.0448	0.0148	34.6953
May	6991	0.0210	0.1276	0.0070	0.0034	4.6956
Jun	7191	0.0259	0.1575	0.0084	0.0039	5.8361
Jul	5013	0.0312	0.1902	0.0100	0.0043	7.0795
Aug	3506	0.0326	0.1990	0.0104	0.0045	7.4152
Sep	4720	0.0253	0.1543	0.0082	0.0038	5.7123
Oct	2460	0.0365	0.2229	0.0115	0.0048	8.3258
Nov	1115	0.0768	0.4701	0.0234	0.0083	17.7375
Dec	821	0.1052	0.6446	0.0317	0.0109	24.3822
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.1827	1.1376	0.0588	0.0218	41.2292
Feb	912	0.2167	1.3526	0.0698	0.0257	48.9978
Mar	981	0.2528	1.5804	0.0808	0.0292	57.2109
Apr	1784	0.1786	1.1142	0.0564	0.0202	40.2975
May	14480	0.0263	0.1627	0.0089	0.0043	5.8436
Jun	14796	0.0404	0.2565	0.0141	0.0060	9.6084
Jul	10302	0.0466	0.2946	0.0161	0.0067	10.7915
Aug	7268	0.0480	0.3040	0.0167	0.0071	11.1199
Sep	9748	0.0402	0.2555	0.0143	0.0062	9.3801
Oct	5108	0.0532	0.3374	0.0186	0.0078	12.4068
Nov	2303	0.1024	0.6430	0.0342	0.0133	23.5367
Dec	1705	0.1394	0.8730	0.0460	0.0174	31.9130
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.1285	0.8003	0.0418	0.0160	28.9504
Feb	1230	0.1541	0.9619	0.0500	0.0189	34.7899
Mar	1301	0.1833	1.1459	0.0589	0.0217	41.4329
Apr	2402	0.1291	0.8052	0.0410	0.0151	29.0781
May	19992	0.0189	0.1166	0.0066	0.0035	4.1439
Jun	20466	0.0296	0.1873	0.0105	0.0049	6.9716
Jul	14254	0.0340	0.2146	0.0119	0.0053	7.8204
Aug	10032	0.0351	0.2218	0.0124	0.0056	8.0699
Sep	13469	0.0294	0.1866	0.0106	0.0050	6.8096
Oct	7047	0.0389	0.2463	0.0138	0.0061	9.0120
Nov	3181	0.0742	0.4656	0.0250	0.0101	16.9992
Dec	2352	0.1003	0.6279	0.0333	0.0130	22.9070
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0447	0.2777	0.0151	0.0067	9.9392
Feb	3272	0.0544	0.3389	0.0183	0.0078	12.1513
Mar	3362	0.0667	0.4161	0.0220	0.0090	14.9435
Apr	6375	0.0469	0.2915	0.0154	0.0065	10.4276
May	55468	0.0072	0.0438	0.0030	0.0023	1.4554
Jun	56957	0.0113	0.0708	0.0045	0.0028	2.5324
Jul	39693	0.0129	0.0805	0.0050	0.0030	2.8333
Aug	27824	0.0133	0.0833	0.0052	0.0031	2.9303
Sep	37419	0.0113	0.0706	0.0045	0.0029	2.4760
Oct	19528	0.0147	0.0923	0.0057	0.0033	3.2760
Nov	8835	0.0272	0.1701	0.0097	0.0047	6.1103
Dec	6515	0.0363	0.2261	0.0126	0.0057	8.1462
Total	269678					

Mine Area Stabilize in Place + Tailings Stabilize in Place

Summary Water Quality		Bkgd	0.0010	0.0050	0.0011	0.0017	0.0256
Conditions	**FUTURE 1**	CCME	0.005	0.002	0.025	0.001	0.03

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0010	0.0048	0.0012	0.0016	0.0457
Feb	403	0.0010	0.0048	0.0012	0.0016	0.0504
Mar	407	0.0011	0.0049	0.0012	0.0017	0.0573
Apr	784	0.0011	0.0050	0.0012	0.0017	0.0484
May	6991	0.0010	0.0049	0.0011	0.0017	0.0283
Jun	7191	0.0010	0.0049	0.0011	0.0017	0.0290
Jul	5013	0.0010	0.0049	0.0011	0.0017	0.0297
Aug	3506	0.0010	0.0049	0.0011	0.0017	0.0297
Sep	4720	0.0010	0.0049	0.0011	0.0017	0.0288
Oct	2460	0.0010	0.0048	0.0011	0.0016	0.0302
Nov	1115	0.0010	0.0048	0.0011	0.0016	0.0361
Dec	821	0.0010	0.0049	0.0011	0.0017	0.0408
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0026	0.0091	0.0110	0.0111	0.1748
Feb	912	0.0029	0.0107	0.0131	0.0131	0.2223
Mar	981	0.0030	0.0122	0.0139	0.0137	0.2669
Apr	1784	0.0021	0.0094	0.0079	0.0081	0.1757
May	14480	0.0011	0.0056	0.0019	0.0025	0.0458
Jun	14796	0.0011	0.0055	0.0019	0.0024	0.0463
Jul	10302	0.0012	0.0057	0.0023	0.0028	0.0514
Aug	7268	0.0012	0.0059	0.0027	0.0032	0.0601
Sep	9748	0.0012	0.0057	0.0023	0.0028	0.0507
Oct	5108	0.0013	0.0062	0.0034	0.0039	0.0687
Nov	2303	0.0018	0.0070	0.0060	0.0064	0.1015
Dec	1705	0.0021	0.0075	0.0080	0.0082	0.1231
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0021	0.0080	0.0084	0.0086	0.1355
Feb	1230	0.0024	0.0092	0.0100	0.0101	0.1714
Mar	1301	0.0025	0.0104	0.0106	0.0107	0.2054
Apr	2402	0.0018	0.0082	0.0061	0.0064	0.1358
May	19992	0.0011	0.0054	0.0017	0.0023	0.0402
Jun	20466	0.0011	0.0054	0.0017	0.0022	0.0406
Jul	14254	0.0011	0.0055	0.0019	0.0025	0.0442
Aug	10032	0.0012	0.0057	0.0023	0.0028	0.0506
Sep	13469	0.0011	0.0055	0.0020	0.0025	0.0438
Oct	7047	0.0013	0.0059	0.0028	0.0033	0.0569
Nov	3181	0.0016	0.0064	0.0047	0.0051	0.0809
Dec	2352	0.0018	0.0069	0.0061	0.0065	0.0969
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0014	0.0061	0.0038	0.0043	0.0663
Feb	3272	0.0015	0.0066	0.0044	0.0049	0.0803
Mar	3362	0.0016	0.0070	0.0047	0.0051	0.0937
Apr	6375	0.0013	0.0062	0.0029	0.0034	0.0663
May	55468	0.0010	0.0051	0.0013	0.0019	0.0309
Jun	56957	0.0010	0.0051	0.0013	0.0019	0.0310
Jul	39693	0.0010	0.0052	0.0014	0.0020	0.0323
Aug	27824	0.0011	0.0052	0.0015	0.0021	0.0346
Sep	37419	0.0010	0.0052	0.0014	0.0020	0.0322
Oct	19528	0.0011	0.0053	0.0017	0.0023	0.0369
Nov	8835	0.0012	0.0055	0.0024	0.0029	0.0457
Dec	6515	0.0013	0.0057	0.0029	0.0034	0.0517
Total	269678					

Mine Area Stabilize in Place + Tailings Stabilize in Place
Summary Tables
Conditions FUTURE 2

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0011	0.0057	0.0016	0.0019	0.1279
Feb	403	0.0011	0.0058	0.0017	0.0019	0.1518
Mar	407	0.0011	0.0061	0.0019	0.0020	0.1842
Apr	784	0.0011	0.0059	0.0017	0.0020	0.1369
May	6991	0.0010	0.0051	0.0012	0.0017	0.0401
Jun	7191	0.0010	0.0051	0.0012	0.0017	0.0436
Jul	5013	0.0010	0.0051	0.0012	0.0017	0.0476
Aug	3506	0.0010	0.0050	0.0012	0.0017	0.0483
Sep	4720	0.0010	0.0050	0.0012	0.0017	0.0431
Oct	2460	0.0010	0.0051	0.0012	0.0017	0.0512
Nov	1115	0.0010	0.0053	0.0014	0.0018	0.0810
Dec	821	0.0011	0.0055	0.0015	0.0018	0.1027
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0027	0.0120	0.0113	0.0112	0.2967
Feb	912	0.0030	0.0145	0.0135	0.0132	0.3793
Mar	981	0.0031	0.0170	0.0143	0.0139	0.4588
Apr	1784	0.0022	0.0124	0.0082	0.0082	0.3007
May	14480	0.0011	0.0060	0.0020	0.0025	0.0632
Jun	14796	0.0011	0.0059	0.0019	0.0024	0.0652
Jul	10302	0.0012	0.0062	0.0023	0.0028	0.0746
Aug	7268	0.0013	0.0066	0.0028	0.0032	0.0891
Sep	9748	0.0012	0.0062	0.0023	0.0028	0.0722
Oct	5108	0.0014	0.0071	0.0035	0.0039	0.1039
Nov	2303	0.0018	0.0085	0.0062	0.0064	0.1656
Dec	1705	0.0022	0.0094	0.0082	0.0083	0.2064
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0022	0.0102	0.0086	0.0087	0.2251
Feb	1230	0.0025	0.0121	0.0103	0.0103	0.2878
Mar	1301	0.0026	0.0139	0.0109	0.0108	0.3488
Apr	2402	0.0019	0.0104	0.0063	0.0065	0.2278
May	19992	0.0011	0.0057	0.0017	0.0023	0.0528
Jun	20466	0.0011	0.0057	0.0017	0.0022	0.0543
Jul	14254	0.0011	0.0059	0.0020	0.0025	0.0610
Aug	10032	0.0012	0.0062	0.0023	0.0028	0.0717
Sep	13469	0.0011	0.0059	0.0020	0.0025	0.0593
Oct	7047	0.0013	0.0065	0.0028	0.0033	0.0824
Nov	3181	0.0016	0.0075	0.0048	0.0052	0.1275
Dec	2352	0.0019	0.0082	0.0063	0.0065	0.1576
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0015	0.0069	0.0039	0.0043	0.0995
Feb	3272	0.0016	0.0076	0.0046	0.0049	0.1240
Mar	3362	0.0016	0.0084	0.0048	0.0052	0.1483
Apr	6375	0.0013	0.0070	0.0030	0.0035	0.1004
May	55468	0.0010	0.0053	0.0013	0.0019	0.0354
Jun	56957	0.0010	0.0052	0.0013	0.0019	0.0359
Jul	39693	0.0011	0.0053	0.0014	0.0020	0.0383
Aug	27824	0.0011	0.0054	0.0015	0.0021	0.0422
Sep	37419	0.0011	0.0053	0.0014	0.0020	0.0377
Oct	19528	0.0011	0.0055	0.0017	0.0023	0.0461
Nov	8835	0.0012	0.0059	0.0025	0.0030	0.0626
Dec	6515	0.0013	0.0062	0.0030	0.0035	0.0738
Total	269678					

Mine Area Stabilize in Place + Tailings Stabilize in Place
Summary Tables
Conditions **FUTURE 3**

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0163	0.0992	0.0058	0.0030	3.6565
Feb	403	0.0198	0.1212	0.0069	0.0034	4.5025
Mar	407	0.0246	0.1506	0.0084	0.0038	5.6333
Apr	784	0.0175	0.1066	0.0062	0.0032	3.9358
May	6991	0.0032	0.0185	0.0018	0.0019	0.5465
Jun	7191	0.0037	0.0218	0.0019	0.0019	0.6740
Jul	5013	0.0043	0.0254	0.0021	0.0020	0.8131
Aug	3506	0.0045	0.0263	0.0021	0.0020	0.8504
Sep	4720	0.0037	0.0214	0.0019	0.0019	0.6600
Oct	2460	0.0049	0.0289	0.0023	0.0020	0.9524
Nov	1115	0.0093	0.0564	0.0036	0.0024	2.0104
Dec	821	0.0125	0.0760	0.0046	0.0027	2.7620
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0116	0.0792	0.0139	0.0119	2.5457
Feb	912	0.0135	0.0961	0.0165	0.0141	3.0702
Mar	981	0.0155	0.1142	0.0179	0.0149	3.6478
Apr	1784	0.0113	0.0810	0.0108	0.0090	2.5957
May	14480	0.0025	0.0158	0.0023	0.0026	0.3961
Jun	14796	0.0028	0.0178	0.0024	0.0026	0.4721
Jul	10302	0.0032	0.0206	0.0029	0.0030	0.5701
Aug	7268	0.0034	0.0226	0.0034	0.0034	0.6216
Sep	9748	0.0028	0.0183	0.0028	0.0030	0.4797
Oct	5108	0.0038	0.0254	0.0042	0.0041	0.7102
Nov	2303	0.0069	0.0458	0.0077	0.0068	1.4291
Dec	1705	0.0091	0.0597	0.0102	0.0089	1.9227
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0088	0.0594	0.0105	0.0092	1.8735
Feb	1230	0.0103	0.0725	0.0125	0.0109	2.2839
Mar	1301	0.0119	0.0870	0.0136	0.0116	2.7486
Apr	2402	0.0086	0.0613	0.0083	0.0070	1.9301
May	19992	0.0021	0.0128	0.0020	0.0023	0.2939
Jun	20466	0.0023	0.0142	0.0020	0.0023	0.3484
Jul	14254	0.0026	0.0163	0.0024	0.0026	0.4192
Aug	10032	0.0027	0.0177	0.0028	0.0029	0.4574
Sep	13469	0.0023	0.0146	0.0023	0.0026	0.3543
Oct	7047	0.0030	0.0198	0.0033	0.0034	0.5220
Nov	3181	0.0053	0.0346	0.0059	0.0054	1.0429
Dec	2352	0.0069	0.0447	0.0077	0.0069	1.4029
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0039	0.0251	0.0046	0.0045	0.7058
Feb	3272	0.0045	0.0304	0.0054	0.0052	0.8739
Mar	3362	0.0052	0.0365	0.0059	0.0054	1.0740
Apr	6375	0.0039	0.0260	0.0038	0.0037	0.7399
May	55468	0.0014	0.0078	0.0014	0.0019	0.1223
Jun	56957	0.0015	0.0083	0.0014	0.0019	0.1416
Jul	39693	0.0016	0.0091	0.0016	0.0020	0.1670
Aug	27824	0.0016	0.0096	0.0017	0.0021	0.1814
Sep	37419	0.0015	0.0085	0.0015	0.0020	0.1439
Oct	19528	0.0017	0.0103	0.0019	0.0023	0.2048
Nov	8835	0.0025	0.0157	0.0028	0.0031	0.3927
Dec	6515	0.0031	0.0194	0.0035	0.0036	0.5241
Total	269678					

Mine Area Stabilize in Place + Tailings Complete Relocation

Summary Water Quality		Bkgd	0.0010	0.0050	0.0011	0.0017	0.0256
Conditions	**FUTURE 1**	CCME	0.005	0.002	0.025	0.001	0.03

