Faro Mine Remediation Project

Medium Term Plan Work Plan FY2014–2017



DATE OF SUBMISSION:

March 26, 2014

PREPARED BY:

Faro Project Execution Team

Faro Mine Closure
Fermeture de la mine Faro

Final

Medium Term Plan, Faro Mine Remediation Project

March 26, 2014

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Glossary

AAM	Assessment and Abandoned Mines
AANDC	Aboriginal and Northern Development Canada
AYFN	Affected Yukon First Nations
C&M	care and maintenance
C&R Plan	closure and remediation plan
CAD	Canadian dollars
Canada	Government of Canada
CDA	Canadian Dam Association
CH2M HILL	CH2M HILL Canada Limited
CPAWS	Canadian Parks and Wilderness Society
CPF	Control Point Framework
CSP	Contaminated Sites Program
CVD	Cross Valley Dam
DO	Designated Office
DQO	data quality objective
DWP	Detailed Work Plan
DVIHU	Down Valley Interim Hydraulic Upgrades
ETA	Emergency Tailings Area
FPET	Faro Project Execution Team
FMC	Faro Mine Complex
FMRP	Faro Mine Remediation Project
FY	fiscal year
G/L	general ledger
ha	hectare
ICAP	Integrated Comprehensive Abandonment Plan
ID	Intermediate Dam
IE	Independent Engineer
IPRP	Independent Peer Review Panel
IW	Interim Works
IWPP	Interim Works Project Proposal
IWTS	Interim Water Treatment System
KDC	Kaska Dena Council
km	kilometre
KPI	Key Performance Indicator
m	metre
m^2	square metre
m^3/s	cubic metres per second

M	million
masl	metre above sea level
MB	Management Board
mg/L	milligram per litre
MPO	Major Projects Office
MTP	Medium Term Plan
O&M	operations and maintenance
OBV	Operating Baseline Value
OSC	Oversight Committee
PBMS	Project Budget and Management System
PDT	Project Design Team
PEP	Project Execution Plan
PLT	Project Leadership Team
PMF	Probable Maximum Flood
PMP	Performance Measurement Plan
RCA	Reference Condition Approach
RCD	Rose Creek Diversion
RCAA	Rose Creek Alluvial Aquifer
RCTA	Rose Creek Tailings Area
RLT	Regulatory Leadership Team
ROM	rough order-of-magnitude
SIS	Seepage Interception System
SFN	Selkirk First Nation
SRK	SRK Consulting Engineers and Scientists
TAC	Technical Advisory Committee
TMS	Tender Management System
TRB	Technical Review Board
USEPA	U.S. Environmental Protection Agency
VCD	Vangorda Creek Diversion
WBS	Master Work Breakdown Structure
WTP	water treatment plant
YESAA	*Yukon Environmental and Socio-economic Assessment Act*
YESAB	Yukon Environmental and Socio-economic Assessment Board
YCS	Yukon Conservation Society
YG	Government of Yukon
YGMB	Government of Yukon Management Board
YT	Yukon

Executive Summary

Project Description

Located in south-central Yukon Territory (YT), close to the Town of Faro, the Faro Mine Complex (FMC) was an open-pit lead and zinc mine that operated from 1969 until 1998. Closure of the FMC will take place under the Faro Mine Remediation Project (FMRP). The FMRP covers approximately 2,500 hectares and includes 70 million tonnes of tailings and 320 million tonnes of waste rock, which both contain high levels of heavy metals that could leach into the environment. Much of the stationary and mobile infrastructure was purpose-built with a design life that has already been significantly exceeded, and in its current condition presents a significant risk to both human health and the environment. As such, there are significant long-term risks to the environment and health and safety associated with the FMC.

In 1998, following the abandonment of the mine operations, Deloitte and Touche was court-appointed as Interim Receiver. In this role, they assumed responsibility for ongoing site operations, which were funded annually by the Government of Canada (Canada). In 2009, pursuant to the *Yukon Northern Affairs Program Devolution Transfer Agreement* and the *Yukon Act*, responsibility for site operations transferred to the Government of Yukon (YG), while funding was maintained by Canada (as represented by the Department of Aboriginal Affairs and Northern Development Canada [AANDC]) as a Type II Site.

When devolution took place, YG and Canada acknowledged that the FMC would not reopen, and initiated a process to develop an overall site closure and remediation plan (C&R Plan). The first stage in this process was to develop a set of overarching closure objectives for the FMC. These five overarching closure objectives define the desired results of a closure plan, and guide the entire planning and remediation process:

1. Protect human health and safety.
2. Protect and, to the extent practicable, restore the environment, including land, air, water, fish, and wildlife.
3. Return the FMC to an acceptable state of use that reflects pre-mining land use where practicable.
4. Maximize local and Yukon socio-economic benefits.
5. Manage long-term site risk in a cost-effective manner.

From these objectives and through a process of options analysis, the approach to mine closure was established to include the following tasks:

- Divert clean water entering the site to keep it clean
- Collect and treat contaminated water
- Cover waste (waste rock and tailings) in place
- Decontaminate and demolish infrastructure

The current iteration of the C&R plan is consistent with this approach and efforts are ongoing to further define the individual solutions and obtain the necessary regulatory approvals for implementation.

In 2009, the Assessment and Abandoned Mines branch of the YG Department of Energy, Mines and Resources obtained a Minister's Determination entitled "Faro Mine Complex Reclamation and Closure Activities," as per Section 37(1) of the *Waters Act,* for works to be undertaken at the FMC. This Minister's Determination is an authorization provided by the YG's Department of Environment and is intended to allow actions to be taken to protect human health and safety and the environment if a company is no longer financially viable, until a plan can be made to remediate the site. Site operations continue under this authorization until such time as YG and AANDC, as co-proponents, enter into an application for assessment (termed a Project Proposal) through the Yukon Environmental and Socio-economic Assessment process. At

the height of its operation, the FMC's mill had a capacity of 13,500 tonnes per day; the project will therefore be subject to assessment by Executive Committee under Item 3(a) of Schedule 3 of the *Assessable Activities, Exceptions and Executive Committee Projects Regulations* (SOR/2005-379) of the *Yukon Environmental Socio-economic Assessment Act* (YESAA). In 2013, it was agreed that certain urgent projects may be submitted outside of and before the Remediation Project Proposal under an Interim Works Project Proposal (IWPP) that will be assessed at the designated office (DO) level because of the interim nature of the subject works.

Medium Term Plan

Faced with growing evidence of several critical emerging issues associated with deteriorating site infrastructure and evolving geochemistry, the Faro Project Execution Team (FPET) brought their concerns forward to AANDC in early 2012. To ensure alignment with good major project management practice, AANDC requested that the FPET develop a "Medium Term Plan" (MTP) of approximately 5 years' duration, by the end of December 2012. In late July 2012, AANDC and YG reached an agreement on the process and outcomes required of this plan in the *Medium Term Planning Proposal*.

The primary activities included in the MTP are summarized as follows:

- Care and maintenance (C&M)
- Other activities of Phase 2a (Conceptual Design) and Phase 2b (Advanced Design) occurring during the period of the MTP
- Preparation of the Remediation Project Proposal for submission to YESAB
- Planning, permitting and execution of interim projects ahead of the planned final remediation

This Medium Term Plan is intended as a multi-year planning document used for operational needs and funding approvals. It contains all the work plans which are to be executed during the next four years and will be reconciled on an annual basis. The primary milestone of the MTP was determined to be the submission of the Remediation Project Proposal to YESAB. The first draft of the MTP was submitted to AANDC on December 14, 2012 and contained the medium-term basis for project governance, C&M and Remediation Project Proposal, other fixed costs (i.e., Project Management) and committed works (including Affected Yukon First Nation funding). Also included were design and construction of interim projects including: replacement of the Faro Mill Water Treatment Plant (WTP); hydraulic upgrades to structures in the Rose Creek Valley (Down Valley Interim Hydraulic Upgrades); enabling works for interception of groundwater in the Rose Creek Valley Alluvial Aquifer (Cross Valley Dam Seepage Interception System); and replacement of the Vangorda Creek Diversion.

Subsequent to discussions in early 2013, the December draft was modified to optimize cash flows as well as to include both IWPP for submission to YESAB, permitting of most activities planned within the MTP time frame and a Water License (for interim works).

In the spring of 2013, the Mill Building was closed to all personnel citing health and safety risks. The closure of the Mill Building essentially ceased all water treatment operations on the Faro portion of the site. Because of the lack of water treatment and the increased inflow into Faro Pit, it was determined that the Faro Pit possessed insufficient storage capacity to contain contaminated water while the WTP replacement was constructed, thus requiring an interim water treatment system (IWTS). The IWTS is intended to be sufficient to manage the necessary water treatment until the full-scale WTP is constructed. Following the addition of the IWPP and IWTS and removal of the WTP, Draft 4 of the MTP was submitted to AANDC on November 15, 2013. Subsequently, because of the timing of the submitted draft, the 2013/14 scope and budget was removed from the MTP (thus constituting Draft 5, upon which this final MTP is based).

The MTP contains the scope, schedule, budget, and planning and approval framework to advance the FMRP through Phase 2b up to the submission of the Remediation Project Proposal to YESAB. The content of the MTP ranges in its level of definition from well-defined work packages to high-level concepts of scope,

schedule, and rough order of magnitude budget estimates. Part of the planning and approval framework will continue to be the development and submission of annual Detailed Work Plans for the purposes of funding approval and allocation. The MTP scope is organized by the FMRP Work Breakdown Structure and is presented in varying levels of detail according to the nature of magnitude of the work in question. Depending on the level of scope definition, cost estimates have also been associated with Design Allowances for known-unknowns (held by YG) and Contingencies for unknown-unknowns (held by AANDC) for budgetary planning purposes. The MTP 4-year budget is $156,871,163 and is planned to complete in May 2017 with the submission of the Remediation Project Proposal to YESAB. The MTP includes $28,360,510 in Design Allowances and $56,660,839 in Contingencies.

SECTION 1

Purpose

1.1 Background

Located in south-central Yukon (YT), close to the Town of Faro (Faro), the Faro Mine Complex (FMC) was an open-pit lead and zinc mine, which operated from 1969 until 1998. The Faro Mine Remediation Project (FMRP) covers approximately 2,500 hectares (ha) and includes 70 million tonnes of tailings and 320 million tonnes of waste rock. Figure 1-1, *Faro Mine Complex Landmarks Map*, shows the spatial extent of the FMC and details the location of key site features. Both the tailings and waste rock contain high levels of heavy metals that could leach into the environment (see Appendix A, *Geochemical Status*). As such, there are significant long-term environmental risks associated with the FMC. Much of the stationary and mobile infrastructure was purpose-built with a design life that has already been significantly exceeded, and in its current condition presents a significant risk to both human health and the environment (see Appendix B, *Infrastructure*).

At one point, the FMC was the world's largest lead and zinc mine, supplying 15 percent of the global output. Faro's population reached 2,000 by the early 1980s. The first of numerous mine shutdowns took place in 1982, and by the mid-1980s, Faro's population had fallen to 97 individuals. In 1998, all operations ceased at the FMC, and Deloitte and Touche was court-appointed as Interim Receiver. In this role, they assumed responsibility for ongoing site operations, which were funded annually by the Government of Canada (Canada). Deloitte and Touche continued in this role until 2009, when responsibility for site operations transferred to the Government of Yukon (YG).

In YT, effective April 1, 2003, authority to manage public lands and resources was transferred to the YG, pursuant to the *Yukon Northern Affairs Program Devolution Transfer Agreement* (YG, 2001) and the *Yukon Act* (Canada Department of Justice, 2002). Upon devolution, YG took administration and control of all public lands. Under the terms of this agreement, Canada remained responsible for the cost of remediating the major contaminated sites, known as Type II Sites, that were created in the Yukon before public lands were transferred to YG. This included the FMC.

When devolution took place, YG and Canada acknowledged that the FMC would not reopen, and initiated a process to develop an overall site closure and remediation plan (C&R Plan) (SRK Consulting Engineers and Scientists [SRK], 2010a; SRK 2010b). An agreement was reached with the Ross River Dena Council (on behalf of the Kaska Nation) and the Selkirk First Nation to establish a joint project Oversight Committee (OSC). The Terms of Reference for the OSC focused on arriving at a preferred or recommended approach to long-term site closure and remediation. The first stage in this process was to develop a set of overarching closure objectives for the FMC. These five overarching FMC Closure Objectives define the desired results of a closure plan, and guide the entire planning and remediation process:

1. Protect human health and safety.
2. Protect and, to the extent practicable, restore the environment, including land, air, water, fish, and wildlife.
3. Return the FMC to an acceptable state of use that reflects pre-mining land use where practicable.
4. Maximize local and Yukon socio-economic benefits.
5. Manage long-term site risk in a cost-effective manner.

Further background on the development of the Closure Option Plan and on the governance and management of the Faro Mine Remediation Project reside in the Project Charter dated July 5, 2013, endorsed by Management Board on September 5, 2013 and approved by the Project Leader (AND-NAO) on October 25, 2013.

Since consensus was reached on a long-term C&R Plan, additional engineering tasks and investigations have taken place; these have served to refine the scope of the major site components and to understand the potential changes to site conditions over time. In 2010, SRK submitted a draft *Faro Mine Complex – Final Closure & Remediation Plan: Project Proposal* (SRK, 2010a) to Governments (Canada and YG), which represented a first draft of the documentation needed to submit the C&R Plan into the Yukon Environmental and Socio-economic Assessment process. Following governmental and independent review of this documentation, Canada determined that YG would enter into an open and transparent public procurement process to secure a long-term project design partner. This process concluded in September 2011, with YG entering into a 3-year (+1+1) contract with CH2M HILL Canada Limited (CH2M HILL).

1.2 Medium Term Planning Framework Objectives

1.2.1 Program and Funding Requirements

Faced with growing evidence of the criticality of several emerging issues associated with deteriorating site infrastructure and evolving geochemistry, the Faro Project Execution Team (FPET) brought their concerns forward to Aboriginal Affairs and Northern Development Canada (AANDC) for discussion in early 2012. To ensure alignment with good major project management practice, AANDC requested that the FPET produce a "medium term plan" (MTP) of approximately 5 years' duration, by the end of December 2012. In late July 2012, AANDC and YG reached an agreement on the process and outcomes required of this plan in the *Medium Term Planning Proposal*. The primary activities to be included in the Plan – described in further detail in Section 1.2.2, *Project Objectives - Medium Term Plan,* and throughout the Work Plan – were summarized as care and maintenance (C&M), all other normal activities of Phase 2a and Phase 2b (*Advanced Design*) occurring during the period of the MTP, preparation of the Remediation Project Proposal for submission to YESAA, and planning and execution of urgent projects requiring Interim Works (IW) ahead of the planned final remediation. The primary milestone of the Plan was determined to be the submission of the Remediation Project Proposal to the Yukon Environmental and Socio-economic Assessment Board (YESAB). Subsequent to discussions in early 2013, the December draft was modified to optimize cash flows as well as to include both an IW Project Proposal (IWPP) to YESAB and a Water Licence for IW.

As such, the MTP will form the basis of a 4-year (fiscal year [FY] 2014/2015 to FY2017/2018) multi-year funding agreement between AANDC and YG, as further detailed in Section 6*, Risks.*

1.2.2 Project Objectives – Medium Term Plan

This work plan includes the work to be undertaken by the FPET in service of the five overarching FMC Closure Objectives detailed in Section 1.1, *Background*.

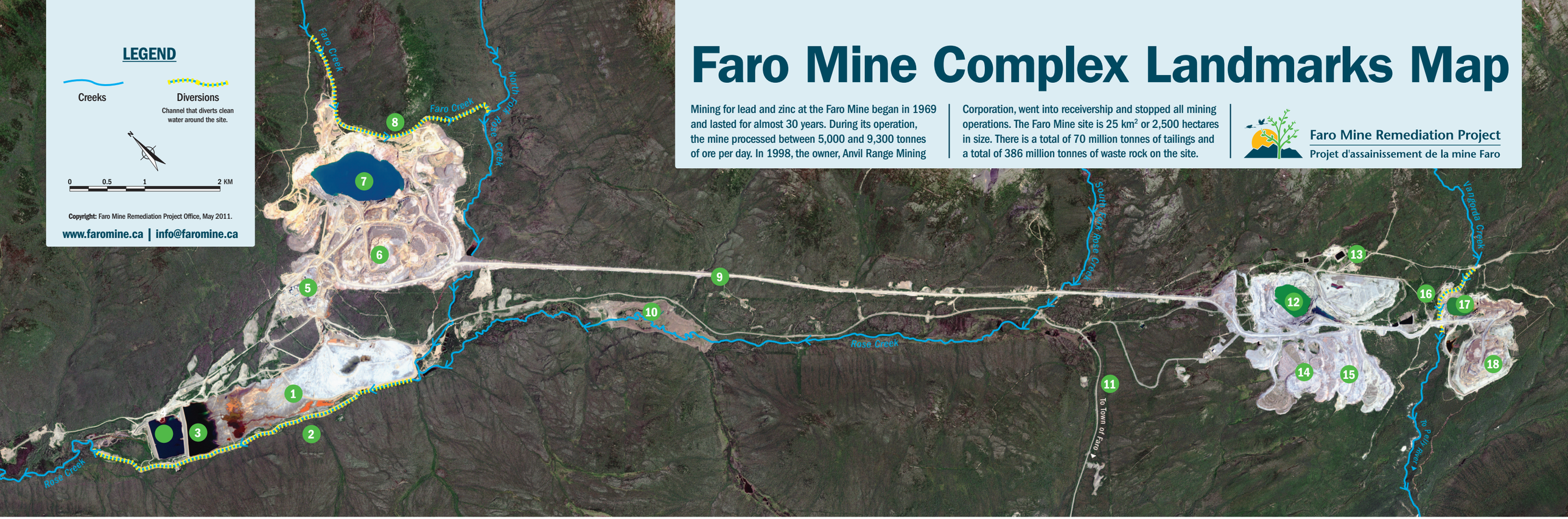
Building on the summary list included in the *Medium Term Planning Proposal*, this multi-year work plan includes the following activities, with the primary overarching objectives to be achieved via the activities also described:

- Ongoing C&M activities, which includes work to provide ongoing environmental compliance and mitigate the short-term environmental and health and safety risks at the FMC (Objective 1: Protect human health and safety; Objective 2: Protect and, to the extent practicable, restore the environment, including land, air, water, fish, and wildlife; Objective 4: Maximize local and Yukon socio-economic benefits)
- Normal activities associated with Phase 2a and Phase 2b Advanced Design occurring during the period of the MTP, including engineering design, project planning (e.g., schedule and cost), and procurement of goods and services (all objectives)
- Preparation of the IWPP and the Remediation Project Proposal for submission to the Yukon Environmental and Socio-economic Assessment Board (YESAB) (all objectives)

Faro Mine Complex Landmarks Map

Mining for lead and zinc at the Faro Mine began in 1969 and lasted for almost 30 years. During its operation, the mine processed between 5,000 and 9,300 tonnes of ore per day. In 1998, the owner, Anvil Range Mining Corporation, went into receivership and stopped all mining operations. The Faro Mine site is 25 km^2 or 2,500 hectares in size. There is a total of 70 million tonnes of tailings and a total of 386 million tonnes of waste rock on the site.

Faro Mine Remediation Project
Projet d'assainissement de la mine Faro



1. Rose Creek Tailings Area

This area is 4 km long and up to 1 km wide and located at the base of Rose Creek Valley. It holds over 55 million tonnes of tailings. Three dams (original, secondary and intermediate) hold the tailings in place. A fourth dam, the Cross Valley Pond, holds treated water.

2. Rose Creek Diversion

The 4 km long channel diverts the Rose Creek around the tailings impoundment area.

3. Intermediate Pond & Dam

Pond where contaminated water is collected and pumped to the Faro Water Treatment Plant.

4. Cross Valley Pond & Dam

Pond where treated water is stored and tested. Water meeting acceptable standards is discharged into Rose Creek.

5. Mill Area – Faro Water Treatment Plant

The original mill structure was modified and is now used as a water treatment plant. Contaminated water from the Faro Pit is collected and treated at this plant.

6. Faro Waste Rock

Over 260 million tonnes of waste rock (divided into 30 separate dumps) are in the Faro area covering approximately 3.35 km^2 or 335 hectares.

7. Faro Pit

The pit is approximately 1,675 m long, 975 m wide and 335 m deep. It covers an area approximately 1.6 km^2 or 106 hectares.

8. Faro Creek Diversion

The 3.35 km long channel diverts the Faro Creek around the Faro Pit. Faro Creek then joins the North Fork of Rose Creek.

9. Haul Road

The 10 km road connects the Faro area to the Grum/ Vangorda areas and was used to haul ore from the Grum/ Vangorda areas to the mill for processing.

10. Fresh Water Supply Dam & Reservoir

The reservoir was used to provide a constant source of water to the mill for processing ore. When mining operations ceased, the reservoir was no longer required and the dam was breached.

11. Access Road

The 22 km road connects the Town of Faro to the Faro Mine Complex.

12. Grum Pit

The pit is approximately 1,100 m long, 700 m wide and 200 m deep. It covers an area approximately 0.77 km^2 or 77 hectares. A bio-treatment program occurs in the pit to treat the water.

13. Vangorda Water Treatment Plant

Contaminated water from the Vangorda Pit is collected and treated at this plant. Water meeting acceptable standards is discharged into Vangorda Creek.

14. Grum Waste Rock

Over 110 million tonnes of waste rock are in the Grum area covering approximately 1.48 km^2 or 148 hectares.

15. Grum Sulphide Cell Cover Project

The Grum Sulphide Cell is a portion of Grum Waste Rock which contains a higher quantity of sulphidic material prone to generating acid. The 0.275 km^2 area was resloped and covered with a liner and soil to control the generation of acid rock drainage.

16. Vangorda Creek Diversion

The 1.2 km long channel diverts the Vangorda Creek around the Vangorda Pit.

17. Vangorda Pit

The pit is approximately 1,150 m long, 350 m wide and 150 m deep. It covers an area approximately 0.42 km^2 or 42 hectares.

18. Vangorda Waste Rock

Over 16 million tonnes of waste rock are in the Vangorda area covering approximately 0.4 km^2 or 40 hectares.

FIGURE 1-1
Faro Mine Complex Landmarks Map
Faro Mine Remediation Project

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- The identification, planning, design, and execution of IW components for which the identified risks have exceeded acceptable tolerance levels (Objective 1: Protect human health and safety; Objective 2: Protect and, to the extent practicable, restore the environment, including land, air, water, fish, and wildlife; Objective 4: Maximize local and Yukon socio-economic benefits; Objective 5: Manage long-term site risk in a cost-effective manner)
- Ongoing environmental monitoring designed to measure changes in the receiving environment and to inform design and performance of remedial solutions (all objectives)
- Funding for participation by the Affected Yukon First Nations (AYFN) in the proposed (but not yet approved) Governance and Management model (Objective 4: Maximize local and Yukon socio-economic benefits)
- YG project management resources, support functions, and related infrastructure (necessary to enable achievement of all objectives, including Objective 5: Manage long-term site risk in a cost-effective manner)

1.2.3 Medium Term Plan Work Packages

Between Spring 2012 and Fall 2013, YG and AANDC underwent an extensive process of identification and refinement of the work packages to be included in the MTP, which included the participation of the FPET, the Project Design Team (PDT), the Independent Engineer (IE), the Independent Peer Review Panel (IPRP), YG technical advisors, and AANDC technical staff and advisors. In early November 2013, the following list of projects have been carried forward for final detailing of scope, schedule, and budget for this Medium Term Work Plan.

- Design, Procure, Install, and Commission Interim Water Treatment System (IWTS)
- Design and Implement Down Valley Interim Hydraulic Upgrades (DVIHU)
- Design and Enable Cross Valley Dam (CVD) Seepage Interception System (SIS)
- Design and Implement Replacement Vangorda Creek Diversion (VCD)

Summary and detailed descriptions of these projects may be found in Section 2 and Appendix C, respectively.

As part of the identification and refinement process, the FPET and PDT substantially developed scope definition and costs for a number of additional candidate projects. This information has been retained in this plan as “potential scope.” Should conditions regarding both risk and execution environment change to warrant their consideration for implementation prior to execution of the remediation plan (~2020), these scope descriptions will prove useful for planning purposes and can decrease response time.

Descriptions of these potential projects may be found in Appendix D; however, as they remain potential, their associated cost and schedule implications have not been carried into the budget, cash flow, and schedule summaries, and they currently remain outside the scope of this Work Plan.

1.3 Current Project Status

1.3.1 Regulatory Authority

Within the MTP, the FPET has identified various works to be completed over the next 4 fiscal years. With the exception of the Advanced Design and Remediation Project Proposal for the final remediation plan and the project’s on-going costs related to management and governance, these activities are considered IW. The proposed IW is being completed in advance of the final remediation project assessment (that is, before March 2017), due to the critical nature of the activities.

In 2009, the FMRP obtained a Minister’s Determination entitled “Faro Mine Complex Reclamation and Closure Activities,” as per Section 37(1) of the *Waters Act* (YG, 2003a), for works to be undertaken at the FMC. This document is included as Appendix E. Section C of the Minister’s Determination, “Measures to be

Taken," provides authorization for a list of activities that Assessment and Abandoned Mines (AAM) may undertake to "prevent, counteract, mitigate, or remedy any resulting adverse effects on persons, property, or the environment, and in particular the Surrounding Waters." This Determination is an authorization provided by the YG's Department of Environment directly to AAM, Department of Energy, Mines and Resources.

Section 37 of the *Waters Act* (YG, 2003a) states:

> 37(1) Where the Minister believes, on reasonable grounds, that
>
> (a) a person has closed or abandoned, temporarily or permanently, a work related to the use of waters or the deposit of waste, and
>
> (b) either
>
> (i) the person has contravened or failed to comply with any condition of a licence or any provision of this Act or the regulations, whether or not the condition or provision relates to closing or abandonment, or
>
> (ii) a danger to persons, property, or the environment may result from the past operation of the work or from its closing or abandonment, the Minister may take any reasonable measures to prevent, counteract, mitigate, or remedy any resulting adverse effect on persons, property, or the environment, and for that purpose may enter any area, place, or premises, except one that is designed to be used and is being used as a permanent or temporary private dwelling-place.

In consideration of this regulatory section and its implied scope, it is important to understand and acknowledge its purpose. Arguably this component of the Act, in the case of the FMC, is intended to allow YG to take the actions required to protect human health and safety and the environment if a company is no longer financially viable, until a plan can be made to remediate the site. Although there are clear benefits to the public and other agencies to participate in the assessment and permitting of the final remediation plan, it is important to consider how this process is to be applied to works required for the protection of human health and safety and the environment before the final remediation project is implemented. For example, governments may need to expend funds to complete work required to manage emergency events that occur while remediation planning is underway.

Canada and YG will seek, as part of the MTP, to assess and permit immediate site operational requirements (e.g., site operations activities, water treatment, and site investigations,) during the 2013 and 2014 calendar years. AAM will continue to operate the FMC under the Minister's Determination until the co-proponents have completed the assessment and obtained the applicable licences for the Interim Works.

The IW identified in the following bullets are assessable at the Designated Office-level (i.e., lower-level assessment), as they are considered "interim" measures and not the completion of remedial works.

- Operate and Maintain the FMC (including design and operation of any interim water treatment measures required to address ongoing water quality issues).
- Design and Implement the DVIHU.
- Design and Implement Enabling works for the CVD SIS.
- Undertake Site Investigations to Enable Design of the Final Remediation Plan.

The individual work packages within this MTP provide specific descriptions and justifications for why these works are required before the final remediation plan is implemented. In summary, these items have been selected because they pose immediate risks to both the environment and human health and safety in the presence of degrading site infrastructure and changing environmental conditions.

In addition to the works included in the list above, the MTP includes a work package describing the design and replacement of the VCD. Currently the regulatory approach for this work package has not been

determined. Specifically, the site requires a higher level of assessment (i.e. an Executive Committee Screening) for remediation works and therefore the VCD has been separated from the IW to allow the Designated Office Assessment to proceed in a more efficient and effective manner.

Please see the Project Leadership Team Memo: Overall Approach to Faro Water Treatment Systems (YG & AANDC, 2013) for further details. As the installation of the IWTS will be complete before or during the initial stages of the YESAA process for IW, the construction/installation of the IWTS will not be included in the activities of the IWPP being prepared for a Designated Office level review by YESAB, given the urgency of requiring water treatment on site. Since the closure of the old Mill building at the beginning of FY2013/2014 due to worker safety concerns, there has been no treatment of water on site this year. Contaminated water has been stored in Faro Pit. As such, the operation of the IWTS post-construction will be included as an ongoing C&M activity within the scope of this plan.

SECTION 2

Scope of Work

2.1 Total Project Context

2.1.1 Overall Work Breakdown Structure

As is typical for major projects, the overall or Master Work Breakdown Structure (WBS) is a primary scope planning and control tool for the FMRP. It is a comprehensive planning structure that allows for the entire scope of the project to be broken down into manageable units of work, progressively developed from work components down to the work package level.

Development of the FMRP Master WBS was undertaken by the FPET with input from the PDT, technical advisors, and AANDC. The approach to the FMRP WBS is similar to, but varies in detail where appropriate from, the WBS for the other major Contaminated Sites Program project, the Giant Mine Remediation Project.

Being reflective of 100 percent of project scope, the Master WBS also includes within its structure the work of the Project Sponsor's team (AANDC). However, it is important to note this FPET Medium Term Plan specifically excludes AANDC's activities – these activities are captured in detail in AANDC's own annual work plans.

Level 1 of the FMRP Master WBS comprises four work components – Planning & Design (01), Site Remediation (02), Operations & Maintenance (O&M) (03), and Governance & Management (04).

Planning & Design (01) captures all activities associated with planning and design of remedial solutions for all areas of the FMC footprint, as well as any works that may be required in the surrounding environment. Work undertaken within this stream also facilitates and enables the implementation of these solutions through all applicable assessment and permitting processes. The Planning & Design stream is organized into work components that include: site investigations and monitoring to inform remediation planning and our understanding of geochemical processes (Ongoing Site Investigations 01.01), remediation planning and design (Design 01.02), preparation of YESAA Project Proposals with associated consultation and support activities (Project Proposal 01.03), and all other permits and licences required for implementation of the remediation plan, such as the Water Licence (Permitting 01.04).

Site Remediation (02) captures activities specifically associated with the implementation of remediation solutions, beginning with pre-construction activities such as procurement and ending with transition and hand over of ongoing management associated with the completed works to the O&M stream. Remediation work packages are delineated geographically, depending on where they occur on site, whether they are located in Area 100 Faro Mine (02.01), Area 200 Tailings (02.02), or Area 300 Vangorda/Grum (02.03). Activities that cross or fall outside these spatial boundaries are captured under Area 400 Site Wide (02.04).

O&M (03) captures activities associated with the ongoing protection of human health and safety and the environment at the FMC, as well as maintenance of all site infrastructure and equipment. The activities under O&M (03) occur before, during, and after completion of the remediation works implemented in Site Remediation (02). The O&M stream also includes any onsite "interface" activities that may be required between ongoing O&M activities and new remediation construction. The current version of the WBS delineates Level 2 work components for onsite management and administrative activities (Management 03.01); all onsite operations (Operations 03.02); maintenance and repair of facilities, equipment and infrastructure (Maintenance 03.03); and ongoing monitoring of site conditions to inform operations activities and for ensuring environmental compliance (Monitoring 03.04).

Governance & Management (04) captures the activities undertaken by the staff of both the Project Director's team (YG FPET) and the Project Sponsor's team (AANDC). This stream of the WBS contains three Level 2 work

components. The first captures activities related to project oversight, funding, quality assurance and political engagement between and within participating governments (Governance 04.01). The second component includes activities related to all aspects of project and program management, financial and quality control functions, and risk management (Management 04.02). The final component includes all activities related to day-to-day management of health and safety, land use, communications, achievement of socioeconomic objectives, and other support functions (Enabling Functions 04.03).

A full layout of the detailed Master WBS to Level 4 is provided in Appendix F1. Those activities described as occurring in the 4-year period are discussed in more detail in Section 2.3, *Work Breakdown Structure*, and are presented in Appendix F2.

2.1.2 Medium Term Plan in Phase Gate Context

In the spring of 2011, the AANDC Contaminated Sites Program Major Projects Office (MPO) issued a draft set of standards and approaches that now apply to the management of the Major Crown Projects under their purview – presently, that list includes the Giant Mine Remediation Project and the FMRP. Section 6 of Chapter 1: Overview of the *Contaminated Sites Plan Major Project Office Standards and Guidelines Manual* (final version r0, March 2013) (AANDC, 2013a) describes the MPO control point delivery model, its advantages, and its purpose in detail.

In accordance with the MPO guidance, the FMRP adopted a Control Point Framework and Phase Gate Review Process in the summer of 2011, partway through the execution of the project. The 2011 version of the *Faro Project Stage Gate Control Point Framework (CPF)* was significantly revised in June 2013. This revised document is provided as Figure 2-1.

An underlying requirement of this gated review process is for a defined set of gate deliverables to be achieved, documented, and approved before proceeding through any specific gate and into the next phase. Since the phase gate model was retroactively applied to the FMRP, there remain a number of outstanding deliverables from previous phases/sub-phases; these are scheduled for completion during the period of the Medium Term Plan. The outstanding deliverables are discussed in detail in Section 2.1.3, *Outstanding Phase Gate Deliverables*.

This Work Plan details many FPET activities associated with Phase 2b: Advanced Design – as such, it forms a partial Medium Term Plan. This plan also specifically excludes the work of AANDC, which is detailed separately in various AANDC work plans. The FPET will begin work to complete the remainder of its Medium Term Plan within FY2014/2015.

In addition to continuing the FPET's default work to provide ongoing protection of human health and safety and the environment through the care and maintenance program, the central goals of the FPET's work to be undertaken during Medium Term Plan are three-fold.

A primary goal is to prepare the remainder of the FMRP to enter the regulatory process under the YESAA, with Remediation Project Proposal preparation scheduled to take place from FY2014/2015 through FY2017/2018 (plus ~1 year schedule float). A gate review during Phase 2bi will focus on confirming that the FMRP is prepared to successfully navigate regulatory and licensing processes for remediation. The scope of work required for the submission of the RPP is described in Section 2.2.1 and Appendix C1.

Stage Gate Control Point Framework (CPF)

March 8, 2013

Faro Project

Gate	Stage Gate 1	Stage Gate 2a	Stage Gate 2b	Stage Gate 2c	Stage Gate 2d	Stage Gate 3a	Stage Gate 3b	
	Start	Remediation Project					Provisional Finish	
Phase	1: Assessment	2: Definition				3: Implementation		4: Monitoring & Maintenance
Sub-Phase		2a: Conceptual Design	2b: Advanced Design	2c: Detail Design	2d: Pre-Construction	3a: Construction	3b: Adaptation	
Activity	Selection	Planning/Development	Env. Assessment	Permitting		Remediation		Post-Closure
Level of Development	Closure Option Report	Design Basis	Fixed Scope of Work	Tender Ready	Construction Ready	Substantial Completion	Regulatory Compliance	Operation
Key Lifecycle Criteria* — General Project Deliverables — Regulatory Deliverables	☐Written Inspector's Direction	☐Written Inspector's Direction	☐YESAA Project Proposal submiss. ☐Written Inspector's Direction ☐Env. & eng. perform. standards ☐YESAB recommendations ☐YG and Federal Government Decision Document	☐Water license submission ☐Written Inspector's Direction ☐Other license submissions	☐Water license & ancillary permits ☐Other licenses: ☐DFO HADD Authorization ☐Nav. Waters Authorization ☐Ancillary Permits	☐Assessment & Regulatory Renewals ☐Regulatory compliance ☐Adaptive Management Plan (Environ.) & Reporting submission ☐Compliance with perform. stds.	☐Assessment & Regulatory Renewals ☐Regulatory compliance ☐Compare EA OS ☐Compliance with performance standards	
— Governance Management	☐Preliminary Project Governance Framework ☐Bi-lateral co-proponent agreement ☐Project Sponsor appointed ☐Concept. Design Eng. appointed ☐Stage gate review report ☐Lessons learned report	☐Project Director (PD) appointed ☐Advanced Design Engineer appointed ☐Key project team positions filled ☐Stage gate review report ☐Lessons learned report	☐Final Project Governance Framework ☐Stage gate review report ☐Lessons learned report ☐All project team positions filled	☐Final org. chart of project team ☐Construction Manager (CM) identified ☐Detail Design Engineer appointed ☐Stage gate review report ☐Lessons learned report ☐Contracting Authority submission	☐All key CM position filled ☐All major Contractor(s) appointed ☐CM appointed ☐Stage gate review report ☐Lessons learned report	☐Project team demobilized/sub-proj. ☐Stage gate review report/sub-proj. ☐Construction Close Out report/ sub-project ☐Lessons learned report/sub-project ☐Appointment of resources for assessment and regulatory renewal	☐Appointment of resources for assessment and regulatory renewal	
— Planning	☐Closure Option Evaluation report ☐Preliminary Project Charter: ☐Scope definition ☐Level 1 milestone schedule ☐Cost estimate AACE Class 5 (+100% -50%) ☐Integrated Project Risk Register (Operational, Technical & Strategic) ☐Conceptual design PWP	☐Final Project Charter ☐Preliminary PEP: ☐Updated Project Risk Register ☐Scoping Document ☐Preliminary WBS ☐Level 2 C&C schedule ☐Cost estimate AACE Class 4 (+50% -30%) ☐Advanced Design PWP	☐Advanced PEP: ☐Updated Project Risk Register ☐Final scope i.e. WPs defined ☐Final WBS ☐Level 3 master WP schedule ☐Cost estimate AACE Class 3 (+30% -20%) ☐Detail Design PWP ☐Identify sub-projects	☐Final PEP: ☐Updated Project Risk Register ☐Updated Level 3 master WP schedule ☐Cost estimate AACE Class 2 (+20% -15%) ☐Pre-construction PWP ☐Finalize sub-project planning	☐Updated PEP Chapters for each sub-project: ☐Project Risk Register ☐Some Level 4 activity schedules ☐Updated cost estimate AACE Class 2 (+20% -15%) ☐Construction PWP	☐All CWP's for each sub-project ☐All Level 4 activity schedules for each sub-project ☐Cost estimate AACE Class 1 (+15% -10%) for each sub-project ☐Adaptation Plan for each sub-project	☐Post-Closure Plan	
— Technical — Environ. & SE	☐Characterization of Env. and SE baseline	☐Conceptual Env. baseline ☐Conceptual SE baseline ☐Development of consultation strategy for YESAA	☐Project Proposal ☐Env. & SE baseline ☐Project description ☐Effects assessment ☐Cumulative effects assessment ☐Consultation ☐Development of Environmental and SE AMP	☐Water License application (incl. detailed design of water related project components) ☐Development of Habitat Comp. Plan ☐Other License Applications (incl. specific info requirements) ☐AMP finalization ☐DB Consultation on YESAB recom.	☐Development of Compliance Tracking - Framework/Protocols ☐Compliance and reporting ☐Monitoring of new baseline/ implementation conditions	☐Development of Compliance Tracking - Framework/Protocols ☐Compliance and reporting ☐Monitoring of new baseline/ implementation conditions ☐Potential Env. and SE work related to license renewals	☐Development of Compliance Tracking - Framework/Protocols ☐Compliance and reporting ☐Monitoring and new baseline development ☐Potential Env. and SE work related to license renewals	
— Engineering	☐Design concept description ☐Independent technical validation (IPRP)	☐Conceptual engineering design ☐Reviews: ☐30% 3-D model ☐Value engineering ☐Independent validation (IPRP/IE)	☐Advanced engineering design ☐Reviews: ☐60% 3-D model ☐Constructability ☐Value engineering ☐Independent validation (IPRP/IE)	☐Detail engineering design ☐Reviews: ☐90% 3-D model ☐Constructability ☐Independent validation (IPRP/IE)		☐As-built documentation for each sub-project ☐O&M Manuals for each sub-project		
— Execution					☐Pre-construction gate for each sub-project ☐Water license and ancillary permits ☐Site facilities established	☐For each sub-project: ☐Executed PEP ☐Substantial Completion ☐Commissioning & start-up ☐Construction site closed ☐Final project documentation	☐Adaptation Plan (Engineering) for each sub-project implemented	☐Post-Closure Plan implemented
— Governance Endorsements	☐Phase funding confirmed ☐Five government concurrence ☐Faro MB approval of: ☐Stage gate review report ☐IPRP report ☐Conceptual design PWP ☐Benefits Agreement	☐Phase funding confirmed ☐Faro MB approval of: ☐Stage gate review report ☐IPRP/IE report ☐Advanced design PWP ☐Project Charter	☐Phase funding confirmed ☐Faro MB approval of: ☐Stage gate review report ☐IPRP/IE report ☐Detail Design PWP ☐YESAA Regulatory submission	☐Phase funding confirmed ☐Faro MB approval of: ☐Stage gate review report ☐IPRP/IE report ☐Pre-construction PWP ☐Final PEP ☐Conceptual HADD Plan	☐Yukon Government MB approval of Contracting Authority ☐Phase funding confirmed ☐Faro MB approval of: ☐Stage gate review report ☐Construction PWP ☐Outstanding PEP chapters	☐Project funding confirmed for each sub-project ☐Faro MB approval of: ☐Stage gate review report per sub-project ☐Close-out reports per sub-project	☐Funder's approval of Remediation Project Close-out Report	

* - Deliverables are produced at any point during the life cycle phase, but only checked at the end of each phase or stage gate

FIGURE 2-1

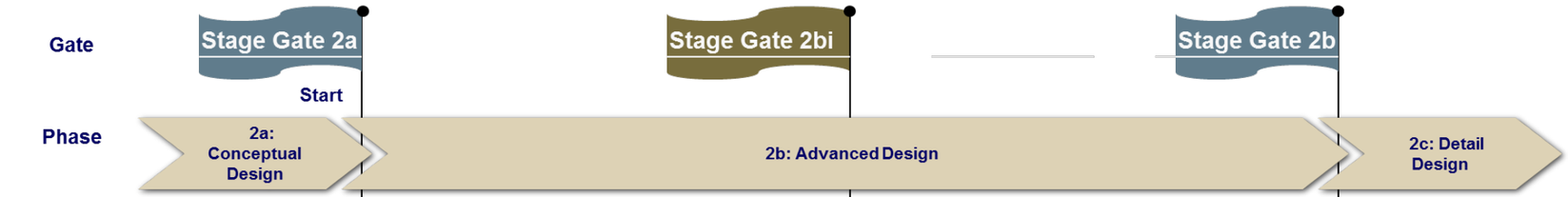
Stage Gate Control Point Framework (CPF)

Faro Mine Remediation Project

Stage Gate Control Point Framework (CPF)

March 11, 2013

Faro Interim Gate 2bi



Level of Development			Design Basis	YESAA Regulatory Submission	Fixed Scope of Work	Tender Ready
Key Lifecycle Criteria	Regulatory Deliverables			☐YESAA Project Proposal submission ☐Written Inspector's Direction ☐Environmental & engineering performance standards	☐YESAB recommendations ☐YG and Federal Government Decision Document	
	General Project Deliverables	Management		☐Stage gate review report ☐Lessons learned report	☐Final Project Governance Framework ☐Stage gate review report ☐Lessons learned report ☐All project team positions filled	
		Planning		☐Scope of work for Project Proposal	☐Effective PEP: ☐Updated Project Risk Register ☐Final scope i.e. WPs defined ☐Final WBS ☐Level 3 master WP schedule ☐Cost estimate AACE Class 3 (+30% -20%) ☐Detail Design PWP ☐Identify sub-projects	
		Technical – Env & SE		☐Project Proposal ☐Environmental & SE baseline ☐Project description ☐Effects assessment ☐Cumulative effects assessment ☐Consultation ☐Development of Environmental and SE AMP		
		Technical – Engineering		☐Total project Value Engineering ☐Independent validation by IPRP/IE of Project Proposal	☐Advanced engineering design ☐Reviews: ☐60% design ☐Constructability ☐Value engineering ☐Independent validation (IPRP/IE) ☐For each sub-project (early remediation WPs): ☐As-built documentation ☐O&M Manuals	
		Execution			☐For each sub-project (early remediation WPs): ☐Executed Project Plan ☐Substantial Completion ☐Commissioning & start-up ☐Construction site closed ☐Final project documentation	
	Governance Endorsements			☐Faro MB approval of: ☐Stage gate review report ☐IPRP/IE report ☐YESAA Regulatory submission	☐Phase funding confirmed ☐Faro MB approval of: ☐Stage gate review report ☐IPRP/IE report ☐Detail Design PWP ☐Gate 3a review report for each sub-project (early remediation project) ☐Close-out report for each sub-project	

FIGURE 2-1 (CONT.)
Stage Gate Control Point Framework (CPF)
Faro Mine Remediation Project

TABLE 2-1
Summary of Control Point Framework Deliverables* – Medium Term Plan
Faro Mine Remediation Project

Phase	Deliverable	Partner Accountable/Responsible (A/R)			In FPET Medium Term Plan? (Y/N)
		YG FPET	AANDC	Joint	
Outstanding Deliverables - Phase 2a Conceptual Design	Key project team positions filled	A/R	A/R		Y – FPET only
	Final Project Charter		A/R		N
	Conceptual PEP	A/R			Y
	Cost Estimate AACE Class 4	A/R			Y
	Advanced Design PWP	A/R	A/R		Y – FPET only
	Phase Funding Confirmed		A/R		N
	Faro MB approval of Advanced Design PWP			A/R	Y
	Faro MB Approval of Project Charter			A/R	N
Phase 2b Advanced Design	YESAA Project Proposal Submission			A/R	Y
	Environmental & Engineering Performance Standards			A/R	Y
	Final Project Governance Framework			A/R	N
	2b Stage Gate Review Report		A/R		N
	2b Lessons Learned Report	A/R			Y
	All project team positions filled	A/R	A/R		Y – FPET only
	Advanced PEP	A/R			Y
	Cost Estimate AACE Class 3	A/R			Y
	Detailed Design PWP	A/R	A/R		Y – FPET only
	Remediation Project Proposal	A/R	A/R		Y – FPET only
	Advanced Engineering Design	A/R			Y
	Independent Validation (IPRP/IE)	R	A/R		Y – FPET only
	Phase Funding Confirmed		A/R		N
	Faro MB Approval - 2b Stage Gate Report			A/R	Y – milestone only
	Faro MB Approval of IPRP/IE Report			A/R	Y – milestone only
	Faro MB Approval of Detailed Design PWP			A/R	Y – milestone only
	Faro MB Approval of YESAA Submission			A/R	Y – milestone only

As discussed in Section 1.2, *Medium Term Planning Framework Objectives*, there are other risks at the FMC that continue to mature as required remediation planning for the entire site continues. These risks have exceeded, or have strong potential to exceed, our ability to adequately mitigate during the period of the Plan without additional and timely remedial measures as described in the work packages for DVIHU, CVD SIS, and VCD. Additional information concerning these risks is included in Appendix G, *Technical Risk Register*; risks are further discussed in the individual work packages for the projects (Sections 2.2.5 through 2.2.7 and Appendices C3 through C5). While implementing components of the remediation solution in advance may

seem out of step with a disciplined, gated approach to planning and implementation of the overall remedial approach (which would ordinarily see construction occur in Phase 3) the need for IW to address specific, elevated risks has long been identified as a possibility. In spring 2013, a decision was reached by AANDC and YG to submit an IWPP to YESAB and to seek a Water Licence for the period from FY2014 until remediation, which will occur under a separate Water Licence. The scope of the IWPP as it pertains to the IW is discussed in Section 1.3.1 (*Regulatory Authority*).

Based on information received in March 2012 from the PDT (and corroborated by the IPRP), the WTP at the FMC requires prompt replacement. This facility, built in 2001 under the direction of the Interim Receiver, had a design life of 5 years and was created using existing equipment at the FMC. A number of interim repairs, upgrades, and improvements have been completed over the years; however, according to recent work, the existing WTP poses risks to human health and safety and the environment that are unacceptable for continued operations. The Faro Mill WTP therefore ceased operations at the beginning of the 2013 operating season. Section C, *Measures to be Taken*, in the February 2009 *Minister's Determination Re: Faro Mine Complex Reclamation and Closure Activities* (Appendix E), anticipated that this risk may increase before the final remedial solution is approved and implemented. This document identifies the installation and commissioning of interim water treatment solutions as one of the protective measures necessary to protect of people, property, and the environment. Consequently, the Medium Term Plan includes a series of interim risk mitigation and water management and treatment measures necessary to manage the period between initiation of design and start-up of a more permanent water treatment plant. This includes the installation, commissioning, and operation of a modular IWTS beginning in FY2014/2015 (Section 2.2.10.1; Appendix C6). Until the project obtains a water licence for IW, these activities will be executed under the Minister's Section 37 authority.

2.1.3 Outstanding Phase Gate Deliverables

The application of the Control Point Framework Reviews (i.e., Stage-gate Reviews) will occur at key milestones through the overall FMRP life cycle and involve assessment by independent bodies as outlined in the *Contaminated Sites Plan Major Project Office Standards and Guidelines Manual* (AANDC, 2013a) and Project Charter (2013).

2.1.3.1 Phase 1 (Closure Option Selection) Overview

Characterization of issues at the FMC has been going on since preparation of the first Integrated Comprehensive Abandonment Plan (ICAP) in the late 1980s. In 2003/4, the federal and territorial governments formally recognized that the FMC would not reopen and agreed to work together on development of a C&R Plan. Phase 1 can be considered to have begun at this point. The phase concluded when the Faro Oversight Committee reached agreement on an overall closure option for the FMC in October 2008. During this period, care and maintenance for the site was implemented by the Interim Receiver under direct funding from Canada. Closure planning was co- managed by the federal and territorial governments through a joint Type II Office, with input from the Selkirk First Nation and Ross River Dena Council.

2.1.3.2 Phase 2a (Conceptual Design) Overview & Outstanding Deliverables

Phase 1 concluded when the Faro Oversight Committee reached agreement on an overall closure option for the FMC in October 2008. This signalled the transition into Phase 2a, Conceptual Design. During this phase, care and maintenance for the site was implemented by YG, and conceptual design development was co-managed by the federal and territorial governments, with input from the Selkirk First Nation, Ross River Dena Council, and Liard First Nation. The lead design consultant during most of this phase was SRK Engineering, with CH2M HILL replacing this firm at the end of the phase. Phase 2a also served as the point of initiation of discussions between Canada, YG, and AYFN that centered on arriving at a revised Governance and Management model to replace the historical Project OSC. YG and AAANDC will be meeting to further discuss the governance and management model in FY2014/2015.

In the 2011 version of the CPF, Phase 2a is considered functionally complete at the end of FY2012/2013, thereby allowing a fiscal year end phase gate transition point and generally aligning the project to a phased approach for FY2013/2014 and beyond. YG and AANDC will be meeting to further discuss the governance and management model in FY2013/2014.

Deliverable: Key Project Team Positions Filled (Governance & Management)

The filling of some key project positions has been deferred to pending conclusion of ongoing discussions between Canada and YG regarding project governance and management.

Owner: Project Director ***Estimated completion: 6-12 months following conclusion of bilateral governance/management discussions***

Deliverable: Conceptual Project Execution Plan (Planning)

The requirements to create a Project Execution Plan (PEP) to support the life cycle of the project were established towards the end of Phase 2a. However, completion of the PEP will be contingent on conclusion of ongoing discussions between Canada and YG regarding project governance and management.

Section 2.2.1.3, *Project Execution Plan Development*, provides detailed plans for completing and adapting the PEP as required throughout Phase 2b.

Owner: Project Director ***Estimated completion: schedule to be determined following resolution of bilateral governance/management discussions***

Deliverable: Final Project Charter (Planning)

As discussed, a Preliminary Project Charter was not created during Phase 1; a final charter was completed by the Project Sponsor in August 2013, endorsed by Faro Management Board in September 2013 and approved by the AANDC Project Leader in October, 2013.

Owner: Project Sponsor ***Completed: October 2013/14***

Deliverable: Phase Funding Confirmed (Government Endorsements)

Formal approval of funding for Phase 2b has not yet been provided, pending completion and approval of the phase work plan. The draft MTP (partial Phase 2b) was delivered to the Faro MB for consideration on December 14, 2012, in anticipation of partial phase funding approval for associated works before the start of FY2013/2014. However, as with resourcing and the PEP, multi-year funding (either phase or partial) is contingent on conclusion of ongoing discussions between Canada and YG regarding project governance and management.

Owner: Project Sponsor Estimated completion: Phase/multi-year funding approved no later than March 31, 2015

2.1.4 Execution and Procurement Approach

The following approach to execution, procurement and AYFN and Yukoner participation is predicated on continuation of the status quo regarding project governance and management for the entire 4-year period of the MTP. Should the ongoing discussions between Canada and YG result in changes to project governance and management structures during that timeframe, changes to the approach may be required.

While advice and assistance may be sought from outside YG, such as from the PDT or other technical advisors, the FPET will award all contracts for the work of the Medium Term Plan as YG contracts. As a result, all contracts will follow YG contracting regulations, guidelines, and procedures, and will be subject to specific YG authorities, based on their overall dollar values.

The existing contracts for care and maintenance services and the PDT are currently set to expire during the term of this Plan. Upon approval of the Medium Term Plan, YG will work directly with Canada to determine the best strategic approach for providing these services over the duration of the plan.

2.1.4.1 Interim Works

While the details of the procurement approach may vary somewhat according to the scope of an individual work package, it is expected that a traditional design-bid-build approach will be followed for the Interim Works project work packages included in this plan. The PDT, led by CH2M HILL, will serve as engineer-of-record, and will provide other support services where appropriate.

The FPET will update the publicly accessible, searchable online YG tender forecast (http://www.gov.yk.ca/tenderforecast/search.html) on a quarterly basis, providing potential bidders advanced notice of upcoming opportunities related to Interim Works projects. Active tenders will be advertised in local media and on the online YG Tender Management System (TMS) (http://www.gov.yk.ca/tenders/tms.html). Outside communication resources, such as major Canadian newspapers, MERX, and the like, will also be utilized as appropriate.

More information about proposed execution and procurement approaches for specific work packages can be found in Section 2.2, *Work Packages Included*.

2.1.4.2 Affected Yukon First Nations and Yukoner Participation Contract Strategy

A somewhat unique aspect of the FMRP is the commitment, enshrined in the overall project objectives, to maximize economic opportunities for AYFN and Yukoners that may arise as a result of the FMRP. Those First Nations defined as "Affected First Nations" with regard to the FMRP in the *Yukon Northern Affairs Program Devolution Transfer Agreement* (YG, 2001) are Ross River Dena Council, Liard First Nation, Kaska Dena Council and Selkirk First Nation. Every major contract the FPET has awarded since 2009 has mandated specific measures to meet this goal (including care and maintenance, project design, and the 2010/11 Grum Sulphide Cell Cover project).

The draft *Affected Yukon First Nation & Yukoner Participation Contract Strategy* (Appendix J) outlines the framework for providing benefits wherever reasonable opportunities for AYFN and Yukoner participation exist. Founded on work that started in 2008 with the Chiefs of Ross River Dena Council and Selkirk First Nation, the proposed strategy will inform the FPET's approach to AYFN and Yukoner participation until it is replaced by a new, negotiated agreement between the parties.

2.2 Work Packages Included

2.2.1 Advanced Design and Remediation Project Proposal Submission (AD/RPP)

Canada, represented by AANDC, and YG, as represented by AAM, are co-proponents for the preparation of a Project Proposal for the FMRP. At the height of its operation, the FMC's mill had a capacity of 13,500 tonnes per day; the project will therefore be subject to assessment by Executive Committee under Item 3(a) of Schedule 3 of the *Assessable Activities, Exceptions and Executive Committee Projects Regulations* (SOR/2005-379) of YESAA. An application for assessment under YESAA is termed a Project Proposal. This application contains information about the proposed project (e.g., where it will be located, how it will be accomplished, and when it will occur), the environmental and socio-economic conditions, and the potential effects of the proposed project. The Project Proposal is intended to provide sufficient information for the assessors (i.e., Executive Committee) to conduct the YESAA assessment and reach assessment conclusions. AAM intends to submit a Project Proposal for the final remediation of the FMC to YESAB in spring 2017, thereby initiating the assessment process.

In September 2011, the FPET awarded the contract for a PDT to prepare the Project Proposal and advance engineering design for remediation of the FMC. The PDT consists of two core technical focus teams: a Regulatory Focus Team and an Engineering Focus Team. These teams will support AANDC and YG in preparing the Project Proposal for the remediation of the FMC.

AAM intends to submit works that require completion prior to 2017 for assessment and permitting. These works have been described as IW in earlier sections of the MTP, and the associated Remediation Project

Proposal is described as the IWPP. Efforts described in this section relate to the preparation of the Project Proposal for final remediation of the FMC, which will be referred to as the Remediation Project Proposal to differentiate it from the lower level assessment required for Interim Works.

This work plan presents the proposed scope, budget, and schedule for the PDT to prepare this Remediation Project Proposal. The work has been organized within the Planning and Design tree of the overall FMRP WBS, as illustrated in Appendix F.

2.2.1.1 Description of Scope

This work package has been written to include the preparation of the Remediation Project Proposal (including the engineering design, environmental and socio-economic existing conditions and effects assessment, and field programs to support this effort). Each component of this work package is summarized in the following sections, and is described in detail in Appendix C1.

Permitting for Field Programs – While major permitting requirements for field programs (e.g., YESAA assessment or water licence) will be addressed through the Interim Works Project Proposal, there are some minor permits that may be required to support field programs. These may include for example, Fisheries Research Licences, Heritage Resources Permits, Yukon Archaeological Sites Regulations Permits, Scientists and Explorers Licences, and other non-discretionary permits (e.g., building or electrical permits). These permits will be addressed on an as-required basis during field planning. This task also includes close-out reporting for permits.

Environmental and Socio-economic Baseline Data Collection and Research – Data collection and research programs to support the environmental and socio-economic assessments are ongoing at the FMC, based on earlier gap analysis outcomes. Gaps analysis refinements and field planning conducted in 2013 and 2014 will guide the continuation of data collection and research programs to be conducted in 2014 and 2015. Iterative approaches to data collection and refining gap analysis will be applied with the overall intent that environmental and socio-economic baseline data collection and research programs must ultimately meet the needs of the YESAA Project Proposal. The majority of data collection programs will occur in 2014, with 2015 activities limited to addressing outstanding gaps arising from previous programs.

Engineering for the Remediation Project Proposal – Designs for the remediation of the FMC will be advanced to a point where the environmental and socio-economic effects may be assessed, and requirements of YESAA as met. An evaluation of design requirements, by CH2M HILL, in early 2013 identified 30 percent design as an appropriate level of design detail for the YESAA Project Proposal. Additionally a data gaps evaluation was completed to identify specific investigations necessary before the designs may be completed. Completion of these investigations and associated reporting is included in this work package. Designs will be required for all components of the FMRP, including Faro Mine Area – 29 packages, Tailings Area – 17 packages, Vangorda/Grum Area – 22 Packages, and Site Wide – 4 packages. Designs will also need to address management plans that will describe how the activities will be conducted. A detailed project description will be prepared to support the environmental and socio-economic effects assessments.

Environmental and Socio-economic Effects Assessment – Conducting the environmental and socio-economic effects assessments entails several activities that culminate in an evaluation of the significance of potential effects of the remediation project. These include defining the project and assessment scope (e.g., Valued Components); compiling and interpreting baseline information; identifying and analyzing potential interactions between project activities and the environmental and socio-economic valued components; identifying uncertainty about environmental and socio-economic effects and developing appropriate adaptive management plans; evaluating significance of effects; developing monitoring programs that will confirm the outcomes of the assessment predictions; and refining the proposed project to minimize or eliminate potential effects.

Conduct Consultation and Engagement – The preparation of a YESAA Project Proposal for submission to the Executive Committee triggers consultation and engagement requirements for YG and AANDC. Consultation

and engagement activities will continue throughout the development of the YESAA Project Proposal, occurring as required in accordance with a Consultation and Engagement Plan prepared under YG's lead. It is anticipated that consultation events will take place in the communities of Pelly Crossing, Ross River, Faro, Watson Lake, and Whitehorse and are expected to address (1) scope of assessment, (2) baseline conditions, (3) project design, and (4) effects assessment.