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0011	0.0051	0.0012	0.0017	0.0472
Feb	403	0.0011	0.0051	0.0012	0.0018	0.0522
Mar	407	0.0011	0.0052	0.0013	0.0018	0.0589
Apr	784	0.0011	0.0051	0.0012	0.0018	0.0488
May	6991	0.0010	0.0049	0.0011	0.0017	0.0283
Jun	7191	0.0010	0.0049	0.0011	0.0017	0.0289
Jul	5013	0.0010	0.0049	0.0011	0.0017	0.0297
Aug	3506	0.0010	0.0049	0.0011	0.0017	0.0298
Sep	4720	0.0010	0.0049	0.0011	0.0017	0.0287
Oct	2460	0.0010	0.0048	0.0011	0.0016	0.0301
Nov	1115	0.0010	0.0048	0.0011	0.0016	0.0360
Dec	821	0.0010	0.0048	0.0011	0.0017	0.0406
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0020	0.0079	0.0078	0.0080	0.0712
Feb	912	0.0022	0.0091	0.0093	0.0094	0.0800
Mar	981	0.0023	0.0101	0.0097	0.0097	0.0888
Apr	1784	0.0017	0.0080	0.0056	0.0058	0.0694
May	14480	0.0011	0.0054	0.0016	0.0022	0.0316
Jun	14796	0.0011	0.0053	0.0016	0.0021	0.0329
Jul	10302	0.0011	0.0054	0.0019	0.0024	0.0346
Aug	7268	0.0011	0.0056	0.0022	0.0027	0.0354
Sep	9748	0.0011	0.0054	0.0019	0.0024	0.0330
Oct	5108	0.0012	0.0057	0.0026	0.0031	0.0368
Nov	2303	0.0015	0.0062	0.0043	0.0047	0.0500
Dec	1705	0.0017	0.0066	0.0056	0.0059	0.0594
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0018	0.0071	0.0060	0.0063	0.0590
Feb	1230	0.0019	0.0080	0.0071	0.0073	0.0658
Mar	1301	0.0020	0.0087	0.0075	0.0076	0.0729
Apr	2402	0.0015	0.0072	0.0044	0.0047	0.0580
May	19992	0.0011	0.0053	0.0015	0.0020	0.0300
Jun	20466	0.0011	0.0052	0.0015	0.0020	0.0309
Jul	14254	0.0011	0.0053	0.0016	0.0022	0.0321
Aug	10032	0.0011	0.0054	0.0019	0.0024	0.0327
Sep	13469	0.0011	0.0053	0.0017	0.0022	0.0310
Oct	7047	0.0012	0.0055	0.0022	0.0027	0.0338
Nov	3181	0.0014	0.0059	0.0035	0.0039	0.0433
Dec	2352	0.0015	0.0062	0.0044	0.0048	0.0502
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0013	0.0058	0.0029	0.0034	0.0378
Feb	3272	0.0013	0.0061	0.0033	0.0038	0.0406
Mar	3362	0.0014	0.0064	0.0035	0.0039	0.0436
Apr	6375	0.0012	0.0058	0.0023	0.0028	0.0377
May	55468	0.0010	0.0051	0.0012	0.0018	0.0272
Jun	56957	0.0010	0.0051	0.0012	0.0018	0.0275
Jul	39693	0.0010	0.0051	0.0013	0.0019	0.0279
Aug	27824	0.0010	0.0052	0.0014	0.0020	0.0282
Sep	37419	0.0010	0.0051	0.0013	0.0019	0.0275
Oct	19528	0.0011	0.0052	0.0015	0.0021	0.0285
Nov	8835	0.0011	0.0053	0.0020	0.0025	0.0320
Dec	6515	0.0012	0.0054	0.0023	0.0028	0.0345
Total	269678					

Mine Area Stabilize in Place + Tailings Complete Relocation
Summary Tables
Conditions FUTURE 2

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0011	0.0059	0.0017	0.0020	0.1294
Feb	403	0.0012	0.0062	0.0018	0.0020	0.1535
Mar	407	0.0012	0.0065	0.0020	0.0021	0.1858
Apr	784	0.0011	0.0060	0.0017	0.0020	0.1373
May	6991	0.0010	0.0051	0.0012	0.0017	0.0401
Jun	7191	0.0010	0.0051	0.0012	0.0017	0.0436
Jul	5013	0.0010	0.0051	0.0012	0.0017	0.0475
Aug	3506	0.0010	0.0051	0.0012	0.0017	0.0485
Sep	4720	0.0010	0.0050	0.0012	0.0017	0.0431
Oct	2460	0.0010	0.0050	0.0012	0.0017	0.0511
Nov	1115	0.0010	0.0052	0.0014	0.0018	0.0809
Dec	821	0.0011	0.0055	0.0015	0.0018	0.1026
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0021	0.0087	0.0081	0.0082	0.1254
Feb	912	0.0023	0.0100	0.0096	0.0095	0.1436
Mar	981	0.0024	0.0112	0.0101	0.0099	0.1636
Apr	1784	0.0018	0.0088	0.0059	0.0059	0.1246
May	14480	0.0011	0.0055	0.0017	0.0022	0.0397
Jun	14796	0.0011	0.0055	0.0017	0.0022	0.0430
Jul	10302	0.0011	0.0056	0.0019	0.0024	0.0470
Aug	7268	0.0012	0.0058	0.0022	0.0027	0.0482
Sep	9748	0.0011	0.0056	0.0019	0.0024	0.0429
Oct	5108	0.0012	0.0059	0.0027	0.0031	0.0512
Nov	2303	0.0015	0.0067	0.0045	0.0048	0.0809
Dec	1705	0.0018	0.0072	0.0059	0.0061	0.1018
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0018	0.0077	0.0062	0.0064	0.0986
Feb	1230	0.0020	0.0086	0.0074	0.0074	0.1130
Mar	1301	0.0020	0.0096	0.0078	0.0078	0.1292
Apr	2402	0.0016	0.0078	0.0046	0.0048	0.0990
May	19992	0.0011	0.0053	0.0015	0.0021	0.0358
Jun	20466	0.0011	0.0053	0.0015	0.0020	0.0382
Jul	14254	0.0011	0.0054	0.0017	0.0022	0.0411
Aug	10032	0.0011	0.0056	0.0019	0.0024	0.0420
Sep	13469	0.0011	0.0054	0.0017	0.0022	0.0381
Oct	7047	0.0012	0.0057	0.0023	0.0027	0.0442
Nov	3181	0.0014	0.0062	0.0036	0.0040	0.0656
Dec	2352	0.0016	0.0066	0.0046	0.0049	0.0809
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0013	0.0060	0.0030	0.0034	0.0524
Feb	3272	0.0014	0.0063	0.0034	0.0038	0.0583
Mar	3362	0.0014	0.0067	0.0036	0.0040	0.0655
Apr	6375	0.0012	0.0060	0.0024	0.0028	0.0532
May	55468	0.0010	0.0051	0.0013	0.0018	0.0293
Jun	56957	0.0010	0.0051	0.0012	0.0018	0.0301
Jul	39693	0.0010	0.0052	0.0013	0.0019	0.0311
Aug	27824	0.0010	0.0052	0.0014	0.0020	0.0315
Sep	37419	0.0010	0.0051	0.0013	0.0019	0.0301
Oct	19528	0.0011	0.0052	0.0015	0.0021	0.0323
Nov	8835	0.0011	0.0055	0.0020	0.0025	0.0400
Dec	6515	0.0012	0.0056	0.0024	0.0029	0.0456
Total	269678					

Mine Area Stabilize in Place + Tailings Complete Relocation
Summary Tables
Conditions **FUTURE 3**

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0163	0.0995	0.0058	0.0031	3.6580
Feb	403	0.0199	0.1215	0.0070	0.0035	4.5043
Mar	407	0.0247	0.1509	0.0084	0.0039	5.6350
Apr	784	0.0175	0.1067	0.0062	0.0033	3.9362
May	6991	0.0032	0.0185	0.0018	0.0019	0.5465
Jun	7191	0.0037	0.0218	0.0019	0.0019	0.6739
Jul	5013	0.0043	0.0254	0.0021	0.0020	0.8130
Aug	3506	0.0045	0.0263	0.0021	0.0020	0.8506
Sep	4720	0.0037	0.0214	0.0019	0.0019	0.6599
Oct	2460	0.0049	0.0289	0.0023	0.0020	0.9523
Nov	1115	0.0093	0.0564	0.0036	0.0024	2.0103
Dec	821	0.0125	0.0760	0.0046	0.0027	2.7618
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0109	0.0629	0.0105	0.0088	2.1305
Feb	912	0.0127	0.0736	0.0124	0.0103	2.4981
Mar	981	0.0145	0.0860	0.0134	0.0108	2.9306
Apr	1784	0.0107	0.0640	0.0083	0.0066	2.1684
May	14480	0.0024	0.0136	0.0020	0.0023	0.3392
Jun	14796	0.0027	0.0156	0.0021	0.0023	0.4182
Jul	10302	0.0031	0.0179	0.0025	0.0026	0.5033
Aug	7268	0.0032	0.0186	0.0028	0.0029	0.5221
Sep	9748	0.0027	0.0154	0.0024	0.0025	0.4087
Oct	5108	0.0036	0.0203	0.0033	0.0033	0.5827
Nov	2303	0.0065	0.0376	0.0059	0.0052	1.2248
Dec	1705	0.0086	0.0496	0.0077	0.0066	1.6708
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0083	0.0474	0.0080	0.0069	1.5671
Feb	1230	0.0096	0.0558	0.0094	0.0080	1.8598
Mar	1301	0.0112	0.0659	0.0102	0.0084	2.2155
Apr	2402	0.0082	0.0488	0.0064	0.0053	1.6175
May	19992	0.0020	0.0112	0.0018	0.0021	0.2527
Jun	20466	0.0023	0.0127	0.0018	0.0021	0.3094
Jul	14254	0.0025	0.0143	0.0021	0.0023	0.3708
Aug	10032	0.0026	0.0149	0.0023	0.0025	0.3853
Sep	13469	0.0022	0.0126	0.0020	0.0023	0.3029
Oct	7047	0.0029	0.0161	0.0027	0.0029	0.4294
Nov	3181	0.0050	0.0286	0.0046	0.0042	0.8937
Dec	2352	0.0065	0.0374	0.0059	0.0053	1.2182
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0037	0.0206	0.0036	0.0036	0.5918
Feb	3272	0.0042	0.0241	0.0042	0.0040	0.7147
Mar	3362	0.0049	0.0285	0.0046	0.0042	0.8730
Apr	6375	0.0037	0.0215	0.0031	0.0030	0.6253
May	55468	0.0014	0.0072	0.0013	0.0019	0.1075
Jun	56957	0.0014	0.0078	0.0014	0.0019	0.1276
Jul	39693	0.0016	0.0084	0.0015	0.0019	0.1496
Aug	27824	0.0016	0.0086	0.0015	0.0020	0.1553
Sep	37419	0.0014	0.0077	0.0014	0.0019	0.1254
Oct	19528	0.0017	0.0090	0.0017	0.0021	0.1713
Nov	8835	0.0024	0.0135	0.0024	0.0026	0.3382
Dec	6515	0.0030	0.0167	0.0029	0.0030	0.4561
Total	269678					

Mine Area Stabilize in Place + Tailings Partial Relocation

Summary Water Quality		Bkgd	0.0010	0.0050	0.0011	0.0017	0.0256
Conditions	**FUTURE 1**	CCME	0.005	0.002	0.025	0.001	0.03

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0010	0.0048	0.0011	0.0016	0.0455
Feb	403	0.0010	0.0048	0.0012	0.0016	0.0502
Mar	407	0.0011	0.0048	0.0012	0.0016	0.0570
Apr	784	0.0011	0.0050	0.0012	0.0017	0.0482
May	6991	0.0010	0.0049	0.0011	0.0017	0.0283
Jun	7191	0.0010	0.0049	0.0011	0.0017	0.0289
Jul	5013	0.0010	0.0049	0.0011	0.0017	0.0296
Aug	3506	0.0010	0.0049	0.0011	0.0017	0.0298
Sep	4720	0.0010	0.0049	0.0011	0.0017	0.0287
Oct	2460	0.0010	0.0048	0.0011	0.0016	0.0300
Nov	1115	0.0010	0.0048	0.0011	0.0016	0.0359
Dec	821	0.0010	0.0048	0.0011	0.0016	0.0406
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0021	0.0083	0.0084	0.0086	0.1718
Feb	912	0.0023	0.0095	0.0099	0.0100	0.2188
Mar	981	0.0024	0.0107	0.0104	0.0104	0.2631
Apr	1784	0.0018	0.0085	0.0061	0.0063	0.1736
May	14480	0.0011	0.0054	0.0017	0.0022	0.0455
Jun	14796	0.0011	0.0054	0.0017	0.0022	0.0460
Jul	10302	0.0011	0.0055	0.0019	0.0025	0.0510
Aug	7268	0.0012	0.0058	0.0023	0.0028	0.0599
Sep	9748	0.0011	0.0055	0.0020	0.0025	0.0503
Oct	5108	0.0012	0.0059	0.0028	0.0033	0.0680
Nov	2303	0.0016	0.0066	0.0047	0.0051	0.0999
Dec	1705	0.0018	0.0070	0.0062	0.0065	0.1210
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0018	0.0074	0.0065	0.0067	0.1332
Feb	1230	0.0020	0.0083	0.0077	0.0078	0.1687
Mar	1301	0.0020	0.0093	0.0081	0.0082	0.2025
Apr	2402	0.0016	0.0076	0.0048	0.0051	0.1342
May	19992	0.0011	0.0053	0.0015	0.0021	0.0400
Jun	20466	0.0011	0.0053	0.0015	0.0021	0.0404
Jul	14254	0.0011	0.0054	0.0017	0.0023	0.0440
Aug	10032	0.0011	0.0056	0.0020	0.0025	0.0504
Sep	13469	0.0011	0.0054	0.0017	0.0023	0.0435
Oct	7047	0.0012	0.0057	0.0023	0.0028	0.0564
Nov	3181	0.0014	0.0061	0.0037	0.0042	0.0797
Dec	2352	0.0016	0.0065	0.0048	0.0052	0.0953
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0013	0.0059	0.0031	0.0036	0.0655
Feb	3272	0.0014	0.0062	0.0036	0.0040	0.0793
Mar	3362	0.0014	0.0066	0.0037	0.0042	0.0925
Apr	6375	0.0012	0.0059	0.0025	0.0029	0.0657
May	55468	0.0010	0.0051	0.0013	0.0018	0.0308
Jun	56957	0.0010	0.0051	0.0012	0.0018	0.0309
Jul	39693	0.0010	0.0051	0.0013	0.0019	0.0322
Aug	27824	0.0010	0.0052	0.0014	0.0020	0.0345
Sep	37419	0.0010	0.0051	0.0013	0.0019	0.0321
Oct	19528	0.0011	0.0052	0.0015	0.0021	0.0367
Nov	8835	0.0011	0.0054	0.0021	0.0026	0.0453
Dec	6515	0.0012	0.0055	0.0025	0.0030	0.0511
Total	269678					

Mine Area Stabilize in Place + Tailings Partial Relocation
Summary Tables
Conditions **FUTURE 2**

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0011	0.0056	0.0016	0.0019	0.1277
Feb	403	0.0011	0.0058	0.0017	0.0019	0.1516
Mar	407	0.0011	0.0061	0.0019	0.0020	0.1840
Apr	784	0.0011	0.0059	0.0017	0.0020	0.1367
May	6991	0.0010	0.0051	0.0012	0.0017	0.0401
Jun	7191	0.0010	0.0051	0.0012	0.0017	0.0435
Jul	5013	0.0010	0.0051	0.0012	0.0017	0.0475
Aug	3506	0.0010	0.0051	0.0012	0.0017	0.0485
Sep	4720	0.0010	0.0050	0.0012	0.0017	0.0430
Oct	2460	0.0010	0.0050	0.0012	0.0017	0.0510
Nov	1115	0.0010	0.0052	0.0013	0.0018	0.0808
Dec	821	0.0010	0.0055	0.0015	0.0018	0.1025
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0022	0.0107	0.0087	0.0087	0.2691
Feb	912	0.0024	0.0126	0.0103	0.0101	0.3418
Mar	981	0.0025	0.0146	0.0108	0.0106	0.4125
Apr	1784	0.0018	0.0110	0.0064	0.0064	0.2731
May	14480	0.0011	0.0058	0.0017	0.0023	0.0595
Jun	14796	0.0011	0.0058	0.0017	0.0022	0.0618
Jul	10302	0.0011	0.0060	0.0020	0.0025	0.0702
Aug	7268	0.0012	0.0063	0.0024	0.0028	0.0831
Sep	9748	0.0011	0.0059	0.0020	0.0025	0.0676
Oct	5108	0.0013	0.0066	0.0029	0.0033	0.0956
Nov	2303	0.0016	0.0078	0.0049	0.0052	0.1519
Dec	1705	0.0019	0.0086	0.0064	0.0066	0.1894
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0019	0.0092	0.0067	0.0068	0.2046
Feb	1230	0.0021	0.0107	0.0079	0.0080	0.2599
Mar	1301	0.0021	0.0122	0.0084	0.0083	0.3142
Apr	2402	0.0016	0.0094	0.0050	0.0052	0.2076
May	19992	0.0011	0.0056	0.0016	0.0021	0.0502
Jun	20466	0.0011	0.0056	0.0015	0.0021	0.0517
Jul	14254	0.0011	0.0057	0.0018	0.0023	0.0579
Aug	10032	0.0011	0.0060	0.0020	0.0025	0.0672
Sep	13469	0.0011	0.0057	0.0018	0.0023	0.0560
Oct	7047	0.0012	0.0062	0.0024	0.0029	0.0764
Nov	3181	0.0014	0.0070	0.0039	0.0042	0.1175
Dec	2352	0.0016	0.0076	0.0050	0.0053	0.1451
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0013	0.0065	0.0032	0.0036	0.0918
Feb	3272	0.0014	0.0071	0.0037	0.0040	0.1135
Mar	3362	0.0014	0.0077	0.0039	0.0042	0.1352
Apr	6375	0.0012	0.0066	0.0025	0.0030	0.0930
May	55468	0.0010	0.0052	0.0013	0.0018	0.0344
Jun	56957	0.0010	0.0052	0.0013	0.0018	0.0350
Jul	39693	0.0010	0.0052	0.0013	0.0019	0.0372
Aug	27824	0.0011	0.0053	0.0014	0.0020	0.0406
Sep	37419	0.0010	0.0052	0.0013	0.0019	0.0365
Oct	19528	0.0011	0.0054	0.0016	0.0021	0.0439
Nov	8835	0.0012	0.0057	0.0021	0.0026	0.0590
Dec	6515	0.0012	0.0060	0.0025	0.0030	0.0692
Total	269678					

Mine Area Stabilize in Place + Tailings Partial Relocation
Summary Tables
Conditions FUTURE 3

Loc X2

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	553	0.0163	0.0992	0.0058	0.0030	3.6563
Feb	403	0.0198	0.1211	0.0069	0.0034	4.5023
Mar	407	0.0246	0.1505	0.0084	0.0038	5.6331
Apr	784	0.0175	0.1066	0.0062	0.0032	3.9355
May	6991	0.0032	0.0185	0.0018	0.0019	0.5465
Jun	7191	0.0037	0.0218	0.0019	0.0019	0.6739
Jul	5013	0.0043	0.0254	0.0021	0.0020	0.8130
Aug	3506	0.0045	0.0263	0.0021	0.0020	0.8505
Sep	4720	0.0037	0.0214	0.0019	0.0019	0.6599
Oct	2460	0.0049	0.0289	0.0023	0.0020	0.9522
Nov	1115	0.0093	0.0564	0.0036	0.0024	2.0102
Dec	821	0.0125	0.0760	0.0046	0.0027	2.7617
Total	33964					

Loc X14

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1192	0.0111	0.0744	0.0112	0.0094	2.4679
Feb	912	0.0129	0.0895	0.0133	0.0110	2.9637
Mar	981	0.0149	0.1060	0.0143	0.0116	3.5150
Apr	1784	0.0109	0.0761	0.0089	0.0071	2.5163
May	14480	0.0024	0.0152	0.0021	0.0024	0.3855
Jun	14796	0.0028	0.0172	0.0022	0.0024	0.4621
Jul	10302	0.0032	0.0198	0.0026	0.0027	0.5577
Aug	7268	0.0033	0.0215	0.0030	0.0030	0.6038
Sep	9748	0.0028	0.0175	0.0025	0.0026	0.4665
Oct	5108	0.0036	0.0239	0.0036	0.0035	0.6865
Nov	2303	0.0067	0.0434	0.0063	0.0056	1.3907
Dec	1705	0.0088	0.0568	0.0084	0.0071	1.8753
Total	70579					

Loc Mouth of Rose Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	1628	0.0084	0.0559	0.0085	0.0074	1.8160
Feb	1230	0.0098	0.0676	0.0101	0.0086	2.2048
Mar	1301	0.0114	0.0808	0.0110	0.0091	2.6496
Apr	2402	0.0084	0.0576	0.0069	0.0057	1.8719
May	19992	0.0020	0.0124	0.0018	0.0022	0.2862
Jun	20466	0.0023	0.0138	0.0019	0.0022	0.3412
Jul	14254	0.0026	0.0157	0.0022	0.0024	0.4102
Aug	10032	0.0027	0.0169	0.0025	0.0026	0.4444
Sep	13469	0.0023	0.0140	0.0021	0.0024	0.3447
Oct	7047	0.0029	0.0187	0.0029	0.0030	0.5047
Nov	3181	0.0051	0.0328	0.0049	0.0045	1.0148
Dec	2352	0.0067	0.0426	0.0064	0.0057	1.3681
Total	97354					

Loc Mouth of Anvil Creek

	Flows (x 1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	4432	0.0037	0.0237	0.0038	0.0038	0.6843
Feb	3272	0.0043	0.0285	0.0045	0.0043	0.8441
Mar	3362	0.0050	0.0341	0.0049	0.0045	1.0365
Apr	6375	0.0038	0.0247	0.0033	0.0032	0.7185
May	55468	0.0014	0.0077	0.0014	0.0019	0.1195
Jun	56957	0.0015	0.0082	0.0014	0.0019	0.1390
Jul	39693	0.0016	0.0088	0.0015	0.0020	0.1637
Aug	27824	0.0016	0.0093	0.0016	0.0020	0.1766
Sep	37419	0.0015	0.0082	0.0015	0.0019	0.1405
Oct	19528	0.0017	0.0100	0.0017	0.0022	0.1986
Nov	8835	0.0025	0.0151	0.0025	0.0027	0.3825
Dec	6515	0.0030	0.0186	0.0030	0.0031	0.5112
Total	269678					

VG01 - Backfill Vangorda Pit

Concentrations Estimates for Vangorda Creek Catchments

Note: Revision - Vangorda Pit loads removed - assume that backfill is limed; pit la

Loading Future 1

	Bkgd	0.0037	0.002	0.0039	0.0037	0.0137
	CCME	0.005	0.002	0.025	0.001	0.03

Concentrations at V27

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	87	0.004	0.009	0.016	0.012	0.069
Feb	73	0.004	0.009	0.016	0.013	0.068
Mar	85	0.004	0.008	0.017	0.014	0.070
Apr	121	0.004	0.009	0.017	0.013	0.072
May	463	0.004	0.012	0.012	0.008	0.068
Jun	525	0.004	0.012	0.012	0.008	0.066
Jul	392	0.004	0.012	0.012	0.008	0.065
Aug	284	0.004	0.012	0.012	0.008	0.064
Sep	344	0.004	0.012	0.012	0.008	0.066
Oct	212	0.004	0.011	0.012	0.008	0.063
Nov	130	0.004	0.010	0.014	0.010	0.065
Dec	105	0.004	0.009	0.015	0.012	0.070

Concentrations at V8

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	380	0.0020	0.0072	0.0047	0.0039	0.0196
Feb	284	0.0021	0.0070	0.0052	0.0043	0.0213
Mar	296	0.0022	0.0069	0.0058	0.0048	0.0236
Apr	543	0.0021	0.0072	0.0049	0.0040	0.0202
May	4356	0.0017	0.0077	0.0026	0.0021	0.0122
Jun	4500	0.0017	0.0076	0.0027	0.0022	0.0125
Jul	3152	0.0017	0.0076	0.0028	0.0023	0.0129
Aug	2207	0.0017	0.0076	0.0029	0.0023	0.0129
Sep	2952	0.0017	0.0076	0.0027	0.0022	0.0125
Oct	1553	0.0018	0.0075	0.0029	0.0024	0.0132
Nov	728	0.0019	0.0074	0.0037	0.0030	0.0158
Dec	549	0.0019	0.0073	0.0042	0.0034	0.0176

VG01 - Backfill Vangorda Pit
Loading Future 2

Concentrations at V27

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	87	0.004	0.009	0.017	0.012	0.086
Feb	73	0.004	0.009	0.017	0.013	0.086
Mar	85	0.004	0.008	0.018	0.014	0.089
Apr	121	0.004	0.009	0.018	0.013	0.091
May	463	0.004	0.012	0.013	0.008	0.085
Jun	525	0.004	0.012	0.013	0.008	0.082
Jul	392	0.004	0.012	0.013	0.008	0.081
Aug	284	0.004	0.012	0.013	0.008	0.079
Sep	344	0.004	0.012	0.013	0.008	0.081
Oct	212	0.004	0.011	0.013	0.008	0.078
Nov	130	0.004	0.010	0.015	0.010	0.081
Dec	105	0.004	0.009	0.017	0.012	0.088

Concentrations at V8

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	380	0.0020	0.0072	0.0050	0.0039	0.0236
Feb	284	0.0021	0.0070	0.0056	0.0043	0.0260
Mar	296	0.0022	0.0069	0.0062	0.0048	0.0289
Apr	543	0.0021	0.0072	0.0052	0.0040	0.0245
May	4356	0.0017	0.0077	0.0028	0.0021	0.0139
Jun	4500	0.0017	0.0076	0.0029	0.0022	0.0143
Jul	3152	0.0017	0.0076	0.0030	0.0023	0.0148
Aug	2207	0.0017	0.0076	0.0030	0.0023	0.0149
Sep	2952	0.0017	0.0076	0.0029	0.0022	0.0143
Oct	1553	0.0018	0.0075	0.0031	0.0024	0.0153
Nov	728	0.0019	0.0074	0.0039	0.0030	0.0187
Dec	549	0.0019	0.0073	0.0044	0.0034	0.0210

VG01 - Backfill Vangorda Pit

Loading Future 3

Concentrations at V27

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	87	0.006	0.177	0.051	0.012	7.640
Feb	73	0.006	0.180	0.052	0.013	7.777
Mar	85	0.006	0.188	0.055	0.013	8.173
Apr	121	0.006	0.189	0.055	0.013	8.194
May	463	0.005	0.145	0.040	0.009	6.019
Jun	525	0.005	0.142	0.039	0.009	5.909
Jul	392	0.005	0.143	0.040	0.009	5.977
Aug	284	0.005	0.141	0.039	0.009	5.883
Sep	344	0.005	0.141	0.039	0.009	5.882
Oct	212	0.005	0.140	0.039	0.009	5.852
Nov	130	0.005	0.156	0.045	0.011	6.647
Dec	105	0.006	0.175	0.051	0.012	7.547

Concentrations at V8

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	380	0.0024	0.0454	0.0128	0.0039	1.7439
Feb	284	0.0025	0.0511	0.0146	0.0043	2.0082
Mar	296	0.0027	0.0583	0.0168	0.0048	2.3417
Apr	543	0.0024	0.0474	0.0134	0.0040	1.8323
May	4356	0.0019	0.0218	0.0056	0.0023	0.6453
Jun	4500	0.0019	0.0228	0.0059	0.0023	0.6947
Jul	3152	0.0019	0.0240	0.0063	0.0024	0.7482
Aug	2207	0.0019	0.0243	0.0064	0.0024	0.7626
Sep	2952	0.0019	0.0227	0.0059	0.0023	0.6894
Oct	1553	0.0019	0.0251	0.0066	0.0025	0.8014
Nov	728	0.0021	0.0334	0.0092	0.0030	1.1893
Dec	549	0.0023	0.0391	0.0109	0.0035	1.4494

VG02 - Stabilize in Place
Concentrations Estimates for Vangorda Creek Catchments

Loadings: Future 1

	As	Cu	Ni	Pb	Zn
Bkgd	0.0037	0.002	0.0039	0.0037	0.0137
CCME	0.005	0.002	0.025	0.001	0.03

Concentrations at V27

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	137	0.005	0.008	0.023	0.021	0.239
Feb	120	0.005	0.008	0.024	0.022	0.243
Mar	131	0.005	0.008	0.024	0.022	0.274
Apr	145	0.005	0.009	0.023	0.020	0.321
May	428	0.003	0.012	0.014	0.010	0.167
Jun	434	0.004	0.013	0.014	0.010	0.195
Jul	339	0.004	0.012	0.015	0.012	0.206
Aug	271	0.004	0.011	0.017	0.013	0.193
Sep	322	0.004	0.012	0.015	0.012	0.177
Oct	223	0.004	0.010	0.018	0.015	0.187
Nov	159	0.005	0.009	0.021	0.019	0.231
Dec	149	0.005	0.009	0.022	0.020	0.245

Concentrations at V8

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	430	0.0025	0.0073	0.0085	0.0077	0.1039
Feb	331	0.0026	0.0072	0.0097	0.0088	0.1199
Mar	342	0.0027	0.0073	0.0102	0.0093	0.1423
Apr	566	0.0023	0.0077	0.0070	0.0062	0.1140
May	4313	0.0017	0.0077	0.0028	0.0024	0.0259
Jun	4401	0.0017	0.0077	0.0028	0.0023	0.0296
Jul	3093	0.0017	0.0076	0.0031	0.0026	0.0340
Aug	2189	0.0018	0.0076	0.0034	0.0029	0.0354
Sep	2925	0.0017	0.0076	0.0031	0.0026	0.0295
Oct	1562	0.0018	0.0075	0.0039	0.0034	0.0387
Nov	756	0.0021	0.0074	0.0057	0.0050	0.0678
Dec	592	0.0022	0.0075	0.0068	0.0061	0.0852

VG02 - Stabilize in Place
Loadings: Future 2

Concentrations at V27

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	137	0.005	0.016	0.024	0.021	0.485
Feb	120	0.005	0.016	0.025	0.022	0.495
Mar	131	0.005	0.018	0.026	0.022	0.566
Apr	145	0.005	0.021	0.024	0.020	0.675
May	428	0.003	0.017	0.015	0.011	0.310
Jun	434	0.004	0.019	0.015	0.010	0.375
Jul	339	0.004	0.018	0.016	0.012	0.401
Aug	271	0.004	0.017	0.017	0.013	0.372
Sep	322	0.004	0.017	0.016	0.012	0.333
Oct	223	0.004	0.016	0.019	0.015	0.358
Nov	159	0.005	0.017	0.022	0.019	0.465
Dec	149	0.005	0.017	0.023	0.020	0.497

Concentrations at V8

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	430	0.0025	0.0110	0.0090	0.0078	0.2149
Feb	331	0.0026	0.0116	0.0102	0.0089	0.2496
Mar	342	0.0027	0.0126	0.0109	0.0093	0.3009
Apr	566	0.0023	0.0120	0.0076	0.0062	0.2427
May	4313	0.0017	0.0084	0.0029	0.0024	0.0460
Jun	4401	0.0017	0.0085	0.0029	0.0023	0.0548
Jul	3093	0.0017	0.0086	0.0032	0.0026	0.0643
Aug	2189	0.0018	0.0086	0.0035	0.0029	0.0668
Sep	2925	0.0017	0.0084	0.0032	0.0026	0.0539
Oct	1562	0.0018	0.0086	0.0040	0.0034	0.0735
Nov	756	0.0021	0.0097	0.0060	0.0051	0.1374
Dec	592	0.0022	0.0105	0.0072	0.0061	0.1754