Regulatory Planning and Strategy – The Regulatory Leadership Team (RLT) developed a draft Regulatory Approvals Strategy in 2011. This document will guide the project team to prepare a YESAB-compliant Project Proposal proactively, effectively, and in a timely manner. The document and strategies will be tracked and refined throughout the process of developing a YESAA Project Proposal.

Regulatory Communications and Coordination – This task will include communications between members of the RLT, the Regulatory Working Group, Regulatory Focus Team, and Engineering Focus Team. This task will also include general PDT coordination and technical guidance. Successful communication and coordination between AANDC, AAM, and the PDT, as well as further communication to external parties, will relate to the effectiveness and efficiency of the design and its review in the regulatory processes.

Project Proposal Production – The Project Proposal is the document that will be submitted to the Executive Committee to initiate the YESAA process. The PDT prepared an updated draft Annotated Table of Contents for the FMRP in March 2013, providing an overview of the content required in a YESAA Project Proposal. The final Project Proposal will include: a project introduction and overview; regulatory context; project location, purpose and alternatives; project description (includes advanced engineering design); First Nations/Community consultation; description of existing or baseline environmental and socio-economic conditions; environmental and socio-economic effects assessment; cumulative effects assessment and mitigation, monitoring, and adaptive management plans. It should be noted that the majority of information will be presented in supporting documents appended to a main document. The complete Project Proposal will be a large, complex document that will require substantial effort for compilation and review by the PDT, as well as the co- proponents.

2.2.1.2 Schedule Summary

The draft schedule (Appendix H) assumes the following:

- FY2014/2015 – Commence the Project Proposal work in late 2015 (Third Quarter) with baseline program coordination, including YG's approval of a historical resources and socio-economic team. Prepare applications and acquire permits for baseline, field research and ancillary permits in early 2016. Conduct consultation from approved Consultation and Engagement Plan associated with the assessment of the remediation project.
- FY2015/2016 – Execute first year of baseline data collection, analysis and reporting. Prepare supporting plans including draft assessment approach, as well as upfront sections of the Project Proposal. Finalize the project description for commencing the effects assessment. Complete two consultation events: one for project description and the other for effects assessment.
- FY2016/2017– Execute second year of baseline data collection (where required), conduct analysis, and update reporting. Finalize effects assessment writing of the Project Proposal including monitoring, mitigation, and adaptive management plans. Submission of the Project Proposal to YESAB is targeted for May 2017.

2.2.1.3 Budget

In December 2011, the PDT prepared a total cost opinion for the preparation of the Project Proposal and advanced design (*Memorandum - Cost Opinion for Preparation of the Faro Mine Remediation Project Proposal*, CH2M HILL, 2011). An updated cost opinion was provided of approximately CAD$49 million (M), based on the then-current scope of the Project Proposal, investigations to address technical gaps, and an equivalent of a 30 percent level of engineering design.

The cost estimate for this work is approximately $39 M, and includes additional environmental field investigations that were not initially included (e.g., fish telemetry, historical resources, additional wildlife studies) and scope reductions for design work completed during the 2012 field season or planned to occur in parallel with the Remediation Project Proposal under the MTP. Tables 2-2 and 2-3 summarize the engineering and regulatory cost estimates, respectively; details of these costs are also provided in Appendix C1.

This cost opinion is a rough order-of-magnitude (ROM), with an expected accuracy of +100 to -50 percent (Class 5), and is intended for planning purposes. Costs have not been escalated and are presented as 2012 costs in Canadian dollars (CAD).

TABLE 2-2
Project Proposal - Engineering Cost Estimate
Faro Mine Remediation Project

WBS	Phase	Labour	Expense	Subcontractor	Total
01.01.01.04 - 33	Faro Mine Area Field Investigations (29)	$ 1,821,221	$ 1,020,143	$ 2,690,282	$ 5,531,646
01.01.02.04 - 21	Tailings Area Field Investigations (17)	$ 900,637	$ 815,022	$ 1,733,927	$ 3,449,586
01.01.03.02 - 24	Vangorda/Grum Area Field Investigations (22)	$ 1,230,322	$ 997,055	$ 2,089,733	$ 4,317,110
01.01.04.02 - 06	Site-Wide Field Investigations (4)	$ 287,651	$ 140,531	$ 765,851	$ 1,194,032
01.02.01.04 - 33	Faro Mine Area Engineering Design Packages (29)	$ 5,784,102	$ 177,383	$ -	$ 5,961,485
01.02.02.04 - 21	Tailings Area Field Engineering Design Packages (17)	$ 3,504,344	$ 113,627	$ 26,692	$ 3,644,663
01.02.03.02 - 24	Vangorda/Grum Area Engineering Design Packages (22)	$ 4,700,111	$ 148,114	$ -	$ 4,848,225
01.02.04.02 - 06	Site-Wide Engineering, Design Packages (4) and Class 3 Cost Estimate	$ 942,927	$ 107,768	$ 232,074	$ 1,282,770
	Total	$ 19,171,315	$ 3,519,643	$ 7,538,559	$ 30,229,517

TABLE 2-3
Project Proposal - Regulatory Cost Estimate
Faro Mine Remediation Project

WBS	Phase	Labour	Expense	Subcontractor	Total
01.03.01	Project Description	$ 69,250	$ 4,002	$ 26,472	$ 99,724
01.03.02	Baseline Data Collection and Research	$ 1,346,404	$ 596,526	$ 1,323,453	$ 3,266,383
01.03.03	Environmental and Socio-economic Effects Assessment	$ 1,446,003	$ 79,459	$ 401,694	$ 1,927,156
01.03.04	Project Proposal Consultation	$ 89,979	$ 23,205	$ 178,910	$ 292,094
01.03.06	Project Proposal Supporting Plans	$ 287,596	$ 73,905	$ 290,301	$ 651,802
01.03.07	Project Proposal Communication and Coordination	$ 543,655	$ 44,705	$ 256,099	$ 844,460
01.03.08	Project Proposal Production	$ 874,330	$ 98,708	$ 195,595	$ 1,168,633
01.04	Permitting	$ 51,815	$ 2,517	$ 12,472	$ 66,804
	Total	4,709,033	$ 923,028	2,684,996	8,317,056

2.2.2 Interim Works Project Proposal

Since 2009, YG has conducted site operations and remediation planning activities for the FMC under the authority of a Minister's Determination under the *Waters Act* (YG, 2003). However YG and AANDC (the co-proponents) have recently agreed to complete a YESAA assessment and permitting for IW that will occur within approximately 10 years before the FMRP is implemented. The Interim Works include the following activities:

- Site Operations (C&M)
- Site Investigations
- DVIHU
- Accessory Activities

AAM intends to submit a Designated Office-level Project Proposal for these Interim Works to YESAB in early 2014, initiating the YESAA process that is expected to take approximately 6 months. Once the YESAA process is complete, the co-proponents will seek appropriate regulatory authorizations, including a water licence under the *Waters Act*. This will include preparing applications, and completing licensing and permitting processes.

The assessment and permitting processes for the Interim Works are independent with those for the FMRP. They are specifically intended to support the activities required to operate the FMC, reduce unacceptable site risks, and conduct site investigations necessary for remediation planning.

2.2.2.1 Description of Scope

This work package has been developed to include the preparation of the IWPP. Each component of this work package is summarized in the following sections, and is described in detail in Appendix C2.

YESAA IWPP – This task includes the preparation of the IWPP, which describes the proposed project and its potential environmental and socio-economic effects. The PDT initiated preparation of an IWPP in Q2 2013/14, to meet the co-proponents' schedule to submit the IWPP to the Watson Lake Designated Office in early 2014. This schedule is driven by the need for permits and licences to be in place for the construction and operation of the new water treatment plant. Preparing the project proposal includes the following steps: prepare scoping and project description working documents; collect baseline data; conduct effects assessment and refine project; assemble the IWPP (main document and supporting documents); and review and refine the IWPP. This task also includes consultation and engagement, and technical coordination and communication. Within the time frame of the 4-year MTP, this activity may include the final stages of finalizing and submitting the IWPP.

Interim Works YESAA Process – Submission of the IWPP to the Watson Lake Designated Office will initiate the YESAA process. This will include the adequacy review, YESAA evaluation, and Decision Document stages, which are anticipated to take approximately 6 months.

Interim Works Water Licence and other Permitting Processes – Obtaining permits and licences for the Interim Works project will require the development of permit applications. The most substantial of these is the water licence application, which will require a level of detail similar to the YESAA Project Proposal, with additional detail in areas related to water management. The water licence process will be completed following the YESAA assessment process. It includes a requirement for the Yukon Water Board to schedule a public hearing. The adequacy review, public review, hearing, deliberation, and licence approval stages of the water licence process are expected to take approximately 6 months.

2.2.2.2 Schedule Summary

The schedule for the IWPP assumes the following:

- 2013-2014 –Finalize project description, baseline data collection, analysis and reporting, consultation, and effects assessment for the IWPP for YG review and approval. Submit IWPP to YESAB in January 2014. Initiate adequacy review and development of water licence application.

- 2014-2015 – Complete YESAA process and obtain Decision Document. Complete preparation of water licence application and other permit applications. Initiate and conduct water licence process and other permitting processes.
- Q1 2015-2016 –Finalize outstanding permit requirements.

2.2.2.3 Cost Estimate

In December 2011, the PDT prepared a cost opinion for the expected total cost to prepare the Remediation Project Proposal (CH2M HILL, 2011). This cost opinion did not include a cost estimate for preparing the IWPP. Subsequently, while the scope of the MTP was finalized in 2013, the IWPP scope was agreed to be required, and an initial cost estimate of $1,000,000 ($500,000 in 14/15) was established for cashflow forecasting. The following cost opinion carries that initial estimate forward and is not reflective of detailed cost estimation that has occurred since that time. As such, this cost opinion is considered ROM, with an expected accuracy of +100 to -50 percent (Class 5). Costs have not been escalated and are presented as 2012 costs.

The total cost estimate for the IWPP described herein is $500,000. Table 2-4 summarizes the estimate. Because of the method used to develop the following cost opinion, it does not have the necessary basis to estimate costs for labour, expense, or subcontractors.

TABLE 2-4
Interim Works Project Proposal – Cost Estimate
Faro Mine Remediation Project

WBS	Phase	Total
01.04.06.01.02	IWPP YESAA Process	$90,000
01.04.06.01.03	IWPP Water Licence Process	$410,000
	TOTAL	$500,000

2.2.3 Project Execution Plan Development

In accordance with the Project Control Point Framework and the AANDC *Contaminated Sites Plan Major Project Office Standards and Guidelines Manual* (AANDC, 2013a), a Preliminary PEP is to be created in Phase 2a and an Advanced PEP in the Medium Term. A final PEP will be developed for Phase 2c of the FMRP and will be maintained and updated throughout the life of the Project.

Once developed, the PEP will become one of the critical project work planning documents, along with the Project Charter and the Phase Work Plan. The PEP specifies how the Project will be implemented; describes roles and responsibilities; provides schedule and budget information; and identifies assumptions, constraints, dependencies, risks, and issues.

Final planning for the development of the PEP during the period of the MTP, including scope, schedule, and costing, is dependent on the outcome of current discussions between Canada and YG regarding project governance and management arrangements. It is expected that the necessary direction required to reinitiate development of the PEP will be received during Q4 FY2013/2014 or early in Year 1 (FY2014/2015). For the purposes of the MTP, a provisional or “placeholder” budget amount has been assigned; actual funding requirements will depend heavily on the final agreed scope of the FPET’s PEP development efforts.

2.2.4 Grum Building Lease

2.2.4.1 Background Information

On the Grum side of the FMC, the Faro owns two buildings that are potentially significant assets to the FMRP. There is a two-storey Administration Building (735 square metres [m^2]) and a Warehouse Building (1,092 m^2) (Figure 2-2).

FIGURE 2-2
Grum Administration and Warehouse Buildings
Faro Mine Remediation Project



Grum Administration Building



Grum Warehouse Building Interior

This work package describes general lease terms and the division of responsibilities for managing the lease and the buildings, should one or both of the buildings be able to be used by CH2M HILL during the term of the MTP. It is anticipated that the future lease agreements will be established between Faro and CH2M HILL.

2.2.4.2 Current Condition

In 2003, with approval from Indian and Northern Affairs Canada and under Court authorization, Deloitte and Touche (as site interim receiver) transferred two buildings on the Grum portion of the FMC to Faro in lieu of back taxes. Faro does not have any tenure on, or access rights to, the land on which these buildings reside.

For 2012-2013, CH2M HILL entered into a 1-year lease agreement with Faro for use of the two buildings. Appendix K1 provides a copy of the lease agreement. Lease rates did not include utilities; however, Faro was responsible for maintaining the overall structures. Once the lease agreement was in place, YG agreed to pay for the first CAD$10,000 of upgrades, with Faro paying for additional costs. Faro was responsible for maintaining property insurance on the buildings, whereas CH2M HILL was responsible for maintaining CAD$2 M Commercial General Liability insurance and CAD$1 M tenant legal insurance.

To prepare for the Administration Building's use in 2012, YG facilitated and paid for upgrades, including: re-commissioning the furnace on the upper level, renting and initially filling the propane tank, general cleaning, and segregating known mould-containing areas. Through the C&M operator, YG also provided electricity for the buildings. The Administration Building does not currently have functioning plumbing (potable water or washroom facilities) or communications. In response to observations made during the course of the 2012 season, an independent evaluation of the buildings' condition was completed in FY2013/2014. This evaluation indicated that the Administration Building would likely require extensive upgrades to be able to be safely used by the FMRP, while the Warehouse Building may be of more immediate use. Discussions are ongoing between YG and Faro as to how to best capitalize on the opportunity presented by the Warehouse Building; the details of the agreed-upon approach will be included in subsequent detailed work plans for the applicable fiscal years.

2.2.4.3 Justification for Action

In 2012, CH2M HILL conducted a cost comparison to determine whether leasing the building(s) would save money, rather than renting and outfitting four 10-foot-by-40-foot administrative trailers and a washroom trailer.

It was hoped that the Administration Building could be used for daily operations, planning, and directing exploration field work and construction, as well as associated business relating to engineering and construction.

Similarly, it was hoped that the Warehouse Building could be used for equipment maintenance and storage. The Administration Building could also function as an additional point of access control during construction (i.e., as a security guardhouse) to reduce pressure on the Faro Guardhouse, where site security and management are currently based. Figure 2-2 provides photographs of these buildings.

Appendix K2 provides a copy of the annual trailer rental costs, which were estimated at CAD$150,000. This amount was also the total lease rate that Faro provided for use of the Administration Building and the Warehouse Building. The building lease could be viewed as offering an annual savings of approximately CAD$50,000 for use of just the Administration Building, or offering free use of the warehouse building when both buildings are used. By leasing the buildings, CH2M HILL would fulfill one of YG's mandates of local capacity building, by providing an additional revenue stream for the Faro from otherwise non-utilized resources.

2.2.4.4 Scope of Work

General lease terms were established in 2012. CH2M HILL assumes that the original lease can be used as a basis for future agreements; therefore, this work package will include the following management and administrative tasks:

- Review proposed lease agreement terms and conditions with YG.
- Initiate and complete lease negotiations with Faro, culminating in an executed lease agreement(s).
- Process and review payments to Faro.
- Negotiate ad-hoc issues with Faro and YG.
- Complete task initiation, close-out, invoicing, and reporting.
- Keep the premises clean.

2.2.4.5 Uncertainties

Before the 2012 field season began, the Administration Building had not been used for nearly 15 years. Despite completed and currently planned upgrades to the Administration Building, as discussed, it is likely that the Administration Building would require extensive upgrades to be usable, while the Warehouse Building is in considerably better condition. YG and Faro continue to discuss possible options regarding the two buildings.

2.2.4.6 Budget (not including repairs)

Annual Lease Costs for Two Buildings	$150,000
Annual Management / Administrative Costs for CH2M HILL	$30,000*
Total Annual Costs	$180,000
Four-Year Total Estimated Cost	$720,000

*Note: This amount includes CAD$7,500 of Goods and Services Tax that are due on the lease.

2.2.5 Down Valley Interim Hydraulic Upgrades

The DVIHU work package provides an upgrade of the hydraulic capacity of the Intermediate Dam (ID) spillway and the Rose Creek Diversion (RCD) to allow the system to pass a 1-in-500-year flood event. The proposed interim upgrades will increase the ID spillway capacity to approximately 135 cubic metres per second (m^3/sec).

Despite the ID being rated as a "Very High" to "Extreme" risk dam based on the Canadian Dam Association (CDA) *Dam Safety Guidelines 2007* (CDA, 2007), the existing spillway (capacity of 32 m^3/sec) cannot safely pass a moderate or major flood event without potentially failing the dam. ID dam failure may cause an environmentally damaging discharge of metals-laden tailings to the Rose Creek Valley, Anvil Creek, and the

Pelly River that would result in a significant or major loss of critical fish and wildlife habitat that would be impractical or impossible to restore. Failure of the Secondary Dam in 1975 within the Rose Creek Valley resulted in a loss of wildlife habitat, with little recovery evident more than 35 years later.

The work is proposed for completion as soon as possible because the DVIHU are intended to provide temporary protection of the ID until implementation of the final closure plan. The enhanced spillway that will be constructed as part of the final closure plan will have the capacity required for a dam with a "Very High" or "Extreme" risk classification (up to the Probable Maximum Flood [PMF]). PMF spillway construction, however, is a major undertaking that is impractical to implement during the MTP due to limitations in time and funding, and the risks inherent with a project that will involve a major bedrock excavation adjacent to the ID, which is the highest risk structure at the FMC.

A workshop conducted in August 2012 to review and evaluate proposed closure alternatives for routing the PMF flood through the Rose Creek Valley was attended by representatives from Canada as represented by AANDC and YG, as well as the IPRP, the CH2M HILL Technical Review Board (TRB), the IE, and the PDT. Based on these discussions, the IPRP and the TRB provided the following recommendations:

- Build the permanent PMF spillway as soon as reasonably possible.
- Because it is projected that a new PMF spillway would only be incorporated as part of the final mine closure measures following field investigation, plan, design, fund, and obtain required agency approvals for construction of a new PMF spillway, the capacity of the existing ID spillway and the RCD should be improved as soon as possible.

Based on these recommendations, the proposed down valley interim hydraulic upgrades consist of the following elements:

- Increase the existing ID spillway capacity by increasing the depth of the existing spillway channel. Relocate existing piping and lime mix tank that have been placed within the ID spillway
- Increase the height of the ID embankment crest by installing a geomembrane layer to extend the core to the dam crest and by adding concrete traffic barriers
- Protect the ID spillway channel from erosion by installing gabion mattresses or other approach
- Increase the RCD capacity to pass the 1-in-500-year flood event, by removing vegetation, repairing raveled slopes on the dike and cut slope, and by filling in low spots on the dike crest.

The combined effect of deepening the spillway channel and raising the crest will be to increase the capacity of the ID spillway to about 135 m^3/sec, approximately equal to a 1-in-500-year flood event. This does not include attenuation of flood flow by the NFRC rock drain, which would tend to increase protectiveness of the proposed modification. Attenuation of flood flow by the rock drain will be evaluated during design.

The proposed work includes the following tasks:

- A geotechnical field exploration and design definition including hydraulic analysis and flood routing
- Detailed design including preparation of conceptual, advanced, detailed and final designs
- Procurement assistance, including preparation of tender-ready subcontract documents plans and specifications, and contract assistance
- Permitting
- Construction management
- Construction

Uncertainties that will be addressed during the design process include (1) functionality and hydraulic behavior of the upgraded spillway, functionality of the existing "fuseplug" and potential overtopping of the

RCD, attenuation of the North Fork of Rose Creek at the rock drain and performance of the CVD impoundment and spillway.

Assuming data collection and design definition through 90 percent design are completed prior to the start of the MTP, the schedule for the DVIHU includes 100 percent design in FY2014/2015 and procurement and construction in FY2016/2017.

Cost estimates for the work have been prepared based on conceptual designs for the proposed hydraulic upgrades. These cost opinions are ROM, with an expected accuracy of +100 to -50 percent (Class 5). Costs are presented as 2012 costs and have not been escalated. The total cost estimate, summarized in Table 2-5, equals $5,965,000.

TABLE 2-5
Down Valley Interim Hydraulic Upgrades – Cost Estimate
Faro Mine Remediation Project

Phase	Labour	Expense	Subcontractor	Total
Final Design	$80,000	$13,000	$7,000	$100,000
Procurement	$193,000	$6,000	-	$199,000
Construction Management	$523,000	$163,000	$50,000	$736,000
Construction	$1,316,000	$3,574,000	$40,000	$4,930,000
Total	$2,112,000	$3,756,000	$97,000	$5,965,000

2.2.6 Cross Valley Dam Seepage Interception System

The purpose of this work package is to design an SIS downgradient of the CVD that will serve as a "last line of defence" for collecting contaminated groundwater and construct the enabling works for the system. In the absence of the CVD SIS, contaminated groundwater originating from the FMC will eventually flow beneath the CVD, leave the mine footprint, and migrate down the Rose Creek Valley as an acidic plume containing dissolved metals that are toxic to aquatic and terrestrial life. The exact timing of breakthrough of the plume beneath the CVD cannot be accurately predicted; however, groundwater monitoring near the CVD indicates sulphate and metal concentrations are increasing. Ensuring that the CVD SIS enabling works are constructed during Phase 2B will allow rapid commissioning of the complete SIS when breakthrough occurs.

The Rose Creek Tailings Area (RCTA) consists of a series of tailings impoundments spanning the Rose Creek Valley that retain tailings discharged during operations of Mill Buildings and water decanted from the tailings. The tailings were deposited over the alluvial valley-fill deposits (the Rose Creek Alluvial Aquifer [RCAA]) to a maximum thickness of about 25 metres (m). Three dams hold the tailings in place, and a fourth dam (CVD), holds polishing pond water, discharged from the Faro Water Treatment Plant (WTP).

The RCAA system is a fluvial depositional system deposited by Rose Creek and its tributaries, the North Fork Rose Creek and the South Fork Rose Creek. The alluvial aquifer is composed of a heterogeneous mixture of silt, sand, gravel, and cobbles. The alluvial deposits are thickest near the centre of the valley (on the order of 50 m), aligned with the ancestral thalweg of Rose Creek.

Contamination originating from within the tailings deposits, as well as from the Emergency Tailings Area (ETA) via Faro Creek Canyon, is migrating through the RCAA toward the CVD (RGC, 2006a). Attenuation processes acting within the alluvial aquifer system are currently limiting the rate of movement of these contaminants downgradient. Because of uncertainty in the attenuation processes, it is not possible to predict how long these processes will continue to limit contaminant movement. Data indicate the metals contaminant front is currently more than 400 m upgradient of the CVD. However, the risk of early

contaminant breakthrough remains high, because the rate of the contaminant migration is difficult to estimate.

Movement of contamination through the RCAA represents an environmental threat to the downstream aquifer and to Rose Creek. When contaminated groundwater eventually moves beneath the CVD, it effectively leaves the FMC and enters the receiving environment, at which point it is not possible to stop the spread of the contamination. Therefore, the design and construction of an SIS at the CVD is the "last line of defense" for collecting contaminated groundwater that originates from the FMC. A CVD SIS is proposed to capture contaminated groundwater moving beneath the CVD as part of the FMC remedial actions. The importance of a CVD SIS was recognized by the Independent Peer Review Panel and an SIS and cut-off wall were included in the Draft 4A 2010 Closure Plan.

RCTA groundwater contamination distribution and trend data indicate that to protect groundwater and surface water quality downstream from the CVD, it may be necessary to construct an SIS down gradient of the CVD over the next 5 to 10 years, capable of intercepting a high percentage of the groundwater flow through the RCAA (RGC, 2012). Although the timing of the breakthrough of zinc and other contaminants is uncertain, data indicate that a significant threat to down gradient water quality will persist until an SIS is implemented to intercept contaminated groundwater before contaminant concentrations reach unacceptable levels.

The CVD SIS will be located down gradient of the CVD and assumptions for the preliminary design include the following:

- Ten extraction wells aligned across the valley at the downstream toe of the dam, spaced approximately 55 m apart and screened along the entire thickness of the glacio fluvial sediments (drilled into the weathered bedrock).
- A conveyance system to transport the groundwater pumped year-round from the SIS location up into the Faro Pit or the Faro WTP, depending on the time of year. The SIS conveyance system will include high-density polyethylene piping, which will be insulated and heat taped.

Eventually, each of the production wells will be connected to a pipeline header that will convey the extracted groundwater from each well into a single conveyance pipeline. However, these pumps, controllers, and pipeline header systems will be installed when the system is put into operation.

The following activities are included in the current scope:

- Preparation of a detailed design package for construction of the SIS and conveyance system. This includes completing the 60 percent started in FY2013/2014, detailed design (90 percent), and final design (100 percent).
- Procurement, contracting, and permitting to arrange for the construction of road access to the SIS construction site, surface preparation of the construction area, and the provision of power to the area.
- Construction of the initial work phase, including construction of road access, surface preparation, and power provision. Construction activities consist of physical construction and construction management.

The remaining CVD SIS construction work (including well installation and conveyance) is not included in the scope at this time.

The total cost estimate for the CVD work package equals $970,000. This includes construction ($375,000) and professional services ($595,000) costs for the project elements detailed in Table 2-6.

TABLE 2-6
Cross Valley Dam – Professional Services and Construction Cost Estimate
Faro Mine Remediation Project

Phase	Labour	Expense	Subcontractor	Total
Detailed Design	$456,000	$30,000	-	$486,000
Procurement	$28,000	$5,000	-	$33,000
Construction Management	$36,000	$10,000	$30,000	$76,000
Construction	$109,000	$199,000	$67,000	$374,000
Total	$629,000	$244,000	$97,000	$970,000

2.2.7 Vangorda Creek Diversion

The purpose of the VCD work package is to replace the current diversion, which routes stream flow from Vangorda Creek around Vangorda Pit, with a higher-capacity diversion along a new alignment that is not immediately adjacent to the pit. Due to the close proximity of the existing VCD to the Vangorda Pit highwall, a complete failure of the VCD (i.e., due to pit wall collapse) would allow all of the Vangorda Creek stream flow to enter the Pit. Such an event could not be quickly or easily repaired, and any attempt to do so would expose site staff to considerable health and safety risks. If VCD failure occurred at the initiation of sustained peak flows equal to the design capacity of the VCD (i.e., 10 m^3/s during a 1-in-100-year flood event), overtopping of the pit and release of contaminated water to the environment could occur in less than 7 days. Even with dilution by clean Vangorda Creek water, poor pit water quality (e.g., pH 3; zinc, 180 milligrams per litre [mg/L]) presents significant environmental risks if released to the environment because the lower reaches of Vangorda Creek provide recharge to the Faro water supply and are fish bearing.

In a failure scenario, it would not be possible to commission ample pumping capacity to transfer water around Vangorda Pit. The pit barge and pumping system could also be severely damaged and rendered inoperable by excessive inflows. Design and construction of a new diversion in an emergency situation could not be completed in one season, indicating that there is the possibility for contaminated water to flow out of the pit and into the receiving environment in an uncontrolled manner for several weeks or more. Should Vangorda Pit fill and the pit pumping system remain operational, the Vangorda WTP would be unable to treat the necessary volume of water in a single season to reduce pit water levels below their maximum recommended elevation (3,000,000 cubic metres (m^3) of water would need to be treated to reduce pit water levels from the overflow elevation of 1,122 metres above sea level [masl] to the maximum recommended elevation of 1,085 masl). This concern will be exacerbated from 2013 onwards, when the Vangorda WTP will also begin treating water from the Grum Pit, effectively doubling its current annual throughput from 400,000 m^3 to 800,000 m^3. Essentially, there would be little excess water treatment capacity available to reduce pit water levels, and this would result in contaminated water management challenges that would persist for years.

The VCD has been maintained, since the cessation of mining in 1998, to limit the flow of runoff to the pit while a long-term management plan for the diversion is developed. The following are current conditions and failure potentials:

1. Existing flume structures are failing, potentially resulting in reduction in flow capacity, plugging, erosion of roadway, and discharge to the Vangorda Pit.
2. The existing drop structures at roadways are at risk of plugging and overtopping.
3. The diversion does not have capacity to convey peak flows in excess of 10 m^3/s, which is the estimated 1-in-100-year design peak flow event. Flows of 10 m^3/s or more have occurred twice since 2004.

4. The slopes above and below the diversion are at risk for failure.
5. Ice damage is increasing the instability of the diversion structures.
6. Stability of the diversion is a requisite for sustainable support of downstream aquatic habitat provided by the Vangorda flows.
7. Instability of the diversion represents a potential health and safety risk to site personnel engaged in infrastructure maintenance.

The conveyance structure, consisting of half-round corrugated steel pipe (CSP), has failed at numerous locations, has deteriorated because of corrosion, and has been damaged during removal of ice and snow during winter maintenance.

This work package consists of designing and replacing the existing Vangorda Diversion with a new diversion, to be located approximately 500 metres (m) north of the existing alignment. In support of the Vangorda Diversion work package, field investigations, hydraulic, and physical model studies are required to develop the new VCD design. Because the proposed construction is dependent on the availability of rip rap and large boulder borrow sources located within 5 kilometres (km) of the construction work, it is planned that this source will be confirmed through the field investigation and will be developed in advance of the primary construction work. The proposed Vangorda diversion design includes the following:

- Re-align the Vangorda diversion north of the existing diversion
- Accommodate a 1-in-500-year flood (with a peak instantaneous flow of 30 m^3/s)
- Flows greater than a 1-in-500-year return period (greater than [>] 30 m^3/s) will be diverted to the Vangorda Pit
- A fuse plug, or other structure, will be included in the design of the new headworks dam embankment, such that water will directly flow to the new diversion channel and erode when overtopped during events greater than the peak of a 1-in-500-year return period event
- New re-aligned diversion will use a stepped chute approach to energy dissipation and rip rap

Uncertainties in the Vangorda Diversion design include impacts of steep topography, design of a dam and fuse plug at the headworks of the new diversion, quantification of the magnitude of extreme flow events, poor bedrock, lack of locally available rip rap and large boulders, and impacts of the diversion flow path crossing the access road. These uncertainties will be addressed during design definition. The work will include topographical and channel condition surveys, collection of surface water quality and quantity data, collection and analysis of meteorological data, and geotechnical investigations. Surface water modeling will consist of hydrologic and hydraulic modeling to estimate surface water runoff from the Vangorda Creek sub-basin for sizing and design of the VCD. Physical modeling will be conducted to validate the hydraulic analyses and development of the design, necessary because of the steepness of the proposed diversion alignment and the unique configuration of the step-pool geometry.

The assessment and permitting approach for the Vangorda Creek Diversion requires further consideration and discussion between Canada, YG, and the appropriate regulatory agencies. As such, the MTP does not include scope, schedule, or budget associated with any required assessment and permitting efforts.

The design process will include preparation of concept, advanced, detailed, and final designs. Control point reviews by the IPRP will take place at the concept and final design stages.

The work on the Vangorda Diversion will take place over a 3-year period following the 2013/14 design definition phase, which includes field investigation along the proposed the diversion alignment. The first year included in the MTP (2014/2015) is the design development phase, which includes conceptual (30 percent), advanced (60 percent), detailed (90 percent), and final design (100 percent), including drawings specifications and cost estimation. The second year (2015) includes the first phase of construction, which

consists of producing the borrow sources, installing a culvert at the existing haul road intersection with the proposed alignment, and partially excavating critical locations along the new diversion alignment. The third year (2016) includes the second and final phase of construction, which involves constructing the diversion and the diversion intake structure.

The total cost estimate for the Vangorda Diversion work package, presented in Table 2-7, equals $12,620,000.

TABLE 2-7
Vangorda Diversion - Professional Services and Construction Cost Estimate
Faro Mine Remediation Project

Phase	Labour	Expense	Subcontractor	Total
Detailed Design	$1,089,000	$52,000	-	$1,141,000
Procurement	$193,000	$6,000	-	$199,000
Construction Management	$1,247,000	$430,000	-	$1,677,000
Transition	$15,000	$4,000	$80,000	$99,000
Construction	$2,448,000	$6,909,000	$147,000	$9,504,000
Total	$4,992,000	$7,401,000	$227,000	$12,620,000

2.2.8 Care and Maintenance

2.2.8.1 Background Information

C&M at the FMC complements other work being done with respect to the closure and remediation of the site. Accordingly, the objectives of the Faro Mine Remediation Project also govern the goals for C&M. Those objectives are as follows:

- Protect human health and safety.
- Protect and, to the extent practicable, restore the environment including land, air, water, fish and wildlife.
- Return the mine site to an acceptable state of use that reflects pre-mining land use where practicable.
- Maximize local and Yukon socio-economic benefits.
- Manage long-term site risk in a cost-effective manner.

These objectives have informed the goals developed for the C&M contract. The primary goal of C&M at the FMC is to cost-effectively maintain the site to prevent adverse effects on persons, property, and the environment, and to counteract, mitigate, and remedy any adverse effects that may occur.

Secondary goals of C&M are as follows:

- Ensure that personnel deployed to operate and maintain the FMC are in compliance with the *Yukon Occupational Health and Safety Act* (YG, 2002a) and are operating at all times in accordance with all applicable legislation, regulations, codes, and policies.
- Operate and maintain the FMC in accordance with the water quality standards set out in the Environmental Monitoring Program.
- Provide meaningful economic benefits for AYFN and YT and Faro residents and businesses through the creation of opportunities for training, jobs, and commercial activities.

These goals are being achieved through the management of C&M at the site by the C&M contractor. For example, for the protection of human health and safety, site access is limited with security staff at the gate

24 hours a day, 7 days a week during the operating season (April to September) and 10 hours a day, 7 days a week during the winter (October to March), with security patrols and other access points onto the site gated and locked. A safety orientation is mandatory for all visitors to the site and personal protective equipment requirements are strictly enforced.

The protection of the environment is achieved through water management to reduce the inventory of contaminated water on the site. Contaminated water collects in three open pits, in the ID Pond, and is pumped from a number of pumping wells from backfilled pits or underground seeps, to the pit for storage and ultimately, treatment. The contaminated water storage areas are managed to minimum elevations to protect the integrity of dams and other structures; until the 2013 season the water was treated in the Faro Mill WTP, a facility which repurposed mining-era structures and equipment. The clean, treated water must meet the water quality standards set out in the previous water licence, which are protective of the receiving environment. Once treated to this standard, the treated water can be released. Another aspect of water management is keeping clean surface water sites diverted around contaminated areas and maintaining them clean. Maintaining and repairing these diversions is a critical part of water management activities.

The secondary goal to provide meaningful economic benefits for AYFN and YT and Faro residents and businesses is also addressed through the implementation of an AYFN and Yukoner participation plan as a requirement of the C&M contract. There are three main areas by which the C&M contractor provides opportunities: training, direct employment, and contracting and subcontracting. The minimum achievement targets for each of these areas were developed as part of a participation strategy in conjunction with the AYFN and reported to the Government of Yukon on a monthly basis.

Current Condition

The primary source of contamination at the FMC is associated with the acid and metal leaching process of approximately 70 million tonnes of lead and zinc tailings and 320 million tonnes of waste rock distributed throughout the site. It is estimated that the acid rock drainage from oxidizing sulphides will continue to be released for hundreds of years. Human health and safety is also a risk at mitigated sites.

The issues contributing to site contamination and the risk to human health and safety include the following:

- Ground and surface water contamination (seeps) from tailings and waste rock. The largest volume of tailings and waste rock is located hydraulically above the Rose Creek Alluvial Aquifer, where contaminated groundwater is expected to break through downstream of the Cross Valley Dam within the next 10 to 20 years.
- Soil contaminated by an undetermined quantity of lead and zinc, primarily in the vicinity of the former concentrate storage and load-out building, and an estimated 90,000 m^3 of soil contaminated with hydrocarbons.
- Three partially flooded open pits and one portal (sealed) leading to a flooded exploration drift.
- The tailings impoundment contains approximately 55 million tonnes of acidic lead and zinc tailings contained by a series of three dams, and up to a million m^3 of contaminated water behind the Intermediate Pond. A mass tailings release to the receiving environment because of a dam breach or failure would affect areas downstream of the mine for many generations; the environment might never recover from such contamination.
- Faro Creek, Rose Creek, and Vangorda Creek are diverted around the site and flow in clean water diversions. If any of the diversions were to fail, clean water would flow into pits, tailings, or waste rock and become contaminated.
- Buildings and infrastructure that are aged, decrepit, and contaminated with lead concentrate, dust, asbestos, and other harmful substances.

- Contamination of the terrestrial environment as a result of the transportation of dust from the 70 million tonnes of acidic lead and zinc tailings consisting of finely ground-up waste rock and unrecoverable ore.
- Human and ecological health risks from repeated, long-term contact with waste materials that might have negative impacts on the surrounding flora and fauna of the area.
- The FMC covers an area approximately 25 square kilometres and could be subject to public access via the Faro Mine Road, which is a public highway, and through other entry points surrounding the FMC (adapted from Merit, 2010).

Justification for Action

C&M encompasses the critical, short-term activities that are required to achieve the goals of ensuring human health and safety and protecting the environment. These activities are required through all phases of the overall project, beginning in 1998 with the court-appointed Interim Receiver (Deloitte & Touche Ltd.), through the implementation of the closure plan, and will continue to be required for many years into the future.

2.2.8.2 Description of Scope

The full description of the scope of work for C&M can be found in the various documents used for contracting of the C&M services. The milestones for work at the FMC are shown in Table 2-8. The annual estimated Operating Baseline Values (OBV) for the 2012–2013 year are shown in Table 2-9.

The C&M contractor provides the following services:

- Operations
- Maintenance
- Implementation of AYFN Participation Plan
- Site management and administration
- Environmental monitoring

Operations include operating, maintaining, repairing, and managing the following:

- Fresh water systems
- Contaminated water systems
- Dams and diversions
- Stationary and mobile equipment
- Contaminated water containment areas
- Contaminated water treatment systems
- Sludge management
- Tailings dust management
- Implementation of the preventative maintenance plan
- Provision of emergency response capability and responding to emergencies

Maintenance includes operating, maintaining, repairing, and providing for the following:

- Security, health, and safety for the site
- Site buildings and infrastructure
- Electrical distribution systems
- Purchase and manage use of electricity, fuels, and lubricants
- Roads and culverts
- Waste oil heating system
- Faro housing
- Permits and licences as required

Implementation of the AYFN Participation Plan includes the following:

- Designing, developing, and implementing education, training, and mentorship opportunities in the areas of training/capacity building, contracting/subcontracting, and direct employment
- Acting as a liaison to AYFN communities
- Managing budgets, drafting proposals, and reporting on AYFN and Yukoner participation activities and related functions

Site management and administration includes managing, and providing for the following:

- C&M activities
- Implementation of AYFN and Yukoner participation plans
- Administration services
- Environmental Monitoring Program

These activities include the following:

- Implementing plans, reviewing plans monthly, and updating plans on an annual basis
- Budgeting services to AAM
- Reporting services to AAM
- Record-keeping and site documentation services to AAM
- Human resources services as required
- Communications services as required
- Any and all other administration labour, expenses, and services required to fulfill the C&M goal

Environmental monitoring includes the following:

- Conducting field sampling activities, including provision of supplies and equipment, maintenance of monitoring stations, and measurement of water chemistry and flow levels, as detailed in the Environmental Monitoring Program
- Providing and supervising environmental staff as required to complete these activities
- Shipping and receiving of sampling equipment and samples for offsite analysis, as needed, to support environmental monitoring activities
- Providing documentation and reporting, as needed, to support the Environmental Monitoring Plan activities
- Managing hazardous materials in accordance with applicable territorial and federal laws and regulations

TABLE 2-8
Milestones for Operations and Faro Mine Complex
Faro Mine Remediation Project

Activity	Start Date	End Date
IP Pond Pumping	April	September
CVP Siphoning in Spring	March/April	September/October
Operation of Faro Mill Treatment System	April	September
Faro Pumping	End of April	September
ETA pumping	May	September
Operation of VG Treatment System	June	July/August
Wave Break Boom Installation	June	August
Discharge of Clean Water from Clarification Pond	August	August
VG Pit barge Installation	May	September

TABLE 2-8
Milestones for Operations and Faro Mine Complex
Faro Mine Remediation Project

Activity	Start Date	End Date
Pumping for VG Pit	June	July/August
Swimming Hole Pumping System	April/May	October
Sludge Pumping from Faro Mill	April	September
Dewatering of Faro Sludge	June	September
Bulking Faro Sludge	January	March
Faro Sludge Cells Cleaned	January	January
Mixing and Freezing of Sludge in Grum Clarification Pond	November	January
Sludge Removal from Grum Clarification Pond	February	March
Little Creek Dam Pond Pumping	May	September/October
Zone II Pumping	May	October

2.2.8.3 Uncertainties – Infrastructure

Many uncertainties exist in the C&M of the FMC related to the ever-evolving deterioration of the environmental condition at the site. Much of the stationary infrastructure (buildings and the electrical distribution system) at site was originally designed to last for an approximately 20-year mine life, but have now been in place for more than 40 years. As such, the stationary and mobile infrastructure at the site, from site buildings, mobile heavy-duty equipment to electrical infrastructure, is aging and will continue to require extensive repair and maintenance until it becomes no longer cost-effective to do so.

TABLE 2-9
2012–2013 OBV Estimates
Faro Mine Remediation Project

2	OPERATIONS AND MAINTENANCE	
2.1	Operations	
2.1.1	Maintain surface water management systems	$ 34,000.00
2.1.2	Maintain contaminated water management and treatment systems	$ 1,482,000.00
2.1.3	Maintain and monitor dams, diversions, and pit walls	$ 110,000.00
2.1.4	Maintain sludge management systems	$ 66,000.00
2.1.5	Manage Tailings Dust	$ 10,000.00
2.1	TOTAL OPERATIONS	$ 1,702,000.00
2.2	Maintenance	
2.2.1	Maintain and/or provide mobile equipment	$ 774,500.00
2.2.2	Maintain Stationary Infrastructure	$ 765,000.00
2.2.3	Provide Site Security and Maintain H&S	$ 570,000.00
2.2.4	Administer consumables	$ 1,491,000.00
2.2.5	Obtain and maintain Permits and Licences	$ 10,000.00
2.2.7	Provide Support for Site Remediation	$ 200,000.00
2.2.8	Preventative Maintenance	$ 102,000.00
2.2	TOTAL MAINTENANCE	$ 3,912,500.00

TABLE 2-9
2012–2013 OBV Estimates
Faro Mine Remediation Project

2.3	Provide opportunities for AYFN & Yukoners	
2.3.1	Implement AYFN and Yukoner Participation Plan	$ 350,000.00
2.3	TOTAL OPPORTUNITIES FOR AYFN &YUKONERS	$ 350,000.00
2.4	Management and Administration of O&M	
2.4.1	Provide management and administration services	
	Management	$ 917,668.00
	Administration	$ 2,195,050.00
2.4	TOTAL MANAGEMENT & ADMINISTRATION OF O&M (General Fees & Profit)	$ 3,112,718.00
2.5	On-site Environmental Monitoring	
2.5.1	Site Ops Environmental Monitoring	$ 737,188.00
2.5	TOTAL ENVIRONMENTAL MONITORING	$ 737,188.00
	Total Annual Budget For Care & Maintenance	$ 9,814,406.00

The Faro Mill, used throughout the 30-year life of the mine, was converted to treat contaminated water in 2001. Conventional lime treatment is used to remove high levels of zinc from the Faro Pit water, ID Pond, and several seeps including seeps from the ETA and the S-wells SIS. There are many areas of the mill that have been exposed to the ravages of time through leaks and openings. This damage affects some of the structural components of the mill, only some of which have been inspected thoroughly. As described in Appendix B, *Infrastructure*, the areas of the roof that posed a risk to the health and safety of workers have undergone repairs and follow-up inspections. Continued inspections and recommended minor repairs will be completed, as required, for the health and safety of workers. Components that have been used to treat water for the last decade have also been affected by low pH contaminated water, as well as freeze/thaw effects of seasonal startup and shutdown of the system. Table 2-10 lists seasonal break-up and freezing events. Because of the many health and safety and operational concerns associated with this facility, the Faro Mill WTP was decommissioned and an alternative water management approach was put in place for the 2013 season. Design, procurement, and installation of a modular IWTS were initiated in 2013 for commissioning in 2014. Interim barricades to limit access to the building have been put in place; however, planning for additional access controls and possible stabilization until demolition as part of remediation will be ongoing into FY2014/2015. This work package is summarized in Section 2.2.10.1. And in more detail in Appendix C6.

TABLE 2-10
Seasonal Breakup and Freezing Events
Faro Mine Remediation Project

SEASONAL BREAK UP/FREEZING	
Event	***Date***
Spring	
Fresh water observed on top of the ice along the upper stretch of the Faro Diversion for most of February	2/29/2011
Most culverts began to flow free without requiring steaming	4/28/2011
Natural runoff discharge from the Sheep Pad Pond	5/20/2011
Cross Valley Pond 100% ice free	5/22/2010
Runoff through the ETA began as snow started melting	4/15/2010
Little Creek Dam pond still ice covered and water level not high enough to install the pontoon and pump.	4/27/2010
A significant blanket of snow covered the tailings (probably 0.75 m thick)	Mar-09
Concerns were identified regarding snow pack conditions and, should an aggressive spring melt occur, there may be insufficient holding capacity in the IP and CV ponds.	Mid-march 2009
Intermediate Dam remains mainly snow covered	4/30/2009
Cross Valley Pond (polishing pond) mainly ice covered with some surface water appearing around the edges	4/30/2009
Visible streams of water with high TSS were observed coming from the ice of the first sheep pad pond as it melted.	5/14/2009
Vangorda Flume completely ice free	5/11/2010
Vangorda Pit is 100% ice free	5/20/2010
Vangorda Pit ice free	5/23/2011
Ice melted in Vangorda Pit	5/25/2009
Diversion channel 100% ice free	5/17/2010
Faro Pit 100% ice free	5/19/2010
IP 100% ice free	5/19/2010
Grum Pit 100% ice free	5/27/2010
By month's end, all snow removal was essentially complete.	4/30/2009
Autumn	
Sheep Pad Pond ice cover	10/15/2011
Tailings area was snow covered	10/15/2011
Little Creek Dam holding pond ice covered	10/15/2011
Cross Valley Pond 100% ice covered	10/31/2011
Grum Pit 100% ice covered	10/31/2011
Ice began to form on the surface of the Swimming Hole pond	10/7/2010
Faro Diversion was essentially 100% covered with ice / snow	10/31/2011
Most slow sections of the Rose Creek diversion channel were covered with ice	10/31/2011
Rose Creek diversion channel completely ice covered	11/15/2011
Several trips with the steam truck were required to carry out removal of minor ice damming on Vangorda flume.	"Latter part of" October 2010
80% of the Vangorda flume was ice covered	11/31/2009

2.2.8.4 Uncertainties – Equipment

The heavy equipment assets at the FMC were transferred to YG when the court-appointed Interim Receiver, Deloitte and Touche, was discharged from their duties in 2009. The equipment at site was left after the mine went into receivership in 1998, or has been purchased since that time to continue C&M activities. The equipment had been maintained and repaired at the site and was in varying conditions according to age and number of hours of use. In 2012, several pieces of equipment at site that were identified to be critical for emergency response situations or were required for day-to-day operations at the site, were deemed to be near or had exceeded the maximum recommended hours of use. The details regarding the equipment, including age and the number of hours used are listed in Table 2-11. It is expected that the listed equipment will be replaced and augmented as required, either by lease or through procurement, during the 5-year period of the MTP. For example, in Q1 FY2013/2014, YG purchased a replacement grader, excavator, loader and rock truck, and also leased a replacement dozer for FY2013/2014. Equipment needs will continue to be assessed on an ongoing basis and any funding requirements will be detailed in annual work plans as required.

TABLE 2-11
Equipment Reaching or Exceeding Hour Limitation
Faro Mine Remediation Project

YG Equipment	Year	Hours on Engine	Hours on Equipment[a]	Max Recommended Hours[b]	Estimated Annual Hours of Use
Caterpillar Road Grader	1988	2000	20354	10000	800
Caterpillar Dozer	1996	10900	10900	10000	400
Link-Belt 460LX Excavator	2002	9267	9267	10000	600
Volvo Front-end Loader	2002	8453	8453	10000	800
Volvo Rock Truck (currently being leased because YG-owned truck is no longer functioning)					400

Notes
[a] Number of hours that the equipment has been in use up to August 2012
[b] Number of maximum recommended hours before overhaul/replacement of equipment

Figures 2-3, 2-4, and 2-5 provide aerial views of the FMC.



FIGURE 2-3
Aerial view – Rose Creek Tailings Area, Looking Northwest
Faro Mine Remediation Project



FIGURE 2-4
Aerial view – Faro Mill Buildings
Faro Mine Remediation Project



FIGURE 2-5
Aerial view –Vangorda/Grum Area
Faro Mine Remediation Project

2.2.8.5 Technical Risk Register

The technical risk register can be found in Appendix G.

2.2.9 Environmental Condition Monitoring

2.2.9.1 Background

The FPET monitor the environment on and near the FMC to further its understanding of the evolving site condition, to inform near-term management decisions, and to refine predictive modelling, an essential tool for remediation planning and the formulation of long-term management strategies. As environmental

condition monitoring is linked to several different objectives for the FMRP, the same data point often informs more than one activity in more than one timeframe. This essential cross-cutting nature has led to some historical difficulties in delineating monitoring scope elements between FMRP streams.

For the Medium Term Plan, the budget line item "Environmental Condition Monitoring" will serve to capture the environmental data acquisition and monitoring that does not currently form part of either the C&M operator's activities or as an incidental activity of specific, time-limited engineering investigations undertaken by the PDT. Monitoring performed by the C&M operator is included as part of the scope of C&M contract (described in Section 2.2.3, *Operations and Maintenance*).

2.2.9.2 Justification for Action

Environmental condition monitoring is integral to all activities of the FMRP that relate to short- and long-term environmental protection. Monitoring allows YG to verify that current care and maintenance activities are meeting near-term protection goals (expressed in part through current effluent standards, Table 2-12) and that engineers and managers are using the most current, accurate, and relevant data to inform design and risk management decisions.

TABLE 2-12
Care and Maintenance Effluent Quality Standards
Faro Mine Remediation Project

Parameter	Effluent Quality Standard
Suspended Solids	≤ 15 mg/L
pH	≥ 6.5 pH units
Colour	≤ 20 Pt-Co Units
Turbidity	≤ 15 NTU
Ammonia (as N)	≤ 1.30 mg/L
Antimony	≤ 0.10 mg/L
Arsenic	≤ 0.05 mg/L
Barium	≤ 1.00 mg/L
Cadmium	≤ 0.02 mg/L
Copper	≤ 0.20 mg/L
Cyanide (as CN)	≤ 0.05 mg/L
Lead	≤ 0.20 mg/L
Mercury	≤ 0.005 mg/L
Molybdenum	≤ 0.50 mg/L
Nickel	≤ 0.50 mg/L
Selenium	≤ 0.05 mg/L
Silver	≤ 0.10 mg/L
Zinc	≤ 0.50 mg/L
Bioassay	Pass 100% 96-hour LC_{50}
Oil or Grease	No visible or floating

2.2.9.3 Description of Scope

As discussed in Section 2.2.3.1, *Care and Maintenance*, the scope of environmental condition monitoring across all streams of the FMRP for the MTP will be subject to the findings of a comprehensive program review. However, in general terms, the overall scope of environmental condition monitoring includes the following major activities and/or programs, at prescribed locations and frequencies:

Groundwater Monitoring

Previous and current technical advisors have established a network of groundwater monitoring wells. The groundwater monitoring program has been reviewed periodically and revised as necessary, and will be further refined through the upcoming review process.

Presently, groundwater is sampled on an assigned schedule—primarily in regular spring and fall monitoring rounds—from a total of 90+ sites. Samples are acquired and processed in accordance with established protocols (name, date), with photographs and other applicable observations recorded in the field during sampling. Samples are measured for the following field parameters: pH, conductivity, purge volume, purge rate, and sampling time. Samples are analyzed in certified laboratories for a full suite of parameters that include general chemistry, anions, turbidity, and suspended solids, as well as a full array of dissolved metals. Data is currently acquired by a combination of the C&M operator (Zone II and S-wells only), the PDT, and other Yukon service providers, while the FPET and PDT review the results.

Surface Water Monitoring

Surface water quality and flow are monitored to inform understanding of potential mine-related impacts on the aquatic ecosystem. Reference stations have been established upstream of mine-affected areas; readings from these upstream stations are compared to downstream measurements from 30+ established surface water monitoring stations in drainages on or near the FMC.

Surface water is sampled in all seasons, with frequency individually assigned according to objectives. Field parameters include: pH, conductivity, and temperature. Laboratory parameters include general chemistry parameters (alkalinity, ammonia, chloride, total dissolved solids, total suspended solids, and such), as well as a full suite of total and dissolved metals.

The majority of the surface water samples in current programs are acquired by the C&M operator as part of their contract, otherwise, they are acquired as part of the combined site-wide seep sampling and surface water monitoring program undertaken in 2012/13 by the PDT to inform the site-wide geochemical model. In all cases, the FPET and the PDT review the results. However, if additional sampling points or events are recommended and adopted on an ongoing basis subsequent to the program review, they may be funded from the environmental condition monitoring line item, where appropriate.

Seep Sampling

The program of groundwater seep sampling for waste rock dump seeps and pit seeps was established primarily to inform geochemical modeling efforts. In recent years, data has been acquired by a technical advisors and the C&M operator. The PDF reviewed updated the historical seep program for 2012/13 delivery; seep sampling locations were confirmed and, as in past programs, samples are collected twice annually. Field parameters include: flow (if applicable), temperature, pH, conductivity, dissolved oxygen, oxidation reduction potential, and turbidity. Laboratory parameters include general chemistry parameters (alkalinity, ammonia, total dissolved solids, total suspended solids, and such), as well as dissolved metals, ferrous iron, and sulphide.

The seep sampling program will be included in the monitoring review, and any additions to the program may be funded from the environmental condition monitoring line item where appropriate.

Pelly Aquatics Monitoring Program

The FMC is located at the headwaters of Rose and Anvil Creeks on the Faro Mine side of the FMC, and Vangorda Creek on the Vangorda/Grum side. These creeks eventually flow into the Pelly River, an important resource for the Selkirk First Nation (SFN), as it flows through SFN Traditional Territory. As a downstream user of this water, SFN has expressed concern about the water quality and possible effects to the aquatic ecosystem in the drainages affected by the FMC.

The SFN Final Agreement (1997) states that

> *"…a Yukon First Nation has the right to have water which is on or flowing through or adjacent to its Settlement Land remain substantially unaltered as to quantity, quality, and rate of flow, including seasonal rate of flow.*" (SFN, 1997)

In recognition of this, specific surface water quality investigations have been conducted downstream of the FMC since 2000. The Pelly River Aquatics Monitoring Program assists in confirming that the environmental security interests of SFN are protected, related to water quality in the downstream environment.

Before 2012/13, the Pelly Aquatics Monitoring Program had typically been delivered by SFN itself, in partnership with Yukon service providers, and funded through the FMRP. When current discussions are resolved regarding funding for SFN's involvement this fiscal year, the FPET will re-engage SFN to define their interest in and capacity for participation in this program. In the meantime, the FPET has captured requisite data using contracted Yukon service providers, and the FPET and PDP have reviewed the results.

Benthic Invertebrate Community Monitoring

Monitoring of benthic invertebrates—important components of the aquatic food chain—provides vital information regarding the health of aquatic ecosystems over time. In *Aquatic Ecosystem Monitoring Program, Faro Mine, Yukon* (Minnow Environmental Inc. [Minnow], 2010), recommendations were made regarding methodologies and frequencies for ongoing, long-term monitoring of benthic communities. These recommendations included a change to kick sampling versus artificial substrate collection for ongoing surveys, as well as the adoption of a Reference Condition Approach (RCA) sampling design, to: provide better sensitivity to potential mine-related effects, provide control for sampling biases inherent in former approaches, and facilitate better sharing of data moving forward. These recommendations will continue to be followed pending the outcome of the program review process. The FPET will collect data via contracted Yukon service providers, with results being reviewed by the FPET and the PDT (which includes Minnow as part of the team).

Fish Community and Population Assessment

Fish are among the most highly valued ecosystem components for the FMRP, particularly among AYFN. If the FMRP is "all about the water," then in some ways it is also "all about the fish." In their 2010 report, Minnow made recommendations about the ongoing monitoring of fish community composition and relative species abundance in the FMC area. Methods used include electrofishing and minnow traps, and measured population health indicators include mean length, mean weight, weight relative to length (condition), and length frequency distributions for mine-exposed areas compared to reference areas. Similar to the benthic invertebrate monitoring program, these recommendations will continue to be followed pending the outcome of the program review process. The FPET will collect data via contracted Yukon service providers, with results being reviewed by the FPET and the PDT (which includes Minnow as part of the team).

Other Environmental Monitoring

Occasionally, a more time-limited and focused monitoring program may be required to investigate a new finding, more closely monitor change in an existing condition, or monitor the impacts of a specific off-normal event (e.g., the 2011 freshet). All such additional monitoring will be funded from the environmental condition monitoring line item.

2.2.9.4 Uncertainties

Historically, a number of parties have been involved with various aspects of monitoring program design, review, priority-setting, and delivery. With the procurement of the PDT in fall 2011 and their subsequent project familiarization and data gaps analysis in winter/spring 2012, the FPET now had the opportunity to undertake a comprehensive review of all environmental data collection programs to confirm that these programs collectively meet the needs of the parties responsible for environmental compliance, site operations, remediation planning, and ongoing risk management, efficiently and cost-effectively.

This comprehensive review was originally scheduled to begin in FY2012/2013 but uncertainties regarding funding levels, coupled with unanticipated changes in the near-term scope of remediation planning efforts, led to its postponement. It has now been rescheduled to begin in 2013. The final scope of environmental condition monitoring for the period of the Plan and mechanisms for ongoing review and refinement that may be required during the timeframe will be an output of this process. Until this process is completed, existing monitoring programs will be continued largely unchanged.

The proposed review process, known as Data Quality Objectives (DQO) Process, will be modelled on the established United States Environmental Protection Agency (USEPA) process of the same name. A summary of the USEPA approach is provided in *Guidance on Systematic Planning Using the Data Quality Objectives Process* (USEPA, 2006):

> *"The DQO Process is used to develop performance and acceptance criteria (or data quality objectives) that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions …*
>
> *The DQO Process is a series of logical steps that guides managers or staff to a plan for the resource-effective acquisition of environmental data. It is both flexible and iterative, and applies to both decision-making (e.g., compliance/non-compliance with a standard) and estimation (e.g., ascertaining the mean concentration level of a contaminant). The DQO Process is used to establish performance and acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of the study. Use of the DQO Process leads to efficient and effective expenditure of resources; consensus on the type, quality, and quantity of data needed to meet the project goal; and the full documentation of actions taken during the development of the project."*

The detailed scope description for the FMRP DQO Process is currently being developed.

2.2.9.5 Execution and Procurement Approach

Pending adoption of recommendations for changes that may arise from the DQO process and discussions with AYFNs, the FPET will continue to deliver the existing environmental monitoring programs via contracted Yukon service providers in accordance with established project-specific quality standards.

2.2.10 Adaptive Management Works

Since YG assumed direct responsibility for C&M in 2008, the ongoing degradation of site infrastructure and overall site condition has required the execution of a number of works that are "reactive" in nature, and are beyond the scope of core day-to-day operations and maintenance activities. These projects can be thought of as "adaptive," responding to issues at the site as they arise: issues that cannot be foreseen in sufficient detail to allow for comprehensive advanced planning, but that need rapid and sustained response to mitigate emergent risk.

Through past experience and understanding of the site itself, in addition to assessing the scope of adaptive management works executed over the last 4 years, it has been possible to develop a list of potential works that are likely to be executed sometime within the duration of this plan. To enable flexibility in execution and effectiveness in response, YG and Canada agreed (Email, CH2M HILL, 2012) to use historical values to

estimate and establish an annual budget for these works—benchmarked at 10 percent of the core O&M cost during years 1 and 2, as there are appropriate provisions elsewhere in the budget to deal with the changes that are foreseeable, and 15 percent during years 3 and 4, for which our ability to anticipate the timing/scope of changes further into the future is poor, and a slightly higher allowance would be appropriate.

The adaptive management allowance budget will provide access to funds through a change control framework that is being developed between YG and AANDC. The accessibility for funds will be required when site activities can be conducted most efficiently (spring to fall), as time and resources allow, or as conditions evolve. This budget is separate from the allowance allocated for response to emergency events.

In addition to potential execution of adaptive works to mitigate emergent risk from rapidly changing environmental conditions, potential adaptive management projects will improve and/or upgrade facilities or the efficiency of operations at the site. They may be in response to providing short- term or interim mitigations to emergent human health and safety or environmental risks, in lieu of the execution of an overall remediation plan. With the information that is available, priorities are assigned ranging from red, projects which should be initiated within the next fiscal year, through to yellow, projects that can wait until conditions have degraded to the point where the mitigation must be implemented.

2.2.10.1 Interim Water Treatment System

Because the existing Faro Mill WTP poses a significant human health and safety risk, it was not operated in 2013 and will not be operated in the future. The building and equipment has deteriorated and lead dust is present throughout the building. YG has completed the Detailed Design for a permanent replacement WTP. It will be included as a primary facility in the Faro Mine Remediation Project Proposal, scheduled for submission to the YESAB in 2017. Construction of the permanent replacement WTP will take place after approval of the Project Proposal and obtaining necessary permits. In the interim period, an IWTS will treat contaminated acid drainage collected from the Faro Mine Area and the RCTA. A detailed description of the IWTS is provided in Appendix C6.

2.2.11 Project Management

2.2.11.1 Background

During the MTO, the YG Project Director's team remains responsible for all aspects of day-to-day management of the FMC and the FMRP. In this role, they assure the ongoing protection of human health and safety and the environment by: delivering necessary care and maintenance functions, executing Interim Works, and preparing and submitting the Project Proposal for the final remediation plan to YESAA. As the contracting authority for all work performed at the FMC, YG also manages the provision of socioeconomic opportunities to AYFNs and Yukoners that arise from the work.

As noted in 2.3, *Scope Excluded*, all related and enabling works undertaken by the AANDC Sponsor's Team are excluded from the scope of the MTP.

2.2.11.2 Description of Scope

Project/Site Management Team (YG FPET)

The scope of project management includes all activities associated with management of the entire suite of YG's responsibilities, and incorporates the following elements:

- Staffing management and support positions
- Procuring key advisory services
- Providing team infrastructure
- Outsourcing key project positions (where necessary)
- Providing communications services
- Developing the PEP
- Providing operational and strategic risk assessment and mitigation

The scope for staffing in the MTP reflects additional internal resources required to manage expanded or specialized scope (e.g. increased reporting requirements, physical site activities related to Interim Works), as well outsourcing key positions (such as Head of Engineering), which will now not be provided by Canada, as previously planned. In accordance with comments provided to the Management Board, it must be noted that outsourcing adds a significant cost burden to the FMRP, and was one of the key drivers for YG approaching Canada beginning in 2010-2011 to see if necessary resources were available within the federal system. The latter approach was dismissed as a possibility in late 2011-2012.

The Project Director and Sponsor Teams' project management activities will be undertaken in accordance with the guidelines in Chapter 3: Project Management of the *Contaminated Sites Plan Major Project Office Standards and Guidelines Manual* (Final V0 31, March 2013) (AANDC, 2013a). As detailed in the manual, project management typically includes the following tasks:

- Establishing the Project Execution Team
- Compiling the Project Execution Plan
- Compiling the Phase Work Plan
- Managing the Project, including project controls
- Preparing the Project Management Plan
- Compiling the Project Execution Team responsibility assignment matrix
- Project component or sub-project close-out

Project Management and Support (PDT)

Led by CH2M HILL, the PDT provides significant resources to deliver the work included in the Medium Term Plan, working with the FPET towards the model of an integrated project team. Areas where the PDT currently lends project management resources include: planning, risk assessment, team coordination, task and sub-contract management for PDT-led activities, needs identification, troubleshooting, data management and project controls. The PDT's internal corporate quality and health and safety management systems also provide key management inputs through periodic reviews and audits of the PDT's performance, which are reflected back to the FPET as corrective actions (if required) and lessons learned.

The actual scope of the PDT's project management and support effort varies somewhat according to the level of work occurring in any given year of the Medium Term Plan. As a minimum, the PDT maintains a base "programmatic" level of involvement across the 4-year period to maintain overall consistency and alignment of the PDT's activities with key objectives and performance indicators. Appendix C provides additional information about the overall scope for the Medium Term Plan; detailed scope descriptions for the PDT's project management tasks in a given year will be provided as part of annual detailed work plans.

Execution and Procurement Approach

At time of writing, the FPET's primary project management and support resources consist of YG staff, who are directly employed by YG and funded by YG or AANDC, depending on their position. The PDT currently provides local project management resources based in CH2M HILL's Whitehorse office, and in 2013/14 will begin to provide additional project resources embedded directly with the YG team in the Assessment and Abandoned Mines Branch of Energy, Mines and Resources. Other key advisors are retained as required, procured primarily through the use of standing offer agreements.

For more information about the project's human resources, as organized within the current management framework, please see Appendix L, *Resources*. Finalization of resourcing requirements and approaches is contingent upon the conclusion of ongoing discussions between Canada and YG concerning project governance and management arrangements.

2.2.11.3 Affected Yukon First Nations Project Participation

In the winter of 2008/09, the Faro Project OSC reached consensus on a preferred option for remediation of the Faro mine. This effectively ended the role of the original OSC, having met their original Terms of

Reference (to oversee the selection of a preferred remediation option). In order to establish a Governance and Management framework for future planning and assessment phases of the project, a needs assessment was initiated by the original OSC. This assessment identified the needs and interests of each government and constructed a draft Governance and Management framework that identified future roles and responsibilities.

Since the completion of a revised draft Governance and Management framework in fall 2009, discussions have been ongoing with AYFN, in this regard. The central and unresolved issue in these discussions remains how to balance AYFN roles in governance and management, while ensuring AYFN development corporations and businesses are able to realise upon economic opportunities offered by the remediation works.

In August 2012, the Kaska Dena Council (KDC) (a listed AYFN in Appendix F of the *Yukon Northern Affairs Program Devolution Transfer Agreement*) asserted their right to be independently represented on the project. Up to this point, KDC had delegated their representation on the project to Ross River Dena Council.

While there remains considerable uncertainty related to the future roles and responsibilities of AYFN on the project, the following assumptions have been made to allow development of an initial AYFN participation budget for the purposes of this work plan:

- Aboriginal Affairs and Northern Development Canada continues to provide funding to support an agreed-upon role of AYFN on the project.
- Ross River Dena Council, KDC, Liard First Nation, and Selkirk First Nation each receive direct funding to support their future role and responsibility.
- Funding will support technical participation of the AYFNs with separate governance discussions.
- Funding for each AYFN supports the following:
    - A closure office and full-time community coordinator
    - Participation of the Chief and advisors at the Project Oversight Committee
    - Technical Advisory Committee (TAC)
    - Community meetings
    - Technical Advisor

Based on these set of assumptions and the historic costs associated with support to AYFN, an initial budget of $400,000 has been allocated for each of the four AYFN. This budget will be reviewed and refined once an overall Governance and Management framework has been concluded.

2.3 Work Breakdown Structure

Appendix F2, *FMRP Medium Term Plan Work Breakdown Structure,* shows the organization of all included work packages to WBS Level 5, where applicable. Extracts of the MTP WBS applicable to individual work packages are included with the scope descriptions found in Section 2.2, *Work Packages Included*, and in their associated appendices.

As noted in Section 2.1, *Total Project Context*, the WBS is a dynamic planning document, which will develop progressively as the scope becomes more clear to planners and designers. The MTP presents the most current draft of this document (August 2013 v2).

2.4 Contingency Scope

Table 2-13, Technical Risk Event Contingency, is based upon previous work by John Brodie in 2007, originally drafted to support the transition of care and maintenance responsibilities from the Interim Receiver to YG. It defines the likelihood and cost consequence of major failures to key elements of the FMC and, using an Earned Monetary Value approach, calculates a range of risk contingency that should be applied to the overall FMRP as part of the total uncertainty provision. This provision is in addition to both risk contingencies associated with “new designs” and risk contingencies associated with ongoing site operations. See also Contingency Estimates in Appendix I.

TABLE 2-13
Technical Risk Event Contingency
Faro Mine Remediation Project

		Description	Probability		Consequence		Low end		High End	Assumptions
					Cost	Low End Range	High End Range	Cost x Probability	Cost x Probability	
Dams										
	Intermediate Dam	Breach by any mechanism leading to major failure of structure	Unlikely	300	Critical	$10,000,000	$30,000,000	$33,333.33	$100,000.00	Intermediate dam is replaced - recovery of discharged tailings limited to immediate areas only ($ 1, 000, 000) - legal costs and potential settlements not included; interim hydraulic upgrades will reduce probability to 1:500 when complete
	Cross-Valley dam	Breach by any mechanism leading to major failure of structure	Unlikely	300	Moderate	$500,000	$2,500,000	$1,666.67	$8,333.33	Scenario assumes CVD fails without ID failure - discharge of contaminated water and limited treatment sludges - CVD not replaced, but area stabilized.
	North Fork Rock Drain	Breach by any mechanism leading to major failure of structure	Very unlikely	1000	Critical	$10,000,000	$30,000,000	$10,000	$30,000	
	Vangorda Creek headworks dam	Breach by any mechanism leading to major failure of structure	Possible	50	Low	$0	$100,000	$0	$2,000	Dam would be replaced
	Sheep Pad dam	Breach by any mechanism leading to major failure of structure	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	Moose pond dike	Breach by any mechanism leading to major failure of structure	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	Groucho Pond dike	Breach by any mechanism leading to major failure of structure	Possible	50	Low	$0	$100,000	$0	$2,000	
	Vangorda WTP settling pond dam	Breach by any mechanism leading to major failure of structure	Unlikely	500	Moderate	$500,000	$2,500,000	$1,000	$5,000	
	Little Creek Dam	Breach by any mechanism leading to major failure of structure	Possible	50	Moderate	$500,000	$2,500,000	$10,000	$50,000	
	Rose Creek Diversion dike	Breach by any mechanism leading to major failure of structure	Unlikely	300	Critical	$10,000,000	$30,000,000	$33,333.33	$100,000	RCDC repaired in key areas; channel, dike and immediate banks/tailings surfaces - may require significant civil works
	ETA road embankment	Breach by any mechanism leading to major failure of structure	Possible	50	Moderate	$500,000	$2,500,000	$10,000	$50,000	Embankment stabilized and road way re-established.
Diversions										
	Faro creek diversion	Breach any mechanism	Possible	50	Moderate	$500,000	$2,500,000	$10,000	$50,000	Scenario assumes reestablishment of flow, not construction of new diversion
	Faro Pit, NW By-pass	Breach any mechanism	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	North Wall interceptor ditch	Breach any mechanism	Possible	50	Low	$0	$100,000	$0	$2,000	
	Faro Valley interceptor ditch	Breach any mechanism	Possible	50	Low	$0	$100,000	$0	$2,000	
	Vangorda waste dump collector ditch	Breach any mechanism	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	Vangorda Creek diversion flume	Breach any mechanism	Unlikely	300	Critical	$10,000,000	$30,000,000	$33,333	$100,000	
	Vangorda Creek diversion culvert drop box	Breach any mechanism	Likely	5	Moderate	$500,000	$2,500,000	$100,000	$500,000	
	Vangorda haul road - culverts	Breach any mechanism	Possible	50	Low	$0	$100,000	$0	$2,000	
	Vangorda pit diversion ditches	Breach any mechanism	Possible	50	Low	$0	$100,000	$0	$2,000	
	Grum interceptor ditch	Breach any mechanism	Possible	50	Low	$0	$100,000	$0	$2,000	
Pits & Ponds										
	Zone II	High WL leading to leakage to NFRC	Possible	50	Moderate	$500,000	$2,500,000	$10,000	$50,000	
	Little creek pond	Leakage to Vangorda Cr.	Possible	50	Moderate	$500,000	$2,500,000	$10,000	$50,000	
	Moose pond	Leakage to Vangorda Cr.	Likely	5	Minor	$100,000	$500,000	$20,000	$100,000	
	Groucho pond	Leakage/sediment release	Possible	50	Low	$0	$100,000	$0	$2,000	
Dumps										
	Faro valley dumps	New Seeps	Possible	50	Low	$0	$100,000	$0	$2,000	All scenarios in "dump" category assume capture of new seeps
	Faro, NE dumps	New Seeps	Likely	5	Moderate	$500,000	$2,500,000	$100,000	$500,000	
	Faro, Zone II dumps	New Seeps	Likely	5	Moderate	$500,000	$2,500,000	$100,000	$500,000	
	Faro, Main dump	New Seeps	Likely	5	Moderate	$500,000	$2,500,000	$100,000	$500,000	
	Faro, NW dumps	New Seeps	Likely	5	Low	$0	$100,000	$0	$20,000	
	Faro, LGO/OF dumps	New Seeps	Possible	50	Low	$0	$100,000	$0	$2,000	
	Faro, crusher dumps	New Seeps	Possible	50	Low	$0	$100,000	$0	$2,000	
	Vangorda rock dump	New Seeps	Likely	5	Moderate	$500,000	$2,500,000	$100,000	$500,000	
	Grum rock dump	New Seeps	Likely	5	Moderate	$500,000	$2,500,000	$100,000	$500,000	
	Grum O/B dump	sediment release	Likely	5	Low	$0	$100,000	$0	$20,000	
	Grum ore transfer pad	New Seeps	Likely	5	Minor	$100,000	$500,000	$20,000	$100,000	

TABLE 2-13
Technical Risk Event Contingency
Faro Mine Remediation Project

		Description	Probability		Consequence		Low end		High End	Assumptions
					Cost	Low End Range	High End Range	Cost x Probability	Cost x Probability	
Infrastructure										
	Faro WTP	Process failure - repairable	Likely	5	Moderate	$500,000	$2,500,000	$100,000	$500,000	
	Faro WTP	Process failure - catastrophic	Possible	50	Critical	$10,000,000	$40,000,000	$200,000	$800,000	
	Faro communication system	damage/failure, any mechanism	Likely	5	Minor	$100,000	$500,000	$20,000	$100,000	
	Mine electrical power distribution	transformer/powerline failure	Likely	5	Moderate	$500,000	$2,500,000	$100,000	$500,000	
	Little creek dam pumping system	equipment failure	Possible	50	Low	$0	$100,000	$0	$2,000	
	Vangorda pit pumping system	damage/failure, any mechanism	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	Vangorda WTP	damage/failure, any mechanism	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	ETA collection sump, pumping system	damage/failure, any mechanism	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
Buildings										
	Faro office/guardhouse & dry	damage/fire, any mechanism	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	Maintenance shops	damage/fire, any mechanism	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	Mill	Structural damage/fire, any mechanism	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	Concentrate load-out	wind blown lead dust	Possible	50	Low	$0	$100,000	$0	$2,000	
	Used oil storage	damage/fire, any mechanism	Possible	50	Low	$0	$100,000	$0	$2,000	
	Grum office	damage/fire, any mechanism	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	Grum shop	damage/fire, any mechanism	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
	Grum adit	accidental entry	Possible	50	Minor	$100,000	$500,000	$2,000	$10,000	
							TOTAL	**$1,248,666.67**	**$5,891,333**	
								(Low end cost x probability)	(High end cost x probability)	

2.5 Scope Excluded

Canada, as represented by AANDC, provides resources for activities that are out of scope for YG and for this MTP, but which are captured under Governance and Management (04) in the Master WBS (Appendix F1) as part of 100 percent scope, schedule, and budget for the FMRP. These activities will be more fully articulated in the context of AANDC's submission to the Treasury Board and annual work plans for the Project Sponsor's team, but for context are broadly outlined as follows:

- Provide program management and technical expertise through collaboration with resources internal to AANDC and with independent technical experts and advisors.
- Assure appropriate governance and management structures are in place and operational through AANDC's reporting requirements and consultation with YG's senior management.
- Assure independent monitoring and reporting through consultation with the IE.
- Assure independent peer reviews through engagement with the IPRP.
- Secure funding for the FMRP on an annual basis, and manage the transfer of funds to YG.
- Provide project oversight.

All other scope items for the FMRP are included in the phase and annual work plans of YG's Execution Team.

SECTION 3

Milestone Schedule

Appendix H, *Milestone Schedule,* contains a detailed milestone schedule for all activities included in the MTP.

For the purposes of this plan, the annual schedules for most fixed, committed, and AYFN-related items have been derived by spreading the activities evenly across the 12-month period. More detailed schedules for these items will be provided as part of annual work plans. The schedules for the Advanced Design and Remediation Project Proposal Submission and the IW work packages have been detailed according to currently proposed field and construction seasons, etc., and will be updated as part of annual work plans.

A high-level schedule showing sequencing of major steps in the execution of planned IW work packages is included in Appendix I, *Project Budget Summary.*

SECTION 4

Budget

4.1 Budget Categories and Cost Breakdown

To facilitate better understanding of the various costs presented, and the relationship of cost items to one another, the estimated budget for the MTP is organized in the following broad categories:

- *A - Fixed Costs* – Fixed costs include: contracted care and maintenance, YG staff and advisory costs, YG's team infrastructure and communications costs, and costs associated with the Project Delivery Team's integrated team members (embedded in the YG AAM Branch offices in Whitehorse) and CH2M HILL's project management staff.
- *B - Committed Works* – Costs for committed works include: line items for the existing Grum Building Lease in place with Faro, programmatic requirements such as monitoring and preparing the PEP, and expected costs to replace heavy equipment and to execute adaptive management works over the life of the MTP.
- *C - AYFN Costs* –Costs to facilitate the participation of AYFN in the FMRP.
- *D to G- Interim Works Work Packages* –A large part of the MTP includes IW of varying scales – designing the replacement Faro WTP (D), designing and implementing Down Valley Interim Hydraulic Upgrades (E), designing and enabling works for the Cross Valley Dam Seepage Interception System (F), and replacing the Vangorda Creek Diversion (G).
- *H - Advanced Design & Remediation Project Proposal* – The costs of all activities associated with the creation of the remediation project description and associated project proposal for submission to the Executive Committee level of the Yukon Environmental and Socio-economic Board.
- *I – Interim Works Project Proposal* - The costs of all activities associated with the creation of the IW project description and associated project proposal for submission to the Designated Office (DO) level of the Yukon Environmental and Socio-economic Board.

A selection of definitive scope items, tasks, and deliverables within each of these categories have been called out as individual cost line items. Additional detail regarding the nature of the scope items listed in the budget can be found in Section 2.2, *Work Packages Included*. Summary cost estimates for individual Work Packages can be found in the associated appendices. Annual work plans and budgets will provide more detail regarding the scope and costing of individual budget line items.

Appendix I, *Project Budget Summary*, provides a line item breakdown by year, beginning in fiscal year 2014/15 and extending to 2017/18, and includes information on estimate classes, calculated design allowances, and contingencies. All costs are presented in 2012 dollars.

The FPET budget, which will be transferred to YG from AANDC, includes all Work Package costs plus the associated design allowances. Risk contingencies are held by AANDC outside the FPET budget. Further detail regarding the use of these planning tools – design allowance and risk contingency – and how they are to be calculated can be found in the *Contaminated Sites Plan Major Project Office Standards and Guidelines Manual* (AANDC, 2013a).

4.2 FPET Budget Summary

Table 4-1 summarizes annual and phase costs by individual scope category. All costs are shown in 2012 dollars.

The Fixed Costs, Committed Works, and AYFN Costs categories have been grouped together as they form the "core activities" of the FMRP and the FPET, and include activities and supports which are required on a day-to-day, year-to-year basis regardless of the level of other activities, such as remediation design development IW, that may happen in a given year. This summary also includes the design allowances associated with each of the budget line items.

TABLE 4-1
Faro Project Execution Team Budget Summary, MTP
Faro Mine Remediation Project

	2014/15	2015/16	2016/17	2017/18	
FPET Fixed Costs (FC)	$ 17,867,269	$ 16,818,014	$ 16,875,986	$ 15,912,541	**$ 67,473,810**
Design Allowance – FC	$1,786,727	$1,681,801	$1,687,599	$1,591,254	**$6,747,381**
Committed Works (CW)	$11,629,976	$4,165,000	$4,465,000	$4,165,000	**$24,424,976**
Design Allowance - CW	$1,407,166	$654,750	$684,750	$654,750	**$3,401,416**
AYFN Costs (AYFN)	$1,600,000	$1,600,000	$1,600,000	$1,600,000	**$6,400,000**
Design Allowance - AYFN	$160,000	$160,000	$160,000	$160,000	**$640,000**
Subtotals – FC, CW, AYFN	$34,451,138	$25,079,565	$25,473,335	$24,083,545	**$109,087,583**
Down Valley Interim Hydraulic Upgrades (DVIHU)	$100,582	$0	$5,855,160	$0	**$5,955,742**
Design Allowance - DVIHU	$30,175	$0	$1,756,548	$0	**$1,786,723**
Cross Valley Dam SIS (CVD)	$509,617	$450,260	$0	$0	**$959,877**
Design Allowance – CVD SIS	$152,885	$135,078	$0	$0	**$287,963**
Vangorda Creek Diversion (VCD)	$1,234,924	$2,430,224	$8,945,040	$0	**$12,610,188**
Design Allowance - VCD	$370,477	$729,067	$2,683,512	$0	**$3,783,056**
Subtotals	**$2,398,660**	**$3,744,629**	**$19,240,260**	**$0**	**$25,383,549**
Advanced Design & Remediation Project Proposal (AD&RPP)	$24,277,890	$12,477,641	$1,524,136	$266,903	**$38,546,570**
Design Allowance – AD&RPP	$7,283,367	$3,743,292	$457,241	$80,071	**$11,563,971**
Interim Works Project Proposal	$500,000	$0	$0	$0	$500,000
Design Allowance - IWPP	$150,000	$0	$0	$0	$150,000
Subtotals – AD&RPP & IWPP	**$32,211,257**	**$16,220,933**	**$1,981,377**	**$346,974**	**$50,760,541**
Totals - MTP	**$69,061,055**	**$45,045,127**	**$46,694,972**	**$24,430,519**	**$185,231,673**
	2014/15	**2015/16**	**2016/17**	**2017/18**	

The total FPET budget requirement for MTP, including Work Package costs and design allowances, is CAD $185,231,673. Budgets will be allocated annually within a multi-year funding agreement, with phase budget forecasts updated annually.

4.3 Medium Term Plan Contingency

Appendix I contains the annual amounts of contingency associated with the proposed work, by category. Contingency funds are held outside the FPET's budget allocation. Contingency funds are held by the AANDC Project Sponsor and transferred through Change Requests.

Two types of contingencies are held by AANDC: the first is a work package-level risk contingency related to execution of specific pieces of work; the second is a technical risk event contingency calculated based on the probability and consequences of selected major risk events occurring at the FMC (e.g., breaches of dams or diversions). An explanation of contingency can be found in the AANDC *Contaminated Sites Plan Major Project Office Standards and Guidelines Manual* (AANDC, 2013a).

SECTION 5

Progress and Performance Management System

5.1 Performance Criteria

To comply with AANDC's Contaminated Sites Program requirements, a Performance Measurement Plan (PMP) is being developed. This PMP will follow the *Contaminated Sites Plan Major Project Office Standards and Guidelines Manual* (AANDC, 2013a), and will measure the success of the FMRP, using Key Performance Indicators (KPIs) that align with FMRP's overall closure objectives. These quantitative indicators provide measurable objectives that serve as reference points for tracking performance and progress throughout the life of the FMRP. The Project Director is responsible for developing, maintaining, and administering changes to the list of KPIs, and is supported in this capacity by the FPET.

AANDC recently engaged a consultant to assist them with the development of the key elements of a performance measurement strategy for the FMRP; this includes a logic model, a plan to further develop key performance indicators, and implementation and evaluation plans. This process included obtaining input from AANDC and YG during February and June 2013 workshops. The results of the work will inform and be integrated with the PEP chapter on Performance, the Master WBS, the Control Point Framework, and the AANDC submission to Treasury Board seeking approval to enter into a multi-year funding agreement with YG for the MTP.

A draft Performance Measurement Strategy (October 31, 2013) for FMRP lists current KPIs, based on AANDC Contaminated Sites Program reporting requirements. This will be a "living" list that will be updated beginning in FY2013/2014 and expanded throughout the FMRP to address indicators that become applicable in subsequent FMRP phases.

SECTION 6

Risks

A technical risk assessment has been conducted annually at the FMC for almost 10 years. This technical risk assessment is routinely used to assess the effectiveness of existing mitigations and highlight the need for additional ones. It focuses primarily on risks to human health and safety, environment, and cost (three of the prime overarching objectives of the overall FMRP) caused by the condition of the immediate physical environment of the Project. The 2012 technical risk register update is included as Appendix G.

With the completion of a work plan that focuses on a 4-year period of the FMRP, rather than a single year, an opportunity to conduct a risk assessment with a slightly different focus on the "non-technical" risks to the Project is provided.

"Project risks" may be considered as the strengths, weaknesses, threats, and opportunities associated with the execution of the scope of the Medium Term Plan or a particular project phase. It is the intent of the PLT to complete a project risk assessment associated with the execution of the Plan in FY2013/2014 and append it to this document.

Moving toward an integrated risk management approach for the FMRP will also involve identifying and characterizing other non-technical risks, termed "strategic risks," which threaten achievement of the overarching project objectives. AANDC and YG will be discussing the approach to manage strategic risks as part of the finalization of the Project Charter.

Broadly speaking, risks associated with the execution of the Plan and of the FMRP as a whole are likely to fall into several broad categories. However, it is important to note that assessments will clearly distinguish the differences between risks and issues. The strategic value of risk management is diluted if issues and risks are mixed; issue management is focused on dealing with current, rather than potential, impacts. While prevailing issues can have a negative impact on the collaboration and effectiveness of the Project Team and need to be addressed, they will not be part of the risk assessment process itself.

6.1 Potential Non-technical Risk Categories

- *AYFN Expectations*. An "expectations disconnect" between AYFN and the territorial and federal governments will lead to further deterioration of relationships, delays of the FMRP, and increased costs.
- *Reputation*. As the profile of the FMRP increases, so too will the attention of the public and of both national and local interest groups such as Sierra Club, Mining Watch, Canadian Parks and Wilderness Society (CPAWS), Yukon Conservation Society (YCS), and the like. Political sensitivities surrounding the FMRP could increase as a result, which will in turn increase management efforts and cause delays.
- *Governance*. Project governance will be ineffective, leading to hold-ups in the clearing of stage gate 2B and associated delays in executing subsequent FMRP phases.
- *Regulatory Process*. The nature and complexity of the regulatory process will lead to significant project delays and increase of associated costs.
- *Competition for Resources*. A lack of qualified, capable, and competitive contractors will lead to Project delays and increased cost, and could compromise other Project objectives.
- *Communication*. Inadequate communication about the FMRP within and among AANDC and YG will lead to misconceptions and introduce management insecurities and friction, thereby causing delays.

- *Project Team Capacity and Capability*. The lack of capacity within YG, AANDC, and AYFN, and challenges associated with securing sufficient capacity, will lead to delays in execution and inadequate accountability.
- *Procurement*. Conflicting procurement approaches between YG and AANDC will lead to misalignment of outcomes and project delays.
- *Complexity*. The current governance and management approach is insufficient to address the complexity of the FMRP, resulting in increased costs, delays, unsatisfactory results, and loss of political support for the FMRP.
- *Funding*. Inability to secure and provide committed, long-term FMRP funding will lead to delays and cost overruns, and result in under-performance against FMRP objectives.

The output of the plan-bounded and/or phase-bounded project risk assessment process will be a register of risks containing descriptors of each risk event, an assessment of their likelihood and consequence, and a series of actions designed to act as mitigations to the risk. The FMRP Project Director is responsible for identifying owners for each of the risk mitigations and for tracking the changes in risk versus time. This will be completed on a quarterly basis; each risk owner will be required to provide an update of the status of mitigations and to indicate changes in risk that may have occurred. Risk register updates will be included as part of the FPET's reporting function. Strategic risks have been identified and are characterized in the Project Charter (July 5, 2013).

SECTION 7

Workplanning and Reporting

7.1 Annual Work Planning

This MTP for the FMRP meets the minimum requirements of YG's financial and accounting policy framework. It also follows the *Contaminated Sites Program Major Project Office Standards and Guidance Manual* (Final V0) (AANDC, 2013a) where applicable. To confirm that YG's requirements are met and AANDC's guidance is followed, the FPET will also submit annual Detailed Work Plans (DWP) describing the scope, schedule, and budget of the tasks and requirements for each fiscal year of the 4-year MTP.

Annual funding amendments to the planned multi-year funding agreement are contingent upon the Management Board's (MB's) receipt and approval of the annual DWPs. Each subsequent DWP will provide revised cost estimates for the remainder of the MTP. These will lead to revised annual budgets, which will result in amendments to the multi-year funding agreement. Annual budget approvals will follow the process and schedule outlined in Figure 7-1.

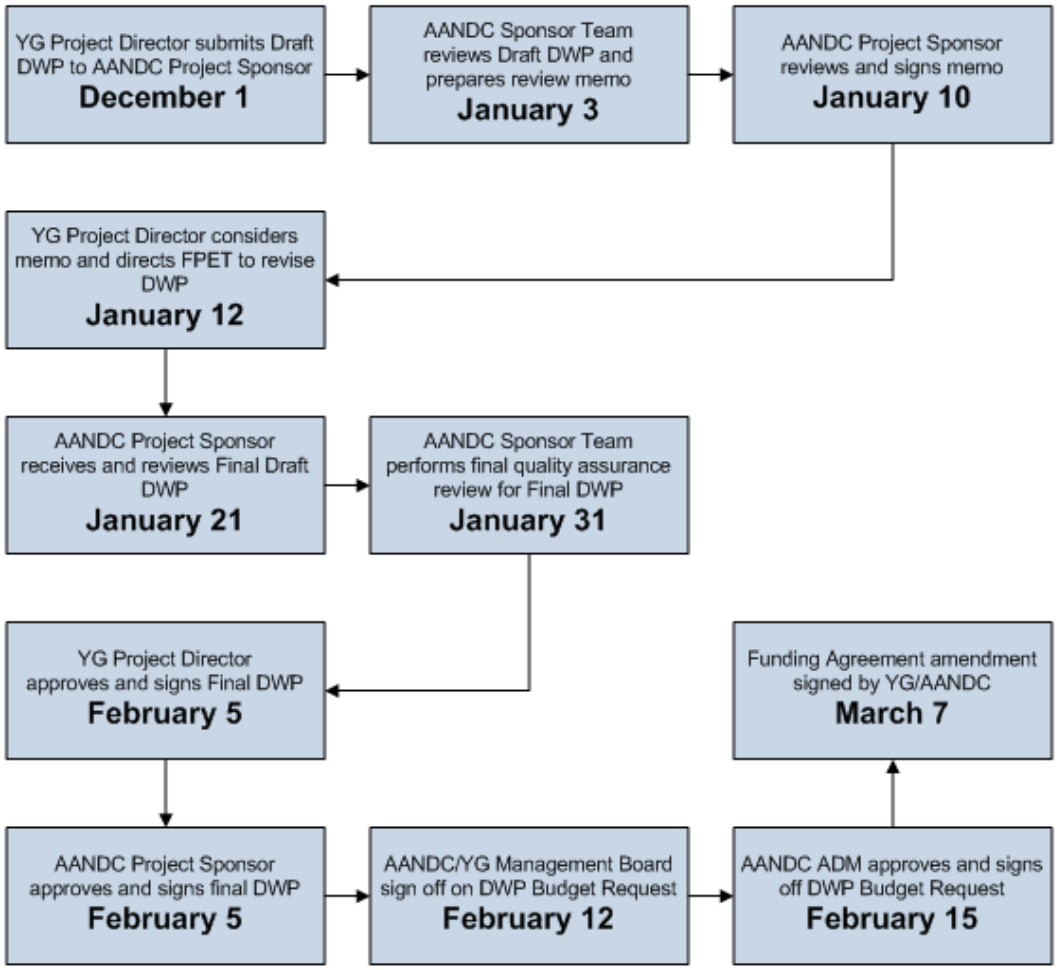


FIGURE 7-1
Annual Detailed Work Plan Approval Process
Faro Mine Remediation Project

The annual DWP approval process is expected to be streamlined compared to previous DWP and funding approval processes. Where past DWPs were standalone documents supporting discrete annual funding

agreements, they will now constitute annual updates to a previously approved 4-year work plan and amendments to an existing multi-year funding agreement. In short, the time and resources required to draft updates and amendments to existing plans agreements are anticipated to be less than previously required to draft new plans and agreements on an annual basis.

7.2 Annual Timetable

Table 7-1 lists AANDC's annual reporting and funding deadlines.

TABLE 7-1
Annual Reporting and Funding Deadlines
Faro Mine Remediation Project

Task	Deadline
Submission of First Quarterly Report to AANDC	June 30 + 30 days
Submission of Monthly Financial Variance Reports to AANDC	End of June, July, August, September + 15 days
Submission of Second Quarterly Report to AANDC	September 30 + 30 days
Submission of Monthly Financial Variance Reports to AANDC	End of October, November, December + 15 days
Submission of Annual Detailed Work Plan to AANDC	December 1
Submission of funding amount for vote in-house (YG)	December 31
Submission of Third Quarterly Report to AANDC	December 31 + 30 days
Management Board Approval of Annual DWP	February 15
Signed amendment to funding agreement between AANDC and YG	March 7
Submission of Monthly Financial Variance Reports to AANDC	End of January, February, March + 15 days
Submission of Fourth Quarterly Report to AANDC	March 31 + 30 days
Submission of Year End Financial Variance Report to AANDC	March 31 + 120 days

7.3 Reporting Requirements

7.3.1 Quarterly Reporting

The FPET will submit Quarterly Reports in the format specified by the Contaminated Sites Program Quarterly Reporting Template, within 30 days of the end of each quarter of the fiscal year.

7.3.2 Financial Variance Reporting

The FPET will submit monthly Financial Variance Reports within 15 days of the end of each month of the fiscal year, beginning with the month of June.

Each Financial Variance Report will detail the amount spent, the amount committed, the forecast spending to the end of the fiscal year, and the projected surplus/deficit for each Work Section and Work Item in the approved DWP, as well as any amounts transferred between the budgets for individual Work Items. Each Financial Variance Report will also note any change orders to scope, schedule, and budget approved by the PLT during the month.

A final Financial Variance Report will be provided for the entire fiscal year, 120 days after the end of the fiscal year. This report will reconcile all expenditures, including those made after the end of the fiscal year, to the budget amounts for each Work Section in the DWP, each Work Item within that Work Section, and the annual budget as a whole. It will identify surpluses and deficits for each Work Section in the DWP and for each Work

Item within that Work Section. It will also reconcile the funds transferred between the budgets for individual Work Items during the fiscal year.

7.3.3 Audience

All Quarterly Reports and Financial Variance Reports will be submitted through the Project Leadership Team (PLT) (that is, Director, Contaminated Sites Program, Natural Resources & Environment Branch, AANDC, and Director, AAM, Energy Mines and Resources, YG) to the MB (Director General, Natural Resources & Environment Branch, AANDC, and the Assistant Deputy Minister, Energy Mines and Resources, YG).

7.3.4 Financial Management Capacity

Three objectives inherent in YG's financial administration policy govern the work of the FPET, as a branch of the territorial government. They are outlined in the *Financial Administration Manual* (YG, 2008):

- *Accountability.* To ensure that responsibility for every commitment of funds is assigned to a responsible individual, that an audit trail of transactions exists to document that responsibility, and that accurate reporting of the transaction occurs;
- *Control*. In order to ensure that every financial transaction is for a purpose specified by the legislature, it will be carried out, in its essential elements, in a manner that is consistent throughout the government, reflecting proper financial procedures in order to ensure that the appropriate authorities authorize and check the various stages of the transaction; and
- *Efficiency.* To ensure that funds will be spent in a manner that maximizes the value received by the government for that expenditure.

While not specifically included in this summary list, the FPET also demonstrates the transparency inherent in responsible government financial management through timely, meaningful, and reliable financial and performance reporting. This information is shared, along with information from all other YG departments and branches, through the Yukon Public Accounts.

The *Yukon Act*, a federal statute (Canada Department of Justice, 2002), grants financial authority and responsibility for YG. The actual delegation of financial powers within the government is done under the authority of the *Financial Administration Act* (FAA), as passed by the legislature of YG. The FAA establishes a committee of the Executive Council, the Yukon Government Management Board (YGMB), which consists of a Chairperson—the Executive Council Member responsible for Finance—and two other members of the Executive Council, appointed by the Commissioner in Executive Council. The FAA grants the YGMB authority, among other things, to establish accounting policies and practices for the government, in addition to establishing accountability for government financial management and control of revenue, disbursements, and assets. The YGMB may, for the performance of its powers and duties, issue directives. The FAA goes on to establish a Department of Finance and outlines the responsibilities of the Executive Council Member responsible for Finance who, under the direction of the Commissioner in Executive Council, is responsible for the management and administration of the Consolidated Revenue Fund and the supervision of the revenues and expenditures of the government, including all matters relating to the fiscal policy of the government. In turn, each member of the Executive Council is made responsible for the management of the financial affairs of his or her department under the general direction of the Executive Council Member responsible for Finance and the YGMB. The Deputy Head of the Department of Finance, under the direction of the Executive Council Member, is responsible for day-to-day administration of the Department of Finance and its activities, including the collection, recording, and disposition of government funds; establishment and evaluation of accounting procedures; maintenance of government accounts; and preparation of financial statements and reports required by the Executive Council Member.

At an operational level, the FPET ensures that its obligations to YG with respect to financial management of funds it receives (from both Canada and YG) are in accordance with the terms and conditions of the FAA. To do this, the FPET follows the directives and guidance included in the *Financial Administration Manual* (YG,

2008). This document explains the government's overall financial processes in broad terms, provides direction to the various departments and agencies of the government such that detailed interdepartmental/agency financial policies and procedures can be developed from a common and consistent base, and provides common financial policies that must be adhered to by all government departments and agencies. A publically available copy of the *Financial Administration Manual* can be found at http://www.finance.gov.yk.ca/general/fam.html, and contains information on the following:

- Financial Management and Budgetary Control
- Financial Systems and Controls
- Accounting and Control of Expenditures
- Accounting and Control of Payroll
- Accounting and Control of Revenue and Accounts Receivable
- Accounting and Control of Assets and Liabilities
- Accounting and Control of Funds
- Role of Internal and External Audits

In accordance with the responsibility imparted by the FAA, the FPET has developed a unique system to meet the financial administration, reporting, and program delivery responsibilities associated with Federal Contaminated Sites Action Plan funding. The Project Budget Management System (PBMS) software allows for complete control, tracking, and reporting of monies received by the Execution Team, and is the core tool for meeting the financial accountability requirements of both Canada and YG. In addition to providing project managers and finance staff with web-based access to up-to-date, real-time information, key PBMS outputs include variance reports, commitment balances, vendor reports, transaction histories, close-out reports, and a wide variety of summary reports. Working with local software developers, the FPET can use PBMS to create custom reports to meet emerging information needs. A team of three individuals provides the resources to execute the financial management systems of the FPET, overseen by a senior manager. The composition and responsibilities of this team are further detailed in Appendix L (Table L-1, *Current Organization Structure*, and Figure L-1, *Organizational Structure to Support Medium Term Plan*). This team also receives direct support from Energy, Mines and Resources Department of Finance.

Under the existing operating environment, responsibilities for database maintenance, processing, and reporting activities that form the overall financial system are assigned, as outlined in Table 7-2.

TABLE 7-2
Financial Database Maintenance, Processing, and Reporting Responsibilities
Faro Mine Remediation Project

Focus Area	Assessment and Abandoned Mines (AAM) Responsibility	Department of Finance Responsibility
Budget Process	• Prepare detailed AAM branch budgets using posting level accounts and computerized facilities • Provide AAM branch budget data to Department, per directives • Provide variance analysis and reporting to departmental managers, central agencies, and Canada	• Compile and prepare consolidated budget using Quest • Reporting software • Load budget to General Ledger (G/L) database • Prepare variance analysis and reporting • Advise YGMB on financial planning and control

TABLE 7-2
Financial Database Maintenance, Processing, and Reporting Responsibilities
Faro Mine Remediation Project

Focus Area	Assessment and Abandoned Mines (AAM) Responsibility	Department of Finance Responsibility
Disbursement	• Prepare cheque requisitions using appropriate distribution codes and in accordance with directives for authorization • Apply control procedures • Verify payments against records/ documents of request • Maintain manual files for commitment documents	• Process payments in accordance with established procedures and controls • Monitor implementation of signing authorities, per YGMB directives • Provide centralized maintenance of vendor master file • Generate disbursement and distribution entries to G/L database • Maintain manual files for paid documents • Monitor and maintain system's effectiveness
Payroll Processing	• Provide accurate and timely employee payroll data, including related distribution accounts • Verify accuracy and reconcile reports with contents of related accounts in G/L database • Perform labour costs analysis	• Maintain Payroll Master File, process payroll, and deposit pays to employee accounts • Maintain detailed payroll records • Generate payroll distributions to the G/L database • Remit payroll deductions to respective agencies • Issue annual T4s • Monitor and maintain system effectiveness
Commitment Processing	• Record (input) commitments using affected budgetary accounts to assist managers in making decisions with respect to expenditures • Ensure completeness and accuracy of commitment data in the system	• Monitor system and data integrity • Manage access and maintenance controls
General Ledger Control	• Develop required chart of account, per coding guidelines and information requirements • Ensure accuracy and appropriateness of G/L contents in AAM branch accounts • Correct coding and other entry errors in AAM branch accounts	• Ensure integrity of financial database • Maintain accounts and relationships • Maintain regular and monthly processing and reporting schedules • Liaise with and assist users in the various aspects of database maintenance • Monitor and ensure accuracy of balances in balance sheet accounts
Financial Reporting	• Develop and implement PBMS to meet specific AAM branch requirements and to provide information to central agencies and Canada • Provide financial reports, per requirements of central agencies and Canada	• Develop, maintain, and distribute standard management reports • Prepare and issue annual financial statements • Provide detailed transaction files accessible by users for their reporting needs

In order to fulfill Financial Management obligations, the Financial Management Team of AAM is required to input into, or generate, the information in Table 7-3.

TABLE 7-3
Financial Management Obligations
Faro Mine Remediation Project

Information Requirements	Purpose	Users	Frequency
• Year-to-date budgets, commitments, and actuals summarized by activity/element and object breakdown for each program • Comparisons of year-to-date actuals and planned expenditures	• For control of expenditures and determination of corrective measures	AAM, Department of Finance, AANDC	Monthly and by request
• Financial transactions summarized by activity, element, and object	• To ensure spending activities remain within budgetary constraints • To evaluate performance in terms of expectations	AAM	Monthly and by request
• Appropriations/ allotments, disbursements to date, commitments, and free balances for each responsibility centre by allotments	• As a basis for cash forecasts and expenditure control at department level • To monitor global expenditures by allotment within appropriations • For Legislative Assembly review	Financial Officers, Department of Finance, Legislative Assembly	Monthly and by request
• Variance analysis of planned and actual expenditures on periodic and cumulative basis for each responsibility centre, department, and global, with narrative explanations	• For analysis of causes and future impact of variances • For projection of year-end positions • To initiate measures to prevent over-expenditures	AAM, Department of Finance	Quarterly and by request
• Summary of financial resources, commitments, and obligations by date/due date	• Cash management	Department of Finance	Weekly, monthly, and as required
• Detail financial transactions, account balances, and system edit/audit	• To verify accuracy of all other reports and for detailed analysis • Maintenance of system integrity and data accuracy	AAM, Canada	Daily and as required
• Financial statements	• For overall evaluation of financial performance • To meet statutory reporting requirements	Legislative bodies, Department of Finance, Canada	Annually

SECTION 8

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Appendix A
Geochemical Status

APPENDIX A

Geochemical Status

Appendix A, *Geochemical Status,* presents an overview of the primary sources of current and potential contamination at the FMC and the status of the geochemical conditions of these sources. The geochemical conditions in waste rock and tailings change over time as neutralizing potential in these materials is consumed by acid generated from the oxidation of sulphide minerals. When the neutralization potential in the waste materials is reduced to low residual levels, the seepage becomes more acidic and contains higher metal concentrations. Seep migration pathways are largely controlled by pre-mining topography with pre-existing drainage focusing most of the seepage into a few key areas around the site. Understanding the pre-mining topography and evolving geochemical conditions for different areas of the site provides a basis for evaluating priorities to address contaminant sources and collect and treat contaminant migration pathways.

The FMC includes three distinct mine areas: Faro, Grum, and Vangorda, each of which has an open pit and associated waste rock dumps (WRD). All of the ore was milled in the Faro Mill and the tailings from the process disposed of primarily in the Rose Creek Tailings Area (RCTA). The Faro, Grum, and Vangorda ore bodies occurred in topographic lows; therefore, they either had creeks running across the planned open pit (Faro and Vangorda) or were a low wetland area for a creek flowing away from the ore body (Grum). In general, all of these former natural creeks associated with the pits flow from north to south in the FMC, such that background conditions prevail north of the FMC, and impacted water leaves to the south. In the Faro Mine Area, water ultimately flows into Rose Creek, which trends southeast to northwest across the site and into Anvil Creek before it flows into the Pelly River. In the Vangorda/Grum Area, water flows to Vangorda Creek before leaving the site and flowing into the Pelly River near the Town of Faro.

All of the WRDs in the Faro Mine Area have the potential to generate acid and release contaminants (metals and sulphate) to the environment. Faro Creek, flowing from the north, is diverted around the Faro Pit via the Faro Creek Diversion (FCD). Leakage from the FCD flows through the North Faro WRD, impacting Faro Pit. The other main contributors impacting Faro Pit are seepage from the Northeast WRD, pumping from Zone II Pit (location X26), and the S-wells. Faro Pit currently has a geochemistry demonstrative of buffered acid rock drainage (that is, pH near neutral) and, in general, contains zinc concentrations that have been gradually increasing since 2004 (Denison Environmental Services [DES], 2012b).

The FCD flows into North Fork Rose Creek (NFRC) just north and east of the Faro Northeast WRD. While both the FCD and NFRC are unimpacted above this confluence, Robertson GeoConsultants Inc. (RGC) has expressed concern for an increasing trend of sulphate and dissolved metals concentrations in water emanating from the Northeast WRD in an easterly direction towards NFRC and below the FCD confluence (RGC, 2012). Groundwater in the Zone II Outwash area is impacted by Zone II WRD seepage. Although groundwater quality conditions appear to be relatively stable in the Zone II Outwash area, there is uncertainty associated with the timing of future contaminant breakthrough, so future contaminant concentrations could increase.

At the periphery of the Faro WRDs, pre-mining topography focuses seepage at two main locations: the S-wells area to the south and the seepage in the historical Faro Creek drainage to the west of the main Faro WRDs (monitoring location X23). At the S-wells area, a seepage interception system was installed to collect seepage and pump it back to the Faro Pit before it migrates to the NFRC. S-well seepage collected in the common sump, as monitored since 2009, has had variable but persistently elevated contaminant concentrations (zinc and sulphate).

The X23 monitoring location represents WRD seepage flow captured by the pre-mining Faro Creek Channel. Contaminant concentrations have steadily increased at X23 over the past 14 years, though with periods of apparent stability and occasional, ephemeral decrease in concentration. Sulphate increases have been fairly consistent and steady, while zinc has shown some indication of breakthrough in the past 4 years (DES, 2012b).

Seepage from the Emergency Tailings Area (ETA) (location FCS-3) is occurring from the ETA just below the Mine Road. This FCS-3 seepage converges with the X23 surface flow in ETA manhole dump. Currently, these two flows are captured in the ETA manhole sump, which was installed in 2006, limiting the flow entering Faro Creek Canyon. RGC demonstrated that during summer operation, the ETA sump intercepted about 80 to 85 percent of the flow; therefore, it captures a significant portion of the contaminant load (RGC, 2010b). However, the interception system is not operated in winter; therefore, any flow when the system is shut down discharges to Faro Creek Canyon.

Under pre-mining conditions, Faro Creek Canyon flowed into Rose Creek. However, once mining started, Rose Creek was diverted to the south in the Rose Creek Diversion and approximately 4 kilometres of the former creek bed was backfilled with tailings. The NFRC flows into Rose Creek just above the RCTA's upstream southern margin. Groundwater in the Rose Creek Alluvial Aquifer (RCAA) is unimpacted upgradient of the RCTA, but impacted below the RCTA. The two main sources of contaminants impacting the RCAA are vertical migration of tailings pore water within the RCTA and runoff/groundwater flow from the Faro WRDs. The tailings pore water is highly impacted, but the tailings material is so fine-grained that the rate of pore water displacement is extremely slow. As observed over the past 10 to 12 years, seepage from the Faro WRDs has a significant impact on the RCAA, gradually increasing sulphate followed by a lagging increase in zinc in the northern portion of the RCAA (RGC, 2012). The more recent increase in zinc concentration near the Intermediate Dam Pond is a concern, as it indicates migration of contaminants towards the CVD (RGC, 2012).

The Vangorda and Grum mine areas were active later in the history of the FMC, and as such, were better managed with respect to placement of WRDs relative to pre-mining topography. The waste rock from the Grum Mine Area does not have as much acid-generating potential as the Vangorda or Faro mine areas. Grum Pit Lake was also subjected to a long-term algal treatment pilot study that reduced contaminant concentrations, although not low enough to meet compliance standards; therefore, the pilot study has been terminated. Contaminant levels are expected to increase in the near future because the algal treatment has been terminated.

The easternmost flank of the Grum WRD was constructed overtop the former Grum Creek Channel. As such, the former Grum Creek drainage acts to focus infiltrating water to two perennial seep locations immediately adjacent to one another that are geochemically similar. Contaminant concentrations at these seeps are relatively stable and only moderately elevated (SRK, 2010f).

During construction of the Grum WRD, the sulphidic waste rock with the highest potential for generating acid and leaching metals was strategically placed in a single "sulphide cell." The sulphide cell was capped with a low- permeability cover in 2010 to minimize impacts downgradient. Seepage below the Grum Sulphide Cell collects in a small sump (V15) before flowing to Moose Pond. Contaminant concentrations at V15 appear to be stabilizing as a result of the installation of the Grum Sulphide Cell cover, although the record of evidence is limited and monitoring is ongoing.

Vangorda Creek, which is unimpacted, was diverted around Vangorda Pit before mining. Vangorda Pit Lake contains highly elevated levels of contaminants. The Vangorda WRD was constructed over a pre-existing ridge. The Vangorda WRD is surrounded to the south, west, and north by a drainage ditch that collects toe seepage from the WRD. There are several transverse drains that direct the seepage to the collection ditch; the collection ditch then leads to Little Creek Dam (LCD) pond, where seepage is collected. Samples collected from these transverse drains are highly acidic, with elevated iron, zinc, and sulphate concentrations. In some of the transverse drains to the west and the south of the WRD, the contaminant concentrations appear to be

fairly stable; however, in a few of the drains on the northwestern side of the WRD closest to the LCD pond, the concentrations are increasing.

While the transverse drains and drainage ditch collect the majority of the toe seepage at the Vangorda WRD, RGC (2012) reports that immediately downgradient of the drainage ditch, groundwater quality is deteriorating based on major ion breakthrough. Zinc concentrations remain low, but have increased near the northwestern corner of the WRD.

Appendix B
Infrastructure

APPENDIX B

Infrastructure

Appendix B, *Infrastructure,* provides an overview of the Faro Mine Complex (FMC) infrastructure. Much of the stationary and mobile infrastructure (i.e., site buildings, mobile heavy-duty equipment, and the electrical distribution system) at the FMC has been in place for more than 40 years (the FMC itself was operational for 30 years). This infrastructure was purpose-built with a design life that has already been significantly exceeded, in a harsh environment with less than ideal maintenance historically. It is possibly contaminated with lead concentrate, dust, asbestos, and other harmful substances, and will continue to require extensive hazard mitigation and remediation, repair and maintenance until it is removed and replaced (where appropriate) as part of the final remediation project. A small number of buildings on the Vangorda/Grum Area of the FMC are around 20 years old and in relatively better condition, because they were not as heavily used compared to the buildings in the Faro Mine Area. However, investigations in 2012 revealed potential mould contamination in some buildings (owned by the Town of Faro), which will require further assessment.

The following buildings are located in the Faro Mine Area of the FMC, their locations detailed in Figure B-1, *Aerial View of the Faro Mine Complex*:

- Warehouse
- Norcan shop
- Lube storage building
- Mill building
- Cold storage
- Reagents building
- Crusher building
- Coarse ore bin
- Guardhouse
- Dry and lunch room
- Concentrate loadout building

The following buildings are located in the Vangorda/Grum Area of the FMC:

- Water Treatment Plant (old mill building)
- Grum administration building (owned by Faro)
- Grum shop building (owned by Faro)

Site buildings that are only used during the operational season are affected by the continued freeze/thaw cycle each spring and fall, contributing to structural building damage. The mill building, used throughout the 30-year life of the FMC, was converted to treat contaminated water in 2001. The mill structural components are degrading over time.

During the time that the Interim Receiver was on site, many of the components for ore processing that were in the mill were removed and sold. However, in that removal process, little consideration was given to future safety implications. Many areas were left with gaping holes or pipes that had been cut and left hanging in place. Because the mill has been used as a WTP for the last ten years, considerable work has gone into ensuring the health and safety of workers accessing these areas within the former mill.

Since 2009, many improvements were made to commonly used areas in the former mill. Access was limited using barriers in areas needed for water treatment operations. Some of the hanging pipes were removed. Improved lighting was installed. Damaged or trip-hazard flooring or grating were repaired. To provide shelter against roof leaks and prevent ice build-up, a wooden roof structure was installed. However, as this temporary roof could not protect against objects that may fall, such as hanging lights or electrical cable trays that may fail, additional monitoring of these ongoing hazards by the C&M operator is ongoing.

A structural assessment of the mill building was conducted in 2009 (WEC Cotterall Consulting Ltd. with Omega & Associates Engineering Ltd., 2009). After following up on the assessment, further investigation of the mill roof was completed. The recommendation to repair certain sections of the roof (those in high traffic areas that posed a health and safety risk to workers below, as prioritized in the Cotterall report) were carried out in September 2011 and inspected in October 2011 (Associated Engineering, 2011b). Scheduled follow-up inspections of the repaired roof were carried out again in May and October of 2012.

At the beginning of fiscal years 2013/2014, the FPET determined that it did not have sufficient confidence in the safety of the Faro Mill Water Treatment Plant facility to initiate commissioning for the 2013 season, and so delayed startup pending the completion of a comprehensive health and safety review of the Mill WTP by AMEC (AMEC, 2013). Alternative water management practices were then implemented, including the use of the Faro Pit to store water from the Intermediate Pond/ETA. The AMEC review confirmed that the Mill building was unsafe for workers, which led the FPET and AANDC to close and barricade the Mill building, relocate work spaces elsewhere, and put in place an IWTS to begin operations in the 2014 season.

The concentrate load out has been mostly been removed, with only the foundation and some of the cement walls remaining. There is a quantity of lead concentrate that remains in what is left of the foundation and is covered with a gravel layer to minimize contact and contain the concentrate to prevent airborne contamination until such time as the facility can be fully demolished and remediated.

Areas of the Guardhouse were remediated for mould damage in 2011; follow-up inspections are being carried out by the C&M operator. The building has been reviewed for fire safety and compliance to code. Fire safety plans have been put in place to mitigate for any identified deficiencies. The Guardhouse is occupied daily by security staff on a year-round basis with offices that are in use during the week. There are three additional trailers that are in regular use by staff. The analytical laboratory is connected to the Guardhouse through a closed breezeway, and other trailers contain a men's and women's dry (a trailer comprising a shower, change room, and washroom) and a large lunch room. The trailers can be mobilized if necessary, but are currently wired and plumbed into the Guardhouse system.

The primary crusher and coarse ore storage area has not been in use for some time and is barricaded against public or worker access. There are warning signs in place. These buildings have been de-energized and have not been maintained for many years. The buildings have been secured against access until the facility can be demolished and remediated.

The warehouse and offices are generally not used, except as storage. The whole warehouse is currently accessible with items stored in one half of the garage bays and the other half is used to store rarely used items to protect them against the elements. Half of the warehouse is not fully weatherproof; many of the roof drains have not been maintained and leak into the building, affecting continued utility of the warehouse as storage. The offices are on the second floor of the side of the warehouse that is not used or maintained.

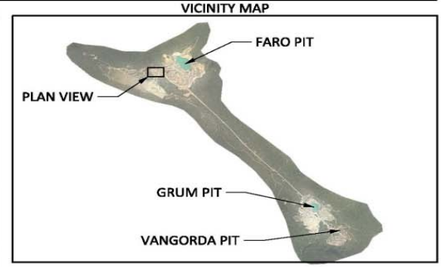
The heavy duty equipment repair shop, tire shop, and light vehicle repair shops are used on a regular basis. Any onsite equipment maintenance and repairs are completed in this building. The building is maintained, with some of the roofing and flashing replaced in 2012.

On the Vangorda/Grum Area of the property, the WTP is located close to Grum Pit but had been used to treat contaminated water and seepage from Vangorda Pit and the Vangorda Waste Rock Pile. The WTP is sized to treat up to 2,000 United States gallons per minute (USgpm) and was constructed in 1992. It was built specifically for water treatment and is therefore more efficient than the modified Faro Mill WTP. Beginning in 2013, the Vangorda WTP began to treat water from Grum Pit, which will continue to be pumped and added to Vangorda Pit as part of ongoing Grum Pit dewatering efforts.

The electrical distribution system at the FMC is directly connected to the Whitehorse Aishihik Faro Grid in Faro. Power is supplied to the FMC via a 38-kilovolt (kV) power line connected to the Whitehorse Aishihik Faro Grid. There are transformers at the Faro Mill building that step the power down for local distribution onsite. A 27-kV overhead power line runs from the Faro Mill building to the Vangorda Plateau, which feeds a 4,160-volt distribution system for the Grum and Vangorda mine sites. See Figure B-2, *Faro Mine Complex Landmarks Map*.



VICINITY MAP



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METRES

LEGEND

(X) Building Designation

— — Indicates Buildings not Currently On Site

——— Approximate Boundary of Laydown Areas

Building Key

1	Warehouse
2	Norcan Shop
3	Lube Storage Building
4	Mill Building
5	Cold Storage
6	Reagents Building
7	Crusher Building
8	Coarse Ore Bin
9	Guard House
10	Dry & Lunch Room
11	Loadout Building

Notes:
1. Aerial Photo shown dated August 2012.

Figure E8-1
Aerial View of the Faro Mine Complex
Faro Mine Remediation Project

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FIGURE B-1
Aerial View of the Faro Mine Complex
Faro Mine Remediation Project



1. Rose Creek Tailings Area
This area is 4 km long and up to 1 km wide and located at the base of Rose Creek Valley. It holds over 55 million tonnes of tailings. Three dams (original, secondary and intermediate) hold the tailings in place. A fourth dam, the Cross Valley Pond, holds treated water.

2. Rose Creek Diversion
The 4 km long channel diverts the Rose Creek around the tailings impoundment area.

3. Intermediate Pond & Dam
Pond where contaminated water is collected and pumped to the Faro Water Treatment Plant.

4. Cross Valley Pond & Dam
Pond where treated water is stored and tested. Water meeting acceptable standards is discharged into Rose Creek.

5. Mill Area – Faro Water Treatment Plant
The original mill structure was modified and is now used as a water treatment plant. Contaminated water from the Faro Pit is collected and treated at this plant.