VG02 - Stabilize in Place

Loadings: Future 3

Concentrations at V27

	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	137	0.005	0.033	0.027	0.022	1.231
Feb	120	0.005	0.034	0.028	0.022	1.258
Mar	131	0.005	0.038	0.029	0.022	1.454
Apr	145	0.005	0.046	0.028	0.020	1.751
May	428	0.003	0.027	0.016	0.011	0.743
Jun	434	0.004	0.031	0.017	0.010	0.922
Jul	339	0.004	0.032	0.018	0.012	0.993
Aug	271	0.004	0.030	0.019	0.014	0.917
Sep	322	0.004	0.028	0.018	0.012	0.807
Oct	223	0.004	0.028	0.021	0.015	0.879
Nov	159	0.005	0.033	0.025	0.019	1.173
Dec	149	0.005	0.035	0.026	0.020	1.263

Concentrations at V8

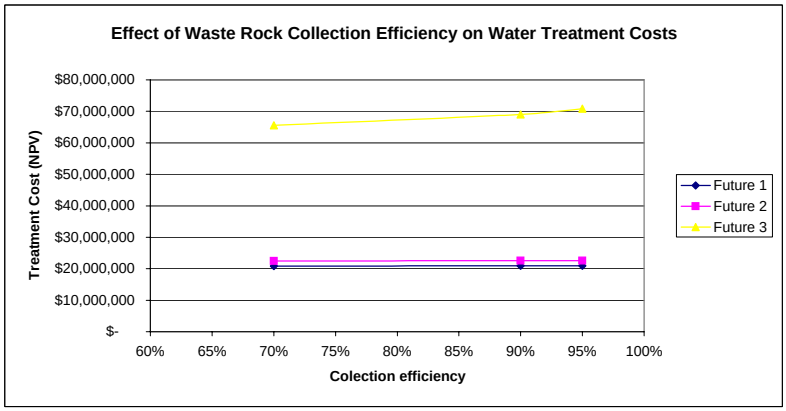
	Flow (x1000 m3)	As mg/L	Cu mg/L	Ni mg/L	Pb mg/L	Zn mg/L
Jan	430	0.0025	0.0168	0.0098	0.0078	0.4623
Feb	331	0.0026	0.0183	0.0112	0.0090	0.5386
Mar	342	0.0027	0.0209	0.0121	0.0094	0.6545
Apr	566	0.0023	0.0187	0.0086	0.0063	0.5294
May	4313	0.0017	0.0094	0.0031	0.0024	0.0907
Jun	4401	0.0017	0.0098	0.0031	0.0024	0.1109
Jul	3093	0.0017	0.0102	0.0034	0.0026	0.1319
Aug	2189	0.0018	0.0102	0.0038	0.0030	0.1368
Sep	2925	0.0017	0.0097	0.0034	0.0026	0.1081
Oct	1562	0.0018	0.0104	0.0043	0.0034	0.1508
Nov	756	0.0021	0.0133	0.0065	0.0051	0.2924
Dec	592	0.0022	0.0152	0.0079	0.0062	0.3762

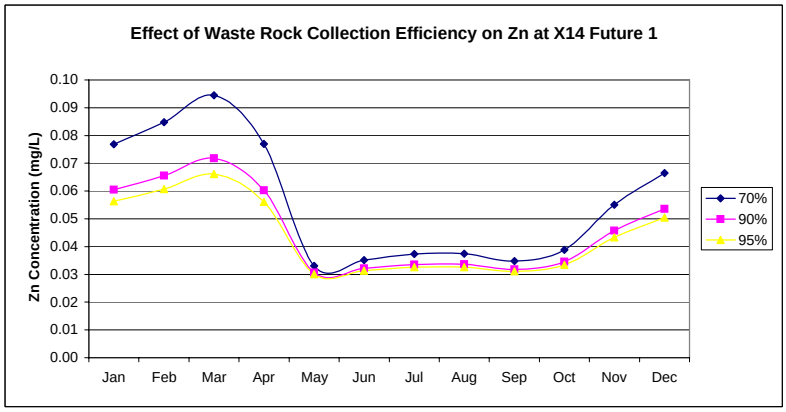
Attachment C

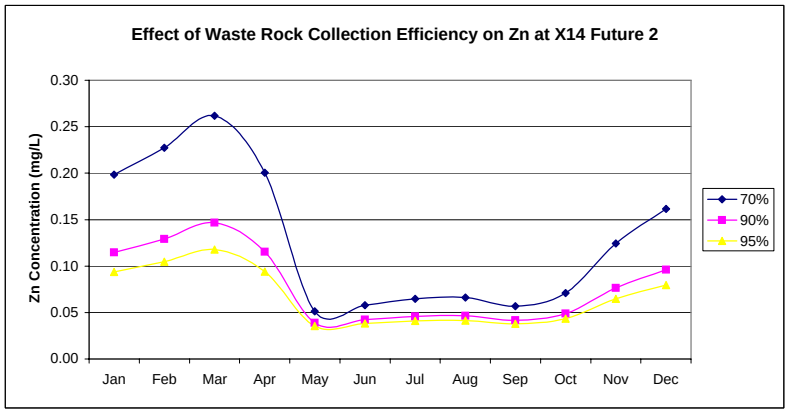
Water and Load Balance Calculations – Sensitivity Analyses

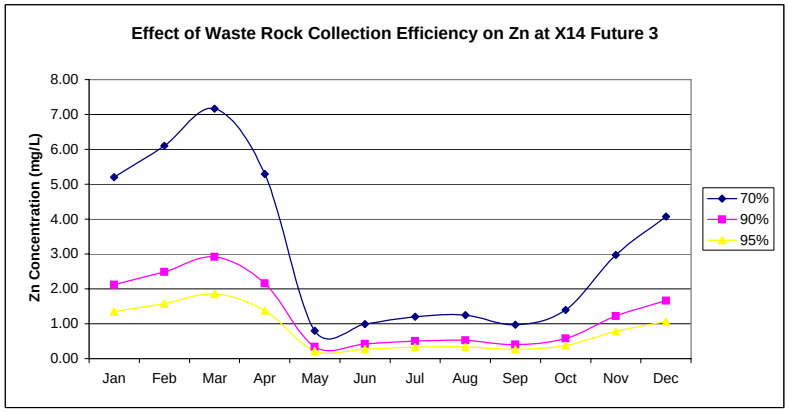
Sensitivity Runs

	Run	Base Case	Capture Eff % WR	ETA	TAILS	Cover % Infil Rudimentary	Low Infil	Load Incr % Rudiment	Low Infiltr	Source	Maximum Zinc at X14 (mg/L)	Water Treatment Cost (NPV)
Mining Area	**Base**	FM02	90	98	n/a	20	5	0	0	F2	0.15	$22,539,000
	SF01	FM02	**70**	98	n/a	20	5	0	0	F2	0.26	$22,419,000
	SF02	FM02	**95**	98	n/a	20	5	0	0	F2	0.12	$22,607,000
	SF03	FM02	90	**90**	n/a	20	5	0	0	F2	0.38	$22,348,000
	SF04	FM02	90	**99**	n/a	20	5	0	0	F2	0.12	$22,605,000
	SF05	FM02	90	98	n/a	**15**	**3**	0	0	F2	0.11	$21,850,000
	SF06	FM02	90	98	n/a	**25**	**8**	0	0	F2	0.18	$23,344,000
	SF07	FM02	90	98	n/a	**15**	5	0	0	F2	0.12	$22,087,000
	SF08	FM02	90	98	n/a	**25**	5	0	0	F2	0.17	$23,019,000
	SF09	FM02	90	98	n/a	20	**3**	0	0	F2	0.14	$22,328,000
	SF10	FM02	90	98	n/a	20	**8**	0	0	F2	0.16	$22,816,000
	SF11	FM02	90	98	n/a	20	5	**50**	**100**	F2	0.22	$24,065,000
	SF12	FM02	90	98	n/a	20	5	**50**	0	F2	0.20	$23,515,000
	SF13	FM02	90	98	n/a	20	5	0	**100**	F2	0.17	$22,987,000
Tailings Area	**Base**	RCT01	n/a	n/a	98	10	n/a	n/a	n/a	F2	0.33	$45,824,000
	SF15	RCT01	n/a	n/a	**97**	10	n/a	n/a	n/a	F2	0.49	$45,514,000
	SF16	RCT01	n/a	n/a	**99**	10	n/a	n/a	n/a	F2	0.19	$46,159,000
	SF17	RCT01	n/a	n/a	98	**20**	n/a	n/a	n/a	F2	0.64	$36,720,000
	SF18	RCT01	n/a	n/a	98	**5**	n/a	n/a	n/a	F2	0.19	$59,312,000

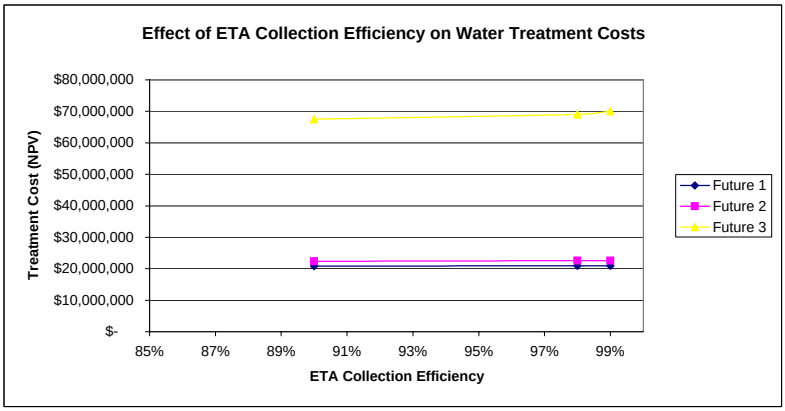

Effect of Waste Rock Collection Efficiency on Water Treatment Costs
Treatment Cost (NPV)
$80,000,000
$70,000,000
$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
$-
60%
65%
70%
75%
80%
85%
90%
95%
100%
Colection efficiency
Future 1
Future 2
Future 3

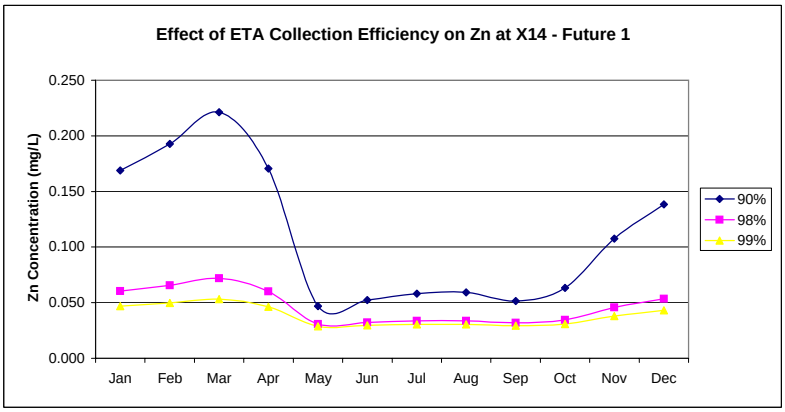

Effect of Waste Rock Collection Efficiency on Zn at X14 Future 1
Zn Concentration (mg/L)
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
70%
90%
95%

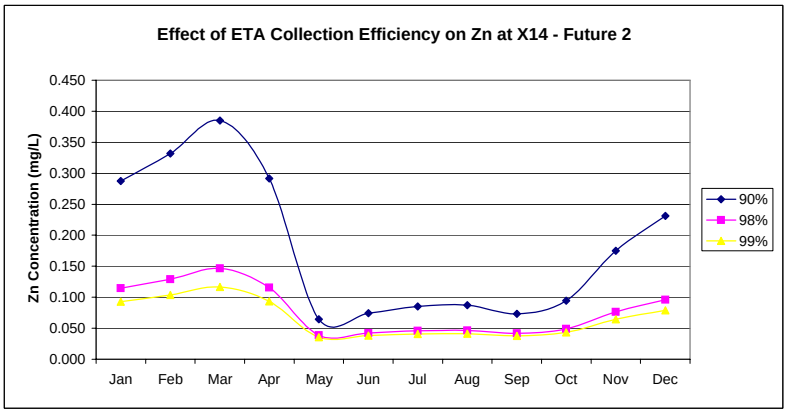

Effect of Waste Rock Collection Efficiency on Zn at X14 Future 2
Zn Concentration (mg/L)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
70%
90%
95%

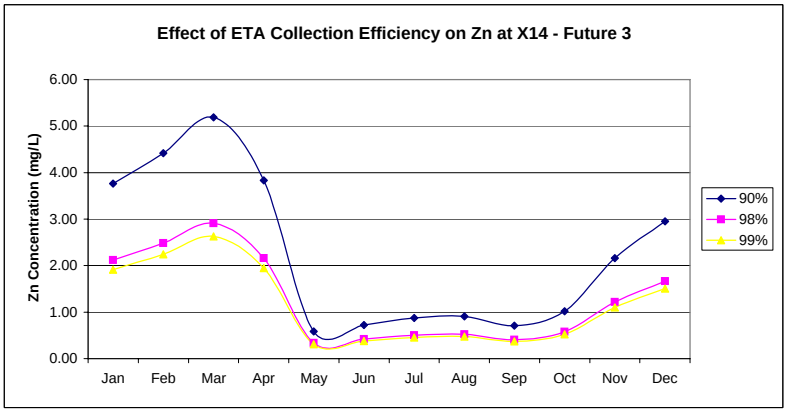

Effect of Waste Rock Collection Efficiency on Zn at X14 Future 3
Zn Concentration (mg/L)
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
70%
90%
95%

		70%	90%	95%						
Run		**SF01**	**FM02**	**SF02**	**SF01**	**FM02**	**SF02**	**SF01**	**FM02**	**SF02**
Description		SF01 WR 70%	SF01 WR 90%	SF02 WR 95 %	SF01 WR 70%	SF01 WR 90%	SF02 WR 95 %	SF01 WR 70%	SF01 WR 90%	SF02 WR 95 %
Source		Future 1	**Future 1**	Future 1	Future 2	**Future 2**	Future 2	Future 3	**Future 3**	Future 3
Operating	days/year	365	365	365	365	365	365	365	365	365
Design Flow	m3/s	0.125	0.126	0.127	0.125	0.126	0.127	0.125	0.126	0.127
Surge Capacity Required	m3	322,000	326,000	327,000	322,000	326,000	327,000	322,000	326,000	327,000
Annual Treatment	m3	2,014,000	2,037,000	2,042,000	2,014,000	2,037,000	2,042,000	2,014,000	2,037,000	2,042,000
Reagents	tonne/year	75	74	76	162	163	166	3,006	3,232	3,342
	g/L	0.037	0.036	0.037	0.080	0.080	0.081	1.493	1.587	1.637
Sludge Production	m3/year	1,266	1,281	1,298	2,166	2,205	2,242	37,070	40,767	42,599
	m3/year	394	399	404	675	687	698	11,546	12,698	13,268
Costs										
Capital Cost		$ 3,504,000	$ 3,519,000	$ 3,526,000	$ 3,570,000	$ 3,590,000	$ 3,592,000	$ 4,786,000	$ 4,880,000	$ 4,923,000
Operating Cost		$ 522,000	$ 525,000	$ 525,000	$ 567,000	$ 570,000	$ 572,000	$ 1,829,000	$ 1,931,000	$ 1,982,000
	$/m3	0.26	0.26	0.26	0.28	0.28	0.28	0.91	0.95	0.97
Net Present Value										
Discount Rate		3%	3%	3%	3%	3%	3%	3%	3%	3%
Capital Costs		$ 3,504,000	$ 3,519,000	$ 3,526,000	$ 3,570,000	$ 3,590,000	$ 3,592,000	$ 4,786,000	$ 4,880,000	$ 4,923,000
NPV Annual Operating Costs		$ 17,353,000	$ 17,453,000	$ 17,453,000	$ 18,849,000	$ 18,949,000	$ 19,015,000	$ 60,802,000	$ 64,192,000	$ 65,888,000
Total NPV		**$ 20,857,000**	**$ 20,972,000**	**$ 20,979,000**	**$ 22,419,000**	**$ 22,539,000**	**$ 22,607,000**	**$ 65,588,000**	**$ 69,072,000**	**$ 70,811,000**