6. Faro Waste Rock
Over 260 million tonnes of waste rock (divided into 30 separate dumps) are in the Faro area covering approximately 3.35 km² or 335 hectares.

7. Faro Pit
The pit is approximately 1,675 m long, 975 m wide and 335 m deep. It covers an area approximately 1.6 km² or 106 hectares.

8. Faro Creek Diversion
The 3.35 km long channel diverts the Faro Creek around the Faro Pit. Faro Creek then joins the North Fork of Rose Creek.

9. Haul Road
The 10 km road connects the Faro area to the Grum/ Vangorda areas and was used to haul ore from the Grum/ Vangorda areas to the mill for processing.

10. Fresh Water Supply Dam & Reservoir
The reservoir was used to provide a constant source of water to the mill for processing ore. When mining operations ceased, the reservoir was no longer required and the dam was breached.

11. Access Road
The 22 km road connects the Town of Faro to the Faro Mine Complex.

12. Grum Pit
The pit is approximately 1,100 m long, 700 m wide and 200 m deep. It covers an area approximately 0.77 km² or 77 hectares. A bio-treatment program occurs in the pit to treat the water.

13. Vangorda Water Treatment Plant
Contaminated water from the Vangorda Pit is collected and treated at this plant. Water meeting acceptable standards is discharged into Vangorda Creek.

14. Grum Waste Rock
Over 110 million tonnes of waste rock are in the Grum area covering approximately 1.48 km² or 148 hectares.

15. Grum Sulphide Cell Cover Project
The Grum Sulphide Cell is a portion of Grum Waste Rock which contains a higher quantity of sulphidic material prone to generating acid. The 0.275 km² area was resloped and covered with a liner and soil to control the generation of acid rock drainage.

16. Vangorda Creek Diversion
The 1.2 km long channel diverts the Vangorda Creek around the Vangorda Pit.

17. Vangorda Pit
The pit is approximately 1,150 m long, 350 m wide and 150 m deep. It covers an area approximately 0.42 km² or 42 hectares.

18. Vangorda Waste Rock
Over 16 million tonnes of waste rock are in the Vangorda area covering approximately 0.4 km² or 40 hectares.

Figure 2-1
Faro Mine Complex Landmarks Map
Faro Mine Remediation Project
CH2MHILL.

FIGURE B-2
Faro Mine Complex Landmarks Map
Faro Mine Remediation Project

Appendix C
Work Packages

Appendix C1
Advanced Design and Remediation Project Proposal Submission (AD/RPP)

APPENDIX C1

Advanced Design and Remediation Project Proposal Submission

C1.1 Context

C1.1.1 Devolution Transfer Agreement

In April 2003, the Government of Canada, represented by the Department of Indian Affairs and Northern Development, devolved most of its land and resource management powers to the Government of Yukon (YG) through the Yukon Devolution Transfer Agreement (DTA). At that time, YG took over the environmental responsibilities and obligations associated with water, forestry, minerals, and lands from the Government of Canada.

The term Type-II Mines was coined in the DTA and refers to numerous mines in the Yukon that were identified as having potentially unfunded environmental liabilities related to closure and remediation at the time of devolution. A majority of these mines remain under company control; however, three sites (i.e., Faro, Mount Nansen, and Clinton Creek) have no operator and are therefore considered Abandoned Type II Mines.

The Government of Canada's responsibilities, including its liabilities with regard to Type II sites, are indicated under Chapter 6 of the DTA. Chapter 6 provides clarity regarding the roles of each government and states the federal government's financial responsibility for the remediation of these sites. Funding for the remediation of these sites is provided through the Federal Contaminated Sites Action Plan and the custodian department is the department of Aboriginal Affairs and Northern Development Canada (AANDC). Per the DTA, YG is in charge of the administration; therefore, the two governments have agreed that the management and administration of Abandoned Type II Mines should be conducted by both parties.

C1.1.2 Faro Mine Remediation Project

In January 2003, Government of Canada and YG agreed that the Faro Mine Complex (FMC) should not reopen. Instead, they decided that a long-term remediation and closure plan should be developed and implemented. Because of their respective roles with Type II Mines, both governments have agreed that they will act as co- proponents for the Faro Mine Remediation Project (FMRP) assessment and subsequent licences. As co- proponents, the federal government will be represented by AANDC and YG will be represented by Assessment and Abandoned Mines (AAM).

C1.1.3 Yukon Environmental and Socio-economic Assessment Act

In the Yukon, project assessments are conducted by the Yukon Environmental and Socio-economic Assessment Board (YESAB) under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA). YESAA is the legislative framework to assess the environmental and socio-economic effects of a project. YESAA came into force in 2005 in accordance with Chapter 12 of the Umbrella Final Agreement and was drawn up through a collaborative effort by the Government of Canada, YG, and the Yukon First Nations.

YESAA has functionally replaced the *Canadian Environmental Assessment Act* and the *Yukon Environmental Assessment Act* providing for a single assessment process. Although YESAA is similar to the *Canadian Environmental Assessment Act*, there are a few notable differences. YESAA guarantees opportunities for Yukon First Nations to participate in assessments, it has mandatory timelines for the process to occur in a timely manner, it has guaranteed provisions of public participation, it evaluates socio-economic impacts independent of environmental impacts, and it considers both positive and negative impacts.

In addition to meeting the legislative requirements described above, there are Crown liability risks arising from the common law that must be managed in relation to the site. These additional legal obligations are

being considered by AANDC in their planning and execution of the FMRP and include section 35 of the *Constitution Act*, 1982, which raises Crown consultation responsibilities.

SRK Consulting produced a draft of the FMRP Project Proposal, and this document will be used to assist in the further development of the final Project Proposal for submission to YESAA. The PDT began preparing the Project Proposal in 2011/2012; however, because of current funding conditions, AAM has had to re-prioritize various works and permitting and reschedule the planned submission date to 2017. As such, this revised work plan is intended to reschedule and refine the original work plan to meet the new submission date target of 2017. AAM intends to submit works that require completion before 2017 for assessment and permitting. These works have been described as Interim Works in earlier section of the MTP, and the associated YESAA submission is described as the "Interim Works Project Proposal". Efforts described in this section relate to the preparation of the Project Proposal for final remediation of the FMC, which will be referred to as the "Remediation Project Proposal" to differentiate it from the lower level assessment required for Interim Works.

AAM intends to submit an Executive Committee-level Project Proposal for the overall remediation project to YESAB in spring 2017, which will initiate the regulatory process. At the height of its operation, the Faro Mine's mill had a capacity of 13,500 tonnes per day, and therefore, the FMRP will be subject to assessment by Executive Committee under Item 3(a) of Schedule 3 of the *Assessable Activities, Exceptions and Executive Committee Projects Regulations* (SOR/2005-379) of the *Yukon Environmental Socio-economic Assessment Act*: "3. Construction, decommissioning or abandonment of (a) a metal mine, other than a gold mine, with an ore production capacity of 1500 t/day or more."

C1.2 Faro Project Execution and Design Teams

The Faro Project Execution Team (FPET) is represented by AAM's Director, Project Managers, and support staff pertinent to the development of the Project Proposal. FPET is responsible for "implementing the FMRP within the established parameters of scope, schedule, budget, quality, safety, [and] environmental and technical integrity" and is accountable to the AAM Project Director. It is assumed that the items detailed in the following bullets are integrally linked to the relationship between Canada and Affected Yukon First Nations (AYFN); for instance, preparation of the Project Proposal will include Canada as a co-proponent and the AYFN as parties to the project, as well as parties to be consulted.

FPET's role entails the following responsibilities:

- Engineering Component: Design and development of Project Proposal; site operations and engineering design and approval; remediation activities engineering design and approval
- Regulatory Component: Design and development of the Project Proposal; preparation and processing of permit and licensing applications; ongoing conduct of environmental monitoring; preparation and implementation of team policies and procedures; reporting; and ongoing consultation and engagement
- Site Operations: Remediation activities (non-Operations & Maintenance construction); project controls; project risk management; health and safety; AYFN work plan development and oversight
- Support Services: Contracting; financial management; administration; and information management
- Communications: Support, enhance, and enable all Project functions

FPET will work with their team to ensure that the full range of issues are addressed, and that deliverables are completed and distributed on schedule.

In September 2011, FPET awarded the contract for undertaking the role of the Project Design Team (PDT) for the FMRP to CH2M HILL Canada Limited (CH2M HILL). This contract took the form of a Master Service Agreement, which included the following responsibilities:

A) "Under a publicly tendered process, the Contractor has been awarded the Contract to support YG and the Government of Canada, as they prepare for the assessment and regulatory processes related to the remediation of the Faro Mine Complex, also known as the Faro Mine Remediation Project ("FMRP"),

B) The Contractor will assist in the development of the FMRP, which includes:

i. Preparation of a project proposal, which includes: advanced engineering, environmental and socio- economic baseline, a project description, and effects assessment and cumulative effects assessment;

ii. Preparation of applications for regulatory processes and authorizations, including applications for a Water Licence and fisheries authorizations; and

iii. Technical support for ongoing site operations at the Faro Mine Complex;

C) The Contractor will provide detailed engineering and design of the FMRP at a level sufficient to support the assessment and regulatory processes and to allow implementation of the project to begin once approvals are in place".

The PDT consists of two core technical focus teams: a Regulatory Focus Team and an Engineering Focus Team. The Regulatory Focus Team consists of an integrated team of discipline leads representing the technical expertise that will address the baseline and effects assessment components of the Project Proposal. The Regulatory Focus Team includes the following disciplines: hydrogeology, hydrology, aquatics, water quality, geochemistry, terrain and geology, landforms and vegetation, wildlife, historical resources, human health and ecological risk assessment, air quality and noise, climate change, and socio-economics. The Engineering Focus Team consists of many of the same discipline leads as the Regulatory Focus Team, and also includes other discipline leads who specialize in waste rock and tailings, water treatment, site civil and mapping, dam design, and major structures.

To promote communication and interaction between these two teams, a number of the discipline leads are members of both Focus Teams. Interaction between the two technical focus teams will be structured by regularly scheduled calls and specific meetings to foster dialogue and understanding among engineering design, baseline data collection, effects assessment, and monitoring activities.

The Regulatory Focus Team includes a Regulatory Leadership Team (RLT) with the mandate to provide direction and guidance to the PDT in the preparation, refinement, and finalization of the Project Proposal and supporting documents so that the Project Proposal is compliant and fulfills the needs of the proponents, and therefore, the requirements of YESAB. The RLT is led by representatives of the Project's co-proponents from AAM and AANDC and includes members of the PDT.

The PDT, in conjunction with FPET, has initiated various tasks under this contract. Work initiated includes the production of draft documents such as the Regulatory Approval Strategy, Assessment Methodology and Scope, and Preliminary Gap Assessment Report, all of which will require further refinement before incorporation into a Project Proposal for submission to YESAB.

C1.3 Justification

Multiple aspects of the Faro Mine pose a real and increasing risk to the environment and human health and safety if left unmanaged. In order to mitigate and avoid these risks, the site must be remediated; therefore a detailed remediation plan must be developed and implemented. Before its implementation, the FMRP will be subject to assessment by the Executive Committee under Item 3(a) of Schedule 3 of the *Assessable Activities, Exceptions and Executive Committee Projects Regulations* (SOR/2005-379) of the *Yukon Environmental Socio-economic Assessment Act*. Because of the regulatory requirements as well as the risks, size, and complexities of the Faro Mine Site, several cursory works, studies, and planning and management initiatives must initially be undertaken before submission of the Project Proposal to YESAB. AAM, in

conjunction with AANDC, is responsible for the closure and remediation of the Faro Mine. AAM intends to submit the Project Proposal to YESAB in 2017, thereby initiating the regulatory process.

C1.4 Description of Scope

The PDT conducted a gaps analysis assessment in Q4 2011/Q1 2012 to identify information gaps that would be required to complete the FMRP Project Proposal, a ~60% engineering design (initial forecast requirement to support the Project Proposal), and an AACE Class 3 cost estimate. A site visit of the Faro Mine Complex and review of the PDT charter took place with discipline leads on October 3 and 4, 2011. A preliminary *Gap Assessment Report* was submitted to YG on December 13, 2011 (CH2M HILL, 2011a; CH2M HILL, 2011b).

Representatives from YG, AANDC, and the PDT met January 9 through January 12, 2012, to review the preliminary *Gap Assessment Report* and revisit the gaps in context with the Project Proposal needs. A final *Gap Assessment Report* was submitted to YG on February 22, 2012. CH2M HILL, 2012b). Appendix A of that report summarized the documents (i.e., FMRP reports, maps, data, and analyses) that were reviewed for the gap assessment.

In July 2013, the PDT initiated a process to refine and update the gaps identified in the 2012 *Gaps Assessment Report*. The revised gaps assessment specifically addresses the requirements for submission of a YESAA Project Proposal, including 30% engineering design, which the PDT concluded will provide sufficient detail for the Project Proposal. As the revised gap analysis and associated scopes to close gaps remain under development, for the purposes of the MTP, the details for scope, schedule, and cost are the same as existed at the time the draft Plan was submitted in December 2012.

C1.4.1 2014 Field Planning (WBS 01.01.04.01.01.06)

The revised gaps analysis will form the basis for field planning for 2014. The PDT will develop field plans and prepare a detailed field program to address the gaps described in the updated gaps assessment, including gaps related to both assessment (e.g., environmental baseline) and engineering (e.g., foundation conditions) requirements.

Section 3 of that Gap Assessment Report summarizes site-wide gaps, Section 4 describes engineering data gaps (details of the data collection needs organized by activity tasks are presented in Appendix B), and Section 5.2 presents the environmental and socio-economic baseline research and field investigation needs (detailed support tables are provided in Appendix C [Table C-1]).

The PDT prepared a *Draft Field Implementation Plan* (FIP) (CH2M HILL, 2012c) for the FMRP in March 2012 to present a structured plan for conducting the field investigation activities to support the development of the Project Proposal. The FIP included 63 engineering design and environmental field investigations that were proposed for the 2012 field season and are now deferred. Section 3 of the FIP provides an overview of the proposed engineering design, environmental and socio-economic field investigation activities that integrate the data collection needs from the Gap Assessment Report. The FIP will be updated specifically for the activities that are proposed for 2014.

C1.4.2 Permitting (WBS 01.04.06.02)

While major permitting requirements for field programs (e.g., YESAA assessment or water licence) will be addressed through the Interim Works Project Proposal, there are some minor permits that may be required. These will be addressed during the field planning process and acquired as required for specific field investigations, using the following general steps:

- Identify the permit requirements, for baseline and engineering field work activities.
- Prepare and secure the required permits.
- Prepare the permit close-out documentation following completion of the field work activities in accordance with the permits.

Possible requirements include the following:

- **Fisheries Research Licence:** These licences are issued by Fisheries and Oceans Canada under the *Fisheries Act* and will be required for some of the proposed fisheries research programs. They will be required for research programs that include activities such as electro-shocking, capture, and tagging of fish. The licence requirements apply to specific research, data collection, and monitoring activities; and the applications require details about the scientific methods and protocols that will be applied during the research program.
- **Heritage Resources Permit:** This permit is issued through the Department of Tourism and Culture (Heritage), Government of Yukon and is required to conduct a physical archaeological assessment.
- **Various minor permits: Various permits (e.g., building or electrical permits) might also be required for facilities that may be established to support field program logistics.**

Some socio-economic data collection or research programs may require permits that may include the following:

- **Yukon Archaeological Sites Regulations Permit:** Under the Yukon Archaeological Sites Regulations, a Class 1 or Class 2 permit may be indirectly required from the YG department of Tourism and Culture as a consequence of YESAA Assessment and Land Use Permit requirements.
- **Scientists and Explorers Licence:** This permit is issued by the YG department of Tourism and Culture and may be required for social and natural sciences research under the *Scientists and Explorers Act*.

These permits will be addressed on an as-required basis during research planning.

C1.4.3 Environmental and Socio-economic Baseline Data Collection and Research (WBS 01.03.02)

C1.4.3.1 Environmental Baseline Data Collection and Research

The *2012 Gap Assessment Report* (CH2M HILL, 2012a; 2012b) describes outstanding requirements for collecting baseline environmental data to support the effects assessment and the YESAA Project Proposal. Collection of baseline environmental data will be an iterative process. Extensive databases of environmental data already exist for the FMC, and additional data are being collected as part of ongoing PDT and site operations programs. The updated gaps analysis and 2014 field planning will be the first steps in ensuring that data collection and research programs meet the needs of the YESAA Project Proposal. Once these tasks are complete, the following activities will comprise the environmental baseline data collection and research; however, because of the developing nature of the revised gap analysis, specifics around scope, schedule and cost to complete gap closure remain at the same point as in December 2012:

- Complete 2013 Baseline Field Investigations and Monitoring: Some of the field investigations underway in 2013 are intended to help define baseline conditions. For example, a fish telemetry program has helped to define fish habitat conditions. Also, ongoing seep sampling programs will support characterization of existing geochemical conditions on the site.
- Complete 2014 Baseline Field Investigations: The 2014 field program will provide additional baseline characterization to support the YESAA Project Proposal, in accordance with the re-evaluation of gaps.
- Identify Final Environmental Baseline Gaps: The 2014 research program may lead to identification of additional data gaps. Evaluation of compiled data and research results will lead to identification of outstanding gaps by the end of 2014/15.
- Complete 2015 Baseline Field Investigations and Data Collection: 2015 will provide a final opportunity to collect additional environmental baseline if required. Ongoing baseline monitoring programs will continue, with a baseline data cutoff occurring in late 2015.

C1.4.3.2 Socio-economic Data Collection and Research

YESAA requires thorough evaluation of potential socio-economic effects of proposed projects. This necessitates a comprehensive understanding of existing socio-economic conditions in communities that may be affected by the project. Collection and compilation of socio-economic data to characterize existing conditions will be iterative. Work will be initiated to support the development of the Interim Works Project Proposal, but additional detail will be required for the more comprehensive FMRP Project Proposal that will be submitted to the Executive Committee, with a higher level of assessment. The following steps will comprise the socio-economic data collection and research:

- Conduct 2014 Socio-economic Gap Analysis: Evaluate the existing socio-economic data to identify requirements for additional research and data collection. This will be conducted in early 2014/15, after completion of the Interim Works Project Proposal.
- Complete 2014 Socio-economic Research/Data Collection: A research program will be conducted in 2014 to address socio-economic data gaps. Data will be collected through community research programs (e.g., targeted interviews and community meetings) as well as compilation of data from other key sources.
- Conduct Heritage Resource Investigations: In 2012, YG conducted a heritage resource overview assessment for the FMC. In 2015, once the Preliminary Project Description is completed, more detailed heritage resource assessment will be required for areas of new disturbance that will be associated with the FMRP.
- Identify Final Socio-economic Gaps: The 2014 research program may lead to identification of additional data gaps. Evaluation of compiled data and research results will lead to identification of outstanding gaps by the end of 2014/15.

Complete 2015 Socio-economic Research/Data Collection: If necessary, data collection and research to finalize the characterization of socio-economic conditions will be completed in 2015.

C1.4.3.3 Environment and Socio-economic Existing Conditions

The environment and socio-economic existing conditions will be used to describe the baseline condition of the project. The environmental existing conditions will describe the general physiography, surficial geology and soils, terrain hazards, climate, air quality, noise, vegetation, wildlife, surface water quality and flow, hydrogeology, and aquatic ecosystems and resources. The environmental baseline will use study areas relevant to individual environmental components, some of which will be used to understand the potential for change and ultimately the requirement for monitoring, mitigation and adaptive management.

YESAA requires the consideration of socio-economic components that may be affected by the project. For the purposes of the FRMP, the project proposal will need to consider the social and economic baseline for Pelly Crossing, the Town of Faro, Ross River, and the communities associated with Liard First Nation and the Kaska Dena Council. Typically this section would include consideration of items such as community structure, land and resource use, community wellbeing and cohesion, availability of services and associated infrastructure, etc. This description is required in order to understand the how communities may be effected by the development of a project.

C1.4.4 Engineering for Remediation Project Proposal

In support of the Remediation Project Proposal, it is required that the current closure plan be advanced in its design to a point where the environmental and socio-economic effects may be assessed. The specific work packages to be designed are discussed in detail in both the SRK Draft 4A Closure Plan as well as in the PDT's February 2012 Cost Opinion (CH2M HILL, 2011c). In general, they have been organized as follows:

- Faro Mine Area – 29 packages (WBS 01.02.01.04 – 33)
- Tailings Area – 17 packages (WBS 01.02.01.04 – 21)
- Vangorda/Grum Area – 22 Packages (WBS 01.02.03.02 – 24)
- Site Wide – 4 packages (WBS 01.02.04.02 – 06)

In addition to their use for the YESAA submission, the design packages will also be used for the preparation of a Class 3 cost estimate as defined by the American Association of Cost Engineers (AACE) for the Total Remediation Project Cost (TPRC). The Class 3 Cost Estimate is required by YG under their Control Point Framework as one of the General Project Deliverables of Phase 2b of the FMRP. For the purposes of this Class 3 cost estimate the designs will be advanced to level equivalent to Schematic Design as defined by AACE or to a level as may be deemed appropriate to achieve both the YESAA-ready level and prepare the cost estimate. The scope for the preparation of the cost estimate is included under the Site Wide task (WBS 01.02.04.06) listed above.

On the basis of discussions at two workshops (March 2013 and July 2013), the PDT has concluded that 30% engineering design will be sufficient to support the development of a YESAA Project Proposal. As a result, this level of engineering must be completed as part of the Medium Term Plan. The following tasks summarize the activities entailed in completion of sufficient design detail for the YESAA Project Proposal:

Engineering Field Investigations and Reporting (WBS 01.01)

- Conduct 2014 Engineering Field Investigations and associated reporting: The 2014 field program will address remaining gaps to support development of a 30% design for the FMRP.
- Conduct supplemental field investigation and reporting in 2015 as required to complete necessary datasets for 30% design.

Engineering Design (WBS 01.02)

- Develop FMRP Design Definitions and Concepts: Identify appropriate design criteria for the FMRP and develop basis of design for each physical component (e.g., diversions) of the FMRP. Develop frameworks for management components (e.g., contaminated water management plan) of the FMRP. These materials will be developed in late 2014 and early 2014 to support the development of a preliminary project description.
- Prepare Preliminary Project Description: Develop a preliminary project description that will be sufficient to initiate the environmental and socio-economic assessment activities. This will be developed in early 2015, with a target for completion by May 2015.
- The Project Description section will be used to present a plain language summary of the project design, schedule and proposed implementation approach for all phases of the project, including mobilization, construction, operation, modification, decommissioning, and abandonment and items such as engineered design drawings, description of design standards, description of the s material requirements, energy requirements, workforce.

Further this section is required to contain a description of the alternatives considered to the project, the means of completing the project and the rationale for the decisions that were made which lead to the selected approaches.

- Complete FMRP 30% Engineering Designs: This task entails completion of 30% designs for physical components of the FMRP, and development of management components (e.g., adaptive management plan, contaminated water management plan, monitoring plan) that are commensurate with a 30% design.
- Refine 30% designs as necessary to address the mitigations developed as part of the environmental and socio- economic effects analysis. Completion of the project design and the environmental and socio-economic effects assessments will be an iterative process. The identification of potential effects will lead to refinements of the designs for project components in order to mitigate effects. These refinements will be identified and developed through collaboration between the assessment and engineering teams throughout the design and assessment processes. This will be completed by August 2016 so that design documentation can be included as supporting documents for the YESAA Project Proposal.

C1.4.5 Environmental and Socio-economic Effects Assessment (WBS 01.03.03)

C1.4.5.1 Define and Refine Scope of Assessment

The Scope of Assessment for the final remediation of the FMC defines how the environmental and socio-economic assessments will be conducted and what they will consider. The RLT developed a draft Assessment Methodology and Scope document in January 2012 to "serve as a guidance document for the PDT in conducting the environmental and socio-economic assessment for the FMRP and completing the associated sections and supporting documents for the FMRP Project Proposal." The draft document defines the valued components, geographic assessment scope, temporal assessment boundaries, baseline definition, scope of external factors, scope of accidents/malfunctions, scope of cumulative effects assessment, and the assessment methodology.

As the assessment proceeds, greater levels of detail will be developed and the Assessment Methodology and Scope document will be updated as appropriate. For example, additional detail is still required about the socio-economic effects assessment methodology and the approach for evaluating significance. The content of the document will eventually be refined to form part of the Project Proposal describing the project and assessment scopes and the assessment methodology.

C1.4.5.2 Conduct Environmental and Socio-economic Effects Analysis

Because YESAA's purposes centre around the evaluation and mitigation of adverse environmental and socio-economic effects, the effects analysis will form the core of the Project Proposal. The environmental and socio-economic effects assessment will apply a systematic approach to the identification and characterization of potential interactions between the proposed project and the environmental and socio-economic valued components. The assessments will consider the direct and indirect effects of the project on valued components, the effects of the project in combination with other activities (cumulative effects assessment) and the effects of extreme events (e.g., accidents and malfunctions, climate change, floods, earthquakes, forest fires, and labour unrest).

The draft Assessment Methodology and Scope document describes the important considerations for the environmental and socio-economic assessments, and the methods that will be used to carry these out. This includes identification of valued components, which are the key elements on which the effects of the project will be assessed. Using valued components is a standard assessment approach that recognizes the impracticality of identifying and characterizing effects on all environmental, social, and economic components. Selected valued components will encompass components that are important to communities, and are ecosystem health indicators and sentinel species, or important for other reasons.

Using the valued components as a foundation, the effects assessments will entail the following general steps:

- Identify all potential interactions between project activities and the environmental and socio-economic valued components.
- Classify potential interactions to select those that warrant more detailed consideration in the effects assessment. Criteria for making these selections will be developed and refined for consistency among all VCs.
- Detailed characterization of interactions identified in the initial classification. This will include identification and description of interaction pathways, identification of indicators and metrics, definition of environmental or socio-economic objectives, and prediction of the effects associated with the interaction.
- Identification of uncertainty and development of appropriate adaptive management plans.
- Evaluation of significance of effects, considering for example magnitude, direction, duration, frequency, severity, reversibility, and context for potential effects.
- Development of monitoring programs that will confirm the outcomes of the assessment predictions.

C1.4.5.3 Conduct Consultation and Engagement (WBS 01.03.04)

The preparation of a YESAA Project Proposal for submission to the Executive Committee triggers consultation and engagement requirements for YG and AANDC. Consultation and engagement activities will continue throughout the development of the YESAA Project Proposal, occurring as required in accordance with a consultation and engagement plan. YG will take the lead in developing a Consultation and Engagement Plan that will describe the following:

- Communities and groups to be consulted
- Timing
- Methodologies and approaches
- Roles, responsibilities, and relationships among YG, the federal co-proponent, and the PDT

The PDT will support YG in preparing the Consultation and Engagement Plan, and in conducting the consultation and engagement activities.

Based on its current understanding of the consultation and engagement requirements, the PDT envisions four consultation events conducted in association with YG. These events will address (1) scope of assessment, (2) baseline conditions, (3) project design, and (4) effects assessment. Consultation events are expected to occur with the Ross River Dena Council, Liard First Nation, Kaska Dena Council, Selkirk First Nation and the Town of Faro... The sessions will be attended by AANDC, YG, and the PDT.

C1.4.6 Regulatory Planning and Strategy (WBS 01.03.06)

The approach and management for the development of a YESAA Project Proposal will be guided by an overall Approval Process Strategy intended to outline the proposed approaches and plans to achieve the following:

1. Guide the FMRP's Regulatory Leadership Team (RLT) to proactively, effectively, and in a timely manner prepare a quality and compliant Project Proposal for assessment by YESAB.
2. Efficiently advance the Project through approvals processes and obtaining necessary approvals for implementing the Project (e.g., *Fisheries Act* Authorization, Water Licence, and other required regulatory authorizations).

The RLT developed a draft Regulatory Approval Strategy in December 2011 to outline the proposed approaches to guide the project team to proactively, effectively, and in a timely manner prepare a YESAB-compliant Project Proposal. This Strategy will need to be revisited in early 2014 and updated. The intent is that this document will then be dynamic and will be reviewed and refined as needed on a quarterly basis, or as required.

C1.4.7 Regulatory Communications and Coordination (WBS 01.03.07)

C1.4.7.1 Regulatory Leadership Team Calls and Client Communications

Communications among AANDC, YG, and the PDT will consist of regular teleconferences and other discussions to coordinate and complete regulatory coordination deliverables as outlined in the Regulatory Approvals Strategy.

C1.4.7.2 Regulatory Working Group

FPET, in conjunction with the RLT, will establish a Regulatory Working Group as they work towards the development of assessment and regulatory applications. The Regulatory Working Group will provide a structured forum for communication among the FPET, PDT, assessment bodies, regulatory agencies, and expert government agencies.

The Regulatory Working Group is intended to achieve the following communication objectives:

- Share information about the project's status.
- Share, review, gather input, and discuss technical issues related to site conditions or proposed remediation approaches.

- Share, review, gather input, and discuss assessment and regulatory expectations, approaches and information requirements.
- Collaborate in identifying and resolving technical and regulatory issues.

As outlined in the Regulatory Approvals Strategy, it is anticipated that this Regulatory Working Group would provide input to baseline and assessment methodology, and to other topics specific to preparing the Regulatory Approvals Strategy so that the requirements of assessors, regulators, First Nations, and non-regulator governments are addressed. Input from this group will be communicated to the broader team, specifically through the discipline leads.

The membership of the Regulatory Working Group is intended to be inclusive. It will be open to participation by representatives from the following groups and agencies:

- Government of Canada departments
- YG departments
- First Nation Government departments
- Town of Faro
- YESAB
- Yukon Water Board

Participation in the Regulatory Working Group is optional and flexible and expected to vary depending on the specific topics of discussion at each meeting. In leading this initiative, FPET and the PDT will work to establish and provide clear agendas to facilitate efficient and effective use of time and resources.

C1.4.7.3 Regulatory–Engineering Interface

The integration of the regulatory deliverables (baseline and effects assessment), and the engineering deliverables (design) will be emphasized, recognizing the interconnections among these deliverables. These discussions will also be a forum for discussing the implementation of actions arising from the RLT Calls and Regulatory Working Group Meetings.

C1.4.7.4 Regulatory Discipline Lead Coordination

Communications among the PDT and the environmental and socio-economic discipline Leads will consist of regular teleconferences and other discussions to coordinate and complete baseline and effects assessment deliverables for the Project Proposal.

C1.4.8 Overarching Coordination and Technical Guidance

The FPET, in consultation with the PDT, will provide general team coordination, technical guidance, and direction for the design and assessment of the FMRP.

C1.4.9 Project Proposal Production (WBS 01.03.08)

The PDT prepared an updated draft Annotated Table of Contents for the FMRP in March 2013. This Annotated Table of Contents is a working document that provides an overview of the content required in a YESAA Project Proposal. The final Project Proposal will include a project introduction and overview; regulatory context; project location, purpose and alternatives; project description (includes advanced engineering design); First Nations/Community consultation; description of existing or baseline environmental and socio-economic conditions; environmental and socio-economic effects assessment; cumulative effects assessment and mitigation, monitoring, and adaptive management plans.

C1.4.9.1 Prepare Project Proposal Supporting Documents

A series of supporting documents will be required for the Project Proposal. These will provide the details that corroborate the effects assessment conclusions, and will demonstrate to YESAB that the proposed FMRP is feasible and that the predicted effects are reasonable and defensible. As shown in the draft Annotated Table of Contents, the supporting documents fall into three main categories, as follows:

- Baseline Supporting Documents: These documents will describe the existing conditions in the environment around the site, and the existing site conditions. They will include comprehensive data compilations, as well and analysis and interpretation of data to characterize conditions of various environmental components (e.g., water quality, water flow, and climate).
- Project Description Supporting Documents: These documents will provide details about the proposed FMRP, including design details for physical components (e.g., diversion designs) as well as plans that are fundamental for describing how the project will be implemented (e.g., contaminated water management plan, adaptive management plan, and monitoring plan). These may also describe specific mitigation plans that may be required.
- Effects Assessment Supporting Documents: These documents will provide details about analysis and evaluation environmental and socio-economic effects. For example, supporting documents will describe water quality modelling methods and results for predicting effects of mine effluent on aquatic environments.

C1.4.9.2 Prepare Main Project Proposal Document

The main document for the Project Proposal will summarize the results of the environmental and socio-economic effects assessment and, in accordance with the current version of the draft Annotated Table of Contents, will include the following major sections:

- Project Introduction and Overview
- First Nations/Community Consultation and Engagement
- Project Location
- Project and Assessment Scopes and Assessment Methodology
- Current Site Conditions
- Description of Existing Environmental Conditions
- Description of Existing Social and Economic Context
- Alternatives, describing alternatives to the project and alternative means of carrying out the project or its components. Rationale will be provided for selected alternatives.
- Project Description, including the following:
  - All of the project's major components, activities, and phases
  - Management plans that define how the projects activities will be conducted (e.g. contaminated water management plan, surface water management plan)
  - Adaptive Management Plan, identifying areas where performance of planned remediation measures is uncertain and how to monitor and respond to that uncertainty
  - Mitigation, monitoring, and environmental management plans
  - Accessory activities; for example, access, transportation, energy supplies, and worker accommodation
  - Socio-economic project information including expenditures and workforce requirements
- Environmental and Socio-economic Effects Assessments and Effects of Extreme Events, including the characterization of potential effects, description of mitigation measures, and evaluation of the significance of residual effects.

C1.4.9.3 Assemble and Review Project Proposal

The complete Project Proposal for the final remediation of the FMC will be a large complex document that will require substantial effort for compilation and review by the PDT as well as the co-proponents. The 6-month period identified for conducting this review assumes that many of the supporting documents will be reviewed as they are prepared in order to expedite the final review of the complete document.

C1.4.10 Submit Project Proposal

The Final Project Proposal is to be completed by May 2017, ready for submission to the YESAA Executive Committee, initiating the YESAA process.

C1.5 Work Breakdown Structure

The Project Proposal work package includes work elements exclusively within the Planning and Design tree of the overall Work Breakdown Structure (WBS) (see Appendix F).

C1.6 Uncertainties

C1.6.1 Baseline Data Requirements

The Gaps Analysis conducted in 2011/2012 considered data requirements to support the submission of a Project Proposal for the remediation of the FMC in 2013/2014. With the delay in development of the Project Proposal, some additional data gaps could arise from areas in which data become outdated.

C1.6.2 Socio-economic Scope and Budget

The current budget estimate is based on an estimate provided by a previous socio-economic team, which is likely to be low. A socio-economic team has been engaged for the Interim Works Project Proposal, and YG and the PDT will decide if this team should be retained for the Remediation Project Proposal in early 2014. The scope and budget for the socio-economic baseline and effects assessment will then need to be revisited with this team.

C1.6.3 Changes in Regulatory Requirements

As the FMRP Project Proposal is intended to be submitted in May 2017, it is difficult to forecast regulatory requirements.

Case law and environmental precedents may impose changes, thereby altering predicted regulatory requirements (e.g., consultation requirements).

C1.7 Risks

Obtaining approvals for the FMRP in a timely and efficient manner requires AANDC, YG, and the PDT to identify, understand, and plan for risks that could adversely affect the team's work or assessment and regulatory processes or outcomes. Representatives of AANDC, YG, and the PDT met on December 12, 2011, to identify and characterize regulatory risks for the FMRP Project Proposal. Section 5.8 of the draft Regulatory Approvals Strategy provided a qualitative summary of these risk events and potential consequences. It also prescribed measures and approaches that will be taken to minimize the likelihood of risk events occurring and to reduce or eliminate consequences should those events arise. This risk summary is included as Attachment C1-1.

The majority of the risks identified in the risk assessment were process risks, and as such, they do not lead to direct environmental, human health, or safety consequences. Instead, the direct consequences of the risk events fall into the following categories:

- Almost all of the regulatory risk events have a potential to delay the project schedule, which may delay implementing the project. Delays may lead indirectly to increases in risks for a broad range of environmental, health, safety, land use, and socio-economic consequences.

- Some of the risk events could lead to direct increases in project costs because the events could require additional work to complete regulatory submissions or processes.
- Some risk events could entail legal consequences.
- Regulatory risks often have effects on relationships (e.g., intergovernmental) and reputations for project proponents and consultants.

In addition to the direct consequences, a risk event that delays the schedule for receiving approvals will also delay the schedule for implementing the FMRP. Such a delay could have indirect consequences on overall costs because of increased duration for operations and maintenance (approximately $10 million per year) and potential escalation of costs for remediation.

Other potential risks for the FMRP include the following:

- Technical adequacy
- Legal
- Consultation
- Project management

The draft scope of identified risks and consequences within each of these categories as defined in Q1 2012/13 is described in the appended Risk Identification Table along with measures and approaches for avoiding or mitigating potential events.

Periodic evaluation of these risks will be required as part of the Project Proposal development to identify additional risk events as they may arise, the status of potential risk events and the effectiveness of preventative or mitigative measures to minimize the likelihoods and consequences of risk events.

C1.8 Schedule Summary

C1.8.1 Schedule Constraints and Assumptions of Work Package

The Milestone Schedule (see Appendix H) illustrates the anticipated schedule for the preparation and submission of the Remediation Project Proposal. The schedule is considered to be a tight schedule to complete the effects assessment, and does not allow for contingency should other baseline work be required as a result of other gaps being identified over time since the issuance of the gap assessment (i.e., over a 3-4 year period).

The schedule assumes that the bulk of the baseline data collection will occur in 2014 and 2015 so baseline analysis and reporting can be finalized before the effects assessment work.

The schedule also assumes that the Consultation and Engagement Strategy will be finalized and approved in 2014, so that consultation can commence in early 2014 for the scope of the assessment and for baseline studies (i.e., before baseline field studies and research start in spring 2014).

C1.8.2 Milestone Schedule

This schedule is based upon the following:

- 2014/2015 – The core elements of the Remediation Project Proposal work will commence in early 2014 with consultation about the proposed baseline research programs completed before implementing the field program in summer 2014. The 2014 field program will be the major program for addressing data gaps. Design definition and development of a project description will also be initiated in 2014/15.
- 2015/2016– Development and implementation of field programs to address outstanding data gaps. Programs are intended to be minimal, addressing issues identified as a result of 2014 field programs. Finalize baseline characterizations, complete 30% engineering designs, and initiate environmental and socio-economic assessments. Preparation of most Project Proposal supporting documents will be

initiated during 2015/1016. Conduct consultation activities about the project description and the effects assessment.

- 2016/2017 – Finalize design and effects assessment, and complete writing the Remediation Project Proposal including both main and supporting documents. Complete reviews and approvals of Project Proposal final document. YG intends to submit the Remediation Project Proposal to YESAB in May 2017/18.

For further understanding of the intended schedule, please see Appendix H.

C1.9 Cost Estimate

In December 2011, the PDT prepared a cost opinion for the expected total cost for the preparation of the overall Project Proposal (CH2M HILL, 2011c). This cost opinion was subsequently finalized in March 2013 (CH2M HILL, 2013). The cost opinion was based on the established scope of the Proposal (i.e., the standard submission for a project of this nature) in addition to the scope of work to address technical gaps listed in the Gaps Assessment. As described in this deliverable, the total cost for this scope of work was $57,487,000. Subsequent to this, and in discussion with YG, it was agreed that the proposal did not require engineering design be completed to approximately 60% but rather to a level appropriate to meet the requirements of YESAA. For costing purposes, this level of design was considered to be approximately 30% design. The reduction in scope resulting from this change resulted in an approximate $8,000,000 reduction in the cost opinion to a total of approximately $49,000,000.

The previous cost opinions form the basis for the estimate provided herein. At the time the current estimate was developed, one season of fieldwork, site-wide engineering, and pre-design and conceptual design in support of the replacement of the Faro Mine Water Treatment Plant had been contracted. However, at this time re- evaluation of the Gaps Assessment has not been conducted to confirm the closure of existing gaps or the identification of new ones. Additionally, the prior cost estimates have not been evaluated to reflect any new understanding of field study costs or other implementation costs, as many have been included in the work currently being executed.

This cost estimate is a rough order-of-magnitude (ROM), with an expected accuracy of +100 to -50 percent (Class 5). Costs have not been escalated and are presented as 2012 costs.

C1.9.1 Basis of Estimate

The estimate is based entirely on the process undertaken in the development of the CH2M HILL (2013). No additional evaluation of either scope or cost have been undertaken at this time with the exception of:

- Additional scope as follows:
  - Added fish telemetry surveys
  - Added historical resources evaluation component
  - Added moose, caribou, bear and sheep surveys (as per request from YG on October 15, 2012)
  - Added additional two years for AYFN and Yukoner Participation Plan updates and also for engineering and regulatory interface coordination for the 2013/14 and 2014/15 fiscal years.
- Scope reductions through accounting of work performed in 2012/13 or the current understanding of that planned to occur in parallel with the Remediation Project Proposal elsewhere in the Medium Term Plan as follows:
  - Completion of approximately 30% of the planned site wide activities (TCO Ref E01)
  - Design of the Zone II pumping well (TCO Ref. E02.02.01)
  - Design of the Cross Valley Dam Seepage Interception System (TCO Ref E03.04.03)
  - Design of the Vangorda Creek Diversion (TCO Ref E04.03.01)

- Design of the Faro Mine WTP (TCO Ref E06.01.01)
- Design of the Vangorda WTP because of design decisions resulting in one WTP for the entire FMC (TCO Ref E06.01.02)
- Removal of Project Management and all 60% Designs as existed in the Cost Opinion.

- The following scope items are currently undefined and are not included in the estimate but they do represent some of the additional scope expected to be identified following the re-evaluation of the Gaps Assessment:
  - Design of the pit water collection and piping systems for the Vangorda and Grum Pits
  - Design of the pipe conveyance system from the Vangorda/Grum Mine Area to the Faro Mine Area
  - Modifications to the Draft 4A Closure Plan associated with using the haul road for conveying the Vangorda/ Grum area mine water to the Faro Mine area for treatment
  - Preparation of geochemical models for the Waste Rock Dumps (WRD) required for use in development of the GoldSIIM model and the Project Proposal
  - Changes in scope from that assumed in the Total Cost Opinion based on data acquired in 2012. For example, the North Fork of Rose Creek Work Package (see Appendix D3) identified additional field investigation requirements for aquifer testing and monitoring well installation not included in the Total Cost Opinion.

C1.9.2 Supporting Documentation

The following sources of information were used in developing the cost estimates:

- Final Gap Assessment Report, February 2012
- Total Cost Opinion, March 2013

C1.9.3 Cost Estimate

The total cost estimate for the Remediation Project Proposal described herein is $38, 546,570. This estimate is summarized with engineering and regulatory costs provided in Tables C1-1 and C1-2 respectively.

TABLE C1-1
Project Proposal - Engineering Cost Estimate
Faro Mine Remediation Project

WBS	Phase	Labour	Expense	Subcontractor	Total
01.01.01.02 - 31	Faro Mine Area Field Investigations (29)	$1,821,221	$1,020,143	$2,690,282	$5,531,646
01.01.02.03 - 20	Tailings Area Field Investigations (17)	$900,637	$815,022	$1,733,927	$3,449,586
01.01.03.02 - 24	Vangorda/Grum Area Field Investigations (22)	$1,230,322	$997,055	$2,089,733	$4,317,110
01.01.04.04 - 08	Site-Wide Field Investigations (4)	$287,651	$140,531	$765,851	$1,194,032
01.02.01.02 - 31	Faro Mine Area Engineering Design Packages (29)	$5,784,102	$177,383	$ -	$5,961,485
01.02.02.03 - 20	Tailings Area Field Engineering Design Packages (17)	$3,504,344	$113,627	$26,692	$3,644,663
01.02.03.02 - 24	Vangorda/Grum Area Engineering Design Packages (22)	$4,700,111	$148,114	$ -	$4,848,225
01.02.04.02 - 06	Site-Wide Engineering, Design Packages (4) and Class 3 Cost Estimate	$942,927	$107,768	$232,074	$1,282,770
TOTAL		$19,171,315	$3,519,643	$ 7,538,559	$30,229,517

TABLE C1-2
Project Proposal - Regulatory Cost Estimate
Faro Mine Remediation Project

WBS	Phase	Labour	Expense	Subcontractor	Total
01.03.01	Project Description	$69,250	$4,002	$26,472	$99,724
01.03.02	Baseline Data Collection and Research	$1,346,404	$ 596,526	$ 1,323,453	$ 3,266,383
01.03.03	Environmental and Socio-economic Effects Assessment	$1,446,003	$79,459	$401,694	$ 1,927,156
01.03.04	Project Proposal Consultation	$89,979	$23,205	$178,910	$292,094
01.03.06	Project Proposal Supporting Plans	$287,596	$73,905	$290,301	$651,802
01.03.07	Project Proposal Communication and Coordination	$543,655	$44,705	$256,099	$844,460
01.03.08	Project Proposal Production	$874,330	$98,708	$195,595	$ 1,168,633
01.04	Permitting	$51,815	$2,517	$12,472	$66,804
TOTAL		$4,822,998	4,709,033	$ 923,028	$2,684,996

C1.9.4 Assumptions

The following assumptions were made during the preparation of this cost estimate:

- The YESAA-ready level of engineering design required to support the Remediation Project Proposal is the equivalent of 30% design; however, for the purposes of the Class 3 Cost Estimate designs will be advanced to a level consistent with the AACE classification of Schematic Design.
- The cost estimate does not include cost consideration for administration of the work package (i.e., statusing, coordination and invoicing and management) which will vary throughout the duration of the work depending on the type of work.
- The cost estimate does not include any markups to professional services (labour) or subcontractor and expense costs.
- Work described in the work package is a standalone effort. No accommodation or economy of scale with combining different work packages has been used in developing this opinion of cost.

C1.9.5 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are non-binding and are provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, implementation schedule, and other variables. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding requirements must be carefully reviewed before making specific financial decisions.

C1.9.6 Summary of Approach to Execution and Procurement of the Project Design Team

CH2M HILL has been contracted to undertake the roles and responsibilities of the PDT for the FMRP. The procurement occurred through a two staged, public tender process. This process began with a Request for Qualifications in January 2011 and was followed by a Request for Proposal in May 2011. The procurement

process was completed through the signing of the contract on September 1, 2011. The procurement resulted in the formulation of a contract in the form of a Master Service Agreement (MSA) with specific work packages scoped, budgeted and approved through the Task Authorization Request (TAR) process.

C1.10 References

CH2M HILL Canada Limited (CH2M HILL). 2011a. *Gap Assessment Report, Faro Mine Remediation Project. Volume 1: Report.* Preliminary Draft. Prepared for Government of Canada as represented by Aboriginal Affairs and Northern Development Canada and the Government of Yukon. December 13.

CH2M HILL Canada Limited (CH2M HILL). 2011b. *Gap Assessment Report, Faro Mine Remediation Project. Volume 2: Appendixes B and C.* Preliminary Draft. Prepared for Government of Canada as represented by Aboriginal Affairs and Northern Development Canada and the Government of Yukon. December 13.

CH2M HILL Canada Limited (CH2M HILL). 2011c. *Cost Opinion for Preparation of the Faro Mine Remediation Project. Memorandum.* Prepared for Deborah Pitt and Stephen Mead, Government of Yukon. December 11.

CH2M HILL Canada Limited (CH2M HILL). 2012a. *Gap Assessment Report, Faro Mine Remediation Project. Volume 1: Report.* Final. Prepared for Government of Canada as represented by Aboriginal Affairs and Northern Development Canada and the Government of Yukon. February 22.

CH2M HILL Canada Limited (CH2M HILL). 2012b. *Gap Assessment Report, Faro Mine Remediation Project. Volume 2: Appendixes B and C.* Final. Prepared for Government of Canada as represented by Aboriginal Affairs and Northern Development Canada and the Government of Yukon. February 22.

CH2M HILL Canada Limited (CH2M HILL). 2012c. *2012 Field Implementation Plan, Faro Mine Remediation Project.* Preliminary Draft. Prepared for Government of Canada as represented by Aboriginal Affairs and Northern Development Canada and the Government of Yukon. March.

CH2M HILL Canada Limited (CH2M HILL). 2013. *Cost Opinion for 30 Percent Level of Design Preparation of the Faro Mine Remediation Project Proposal.* Memorandum. March 28.

Attachment C1-1
Risk Identification Table

	Risk Events	Consequences	Mitigation
Technical Adequacy Risks: Events that could result in missing or inadequate technical information for assessment or regulatory documents or processes.			
TA1	Seasonally dependent baseline data is not identified and therefore is unavailable to support assessment or regulatory submissions.	Schedule delay Direct cost increase Potential reputation issues	Completion of a comprehensive gaps analysis with specific consideration of assessment and regulatory requirements. Development and monitoring of overall project schedule, including activities to address identified data gaps. Ongoing re-evaluation of available data in comparison to anticipated data needs. Early and ongoing engagement of YESAB, Regulatory Working Group, communities, First Nations and government experts to confirm information needs and expectations. Early decisions and documentation of assessment scopes, including identification of valued components, indicators and study areas. Consultation on environmental baseline conditions with adequate lead time to collect additional data in 2013 if needed.
TA2	Year 1 data collection shows that additional baseline information is needed, requiring additional season of data gathering.	Schedule delay Direct cost increase Potential reputation issues	See mitigation for event No. TA1. Collect additional data in 2013 for late incorporation into documentation.
TA3	PDT lacks capacity or expertise to compile technically adequate assessment or regulatory documentation.	Schedule delay Direct cost increase Potential reputation issues	Ongoing team coordination to ensure that team members understand assessment and regulatory needs, and are focussing their work on achieving these outcomes. Early involvement of the team in the development of guiding documents that clarify scope and expectations of work (e.g. Assessment Methodology and Scope). CH2M Hill team comprised of broad range of technical, assessment and regulatory experts. CH2M Hill team includes redundancy of expertise and provides flexibility to address changing needs.
Legal Risks: Events that entail legal challenges or could result in legal issues.			
L1	Legal challenge relating to project governance (e.g. role of First Nation governments in project management or administration), stalling process.	Schedule delay Legal consequences Direct cost increase (legal) Reputation issues	Canada, Yukon and First Nations are developing relationship agreements that address roles and responsibilities during project design and permitting.
L2	Legal challenge related to Canada's or Yukon's duty to consult with First Nations, stalling or delaying process.	Schedule delay Legal consequences Direct cost increase (legal) Reputation issues	Development and implementation of a Consultation and Engagement Plan that will describe how project-related consultation obligations will be addressed. Seeking and incorporating input from First Nations during development of the Consultation and Engagement Plan. Ongoing communications with First Nations to ensure that consultation needs are being addressed. Canada will undertake additional consultation activities as necessary to address broader duty to consult.
L3	Legal challenge relating to compensation of First Nations for past or future effects causes changes in scoping for assessment, or process delays.	Schedule delay Legal consequences Direct cost increase (legal) Reputation issues	Canada, Yukon and First Nations are developing relationship agreements that address roles and responsibilities during project design and permitting.

	Risk Events	Consequences	Mitigation
L4	Legal challenge by NGO during assessment or regulatory process leads to process delays.	Schedule delay Legal consequences Direct cost increase (legal) Reputation issues	Development and implementation of a Consultation and Engagement Plan that will describe plans for seeking input from NGOs and the public throughout the development of assessment and regulatory documentation.
L5	Legal challenge of procurement process causes project delays.	Schedule delay Legal consequences Direct cost increase (legal)	Yukon selects contractors using standard government procurement processes, which minimize potential for legal challenges. CH2M Hill utilizes well-defined and fair procurement processes. Development and implementation of "Affected Yukon First Nation (AYFN) and Yukoner Participation Plan."
L6	Field or research programs undertaken without proper assessment or permits, leading to legal action by regulators or NGOs.	Schedule delay Legal consequences Direct cost increase (legal) Reputation issues	Development of detailed field implementation plans for all field activities and programs, including planning for permitting activities. Defined process for CH2M Hill and Yukon to evaluate potential permit requirements and identify activities that trigger permits. Identified leads for permitting within CH2M Hill team. Project controls to ensure that activities are not undertaken until permit requirements have been evaluated.
Consultation Risks: Events that reduce the effectiveness of consultation activities, thereby reducing community understanding of the proposed project and the PDT's understanding of community concerns.			
C1	Consultation fatigue in communities reduces participation in consultation activities, or prevents completion of consultation activities.	Schedule delays.	Early development of a Consultation and Engagement Plan, including seeking input from communities about their expectation and capacity for consultation activities. Ongoing communication with communities about the implementation of the Consultation and Engagement Plan so that communities are aware of upcoming events and can plan for them. Reliance on a variety of consultation approaches and mechanisms.
C2	Consultation failures on other projects affect consultation needs and expectations for the FMRP	Schedule delays.	See mitigation for Event No. C1.
C3	First Nations or communities have inadequate human resource or financial capacity to participate effectively in consultation activities.	Schedule delays. Direct costs (supporting capacity).	Ongoing support from Yukon and Canada for community coordinators and technical advisors. Canada, Yukon and First Nations are developing relationship agreements that address roles and responsibilities during project design and permitting. Capacity needs should be addressed and monitored through these agreements. Development and implementation of "AYFN and Yukoner Participation Plan," especially training and capacity building components.
C4	Documentation, issue tracking and response from consultation activities do not meet community, assessor or regulator expectations.	Schedule delays. Direct costs (additional work).	Early and ongoing engagement with YESAB to understand expectations about consultation and documentation requirements. Detailed record keeping for all consultation activities.

	Risk Events	Consequences	Mitigation
Project Management Risks: Events that reduce the effectiveness of overall project management.			
PM1	Leadership continuity (e.g. election) in federal, territorial or First Nation government affects project schedule.	Schedule delays.	
PM2	Co-proponents' inability to respond and act in coordinated and expedient manner leads to delays in procurement, document review, approval processes, etc.	Schedule delays.	Development, refinement and monitoring of overall project schedule, including activities that require effort or decisions from co-proponents.
PM3	Co-proponent governance challenges affect ability to meet schedules.	Schedule delays	Canada and Yukon have developed a co-proponent agreement that defines roles and responsibilities.
PM4	Governance processes among federal, territorial and First Nation governments cause delays in overall project schedule.	Schedule delays	Canada, Yukon and First Nations are working to develop partnership agreements that address roles and responsibilities during project design and permitting.
PM5	Change in government priority leads to change in overall project direction (e.g. closure option).	Schedule delays Direct costs	Written agreements are in place, establishing all governments' agreement about overall project direction.
PM6	Change in funding priorities or funding availability reduces funds available for project design, or changes funding outlook for FMRP implementation.	Schedule delays Reputation issues Legal issues	
Assessment or Regulatory Process Issues: Events that could influence the expediency or outcome of assessment and regulatory processes.			
PR1	Regulatory or expert agencies raise comments during assessment or regulatory processes that are different from FPET's expectations.	Schedule delays	Early and ongoing engagement of the regulatory working group, including regulatory and expert agencies, to understand and address concerns.
PR3	Number of Executive Committee projects causes capacity issues for members and reviewers.	Schedule delays	Early and ongoing engagement of YESAB, regulatory working group, communities, First Nations and government experts will help to minimize the level of effort required during the formal assessment and regulatory processes.
PR4	Request to refer FMRP to Panel Review leads to longer process.	Schedule delays Direct costs	Early and ongoing engagement of YESAB, regulatory working group, communities, First Nations and government experts to minimize applicability of triggers for Panel Review (e.g. public concern). Development and implementation of Consultation and Engagement Plan will also minimize applicability of triggers for Panel Review.
PR5	Lack of participant funding for Executive Committee projects affects ability of groups to participate effectively.	Direct costs (participants seeking funding from proponents)	Early and ongoing engagement of communities including NGOs and other interest groups so that they have ample opportunity to understand and plan for the project.
PR6	Scale of FMRP leads to long time lines during assessment and regulatory processes.	Schedule delays Direct costs	Early and ongoing engagement of YESAB, regulatory working group, communities, First Nations and government experts will help to minimize the level of effort required during the formal assessment and regulatory processes.

	Risk Events	Consequences	Mitigation
PR7	Scope of project revised during YESAA process (e.g. coal mines, truck yards, ancillary facilities).	Schedule delays Direct costs	Early and ongoing engagement of YESAB, regulatory working group, communities, First Nations and government experts to understand potential issues and concerns. Consultation and engagement in relation to the project and assessment scopes, early in the project planning phase.
PR8	Project components require early remediation in advance of overall assessment, leading to early and multiple assessment processes. Potential confusion and delays in other parts of project.	Schedule delays Direct costs	Agreement on the 5 year plan between Yukon and Canada along with planned allowance for degrading infrastructure.
PR9	Executive Committee applies conditions that are technically, financially or temporally impractical.	Direct costs	Early and ongoing engagement of YESAB, regulatory working group, communities, First Nations and government experts to understand potential issues and concerns including potential recommendations for mitigation conditions.

Appendix C2
Interim Works Project Proposal

APPENDIX C2

Interim Works Project Proposal

C2.1 Introduction and Context

Since 2009, the Government of Yukon (YG) has conducted site operations and remediation planning activities for the Faro Mine Complex (FMC) under the authority of a Minister's Determination under the *Waters Act* (YG, 2003). YG and the Government of Canada, as represented by Aboriginal Affairs and Northern Development Canada (AANDC) (the co-proponents), have agreed to assess and permit activities required to maintain the FMC and design the Remediation Plan before implementing the Faro Mine Remediation Project (FMRP). Specifically, they have initiated work to complete a *Yukon Environmental and Socio-economic Assessment Act* (YESAA) assessment and permitting for Interim Works (IW) - activities that will take place at the FMC before the FMRP is implemented. The scope includes the following activities:

- Site Operations (Care and Maintenance)
- Site Investigations
- Down Valley Interim Hydraulic Upgrades
- Accessory Activities

The co-proponents will request a 10-year licence term to allow adequate time for the submission of the Remediation Project Proposal (scheduled for 2017/18), assessment and permit processing (estimated to take approximately 3 years), and procurement of works.

Assessment and Abandoned Mines (AAM) intends to submit a Designated Office-level Project Proposal for these IW to YESAB in early 2014, initiating the YESAA process that will take approximately 6 months. The Project Design Team (PDT) initiated work to prepare the Interim Works Project Proposal (IWPP) in Q2 2013/14.

Designated Office evaluations are conducted by regional YESAA offices, and the FMC falls within the geographic jurisdiction of the Watson Lake Designated Office. All assessments under YESAA assessment require a comprehensive evaluation of the proposed project's environmental and socio-economic effects.

Once the YESAA process is complete, the co-proponents will seek appropriate regulatory authorizations, including a water licence under the *Waters Act*. To obtain these authorizations, it will be necessary to prepare applications and to complete licencing and permitting processes.

The assessment and permitting processes for the IW are independent of those for the FMRP. They are specifically intended to support the activities required to operate the FMC, reduce unacceptable site risks, and conduct site investigations necessary for remediation planning.

C2.2 Justification

Assessment and permitting for the proposed IW will provide authorization for the co-proponents to conduct the proposed activities. Under YESAA, governments are generally prohibited from undertaking many of the site operations, investigations activities, and proposed construction projects without completing environmental and socio-economic assessments. The IW Assessment and Permitting will resolve uncertainty about assessment and regulatory requirements within the context of the Section 37 Minister's Determination (*Waters Act*). It will also provide an opportunity for assessors and regulators to evaluate the current and proposed activities at the FMC, and identify concerns and appropriate mitigation. This will provide guidance about expectations for the FMRP, which is scheduled to enter the assessment and permitting process in 2017, with a Project Proposal submitted to the Executive Committee.

C2.3 Description of Scope

The PDT initiated preparation of a Project Proposal in Q2 2013/14 with submission scheduled for Q4. The following scope assumes this schedule was met.

C2.3.1 Interim Works YESAA Process (WBS 01.04.06.01.02)

Once the IWPP is submitted to the YESAA Designated Office, the formal YESAA process will begin. This process will comprise the following steps:

- **Adequacy Review:** The Designated Office will review the IWPP to evaluate the adequacy of the information to support the YESAA assessment process. The Designated Office may seek input from regulators, First Nations, or others during the adequacy review. Upon completing an adequacy review, the Designated Office may issue an information request. Most adequacy reviews result in at least one information request. The PDT will prepare responses to information requests, and may be asked to provide subsequent clarifications.
- **YESAA Evaluation:** Once it determines that the IWPP includes sufficient information, the Designated Office will initiate the YESAA evaluation, including a public review phase that can be up to 70 days in duration. This review phase will begin with a shorter duration, but can be extended depending on the results of the comments and input received, as well as the quality of the submission. The Designated Office may request additional information during the evaluation phase of the assessment. Once information requirements have been addressed and the Designated Office has concluded public review phases, it will prepare an evaluation report describing the conclusions and recommendations of the assessment, including any terms and conditions that it recommends for the project.
- **Decision Document:** At the conclusion of the YESAA assessment, the Decision Bodies (YG and AANDC) are required to issue a Decision Document that accepts, rejects, or varies the recommendations from the Designated Office.

The PDT will support the co-proponents throughout the YESAA process, for example, providing advice and developing responses to information requests. The YESAA process for the IW is anticipated to take approximately 6 months, scheduled for completion in August 2014.

C2.3.2 Interim Works Water Licence Process (WBS 01.04.06.01.03)

Carrying out the IW activities will require a water licence in accordance with the *Waters Act* (YG, 2003). Other permits and authorizations may also be required - for example, some form of land tenure.

C2.3.2.1 Prepare Water Licence Permit Application

The PDT will begin preparing permit applications in Q4 2013/14, with the primary focus on the water licence application. The water licence application requires a level of detail similar to the YESAA IWPP, though additional detail may be required for water management plans and facilities. The water licence application will be submitted as a near-final draft while the YESAA process is active, to facilitate the completion of the adequacy review with finalization of the YESAA process. The final WL submission will occur after the YESAA process is completed, to allow those outcomes to be reflected in the final submission.

C2.3.2.2 Water Licence Process Support

Once the regulatory applications are completed and submitted, they will initiate the formal regulatory processes. The most lengthy and complex component is likely to be the water licence process, which will begin with an adequacy review stage. Yukon Water Board staff and experts will review the application and may request additional information. The PDT will provide support to the co-proponents for preparing responses to information requests.

Once the Yukon Water Board staff accepts the application, they will initiate the public review phase of the water licensing process. The IW will require a Type A water licence, for which the Yukon Water Board is

obliged to schedule a public hearing. Regulatory agencies, government departments, First Nations and public interest groups will likely provide input during the water licence process and may intervene at a public hearing. The PDT will support the co-proponents throughout the public review and hearing processes.

Once a hearing has taken place (which may be cancelled if no intervenors wish to participate), the Yukon Water Board will deliberate about the application and submissions. It will likely issue a water licence that will include terms and conditions related to the implementation of the project. The licence will require the approval of the Yukon Premier.

The duration of the water licence process can vary substantially but is expected to take approximately 6 months, after the assessment is completed, if the application is strong and there are not lengthy interventions.

C2.4 Work Breakdown Structure

The Project Proposal work package includes work elements exclusively within the Planning and Design tree of the overall Work Breakdown Structure (WBS) (see Appendix F).

C2.5 Uncertainties

C2.5.1 Baseline Data Requirements

The gaps analysis for the IWPP is being finalized and the baseline data requirements for 2013 will be confirmed when this is complete.

C2.5.2 Changes in Regulatory Requirements

At this point, there are no anticipated regulatory requirement changes that will need to be addressed for the IWPP submission in 2014.

C2.6 Risks

Obtaining approvals for the IWPP in a timely and efficient manner requires AANDC, YG, and the PDT to identify, understand, and plan for risks that could impact the team's work, or assessment and regulatory processes or outcomes. Representatives of AANDC, YG, and the PDT met on December 12, 2011, to identify and characterize regulatory risks for the FMRP IWPP. Many of these risks are also relevant to the IW. Section 5.8 of the draft Regulatory Approvals Strategy provided a qualitative summary of these risk events and potential consequences. It also prescribed measures and approaches to minimize the likelihood of risk events occurring and to reduce or eliminate consequences should those events arise.

The majority of the risks identified in the risk assessment were process risks; as such, they do not lead to direct environmental, human health, or safety consequences. Instead, the direct consequences of the risk events consist of:

- Almost all of the regulatory risk events have a potential to delay the IW project schedule, which may delay FMRP implementation. Delays may lead indirectly to increases in risks for a broad range of environmental, health, safety, land use, and socio-economic consequences.
- Some risk events could lead to direct increases in project costs because the events could require additional work to complete regulatory submissions or processes.
- Some risk events could entail legal consequences.
- Regulatory risks often have effects on relationships (e.g., intergovernmental) and reputations for project proponents and consultants.

Risks will need to be continually reviewed as part of the IW assessment and permitting processes to identify additional risk events as they arise, the status of potential risk events, and the effectiveness of preventative or mitigative measures to minimize the likelihoods and consequences of risk events.

C2.7 Schedule Summary

C2.7.1 Schedule Constraints and Assumptions of Work Package

The Milestone Schedule (Appendix H) illustrates the anticipated schedule for the assessment and permitting of IW activities. The schedule assumes that consultation and engagement, IWPP preparation and submission all occurred in FY 2013/14. .

C2.7.2 Milestone Schedule

This schedule is based upon the following milestones:

- 2014/15 – Complete YESAA process and obtain Decision Document. Complete water licence application and other permit applications. Initiate and conduct water licence process and other permitting processes.
- Q1 2015/16 – Complete outstanding permitting process requirements.

For more details about the intended schedule, please see the Milestone Schedule (Appendix H).

C2.8 Cost Estimate

In December 2011, the PDT prepared a cost opinion for the expected total cost to prepare the Remediation Project Proposal (CH2M HILL, 2011). This cost opinion did not include a cost estimate for preparing the IWPP. Subsequently, while the Medium Term Plan was finalized in early 2013, the IWPP scope was agreed to be required, and an initial cost estimate of $1,000,000 ($500,000 in 2014/15) was established for cashflow forecasting. The following cost opinion carries that initial estimate forward and is not reflective of detailed cost estimation that has occurred since that time. As such, this cost opinion is considered a rough order-of-magnitude (ROM), with an expected accuracy of +100 to -50 percent (Class 5). Costs have not been escalated and are presented as 2012 costs.

C2.8.1 Basis of Estimate

As mentioned, when it was developed the initial estimate did not have a detailed basis. The initial estimate for the IWPP, and therefore this cost opinion, was based on some approximate estimates of the costs incurred by other proponents to prepare comparably sized DO-level submissions.

C2.8.2 Cost Estimate

The total cost estimate for the IWPP described herein is $500,000. This estimate is summarized in Table C2-1. Because of the method used to develop the following cost opinion, it does not have the necessary basis to estimate costs for labour, expense, or subcontractors.

TABLE C2-1
Interim Works Project Proposal – Cost Estimate
Faro Mine Remediation Project

WBS	Phase	Total
01.04.06.01.02	IWPP YESAA Process	$90,000
01.04.06.01.03	IWPP Water Licence Process	$410,000
	TOTAL	$500,000

C2.8.3 Assumptions

The following assumptions were made while preparing this cost estimate:

- The cost estimate does not include cost consideration for administration of the work package (i.e., statusing, coordination, and invoicing and management), which will vary throughout the work, depending on the type of work.
- The cost estimate does not include markups to professional services (labour) or subcontractor and expense costs.
- Work described in the work package is a standalone effort. No accommodation or economy of scale with combining different work packages has been used in developing this opinion of cost.

C2.8.4 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are nonbinding and are provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the indicated time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, implementation schedule, and other variables. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding requirements must be carefully reviewed prior to making specific financial decisions.

C2.9 References

CH2M HILL Canada Limited (CH2M HILL). 2011. *Cost Opinion for Preparation of the Faro Mine Remediation Project. Memorandum.* Prepared for Government of Yukon. December 11.

Government of Yukon (YG). 2003. *Waters Act.* O.I.C. 2003/58; amended O.I.C. 2009/29. March 25; amended.

Appendix C3
Down-Valley Interim Hydraulic Upgrades

APPENDIX C3

Down-Valley Interim Hydraulic Upgrade

The existing Intermediate Dam (ID) spillway does not have the capacity to safely pass a moderate or major flood event without potentially failing the dam. Failure of the ID would potentially result in an environmentally damaging discharge of metals-laden tailings to the Rose Creek Valley, Anvil Creek, and the Pelly River, and a significant or major loss of critical fish and wildlife habitat. Because of this threat to the environment, the ID is rated as a "Very High" or "Extreme" risk dam based on the Canadian Dam Association (CDA) *Dam Safety Guidelines 2007* (CDA, 2007). Flood flows over the intermediate tailings surface would mobilize some tailings, but the scale and consequence of this tailings loss would be minor compared to the tailings loss resulting from a breach of the ID.

This work package provides a significant upgrade of the hydraulic capacity of the ID spillway and some improvements of the Rose Creek Diversion (RCD). The work is proposed for completion in Year 4 of the Medium Term Plan. This upgrade will provide an increase in the capacity of the ID spillway to safely pass flood flows of about 135 cubic metres per second (m^3/sec), increasing the safety of the ID while the field investigation, planning, and design take place to construct a spillway with the capacity required for a dam with a "Very High" or "Extreme" risk classification. The flow of 135 m^3/sec is estimated to exceed the 1-in-500-year flood event and may approach 90 percent of the estimated 1-in-1,000-year flood (150 m^3/sec) peak flow depending on the assumption regarding attenuation of flood flows through the NFRC rock drain.

C3.1 Current Conditions

Approximately 28.6 m^3 of flotation-derived process tailings were deposited in the Rose Creek Tailings Area between 1969 and 1998 (CH2M HILL Canada Limited [CH2M HILL], 2012). The tailings are contained by a series of three dams (Original, Secondary, and Intermediate dams) constructed across the Rose Creek Valley, as shown on Figure C3-1.

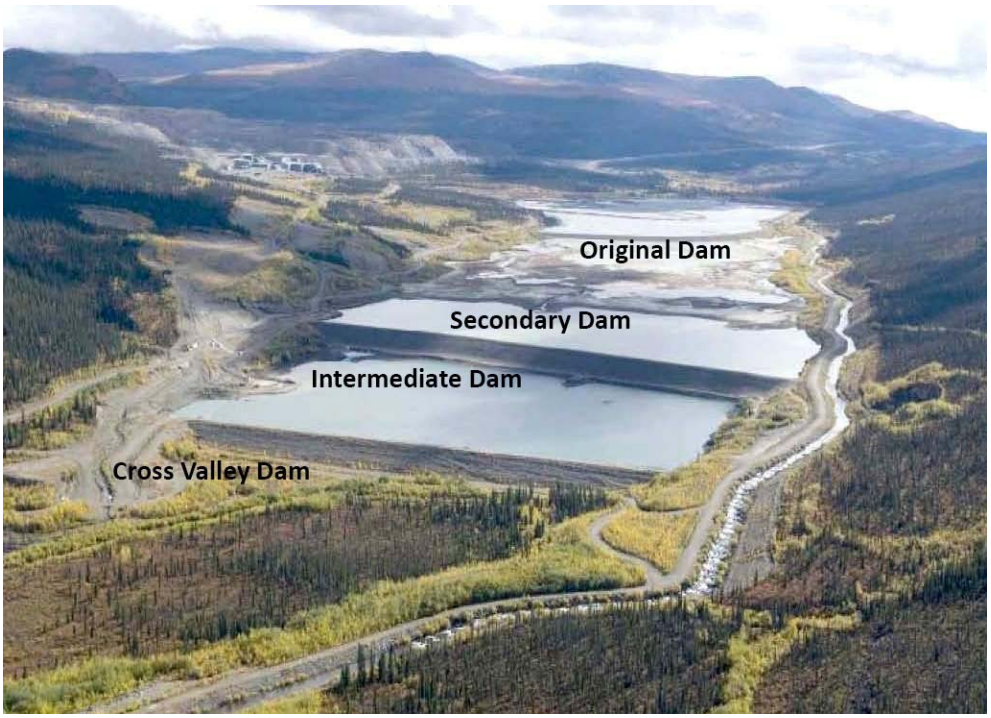


FIGURE C3-1
Rose Creek Tailings Area
Faro Mine Remediation Project

The Cross Valley Pond (CVP), downstream of the tailings impoundment dams, serves as a polishing pond for the treated effluent from the Faro Mine Water Treatment Plant. The ID is the major tailings impoundment structure and also contains any flood waters entering the intermediate tailings area. Any floodwater routed through the ID spillway flows into the CVP, and once the storage capacity of the CVP is exceeded, water is routed through the Cross Valley Dam (CVD) spillway down into the Rose Creek Valley, where it flows into Rose Creek.

The tailings vary in thickness upstream to downstream and across the valley, with a thickness estimated as 5 to 10 metres (m) at the edges of the valley, with maximum thickness of more than 25 m upstream of the Secondary Dam, and maximum thickness of 20 to 25 m upstream of the Intermediate Dam (SRK Consulting Canada Inc., 2006). The maximum thickness of the original tailings is also estimated to be 20 to 25 m.

Analyses of Faro Mill production records and assays indicate that the tailings have an average concentration of lead, zinc, and copper equal to 0.8 percent, 1.3 percent, and 0.12 percent, respectively (Curragh Resources Limited, 1993). Oxidation of the sulfides results in production of low pH (acidic) water with elevated concentrations of sulfate, zinc, and other metals (Robertson GeoConsultants, 1996). These metals are toxic to aquatic and terrestrial life.

C3.1.1 Secondary Dam

Construction of the Secondary Dam began in 1974 and was completed in 1975. A failure of the Secondary Dam occurred in 1975, resulting in more than 200,000 m^3 of decant water and tailings discharged to the Rose Creek Valley. The spill was observed to move downstream several miles from the site (Williams, 1975). A survey conducted almost 30 years later indicated “obvious areas of killed and stressed vegetation” and “many areas of stressed vegetation and dead trees that appear to also have been impacted by the spill” (Gartner Lee Limited, 2004).

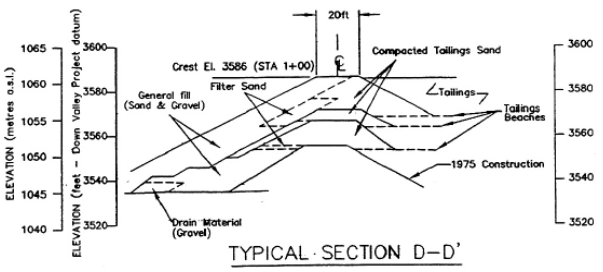
The West Limb of the Secondary Dam is defined as the curved portion of the dam that crosses the Rose Creek Valley in a roughly north–to-south direction. The East Limb is the portion of the Secondary Dam that is parallel to the south Rose Creek Valley wall. The West Limb of the Secondary Dam was raised using centerline construction and compacted fill to a maximum height of 27 m. The East Limb is a low retention dike that was constructed of compacted fill. Tailings were deposited behind this dam from 1975 until 1982 and then for approximately 5 months in 1986. Rose Creek was diverted to a channel that ran parallel to the south Rose Creek Valley wall and emptied into its original channel downstream from the Secondary Dam. Cross sections and photos of the Secondary Dam are shown on Figure C3-2. Elevations shown on figures are in feet relative to the Down Valley Project datum. To convert to mean sea level datum (NAD 27), subtract 106 feet (32.3 m). To convert from feet to metres, multiply by 0.3048 metres per feet.

C3.1.2 Intermediate Dam

In 1981, the ID was constructed across the Rose Creek Valley to contain supernatant water and tailings solids. It was raised in 1988, 1989, and 1991 to a final crest elevation of 1,049.8 metres above mean sea level (mamsl), a maximum height of about 32 m above the old Rose Creek channel. A typical section through the dam is shown on Figure C3-3. There is an emergency spillway channel on the right (north) abutment, constructed as a rock-lined channel in natural overburden material.

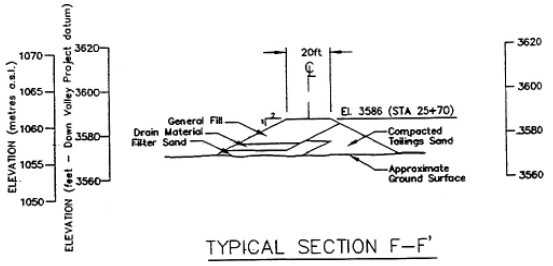
Based on available drawings, the ID can be described as a zoned earthfill embankment with a sloping upstream low-permeability core and a downstream random fill shell. Granular filter zones were constructed on both sides of the core. The initial construction in 1981 made use of natural terrace material present across the valley. A drainage blanket was placed over this footprint downstream from the core and filter zone, extending to the toe of the planned final dam construction.

Upstream and downstream slopes are at 2:1 (H:V). A 20-m-wide berm was constructed on the downstream slope at about elevation 1034 mamsl, approximately adjacent to the polishing pond; therefore, the overall downstream slope is at 2:1 (H:V). It is assumed that the purpose of the berm is to provide access to the blanket drain exit and to provide stability against drawdown loading from the CVP.



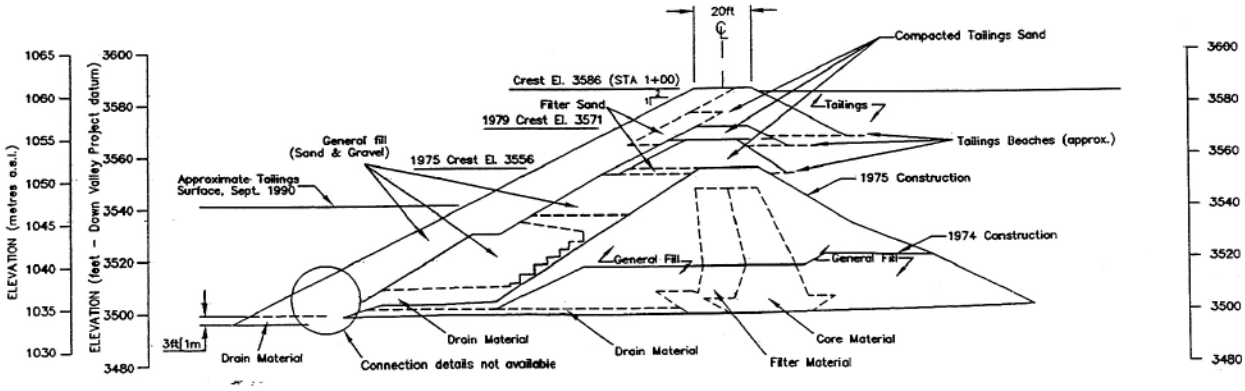
TYPICAL SECTION D–D'

(REPRESENTS STATIONS 0+00 TO 10+00, AND 19+00 TO 26+00)



TYPICAL SECTION F–F'

(REPRESENTS STATIONS 26+00 TO 27+86)



TYPICAL SECTION E–E'

(REPRESENTS STATIONS 10+00 TO 19+00)

REFERENCES

1. Golder, Brawner & Associates Dwg. V74011, "Construction Carried Out to End of 1975"' Sept. 1975.
2. Golder Associates, Report No. 782–2736, "1978 Dyke Raising for the Tailings Retention Facility, Faro, Yukon Territory", April 1979, Figure 2 "Tailings Dam, 1978 Construction".
3. Golder Associates, Report no. 802–2024, "Construction Report, Cyprus Anvil Mining Corporation, 1980 Raising of the Tailings Dam, Faro, Yukon Territory", Appendix II, (Tender Drawings).

NOTES

1. All elevations are in feet relative to the Down Valley Project datum. To convert to sea level datum (NAD 27), subtract 106ft (32.3m). To convert from feet to metres, multiply by 0.3048m/ft.

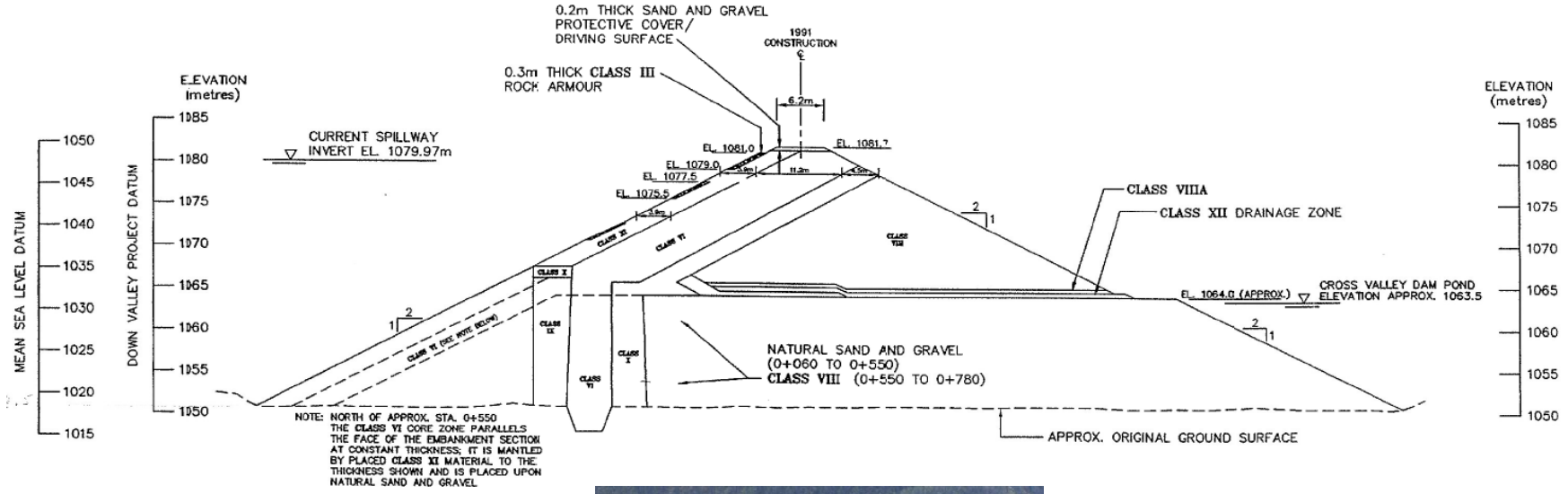




FIGURE C3-2

As-built Cross Sections and Photographs of the Secondary Dam

Faro Mine Remediation Project





NOTES :

1. Embankment geometry cnd internal zoning as shown in Golder Associates Drawing 912–2402–3, Int. Dam Raising & C.V. Dam Toe Drain, Cross Section and Detailed Plan, Rev. 1, Aug. 8, 1991.
2. All elevations are referenced to Down Valley Project Datum. Subtract 32.3m from elevations shown to convert to mean sea level (NAD27) datum.
3. Refer to Golder Associates as built reports for detailed descriptions of material classes. General descriptions as follows :

CLASS VI	Dam Core (glacial till)
CLASS VII	Upstream Shell (silty sand and gravel)
CLASS VIII	Downstream Shell (sand and gravel)
CLASS VIIIA	Drainage Filter (sand and gravel)
CLASS IX	Upstream Filter (silty sand)
CLASS X	Downstream Filter (sand and gravel)
CLASS XI	Tailings Sand (fine to medium sand)
CLASS XII	Drainage Zone (gravel)

FIGURE C3-3

As-built Cross Sections and Photograph of the Intermediate Dam

Faro Mine Remediation Project

Although there is a nominal cut off beneath the core of the dam to reduce seepage through the uppermost natural soils, no deep foundation cut off is present to reduce seepage through the permeable foundation soils. Instead, the tailings on the upstream slope and foundation were relied on to reduce seepage to an acceptable level; the hydraulic gradient would be reduced because of longer seepage path through relatively thick layers of fine-grained tailings. The drains on the dam section are set to just above the design level of the polishing pond.

C3.1.3 Cross Valley Dam

The CVD was constructed as part of the Down Valley Project in the early 1980s to expand the tailings disposal capacity in the Rose Creek Valley. The CVD retains a polishing pond downstream from the ID. Based on available drawings, the embankment can be described as a zoned dam with core and filters constructed as a conventional water-retaining dam with no retained tailings. Figure C3-4 shows the design section of the CVD without the seepage berm at the downstream toe. The seepage berm was constructed at a later date (after the original construction was completed) to control seepage that appeared near the toe of the dam. The crest of the dam is at elevation 1,034 mamsl and the downstream toe is at elevation 1,016 mamsl (nominal). The height of the dam is about 18 m above original grade. The dam is approximately 500 m long.

The dam section is a central impervious core, supported by upstream and downstream granular shells at slopes of 2H:1V. The core and downstream shell are separated by a chimney drain that connects to a blanket drain that extends to the toe of the drain. There is also a filter/transition zone on the upstream side of the core, which would act as a crack filler. The central impervious core connects to a low-permeability upstream blanket that extends beneath the upstream shell, to 60 m upstream from the toe. The core was extended a few metres into existing ground below the stripped grade. This nominal cut-off and upstream blankets were designed to reduce seepage through the foundation soils. There are no other cut-offs extended into the pervious Rose Creek sediments.

C3.1.4 Emergency Spillways

The current spillways at the right (north) abutments of the ID and the CVD are not sized to pass large floods. The ID spillway has a capacity equal to about 32 m^3/sec when the pool reaches the top of the core zone, whereas the CVD has a spillway capacity equal to about 300 m^3/sec (northwest hydraulic consultants inc. [nhc], 2006). The ID spillway discharges into the CVP. Once the CVP is filled, additional water is routed through the CVD spillway down into the Rose Creek Valley, where it flows into Rose Creek.

C3.1.5 Rose Creek Diversion

The RCD, on the south side of the valley, diverts clean water from the North and South Forks of Rose Creek around the Rose Creek Tailings Area. The RCD was constructed in two stages. An upstream section of the channel was completed in 1974 to carry clean water past the second tailings impoundment. A longer downstream section was completed in 1981 in preparation for construction of the intermediate tailings impoundment downstream (west) of the secondary tailings impoundment. This second reach extended the diversion by about 3,800 m, to the location where it discharges back into Rose Creek, downstream from the CVD.

The existing diversion is approximately 4,700 m in total length. Rock weirs were constructed to reduce stream velocities and compensate for the grade difference between the RCD (0.2 percent) and the original Rose Creek Valley (2 percent). The weirs were designed on the basis of a 1-in-50-year flood event. The diversion was designed to carry a 1-in-50-year flood event (approximately 79 m3/sec), with 1 m of freeboard. The contingency design capacity, with no freeboard, was such that it would carry a 1-in-500-year flood event of 132 m3/sec. Following a review of the RCD capacity in 2003, low sections of crest as a result of settlement was found (BGC Engineering [BGC], 2004), such that the original design flood event would have resulted in overtopping the RCD dike. The low sections were subsequently raised by the required amount (BGC, 2005); after raising these sections, it was concluded that the existing RCD has a flow capacity sufficient to bypass stream flows of 140 m3/sec, which is slightly more than the 1-in-500-year flood event (nhc, 2006). The flow from storm events exceeding the capacity of the RCD will discharge onto the intermediate tailings area, flow over the intermediate tailings into the Intermediate Impoundment, and flow out through the ID spillway into the CVP.

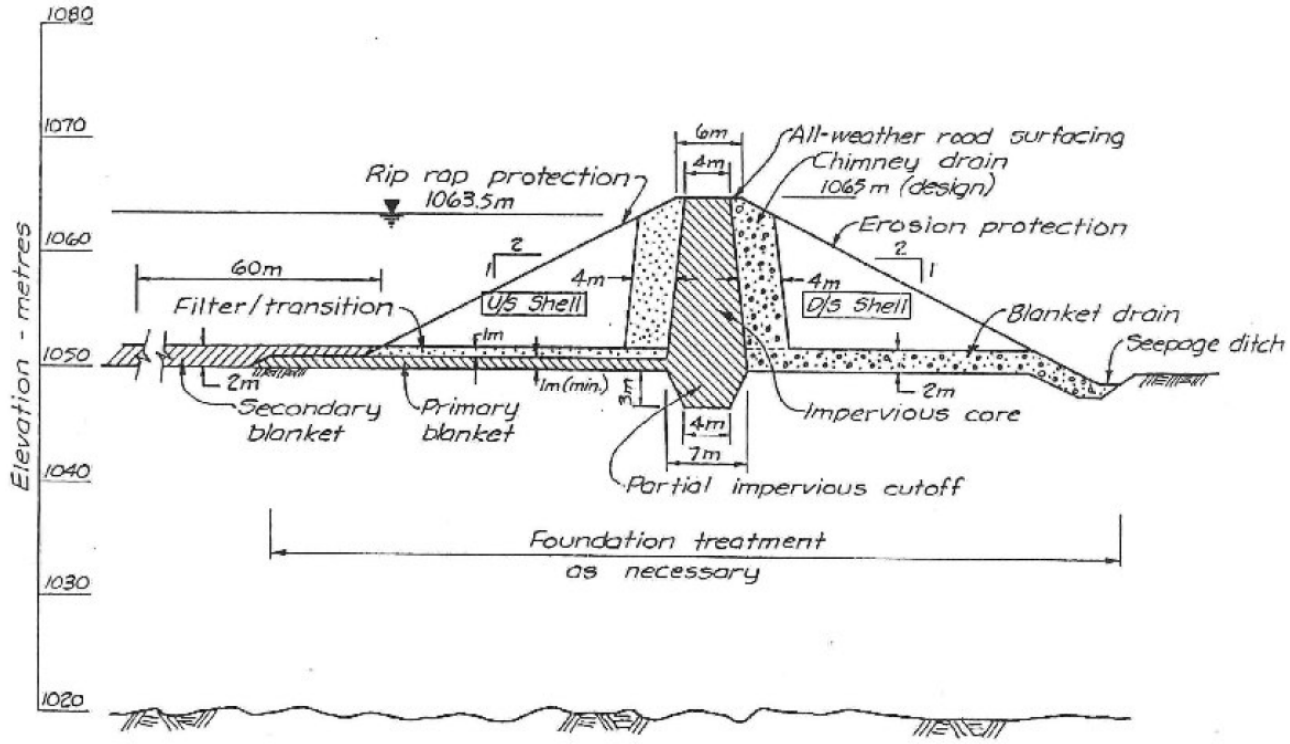




FIGURE C3-4
As-built Cross Section and Photograph of the Cross Valley Dam
Faro Mine Remediation Project

A large storm event exceeding the capacity of the RCD will potentially fail the RCD dike, most likely by overtopping at the existing fuse plug / overflow weir location, but it is also possible that the dike could fail at other locations by overtopping or other failure mechanisms such as piping.

Although hydraulic analyses suggest that the fuse plug/overflow weir should remain stable during the Inflow Design Flood (nhc, 2006), there is uncertainty in the way it was constructed. nhc (2006) noted that the downstream slope is 20 percent with median riprap size of 800 millimetres immediately downstream of the crest of the fuse plug and a cobble transition zone at 6 percent slope between the structure and the intermediate tailings. About 6.2 m^3/sec of flow of the 1-in-500-year flood event is estimated to occur through the fuse plug.

Once the RCD is breached, flood water would be conveyed over the intermediate tailings surface and through the ID spillway. Because the flow could be significantly larger than the capacity of the ID spillway, it has the potential to result in overtopping and breaching the ID. Failure of the ID would likely result in discharge of a large volume of tailings to the environment. This is because the dynamic flow of a large amount of mobilized tailings is likely to overwhelm the storage of the CVP such that it would run up and over the crest of the CVD, or would run through the CVD spillway. In both cases, the intermediate tailings would then be released into the Rose Creek tailings area downstream of the dam.

C3.2 Justification for Action

C3.2.1 CDA Dam Safety Guidelines

The ID contains more than 26 million m^3 of copper, lead and zinc-laden tailings toxic to aquatic and terrestrial life. The failure of the Secondary Dam in 1975 resulted in a loss of wildlife habitat, with little recovery evident more than 35 years later. It is also possible that there was a loss in fish habitat, but not as obvious. Failure of the ID could result in a significant or major loss or deterioration of critical fish or wildlife habitat downstream of the Faro Mine Complex within Rose Creek, Anvil Creek, and possible extending to the Pelly River.

Based on threat to the environment and cultural values, the CDA dam safety guidelines, presented in Table C3-1 (CDA, 2007), indicate that the ID should have a minimum dam classification of “Very High Risk” and justifiably could have a dam classification of “Extreme” risk. The classification of “Very High Risk” to “Extreme” risk is based on (1) significant to major loss or deterioration of critical fish or wildlife habitat and (2) the fact that restoration in kind would be impractical or impossible.

Table C3-2 provides the CDA Dam Safety Guidelines (CDA, 2007) for required spillway capacity and stability under design earthquake conditions, based on the dam risk classification. For a dam rated as a “Very High” risk dam, the inflow design flood equals two-thirds of the flow between the 1,000-year return period flood event and the PMF event.

For the RCD, the 1,000-year flood event is an estimated 167 m^3/sec, and the PMF is an estimated 674 m^3/sec at the upper end of the RCD and 692 m^3/sec at the lower end of the RCD (nhc, 2004, 2006). These flows include runoff from the North Fork of Rose Creek (including flows from Faro Creek), the South Fork of Rose Creek, and the south slope above the RCD. Klohn Crippen Berger (KCB) 2008 noted that the PMF and other flood estimates do not by definition include runoff from the catchment along the north slope of the Intermediate Tailings Area. KCB further noted that this north-slope runoff will discharge into the tailings impoundment so it has to be included with the flood waters that pass by the ID; i.e., it is assumed that the RCD will breach during a PMF event and all the flood waters will have to be conveyed by the ID spillway (KCB, 2008). KCB made a rough estimate of the PMF for the north slope by proportional area, using a catchment of 12 square kilometres for the north slope compared to a total catchment at the lower end of the RCD of 217 square kilometres (KCB, 2008). Using these proportions, KCB estimated that the PMF for the north slope is 38 m^3/sec, so that the total PMF for all the catchment areas would be about 730 m^3/sec. Using a similar rationale for the 1,000-year flood event, the 1,000-year flood flows for the north slope would be 9.2 m^3/sec, and the total 1,000-year flood would equal approximately 176 m^3/sec.

TABLE C3-1
Dam Classification – CDA 2007
Faro Mine Remediation Project

Dam Class	Population at Risk [a]	Incremental losses		
		Loss of Life [b]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short-term loss No long-term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat Loss of marginal habitat only Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 people or fewer	Significant loss or deterioration of *important* fish or wildlife habitat Restoration or compensation in kind highly possible	High economic loses affecting infrastructure, public transportation, and commercial facilities
Very high	Permanent	100 people or fewer	Significant loss or deterioration of *critical* fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances)
Extreme	Permanent	More than 100 people	Major loss of *critical* fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances)

Notes:

[a] Definitions for population at risk:

None = There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary = People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).

Permanent = The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more-detailed estimates of potential loss of life (to assist in decision making if the appropriate analysis is carried out).

[b] Implications for loss of life:

Unspecified = The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirements, for example, might not be higher if the temporary population is not likely to be present during the flood season.

TABLE C3-2
CDA Dam Safety Guidelines – Suggested Design Flood and Earthquake Levels (for Use in Deterministic Assessments)
Faro Mine Remediation Project

	Annual Exceedance Probability (AEP)	
Dam Class [a]	**Inflow Design Flood [b]**	**Earthquake Design Ground Motion (EDGM)[c]**
Low	1/100	1/500
Significant	Between 1/100 and 1/1,000 [d]	1/1,000
High	1/3 between 1/1,000 and PMF [e]	1/2,500[f]
Very high	2/3 between 1/1,000 and PMF [e]	1/5,000[f]
Extreme	PMF[e]	1/10,000

Notes:

[a] As defined in Table C3-1 Dam Classification – CDA 2007.

[b] Extrapolation of flood statistics beyond 1/1000-year flood (10^{-3} AEP) is discouraged.

[c] AEP levels for EDGM are to be used for mean rather than median estimates of the hazard.

[d] Selected on the basis of incremental flood analysis, exposure, and consequences of failure.

[e] PMF has no associated AEP. The flood defined as "1/3 between 1/1000 year and PMF" or "2/3 between 1/1000 year and PMF" has no defined AEP.

[f] The EDGM value must be justified to demonstrate conformance to societal norms of acceptable risk. Justification can be provided with the help of failure modes analysis focused on the particular modes that can contribute to failure initiated by a seismic event. If the justification cannot be provided, the EDGM should be 1/10,000.

The Inflow Design Flood for a "Very High" risk dam is therefore an estimated 546 m^3/sec (equals two-thirds of the flow between the 1,000-year return period flood event and the PMF event). For an "Extreme" risk dam, the spillway should have a capacity to pass the PMF event, approximately 730 m^3/sec for the ID.

The existing ID has a spillway capacity of approximately 32 m^3/sec at the top of the dam's core. The top of core elevation is used to measure spillway capacity because flow above the top of the dam core elevation, and below the crest of the dam, has the potential to cause internal erosion of the non-core material, leading to internal erosion through piping and dam failure. The existing spillway capacity is approximately 6 percent of the recommended capacity for a "Very High Risk" dam, and less than 5 percent of the capacity required for an "Extreme" risk dam.

C3.2.2 Recommendation of the Independent Peer Review Panel and Technical Review Board

A workshop was conducted in August 2012 to review and evaluate the proposed closure alternatives for routing the PMF flood through the Rose Creek Valley. The workshop was attended by representatives from the Government of Canada as represented by Aboriginal Affairs and Northern Development Canada and the Government of Yukon (YG), as well as the Independent Peer Review Panel (IPRP), the CH2M HILL Technical Review Board (TRB), the Independent Engineer, and the Project Design Team. Based on these discussions, the Independent Peer Review Panel provided the following recommendations:

- Build the permanent PMF spillway structure as soon as reasonably possible.
- Because it will take significant time to design and construct a new PMF spillway structure, other short-term improvements should be considered to decrease the risk of overtopping and breaching the ID until such time that a PMF spillway is implemented. These interim hydraulic upgrades include:
  - Increasing the hydraulic capacity of the existing spillway by increasing the width and depth of the existing spillway channel

- Increasing the hydraulic capacity of the existing spillway by increasing the height of the ID embankment crest; this could be accomplished by installing a geomembrane to extend the core to the dam crest and by adding a temporary crest berm
- Protecting the spillway channel from erosion by installing reno/gabion mattresses
- Increasing the RCD capacity by removing vegetation and raising the north dike

These recommendations were used as a basis for developing the Down Valley Interim Hydraulic Upgrades (DVIHU).

C3.3 Basis of Design

The DVIHU consist of the following elements:

- Increase the existing spillway capacity by increasing the depth of the existing spillway channel (Figures C3-5 and C3-6 [labeled Figures 256 and 257], located at the end of this work package).
- Remove existing piping and structures that have been placed within the ID spillway. This will require relocating piping and moving a lime slurry mix tank to new location.
- Increase the height of the ID embankment crest by installing a geomembrane layer to extend the core to the dam crest and by adding concrete traffic barriers (Figures C3-5 and C3-6 [labeled Figures 256 and 257]).
- Protect the spillway channel from erosion by installing reno/gabion mattresses in the existing spillway channel (Figures C3-5 and C3-6 [labelled Figures 256 and 257]).
- Increase the RCD capacity by removing vegetation, repairing raveled slopes on the dike and cut slope (south slope), and by filling in low spots on the dike crest (Figures C3-7 to C3-10 [labeled Figures 250 to 253]).

Concepts for improving the spillway capacity and reliability in the short term are shown on Figures C3-5 and C3-6 (labeled Figures 256 and 257). The improvements consist of excavating the existing channel by 1.5 metres and placing a 0.45-m-thick gabion mattress on the excavated surface and side slopes of the channel. Besides this slight enlargement of the spillway channel, increased spill capacity will also be accomplished by raising the effective crest. This improvement in the spillway channel will be accompanied by measures to raise the ID crest, including installation of a geomembrane to extend the core to the dam crest, and by adding a row of concrete traffic barriers on the crest, shown on Figures C3-5 and C3-6 (labeled Figures 256 and 257).

The combined effect of deepening the spillway channel and raising the crest is to increase the differential head between the spillway invert and the dam crest by about 1.5 metres. It is estimated that these improvements would increase the spillway capacity by 103 m^3/sec. The spillway capacity would increase to about 135 m^3/sec, which is slightly more than the 500-year flood flow in the RCD, assuming that the rock drain at the haul road has been removed.

Taking anticipated attenuating effects from the haul road rock drain into account, it is roughly estimated that the improved spillway would nearly have the capacity to pass a 1,000-year flood (estimated to be about 150 m^3/sec accounting for rock drain attenuation). This attenuation estimate needs to be evaluated more carefully during design.

The increase in the spillway hydraulic capacity will be accomplished by installing a geomembrane between the dam core and the crest of dam to raise the effective crest height. To design the geomembrane installation, test pits will be excavated to confirm the depth to the top of the core material. Test pit excavation will also be useful in obtaining information about the stability of trench to install the geomembrane.

C3.4 Description of Scope

C3.4.1 Final Design (100 Percent) (WBS 01.02.02.02.05)

The project's final design phase considers vendor and contractor constraints and requirements and results in a full set of detailed design drawings and specifications. Barring unforeseen conditions, final design documents must include everything necessary to procure the intended scope, quality, and design without requiring change orders during construction. These drawings are used for "redline" revisions to produce as-built drawings at the end of construction.

C3.4.2 Procurement/Contracting (WBS 02.02.02.01.01)

For the Faro Mine Remediation Project, procurement will follow YG's established processes and will be supported by project management and construction management services personnel. In this case, the procurement manager or construction manager (CM) will prepare specifications as part of the coordinated design process and will leverage a procurement support team to assist YG with tender issue, tender evaluation (with emphasis on technical capabilities), and recommendations regarding contractors and subcontractors.

YG could use one of two approaches to deliver these projects. Each would minimize project costs and maximize effective implementation:

- **Option 1:** The CM is established as a separate contractual role, where YG issues the construction contract directly to the selected subcontractor(s).
- **Option 2:** The CM is established in a prime contractor position and issues the construction contract directly with the selected subcontractor(s). This is known as a construction management-at-risk (CM-at-risk) approach.

The DVIHU work is best suited for the delivery model outlined in Option 2. In this option, the CM serves as consultant to the owner during the project's development and design phases and as a general contractor, or equivalent, during the project's construction phase.

C3.4.3 Construction Activities (WBS 02.02.02.02)

Construction activities consist of physical construction and construction management. The scope of these activities is illustrated in the following sections.

C3.4.3.1 Construction (WBS 02.02.02.02.01)

The DVIHU construction scope is described below. The construction work will include the following tasks:

- Mobilization
- Surveying and layout
- Relocating existing piping and structures that have been placed within the ID spillway
- Increasing the depth of the existing spillway channel
- Increasing the height of the ID embankment crest by installing a geomembrane layer to extend the core to the dam crest and by adding concrete traffic barriers
- Protecting the spillway channel from erosion by installing reno/gabion mattresses, or other foundation protection structures in the existing spillway channel
- Increasing the RCD capacity by removing vegetation, repairing raveled slopes on the dike and cut slope, and filling in low spots on the dike crest
- Demobilization

C3.4.3.2 Construction Management (WBS 02.02.02.02.02)

The project's construction management task involves implementing the design plans and specifications, effectively managing the construction activities (main contractor and subcontractors), integrating activities, and maintaining the overall project schedule and budget. If YG holds the contract with the subcontractor, then YG is responsible for directing the work of the subcontractor. If the CM holds the contract with the subcontractor, then the CM is responsible for directing the work of the subcontractor.

The CM provides a single point of contact representing the owner's interests first and foremost. The SOW includes the following range of responsibilities:

- Ensure the project is built in general accordance with the design plans and specifications
- Oversee quality assurance and quality control
- Ensure health and safety plan compliance
- Ensure that environmental management plans are adhered to during construction work
- Provide scheduling and cost control services
- Provide the client with advice regarding engineering aspects of contractual issues that may evolve during construction
- Provide adaptive management advice if unexpected circumstances arise
- Require that as–built drawings are completed and that any defects or warranty aspects are addressed

Overall, comprehensive CM services are used to integrate the various facets of the construction process, planning, design, procurement, construction, and commissioning and to provide standardized technical and management expertise on each project.

C3.5 Work Breakdown Structure

As described, the DVIHU work package includes work elements from across the overall work breakdown structure (WBS) (see Appendix F).

C3.6 Uncertainties

Major uncertainties associate with this work package include the following:

- Excavatability for deepening the existing spillway.
- Functionality and hydraulic behavior of the upgraded spillway. This will be addressed through hydraulic modelling and geotechnical (scour) analysis to predict performance.
- Functionality of the existing "fuseplug" and potential overtopping of the RCD. This will be addressed through hydraulic modelling and geotechnical analysis to predict performance. Redesign and reconstruction of the fuseplug will not be addressed in this proposed work package.
- Actual attenuation of the North Fork of Rose Creek at the rock drain. This will be evaluated through hydraulic analysis.
- Mobilization of tailings though the ID spillway during moderate to large storm events. This proposed work package does not address potential erosion and transport of the tailings during large storm events. This will be addressed within the 5-year planning period during preparation of the project proposal.
- Performance of the CVD impoundment and spillway if tailings are mobilized from the ID impoundment into the CVD impoundment.

- Requirements for replacing conflicting pipeline conveyance systems, including: (1) the WTPES, (2) the IPPS, and (3) the SLMS.
- Requirements for use of lime slurry plant treatment to treat CVD impoundment "polishing pond" water. Existing lime slurry equipment will need to be removed from current location within the ID spillway.

C3.7 Technical Risk Register

The technical risks associated with the DVIHU package are detailed in Appendix G: Technical Risk Register.

C3.8 Schedule

The basis for this schedule is described in Section C3.3: Basis of Design. This scope has been prepared as a feasibility-level design concept to support the Medium Term planning objectives.

C3.8.1 Milestone Schedule

The following is a general summary of the major milestones and salient components of the schedule. Refer to Appendix H for a detailed schedule for implementing the work package.

The attached schedule illustrates that the work package will be initiated and substantially completed within 2 fiscal years (2014/15 and 2016/17) and assumes that data collection and earlier design phases were completed in prior years.

The 2016/17 construction milestones are as follows:

- Milestone 1 – Complete removal of piping and structures within existing spillway: End of June
- Milestone 2 – Complete installation of stormwater pollution prevention plan components: End of June
- Milestone 3 – Complete excavation of the spillway channel: End of July
- Milestone 4 – Complete installation of gabion mattress: End of September
- Milestone 5 – Complete ID crest improvements to increase freeboard: End of September
- Milestone 6 – Complete RCD maintenance to increase channel capacity: End of September

C3.8.2 Schedule Constraints and Assumptions

The following constraints and assumptions have been made in the development of this schedule:

- In support of the DVIHU work package, and as described in Section C3.3.2, additional data must be collected to support the design. This data collection was performed in the summer of 2013/14.
- The construction of the gabion mattress is dependent on a potential borrow source located in the vicinity of the construction work. Because the gabions will be temporary, it is anticipated that material can be recovered from the Faro Pit waste rock piles for this use. It is expected that this source will be confirmed through the associated field investigation, but it may be advisable to develop this source in advance of the primary construction work.
- The construction season at the site is 6 months long and extends from April 1 to September 30.
- To the extent possible, this schedule has been developed in consideration of the constraints of the fiscal year funding requirements. In instances where tasks are shown as occurring across this date, it is understood that additional contracting requirements may be necessary.

C3.9 Cost Estimate

The cost opinions presented herein are based on information and experience obtained from visits to the site, discussions with the current Care and Maintenance Contractor, actual costs from working on site during the CH2M HILL 2012 field investigation (late May to early October this year) and from concept designs developed by CH2M HILL. (2012). Cost opinions are rough order-of-magnitude (ROM), with an expected accuracy of +100 to -50 percent (Class 5). Costs have not been escalated and are presented as 2012 costs.

C3.9.1 Basis of Estimate

The following points represent the basis upon which the provided cost estimate has been developed:

- The estimate uses 2012 CH2M HILL Master Services Agreement rates for professional services.
- Escalating factors affecting productivity have been applied where appropriate to field exploration costs and construction estimates for working conditions, access restrictions, site limitations, and logistics anticipated for implementing the described work package. These factors are based on actual measures recorded during the 2012 field implementation program at the site.
- Design costs (concept through final design) are presented as labour and expenses estimates developed as a percentage of construction costs.
- Construction management and construction procurement and contracting costs were developed as fixed costs spread across four work packages. In order to maintain efficiency, a core construction management and procurement team has been estimated.
- Construction costs were based on hydraulic improvements to the existing spillway, increasing capacity of the ID, and hydraulic adjustments to increase existing capacity of the RCD. Initial work will consist of excavation within the existing spillway of 20,625 m^3 of soil and rock to increase the capacity of the spillway, installation of gabion mattresses over the spillway invert, and construction of temporary spillway walls using gabion baskets. The capacity of the intermediate dam will be increased by installing precast concrete traffic barriers and a lining tied into the existing dam core trench. RCD capacity will be increased by removing vegetation and eroded material from the hillside embankment and making minor earthwork repairs to the RCD dike.
- Costs have been included to relocate the existing lime slurry system before excavation for spillway improvements.
- CH2M HILL's Heavy Construction Systems Specialists, Inc. estimating system was used to build up the construction cost estimate with identified activities for construction.
- Unit rates for equipment and craft labour were localized to Yukon.
- Production factors for current market conditions and location of the site were used in the buildup of the estimate.
- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document, to account for items that may change between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors.
- Markups were applied from historical experience with similar construction works.

C3.9.2 Supporting Documentation

The following sources of information were used in developing the cost estimates:

- *Canadian Blue Book* adjusted for the Yukon project site location (central Yukon)
- 2012 Canadian labour rates from the CH2M HILL Master Services Agreement (C00012050)
- 2012 Yukon fair wage schedule for craft labour
- Historical cost data and estimator judgment
- Productivity adjusted to account for current field conditions

C3.9.3 Cost Estimate

The total cost estimate for the DVIHU work package described herein is $5,965,000. This estimate is summarized with construction and professional services costs provided in Tables C3-3 and C3-4, respectively.

TABLE C3-3
Down Valley Interim Hydraulic Upgrades – Construction Estimate
Faro Mine Remediation Project

02.02.02.02.01	Labour	Expenses/Materials	Equipment	Subcontractor	Markup	Total [a]
TOTAL	$1,316,000	$2,190,000	$590,000	$40,000	$794,000	$4,930,000

[a] The costs presented in this report are contractor direct costs.

The component costs of this construction estimate are summarized in Attachment C3-1 *Construction Estimate Summary*, and show the task descriptions plus markup by the contractor to get to a bid or tender cost estimate.

TABLE C3-4
Down Valley Interim Hydraulic Upgrades – Professional Services Estimate
Faro Mine Remediation Project

Work Breakdown Structure	Phase	Labour [a]	Expense	Subcontractor	Total
01.02.02.02.05	Final Design (100%)[b]	$80,000	$13,000	$7,000	$100,000
02.02.02.01.01	Procurement	$193,000	$6,000	-	$199,000
02.02.02.02.02	Construction Management	$523,000	$163,000	$50,000	$736,000
TOTAL		$796,000	$182,000	$57,000	$1,035,000

[a] Estimated based on assumed full time equivalents and materials cost.

[b] Design cost equals 12 percent of estimated capital construction costs; i.e., 30 % design costed at 3.6 % of construction costs, 60 % design costed at 3.36 % of the construction costs, 90 % design costed at 3 % of construction costs, and 100 % design costed at 2.04 % of construction costs.

The component costs of this professional services estimate are summarized in Attachment C3-2, *Professional Services Estimate.*

C3.9.4 Assumptions

The following assumptions were made during the preparation of this cost estimate:

- The estimated costs for engineering services were developed based on review of provincial association guidelines and recommendations for determining engineering fees. These included publications from the Consulting Engineers of British Columbia and Professional Engineers and Geoscientists (2009), the Association of Professional Engineers of Ontario (2001), and the Association of Professional Engineers and Geoscientists Manitoba (2011).
- Work described in the work package is a standalone effort. Limited accommodation or economy of scale with combining four work packages has been used in developing this opinion of cost for construction management.
- The cost estimate does not include cost consideration for administration of the work package (i.e., statusing, coordination and invoicing and management) which will vary throughout the duration of the work depending on whether the work focus is construction or professional services.
- The cost estimate does not include markups to subcontractor construction costs.
- Quantities used were based on conceptual design prepared by CH2M HILL.
- Riprap and other granular materials are available and can be developed within the project boundaries.

- No royalties are included.
- Construction season has been assumed to be a maximum of 6 months available in the field from May through October.
- Gabion mattress and basket material development is assumed to occur during the year before construction of the DVIHU. Waste rock is suitable material for gabion construction.
- Construction work for gabion material development is scheduled to be performed in the 2016/2017 construction season.
- Double-shift work at 10 hours per shift will be performed to accomplish the spillway work in one construction season.
- The schedule presented assumes overlapping of work items, sequencing of work and work crews, and accelerated schedule with available construction season daylight hours to accomplish the gabion material development and PMF spillway construction in two separate construction seasons.
- RCD work will be accomplished at low water August through October.
- The 2012/13 YG per diem and lodging rates have been applied. Available housing and lodging are available in the town of Faro to accommodate all personnel required to accomplish the work, or the allowed per diem and lodging costs are sufficient to for camp setup and operation.
- Nineteen percent markup has been applied to contractor construction costs, consisting of home office support, overhead, and profit (10 percent overhead, 9 percent profit).
- Bonds and Insurance have been included at 3 percent of construction costs.
- Adaptive management and repairs are not included in the estimate because it is anticipated that this facility will be constructed in the latter stages of Phase 2b and will be subjected to infrequent flows.

C3.9.5 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are nonbinding and are provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, schedule implementation, and other variable factors. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding needs must be carefully reviewed before making specific financial decisions related to proper project evaluation and adequate funding.