Effect of ETA Collection Efficiency on Water Treatment Costs
Treatment Cost (NPV)
$80,000,000
$70,000,000
$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
$-
85%
87%
89%
91%
93%
95%
97%
99%
ETA Collection Efficiency
Future 1
Future 2
Future 3


Effect of ETA Collection Efficiency on Zn at X14 - Future 1
Zn Concentration (mg/L)
0.250
0.200
0.150
0.100
0.050
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
90%
98%
99%

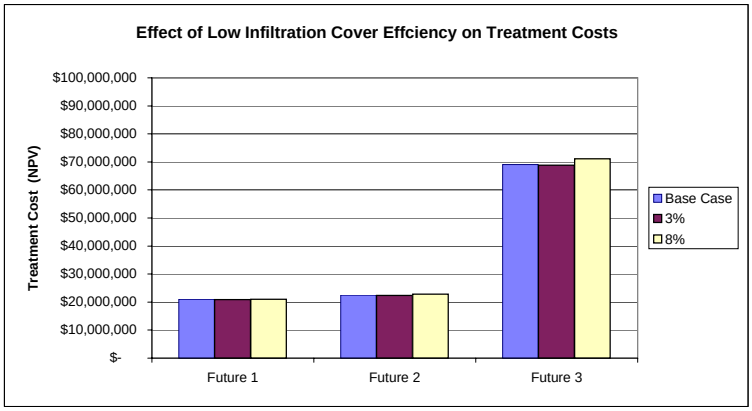

Effect of ETA Collection Efficiency on Zn at X14 - Future 2
Zn Concentration (mg/L)
0.450
0.400
0.350
0.300
0.250
0.200
0.150
0.100
0.050
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
90%
98%
99%

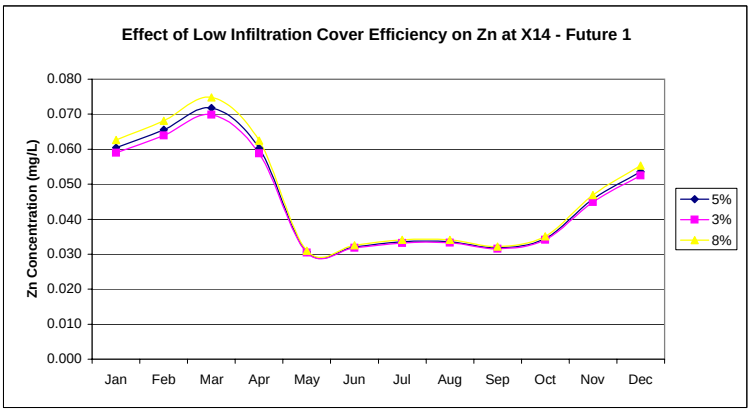

Effect of ETA Collection Efficiency on Zn at X14 - Future 3
Zn Concentration (mg/L)
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
90%
98%
99%

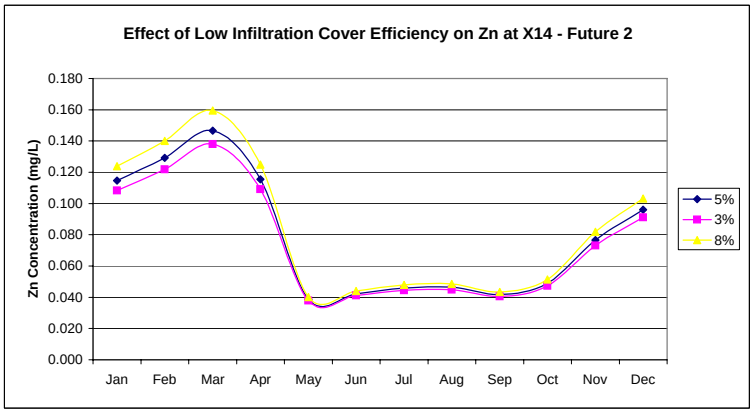
Run		SF03	FM02	SF04
Description		SF03 ETA 90 %	**ETA 98 %**	SF04 ETA 99%
Source		Future 1	Future 1	Future 1
Operating	days/year	365	365	365
Design Flow	m3/s	0.125	0.126	0.126
Surge Capacity Required	m3	323,000	326,000	326,000
Annual Treatment	m3	2,016,000	2,037,000	2,039,000
Reagents	tonne/year	72	74	76
	g/L	0.035	0.036	0.037
Sludge Production	m3/year	1,251	1,281	1,297
	m3/year	390	399	404
Costs				
Capital Cost		$ 3,499,000	$ 3,519,000	$ 3,524,000
Operating Cost		$ 521,000	$ 525,000	$ 525,000
	$/m3	0.26	0.26	0.26
Net Present Value				
Discount Rate		3%	3%	3%
Capital Costs		$ 3,499,000	$ 3,519,000	$ 3,524,000
NPV Annual Operating Costs		$ 17,320,000	$ 17,453,000	$ 17,453,000
Total NPV		**$ 20,819,000**	**$ 20,972,000**	**$ 20,977,000**

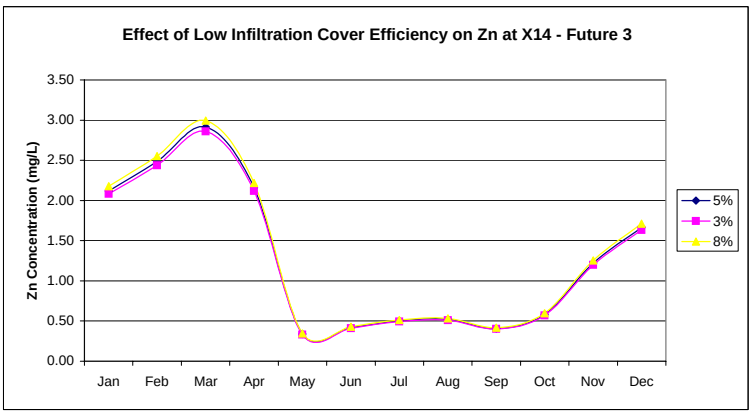
Run		SF03	FM02	SF04
Description		SF03 ETA 90 %	**ETA 98 %**	SF04 ETA 99%
Source		Future 2	Future 2	Future 2
Operating	days/year	365	365	365
Design Flow	m3/s	0.125	0.126	0.126
Surge Capacity Required	m3	323,000	326,000	326,000
Annual Treatment	m3	2,016,000	2,037,000	2,039,000
Reagents	tonne/year	158	163	166
	g/L	0.078	0.080	0.081
Sludge Production	m3/year	2,146	2,205	2,237
	m3/year	668	687	697
Costs				
Capital Cost		$ 3,566,000	$ 3,590,000	$ 3,590,000
Operating Cost		$ 565,000	$ 570,000	$ 572,000
	$/m3	0.28	0.28	0.28
Net Present Value				
Discount Rate		3%	3%	3%
Capital Costs		$ 3,566,000	$ 3,590,000	$ 3,590,000
NPV Annual Operating Costs		$ 18,782,000	$ 18,949,000	$ 19,015,000
Total NPV		**$ 22,348,000**	**$ 22,539,000**	**$ 22,605,000**

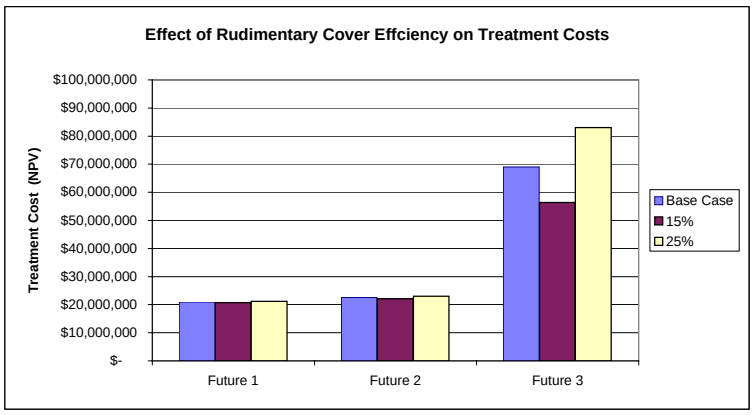
Run		SF03	FM02	SF04
Description		SF03 ETA 90 %	**ETA 98 %**	SF04 ETA 99%
Source		Future 3	Future 3	Future 3
Operating	days/year	365	365	365
Design Flow	m3/s	0.125	0.126	0.126
Surge Capacity Required	m3	323,000	326,000	326,000
Annual Treatment	m3	2,016,000	2,037,000	2,039,000
Reagents	tonne/year	3,129	3,232	3,293
	g/L	1.552	1.587	1.615
Sludge Production	m3/year	39,150	40,767	41,786
	m3/year	12,194	12,698	13,015
Costs				
Capital Cost		$ 4,825,000	$ 4,880,000	$ 4,907,000
Operating Cost		$ 1,884,000	$ 1,931,000	$ 1,959,000
	$/m3	0.93	0.95	0.96
Net Present Value				
Discount Rate		3%	3%	3%
Capital Costs		$ 4,825,000	$ 4,880,000	$ 4,907,000
NPV Annual Operating Costs		$ 62,630,000	$ 64,192,000	$ 65,123,000
Total NPV		**$ 67,455,000**	**$ 69,072,000**	**$ 70,030,000**

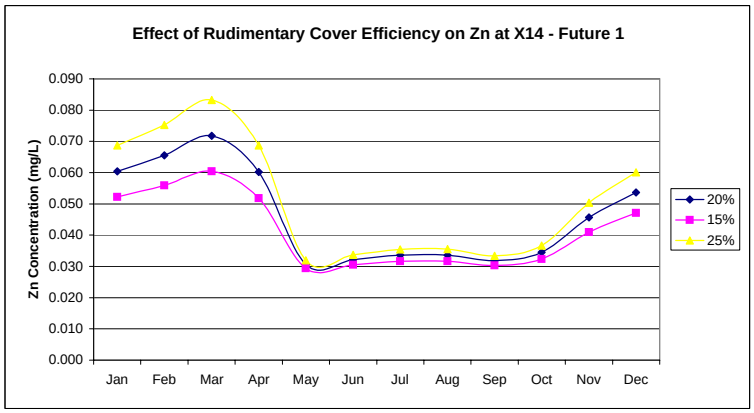

Effect of Low Infiltration Cover Effciency on Treatment Costs
Treatment Cost (NPV)
$100,000,000
$90,000,000
$80,000,000
$70,000,000
$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
$-
Future 1
Future 2
Future 3
Base Case
3%
8%

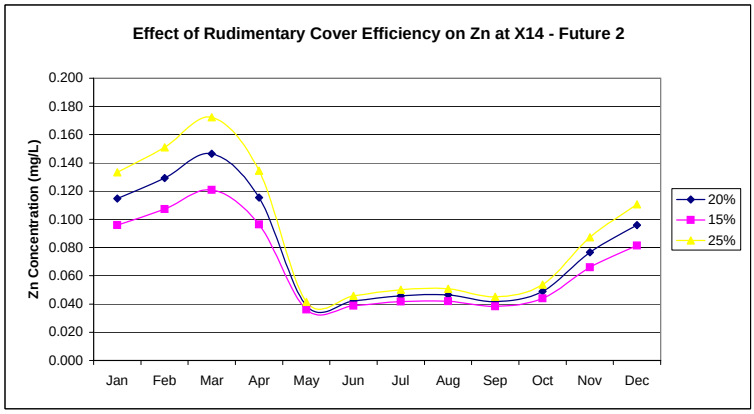

Effect of Low Infiltration Cover Efficiency on Zn at X14 - Future 1
Zn Concentration (mg/L)
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
5%
3%
8%

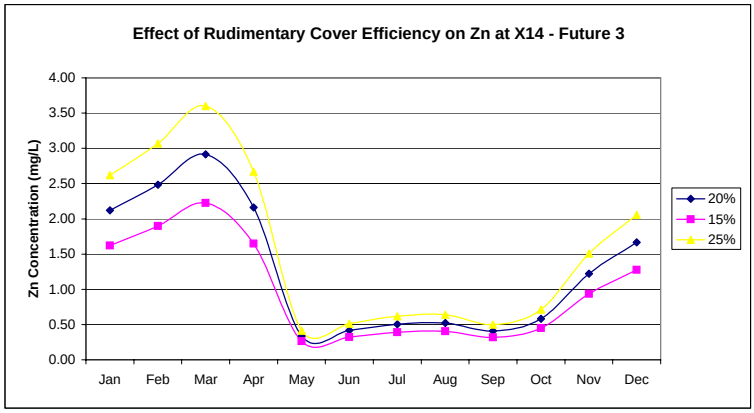

Effect of Low Infiltration Cover Efficiency on Zn at X14 - Future 2
Zn Concentration (mg/L)
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
5%
3%
8%

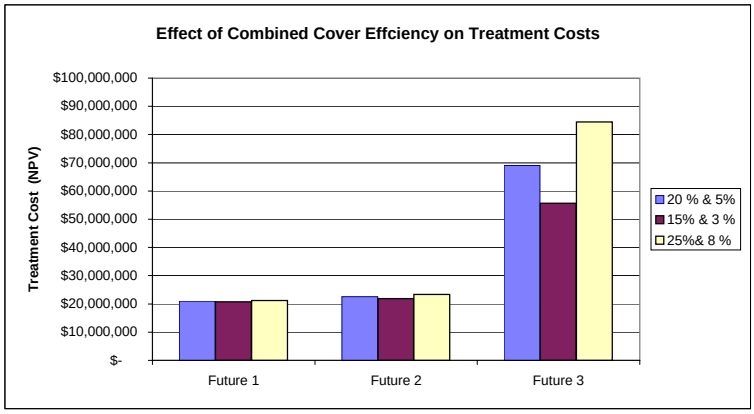

Effect of Low Infiltration Cover Efficiency on Zn at X14 - Future 3
Zn Concentration (mg/L)
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
5%
3%
8%

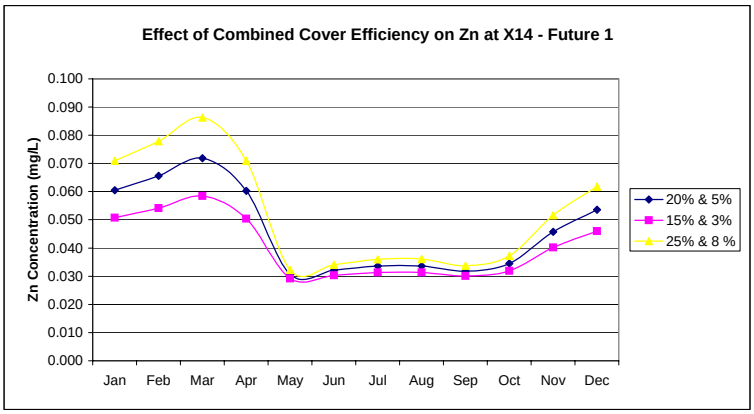

Effect of Rudimentary Cover Effciency on Treatment Costs
Treatment Cost (NPV)
$100,000,000
$90,000,000
$80,000,000
$70,000,000
$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
$-
Future 1
Future 2
Future 3
Base Case
15%
25%

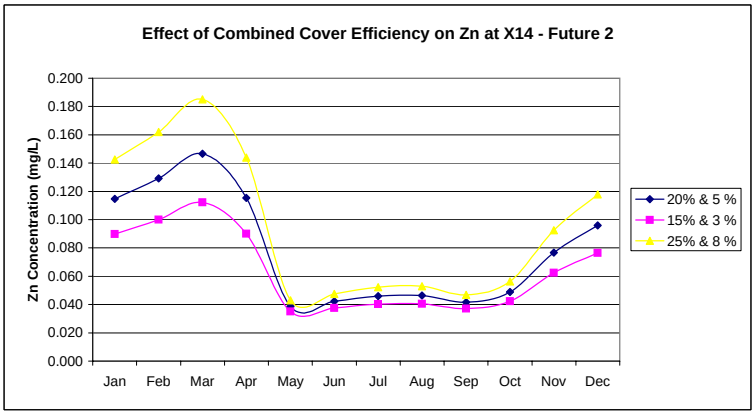

Effect of Rudimentary Cover Efficiency on Zn at X14 - Future 1
Zn Concentration (mg/L)
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
20%
15%
25%

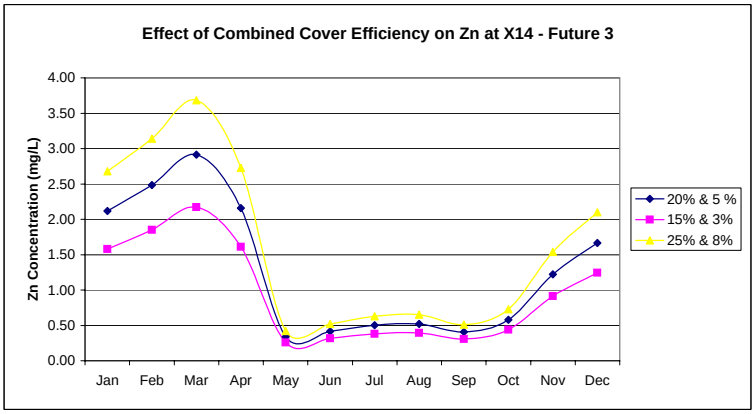

Effect of Rudimentary Cover Efficiency on Zn at X14 - Future 2
Zn Concentration (mg/L)
0.200
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
20%
15%
25%


Effect of Rudimentary Cover Efficiency on Zn at X14 - Future 3
Zn Concentration (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
20%
15%
25%


Effect of Combined Cover Effciency on Treatment Costs
Treatment Cost (NPV)
$100,000,000
$90,000,000
$80,000,000
$70,000,000
$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
$-
Future 1
Future 2
Future 3
20 % & 5%
15% & 3 %
25%& 8 %


Effect of Combined Cover Efficiency on Zn at X14 - Future 1
Zn Concentration (mg/L)
0.100
0.090
0.080
0.070
0.060
0.050
0.040
0.030
0.020
0.010
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
20% & 5%
15% & 3%
25% & 8 %

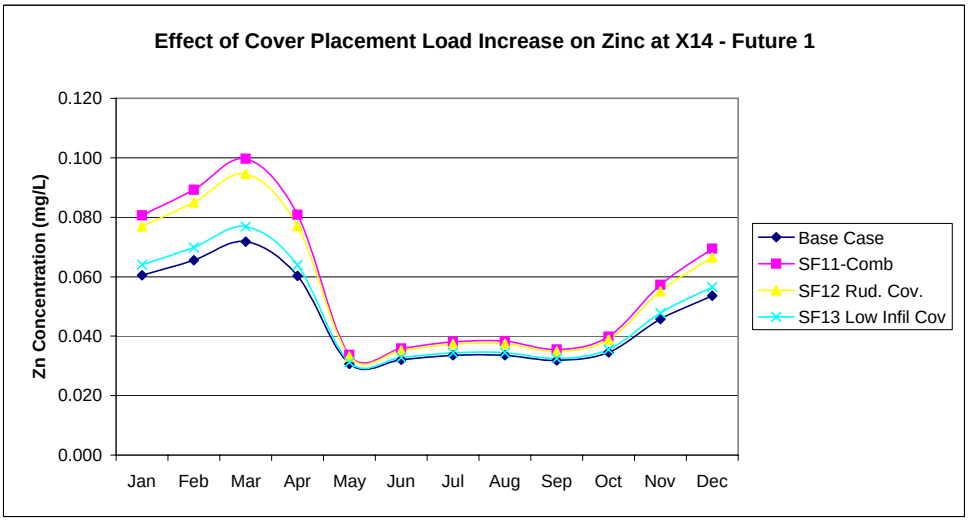

Effect of Combined Cover Efficiency on Zn at X14 - Future 2
Zn Concentration (mg/L)
0.200
0.180
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
20% & 5 %
15% & 3 %
25% & 8 %

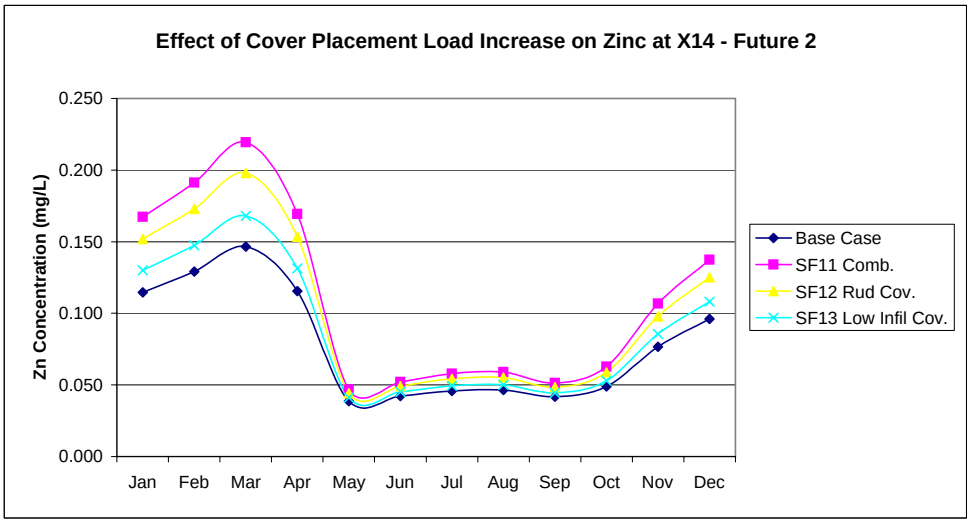

Effect of Combined Cover Efficiency on Zn at X14 - Future 3
Zn Concentration (mg/L)
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
20% & 5 %
15% & 3%
25% & 8%

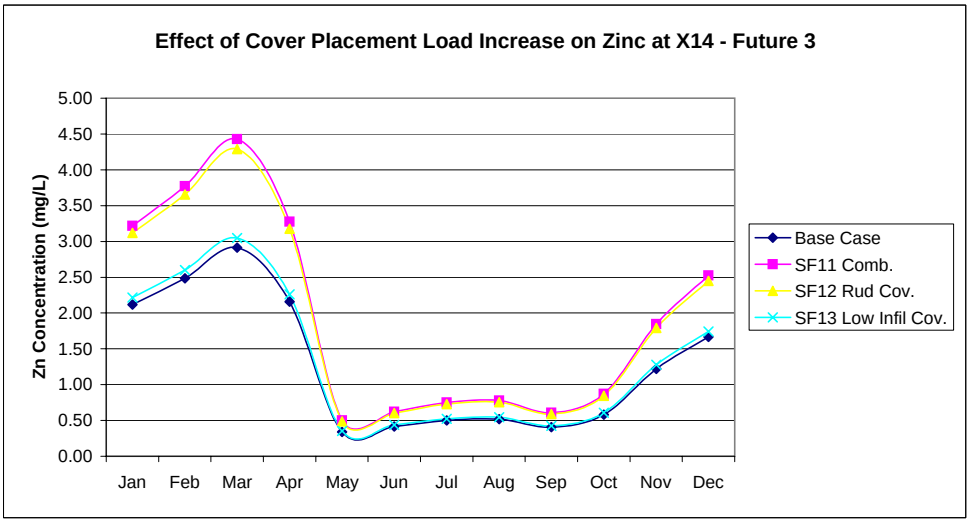
Site Description		FM02 Future 1	FM02 Future 2	FM02 Future 3	SF05 15 % and 3 % Future 1	SF05 15 % and 3 % Future 2	SF05 15 % and 3 % Future 3
Operating	days/year	365	365	365	365	365	365
Design Flow	m3/s	0.126	0.126	0.126	0.126	0.126	0.126
Surge Capacity Required	m3	326,000	326,000	326,000	326,000	326,000	326,000
Annual Treatment	m3	2,037,000	2,037,000	2,037,000	2,037,000	2,037,000	2,037,000
Reagents	tonne/year	74	163	3,232	61	127	2,332
	g/L	0.036	0.080	1.587	0.030	0.062	1.145
Sludge Production	m3/year	1,281	2,205	40,767	1,102	1,787	25,178
	m3/year	399	687	12,698	343	557	7,842
Costs							
Capital Cost		$ 3,519,000	$ 3,590,000	$ 4,880,000	$ 3,505,000	$ 3,566,000	$ 4,551,000
Operating Cost		$ 525,000	$ 570,000	$ 1,931,000	$ 517,000	$ 550,000	$ 1,537,000
	$/m3	0.26	0.28	0.95	0.25	0.27	0.75
Net Present Value							
Discount Rate		3%	3%	3%	3%	3%	3%
Capital Costs		$ 3,519,000	$ 3,590,000	$ 4,880,000	$ 3,505,000	$ 3,566,000	$ 4,551,000
NPV Annual Operating Costs		$ 17,453,000	$ 18,949,000	$ 64,192,000	$ 17,187,000	$ 18,284,000	$ 51,095,000
Total NPV		**$ 20,972,000**	**$ 22,539,000**	**$ 69,072,000**	**$ 20,692,000**	**$ 21,850,000**	**$ 55,646,000**
Cost Increase / (Decrease) on Base Case					$ (280,000)	$ (689,000)	$ (13,426,000)

Site Description		SF06 25 % and 8 % Future 1	SF06 25 % and 8 % Future 2	SF06 25 % and 8 % Future 3	SF07 15 % and 5 % Future 1	SF07 15 % and 5 % Future 2	SF07 15 % and 5 % Future 3
Operating	days/year	365	365	365	365	365	365
Design Flow	m3/s	0.126	0.126	0.126	0.126	0.126	0.126
Surge Capacity Required	m3	326,000	326,000	326,000	326,000	326,000	326,000
Annual Treatment	m3	2,037,000	2,037,000	2,037,000	2,037,000	2,037,000	2,037,000
Reagents	tonne/year	92	209	4,289	64	139	2,380
	g/L	0.045	0.103	2.105	0.031	0.068	1.168
Sludge Production	m3/year	1,491	2,709	58,952	1,123	1,873	26,005
	m3/year	464	844	18,362	350	583	8,100
Costs							
Capital Cost		$ 3,530,000	$ 3,631,000	$ 5,184,000	$ 3,509,000	$ 3,571,000	$ 4,589,000
Operating Cost		$ 533,000	$ 593,000	$ 2,384,000	$ 517,000	$ 557,000	$ 1,557,000
	$/m3	0.26	0.29	1.17	0.25	0.27	0.76
Net Present Value							
Discount Rate		3%	3%	3%	3%	3%	3%
Capital Costs		$ 3,530,000	$ 3,631,000	$ 5,184,000	$ 3,509,000	$ 3,571,000	$ 4,589,000
NPV Annual Operating Costs		$ 17,719,000	$ 19,713,000	$ 79,252,000	$ 17,187,000	$ 18,516,000	$ 51,759,000
Total NPV		**$ 21,249,000**	**$ 23,344,000**	**$ 84,436,000**	**$ 20,696,000**	**$ 22,087,000**	**$ 56,348,000**
Cost Increase / (Decrease) on Base Case		$ 277,000	$ 805,000	$ 15,364,000	$ (276,000)	$ (452,000)	$ (12,724,000)

Site Description		SF08 25 % and 5 % Future 1	SF08 25 % and 5 % Future 2	SF08 25 % and 5 % Future 3	SF09 20 % and 3 % Future 1	SF09 20 % and 3 % Future 2	SF09 20 % and 3 % Future 3	SF10 20 % and 8 % Future 1	SF10 20 % and 8 % Future 2	SF10 20 % and 8 % Future 3
Operating	days/year	365	365	365	365	365	365	365	365	365
Design Flow	m3/s	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126	0.126
Surge Capacity Required	m3	326,000	326,000	326,000	326,000	326,000	326,000	326,000	326,000	326,000
Annual Treatment	m3	2,037,000	2,037,000	2,037,000	2,037,000	2,037,000	2,037,000	2,037,000	2,037,000	2,037,000
Reagents	tonne/year	87	192	4,199	72	154	3,215	80	183	3,365
	g/L	0.043	0.094	2.061	0.036	0.075	1.578	0.039	0.090	1.652
Sludge Production	m3/year	1,461	2,581	57,426	1,271	2,141	40,476	1,322	2,356	43,019
	m3/year	455	804	17,887	396	667	12,607	412	734	13,399
Costs										
Capital Cost		$ 3,528,000	$ 3,605,000	$ 5,155,000	$ 3,518,000	$ 3,579,000	$ 4,880,000	$ 3,524,000	$ 3,601,000	$ 4,926,000
Operating Cost		$ 531,000	$ 584,000	$ 2,344,000	$ 524,000	$ 564,000	$ 1,924,000	$ 527,000	$ 578,000	$ 1,992,000
	$/m3	0.26	0.29	1.15	0.26	0.28	0.94	0.26	0.28	0.98
Net Present Value										
Discount Rate		3%	3%	3%	3%	3%	3%	3%	3%	3%
Capital Costs		$ 3,528,000	$ 3,605,000	$ 5,155,000	$ 3,518,000	$ 3,579,000	$ 4,880,000	$ 3,524,000	$ 3,601,000	$ 4,926,000
NPV Annual Operating Costs		$ 17,652,000	$ 19,414,000	$ 77,922,000	$ 17,419,000	$ 18,749,000	$ 63,960,000	$ 17,519,000	$ 19,215,000	$ 66,220,000
Total NPV		**$ 21,180,000**	**$ 23,019,000**	**$ 83,077,000**	**$ 20,937,000**	**$ 22,328,000**	**$ 68,840,000**	**$ 21,043,000**	**$ 22,816,000**	**$ 71,146,000**
Cost Increase / (Decrease) on Base Case		$ 208,000	$ 480,000	$ 14,005,000	$ (35,000)	$ (211,000)	$ (232,000)	$ 71,000	$ 277,000	$ 2,074,000


Effect of Cover Placement Load Increase on Zinc at X14 - Future 1
Zn Concentration (mg/L)
0.120
0.100
0.080
0.060
0.040
0.020
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Base Case
SF11-Comb
SF12 Rud. Cov.
SF13 Low Infil Cov


Effect of Cover Placement Load Increase on Zinc at X14 - Future 2
Zn Concentration (mg/L)
0.250
0.200
0.150
0.100
0.050
0.000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Base Case
SF11 Comb.
SF12 Rud Cov.
SF13 Low Infil Cov.


Effect of Cover Placement Load Increase on Zinc at X14 - Future 3
Zn Concentration (mg/L)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Base Case
SF11 Comb.
SF12 Rud Cov.
SF13 Low Infil Cov.