C3.10 References

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Figures

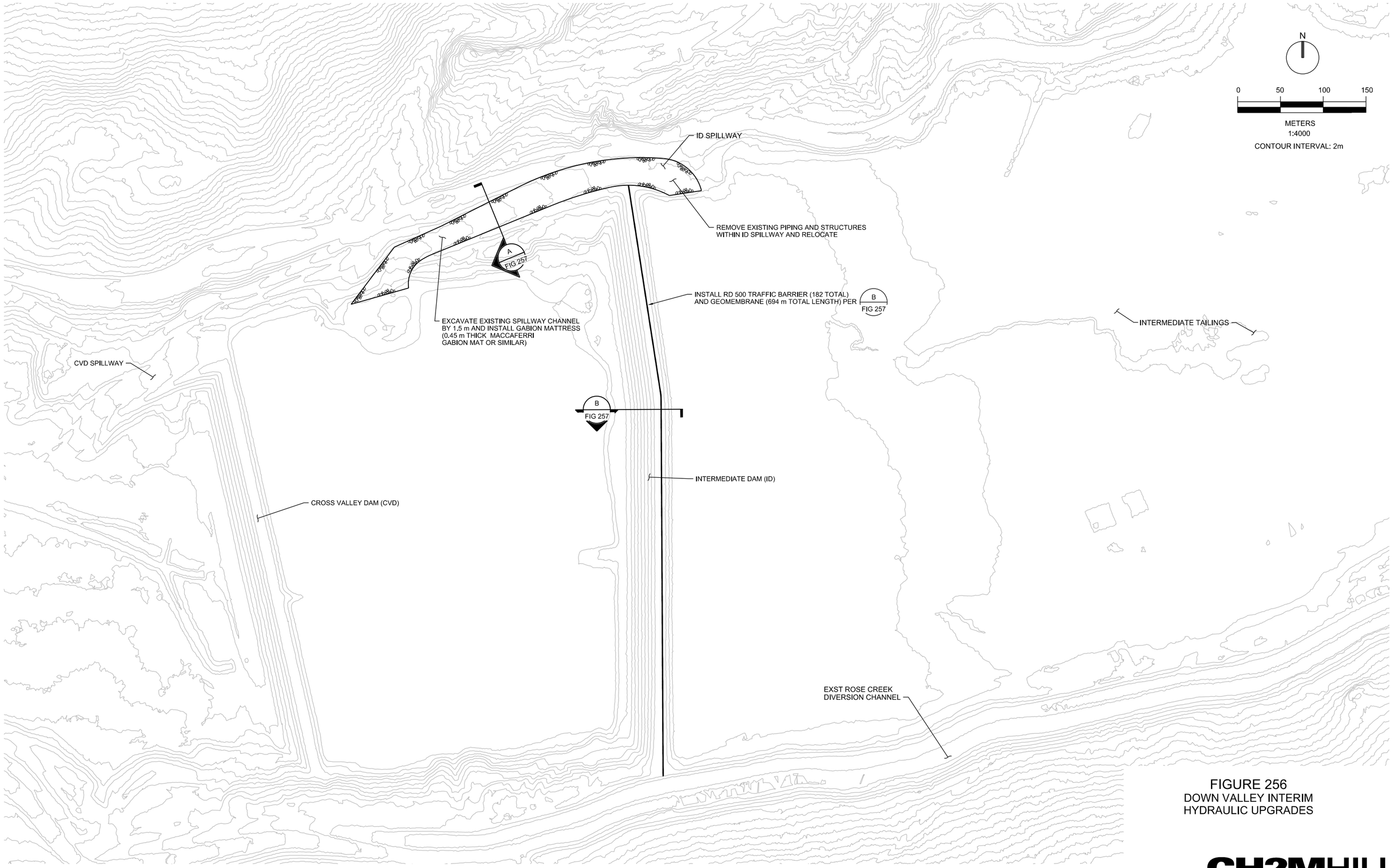
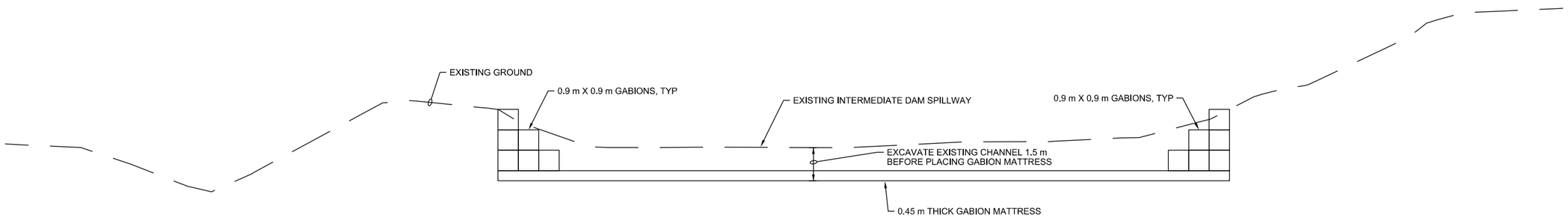


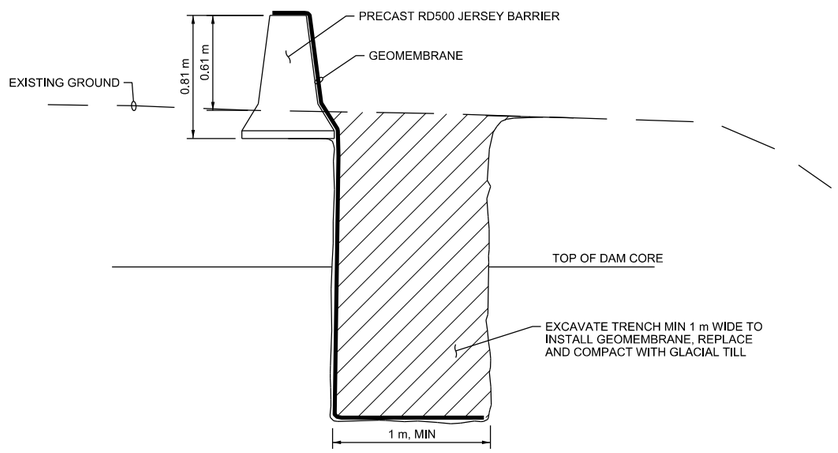
FIGURE 256
DOWN VALLEY INTERIM HYDRAULIC UPGRADES

CH2MHILL®

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2012\11\13
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A SECTION
1:200
FIG 256



B SECTION
1:40
FIG 256

FIGURE 257
DOWN VALLEY INTERIM
HYDRAULIC UPGRADES

CH2MHILL®

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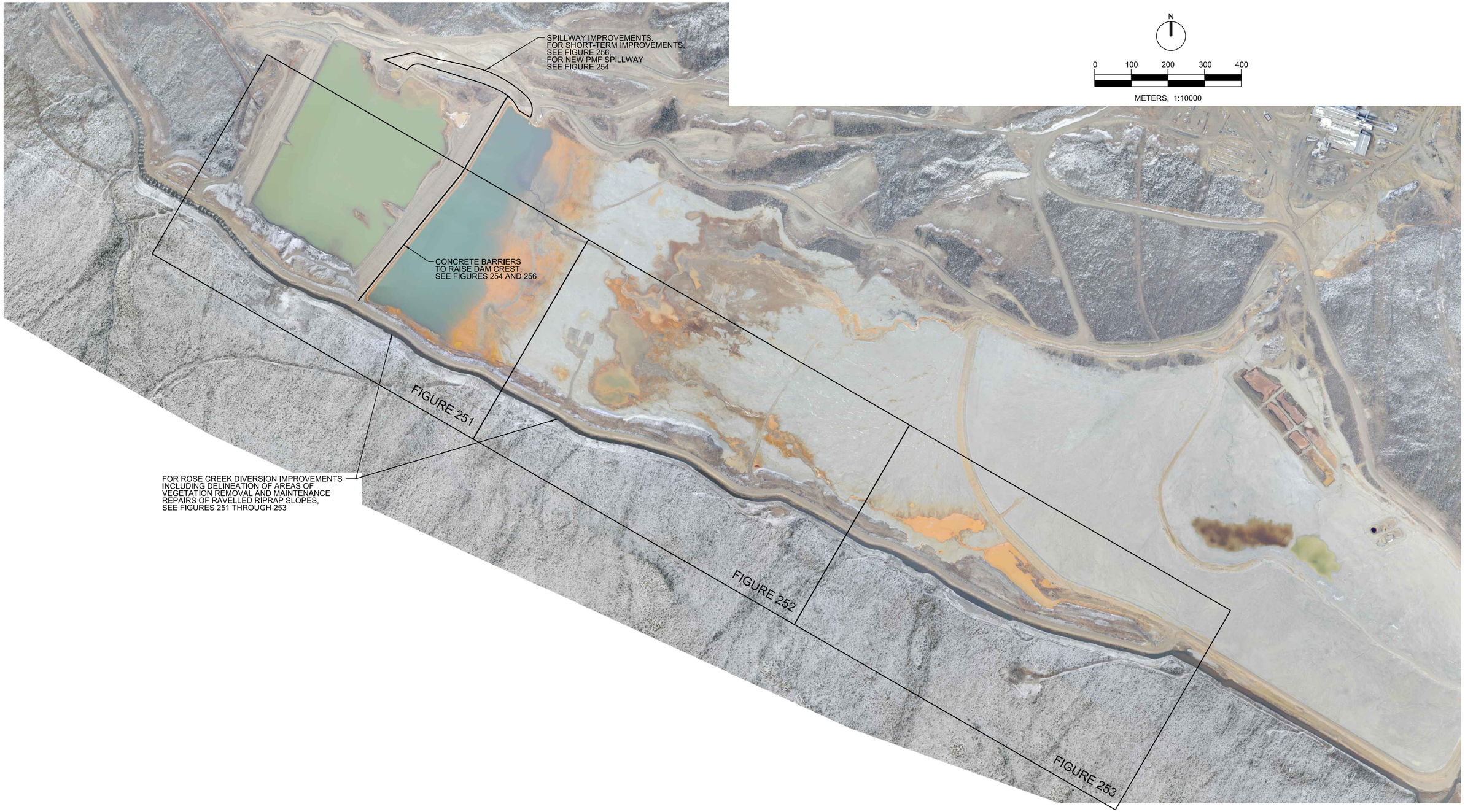


FIGURE 250
ROSE CREEK TAILINGS AREA
MEDIUM TERM IMPROVEMENTS
KEY PLAN

CH2MHILL®

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2012\09\28
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LEGEND:

AREAS OF RIPRAP RAVELLING ON RCD DYKE SLOPE

AREAS OF VEGETATION IN DIVERSION

E 580,000

E 580,250

E 580,500

E 580,750

N 6,914,250

N 6,914,000

N 6,913,750

N 6,914,000

N

0 25 50 75 100

METERS
1:2500

MATCHLINE, SEE FIGURE 252

FIGURE 251
ROSE CREEK TAILINGS AREA
MEDIUM TERM IMPROVEMENTS
RCD PLAN

CH2MHILL®

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LEGEND:

AREAS OF RIPRAP RAVELLING ON RCD DYKE SLOPE

AREAS OF VEGETATION IN DIVERSION

E 581,250

E 581,500

E 581,750

N 6,913,500

N

0 25 50 75 100

METERS
1:2500

N 6,913,750

E 580,750

N 6,913,250

MATCHLINE, SEE FIGURE 251

MATCHLINE, SEE FIGURE 253

FIGURE 252
ROSE CREEK TAILINGS AREA
MEDIUM TERM IMPROVEMENTS
RCD PLAN

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LEGEND:

AREAS OF RIPRAP RAVELLING ON RCD DYKE SLOPE

AREAS OF VEGETATION IN DIVERSION

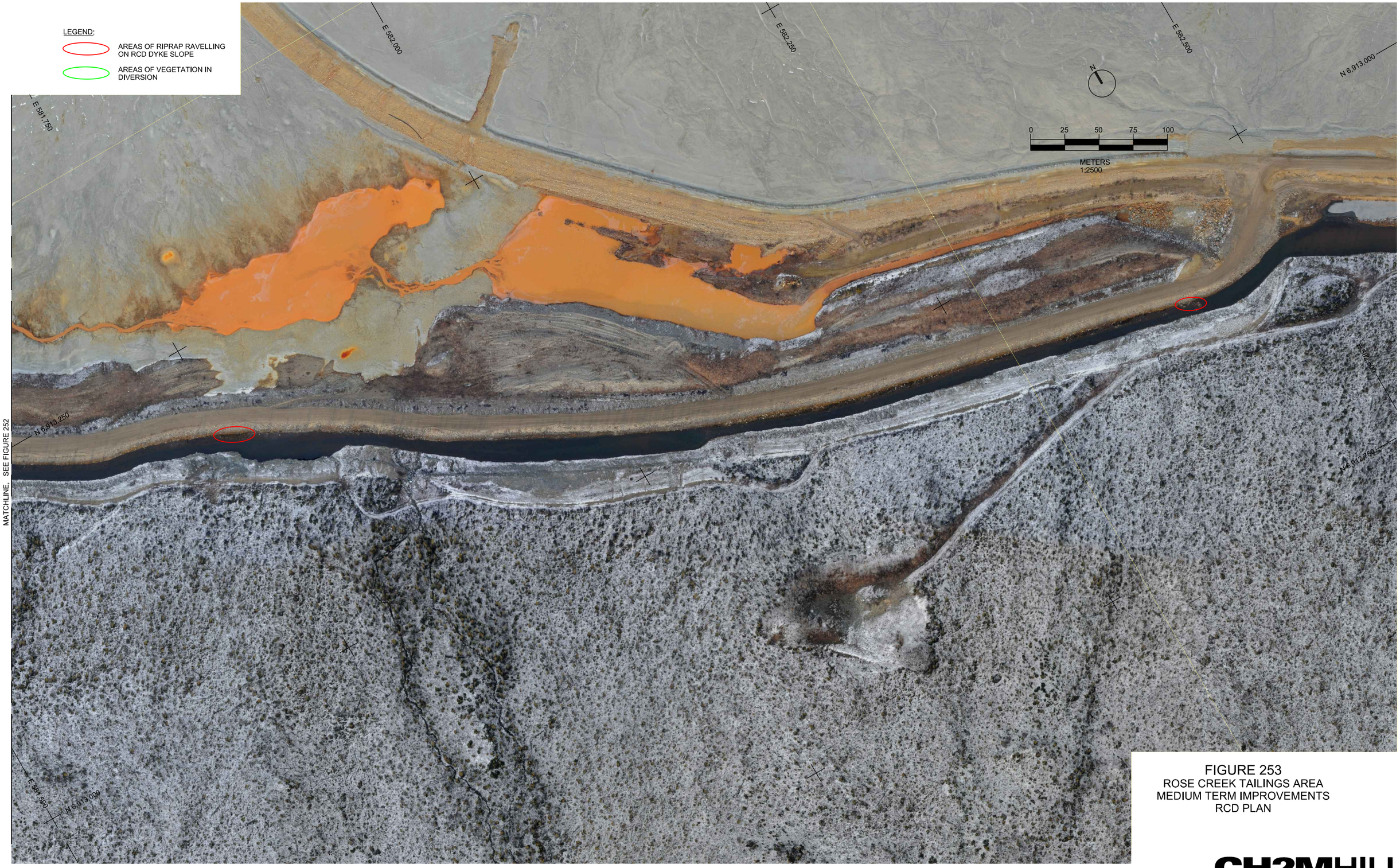


FIGURE 253
ROSE CREEK TAILINGS AREA
MEDIUM TERM IMPROVEMENTS
RCD PLAN

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Attachment C3-1
Construction Estimate Summary

ATTACHMENT C3-1

Construction Cost Estimate Summary

Faro Mine Remediation Project - Down Valley Interim Hydraulic Upgrades Medium Term Plan

BI #	BI Description	Units	Quantity	Labour	Permanent Material	Construction Material	Equipment Operation Expenses	Subcontractors	Construction Equipment	Per Diem	Bond/ Insurance	Direct Total	Markup	Unit Price	Total
10	Mobilization	LS	1	$33,933	$-	$17,463	$13,082	$-	$19,613	$-	$-	$84,091	$16,152	$100,243	$100,243
20	Bonds & Insurance	LS	1	$-	$-	$-	$-	$-	$-	$-	$135,598	$135,598	$26,046	$161,644	$161,644
30	Submittals	LS	1	$14,809	$-	$3,650	$-	$-	$-	$-	$-	$18,459	$3,546	$22,005	$22,005
40	Survey	LS	1	$-	$-	$-	$-	$2,500	$-	$-	$-	$2,500	$480	$2,980	$2,980
50	QC	LS	1	$-	$-	$-	$-	$2,500	$-	$-	$-	$2,500	$480	$2,980	$2,980
60	Install SWPPP Elements	LS	1	$6,810	$-	$2,792	$1,369	$-	$1,439	$-	$-	$12,410	$2,384	$14,794	$14,794
70	Pioneer & Access	LS	1	$14,606	$-	$1,502	$8,295	$-	$15,206	$-	$-	$39,608	$7,608	$47,216	$47,216
75	Relocate Lime Slurry System	LS	1	$43,774	$36,000	$4,708	$13,879	$35,000	$19,430	$-	$-	$152,792	$29,348	$182,140	$182,140
80	Excavate Existing Spillway Channel	m^3	20,625	$122,857	$-	$12,474	$88,812	$-	$189,336	$-	$-	$413,479	$79,421	$24	$492,899
90	Mob & Set Up Screen Plant	LS	1	$4,757	$-	$495	$3,121	$-	$4,939	$-	$-	$13,312	$2,557	$15,869	$15,869
100	Screen & Haul Rock	m^3	10,562	$150,886	$-	$13,871	$85,829	$-	$161,707	$-	$-	$412,293	$79,193	$47	$491,486
110	Set & Fill Gabion Mattress	m^2	13,750	$184,426	$365,092	$40,135	$28,481	$-	$48,620	$-	$-	$666,754	$128,070	$58	$794,824
120	Set & Fill Gabion Wall Baskets	m^3	4,374	$126,223	$253,692	$27,963	$20,684	$-	$35,339	$-	$-	$463,901	$89,106	$126	$553,007
130	Excavate Construction Trench	m	700	$11,508	$-	$-	$5,533	$-	$7,105	$-	$-	$24,146	$4,638	$41	$28,784
140	Set PCC Barriers	m	700	$10,127	$42,000	$1,089	$4,489	$-	$5,446	$-	$-	$63,151	$12,130	$108	$75,281
150	Place Geomembrane	m^2	3,360	$5,107	$27,342	$594	$1,027	$-	$1,079	$-	$-	$35,150	$6,752	$12	$41,901
160	Back Fill Trench	m^3	2,100	$22,241	$-	$2,376	$9,908	$-	$13,734	$-	$-	$48,258	$9,269	$27	$57,528
170	Remove Vegetation RCDC	m	350	$11,317	$-	$1,232	$5,521	$-	$7,175	$-	$-	$25,245	$4,849	$86	$30,094
180	Remove Bank Sloughed Material	m	350	$11,984	$-	$1,232	$5,478	$-	$7,653	$-	$-	$26,347	$5,061	$90	$31,407
190	Repair RCDC Dike	m	350	$17,249	$-	$1,760	$10,052	$-	$14,025	$-	$-	$43,085	$8,276	$147	$51,361
200	Minor Maintenance 3 Yrs	LS	1	$8,631	$-	$891	$4,150	$-	$5,329	$-	$-	$19,001	$3,650	$22,650	$22,650
300	Mobilization	LS	1	$30,163	$-	$17,463	$11,619	$-	$17,404	$-	$-	$76,648	$14,722	$91,370	$91,370
400	Per Diem	LS	1	$-	$-	$-	$-	$-	$-	$803,040	$-	$803,040	$154,247	$957,287	$957,287
800	Contingency	LS	1	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-	$-
900	Field General Conditions	LS	1	$484,752	$-	$27,685	$19,072	$-	$15,711	$2,560	$4,465	$554,247	$106,459	$660,707	$660,707
				$1,316,160	$724,126	$ 179,374	$340,400	$40,000	$590,290	$805,600	$140,064	$4,136,015	$794,443		$4,930,458

Notes:

BI = bid item
LS = lump sum
m = metre(s)
m^2 = square metre(s)
m^3 = cubic metre(s)
PCC = precast concrete
QC = quality control
RCDC = Rose Creek Diversion Channel

Attachment C3-2
Professional Services Estimate

ATTACHMENT C3-2

Professional Services - Class 5 Estimate

Faro Mine Remediation Project - Down Valley Interim Hydraulic Upgrades Medium Term Plan

	Task Name/Subtask/Activity	Principal	Senior III	Mid III	Junior II	Clerical	Labour Cost	Travel ($)	Expenses ($)	Subcontracts ($)	Markup	Total ($)
	Labor Rates	**$232**	**$196**	**$154**	**$103**	**$77**						
WBS	**Down Valley Interim Hydraulic Upgrades**											
01.02.02.02.05	Final Design (100 %)	17	103	183	195	104	80,382	10,000	3,000	7,200		100,582
02.02.02.01.01	Procurement	42	246	439	468	251	192,980				5,789	198,769
02.02.02.02.02	Construction Management	113	668	1,190	1,270	680	523,430	128,550	15,000	50,000	18,953	735,933
	Grand Total	**172**	**1,016**	**1,811**	**1,934**	**1,035**	**796,792**	**138,550**	**18,000**	**57,200**	**27,664**	**1,035,284**

Appendix C4
Cross Valley Dam SIS

APPENDIX C4

Cross Valley Dam Seepage Interception System

C4.1 Work Package Description

The Rose Creek Tailings Area (RCTA) consists of a series of tailings impoundments spanning the Rose Creek Valley that retain tailings discharged during operations of mill facilities and water decanted from the tailings. Three dams hold the tailings in place, and a fourth dam (Cross Valley Dam [CVD]), holds polishing pond water, discharged from the Faro Water Treatment Plant (WTP).

The Rose Creek Alluvial Aquifer (RCAA) system is a fluvial depositional system deposited by Rose Creek and its tributaries, the North Fork of Rose Creek and the South Fork of Rose Creek. The alluvial aquifer is composed of a heterogeneous mixture of silt, sand, gravel, and cobbles. The alluvial deposits are thickest near the centre of the valley, aligned with the ancestral thalweg of Rose Creek. The thickest deposits of alluvium encountered during drilling are on the order of 50 metres (m) (164 feet). Groundwater data demonstrate that contamination originating from the tailings and the Emergency Tailings Area (ETA) is present within the RCAA and is moving downgradient from southeast to northwest, consistent with the flow direction of Rose Creek.

Movement of this contamination represents an environmental threat to the downstream aquifer and to Rose Creek. Contaminated groundwater moving beneath the CVD effectively leaves the mine site and enters the receiving environment, at which point it is not possible to stop the spread of the contamination. Therefore, the design and construction of a seepage interception system (SIS) at the CVD is the “last line of defense” for collecting contaminated groundwater that originates from the Faro Mine Complex (FMC).

This work package provides for the design of the CVD SIS to capture contaminated groundwater moving beneath the CVD, and the pumping and piping system required to convey the contaminated water to the Faro Pit for temporary storage and to the WTP for treatment. This work package also includes field investigation work and enabling construction work, proposed for completion before full implementation of the system.

C4.2 Current Conditions

Following the onset of mining operations, tailings were deposited over the alluvial valley-fill deposits to a maximum thickness of about 25 m. The greatest thicknesses of tailings were deposited in the Intermediate and Second Impoundments, with the thickness decreasing toward the edges of the valley (Robertson GeoConsultants Inc. [RGC], 1996). Contamination originating from within the tailings deposits, as well as from the ETA, is migrating through the RCAA toward the CVD (RGC, 2006a). Attenuation processes acting within the alluvial aquifer system are currently limiting the rate of movement of these contaminants downgradient. The nature of this attenuation has been studied in previous laboratory investigations, and results indicate that the RCAA soils have the ability to attenuate zinc transport as well as to neutralize acidity (SRK Consulting Engineers and Scientists [SRK], 2004) and (SRK, 2006). Although the exact nature of the attenuation process remains uncertain, an SRK study conducted in 2006 indicates that “mineralogical observations and correlations in the chemical analyses suggest that organic material is the most significant attenuating phase…” (SRK, 2006). Because of remaining uncertainty in the attenuation processes, the length of time over which these processes will continue to limit contaminant movement is unknown. Data indicate that the contaminant front is currently more than 1,000 m upgradient of the CVD. However, the risk of early contaminant breakthrough remains high, because the rate of the contaminant migration is difficult to estimate. Therefore, the installation of a groundwater interception system downgradient of the CVD is necessary to protect Rose Creek surface water quality downstream of the CVD.

There are several sources of groundwater recharge to the RCAA. Higher elevation areas on both sides of the Rose Creek Valley represent groundwater recharge areas for the valley aquifer, while seepage and surface

water runoff from the ETA that are not captured by the ETA SIS flow down the Faro Creek Channel and eventually provide additional recharge into the RCAA. A major portion of the Rose Creek watershed contributes flows into the South Fork Rose Creek upstream of the RCTA, and thus contributes recharge to the RCAA upgradient of the Rose Creek

Diversion. Groundwater leaving other areas of the FMC, as well as groundwater moving beneath the North Fork of Rose Creek, also enters the RCAA and flows northwestward down the Rose Creek Valley under the tailings impoundment and the CVD. Finally, seepage from the Rose Creek Diversion (RCD) enters the tailings and the overlying ponds from the south. Therefore, groundwater within the RCTA represents a mixture of upgradient groundwater, surface water from within the RCTA, and seepage from the RCD (AECOM Canada Ltd., 2009).

Hydraulic conductivity data indicate that the fluvial deposits of the RCAA have extremely high hydraulic conductivities in some areas, but also have a high degree of heterogeneity. Information obtained from aquifer testing collected downstream of the CVD supports this hypothesis. The boring log for pumping well PW-1, located in the central portion of the Rose Creek Valley immediately downstream of the CVD, indicates the presence of numerous intervals of “well-washed” sand and gravel layers. Logs from nearby monitoring wells MW-1 and P05-02 indicated a similar lithology (RGC, 2006a). However, wells farther to the north and closer to the valley margins, indicate a stratigraphic section dominated by silty sand or gravel with only a few limited layers of “well-washed” sand and gravel. Productivity of wells completed in the “well-washed” sand and gravel deposits is very high, with wells capable of pumping in excess of 32 to 38 litres per second (L/sec) (500 to 600 United States gallons per minute [USgpm]) with very limited drawdown (less than 5 m [16.4 feet]). The hydraulic conductivity of the other lithologic units present (till, weathered bedrock, and bedrock) is orders of magnitude lower than that of the fluvial sediments.

Vertical hydraulic gradients estimated using measured groundwater levels in multi-level wells installed within the RCTA indicate a component of downward flow between the tailings and the underlying alluvial deposits. Therefore, the potential exists for contaminants to be mobilized from the infiltration of precipitation and snowmelt through the tailings deposits into the underlying RCAA. Seepage moving down Faro Creek Canyon from the ETA is also transported downward into the deeper alluvial system. As is typical of valley-fill alluvial aquifers, hydraulic data resulting from RCAA investigations indicate that vertical hydraulic gradients are upward between the deepest alluvial deposits and the more shallow portions of the alluvial system. These data suggest that deep groundwater is moving upward as it flows down the valley into the higher-permeability stream deposits of ancestral Rose Creek. The total magnitude of groundwater underflow moving through the RCAA has been estimated to be approximately 60 L/sec (950 USgpm) (RGC, 2006b).

Surface water originating as precipitation and snowmelt in the vicinity of the RCTA, as well as seepage from the RCD, accumulate behind the Intermediate Dam. This impoundment is known as the Intermediate Pond. Water accumulating in the Intermediate Pond is pumped down during the summer months and conveyed to the Faro WTP to provide surface water capacity for the subsequent freshet. Treated effluent discharged from the Faro WTP accumulates behind the CVD, forming the Polishing Pond. Water meeting discharged criteria from the Polishing Pond is periodically discharged to Rose Creek downgradient from the CVD. Water level elevations (stages) in the Polishing Pond are maintained at approximately 1,028 m above sea level (3,372.7 feet above sea level), which has been the average stage since 2004 (Denison Environmental Services [DES], 2012).

Generally, clean groundwater from the south and southeast flows to the RCTA, and mine-impacted groundwater flows to the RCTA from the north, with a significant portion of that contamination associated with the Faro Creek Canyon (specifically from the ETA). Locally, the tailings also contribute to groundwater contamination in the RCTA (RGC, 2006b). The seepage of clean water from the RCD (south of the RCTA) into the RCAA has a major influence on the spatial water quality trends in the RCAA, especially downgradient near the CVD. There is a significant spatial trend in groundwater quality from south to north of non-impacted groundwater transitioning to moderately impacted groundwater in the downstream portion of the RCTA.

Groundwater in the RCAA on the southern edge of the Rose Creek Valley, downgradient of the CVD, remains only slightly impacted by mine-related groundwater contamination. Contaminant concentrations increase

from south to north at the toe of the CVD, as expected based on clean water inflows from the RCD seepage. Groundwater contamination in the northern area has higher sulphate and magnesium concentrations, indicative of the leading edge of the total dissolved solids plume. Concentrations of sulphate and metals are gradually increasing in shallow groundwater along the north side of the valley, downgradient of the CVD, but zinc concentrations remain low (less than 0.05 milligrams per litre) (RGC, 2012a). Even though the rate of travel of mine-related contaminants within the RCAA is uncertain, groundwater data suggest that the attenuation potential of the RCAA might be diminishing over time, and contaminant migration rates might accelerate. As such, the intent of this work package is to develop the design basis required to construct an SIS in a timely manner once contaminant concentrations increase toward unacceptable levels.

Groundwater in bedrock at the toe of the CVD follows similar trends from south to north across the valley. Bedrock groundwater in the north portion of the valley (P09-C1) is moderately impacted because of elevated sulphate and zinc concentrations. However, in the central portion of the valley (well P09-C2), bedrock groundwater is not impacted (RGC, 2012a).

C4.3 Justification for Action

The CVD SIS represents the potential "last line of defence" for protecting Rose Creek groundwater and surface water from mine-related contamination. Its importance was recognized by the Independent Peer Review Panel and an SIS and cut-off wall were included in the Draft 4A 2010 Closure Plan.

Natural attenuation mechanisms of mine-related contaminants along the groundwater flow path within the tailings profile and in the RCAA are responsible for delays in zinc breakthrough in the aquifer. However, the magnitude of zinc attenuation in the aquifer is highly uncertain because the complex mechanisms of zinc attenuation at the scale of the RCTA are currently not understood (RGC, 2006b).

Because the RCAA is a groundwater receiving zone for the FMC, any contaminated groundwater bypass flow beneath the CVD could directly impact the water quality in the downstream water bodies. In addition, recently collected data indicate that sections of Rose Creek downstream of the confluence with the RCD exhibit gaining conditions, and therefore could receive, and be impacted by, contaminated groundwater flowing through the underlying aquifer system.

Observed groundwater contaminant concentrations indicate increasing trends within the Primary and Secondary Impoundments, as well as at the north abutment of the Intermediate Dam. Increasing zinc concentrations suggest the attenuation capacity of the aquifer is becoming exhausted and concentrations of metals are expected to increase as a result (RGC, 2012a). The actual timing associated with the breakthrough of contaminants is unknown. Zinc concentrations at the CVD are still low, but could start increasing when the attenuation capacity of the aquifer is exhausted.

These data indicate that construction of an SIS capable of intercepting a high percentage of the groundwater flow through the RCAA might be required over the next 5 to 10 years (RGC, 2012b), downgradient of the CVD to protect groundwater and surface water quality downstream from the CVD. Although the timing of the breakthrough of zinc and other contaminants is uncertain, data indicate that a significant threat to downgradient water quality will persist until an SIS is implemented to intercept contaminated groundwater before contaminant concentrations reach unacceptable levels.

C4.3.1 Cross Valley Dam Seepage Interception System Design Concept Basis

The CVD SIS will be located downgradient of the CVD and include a total of 10 extraction wells oriented across the valley at the downstream toe of the dam. The wells will be spaced approximately 55 m apart and screened along the entire thickness of the glaciofluvial sediments (drilled into the weathered bedrock).

The use of the existing pumping wells at the site, PW-1 and PW-2, would likely not result in the most efficient SIS, especially given the construction deficiencies associated with PW-1 that have resulted in significant sand production in that well. In addition, neither well is completed down to the bedrock interface. Therefore, for

the purposes of this conceptual design, it is assumed that 10 new extraction wells will need to be constructed to develop a highly effective SIS. The actual number of wells will be decided during the design process following completion of the additional field investigation.

The proposed extraction well construction for this SIS consists of 203.2-millimetre (mm) (8-inch) diameter wells requiring a nominal 304.8-mm (12-inch) borehole. Well screens will be continuous wire wrap stainless steel. The screen slot sizes will not be determined until the grain size distribution in the proposed depth intervals of the well screens are known; however, a slot size of 0.040 inches (1.016 mm) is assumed herein for costing purposes. Additionally, an 8 by 16 (8 mesh) filter pack is assumed for costing purposes herein, even though this material size will also be determined based on grain size distributions. A cement-bentonite grout will be used to extend from the top of the filter pack to the ground surface. Figure C4-1 shows a plan-view layout of the proposed extraction well locations for the SIS. Figure C4-2 shows a cross-sectional view along the anticipated alignment of the SIS, including the conceptual extraction well placement within the RCAA.

Preliminary modelling simulations have been performed to evaluate the approximate flow rates that will be required to obtain complete capture of the groundwater flow moving through the RCAA in the SIS area. The results of these simulations suggest that the total average pumping rate from all 10 extraction wells of the SIS will be approximately 70.3 L/sec (1,114 USgpm). This pumping rate results in a simulated maximum drawdown within each well of approximately 4 m. Because well inefficiency is not addressed within the groundwater model, it is likely that the actual drawdown that each pumping well experiences during SIS operation could be as much as 10 m (32.8 feet). The maximum simulated pumping rate at each extraction well was approximately 20 L/sec (317 USgpm) at the center of the valley, and approximately 0.43 L/sec (7 USgpm) at the valley margins. Table C4-1 shows the simulated extraction rates for each of the extractions wells included in the CVD SIS. It should be noted that this design includes the construction of the 10 SIS extraction wells, but does not include installation of the pumps and controller hardware. This infrastructure will be installed at the time the SIS in put into operation.

TABLE C4-1
Simulated Extraction Well Pumping Rates for the CVD SIS
Faro Mine Remediation Project

Extraction Well Number	Approximate Extraction Rate (L/sec) [USgpm]
1	0.3 [5]
2	0.5 [8]
3	0.7 [11]
4	19.0 [300]
5	20.1 [320]
6	17.0 [270]
7	11.3 [180]
8	0.5 [8]
9	0.5 [8]
10	0.4 [6]
Total	70.3 [1,114]

Source: Unpublished data; preliminary modelling results for the CVD SIS developed by CH2M HILL

The other major component of the CVD SIS is the conveyance system that will be required to transport groundwater year-round from the SIS location up into the Faro Pit or the Faro WTP, depending on the time of year. Eventually each of the production wells will be connected to a pipeline header that will convey the

extracted groundwater from each well into a single conveyance pipeline. However, these pumps, controllers, and pipeline header systems will be installed when the system is put into operation.

It is estimated that the CVD SIS will include 10 extraction wells. The four wells located in the center of the valley will be equipped with 100-horsepower pumps, each with a capacity of approximately 320 USgpm (20.2 L/sec) once the system is put into operation. The remaining six wells located near the valley margins will eventually be equipped with 5-horsepower pumps, each with a capacity of approximately 10 USgpm (0.63 L/sec). The extraction wells will be instrumented with data logging flow totalizers to monitor groundwater extraction rates over time. These pumps and control systems are not included in this design package.

The SIS conveyance system will include high-density polyethylene piping, which will be insulated and heat traced. Groundwater extracted from each of the SIS extraction wells will be pumped to a common pump station/header pipe. Groundwater from the CVD SIS will be pumped approximately 3,280 m (10,761 feet) via a single 355.6-mm (14-inch) DR7 high-density polyethylene pipeline from the pump station and header pipe (at an elevation of approximately 1,018 m above mean sea level [amsl] [3,340 feet amsl]) to the split where individual pipes lead to the Faro WTP and the Faro Pit (at an elevation of approximately 1,148 m amsl [3,766 feet amsl]). While the WTP is in operation, groundwater will be conveyed to the WTP via a 180-m-long pipeline to an elevation of 1,140 m amsl (3,740 feet amsl). During the winter months, while the WTP is offline, groundwater will be conveyed to the Faro Pit via a new 1,660-m (5,446 feet)-long pipeline to an elevation of 1,145 m amsl (3,757 feet amsl). Profiles of the conveyance systems for the SIS and additional infrastructure requirements associated with construction of the conveyance system are provided in Figure C4-3.

C4.4 Description of Scope

The activities required to implement this scope of work include the following:

- Preparation of a detailed design package for construction of the SIS and conveyance system
- Construction of the initial work phase, including road access construction, surface preparation, and power provision.

The design concept is to install extraction wells across the Rose Creek Valley at the downgradient toe of the CVD, with associated pumps and controls, and to build a pipeline to convey the intercepted groundwater to the Faro Pit and the Faro WTP. Figure C4-4 shows the anticipated alignment of the long-term subsurface pipeline conveyance system. Low-permeability slurry walls may also be required to reduce the volume of clean water collected and conveyed for treatment. The slurry wall systems could include two separate slurry wall systems–one constructed across the Rose Creek Valley just downstream of the CVD, and one constructed on the southern side of the valley. Currently, it is assumed that these cutoff walls will not be included in the initial construction phase of the project but would be installed as part of the Adaptive Management Planning process. The need for design of the cutoff walls will be evaluated during during the design definition analysis.

The design of this system will require additional field investigations to better understand the aquifer geometry, the potential for the presence of significant bedrock fracture zones in the vicinity of the planned SIS, and the geochemical conditions that occur at the site of the planned SIS. A conceptual-level design including anticipated construction activities is presented in this section.

C4.4.1 Advanced Design (60%) (WBS 01.02.02.01.03)

This design phase will be initiated in 2013/14 and within the timeframe of the MTP, will be completed in Year 1. During the project's Advanced Design Phase, the contents of the BOD Report are developed in more detail, and drawings and specifications are further developed and refined. This phase also engages other functional areas to take part in final constructability and operability reviews. The deliverables include an

updated BOD, in-progress drawings, and a first draft of specifications or statements/scopes of work (SOW). Deliverables include the following:

- Completed piping and instrumentation diagram
- Results of detailed groundwater flow simulations
- Comprehensive equipment, line, and instrument lists
- Site plans, as well as typical geologic cross-sections
- Preliminary equipment specifications (datasheets)
- Other overall layouts that may affect design (e.g., hazardous area classification drawings, fire zone layouts, and safety components)

It is preferable that these drawings are finalized to the Approved for Design status, meaning that they are complete apart from decisions that will be made during the Detailed Design Phase (e.g., regarding vents/drains and vendor data).

At the end of the Advanced Design Phase, drawings and specifications describe all project systems and layout requirements.

C4.4.2 Detailed Design (90%) (WBS 01.02.02.01.04)

The project's Detailed Design Phase results in 90 percent complete detailed drawings and specifications. The scope of this phase includes the completion of the following, documented to the appropriate level of detail for the contracted design scope:

- Construction and tender documentation
- Engineering drawings
- Specifications
- Detailed SOWs
- Calculations

A final pre-tender review takes place for the detailed drawing and specification documents. Following this review, drawings and specifications are further developed and refined. The key Detailed Design deliverables are either bid- or tender-ready documentation for general bidding (as would be the case for a design/bid/build project) or construction-ready documentation for use in procuring subcontractors and equipment (as would be the case for a design/build project).

Detailed Design documents are virtually complete, apart from final coordination, and quality assurance and quality control reviews, which take place before the documents are issued for tender.

C4.4.3 Final Design (100%) (WBS 01.02.02.01.05)

The project's Final Design Phase considers vendor and contractor constraints and requirements, and results in a full set of detailed design drawings and specifications. Barring unforeseen conditions, documents must include everything necessary to procure the intended scope, quality, and design without requiring change orders during construction. These drawings are used for "redline" revisions to produce as-built drawings at the end of construction.

Under this task, construction documents will be prepared to assist in procuring a contractor for the enabling work construction. The enabling work includes running power to the well pump station location and building access roads, as needed, before the actual construction of the CVD SIS.

C4.4.4 Procurement/Contracting (WBS 02.02.01.01.01)

For the Faro Mine Remediation Project, procurement will follow the Government of Yukon's (YG's) established processes, and would be supported by Project Management and Construction Management (CM) services. In this case, the procurement manager or construction manager will prepare the specifications (as part of the coordinated design process). They will leverage a procurement support team to assist YG with

tender issue, tender evaluation (with emphasis on technical capabilities), and recommendations regarding contractors and subcontractors.

For delivery of the CVD project, the construction manager will be established in a prime contractor position, and the construction manager will issue the construction contracts directly with the selected subcontractor(s). This is known as a CM-at-risk approach. Under this arrangement, the construction manager serves as consultant to the owner during the project's development and design phases and as a general contractor, or equivalent, during the project's construction phase.

A primary advantage to delivering this project with a CM-at-risk approach is that this type of approach provides the opportunity to begin construction before design is complete, making it possible to adjust the design during implementation (even though designs are 100% complete) if site conditions differ from those assumed during design. Required revisions after final design are especially likely for SISs, where hydrogeological conditions often vary from those ascertained during the modelling and site assessment tasks. This is the best point in the schedule to integrate construction, equipment (e.g., pumps), and controls, as there is ready access to the designer, who would be part of the CM team. This approach also provides flexibility and the adaptive management that is necessary if changed conditions exist (e.g., unexpected hazardous chemicals found during the hazardous material removal and disposal work).

C4.4.5 Construction Activities (WBS 02.02.01.02)

Construction activities consist of physical construction and construction management. The scope of these activities is illustrated in the following sections.

C4.4.5.1 Construction (WBS 02.02.01.02.01)

For the purposes of the Medium Term Workplan, construction associated with the CVD SIS will be limited to establishing access roads and electrical access locations to support future construction activities.

C4.4.5.2 Construction Management (WBS 02.02.01.02.02)

The project's Construction Management task involves implementing the design plans and specifications, effectively managing the construction activities (main contractor and subcontractors), integrating activities, and maintaining the overall project schedule and budget. For this project, the CM is responsible for directing the work of the subcontractor.

The CM provides a single point of contact representing the owner's interests first and foremost. The SOW includes the following range of responsibilities:

- Assures the project is built in general accordance with the design plans and specifications
- Oversees quality assurance/quality control
- Assures health and safety plan compliance
- Assures adherence to the Environmental Management Plans during construction works
- Provides scheduling and cost control services
- Provides the client with advice regarding engineering aspects of contractual issues that may evolve or arise during construction
- Provides adaptive management advice if unexpected circumstances arise
- Requires that as–built drawings are completed and that any defects or warranty aspects are addressed

Overall, comprehensive CM services are used to integrate the various facets of the construction process, planning, design, procurement, construction, and commissioning, and provide standardized technical and management expertise on each project.

C4.5 Work Breakdown Structure

The CVD SIS work package includes work elements from across the overall work breakdown structure (WBS) (see Appendix F).

C4.5.1 Uncertainties

Several uncertainties associated with the development of the CVD SIS currently remain. These uncertainties need to be addressed before a complete design of the SIS can be developed. Known uncertainties include the following:

- Timing of contaminant breakthrough—This will be addressed through continued monitoring and preparation of a completed design to allow timely construction.
- Bedrock/ alluvial interface location—This will be addressed through geophysical testing and long term monitoring.
- Three-dimensional distribution of fractured and weathered zones in the bedrock underlying the anticipated CVD SIS.
- Geochemical ramifications of combining extracted groundwater with potentially dissimilar water qualities; particularly with regard to conveyance and associated maintenance related to pipeline scaling issues.
- Aquifer transmissivity; capacity to pump aquifer—Aquifer testing conducted in 2012, plus additional aquifer testing at the proposed bedrock well, will provide appropriate information to help estimate these parameters.
- Reliability for operation and maintenance access—This will be addressed through design and maintenance. Most of these uncertainties will be addressed during field investigations and the site preparation phase.

C4.6 Recommendations

To facilitate the evaluation of the effectiveness of the CVD SIS, the installation of performance monitoring wells near the extraction wells is recommended. Monitoring wells currently exist downstream from the CVD, but they are not adequate for the monitoring of potential bypass of contaminated groundwater around or beneath the CVD SIS. It is therefore recommended that five additional monitoring wells be installed for performance monitoring. This activity could be included in the field program during the construction of the SIS, but is not included in this conceptual design package.

C4.7 Technical Risk Register

The technical risks associated with the Cross Valley Dam SIS are detailed in the Technical Risk Register attached to the Medium Term Work Plan (see Appendix G).

C4.8 Schedule

The Milestone Schedule for the scope of work described previously is included in Appendix H. The basis for this schedule is the scope of work described in Section C4.3. This scope has been prepared as a feasibility-level design concept to support the Medium Term work planning objectives.

C4.8.1 Milestone Schedule

The following is a general summary of the major milestones and salient components of the schedule.

The Milestone Schedule (Appendix H) illustrates that the work package will commence with a field program initiated after freshet is complete and the ground is firm enough to support seismic survey and drilling equipment. The field investigations are assumed to occur in 5 months (May through September), with

laboratory testing and reporting (included in the duration of the individual field investigation tasks) requiring an additional 3 months to complete.

The preparation of the final (100-percent) design, any required permitting (to be confirmed), and procurement of a construction contractor will be completed in Quarter 4 to sequence the initiation of construction activity for April 1.

C4.8.2 Schedule Constraints and Assumptions

The following constraints and assumptions were taken into account in the development of this schedule:

- Reporting is expected to extend an additional 60 to 90 days following fieldwork.
- It is assumed design work will continue during the client design review periods to facilitate design completion before the construction field season. It is assumed that construction would not occur until the second field season, occurring after the pre-design field investigation, because of the time required to complete the design.
- It is assumed that mobilization needs to occur in April (before freshet). This should be a reasonable assumption given the reliable access to work areas and the lack of high flow issues at the CVD location.
- Daylight hours in summer allow for extended work shifts.
- Workers can work a maximum of 28 days before obtaining 7 days off (per Yukon Workers' Compensation Health and Safety Board limits).
- Any required permits or natural heritage and archaeology evaluations will not impact the schedule for construction.
- The construction season at the site is 6 months in length and extends from April 1 to September 30.

To the extent possible, this schedule has been developed in consideration of the constraints of the fiscal year funding requirements. In instances where tasks are shown as occurring across this date, it is understood that additional contracting requirements may be necessary.

C4.9 Cost Estimate

The cost opinions presented are based on information and experience from visits to the site, discussions with the current Care and Maintenance Contractor, actual costs from working onsite during the CH2M HILL 2012 Field Investigation (late May to early October 2012), and on concept designs developed by RGC (2006a) and others' work cited in the references. Cost opinions are rough order-of-magnitude, with an expected accuracy of +100 to -50 percent (Class 5). Costs have not been escalated and are presented as 2012 costs.

C4.9.1 Basis of Estimate

The following points represent the basis upon which the provided cost estimate has been developed:

- The estimate uses 2012 CH2M HILL Master Service Agreement rates for professional services.
- Escalating factors impacting productivity have been applied, where appropriate, to field exploration costs and construction estimates for working conditions, access restrictions, site limitations, and logistics anticipated for the implementation of the described work package. These factors are based on actual measures recorded during the 2012 Field Implementation program at the site.
- The construction cost estimate is based on the scope of work presented in the CVD SIS Conceptual Design, Section C4.3.1, of this appendix.
- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document to account for items that may change between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors.

- Construction management and construction procurement costs are estimated based on the scope of work presented in the CVD SIS Conceptual Design, Section C4.3.1, of this appendix.
- CH2M HILL Heavy Construction Systems Specialists, Inc. estimating system was used to build up the construction cost estimate with identified activities for construction.
- Unit rates for equipment and craft labor were localized to Yukon.
- Production factors for current market conditions and location of the site were used in the buildup of the estimate.
- Markups were applied from historical experience with similar construction works.

C4.9.2 Supporting Documentation

The following sources of information were used in developing the cost estimates:

- Canadian Blue Book adjusted for Yukon project site location (central Yukon)
- 2012 Canadian labor rates from CH2M HILL Master Service Agreement (C00012050)
- 2012 Yukon fair wage schedule for craft labor
- Historical cost data and estimator judgment
- Productivity adjusted to account for current field conditions
- Association of Professional Engineers of Ontario (PEO). 2001. Guideline Schedule of Fees for Engineering Services.
- Association of Professional Engineers and Geoscientists Manitoba (APEGM). 2011. Guide for the Engagement of a Consulting Professional Engineer.
- Consulting Engineers of British Columbia and Professional Engineers and Geoscientists (CEBC/APEG). 2009. Budget Guidelines for Consulting Engineering Services

C4.9.3 Cost Estimate

The total cost estimate for the CVD work package described herein equals $969,000. This estimate is summarized with construction and professional services costs in Tables C4-2 and C4-3, respectively. Table C4-2 includes construction of enabling work only.

TABLE C4-2
Cross Valley Dam SIS – Construction Estimate
Faro Mine Remediation Project

02.02.01.02.01	Labour	Expenses/Materials	Equipment	Subcontractor	Markup	Total[a]
TOTAL	$109,000	$111,000	$26,000	$67,000	$63,000	$374,000

[a] The costs presented in this report are contractor direct costs.

Attachment C4-1, *Construction Estimate Summary*, provides a summary of the task descriptions plus markup by the contractor to obtain a “bid or tender” cost estimate.

TABLE C4-3
Cross Valley Dam SIS – Professional Services Estimate
Faro Mine Remediation Project

WBS	Phase	Labour [a]	Expense	Subcontractor	Total
01.02.02.01.03	Advanced Design (60%) [b]	$84,000	$4,000	-	$88,000
01.02.02.01.04	Detailed Design (90%) [b]	$224,000	$13,000	-	$237,000
01.02.02.01.05	Final Design (100%)[b]	$148,000	$13,000	-	$161,000
02.02.01.01.01	Procurement	$28,000	$5,000	-	$33,000
02.02.01.02.02	Construction Management [c]	$36,000	$10,000	$30,000	$76,000
	TOTAL	$520,000	$45,000	$30,000	$595,000

[a] Estimated based on assumed full time equivalents and materials cost.

[b] Design cost noted equals 12 percent of the estimated total construction cost, without contingency, for installation of the SIS including pipelines and pumps provided in Attachment C4-1; 30% design costed at 3.6% of construction costs, 60% design costed at 3.36% of the construction costs, 90% design costed at 3% of construction costs, 100% design costed at 2.04% of construction costs.

[c] Construction management construction oversight and field testing.

The component costs of this professional services estimate are summarized in Attachment C4-2, *Professional Services Estimate.*

C4.9.4 Assumptions

The following assumptions were made during the preparation of this cost estimate:

- The estimated costs for engineering services were developed based on review of provincial association guidelines and recommendations for determining engineering fees. These included publications from the Consulting Engineers of British Columbia and Professional Engineers and Geoscientists (CEBC/APEG, 2009), the Association of Professional Engineers of Ontario (PEO, 2001), and the Association of Professional Engineers and Geoscientists Manitoba (APEGM, 2011).
- The cost estimate does not include cost consideration for administration of the work package (i.e., statusing, coordination and invoicing and management) which will vary throughout the duration of the work depending on whether the work focus is construction or professional services.
- Work described in the work package is a stand-alone effort. No accommodation or economy of scale with combining different work packages has been used in developing this opinion of cost.
- The conceptual design assumes 10 extraction wells spaced 55 m apart. This design may undergo minor modifications based on the interpretation of the data recently collected during the CVD aquifer testing program and the results of seismic profiling.
- The total flow rate for the interception and conveyance system was assumed to be 70.3 L/sec (1,114 USgpm). This flow rate may be adjusted during detailed design based on the analysis of both aquifer test data and seismic profiling.
- The construction cost estimate only includes costs associated with the construction of the enabling works. It does not include costs associated with the construction of the SIS or the conveyance pipeline system.
- No royalties are included.
- The construction season has been assumed to be a maximum of 6 months available in the field from April 1 through September 30.
- 2012/2013 Government of Yukon per diem and lodging rates have been applied. Housing and lodging are available in the Faro to accommodate the personnel required to complete the work, or the allowed per diem and lodging costs are sufficient for camp set up and operation.

- Nineteen percent markup has been applied to contractor construction costs consisting of home office support, overhead, and profit (10 percent overhead; 9 percent profit).
- Bonds and insurance have been included at 3 percent of construction costs.

C4.9.5 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are nonbinding and are provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, schedule implementation, and other variable factors. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding needs must be carefully reviewed before making specific financial decisions related to proper project evaluation and adequate funding.

C4.10 Works Cited

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Figures



NOTES:

1. Topography And Aerial Photo Prepared From Lidar Dated 10-03-11
   Horizontal Datum: NAD83 CSRS
   Vertical Datum: CGVD28 (HTv2.0)
2. Contour Interval shown is 5 metres.
3. New Sea-Can Structure with Insulated / Heated / Vetilated Sea-Can, Type Structure For Housing Control / Power Equipment Of New Pump Station.

FIGURE C4-1

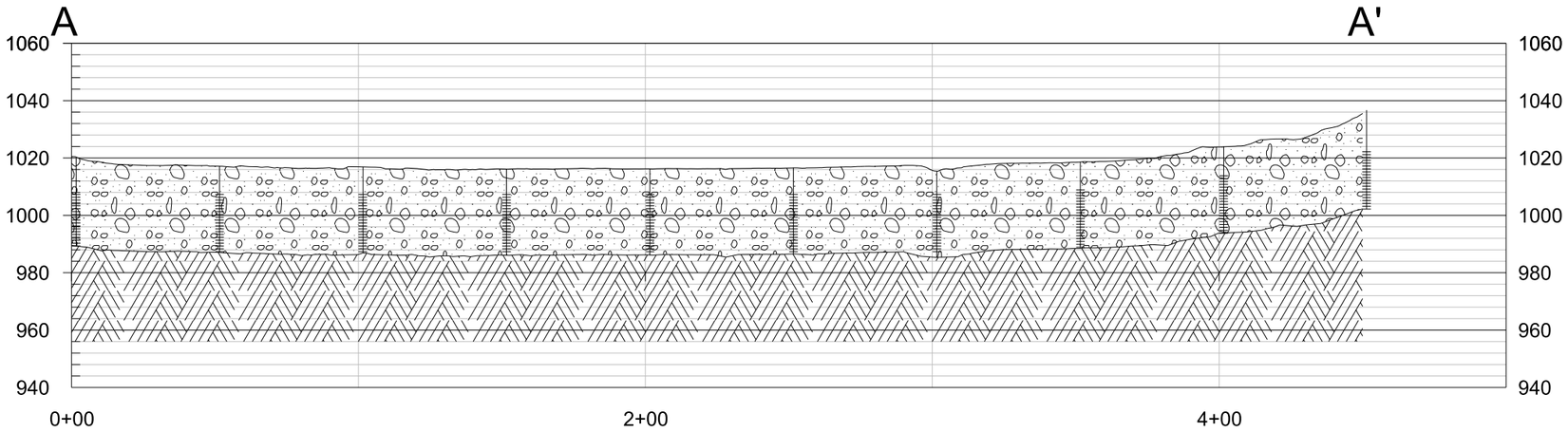
Cross Valley Dam Seepage Interception System

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CROSS VALLEY DAM SEEPAGE INTERCEPTION SECTION



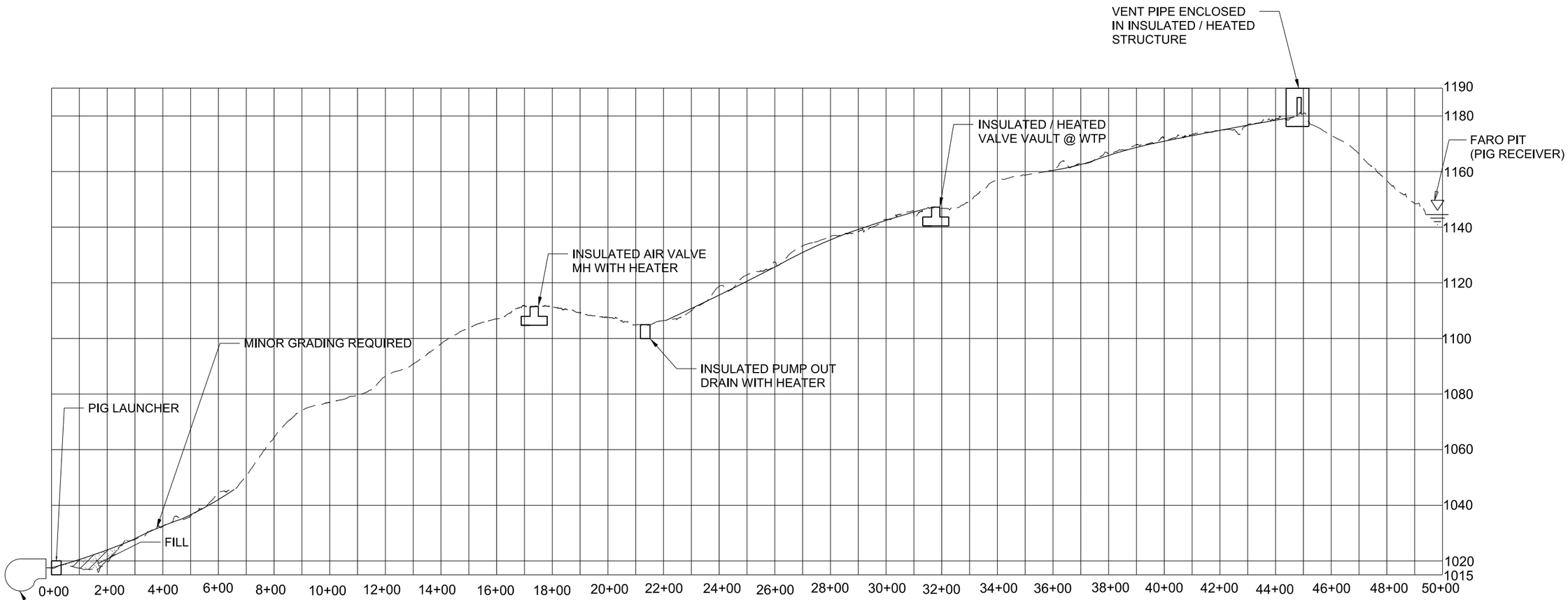
LEGEND

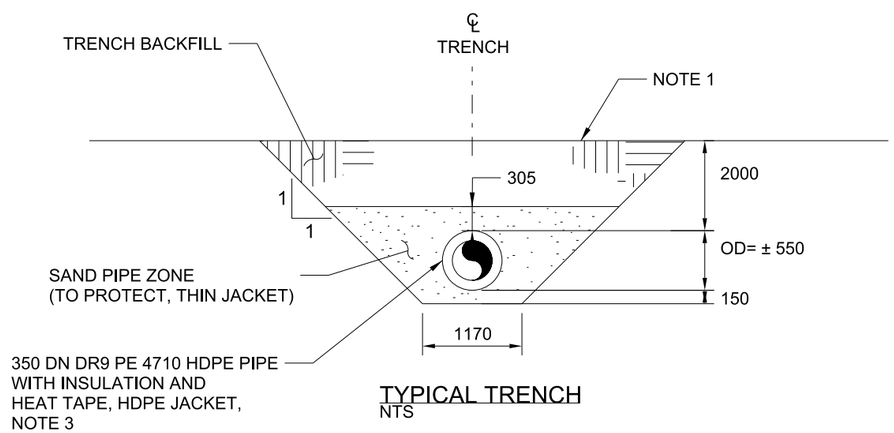
- ALLUVIUM
- WEATHERED BEDROCK
- SIS EXTRACTION WELL

FIGURE C4-2
Cross Valley Dam Seepage Interception System Section

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TYPICAL TRENCH
NTS

NOTES:

1. ASSUME CLSM TRENCH PLUG (FROM 305 BELOW PIPE TO EXISTING SURFACE) LOCATED EVERY 305 METER TO PREVENT SAND WASH OUT (APPROXIMATELY 15 TRENCH PLUGS).
2. SEE PLAN FOR LOCATION OF INSULATED/HEATED/VENTILATED ELECTRICAL EQUIPMENT STRUCTURE.
3. INSTALL 1050 DN DR 17 HDPE CASINGS AT ALL ROAD UNDERCROSSINGS.

FIGURE C4-3
Cross Valley Dam Seepage Interception System Pipe Profile

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© CH2M HILL

N

0 300 600

METRES

FARO PIT

CROSS VALLEY DAM

INTERMEDIATE DAM

INTERMEDIATE IMPOUNDMENT

SECONDARY IMPOUNDMENT

ORIGINAL IMPOUNDMENT

ROSE CREEK DIVERSION CHANNEL

SPUR PIPELINE

MILL/WATER TREATMENT PLANT

EMERGENCY TAILINGS AREA

CH12-204-MW006B
CH12-204-MW006A
CH12-204-MW005A
CH12-204-MW005B
CH12-204-MW001A
CH12-204-MW002B
CH12-204-MW001B
CH12-204-MW003B
CH12-204-MW004B
CH12-204-MW004A
P09-C1
NW-1
PW-1
P05-02
P09-C2
MW2
PW2
P09-C3
P01-03
P01-04
P03-06
X24
X25

LEGEND

- Anticipated Conveyance Pipeline/Header Pipeline
- Existing Well
- SIS Extraction Well
- Existing Water Courses

NOTES:

1. Topography And Aerial Photo Prepared From Lidar Dated 10-03-11
   Horizontal Datum: NAD83 CSRS
   Vertical Datum: CGVD28 (HTv2.0)
2. Contour Interval shown is 5 metres.

FIGURE C4-4

Cross Valley Dam
Seepage Interception System
Pipe Routing

CH2MHILL

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Attachment C4-1
Construction Estimate Summary

ATTACHMENT C4-1

Construction Cost Estimate Summary

Faro Mine Remediation Project - Cross Valley Dam Seepage Interception System Medium Term Plan

Bid Item	Description	Units	Quantity	Labour	Permanent Material	Construction Material	Equipment Operation Expense	Subcontractors	Co Equipment	Per Diem	Bond/ Insurance	Direct Total	Markup	Unit Price	Total
10	MOBILIZATION	LS	1	$ 11,604	$ -	$ 3,727	$ 6,239	$ -	$ 4,934	$ -	$ -	$ 26,504	$ 5,325	$ 31,829	$ 31,829
20	BONDS & INSURANCE	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,290	$ 10,290	$ 2,067	$ 12,357	$ 12,357
30	SUBMITTALS	LS	1	$ 13,366	$ -	$ 3,900	$ -	$ -	$ -	$ -	$ -	$ 17,266	$ 3,469	$ 20,735	$ 20,735
40	SURVEY	LS	1	$ -	$ -	$ -	$ -	$ 14,000	$ -	$ -	$ -	$ 14,000	$ 2,813	$ 16,813	$ 16,813
50	QC	LS	1	$ -	$ -	$ -	$ -	$ 3,000	$ -	$ -	$ -	$ 3,000	$ 603	$ 3,603	$ 3,603
60	INSTALL SWPPP ELEMENTS	LS	1	$ 3,405	$ -	$ 1,646	$ 685	$ -	$ 389	$ -	$ -	$ 6,124	$ 1,230	$ 7,355	$ 7,355
70	PIONEER & ACCESS	LS	1	$ 25,761	$ -	$ 1,188	$ 15,305	$ -	$ 15,082	$ -	$ -	$ 57,336	$ 11,519	$ 68,855	$ 68,855
80	DRILL 12" DIAM BOREHOLES (10 EA)	M	350	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
90	INSTALL 8" DIAM WELLS	M	350	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
100	TEST& DEVELOP WELLS	EA	10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
105	PADS & BOLLARDS	EA	10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
110	INSTALL PUMPS	EA	10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
115	POWER TO PUMPS	LS	1	$ -	$ -	$ -	$ -	$ 50,000	$ -	$ -	$ -	$ 50,000	$ 10,045	$ 60,045	$ 60,045
125	INSTALL HEADER	M	400	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
135	14" DIAM LINE TO WTP/FARO PIT SPLIT	M	3,280	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
140	14" DIAM LINE TO WTP	M	180	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
145	14" DIAM LINE TO FARO PIT	M	1,660	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
150	PIG LAUNCHER & RETRIEVE STATIONS	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
155	INSULATED AIR VALVE, HEATED MH	EA	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
160	INSULLATED HEATED PUMP OUT DRAIN	EA	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
165	INSULLATED VALVE VAULT WTP	EA	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
170	VENT PIPE ENCLOSURE HEATED	EA	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
200	DEMOBILIZE	LS	1	$ 9,426	$ -	$ 2,642	$ 5,329	$ -	$ 4,055	$ -	$ -	$ 21,452	$ 4,310	$ 25,762	$ 25,762
210	CLOSURE REPORTS	LS	1	$ 1,163	$ -	$ 375	$ -	$ -	$ -	$ -	$ -	$ 1,538	$ 309	$ 1,847	$ 1,847
400	PER DIEM	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ 43,200	$ -	$ 43,200	$ 8,679	$ 51,879	$ 51,879
800	CONTINGENCY	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
900	FIELD GENERAL CONDITIONS	LS	1	$ 43,818	$ -	$ 5,909	$ 2,542	$ -	$ 1,143	$ 6,883	$ 754	$ 61,049	$ 12,265	$ 73,314	$ 73,314
	TOTAL			**$ 108,542**	**$ -**	**$ 19,386**	**$ 30,100**	**$ 67,000**	**$ 25,604**	**$ 50,083**	**$ 11,044**	**$ 311,759**	**$ 62,634**		**$ 374,393**

Notes:

" = inch
DIAM = diameter
EA = each
LS = lump sum
QC = quality control
m = metre(s)
m^2 = square metre(s)
m^3 = cubic metre(s)
MH = manhole
WTP = water treatment plan

Attachment C4-2
Professional Services Estimate

ATTACHMENT C4-2

Professional Services - Class 5 Estimate

Faro Mine Remediation Project - Cross Valley Dam SIS Medium Term Plan

	Task Name/Subtask/Activity	Principal	Senior III	Mid III	Junior II	Clerical	Labour Cost	Travel ($)	Expenses ($)	Subcontracts ($)	Markup	Total ($)
	Labor Rates	**$232**	**$196**	**$154**	**$103**	**$77**						
WBS	**Cross Valley Dam Seepage Interception System**											
01.02.02.01.03	**Advanced Design (60 %)**	18	129	164	204	109	84,134	3,333	1,000			88,467
01.02.02.01.04	**Detailed Design (90 %)**	48	343	436	544	291	223,965	10,000	3,000			236,965
01.02.02.01.05	**Final Design (100 %)**	32	227	289	360	192	148,136	10,000	3,000			161,136
	Subtotal Design	**98**	**698**	**889**	**1,107**	**593**	**456,235**	**23,333**	**7,000**			**486,568**
02.02.01.01.01	**Procurement**	6	43	55	68	37	28,154	3,000	1,000		895	33,049
02.02.01.02	**Construction Activities**											
02.02.01.02.02	Construction Management	8	55	70	87	46	35,720	6,000	1,500	30,000	2,647	75,867
	Subtotal Construction	**8**	**55**	**70**	**87**	**46**	**35,720**	**6,000**	**1,500**	**30,000**	**2,647**	**75,867**
	Grand Total	**112**	**796**	**1,013**	**1,262**	**675**	**520,109**	**32,333**	**9,500**	**30,000**	**3,541**	**595,483**

Appendix C5
Vangorda Diversion

APPENDIX C5

Vangorda Creek Diversion

The existing Vangorda Creek Diversion (VCD) diverts stream flow from Vangorda Creek around the Vangorda Pit. The existing diversion, originally designed with a capacity to divert the 100-year return period storm event, is located immediately adjacent to the pit. While the constructed works have been generally successful at diverting stream flow around the pit, the conveyance structure, consisting of half-round corrugated steel pipe (CSP), has failed at numerous locations, has deteriorated because of corrosion, and has been damaged during removal of ice and snow during winter maintenance.