Effect of load increase from cover placement on Water Treatment Costs

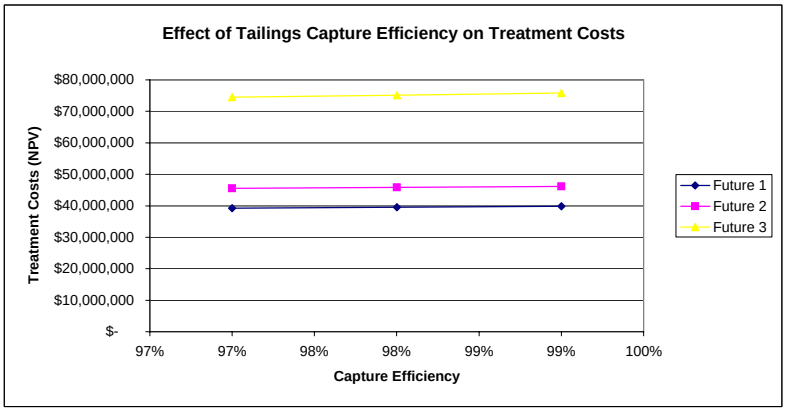
Run		FM02	SF11	SF12	SF13
Description		Base Case	SF11 50 % for Rud; 100 % for Low	SF12 50 % for Rud	SF12 100 % for Low Infiltr.
Source		Future 1	Future 1	Future 1	Future 1
Operating	days/year	365	365	365	365
Design Flow	m3/s	0.126	0.126	0.126	0.126
Surge Capacity Required	m3	326,000	326,000	326,000	326,000
Annual Treatment	m3	2,037,000	2,037,000	2,037,000	2,037,000
0	tonne/year	74	106	99	83
	g/L	0.036	0.052	0.048	0.041
Sludge Production	m3/year	1,281	1,680	1,630	1,342
	m3/year	399	523	508	418
Costs					
Capital Cost		$ 3,519,000	$ 3,547,000	$ 3,542,000	$ 3,526,000
Operating Cost		$ 525,000	$ 541,000	$ 537,000	$ 528,000
	$/m3	0.26	0.27	0.26	0.26
Net Present Value					
Discount Rate		3%	3%	3%	3%
Capital Costs		$ 3,519,000	$ 3,547,000	$ 3,542,000	$ 3,526,000
NPV Annual Operating Costs		$ 17,453,000	$ 17,985,000	$ 17,852,000	$ 17,552,000
Total NPV		**$ 20,972,000**	**$ 21,532,000**	**$ 21,394,000**	**$ 21,078,000**

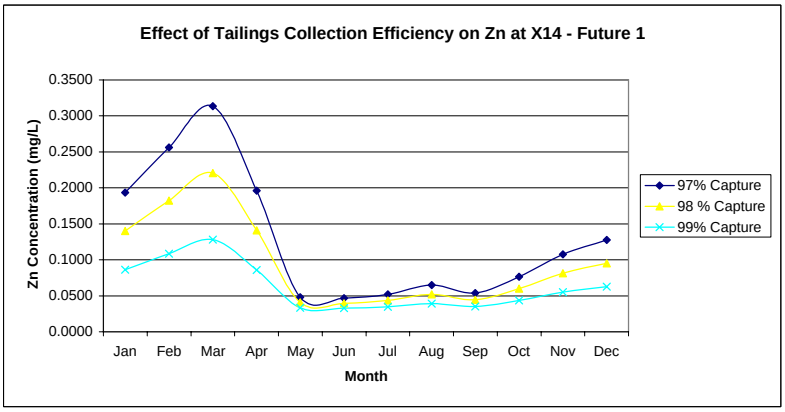
Effect of load increase from cover place

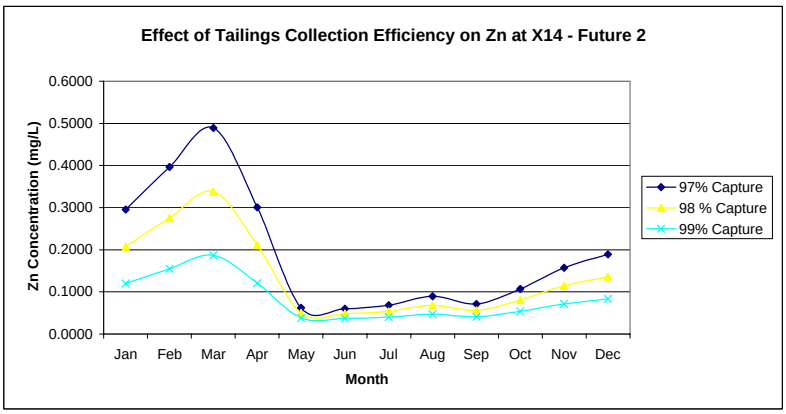
Run		FM02	SF11	SF12	SF13
Description		Base Case	SF11 50 % for Rud; 100 % for Low	SF12 50 % for Rud	SF12 100 % for Low Infiltr.
Source		Future 2	Future 2	Future 2	Future 2
Operating	days/year	365	365	365	365
Design Flow	m3/s	0.126	0.126	0.126	0.126
Surge Capacity Required	m3	326,000	326,000	326,000	326,000
Annual Treatment	m3	2,037,000	2,037,000	2,037,000	2,037,000
0	tonne/year	163	255	222	194
	g/L	0.080	0.125	0.109	0.095
Sludge Production	m3/year	2,205	3,155	2,937	2,441
	m3/year	687	983	915	760
Costs					
Capital Cost		$ 3,590,000	$ 3,654,000	$ 3,636,000	$ 3,606,000
Operating Cost		$ 570,000	$ 614,000	$ 598,000	$ 583,000
	$/m3	0.28	0.30	0.29	0.29
Net Present Value					
Discount Rate		3%	3%	3%	3%
Capital Costs		$ 3,590,000	$ 3,654,000	$ 3,636,000	$ 3,606,000
NPV Annual Operating Costs		$ 18,949,000	$ 20,411,000	$ 19,879,000	$ 19,381,000
Total NPV		**$ 22,539,000**	**$ 24,065,000**	**$ 23,515,000**	**$ 22,987,000**

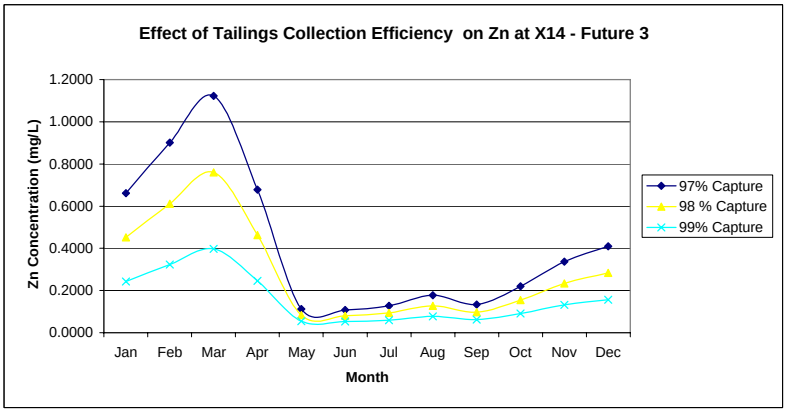
Effect of load increase from cover place

Run		FM02	SF11	SF12	SF13
Description		Base Case	SF11 50 % for Rud; 100 % for Low	SF12 50 % for Rud	SF12 100 % for Low Infiltr.
Source		Future 3	Future 3	Future 3	Future 3
Operating	days/year	365	365	365	365
Design Flow	m3/s	0.126	0.126	0.126	0.126
Surge Capacity Required	m3	326,000	326,000	326,000	326,000
Annual Treatment	m3	2,037,000	2,037,000	2,037,000	2,037,000
0	tonne/year	3,232	5,510	5,151	3,425
	g/L	1.587	2.705	2.529	1.681
Sludge Production	m3/year	40,767	76,073	73,379	44,036
	m3/year	12,698	23,695	22,856	13,716
Costs					
Capital Cost		$ 4,880,000	$ 5,474,000	$ 5,416,000	$ 4,943,000
Operating Cost		$ 1,931,000	$ 2,883,000	$ 2,738,000	$ 2,018,000
	$/m3	0.95	1.42	1.34	0.99
Net Present Value					
Discount Rate		3%	3%	3%	3%
Capital Costs		$ 4,880,000	$ 5,474,000	$ 5,416,000	$ 4,943,000
NPV Annual Operating Costs		$ 64,192,000	$ 95,840,000	$ 91,020,000	$ 67,085,000
Total NPV		**$ 69,072,000**	**$ 101,314,000**	**$ 96,436,000**	**$ 72,028,000**

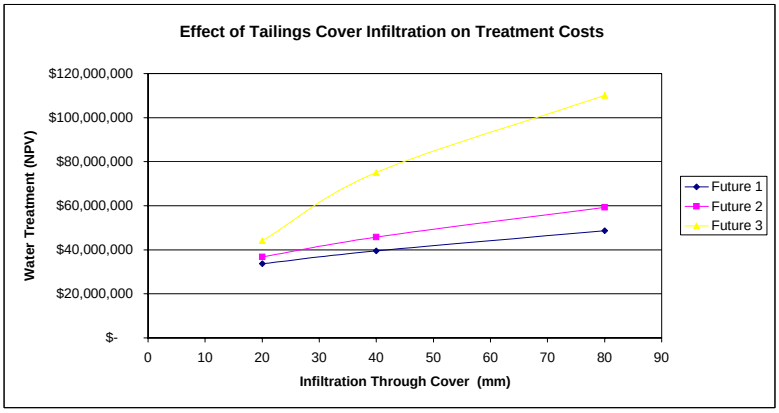

Effect of Tailings Capture Efficiency on Treatment Costs
Treatment Costs (NPV)
$80,000,000
$70,000,000
$60,000,000
$50,000,000
$40,000,000
$30,000,000
$20,000,000
$10,000,000
$-
97%
97%
98%
98%
99%
99%
100%
Capture Efficiency
Future 1
Future 2
Future 3

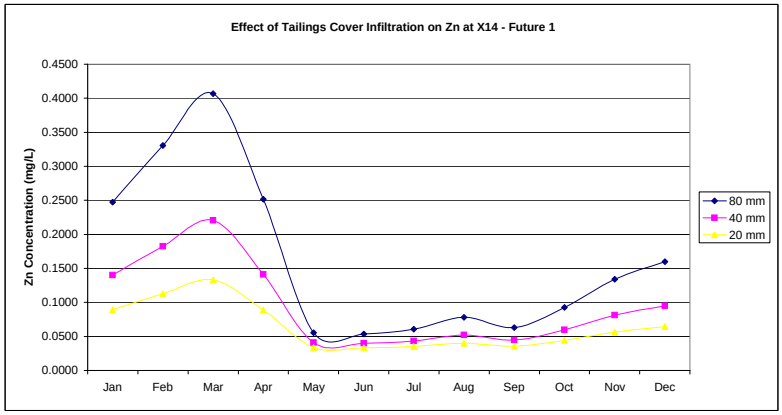

Effect of Tailings Collection Efficiency on Zn at X14 - Future 1
Zn Concentration (mg/L)
0.3500
0.3000
0.2500
0.2000
0.1500
0.1000
0.0500
0.0000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
97% Capture
98 % Capture
99% Capture

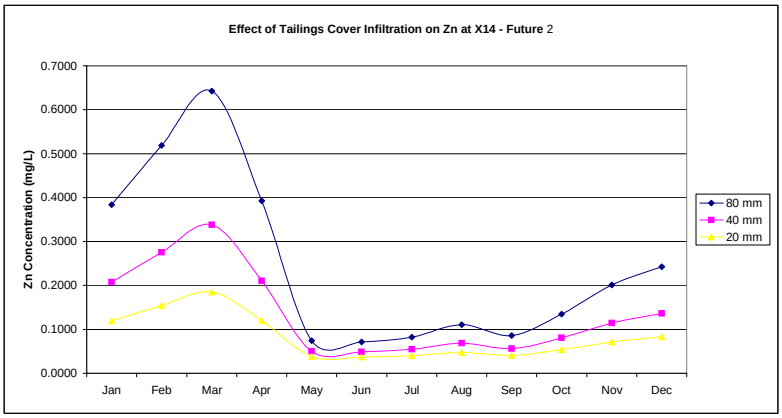

Effect of Tailings Collection Efficiency on Zn at X14 - Future 2
Zn Concentration (mg/L)
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
97% Capture
98 % Capture
99% Capture

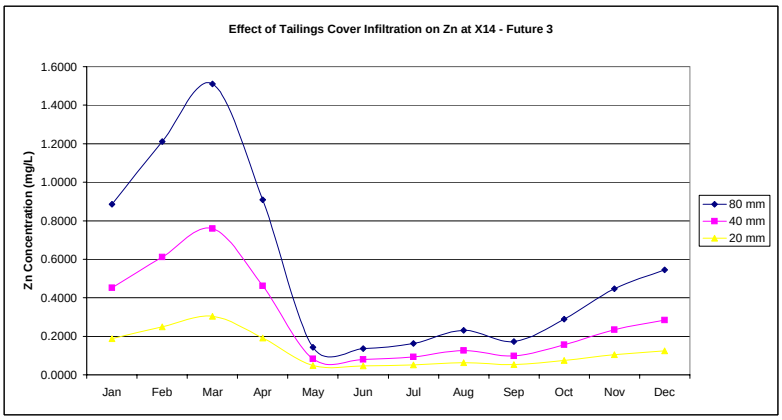

Effect of Tailings Collection Efficiency on Zn at X14 - Future 3
Zn Concentration (mg/L)
1.2000
1.0000
0.8000
0.6000
0.4000
0.2000
0.0000
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
97% Capture
98 % Capture
99% Capture

RUN		**SF15**	**SF15**	**SF15**	**RCT01**	**RCT01**	**RCT01**	**SF16**	**SF16**	**SF16**
Capture	%	97%	98%	99%	97%	98%	99%	97%	98%	99%
Site		Rose Creek Tailings Faro 97%	Rose Creek Tailings Faro 98%	Rose Creek Tailings Faro 99%	Rose Creek Tailings Faro 97%	Rose Creek Tailings Faro 98%	Rose Creek Tailings Faro 99%	Rose Creek Tailings Faro 97%	Rose Creek Tailings Faro 98%	Rose Creek Tailings Faro 99%
Description		Future 1	Future 1	Future 1	Future 2	Future 2	Future 2	Future 3	Future 3	Future 3
Operating	days/year	365	365	365	365	365	365	365	365	365
Design Flow	m3/s	0.266	0.268	0.271	0.266	0.268	0.271	0.266	0.268	0.271
Surge Capacity Required	m3	685,000	692,000	699,000	685,000	692,000	699,000	685,000	692,000	699,000
Annual Treatment	m3	4,282,000	4,326,000	4,370,000	4,282,000	4,326,000	4,370,000	4,282,000	4,326,000	4,370,000
Reagents	tonne/year	644	650	657	1,049	1,060	1,071	2,991	3,022	3,052
	g/L	0.150	0.150	0.150	0.245	0.245	0.245	0.698	0.698	0.698
Sludge Production	m3/year	3,945	3,986	4,027	5,821	5,881	5,941	15,933	16,097	16,261
	m3/year	1,229	1,242	1,254	1,813	1,832	1,851	4,963	5,014	5,065
Costs										
Capital Cost		$ 5,969,000	$ 6,006,000	$ 6,055,000	$ 6,154,000	$ 6,198,000	$ 6,234,000	$ 6,941,000	$ 6,989,000	$ 7,039,000
Operating Cost		$ 1,002,000	$ 1,009,000	$ 1,016,000	$ 1,184,000	$ 1,192,000	$ 1,201,000	$ 2,033,000	$ 2,051,000	$ 2,069,000
	$/m3	0.23	0.23	0.23	0.28	0.28	0.27	0.47	0.47	0.47
Net Present Value										
Discount Rate		3%	3%	3%	3%	3%	3%	3%	3%	3%
Capital Costs		$ 5,969,000	$ 6,006,000	$ 6,055,000	$ 6,154,000	$ 6,198,000	$ 6,234,000	$ 6,941,000	$ 6,989,000	$ 7,039,000
NPV Annual Operating Costs		$ 33,310,000	$ 33,542,000	$ 33,775,000	$ 39,360,000	$ 39,626,000	$ 39,925,000	$ 67,583,000	$ 68,182,000	$ 68,780,000
Total NPV		**$ 39,279,000**	**$ 39,548,000**	**$ 39,830,000**	**$ 45,514,000**	**$ 45,824,000**	**$ 46,159,000**	**$ 74,524,000**	**$ 75,171,000**	**$ 75,819,000**


Effect of Tailings Cover Infiltration on Treatment Costs
$120,000,000
$100,000,000
$80,000,000
$60,000,000
$40,000,000
$20,000,000
$-
Water Treatment (NPV)
0
10
20
30
40
50
60
70
80
90
Infiltration Through Cover (mm)
Future 1
Future 2
Future 3


Effect of Tailings Cover Infiltration on Zn at X14 - Future 1
0.4500
0.4000
0.3500
0.3000
0.2500
0.2000
0.1500
0.1000
0.0500
0.0000
Zn Concentration (mg/L)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
80 mm
40 mm
20 mm


Effect of Tailings Cover Infiltration on Zn at X14 - Future 2
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
Zn Concentration (mg/L)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
80 mm
40 mm
20 mm


Effect of Tailings Cover Infiltration on Zn at X14 - Future 3
1.6000
1.4000
1.2000
1.0000
0.8000
0.6000
0.4000
0.2000
0.0000
Zn Concentration (mg/L)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
80 mm
40 mm
20 mm

		20	40	80						
Description										
Run		**SF18**	**RCT01**	**SF17**	**SF18**	**RCT01**	**SF17**	**SF18**	**RCT01**	**SF17**
		Rose Creek Tailings Faro	Rose Creek Tailings Faro	Rose Creek Tailings Faro	Rose Creek Tailings Faro	Rose Creek Tailings Faro	Rose Creek Tailings Faro	Rose Creek Tailings Faro	Rose Creek Tailings Faro	Rose Creek Tailings Faro
Site		20 mm Infil.	40 mm Infil.	80 mm Infil.	20 mm Infil.	40 mm Infil.	80 mm Infil.	20 mm Infil.	40 mm Infil.	80 mm Infil.
Description		Future 1	Future 1	Future 1	Future 2	Future 2	Future 2	Future 3	Future 3	Future 3
Operating	days/year	365	365	365	365	365	365	365	365	365
Design Flow	m3/s	0.268	0.268	0.268	0.268	0.268	0.268	0.268	0.268	0.268
Surge Capacity Required	m3	692,000	692,000	692,000	692,000	692,000	692,000	692,000	692,000	692,000
Annual Treatment	m3	4,326,000	4,326,000	4,326,000	4,326,000	4,326,000	4,326,000	4,326,000	4,326,000	4,326,000
Reagents	tonne/year	299	650	1,211	483	1,060	1,921	965	3,022	5,283
	g/L	0.069	0.150	0.280	0.112	0.245	0.444	0.223	0.698	1.221
Sludge Production	m3/year	1,915	3,986	7,820	2,882	5,881	11,808	5,227	16,097	37,774
	m3/year	597	1,242	2,436	898	1,832	3,678	1,628	5,014	11,766
Costs										
Capital Cost		$ 5,800,000	$ 6,006,000	$ 6,348,000	$ 5,904,000	$ 6,198,000	$ 6,622,000	$ 6,135,000	$ 6,989,000	$ 7,893,000
Operating Cost		$ 838,000	$ 1,009,000	$ 1,272,000	$ 927,000	$ 1,192,000	$ 1,585,000	$ 1,146,000	$ 2,051,000	$ 3,076,000
	$/m3	0.19	0.23	0.29	0.21	0.28	0.37	0.26	0.47	0.71
Net Present Value										
Discount Rate		3%	3%	3%	3%	3%	3%	3%	3%	3%
Capital Costs		$ 5,800,000	$ 6,006,000	$ 6,348,000	$ 5,904,000	$ 6,198,000	$ 6,622,000	$ 6,135,000	$ 6,989,000	$ 7,893,000
NPV Annual Operating Costs		$ 27,858,000	$ 33,542,000	$ 42,285,000	$ 30,816,000	$ 39,626,000	$ 52,690,000	$ 38,097,000	$ 68,182,000	$ 102,256,000
Total NPV		**$ 33,658,000**	**$ 39,548,000**	**$ 48,633,000**	**$ 36,720,000**	**$ 45,824,000**	**$ 59,312,000**	**$ 44,232,000**	**$ 75,171,000**	**$ 110,149,000**

Attachment D

SENES Draft Human Health & Ecological Risk Assessment

Hockley, Daryl

From: Harriet Phillips - SENES Consultants Limited [hphillips@senes.ca]
Sent: Wednesday, December 07, 2005 3:31 PM
To: Hockley, Daryl
Subject: Re: Anvil Range Water Quality

Daryl,
Runs are completed and I am now working on revising the sections of the report with the new results.

Harriet

At 05:14 PM 12/6/2005 -0800, you wrote:

> Harriet,
>
> John and I have gone through the numbers and he will create a new file that reflects the assumptions. You will need to change your text to say that The assumed infiltration through the covered tailings is 40 mm per year, as in the current condition. In other words the cover does not increase or decrease current infiltration rates.
>
> John will also change the background copper concentrations. He will use 0.002 mg/L in Vangorda and 0.005 in Rose. Those are the maxima of the detected values in the gooddata from Leslies memo.

Harriet Phillips Ph.D.
Senior Specialist Risk Assessment/Toxicology

SENES Consultants Limited
121 Granton Drive, Unit 12
Richmond Hill, Ontario
Canada L4B 3N4
Tel: (905) 764-9380 X305
Fax: (905) 764-9386
Email Address: hphillips@senes.ca
Web Site: http://www.senes.ca/

Attachment E
Water Treatment Cost Estimates

FM02 - Stabilize in Place

CONSTANT OPERATING COSTS

Site Description		FM02 Future 1	FM02 Future 2	FM02 Future 3
Operating	days/year	365	365	365
Design Flow	m3/s	0.126	0.126	0.126
Surge Capacity Required	m3	326,000	326,000	326,000
Annual Treatment	m3	2,037,000	2,037,000	2,037,000
Reagents	tonne/year	74	163	3,232
	g/L	0.036	0.080	1.587
Sludge Production	m3/year	1,281	2,205	40,767
	m3/year	399	687	12,698
Costs				
Capital Cost		$ 3,519,000	$ 3,590,000	$ 4,880,000
Operating Cost		$ 525,000	$ 570,000	$ 1,931,000
	$/m3	0.26	0.28	0.95
Net Present Value				
Discount Rate		3%	3%	3%
Capital Costs		$ 3,519,000	$ 3,590,000	$ 4,880,000
NPV Annual Operating Costs		$ 17,453,000	$ 18,949,000	$ 64,192,000
Total NPV		**$ 20,972,000**	**$ 22,539,000**	**$ 69,072,000**

STAGED ASCENDING OPERATING COSTS

Site Description	Units	FM02 Future 1	FM02 Future 2	FM02 Future 3
Operating	days/year	365	365	365
Design Flow	m3/s	0.126	0.126	0.126
Surge Capacity Required	m3	326,000	326,000	326,000
Annual Treatment	m3	2,037,000	2,037,000	2,037,000
Quicklime	tonne/year	74	163	3,232
	g/L	0.036	0.080	1.587
Sludge Production	m3/year	1,281	2,205	40,767
	m3/year	399	687	12,698
Costs				
Capital Cost		$ 3,519,000	$ 3,590,000	$ 4,880,000
Operating Cost	Stage 1	$ 525,000	$ 525,000	$ 525,000
	Stage 2	$ 525,000	$ 570,000	$ 570,000
	Stage 3	$ 525,000	$ 570,000	$ 1,931,000
Net Present Value				
Discount Rate		3%	3%	3%
Capital Costs		$ 3,519,000	$ 3,714,000	$ 5,693,000
NPV Annual Operating Costs		$ 17,451,000	$ 18,302,000	$ 23,267,000
Total NPV		**$ 20,970,000**	**$ 22,016,000**	**$ 28,960,000**

Treatment Costs

Year Commence	Stage 2	200	20	20
	Stage 3	200	200	75

RCT 1 Stabilize in Place

CONSTANT OPERATING COSTS

		RCT01	RCT01	RCT01
		Rose Creek	Rose Creek	Rose Creek
Site		Tailings Faro	Tailings Faro	Tailings Faro
Description		Future 1	Future 2	Future 3
Operating	days/year	365	365	365
Design Flow	m3/s	0.268	0.268	0.268
Surge Capacity Required	m3	692,000	692,000	692,000
Annual Treatment	m3	4,326,000	4,326,000	4,326,000
0	tonne/year	650	1,060	3,022
	g/L	0.150	0.245	0.698
Sludge Production	m3/year	3,986	5,881	16,097
	m3/year	1,242	1,832	5,014
Costs				
Capital Cost		$ 6,006,000	$ 6,198,000	$ 6,989,000
Operating Cost		$ 1,009,000	$ 1,192,000	$ 2,051,000
	$/m3	0.23	0.28	0.47
Net Present Value				
Discount Rate		3%	3%	3%
Capital Costs		$ 6,006,000	$ 6,198,000	$ 6,989,000
NPV Annual Operating Costs		$ 33,542,000	$ 39,626,000	$ 68,182,000
Total NPV		**$ 39,548,000**	**$ 45,824,000**	**$ 75,171,000**

STAGED ASCENDING OPERATING COSTS

		RCT01	RCT01	RCT01
		Rose Creek	Rose Creek	Rose Creek
Site		Tailings Faro	Tailings Faro	Tailings Faro
Description	Units	Future 1	Future 2	Future 3
Operating	days/year	365	365	365
Design Flow	m3/s	0.268	0.268	0.268
Surge Capacity Required	m3	692,000	692,000	692,000
Annual Treatment	m3	4,326,000	4,326,000	4,326,000
Quicklime	tonne/year	650	1,060	3,022
	g/L	0.150	0.245	0.698
Sludge Production	m3/year	3,986	5,881	16,097
	m3/year	1,242	1,832	5,014
Costs				
Capital Cost		$ 6,006,000	$ 6,198,000	$ 6,989,000
Operating Cost	Stage 1	$ 1,009,000	$ 1,009,000	$ 1,009,000
	Stage 2	$ 1,009,000	$ 1,192,000	$ 1,192,000
	Stage 3	$ 1,009,000	$ 1,192,000	$ 2,051,000
Net Present Value				
Discount Rate		3%	3%	3%
Capital Costs		$ 6,006,000	$ 3,714,000	$ 5,693,000
NPV Annual Operating Costs		$ 33,540,000	$ 38,198,000	$ 47,159,000
Total NPV		**$ 39,546,000**	**$ 41,912,000**	**$ 52,852,000**

Treatment Costs

Year Commence	Stage 2	n/a	10	10
	Stage 3	n/a	n/a	40

Note: Plateau extends > 200 years -i.e. no stage 4

RCT02 - Complete Relocation

Constant - indefinite treatment

Site Description		Faro Tailings Relocated Future 1
Operating	days/year	365
Design Flow	m3/s	0.142
Surge Capacity Required	m3	366,000
Annual Treatment	m3	2,286,000
Reagents	tonne/year	371
	g/L	0.162
Sludge Production	m3/year	2,315
	m3/year	721

Costs

Capital Cost		$ 4,015,000
Operating Cost		$ 693,000
	$/m3	0.30

Net Present Value

Discount Rate		3%
Capital Costs		$ 4,015,000
NPV Annual Operating Costs		$ 23,037,000
Total NPV		**$ 27,052,000**

Treat for 30 years only

Site Description	Units	Faro Tailings Relocated Future 1
Operating	days/year	365
Design Flow	m3/s	0.142
Surge Capacity Required	m3	366,000
Annual Treatment	m3	2,286,000
Quicklime	tonne/year	371
	g/L	0.162
Sludge Production	m3/year	2,315
	m3/year	721

Costs

Capital Cost		$	4,015,000
Operating Cost	Stage 1	$	693,000
	Stage 2	$	-
	Stage 3	$	-

Net Present Value

Discount Rate		3%
Capital Costs		$ 4,015,000
NPV Annual Operating Costs		$ 13,298,000
Total NPV		**$ 17,313,000**

RCT03 - Partial Relocation

CONSTANT OPERATING COSTS

Site / **Description**		Rose Creek Tailings Partial Relocation Future 1	Rose Creek Tailings Partial Relocation Future 2	Rose Creek Tailings Partial Relocation Future 3
Operating	days/year	365	365	365
Design Flow	m3/s	0.171	0.171	0.171
Surge Capacity Required	m3	441,000	441,000	441,000
Annual Treatment	m3	2,759,000	2,759,000	2,759,000
0	tonne/year	534	822	2,222
	g/L	0.194	0.298	0.805
Sludge Production	m3/year	3,416	4,787	12,354
	m3/year	1,064	1,491	3,848
Costs				
Capital Cost		$ 4,544,000	$ 4,666,000	$ 5,279,000
Operating Cost		$ 812,000	$ 942,000	$ 1,558,000
	$/m3	0.29	0.34	0.56
Net Present Value				
Discount Rate		3%	3%	3%
Capital Costs		$ 4,544,000	$ 4,666,000	$ 5,279,000
NPV Annual Operating Costs		$ 26,993,000	$ 31,315,000	$ 51,793,000
Total NPV		**$ 31,537,000**	**$ 35,981,000**	**$ 57,072,000**

STAGED ASCENDING OPERATING COSTS

Site / **Description**	Units	Rose Creek Tailings Partial Relocation Future 1	Rose Creek Tailings Partial Relocation Future 2	Rose Creek Tailings Partial Relocation Future 3
Operating	days/year	365	365	365
Design Flow	m3/s	0.171	0.171	0.171
Surge Capacity Required	m3	441,000	441,000	441,000
Annual Treatment	m3	2,759,000	2,759,000	2,759,000
Quicklime	tonne/year	534	822	2,222
	g/L	0.194	0.298	0.805
Sludge Production	m3/year	3,416	4,787	12,354
	m3/year	1,064	1,491	3,848
Costs				
Capital Cost		$ 4,544,000	$ 4,666,000	$ 5,279,000
Operating Cost	Stage 1	$ 812,000	$ 812,000	$ 812,000
	Stage 2	$ 812,000	$ 942,000	$ 942,000
	Stage 3	$ 812,000	$ 942,000	$ 1,558,000
Net Present Value				
Discount Rate		3%	3%	3%
Capital Costs		$ 4,544,000	$ 3,714,000	$ 5,693,000
NPV Annual Operating Costs		$ 26,991,000	$ 30,300,000	$ 36,726,000
Total NPV		**$ 31,535,000**	**$ 34,014,000**	**$ 42,419,000**

Treatment Costs

Year Commence	Stage 2	n/a	10	10
	Stage 3	n/a	n/a	40

VG02 - Stabilize in Place

Site Description		Vangorda/Grum VG01 Future 1	Vangorda/Grum VG01 Future 2	Vangorda/Grum VG01 Future 3
Operating	days/year	365	365	365
Design Flow	m3/s	0.081	0.081	0.081
Surge Capacity Required	m3	208,000	208,000	208,000
Annual Treatment	m3	1,298,000	1,298,000	1,298,000
Reagents	tonne/year	19	57	89
	g/L	0.015	0.044	0.068
Sludge Production	m3/year	147	394	894
	m3/year	46	123	279
Costs				
Capital Cost		$ 2,688,000	$ 2,746,000	$ 2,781,000
Operating Cost		$ 414,000	$ 435,000	$ 455,000
	$/m3	0.32	0.34	0.35
Net Present Value				
Discount Rate		3%	3%	3%
Capital Costs		$ 2,610,000	$ 2,666,000	$ 2,700,000
NPV Annual Operating Costs		$ 13,763,000	$ 14,461,000	$ 15,126,000
Total NPV		**$ 16,373,000**	**$ 17,127,000**	**$ 17,826,000**