The three primary performance objectives of the design include conveying diverted stream flow away from the pit in a water tight structure, reducing seepage from the diversion into the pit, and reducing instability and raveling of the pit wall. The VCD has experienced leakage without undue seepage to the Vangorda Pit wall, and raveling has not occurred to date. However, potential raveling of the Vangorda Pit adjacent to the diversion and potential failure of the steep slope above the existing diversion places the diversion at risk for failure. Failure would result in the Vangorda Creek being discharged into the Vangorda Pit, the pit filling, and contaminated pit water discharging to the environment.

This work package consists of replacing the existing Vangorda Creek Diversion with a new diversion, to be located approximately 500 metres (m) north of the existing alignment.

C5.1 Current Condition

The Vangorda Pit, developed in the early 1990s, required diverting Vangorda Creek around the perimeter of the pit to limit the amount of runoff that entered the pit; the approximately 1,200-m-long VCD was constructed in 1991 around the northern perimeter of the pit (SRK, 2010a). The diversion was realigned between 1991 and 1992 because of the changing footprint of the Vangorda Pit. Since that time, upgrades and maintenance to the VCD have occurred, but the design and alignment has not changed (SRK, 2010b).

The VCD, shown in Figure C5-1, has, since construction, generally been successful in conveying Vangorda Creek flows around the pit during normal runoff events (SRK, 2010a). The VCD has, however, experienced two flood events within the last 10 years, including an event with a magnitude equivalent to the estimated 100-year return period in June 2004 and an event in June 2012 that caused the water levels in the diversion to overtop the diversion (CH2M HILL, 2012a). The June 2004 event resulted in damage to the VCD requiring extensive repair. In addition, the VCD has experienced slope failures and ice buildup impacts that have compromised the diversion and resulted in significant maintenance requirements.

The April 2010 SRK Design Report (SRK, 2010a) and 1990 original design report (SRK, 1990) identify the following key design parameters for the existing diversion:

- Accommodate a 100 year event (peak instantaneous flow of 10 cubic m per second [m^3/s])
- Reasonably watertight with a half-round CSP
- Headworks designed to retain water to the 1:100 year event elevation of 1,168 m (allowing 1 m of freeboard), dam crest elevation was constructed to 1,169 m
- 1,500-millimetre (mm)-diameter CSP designed to convey flow through the upstream collection dam
- Diversion channel design with a CSP flume in a rip rap-lined trapezoidal section with a longitudinal slope of 0.5 percent, although as-built construction is steeper than 0.5 percent
- The VCD currently consists of the following components (SRK, 2010a):
- Headworks comprising an 8-m-high earth dam and a 1.5-m-diameter culvert within the dam that directs the water into an 800-m-long, 2,400-mm-diameter, half-round CSP culvert section

- A plunge pool or stilling basin located at the end of the culvert sections
- A 3,000-mm-diameter drop-box structure, a 2,000-mm CSP culvert, and a 1-600-mm outfall culvert conveying the discharge from the plunge pool beneath the Haul Road and back into Vangorda Creek
- Two 1,000-mm-diameter culverts at the headworks to provide an emergency spillway (installed 2005) to the Vangorda Pit for events that exceed the 100-year event

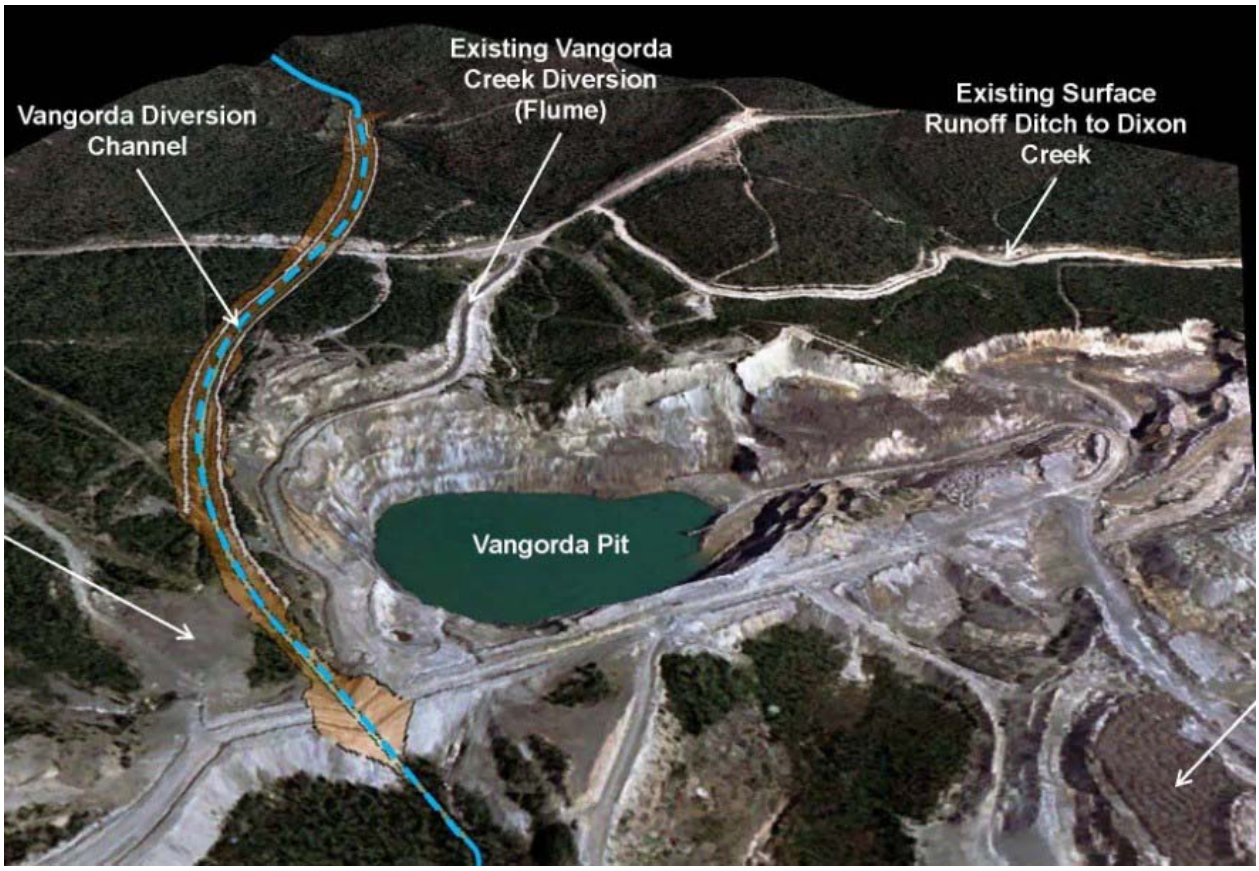


FIGURE C5-1
Existing and Proposed Alignment of Vangorda Creek Diversion
Faro Mine Remediation Project

In June 2004, a storm event occurred, with a magnitude equivalent to the estimated 100-year return period event, which resulted in damage to the conveyance system and nearly overtopped the VCD dam at the head of the diversion (SRK, 2010b). As a result, an overflow spillway was installed in the VCD dam in 2005 to redirect water into Vangorda Pit if this water level is reached again.

The flume structure (2,400-mm-diameter CSP) was designed to accommodate the 1:100-year storm event, with a peak instantaneous flow of 10 m^3/s (SRK, 2010a). The water level in the flume is expected to rise to a maximum depth of 0.73 m during this peak discharge (SRK, 2010a).



FIGURE C5-2
Existing Vangorda Creek Diversion During June 2012 Flood Event
Faro Mine Remediation Project

In June 2012, another significant rainfall event occurred at the Vangorda site. The water level in the flume in June 2012, shown in Figure C5-2, appears to have breached the top of the half-round CSP culvert in places; therefore, it is assumed that the June 2012 event was greater than a 1:100-year event; however, the flow rate and magnitude of the event expressed in terms of a specific return period event are not known at this time. Figure C5-3 shows the condition of the VCD after the June 2012 flood event. Insufficient field data is available for identifying specific damage related to this specific flood event.

Long term management of VCD was recognized as an essential component of the final closure plan for the Vangorda Pit, Little Creek Pond and Vangorda Waste Dump (SRK, 2003). In 2003, SRK Consulting completed an assessment of alternative designs for realigning or upgrading the VCD. After further discussion occurred regarding the alternative designs, SRK put forward the preferred Vangorda Creek Diversion realignment design (SRK, 2010a). This preferred design was not approved for construction because of a number of uncertainties that remained concerning the design. There are, therefore, still a number of elements of that design that require further investigation, particularly the channel alignment, capacities and the energy dissipation options.

The recent June 2012 rainfall event led to a re-prioritization of the Vangorda Creek Diversion realignment design and construction because of the significant risks and impacts associated with overtopping on the VCD. The current condition of the VCD, the uncertainties associated with the 2010 preferred diversion design, and the additional scope required to complete a design for the VCD that address the uncertainties and meet the current required design criteria are summarized in the following sections.

Ice buildup has also caused damage to the existing VCD. Icing conditions and uplift of the CSP flume in diversion sections with low gradients have chronic maintenance issues (SRK, 2010a). The diversion flume is subjected to pressure from ice build-up, and many of the seals between the flume sections have been damaged. Leakage from the Vangorda Creek Diversion is either collected by a seepage collection system and

diverted back to the Vangorda Creek or allowed to flow to the Vangorda Pit. Although this accommodation has proven effective to date, there is potential for seepage to cause additional stability issues (SRK, 2010b). The risk of rock fall from adjacent vertical slopes, as occurred in 1999 (SRK, 2010b) and required emergency replacement of approximately 39 m of the flume, further highlights the need for upgrades.



FIGURE C5-3
Existing Vangorda Creek Diversion Following June 2012 Flood Event
Faro Mine Remediation Project

C5.1.1 Justification for Action

The VCD has been maintained, since the cessation of mining in 1998, to limit the flow of runoff to the Vangorda Pit while a long-term management plan for the diversion is developed. The following are current conditions and failure potentials:

- Existing flume structures are failing, potentially resulting in reduction in flow capacity, plugging, erosion of roadway, and discharge to Vangorda Pit.
- Drop structures at roadways are at risk of plugging and overtopping.
- Diversion does not have capacity to convey peak flow in excess of 10 m^3/s, which is the 100-year design peak flow event. Flows of 10 m^3/s or more have occurred twice since 2004.
- Location adjacent to Vangorda Pit - slopes above and below at risk for failure.
- Ice damage is increasing the instability of the diversion structures.
- Pit wall instability threatens the VCD.
- Stability of the diversion is a requisite for sustainable support of downstream aquatic habitat provided by the Vangorda flows.
- Instability of the diversion represents a potential health and safety risk to site personnel engaged in infrastructure maintenance.

The existing diversion has experienced plugging and overtopping. In 1999, there was a rock fall near a vertical slope, which overlooks one section of the flume that necessitated emergency replacement of approximately 39 m of the flume (SRK, 2010b). In addition, the existing diversion runs adjacent to the Vangorda Pit, where there is risk of slope instability above and below the diversion around the pit. Analyses completed by CH2M HILL (CH2M HILL, 2012a) show that if the VCD were to breach at the initiation of sustained peak flows equal to the design capacity of the VCD (i.e., 10 m^3/s), there is a danger of the Vangorda Pit reaching the water level elevation at which overflow would occur within 7 days. The duration over which the VCD was flowing full during the 2012 event is not known nor are there flow monitoring records that quantify the length of time over which peak flows were sustained. The duration of such a flood event is directly dependent on a number of meteorological factors (e.g., snowpack depth, temperature, rainfall, or antecedent soil moisture). Risks to the receiving watercourse (original alignment of Vangorda Creek) are significant should a breach occur and, as such, design and construction of the upgraded VCD has been made a priority.

C5.1.2 Description of Scope

The proposed Vangorda Creek Diversion design includes the following:

- The Vangorda Creek Diversion will be realigned north of the existing diversion.
- Design will accommodate a 500-year flood (preliminary estimate of peak instantaneous flow equals 30 m^3/s).
- Flows greater than a 500-year return period (> 30 m^3/s) will be diverted to the Vangorda Pit.
- A fuse plug, or other structure, will be included in the design of the new headworks dam embankment, such that water will directly flow to the new diversion channel and erode when overtopped during events greater than the peak of a 500-year return period event.
- The potential for climate change will be included in the evaluation of the design flood.
- New re-aligned diversion will use a stepped chute approach to energy dissipation and rip rap.
- The existing diversion will be abandoned in place, the corrugated liner will be removed.
- The uncertainties associated with this design require additional effort to further evaluate the proposed design alignment. Additional field investigations, hydraulic and physical model studies are required to develop a new VCD design.

C5.1.2.1 Conceptual Design (30 Percent) (WBS 01.02.03.01.02)

The conceptual design phase comprises the development of a more detailed system layout, process sizing, associated calculations, and information derived from early geotechnical explorations to evaluate foundation conditions and earth material types. During this phase, the associated risk identification, assessment, and mitigation elements will also be developed. This phase will typically engage all required engineering design disciplines (e.g., civil, mechanical, and structural) to execute the design. The results of this phase will be summarized and recorded in a conceptual design report that documents the criteria that will be used to complete the design. The conceptual design phase includes the following tasks:

- Identify major processes and equipment.
- Develop a list of required specifications.
- Complete alternative processes and economic evaluations, and select final equipment.
- Specify design criteria including construction materials.
- Estimate utility requirements (moving existing piping in spillway).
- Develop construction architectural and civil specifications to 30 percent completion.
- Complete preliminary sketches and schematics showing major components.
- Develop performance and construction specifications to 30 percent completion.

During conceptual design, most of the important project decisions are established so the opportunity to modify the project design after this stage becomes somewhat limited. As a result, value engineering needs to occur before this phase is complete. Initial constructability, operability, construction sequencing, staging, and traffic control elements will be considered during this phase.

C5.1.2.2 Advanced Design (60 Percent) (WBS 01.02.03.01.03)

During the project's advanced design phase, the basis of design report will be developed, and drawings and specifications further developed and refined. This phase will also engage other functional areas to participate in final constructability and operability reviews. The deliverables for this phase include the basis of design report, in- progress drawings, and a first draft of specifications or scopes or statements of work (SOWs). Deliverables will include the following:

- Site plans, including typical sections
- Preliminary equipment specifications (datasheets)
- Other overall layouts that may affect process design (e.g., hazardous area classification drawings, fire zone layouts, and safety components)

Drawings should be finalized before they are approved for design; that is, they should be complete apart from decisions that will be made during the detailed design phase (such as those regarding vents/drains and vendor data).

At the end of the advanced design phase, drawings and specifications will describe all project systems and layout requirements.

C5.1.2.3 Detailed Design (90 Percent) (WBS 01.02.03.01.04)

The project's detailed design phase results in 90-percent-complete detailed drawings and specifications. The scope of this phase includes the completion of the following, documented to the appropriate level of detail for the contracted design scope:

- Construction and tender documentation
- Engineering drawings
- Specifications
- Detailed SOWs
- Calculations

A final pre-tender review will occur for the detailed drawing and specification documents. Following this review, drawings and specifications will be further developed and refined. The key detailed design deliverables will be either bid- or tender-ready documentation for general bidding (as would be the case for a design/bid/build project) or construction-ready documentation for use in procuring subcontractors and equipment (as would be the case for a design/build project).

Detailed design documents at this phase will be virtually complete, apart from final coordination and quality assurance and quality control reviews, which occur before the documents are issued for tender.

C5.1.2.4 Final Design (100 Percent) (WBS 01.02.03.01.05)

The project's final design phase considers vendor and contractor constraints and requirements and results in a full set of detailed design drawings and specifications. Barring unforeseen conditions, documents will include everything necessary to procure the intended scope, quality, and design without requiring change orders during construction. These drawings will be used for "redline" revisions to produce as-built drawings at the end of construction.

C5.1.2.5 Procurement/Contracting (WBS 02.03.01.01.01)

For the Faro Mine Remediation Project, procurement will follow YG's established processes and will be supported by project management and construction management services. In this case, the procurement manager or construction manager (CM) will prepare specifications as part of the coordinated design process.

A procurement support team will assist YG with tender issues, tender evaluation (with emphasis on technical capabilities), and recommendations regarding contractors and subcontractors.

YG could use one of two approaches to deliver these projects. Each would minimize project costs and maximize effective implementation:

- **Option 1:** The CM is established as a separate contractual role, where YG issues the construction contract directly to the selected subcontractor(s).
- **Option 2:** The CM is established in a prime contractor position, and the CM issues the construction contract directly with the selected subcontractor(s). This is known as a construction management-at-risk (CM-at-risk) approach.

C5.1.2.6 Construction Activities (WBS 02.03.01.02)

Construction activities consist of physical construction and construction management. The scope of these activities is illustrated in the following sections.

Construction (WBS 02.03.01.02.01)

The VCD construction scope is described in Section C5.1.1, Scope of Work. The VCD construction work will include the following:

- Re-align the Vangorda Creek Diversion north of the existing diversion
- Accommodate a 500-year flood (with a peak instantaneous flow of 30 m^3/s)
- A fuse plug, or other structure, will be included in the design of the new headworks dam embankment, such that water will directly flow to the new diversion channel and erode when overtopped during events greater than the peak of a 500-year return period event
- New re-aligned diversion will use a stepped chute approach to energy dissipation and rip rap
- Abandon the existing diversion in place.

Construction Management (WBS 02.03.01.02.02)

The project's construction management task involves implementing the design plans and specifications, effectively managing the construction activities (main contractor and subcontractors), integrating activities, and maintaining the overall project schedule and budget. If YG holds the contract with the subcontractor, then YG is responsible for directing the work of the subcontractor. If the CM holds the contract with the subcontractor, then the CM is responsible for directing the work of the subcontractor.

The CM provides a single point of contact representing the owner's interests, first and foremost. The SOW includes the following range of responsibilities for the CM:

- Oversees that the project is built in general accordance with the design plans and specifications
- Oversees quality assurance and quality control
- Promotes health and safety plan compliance
- Adheres to environmental management plans during construction work
- Provides scheduling and cost control services
- Provides the client with advice regarding engineering aspects of contractual issues that may evolve during construction
- Provides adaptive management advice if unexpected circumstances arise
- Requires that as–built drawings are completed and that any defects or warranty aspects are addressed

Overall, comprehensive CM services are used to integrate the various facets of the construction process, planning, design, procurement, construction, and commissioning, and to provide standardized technical and management expertise on each project.

C5.1.2.7 Transition (WBS 02.03.01.03)

For the first year after completion of construction and initial "cold" commissioning (i.e., post substantial completion), certain activities will be required to ensure the operational effectiveness and efficiency of the system or upgrade. These activities include handover to the operational team and final commissioning/shakedown where the VCD system is observed to be operating with all components in place to ensure that the VCD functions during observed rainfall events as an integrated system. In the case of the VCD, rainfall events of a significant return event period will need to be observed to confirm operation. For the VCD, this is will ensure that system components are working as designed, and that conveyance capacities are adequate and energy dissipation and erosion control elements are performing as designed. This phase of commissioning will also extend to training operators and preparing operations manuals (including health and safety documentation).

During this period, there may also be a need for (1) improvements to any deficiencies in energy dissipation or erosion control components that are not performing as designed, (2) minor civil works to enhance operation or improve safety or operability of the system, (3) identification of additional maintenance needs, (5) SOP modification, and (6) any additional training needs identified during initial start-up. Despite design to 100%, these needs often only become evident once construction is complete or during the start-up and shakedown period.

C5.2 Work Breakdown Structure

As described, the Vangorda Creek Diversion work package includes work elements from across the overall work breakdown structure (WBS) (see Appendix F). See Appendix F that illustrates the WBS of the work associated with the Vangorda Creek Diversion.

C5.3 Uncertainties

The following uncertainties in the Vangorda Creek Diversion design have been identified:

- Steep topography, particularly at the lower end of the diversion, resulting in uncertainty related to energy dissipation and hydraulics; this can be addressed through physical model testing and 2-D modelling. Additional design effort will be required. Prior to detailed analyses, a workshop should be conducted to confirm design objectives and to give consideration to potential sources of damage and the associated repair requirements.
- Design of a dam and fuse plug at the headworks of the new diversion, which would erode under the design condition (i.e., 500-year flood), conveying flow to the existing diversion and eventually the open pit; further modelling and additional design effort will be required.
- Extent of upgrades required to the existing VCD to provide adequate capacity to convey the 200-year peak flow.
- Quantification of the magnitude of extreme flow events, which could impact the discharge of contaminated water and sediment to Vangorda Pit and to the environment. Additional effort to develop appropriate hydrologic conditions will be required.
- Poor bedrock could result in a diversion foundation failure during an extreme flow event, which can be addressed through foundation design or other means of energy dissipation. This will require a review of existing geotechnical information and additional geotechnical effort to characterize the conditions.
- Lack of locally available rip rap and large boulders could impact the construction because of additional costs for transportation or additional costs for design development using alternatives to rip rap. Two

potential borrow sources (one near the Grum Sulfide Cell and adjacent to the haul road) will be explored to determine if suitable materials are available. If not available, additional design effort will be required.

- Diversion flow path crossing the access road impacts the diversion implementation because of cost of culvert installation or loss of the haul road temporarily or long-term; construction optimization and sequencing will be important in addressing this uncertainty and will require additional detailed design effort.

The assessment and permitting approach requires further consideration and discussion between Canada, YG, and the appropriate regulatory agencies. As such, the Medium Term Plan does not include scope, schedule, or budget associated with assessment and permitting efforts.

C5.4 Technical Risk Register

The technical risks associated with the Vangorda Creek Diversion are detailed in the Technical Risk Register (Appendix G).

C5.5 Schedule Summary

See attached the Milestone Schedule (Appendix H) for the scope of work described previously. The basis for this schedule is the scope of work described in Section C5.1.2. This scope has been prepared as a feasibility-level design concept to support the Phase 2b work planning objectives. The schedule for this work package has been developed without consideration for overall sequencing and work planning and is considered a representation of the likely implementation scheduled primarily around fiscal year and construction season constraints.

C5.5.1 Milestone Schedule

The following is a general summary of the major milestones and salient components of the schedule.

The attached Gantt chart schedule (see Appendix H) illustrates that the work package will be initiated by the development of the 30% design. This assumes that the necessary data collection and design definition is completed prior to 2014/15.

The preparation of the final (100%) design and procurement of a construction contractor are all required to occur in the fourth quarter to sequence the initiation of construction activity for April 1.

Because of the nature of the work package being a surface water conveyance structure, it will be required that the performance monitoring period be at least one calendar year to allow for assessment under the full range of seasonal effects. It may be required that additional monitoring take place prior to any adaptation of the facility; however, for the purposes of this schedule, any modifications required after this initial phase are considered to fall under the maintenance portion of the WBS.

C5.5.2 Schedule Constraints and Assumptions

The following constraints and assumptions have been made in the development of this schedule:

- The construction of the Diversion is dependent on there being a potential rip rap and large boulder borrow source located within 5 kilometres (km) of the construction work. It is expected that this source will be confirmed through the field investigation. The source will be developed in advance of the primary construction work.
- The construction phase of the work package involves two major excavation elements: the common and steep section excavations. Logistics and coordination around access for these two areas is challenging, but for the purposes of this schedule, and to complete the construction on time, both excavations may occur simultaneously. This will require a double shift.
- The construction season at the site is 6 months in length and extends from April 1 to September 30.
- To the extent possible, this schedule has been developed in consideration of the constraints of the fiscal year funding requirements. In instances where tasks are shown as occurring across this date, it is understood that additional contracting requirements may be necessary.

C5.6 Cost Estimate

The cost opinions presented are based on information and experience from visits to the site, discussions with the current Care and Maintenance Contractor, actual costs from working onsite during the CH2M HILL 2012 Field Investigation (late May to early October this year) and from concept designs developed by SRK (2010a). Cost opinions are rough order-of-magnitude, with an expected accuracy of +100 to -50 percent (Class 5). Costs have not been escalated and are presented as 2012 costs. Construction costs include contingencies ranging between 10 and 20 percent, depending on the current level of project definition. These values are typical for rough order- of-magnitude-level estimates (Class 5) and account for items that may change between preparing the estimate and construction, such as changes in design criteria or site conditions, construction challenges, or other unknown factors.

C5.6.1 Basis of Estimate

The following points represent the basis upon which the provided cost estimate has been developed:

- The estimate uses 2012 CH2M HILL Master Services Agreement rates for professional services.
- Escalating factors impacting productivity have been applied where appropriate to field exploration costs and construction estimates for working conditions, access restrictions, site limitations, and logistics anticipated for the implementation of the described work package. These factors are based on actual measures recorded during the 2012 Field Implementation program at the site.
- The estimate assumes that large boulders and rip rap will be available at a borrow source within 5 km of the diversion location. The estimate includes exploration and development of the borrow source.
- Design costs (concept through final design) are presented as labour and expenses estimates developed as a percentage of construction costs (see table hereinafter for percentages).
- Additional field work is based on the current understanding of data gaps with an allowance for the need to gather additional geotechnical information should the alignment be adjusted as part of the re-design.
- Construction management and procurement and contracting costs are presented based on the scope of work presented in this Work Package, coupled with performance with other work packages. In order to maintain efficiency, a core construction management and procurement team has been estimated for each of those years as the team completes one construction package and contracts the next.
- Construction costs were based on the concepts presented in the Vangorda Diversion Design Report (SRK, 2010a), with a 40 percent escalation factor for quantities. This was because of the intent for the new channel to manage flows up to and including the 500-year flood on the new alignment (with a peak instantaneous flow of 30 m^3/s), which will require additional materials beyond those estimated by SRK.
- CH2M HILL HCSS (Heavy Construction Systems Specialists, Inc) estimating system was used to build up the construction cost estimate with identified activities for construction.
- Unit rates for equipment and craft labor were localized to Yukon Territory.
- Production factors for current market conditions and location of the site were used in the buildup of the estimate.
- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document, to account for items that may change between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors.
- Markups were applied from historical experience with similar construction works.

C5.6.2 Supporting Documentation

The following sources of information were used in developing the cost estimates:

- Canadian Blue Book adjusted for Yukon project site location (central Yukon)
- 2012 Canadian labor rates from CH2M HILL Master Services Agreement (C00012050)
- 2012 Yukon fair wage schedule for craft labor
- Historical cost data and estimator judgment
- Association of Professional Engineers of Ontario (PEO). 2001. Guideline Schedule of Fees for Engineering Services
- Association of Professional Engineers and Geoscientists Manitoba (APEGM). 2011. Guide for the Engagement of a Consulting Professional Engineer
- Consulting Engineers of British Columbia and Professional Engineers and Geoscientists (CEBC/APEG). 2009. Budget Guidelines for Consulting Engineering Services

C5.6.3 Cost Estimate

The total cost estimate for the Vangorda Creek Diversion work package described herein is $12,620,000. This estimate is summarized with construction and professional services costs provided in Tables C5-1 and C5-2, respectively.

TABLE C5-1
Vangorda Creek Diversion – Construction Estimate
Faro Mine Remediation Project

02.03.01.02.01	Labour	Expenses/Materials	Equipment	Subcontractor	Markup	Total[a]
TOTAL	$2,448,000	$3,442,000	$1,960,000	$147,000	$1,508,000	$9,504,000

[a] The costs presented in this report are contractor direct costs.

Attachment C5-1, *Construction Estimate Summary*, shows a summary of the task descriptions plus markup by the contractor to get to a "bid or tender cost estimate."

TABLE C5-2
Vangorda Creek Diversion – Professional Services Estimate
Faro Mine Remediation Project

WBS	Phase	Labour [a]	Expense	Subcontractor	Total
01.02.03.01.02	Conceptual Design (30%) [b]	$329,000	$13,000	-	$342,000
01.02.03.01.03	Advanced Design (60%) [b]	$306,000	$13,000	-	$319,000
01.02.03.01.04	Detailed Design (90%) [b]	$272,000	$13,000	-	$285,000
01.02.03.01.05	Final Design (100%)[b]	$181,000	$13,000	-	$194,000
02.03.01.01.01	Procurement	$193,000	$6,000	-	$199,000
02.03.01.02.02	Construction Management	$1,247,000	$430,000	-	$1,677,000
02.03.01.03	Transition [c]	$15,000	$5,000	$80,000	$100,000
	TOTAL	$2,543,000	$493,000	$80,000	$3,116,000

[a] Estimated based on assumed full time equivalents and materials cost.

[b] Design cost noted is a percentage of estimated capital construction costs, i.e., 30 % design costed at 3.6 % of construction costs, 60 % design costed at 3.36 % of the construction costs, 90 % design costed at 3 % of construction costs, 100 % design costed at 2.04 % of construction costs.

[c] Transition estimated at 1 % of construction cost. Includes performance monitoring, adaptation design and construction

The component costs of this professional services estimate are summarized in Attachment C5-2, *Professional Services Estimate.*

C5.6.4 Assumptions

The following assumptions were made during the preparation of this cost estimate:

- The estimated costs for engineering services were developed based on review of provincial association guidelines and recommendations for determining engineering fees. These included publications from the Consulting Engineers of British Columbia and Professional Engineers and Geoscientists (CEBC/APEG, 2009), the Association of Professional Engineers of Ontario (PEO, 2001), and the Association of Professional Engineers and Geoscientists Manitoba (APEGM, 2011).
- The cost estimate does not include cost consideration for administration of the work package (i.e., statusing, coordination and invoicing and management) which will vary throughout the duration of the work depending on whether the work focus is construction or professional services.
- The cost estimate does not include any markups to subcontractor construction costs.
- Work described in the work package is a standalone effort. No accommodation or economy of scale with combining different work packages has been used in developing this opinion of cost.
- Modifications or upgrades to existing VCD are not included in this estimate, as the revised design will take into account the 500-year flood scenario.
- Granular materials are available and can be developed within the project boundaries. No royalties are included.
- Construction season has been assumed to be a maximum of 6 months in the field from May through October.
- Quarry borrow proving and development is assumed to occur the year prior to construction of the new diversion channel.
- Construction work for the quarry borrow is scheduled to be performed in one construction season and construction for the new diversion channel alignment is to be performed the following construction season.
- Schedule assumes that access to both the general work areas and the steep slope work area of the new diversion channel can be accomplished in parallel, thus allowing for one construction season for the new diversion channel to be constructed.
- Schedule presented assumes overlapping of work items and accelerated schedule with available construction season daylight hours to accomplish the quarry borrow and new diversion channel alignment work in two separate construction seasons.
- 2012/13 YG per diem and lodging rates have been applied. Available housing and lodging are available in the Town of Faro to accommodate all personnel required to accomplish the work or the allowed per diem and lodging costs are sufficient to for camp setup and operation.
- Nineteen percent markup has been applied to contractor construction costs consisting of home office support, overhead, and profit (10 percent overhead, 9 percent profit).
- Bonds and Insurance have been included at 3 percent of construction costs.
- The cost estimate does not include a contingency to account for scope change, adverse weather impacts, and actual conditions encountered. Required contingencies are provided elsewhere in the planning document.

C5.6.5 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are nonbinding and provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, schedule implementation, and other variable factors. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions related to proper project evaluation and adequate funding.

C5.7 References

Association of Professional Engineers of Ontario. 2001. *Guideline Schedule of Fees for Engineering Services.*

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SRK Consulting Canada Inc. (SRK). 2010a. *Faro Mine Complex Vangorda Creek Diversion Design Report – Draft*. Prepared for Indian and Northern Affairs Canada and Yukon Government. April.

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SRK Consulting Canada Inc. (SRK). 2009. Vangorda Creek Diversion Geotechnical Investigation. Prepared for Indian and Northern Affairs Canada and Yukon Government. August.

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SRK Consulting Canada Inc. (SRK). 1990. Geotechnical/Hydraulic Design Vangorda Creek Diversion Facility Vangorda Plateau Development. Prepared for Curragh Resources Inc.

Attachment C5-1
Construction Estimate Summary

ATTACHMENT C5-1

Construction Cost Summary

Faro Mine Remediation Project - Vangorda Diversion Medium Term Plan

BI #	BI Description	Units	Quantity	Labour	Permanent Material	Construction Material	Equipment Operation Expenses	Subcontractors	Construction Equipment	Per Diem	Bond/ Insurance	Direct Total	Markup	Unit Price	Total
10	MOBILIZATION	LS	1	$ 95,307	$ -	$ 22,999	$ 48,216	$ -	$ 72,027	$ -	$ -	$ 238,549	$ 44,969	$ 283,518	$ 283,518
20	BONDS & INSURANCE	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 261,391	$ 261,391	$ 49,275	$ 310,667	$ 310,667
30	SUBMITTALS	LS	1	$ 15,589	$ -	$ 3,900	$ -	$ -	$ -	$ -	$ -	$ 19,489	$ 3,674	$ 23,163	$ 23,163
40	SURVEY	LS	1	$ -	$ -	$ -	$ -	$ 90,000	$ -	$ -	$ -	$ 90,000	$ 16,966	$ 106,966	$ 106,966
50	QC	LS	1	$ -	$ -	$ -	$ -	$ 30,000	$ -	$ -	$ -	$ 30,000	$ 5,655	$ 35,655	$ 35,655
60	INSTALL SWPPP ELEMENTS	LS	1	$ 18,726	$ -	$ 12,178	$ 3,766	$ -	$ 3,958	$ -	$ -	$ 38,628	$ 7,282	$ 45,910	$ 45,910
70	PIONEER & ACCESS	LS	1	$ 15,456	$ -	$ 1,584	$ 9,183	$ -	$ 16,741	$ -	$ -	$ 42,965	$ 8,099	$ 51,064	$ 51,064
80	SITE PREPARATION	LS	1	$ 98,795	$ -	$ 10,208	$ 50,524	$ -	$ 101,540	$ -	$ -	$ 261,066	$ 49,214	$ 310,281	$ 310,281
90	EXCAVATE CHANNEL-COMMON EXCV	m^3	174,462	$ 345,626	$ -	$ 36,603	$ 228,815	$ -	$ 496,505	$ -	$ -	$ 1,107,549	$ 208,786	$ 8	$ 1,316,335
100	EXCAVATE CHANNEL-ROCK	m^3	35,060	$ 171,907	$ -	$ 142,510	$ 105,179	$ -	$ 209,501	$ -	$ -	$ 629,097	$ 118,592	$ 21	$ 747,689
110	INSTALL 4.2-m CULVERT -HAUL RD	m	125	$ 93,558	$ 31,250	$ 10,016	$ 48,617	$ -	$ 103,051	$ -	$ -	$ 286,491	$ 54,007	$ 2,724	$ 340,498
120	CONSTRUCT ACCESS ROADS	m	3,360	$ 157,759	$ 44,375	$ 27,894	$ 89,656	$ -	$ 172,705	$ -	$ -	$ 492,389	$ 92,821	$ 174	$ 585,210
130	PLACE LINER OVER SAND SECTION	m^2	3,360	$ 6,810	$ 22,680	$ 792	$ 1,369	$ -	$ 1,439	$ -	$ -	$ 33,090	$ 6,238	$ 12	$ 39,328
140	RIP RAP CHANNEL	m^3	11,956	$ 128,930	$ -	$ 13,613	$ 57,762	$ -	$ 123,350	$ -	$ -	$ 323,654	$ 61,013	$ 32	$ 384,667
150	STEEP CHANNEL SECTION	m	650	$ 272,793	$ 117,330	$ 33,331	$ 127,754	$ -	$ 271,521	$ -	$ -	$ 822,729	$ 155,094	$ 1,504	$ 977,823
160	HEADWORKS	LS	1	$ 22,767	$ 9,113	$ 1,298	$ 13,755	$ -	$ 29,022	$ -	$ -	$ 75,954	$ 14,318	$ 90,272	$ 90,272
170	CUT OVER CREEK	LS	1	$ 5,345	$ -	$ 545	$ 3,404	$ -	$ 7,354	$ -	$ -	$ 16,647	$ 3,138	$ 19,785	$ 19,785
180	REVEGETATION	LS	1	$ -	$ -	$ -	$ -	$ 26,600	$ -	$ -	$ -	$ 26,600	$ 5,014	$ 31,614	$ 31,614
185	DEVELOP QUARRY	LS	1	$ 106,917	$ -	$ 11,880	$ 65,401	$ -	$ 130,734	$ -	$ -	$ 314,932	$ 59,368	$ 374,300	$ 374,300
190	MOB & SET UP ROCK PLANT	LS	1	$ 4,757	$ -	$ 495	$ 3,121	$ -	$ 4,939	$ -	$ -	$ 13,312	$ 2,510	$ 15,822	$ 15,822
195	PROCESS RIP RAP	TN	35,100	$ 145,084	$ -	$ 15,342	$ 84,016	$ -	$ 139,568	$ -	$ -	$ 384,011	$ 72,391	$ 13	$ 456,401
200	DEMOBILIZE	LS	1	$ 70,851	$ -	$ 14,592	$ 37,262	$ -	$ 53,303	$ -	$ -	$ 176,007	$ 33,179	$ 209,186	$ 209,186
210	CLOSURE REPORTS	LS	1	$ 4,652	$ -	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ 6,152	$ 1,160	$ 7,311	$ 7,311
400	PER DIEM	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,562,640	$ -	$ 1,562,640	$ 294,577	$ 1,857,217	$ 1,857,217
800	CONTINGENCY	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
900	FIELD GENERAL CONDITIONS	LS	1	$ 666,835	$ -	$ 18,418	$ 27,052	$ -	$ 22,284	$ 3,287	$ 5,733	$ 743,608	$ 140,179	$ 883,787	$ 883,787
				$ 2,448,463	$ 224,748	$ 379,694	$ 1,004,852	$ 146,600	$ 1,959,540	$ 1,565,927	$ 267,124	$ 7,996,949	$ 1,507,522		$ 9,504,471

Notes:

BI = bid item

LS = lump sum

m = metre(s)

m^2 = squared metre(s)

m^3 = cubic metre(s)

QC = quality control

TN = tonne

Attachment C5-2
Professional Services Estimate

ATTACHMENT C5-2

Professional Services - Class 5 Estimate

Faro Mine Remediation Project - Vangorda Diversion Medium Term Plan

	Task Name/Subtask/Activity	Principal	Senior III	Mid III	Junior II	Clerical	Labour Cost	Travel ($)	Expenses ($)	Subcontracts ($)	Markup	Total ($)
	Labor Rates	$ 232	$ 196	$ 154	$ 103	$ 77						
WBS	Vangorda Creek Diversion											
01.02.03.01.02	Conceptual Design (30 %)	71	588	641	799	214	329,161	10,000	3,000			342,161
01.02.03.01.03	Advanced Design (60 %)	66	547	597	744	199	306,351	10,000	3,000			319,351
01.02.03.01.04	Detailed Design (90 %)	59	486	530	661	177	272,135	10,000	3,000			285,135
01.02.03.01.05	Final Design (100 %)	39	323	352	439	117	180,892	10,000	3,000			193,892
	Subtotal Design	**235**	**1,944**	**2,121**	**2,642**	**707**	**1,088,539**	**40,000**	**12,000**	**-**	**-**	**1,140,539**
02.03.01.01.01	Procurement	42	345	376	468	125	192,980				5,789	198,769
02.03.01.02	Construction											
02.03.01.02.02	Construction Management	269	2,226	2,429	3,026	810	1,246,760	377,000	15,000		38,153	1,676,913
02.03.01.03	Transition	3	27	29	37	10	15,045			80,000	4,451	99,496
	Subtotal Construction	**272**	**2,253**	**2,458**	**3,063**	**819**	**1,261,805**	**377,000**	**15,000**	**80,000**	**42,604**	**1,776,409**
	Grand Total	**548**	**4,54**	**4,955**	**6,17**	**1,65**	**2,543,324**	**417,000**	**27,000**	**80,000**	**48,394**	**3,115,718**

Appendix C6
IWTS Work Package

APPENDIX C6

Interim Water Treatment System

C6.1 Work Package Description

Continued deterioration of the existing Faro Mill Water Treatment Plant (WTP) poses a significant human health and safety risk to the Care and Maintenance operations staff. The Faro Mill WTP is in poor operational condition, with severe corrosion of critical components and hence is at a high risk of failure. Failure of some of these components could not be readily repaired, rendering the Faro Mill WTP inoperable. The treatment plant equipment is spread throughout the length of the old mill building, which is in poor physical condition and contains appreciable lead dust, asbestos-containing materials, and other chemical hazards.

The WTP thickeners and clarifiers are in poor condition and missing critical equipment components. The Care and Maintenance Contractor, Tlicho Engineering and Environmental Services Ltd (TEES), measured leakage from both tanks in fall 2012 by performing static water level measurements. The clarifier was found to leak at a rate of 33 litres per minute, and the thickener at a rate of 71 litres per minute. This leakage is through the floor of the tanks, which are not steel and are unlined. Where this water drains to is unknown, but due to the mill's location, it is suspected that this water may discharge into the Emergency Tailings Area (ETA) and be contributing to the seepage requiring capture and treatment. Complete failure of the Faro Mill WTP or major components would result in the inability to treat contaminated site water.

Due to safety concerns, the Faro Mill WTP was not operated in 2013 and will not be operated in the future. This work package describes an interim water treatment system (IWTS) to provide a facility with safe and reliable operations, the ability to meet treatment goals, and a system suited for interim treatment of contaminated site waters. The IWTS is currently planned to operate until the full scale WTP replacement may be constructed in the post-2020 time frame.

C6.1.1 Current Condition

The Faro Mill WTP is located in the old Faro Mill Building. It was constructed using existing ore-processing equipment, spread throughout the mill building. The components are tied together using long runs of piping and electrical connections, and elevated stairways and walkways located on various floors of the mill building. Feed lines from the old mill containing zinc and lead ore processing products have been cut off at various locations and expose workers to contaminated materials. The WTP began operation in 2001, and the tanks are now at least 40 years old (Hatch, 2009). The original design life of the Faro Mill WTP was intended to be 5 years.

The Faro Mill WTP was operated during the warmer months, typically from mid-April to mid-October (5 to 6 months per year), depending on precipitation and the contaminated water inventory. The design by Deloitte & Touche (2003) provided a nominal flow capacity equal to about 19 kilolitres per minute (kL/min) (5,000 United States gallons per minute [USgpm]).

The Faro Mill WTP was a simple-mix lime treatment system; lime is added directly to the influent water to neutralize acidity and to precipitate metals, while solids/liquid separation is accomplished by gravity settling. Sludge is not recycled. Influent to the Faro Mill WTP includes the following:

- **Faro Pit Lake** – Contaminated water from direct inflow, pumping from the S-Wells, and the Zone II Pit is collected in the Faro Pit. During WTP operations, water is pumped to the Faro Mill WTP for treatment.
- **Intermediate Dam Pond (ID Pond)** – Contaminated water is collected at the ID Pond at the Intermediate Dam within the Rose Creek Tailings Area (RCTA) and pumped to the Faro Mill WTP for treatment.
- **Faro Pit and ID Pond Pumps and Piping** – Contaminated water is pumped to the Faro Mill WTP from Faro Pit Lake and IP via barge-mounted pumping systems and aboveground pipelines.
- **ETA** – Contaminated seepage is collected by a sump and pumped to the Faro Mill WTP for treatment.

C6.1.2 Justification for Action

The Mill WTP was initially constructed more than 10 years ago, reusing 30 year old ore-processing equipment not intended for WTP use. The facility was constructed for expedience and was not intended to have a long service life. The following opinions have been received:

- CH2M HILL Review Team (CH2M HILL, 2012d): "In general, the system is subpar compared to typical industrial standards. In terms of operability, H&S, and level of corrosion, it is the worst full-scale WTP the CH2M HILL team has ever inspected."
- Independent Peer Review Panel member Randy Knapp (Knapp, 2012, personal communication): "The Faro water treatment plant is clearly approaching the end of its useful life and needs to be replaced. We fully support the conclusion of CH2M HILL that the design should proceed at the earliest date."
- TEES (2011): "We noted several operational concerns during our tour that "may" have a significant impact on the water treatment program. We will comment on a few of these concerns but the recommendation is simple, the project has no plan B for the water treatment and we are relying on the dated equipment and facility that introduces some concerns as discussed herein. Our current water treatment system is our only line of defense against uncontrolled discharge. We need a plan B."
- Based on these technical opinions and the considerations of reliability, operability, ability to meet treatment goals, and cost evaluated in this report, the FPET concurs with these expert opinions that the Mill WTP should be replaced as soon as possible.

C6.1.3 WBS

The IWTS work package includes work elements exclusively within the Operations and Maintenance tree of the overall Work Breakdown Structure (WBS) as it constitutes an adaptive management work under the C&M scope (see Appendix F).

C6.1.4 Description of Scope

Water Treatment at the Faro Mine Area

Because of considerable uncertainty pertaining to future influent water characteristics and effluent discharge limitations, CH2M HILL conducted high density sludge (HDS) treatment process pilot testing using a range of influent water quality. The HDS process was demonstrated to be suitable for use in treating FMC water with the three water qualities tested. The pilot testing showed that higher influent strength results in increased lime demand and sludge formation.

For the IWTS, the proposed treatment system is anticipated to provide effluent similar to the HDS treatment process, without filtration. The Cross Valley Pond will continue to be used as a polishing step to meet the existing water License standards for zinc (the limiting constituent). Uncertainty exists regarding the effluent quality requirements. The HDS pilot effluent results were reviewed against existing water license requirements as well as the Canadian Environmental Quality Guidelines for the Protection of Aquatic Life (Canadian Council of Ministers of the Environment [CCME], 2012). The latter represents an upper limit, and it is unlikely that the new permit will be as stringent as the CCME guidelines.

In reviewing the pilot plant effluent results, it is important to note that the existing water license and CCME effluent quality guidelines are based on total metals concentrations. The effluent qualities of the three pilot plants had dissolved metals levels substantially lower than the effluent total metal concentration requirements of the current Water License. It is anticipated that the permanent HDS plant will eventually include granular media (sand) filtration designed to remove particulate metals and other suspended solids.

The IWTS will seasonally treat water from the Faro Pit, the ETA, the ID Pond, and other contaminated water sources at the Faro Mine Area and the Rose Creek Tailings Areas. Treated effluent from the IWTS will discharge to the CVD Pond for clarification (solids removal) before discharge to Rose Creek. Water that

complies with the proposed discharge limits (Table 2-12) will be discharged seasonally from the CVD Pond to Rose Creek through a siphon system located at Monitoring Station X5.

Interim Water Treatment System

The IWTS will be a modular lime-neutralization system that can treat up to 32,700 cubic metres per day (m^3/day) (6,000 USgpm). The system is expected to operate seasonally (May to September), though it could be operated at other times if necessary. As planned, the system will include modular equipment for the following operations (CH2M HILL, 2013b):

- Lime storage, slurry makeup, and feed
- Mine-water neutralization and metal precipitation
- Primary clarification, with polymer- and microsand-assisted settling
- Sludge wasting to the tailings sludge ponds or into the Faro Pit

The IWTS will consist of mobile and skid-mounted equipment, connected by rigid and flexible piping. Figure C6-1 shows the proposed location for the IWTS on the existing concrete pad in the Mill Yard, just south the Mill Building (figure located at back of section text). This pad was used as a load-out area for zinc concentrate during mill operations.

Influent will be split between two 16,350 m^3/day (3,000 USgpm) treatment trains from a header pipe connected to existing pipelines from the Faro Pit, the ID Pond, and the ETA. Feed to the IWTS will consist of either a single, blended influent source from Faro Pit, or of influent from each individual source. Flow meters will be used to measure and record the flow split between the two treatment trains.

The treatment system described here is currently being developed to meet treatment requirements in early 2014. However, the system may be refined, as necessary, to provide effective water treatment.

Lime slurry will be made using a PortaBatch portable lime-slaking system from Lhoist North America. Either influent or effluent will serve as the water source for the slurry. A 20-tonne container of quicklime will be used each time a batch of lime is slaked. First, the PortaBatch will be filled with the required volume of water, and then a lime blower will pneumatically convey the 20 tonnes of quicklime into the PortaBatch while it mixes. Dust will be controlled because the lime will be discharged below the liquid surface. After slaking is completed, about 60 to 75 minutes, the slurry will be about 30 to 40 percent solids by weight. To maximize pH control, the slurry will be diluted in a mix tank to provide 10 to 15 percent lime slurry.

The process flow diagram for the IWTS will be prepared in development of the Basis of Design. Once the influent is split between the two trains, it enters a mixed reactor tank configured into three compartments, in series. From there, it will flow into a second, similar mixed reactor tank, which in turn will flow into an Actiflo clarification skid. Polymer will be added to adhere the metal precipitates to microsand to facilitate rapid settling in the lamella clarifier. The settled sludge will be pumped to a cyclone, where the precipitates will be separated from the microsand. The microsand will be recirculated for reuse and the precipitates will be discharged to a sludge mix tank. Makeup microsand will be required periodically, as recovery is not 100 percent.

A variable-speed pump will be used to pump waste sludge via the existing piping to the tailings sludge ponds. The waste sludge is expected to be between approximately 3 and 4 percent solids by weight (Laliberte, 2013, Personal Communication). Wasting will take place as needed. Approximately 210 m^3/day of sludge will be wasted, based on a treatment rate of 32,700 (m^3/day) (6,000 USgpm). A portion of the sludge will flow by gravity to another sludge mix tank for mixing with lime slurry. The amount of additional lime slurry will be controlled automatically via pH feedback from pH probes in the two mixed reactor tanks. A variable-speed pump will pump the lime slurry from the lime slurry mix tank will take place via a recirculation loop. The lime/sludge mixture will then be pumped to the first compartment of the first mixed reactor tank. Figure C6-1 shows a preliminary layout of the IWTS.

Clarified overflow from the Actiflo clarifiers will flow by gravity to the CVD Pond. The turbidity of clarifier overflow will be continuously measured and recorded. Additional clarification will take place in the CVD Pond, similar to the existing Faro Mill WTP's operations. Lime slurry will be added to the clarified overflow as needed, to maintain a high pH in the CVD Pond. This will enhance solids removal before discharge. Effluent will discharge from the CVD Pond to Rose Creek via the CVD Pond siphon system at the X5 Monitoring Station. Using this approach, the IWTS effluent will meet the proposed effluent limits outlined in Table 2-12. If necessary, a flow baffle will be installed within the CVD Pond to increase settling time, or mobile filtration equipment will be used to supplement solids removal at the CVD Pond.

All tanks and vessels, except for the PortaBatch and Baker mix tank, will be housed within a heated building (i.e., a Sprung-type building). The PortaBatch and lime slurry mix tanks are designed for outdoor operation, and will be winterized. A construction-type trailer located outside the Sprung-type building will house the programmable logic controller (PLC) and the human-machine interface (HMI), and will serve as a control room. The Sprung-type building will house 1,000-kilogram (kg) bags of polymer, as well as equipment to make and feed the polymer. Lime will be stored on site in 20-tonne shipping containers to provide sufficient inventory for uninterrupted water treatment.

IWTS performance will be operated and monitored according to the FMC Operations Manual, under development. The IWTS will undergo routine maintenance and repairs, as required, to optimize its performance.

Interim Water Treatment System Sludge Management

Sludge generated in the IWTS will either be deposited (1) in the existing tailings sludge ponds in the Original Impoundment, or (2) in the Faro Pit via a new pipeline. For placement in the existing tailings sludge ponds, at the end of each treatment season, once partially frozen, the sludge will be excavated from the ponds and placed in windrows next to the ponds, similar to the past operations. After placement, water will be decanted off the solids as they thicken and routed to the ID Pond, where it will enter the treatment circuit. If the sludge is disposed in the Faro Pit, a new pipeline will be constructed. This pipeline will run from the IWTS to the pit ramp, down the pit ramp, and into the pit below the surface at sufficient depth to convey the sludge to the lower elevations of the pit lake.

C6.2 Design and Construction

The work is segregated into two packages:

- Package 1 includes the work associated with the VWS system.
- Package 2 includes the work required to prepare the site and tie the VWS system into the facility infrastructure.

C6.2.1 Package 1

The scope of Package 1 is to engineer, procure, and construct the VWS system and related components, and to commission the IWTS. The VWS system will use modular equipment for the following operations:

- Lime storage, slurry makeup, and feeding
- Mine water neutralization and metal precipitation
- Primary clarification with polymer and microsand/coagulant-assisted settling
- Sludge wasting to the tailings sludge ponds

Package 1 also includes the supply and erection of a building to house the VWS system.

C6.2.1.1 Engineering

Veolia's Interim Water Treatment System and related components

Package 1 includes the engineering work described in the VWS proposal (VWS, 2013) and the following additional engineering services:

- Design and supply the IWTS and support equipment.
- Incorporate the VWS systems with a PortaBatch, baker tank, and sludge disposal.
- Integrate the lime dilution, lime distribution, and lime dosing equipment with the VWS system.
- Provide engineering calculations as necessary.

This C3CCE assumes the laboratory equipment at the Faro Mine site operated by the Care and Maintenance contractor is sufficient and available for start-up and operation needs.

Lime Slurry Feed System

Package 1 includes design and sizing the lime slurry feed system components and processes. The design will use the following assumptions:

- The lime system - this will include a PortaBatch (or similar equipment), which will be located outside the VWS system building.
- Chemical batching and metering equipment – this will be integrated into the VWS system. The equipment layout will be detailed to fit within the VWS system building.
- A lime slurry storage tank will be provided. Lime slurry will be metered into lime slurry tank, which will provide mixing and dilution.
- Lime grit will be separated by a vibratory screen or similar equipment. Lime grit will be deposited in a bin near the PortaBatch. The Care and Maintenance Operator will haul grit out of the VWS system building and dispose of it.
- Influent and effluent water will be plumbed to the service water system.
- Service water will be plumbed to the filtered water distribution system.
- Service water and Faro Pit water will be plumbed to be fed to the PortaBatch for lime hydration. This approach assumes influent water is adequate for lime slaking.
- There will be a separate influent flow meter on each treatment train and there will not be a flow meter on effluent.
- No secondary containment is required for process chemicals.
- Veolia will design and supply all piping and cable supports within VWS building and PortaBatch system.

Building

A pre-engineered building performance specification (such as a sprung-type building) will be prepared. The performance specification will include the following components:

- Building, electrical components, process and building mechanical components (lifting bridge, heating, ventilation, plumbing), access to the system components, access doors, and the like
- Heating, ventilation, and (HVAC) units that can maintain 15-degree Celsius (°C) temperatures during the operating season (April to October) and 5-° C temperatures, with no air changes, outside the operating season
- Enough insulation to maintain a minimum 5-°C temperature
- Electrical service and lighting

- Doors and equipment rollup doors
- Eyewash stations and safety showers, to be skid-mounted with independent skid-mounted water storage for each (to be provided by VWS)
- A basic control room with a computer (VWS will provide control wiring to this room)

The specifications will note the following exclusions:

- No windows, washrooms, laboratory, or lunchroom will be included.
- No dormers will be installed over doors.
- No potable water will be provided; potable water will need to be trucked in.
- No sump or drains will be installed for the floor. Any spills will need to free-flow over the floors, depending on the slope of the existing slab. Note: in cold weather, a spill may lead to ice formation in the building; this may require sand or salt to prevent slips.

The following tasks to support the building design will be completed:

- Review building code.
- Review vendor calculations for major structures.
- Review material selection for super structure.
- Assume existing slab is sufficient for support of building and equipment.
- Assume steel structure will not be constructed on a concrete wall.
- Assume basic steel structure with galvanized or painted surfaces.
- Review shop drawings and provide coordination.
- Shop drawings will be stamped by the vendor.
- Assume building will not be sealed at slab.

Crane

A crane will be necessary to offload equipment and to place materials during construction. VWS will prepare Lift Plans before performing lifts that meet the criteria for a Lift Plan.

C6.2.1.2 Procurement

The Procurement scope includes planning and management, strategic planning, coordination, and expediting, in addition to the request for proposal, bid evaluation, and award processes. This scope assumes a single contractor (VWS) will perform the work in package 1. However, due to funding and cash flow criteria, multiple contracts will be awarded, each requiring separate proposal and award processes.

C6.2.1.3 Construction Management

Construction management will be performed by qualified office personnel and field staff to perform construction administration and field direction, respectively.

C6.2.2 Package 2

The scope of Package 2 is to engineer, procure, and construct infrastructure improvements to integrate the VWS system into the FMC.

This package comprises the following major work elements:

- Cap soils around the IWTS or remove and relocate soils to mitigate health and safety risks to personnel operating the IWTS.
- Grade the IWTS site to promote positive drainage and to divert runoff from entering the IWTS building and to further promote access for vehicular and pedestrian traffic in and around the IWTS.

- Prepare and the concrete slab located adjacent to the existing Mill Building by making repairs to minor cracks and divots to prepare a smooth surface and use it as a foundation for the IWTS.
- Install sludge, influent, and effluent pipelines.
- Provide power to the VWS system (excluding equipment interconnections).

Conceptually, this package includes all work excluded from Package 1. The work related to these two packages will be divided into five separate contracts, to facilitate project scheduling and cash flow requirements. The contracting strategy is presented at the end of Section 4.

C6.2.2.1 Engineering

The purpose of design and engineering work in Package 2 is to facilitate the VWS system's integration with existing FMC infrastructure. The following factors have been assumed under this scope of work:

- The design is for a system that will treat water for a maximum of 10 years.
- A single construction package will be prepared.
- The design drawings will be prepared in MicroStation or AutoCAD
- Capital cost estimates will be prepared using standard cost estimating software.

Process Mechanical

Process mechanical design is necessary to tie existing influent and effluent lines in with the VWS system and to add a sludge pipeline. Package 2 process mechanical design will include the following assumptions:

1. New piping and valves or an influent header will connect the VWS system to the existing influent and effluent pipelines.
2. Separate influent lines will supply each VWS system train from the following sources:
    - Existing Faro Pit influent line
    - ETA Seepage Interception System
    - ID Pond influent line
3. Influent piping will allow either a single, blended influent source from the Faro Pit, or allow the three separate sources (influent from either the Faro pit, the ID Pond, or the ETA Seepage Interception System) to be fed separately.
4. Influent waters will be combined upstream of VWS system, and blending will not cause adverse chemical reactions or excess precipitation.
5. Effluent water will flow by gravity to the discharge.
6. Filtered effluent water is adequate for chemical make down. A booster pump will be provided to supply process water and to supply hose bibs.
7. Vendor sludge wasting pumps have adequate capacity to discharge to the tailings area, via the existing sludge pipe.
8. The existing pipeline from ID Pond and ETA to the Faro Pit will be maintained, to allow a treatment system by-pass.
9. Assume existing tailing storage tank can be retrofitted as a break-pressure tank for the influent pipes and provides sufficient hydraulic head to supply the treatment systems.
10. Provide cursory review of Veolia VWS system but not verification of Veolia design calculations. VWS treatment system engineering approval to be provided by Veolia.

The design will also summarize the equipment support utility requirements (process water, etc.).

Site Civil

Site civil engineering will take place to meet the following needs:

- Demolition and removal requirements (coordinate with Site Preparation and Soil Remediation)
- Power supply (coordinate with electrical)
- Yard piping requirements (coordinate with process mechanical)
- Anticipated traffic patterns for delivery
- Anticipated operating equipment for the IWTS's operating life
- Grading and drainage requirements, including overland flow routes and diversions

The site civil engineering work includes but may not be limited to the following tasks:

1. Elevations of the existing terrain, including ditches, top and bottom of slopes, grade breaks, etc.
2. Conduct a physical survey to obtain the following information:
    - Elevations at the planned influent and effluent tie-in points
    - Transects along the planned path of the influent, effluent, and sludge pipelines
    - Slab floor and corner elevations of the concrete slab proposed for the VWS system
    - Elevations of the planned traffic lanes
    - Elevations of the existing retaining walls
    - Boundaries and elevations at the boundaries of the contamination remediation area
3. Re-grade or remove steep slopes, west and north of the existing concrete slab.
4. Evaluate whether a retaining wall will be required to hold back the existing 1:1 and 2:1 slopes. The cost for design and installation of a retaining wall if one is required is not priced or included with this scope of work.
5. Prepare the surface, including the sub-base preparation of a perimeter gravel pad (around the existing slab).
6. Fine-grade perimeter gravel access roads for truck access, and material / chemical delivery.
7. Design site roads, grading, and site requirements during construction.
8. Confirm the geotechnical requirements for excavations and underground piping.
9. Identify a suitable borrow material source for soil cover.
10. Assume that work area requiring contaminated fill removal or storm water management does not extend more than 10 meters from existing concrete slab. A maximum of 0.33-meter thickness of impacted soil like material will be excavated and replaced with suitable clean fill from the borrow area.
11. Assume that the concrete slab can be cleared of walls and debris and that slab can be sufficiently cleaned (decontaminated) by power washing or by a stiff brush.

Stormwater Management

Stormwater management and surface drainage for the IWTS will be evaluated. The existing concrete slab is located south of a fairly steep slope. As a result, all surface drainage that currently flows south will need to be captured and conveyed via an overland swale or ditch ensuring the concrete slab is in the dry for the duration of the IWTSs operations. Stormwater modelling and analysis will determine the size of all overland swales and ditches.

Yard Piping

Figure C6-1 shows the conceptual yard piping layout for influent, effluent, and sludge pipe. Each pipe connection will need to be finalized, including the influent lines from the Faro Pit and the ID Pond, the effluent pipeline to Cross Valley Dry Pond, the sludge line to the tailings area, etc. When the connections are finalized,

CH2M HILL will review access requirements and valve chamber design. As there is no need for winter operations (November to April), the pipes will be above ground. Yard piping design will include the following specifications:

1. Use new high-density polyethylene (HDPE) pipes and fittings to reroute the following pipelines to the proposed IWTS site.
    - 0.240-m ETA pipeline
    - 0.350-m ID Pond pipeline
    - 0.762-m Faro Pit pipeline
2. Establish the effluent pipeline route from IWTS to the existing effluent line from the Faro Mill.
3. Establish the sludge pipeline route from the IWTS.
4. Identify sludge drop boxes to be relocated or replaced, or pipelines to be tied into the existing pipeline.
5. Yard piping will be placed above grade except at road crossings. No heat tracing or insulation will be provided for above grade piping.

Sedimentation and Erosion Control

Package 2 includes development of an Erosion Control Plan, which will specify sedimentation and erosion control measures, to minimize the potential for soil erosion and sediment transport. The Package 2 Tender Package will include this Erosion Control Plan.

Power Supply

Figure C6-1 shows the conceptual layout of the power supply and the tie-in location to existing electrical facilities.

Electrical engineers will coordinate with the site civil engineers to specify the location of power distribution equipment, which may include new power poles and conduits.

Power to the IWTS will be supplied from an existing power pole. A proposed new 4.16-kilovolt– 600-volt pad mounted step down transformer, additional power poles, and duct banks will be considered during the design and specified if necessary. This task includes evaluating the IWTS electrical system requirements. The scope of work does not include any design related to demolishing, refurbishing, or replacing the existing electrical system.

Electrical engineering work includes the following tasks:

- Confirm electrical equipment sizing.
- Lay out cable and conduit runs.
- Size and locate the control panels.
- Evaluate, plan, and design electrical service to the VWS system main control panel. This task includes the following activities:
- Conduct a load study of the existing system.
- Develop load calculations for the IWTS.
- Locate, design, and provide a new step-down transformer.
- Add a high-voltage feeder from the main electrical overhead system or a switchgear, as applicable, to the primary of the step-down transformer. Tap the existing overhead feeder at the pole near the site to the primary of the step down transformer
- Provide a single-point secondary service connection to the IWTS site.

Assumptions

- No heat tracing will be provided.
- VWS will require a single-point connection for the treatment system.
- Each chemical system make down/metering system requires a single point connection.
- There will be a single connection for the PortaBatch system.

Site Preparation and Contaminated Soil Remediation

Package 2 includes preparation of a scope of work for site preparation that will specify the following activities:

1. Remove equipment and materials stored within the construction area for the IWTS and the contractor's office, yard, and lay down areas.
2. Rough grade the site to facilitate installation of equipment and construction work in Package 1 and to protect the work from surface water run on during construction.
3. Prepare the area for the contractor's office, yard, and lay down area.
4. Soil and "soil-like" material surrounding the planned IWTS site may contain levels of contaminants that could pose a risk to human health. YG has collected soil samples, and received test results on
5. A Cleanup and Management Plan based on the sampling results will include the following tasks:
    - Review analytical soils data, to be provided by YG. Select applicable standards from Yukon Environment, Contaminated Sites Regulations (CSR) or to another standard, based on input from YG.
    - Consolidate and analyze the data to identify potential contaminants of concern and compare contaminant concentrations with the selected standards.
    - Prepare a Technical Memorandum summarizing this analysis and recommending soil capping or another remedial approach.
6. Develop a cleanup strategy and construction approach.
7. Prepare an Execution Work Plan based on the assumption that capping is the preferred remedial approach that will provide the following information:
    - Establish Permitting requirements (based on input from YG).
    - Identify the approach to remove remaining above grade materials, and abandoned equipment, near the IWTS. Establish how remaining equipment will be handled onsite and where it will go.
    - Identify disposition of the existing site scale.
    - Identify modifications and repairs to existing concrete slabs, including removing stub walls or curbs, and patching to provide a safe and level working surface.
    - Identify source area for backfill and capping.
    - Identify and scope the extent of contaminant removal
    - Identify the backfill requirements and design a cap sufficient to support anticipated vehicle traffic.
    - Develop a sequencing plan and refine the schedule for each stage of execution.
    - Identify media-testing required to confirm remedial objectives have been achieved (as necessary).
8. Prepare a site-specific Health and Safety Plan (HASP) before site work begins, tailoring it to the needs of the project. The HASP will include aspects such as hazard definition, safety responsibility, personal protective equipment (PPE), personnel training and medical monitoring requirements, onsite monitoring, decontamination, emergency response, and safe operating procedures. It will also include Spill Response Procedures, and will list codes and statutes to be met, security features to be established, and responsible

individuals. The HASP will designate a qualified field staff member as the Site Safety Coordinator (SSC). This person will be responsible for communicating HASP content and enforcing HASP requirements.

Contingency Planning

Contingency Planning is critical to the success of this project from a risk management perspective. The condensed EPC schedule leaves little room for error and possible issues like material or equipment availability, weather, and shipping complications, which could delay the IWTS start-up.

C6.2.2.2 Procurement

The Procurement scope for Package 2 assumes a single general contractor will perform the work that will be described in a single contract requiring only one procurement effort.

C6.2.2.3 Construction Management (One General Contractor)

Package 2 includes construction management and consisting of qualified office personnel and field staff to perform construction administration and field direction, respectively. Construction administration and oversight services for Package 2 will consist of the same elements specified for Package 1.

C6.3 Schedule

The Gantt chart schedule for the scope of work described is presented as Attachment C6-1. The objective of the schedule as it is presented herein is to align the scope of work to achieve the desired cash flow, which has been agreed upon between AAM and AANDC. This alignment does not consider any provisions that exist within the cost estimate for the associated and specific schedule submitted in conjunction with the estimate (CH2M HILL, 2013c). Reconciliation of any less-than-ideal work sequencing will occur with annual detailed work plans so that the major milestones described within the schedule are maintained. This scope has been prepared to support the medium term work planning objectives; as such, this schedule is also considered preliminary and subject to change dependant on contract award dates and as initial milestones are met and SOWs are confirmed and completed.

C6.3.1 Milestone Schedule

The following is a general summary of the major milestones and salient components of the schedule.

- Train 1: 16,350 (m3/day) (3,000 USgpm):
  - Fabricated: June 10, 2014
  - Delivered: June 19, 2014
  - Installed: July 25, 2014
  - Operational: August 5, 2014
- Train 2: 16,350 (m3/day) (3,000 USgpm):
  - Fabricated: July 25, 2014
  - Delivered: August 11, 2014
  - Installed: September 5, 2014
  - Operational: September 12, 2014

Attachment C6-1 provides for a Gantt chart showing the fabrication delivery schedule.

C6.4 Cost Estimate

A draft Class 3 Capital Cost Estimate (C3CCE) was submitted by CH2M HILL Canada Limited (CH2M HILL, 2013c) for the for the IWTS. The C3CCE was based on the Veolia Water Treatment (Veolia Water Solution and Technologies Canada Inc. (VWS, 2013) and on preliminary scope definition meetings with the Government of Yukon (YG).

This C3CCE for the IWTS represents an early Class 3 cost estimate. This cost estimate should be read in conjunction with the VWS submittal (2013). There is no contingency amount in this estimate.

C6.4.1 Cost Estimate Assumptions

Because this estimate is based on a partial design, certain assumptions have been made in its development. As the design progresses, the estimate will be refined. This C3CCE is based on the following construction schedule assumes assumptions:

- The IWTS can be implemented in 2014 in accordance with the project schedule
- Four foul weather days per month
- Sixty-hour work week (6 days x 10-hour days)
- Normal weather conditions
- The IWTS site will be available for mobilization on date shown
- Labour and material required for the project will be available
- Based on these assumptions, this schedule is realistic.

The following assumptions were used to develop this C3CCE:

- The IWTS can be implemented quickly in 2014, and will operate for approximately 10 years, until the permanent Faro Water Treatment Plant is commissioned.
- The interim treatment system will be suitable for treating mine-affected water from Faro Pit, the ID Pond, and the ETA.
- Existing infrastructure will be used where practical.
- Treated water (effluent) quality will be regulated by the current discharge limits for the FMC. Although this water licence expired in February 2009, the standards prescribed therein are still in effect.

This C3CCE is based on the following input:

- Vendor quotes on specific equipment
- Budgetary estimates from vendors on specific equipment
- R.S. Means Company - this C3CCE includes construction cost data from the 2012 Facilities Construction Cost Data Book (Mossman and Baker, 2011).
- CH2M HILL historical data
- Estimator judgment

C6.4.1.1 Vendor Quotes

The cost data used to generate this C3CCE include vendor quotes for the following equipment:

- Porta batch system
- Lime mixing tank
- VWS package water treatment system (VWS, 2013) which represents actual pricing to fabricate and ship the system. The equipment will be built according to VWS's standard for indoor installation (VWS, 2013, Appendix H).

C6.4.1.2 Budgetary Estimates

The cost data used to generate this C3CCE include budgetary estimates for the following categories:

- Labour, Materials, and Equipment
- Engineering and Design
- Construction Oversight
- Pre-engineered Building - (Costs in estimate are based on Sprung Building)

- Heating, ventilation – Electrical supply to maintain a temperature of 15 degrees Celsius (°C) during the operating season (April to October), and a temperature of 5°C with no air changes outside the operating season.
- Electrical and Lighting
- Insulation

For other materials and equipment, costs were obtained from recent mine treatment projects, from water/wastewater treatment plants under construction or operation, or from industry cost data bases. The cost data used to generate this C3CCE comprise estimates for building material purchases and shipments outlined in the following paragraphs. They also include supplies and equipment that are not specifically listed in Section 7.1.

Labour, Materials, and Equipment

The following specific labour and equipment pricing elements were addressed while developing this C3CCE:

- The labour rates used in the cost estimate are Yukon-based rates adjusted to 2013, which have been modified using information from a current Northern British Columbia construction project to include labour fringe costs.
- Production rates for the field work are based on historical data and the CH2M HILL Lead Estimator's extensive experience in construction estimating. All costs have been adjusted for escalation to 2014 and local conditions (e.g., remote location, weather, short construction season, and rugged terrain) at the FMC.
- This C3CCE does not include a camp to house the contractors' workforce. A per diem rate of $240 per person-day is allocated to the workforce for lodging and meals in the Town of Faro. The supervision costs are only for the General Contractor and the subcontractors.
- The mobilization and demobilization sums assume a phased mobilization of VWS personnel for construction under Package 1, and for General Contractor personnel for construction under Package 2, as well as phased demobilization at the end of the 2014 season.
- This C3CCE includes the mobilization and demobilization of a crane, and the procurement of a natural gas-powered forklift to operate indoors. This C3CCE also assumes the crane will be onsite full-time through the construction phase of this project.

Engineering and Design

VWS (2013) includes the costs to engineer and design their system. CH2M HILL has not initiated design, but will develop final designs and drawings for grading, piping, power distribution, site preparation, and contaminant remediation. All other engineering costs associated with piping, power distribution, site grading and drainage, site preparation, and contaminant remediation are estimates.

Construction Management

The construction management estimate is based on an assumption that 1.5 Full-time Equivalents will oversee VWS and a General Contractor during Packages 1 and 2, and that these tasks will adhere to the project schedule. This estimate includes labour, travel, and per diem 7 days a week during this period.

Excavations and Materials

This C3CCE includes the following assumptions related to excavations, backfill, and concrete materials:

1. For excavations costs, it was assumed that rock could be removed using an excavator. No blasting allowance was carried.
2. All surplus excavated material is assumed to be spread, compacted, and shaped within 300 metres (m) of the IWTS site.

3. Influent, effluent, and sludge pipe will be buried in heavy traffic areas and at road crossings. At all other locations, pipe will be placed at grade on the soil surface.

The following site preparation tasks will take place:

1. Remove equipment and materials stored within the construction area for the IWTS and the contractor's office, yard, and lay down areas.
2. Grade the IWTS site to construct a structural road section that will support anticipated equipment and truck traffic during construction and through 10 years of operation and maintenance.
3. Grade the IWTS site to drain away from the VWS equipment.
4. Grade the IWTS site and establish road crossings to accommodate acceptable bedding and grades for influent, effluent, and sludge piping.
5. Develop a soil remediation Conceptual Design, which will involve minimum material grading to achieve cover and structural road section requirements. Contaminated soil cover is assumed to extend 35 m around the slab footprint.
6. Prepare the area for the contractor's office, yard, and lay down area.

C6.4.1.3 Other Factors

This C3CCE incorporates the following factors, related to pricing and scope:

1. YG is sales tax-exempt; therefore, this C3CCE excludes taxes.
2. A bond rate of 1.5 percent and an insurance rate of 0.75 percent are used (both rates vary from contractor to contractor, so these rates are allowances).
3. This C3CCE is for construction, engineering, design, and construction oversight; it does not include permit costs.
4. This C3CCE includes no contingency costs in this estimate, YG and AANDC will carry the contingency costs for this work. The contingency allows for factors such as bad weather, and poor productivity. This contingency will cover known unknowns and unknown unknowns attached to this project.
5. The total price includes a contractor's mark-up of 9.3 percent on items excluding travel and per diem.

C6.4.2 Construction Schedule

The total cost estimate for the IWTS Work described herein is $10,510,535. This estimate is summarized with capital and professional services costs provided in Table C6-1.

TABLE C6-1
Interim Treatment Plant Replacement – Cost Estimate
Faro Mine Remediation Project

Bid Item	Bid Description	Quantity	Units	Bid Total
5	BONDS & INSURANCE	1	LS	$ 276,229.80
10	SUBMITTALS	1	LS	$ 27,206.54
15	MOBILIZATION	1	LS	$ 102,364.80
20	STORM WATER PROTECTION	1	LS	$ 16,017.14
25	QC	1	LS	$ 8,250.00
30	SURVEY	1	LS	$ 5,500.00
35	SNOW REMOVAL	1	LS	$ 32,412.15
40	REMOVE/CAP CONTAMINATED SOIL	3800	M2	$ 151,752.03
50	REMOVE ABANDONED EQUIPMENT	1	LS	$ 25,268.44
60	REMOVE EXISTING WALLS-PARTIAL	57	M	$ 8,659.54

TABLE C6-1
Interim Treatment Plant Replacement – Cost Estimate
Faro Mine Remediation Project

Bid Item	Bid Description	Quantity	Units	Bid Total
70	GRADE SITE - DEVELOP ACCESS	3800	M2	$ 32,345.65
80	CLEAN & PATCH EXISTING SLAB	910	M2	$ 23,193.21
85	MOBILIZE CRANE FOR PLANT WORK	1	LS	$ 88,000.00
90	PURCHASE 6000 GPM PACKAGE PLANT	1	LS	$ 4,224,400.00
100	UNLOAD EQUIPMENT	1	LS	$ 58,816.15
110	SET UP 6000 GPM PACKAGE PLANT	1	LS	$ 430,152.45
120	SET UP RAKE SYSTEM	1	LS	$ 28,182.90
130	INSTALL HAND RAILS AND DECKING	1	LS	$ 22,642.52
140	INSTALL PUMPS AND MIXERS	1	LS	$ 83,288.57
150	INSTALL PIPING	1	LS	$ 184,388.66
160	RENT LIME MIXING TANK	1	LS	$ 23,375.00
170	SET AND PLUMB MIXING TANK	1	LS	$ 14,089.64
175	SET UP LIME FEED SYSTEM	1	LS	$ 105,389.46
180	PURCHASE LIME PORTA BATCH	1	LS	$ 415,000.00
190	SET LIME PORTA BATCH	1	LS	$ 7,554.84
195	LIME- VIBRATORY GRIT SCREEN	1	LS	$ 74,280.65
197	INSTALL ELECTRICAL CONNECTIONS	1	LS	$ 152,694.52
200	PURCHASE AND SET CONTROL TRAILER	1	LS	$ 10,853.66
205	INSTRUMENTATION & CONTROLS	1	LS	$ 93,500.00
210	PURCHASE AND SET TEMPORARY BUILDING	1	LS	$ 1,287,630.19
215	SET UP COAGULANT SYSTEM	1	LS	$ 15,722.44
216	SET UP POLYMER SYSTEM	1	LS	$ 16,288.94
217	SET UP LABORATORY	1	LS	$ 18,710.11
220	CONNECT SLUDGE LINE TO SLUDGE PITS	240	M	$ 70,666.90
230	CONNECT TO EXISTING EFFLUENT LINE	100	M	$ 69,421.88
240	CONNECT TO EXISTING FARO INFLUENT LINE	350	M	$ 248,786.62
250	CONNECT TO EXISTING ETA INFLUENT LINE	36	M	$ 14,560.99
260	CONNECT TO IP INFLUENT	36	M	$ 19,548.64
300	PROVIDE ELECTRICAL POWER TO PLANT	1	LS	$ 88,000.00
350	COMMISSION PLANT	1	LS	$ 70,315.34
700	DEMOBILIZATION	1	LS	$ 75,218.46
710	PER DIEM	1	LS	$ 515,520.00
800	DESIGN	1	LS	$ 300,498.19
810	PROCUREMENT	1	LS	$ 136,289.60
850	COSTRUCTION OVERSIGHT-CH	1	LS	$ 248,834.00
910	GENERAL CONTRACTORS OVERHEAD	1	LS	$ 396,789.80
920	PROJ MANAGEMENT	1	LS	$ 191,925.00
	Total Cost Estimate			**$ 10,510,535**

C6.4.3 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are non-binding and are provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, implementation schedule, and other variables. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding requirements must be carefully reviewed before making specific financial decisions.

C6.4.4 Works Cited

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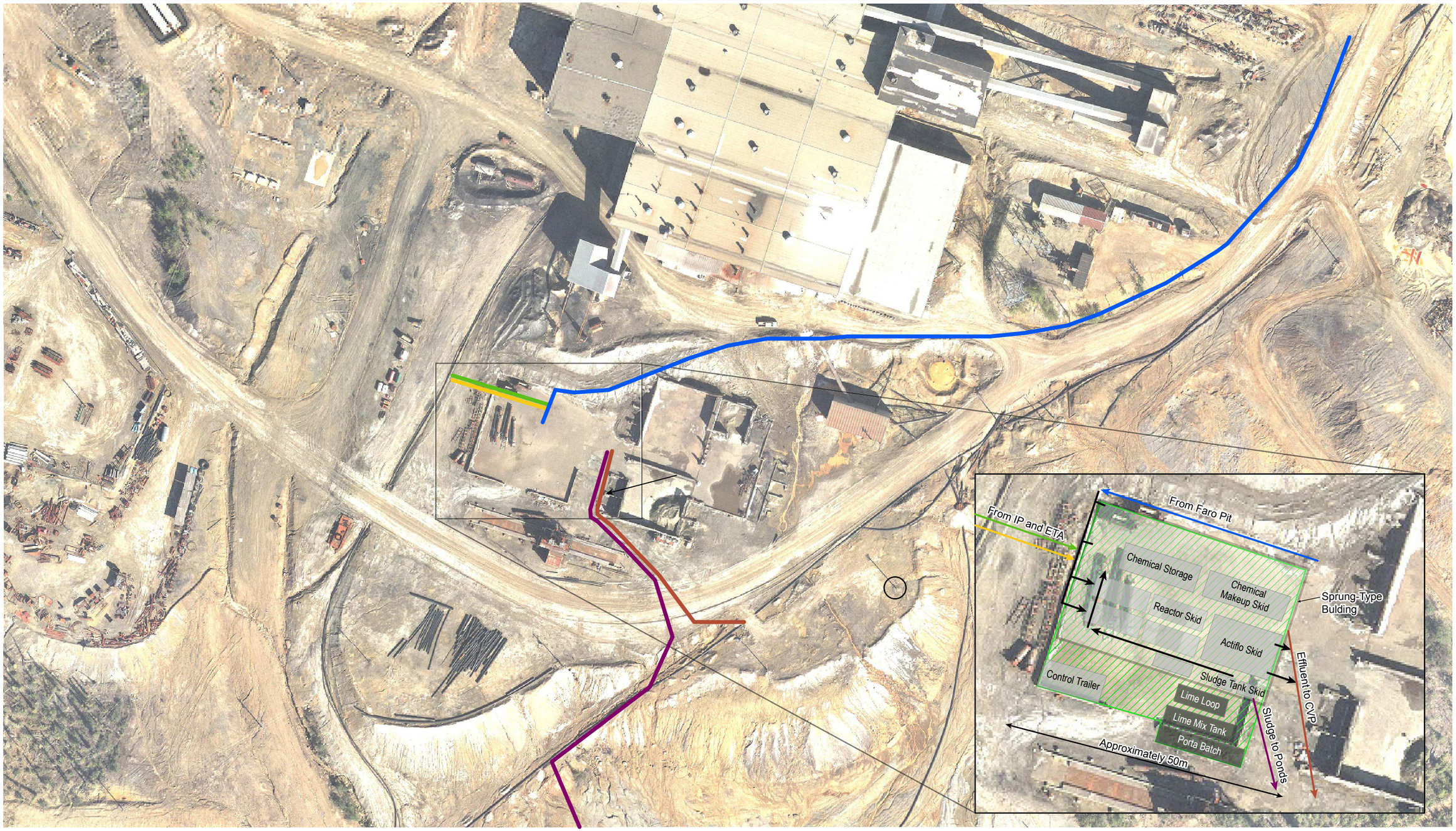
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Figure



LEGEND

- 750 mm Faro Pit at 350 m
- 350 mm ID Pond at 36 m
- 240 mm ETA at 36 m 500 mm
- Effluent at 100 m 200 mm
- Sludge at 240 m

Package 1

Note: Assume all are SDR 17 HDPE

North

0 25 50 75 100

Approximate scale in metres

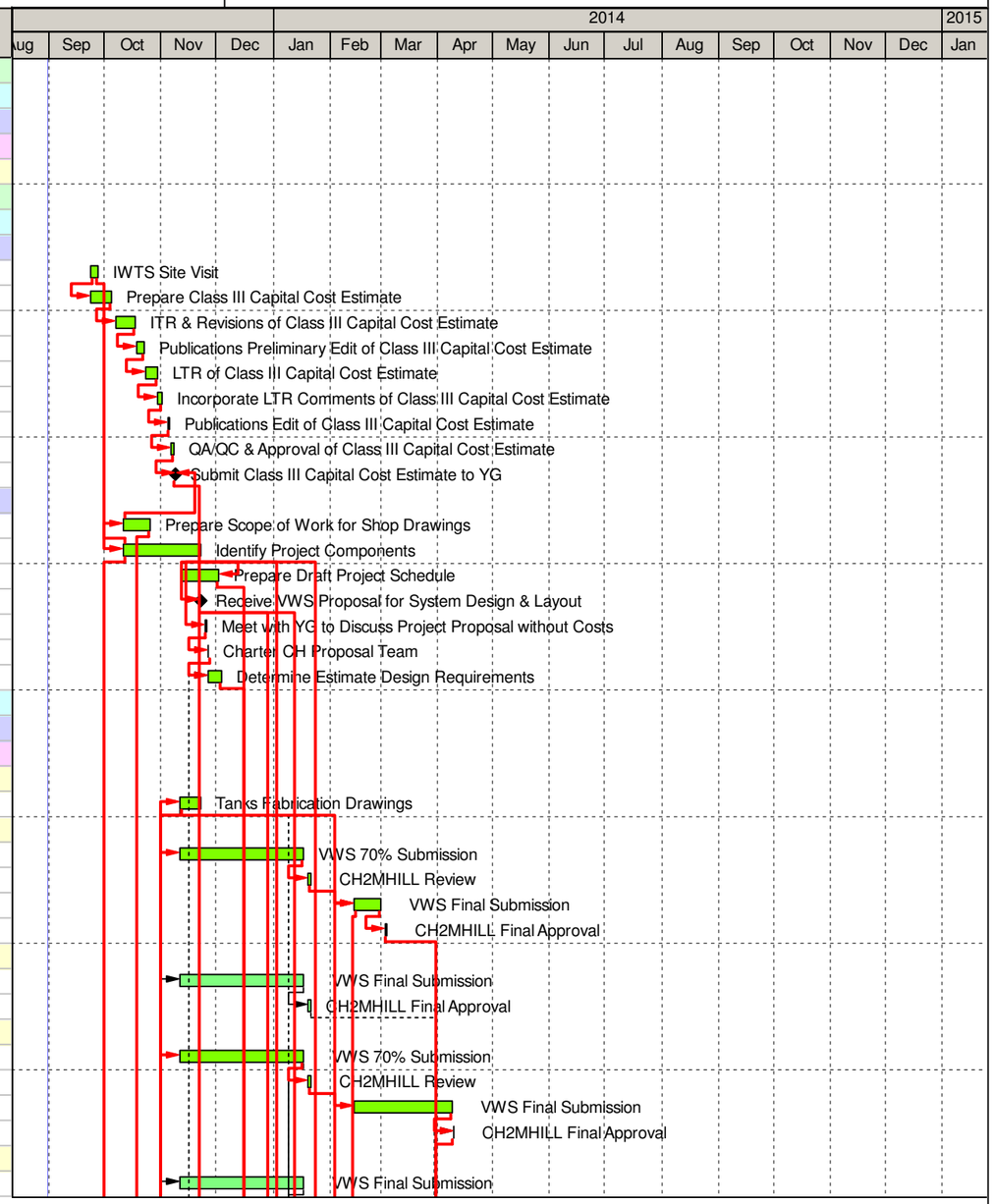
FIGURE C6-1
IWTS Project Location
Faro Mine Remediation Project

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CH2MHILL

Attachment C6-1
Re-baseline Schedule

Activity ID	Activity Name	Original Duration	Start	Finish
Total		253	23-Sep-13	31-Oct-14
Faro Mine Remediation Project FY2013/14 Rebaseline		253	23-Sep-13	31-Oct-14
Operations & Maintenance (O&M)		253	23-Sep-13	25-Sep-14
Maintenance		253	23-Sep-13	25-Sep-14
Care & Maintenance		253	23-Sep-13	25-Sep-14
Interim Water Treatment System (IWTS)		253	23-Sep-13	25-Sep-14
IWTS Project Definition & Scoping		51	23-Sep-13	03-Dec-13
Class III Capital Cost Estimate		34	23-Sep-13	08-Nov-13
FM.19.A1.1835	IWTS Site Visit	5	23-Sep-13*	27-Sep-13
FM.19.A1.1840	Prepare Class III Capital Cost Estimate	10	23-Sep-13	04-Oct-13
FM.19.A1.1845	ITR & Revisions of Class III Capital Cost Estimate	8	07-Oct-13	17-Oct-13
FM.19.A1.1850	Publications Preliminary Edit of Class III Capital Cost Estimate	3	18-Oct-13	22-Oct-13
FM.19.A1.1855	LTR of Class III Capital Cost Estimate	5	23-Oct-13	29-Oct-13
FM.19.A1.1860	Incorporate LTR Comments of Class III Capital Cost Estimate	3	30-Oct-13	01-Nov-13
FM.19.A1.1865	Publications Edit of Class III Capital Cost Estimate	2	04-Nov-13	05-Nov-13
FM.19.A1.1870	QA/QC & Approval of Class III Capital Cost Estimate	2	06-Nov-13	07-Nov-13
FM.19.A1.1875	Submit Class III Capital Cost Estimate to YG	0		08-Nov-13
Project Definition & Proposal		37	11-Oct-13	03-Dec-13
FM.19.A1.1080	Prepare Scope of Work for Shop Drawings	10	11-Oct-13	25-Oct-13
FM.19.A1.1135	Identify Project Components	30	11-Oct-13	22-Nov-13
FM.19.A1.1140	Prepare Draft Project Schedule	15	12-Nov-13	02-Dec-13
FM.19.A1.1330	Receive VWS Proposal for System Design & Layout	0		22-Nov-13
FM.19.A1.1145	Meet with YG to Discuss Project Proposal without Costs	1	25-Nov-13	25-Nov-13
FM.19.A1.1155	Charter CH Proposal Team	1	26-Nov-13	26-Nov-13
FM.19.A1.1165	Determine Estimate Design Requirements	6	26-Nov-13	03-Dec-13
IWTS Package I Veolia Procurement & Construction		238	11-Oct-13	12-Sep-14
IWTS Package I Veolia - Engineering		111	11-Nov-13	22-Apr-14
Veolia IWTS Engineering		104	11-Nov-13	09-Apr-14
Tanks Fabrication Drawings		16	11-Nov-13	22-Nov-13
FM.19.B1.2000	Tanks Fabrication Drawings	16	11-Nov-13	22-Nov-13
General Arrangement Drawings		77	11-Nov-13	03-Mar-14
FM.19.B1.2005	VWS 70% Submission	47	11-Nov-13	17-Jan-14
FM.19.D1.2010	CH2MHILL Review	2	20-Jan-14	21-Jan-14
FM.19.B1.2015	VWS Final Submission	10	14-Feb-14	28-Feb-14
FM.19.D1.2020	CH2MHILL Final Approval	1	03-Mar-14	03-Mar-14
Mechanical Data Sheets		49	11-Nov-13	21-Jan-14
FM.19.B1.2025	VWS Final Submission	47	11-Nov-13	17-Jan-14
FM.19.D1.2030	CH2MHILL Final Approval	2	20-Jan-14	21-Jan-14
Electrical Control Drawings		104	11-Nov-13	09-Apr-14
FM.19.B1.2035	VWS 70% Submission	47	11-Nov-13	17-Jan-14
FM.19.D1.2040	CH2MHILL Review	2	20-Jan-14	21-Jan-14
FM.19.B1.2045	VWS Final Submission	37	14-Feb-14	08-Apr-14
FM.19.D1.2050	CH2MHILL Final Approval	1	09-Apr-14	09-Apr-14
Hydraulic Profile		49	11-Nov-13	21-Jan-14
FM.19.B1.2055	VWS Final Submission	47	11-Nov-13	17-Jan-14



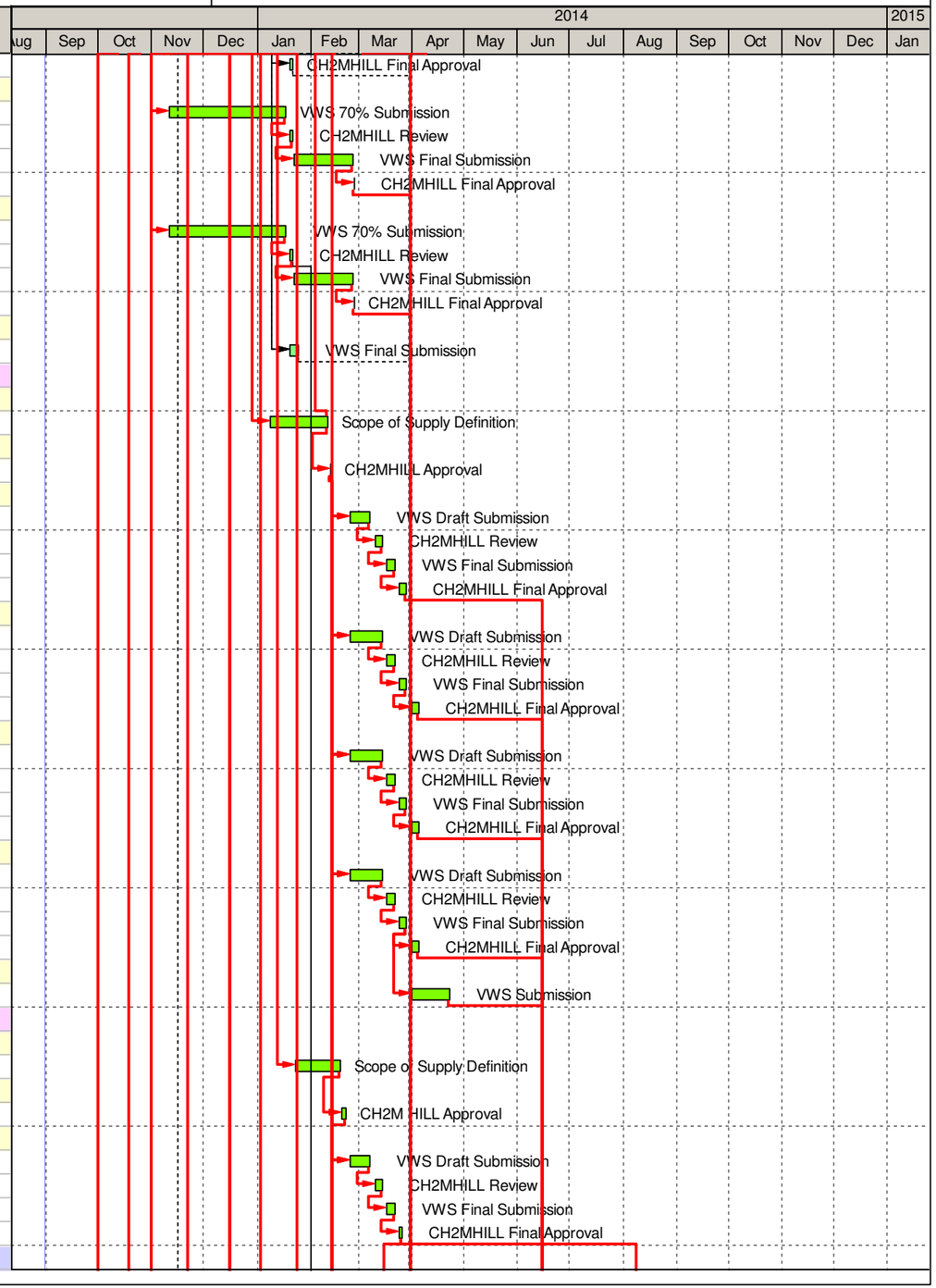
Remaining Level of Effort ◆ Milestone
Actual Level of Effort
Actual Work
Remaining Work
Critical Remaining Work

Faro Mine Remediation Project FY2013/14 Rebaseline

FARO MINE-IWTS
TAR 19

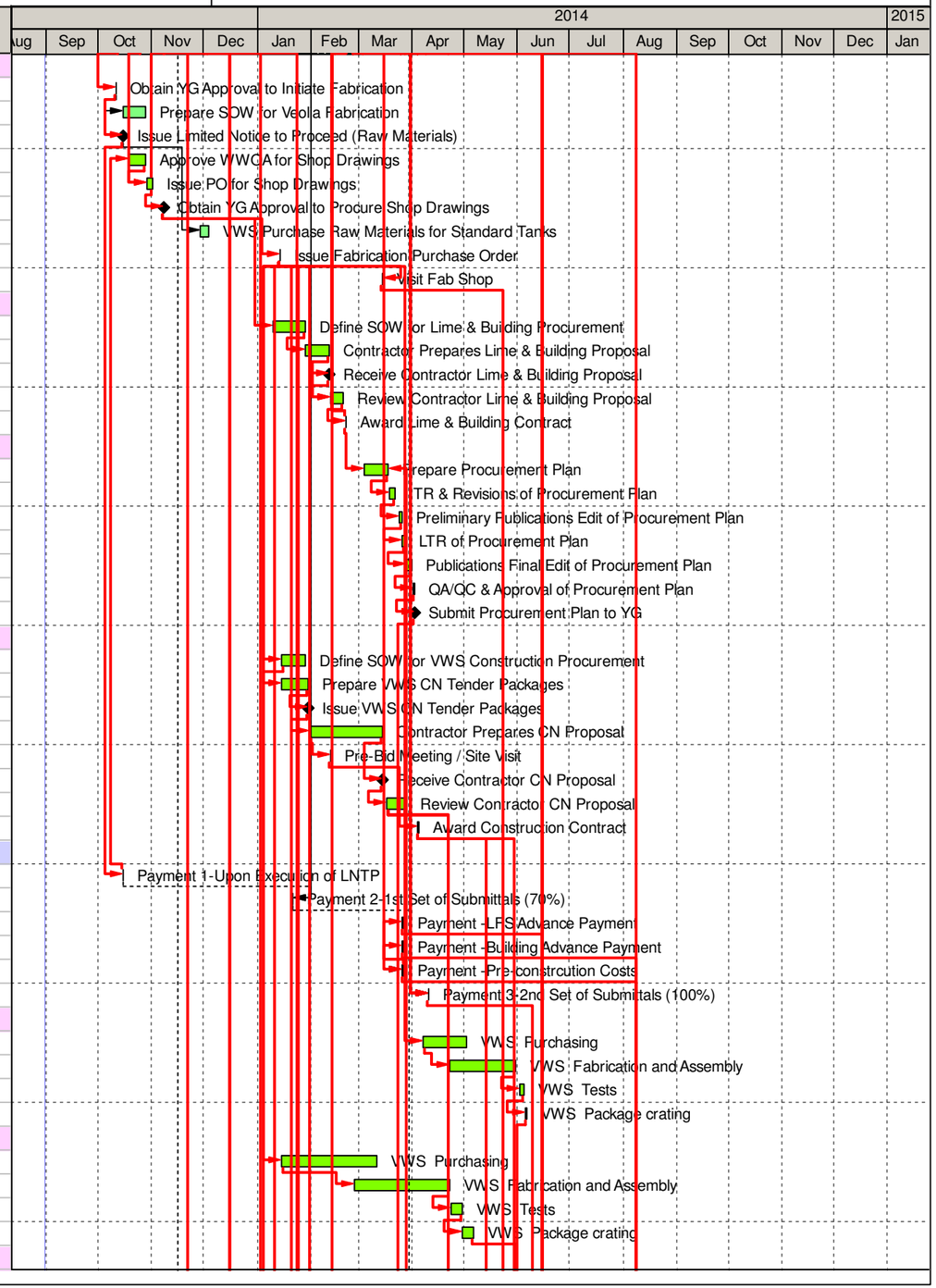
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Activity ID	Activity Name	Original Duration	Start	Finish
FM.19.D1.2060	CH2MHILL Final Approval	2	20-Jan-14	21-Jan-14
P & ID		74	11-Nov-13	26-Feb-14
FM.19.B1.2065	VWS 70% Submission	47	11-Nov-13	17-Jan-14
FM.19.D1.2070	CH2MHILL Review	2	20-Jan-14	21-Jan-14
FM.19.B1.2075	VWS Final Submission	24	22-Jan-14	25-Feb-14
FM.19.D1.2080	CH2MHILL Final Approval	1	26-Feb-14	26-Feb-14
Equipment Information (Including Mass Balance)		74	11-Nov-13	26-Feb-14
FM.19.B1.2085	VWS 70% Submission	47	11-Nov-13	17-Jan-14
FM.19.D1.2090	CH2MHILL Review	2	20-Jan-14	21-Jan-14
FM.19.B1.2095	VWS Final Submission	24	22-Jan-14	25-Feb-14
FM.19.D1.2100	CH2MHILL Final Approval	1	26-Feb-14	26-Feb-14
Inspection and Test Plans		5	20-Jan-14	24-Jan-14
FM.19.D1.2105	VWS Final Submission	5	20-Jan-14	24-Jan-14
Lime Feed System		72	08-Jan-14	22-Apr-14
Scope of Supply Definition		24	08-Jan-14	10-Feb-14
FM.19.D1.2110	Scope of Supply Definition	24	08-Jan-14	10-Feb-14
CH2MHILL Approval		1	12-Feb-14	12-Feb-14
FM.19.D1.2115	CH2MHILL Approval	1	12-Feb-14	12-Feb-14
VWS - General Arrangement Drawings		25	24-Feb-14	28-Mar-14
FM.19.D1.2120	VWS Draft Submission	10	24-Feb-14	07-Mar-14
FM.19.D1.2125	CH2MHILL Review	5	10-Mar-14	14-Mar-14
FM.19.D1.2130	VWS Final Submission	5	17-Mar-14	21-Mar-14
FM.19.D1.2135	CH2MHILL Final Approval	5	24-Mar-14	28-Mar-14
Mechanical Data Sheets		30	24-Feb-14	04-Apr-14
FM.19.D1.2140	VWS Draft Submission	15	24-Feb-14	14-Mar-14
FM.19.D1.2145	CH2MHILL Review	5	17-Mar-14	21-Mar-14
FM.19.D1.2150	VWS Final Submission	5	24-Mar-14	28-Mar-14
FM.19.D1.2155	CH2MHILL Final Approval	5	31-Mar-14	04-Apr-14
Electrical Control Drawings		30	24-Feb-14	04-Apr-14
FM.19.D1.2160	VWS Draft Submission	15	24-Feb-14	14-Mar-14
FM.19.D1.2165	CH2MHILL Review	5	17-Mar-14	21-Mar-14
FM.19.D1.2170	VWS Final Submission	5	24-Mar-14	28-Mar-14
FM.19.D1.2175	CH2MHILL Final Approval	5	31-Mar-14	04-Apr-14
P & ID		30	24-Feb-14	04-Apr-14
FM.19.D1.2180	VWS Draft Submission	15	24-Feb-14	14-Mar-14
FM.19.D1.2185	CH2MHILL Review	5	17-Mar-14	21-Mar-14
FM.19.D1.2190	VWS Final Submission	5	24-Mar-14	28-Mar-14
FM.19.D1.2195	CH2MHILL Final Approval	5	31-Mar-14	04-Apr-14
Inspection and Test Plan		15	31-Mar-14	22-Apr-14
FM.19.D1.2200	VWS Submission	15	31-Mar-14	22-Apr-14
Buildings		43	23-Jan-14	25-Mar-14
Scope of Supply Definition		18	23-Jan-14	18-Feb-14
FM.19.D1.2205	Scope of Supply Definition	18	23-Jan-14	18-Feb-14
CH2MHILL Approval		3	19-Feb-14	21-Feb-14
FM.19.D1.2210	CH2M HILL Approval	3	19-Feb-14	21-Feb-14
VWS - General Arrangement Drawings		22	24-Feb-14	25-Mar-14
FM.19.D1.2215	VWS Draft Submission	10	24-Feb-14	07-Mar-14
FM.19.D1.2220	CH2MHILL Review	5	10-Mar-14	14-Mar-14
FM.19.D1.2225	VWS Final Submission	5	17-Mar-14	21-Mar-14
FM.19.D1.2230	CH2MHILL Final Approval	2	24-Mar-14	25-Mar-14
IWTS Package I Veolia - Procurement		121	11-Oct-13	04-Apr-14



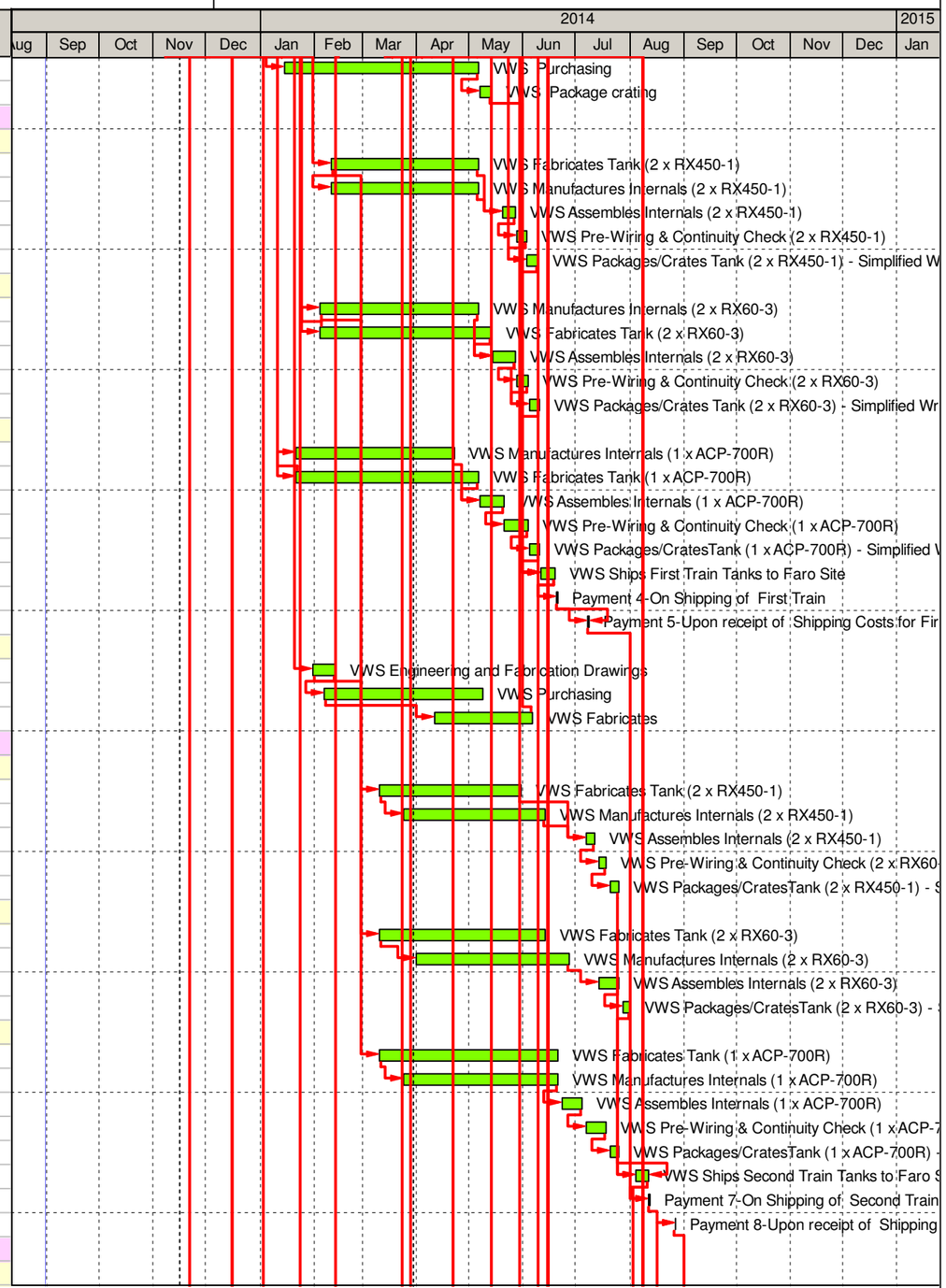
Faro Mine Remediation Project FY2013/14 Rebaseline	FARO MINE-IWTS TAR 19	03-Mar-14 13:56

Activity ID	Activity Name	Original Duration	Start	Finish
VWS Engineering & Fabrication Procurement		106	11-Oct-13	14-Mar-14
FM.19.A1.1090	Obtain YG Approval to Initiate Fabrication	1	11-Oct-13	11-Oct-13
FM.19.B1.1100	Prepare SOW for Veolia Fabrication	10	15-Oct-13	28-Oct-13
FM.19.C1.4000	Issue Limited Notice to Proceed (Raw Materials)	0	15-Oct-13	
FM.19.A1.1075	Approve WWOA for Shop Drawings	7	18-Oct-13	28-Oct-13
FM.19.A1.1085	Issue PO for Shop Drawings	4	29-Oct-13	01-Nov-13
FM.19.A1.1000	Obtain YG Approval to Procure Shop Drawings	0	08-Nov-13	
FM.19.C1.1200	VWS Purchase Raw Materials for Standard Tanks	3	29-Nov-13	03-Dec-13
FM.19.D1.1130	Issue Fabrication Purchase Order	1	14-Jan-14	14-Jan-14*
FM.19.C1.1376	Visit Fab Shop	1	14-Mar-14	14-Mar-14
Lime & Building Procurement		30	10-Jan-14	21-Feb-14
FM.19.D1.1871	Define SOW for Lime & Building Procurement	13	10-Jan-14	28-Jan-14
FM.19.D1.1886	Contractor Prepares Lime & Building Proposal	10	29-Jan-14	11-Feb-14
FM.19.D1.1887	Receive Contractor Lime & Building Proposal	0		11-Feb-14
FM.19.D1.1891	Review Contractor Lime & Building Proposal	5	12-Feb-14	19-Feb-14
FM.19.D1.1896	Award Lime & Building Contract	1	21-Feb-14	21-Feb-14
Procurement Plan		22	04-Mar-14	02-Apr-14
FM.19.D1.1406	Prepare Procurement Plan	10	04-Mar-14	17-Mar-14
FM.19.D1.1411	ITR & Revisions of Procurement Plan	4	18-Mar-14	21-Mar-14
FM.19.D1.1416	Preliminary Publications Edit of Procurement Plan	2	24-Mar-14	25-Mar-14
FM.19.D1.1421	LTR of Procurement Plan	2	26-Mar-14	27-Mar-14
FM.19.D1.1426	Publications Final Edit of Procurement Plan	2	28-Mar-14	31-Mar-14
FM.19.D1.1431	QA/QC & Approval of Procurement Plan	2	01-Apr-14	02-Apr-14
FM.19.D1.1436	Submit Procurement Plan to YG	0		02-Apr-14
Construction Procurement		57	15-Jan-14	04-Apr-14
FM.19.D1.1841	Define SOW for VWS Construction Procurement	13	15-Jan-14	28-Jan-14
FM.19.D1.1846	Prepare VWS CN Tender Packages	15	15-Jan-14	30-Jan-14
FM.19.D1.1851	Issue VWS CN Tender Packages	0		30-Jan-14
FM.19.D1.1866	Contractor Prepares CN Proposal	29	31-Jan-14	14-Mar-14
FM.19.D1.1859	Pre-Bid Meeting / Site Visit	1	12-Feb-14	12-Feb-14
FM.19.D1.1967	Receive Contractor CN Proposal	0		14-Mar-14
FM.19.D1.1861	Review Contractor CN Proposal	10	17-Mar-14	28-Mar-14
FM.19.D1.1856	Award Construction Contract	1	04-Apr-14	04-Apr-14
Fabrication		237	15-Oct-13	12-Sep-14
FM.19.C1.4001	Payment 1-Upon Execution of LNTP	1	15-Oct-13	15-Oct-13
FM.19.D1.4030	Payment 2-1st Set of Submittals (70%)	1	21-Jan-14	21-Jan-14
FM.19.D1.4040	Payment -LFS Advance Payment	1	26-Mar-14	26-Mar-14
FM.19.D1.4045	Payment -Building Advance Payment	1	26-Mar-14	26-Mar-14
FM.19.D1.4050	Payment -Pre-constrcution Costs	1	26-Mar-14	26-Mar-14
FM.19.D1.4035	Payment 3-2nd Set of Submittals (100%)	1	10-Apr-14	10-Apr-14
Control Panel		67	07-Apr-14	06-Jun-14
FM.19.E1.2000	VWS Purchasing	58	07-Apr-14	02-May-14
FM.19.E1.2005	VWS Fabrication and Assembly	58	22-Apr-14	30-May-14
FM.19.E1.2010	VWS Tests	3	02-Jun-14	04-Jun-14
FM.19.E1.2015	VWS Package crating	2	05-Jun-14	06-Jun-14
Polymer System		87	15-Jan-14	06-May-14
FM.19.E1.2020	VWS Purchasing	58	15-Jan-14	11-Mar-14
FM.19.E1.2025	VWS Fabrication and Assembly	58	26-Feb-14	22-Apr-14
FM.19.E1.2030	VWS Tests	3	23-Apr-14	29-Apr-14
FM.19.E1.2035	VWS Package crating	2	30-Apr-14	06-May-14
Utilities		79	15-Jan-14	13-May-14

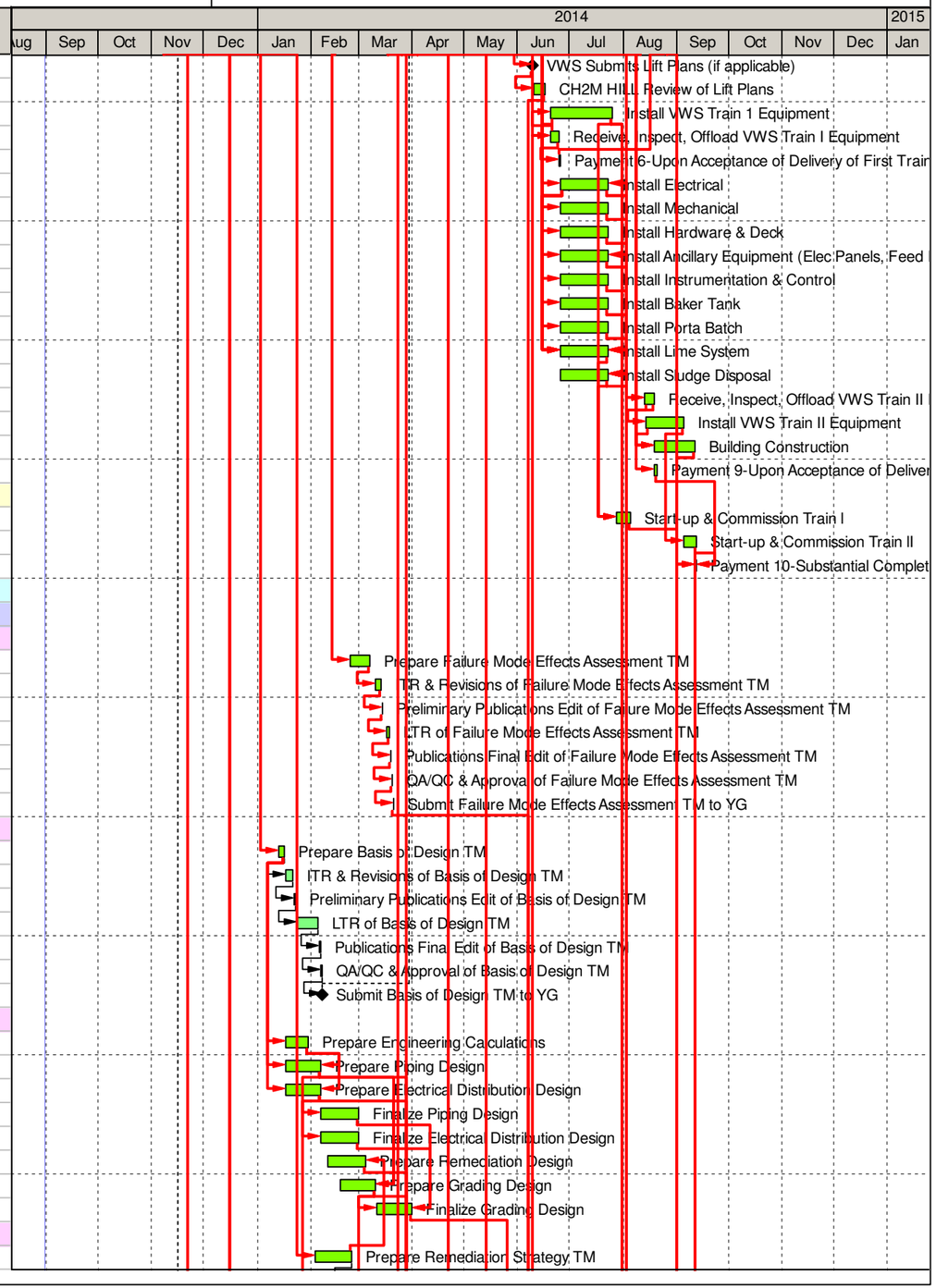


Faro Mine Remediation Project FY2013/14 Rebaseline	FARO MINE-IWTS TAR 19	03-Mar-14 13:56

Activity ID	Activity Name	Original Duration	Start	Finish
FM.19.E1.2040	VWS Purchasing	58	15-Jan-14	06-May-14
FM.19.E1.2045	VWS Package crating	2	07-May-14	13-May-14
First Train		116	21-Jan-14	08-Jul-14
Sludge Tank		81	11-Feb-14	09-Jun-14
FM.19.D1.1202.	VWS Fabricates Tank (2 x RX450-1)	58	11-Feb-14	06-May-14
FM.19.D1.1206	VWS Manufactures Internals (2 x RX450-1)	58	11-Feb-14	06-May-14
FM.19.E1.1210	VWS Assembles Internals (2 x RX450-1)	6	20-May-14	27-May-14
FM.19.E1.1510	VWS Pre-Wiring & Continuity Check (2 x RX450-1)	4	28-May-14	02-Jun-14
FM.19.E1.1215	VWS Packages/Crates Tank (2 x RX450-1) - Simplified Wrapping	5	03-Jun-14	09-Jun-14
Metal Precipitation Reactors		87	04-Feb-14	10-Jun-14
FM.19.D1.1246	VWS Manufactures Internals (2 x RX60-3)	63	04-Feb-14	06-May-14
FM.19.D1.1241	VWS Fabricates Tank (2 x RX60-3)	68	04-Feb-14	13-May-14
FM.19.E1.1250	VWS Assembles Internals (2 x RX60-3)	9	14-May-14	27-May-14
FM.19.E1.1520	VWS Pre-Wiring & Continuity Check (2 x RX60-3)	5	28-May-14	03-Jun-14
FM.19.E1.1255	VWS Packages/Crates Tank (2 x RX60-3) - Simplified Wrapping	5	04-Jun-14	10-Jun-14
ACTIFLO		116	21-Jan-14	08-Jul-14
FM.19.D1.1270	VWS Manufactures Internals (1 x ACP-700R)	63	21-Jan-14	22-Apr-14
FM.19.D1.1266	VWS Fabricates Tank (1 x ACP-700R)	73	21-Jan-14	06-May-14
FM.19.E1.1275	VWS Assembles Internals (1 x ACP-700R)	9	07-May-14	20-May-14
FM.19.E1.1530	VWS Pre-Wiring & Continuity Check (1 x ACP-700R)	10	21-May-14	03-Jun-14
FM.19.E1.1280	VWS Packages/CratesTank (1 x ACP-700R) - Simplified Wrapping	5	04-Jun-14	10-Jun-14
FM.19.E1.1285	VWS Ships First Train Tanks to Faro Site	7	11-Jun-14	19-Jun-14
FM.19.E1.4005	Payment 4-On Shipping of First Train	1	20-Jun-14	20-Jun-14
FM.19.E1.4010	Payment 5-Upon receipt of Shipping Costs for First Train	1	08-Jul-14	08-Jul-14
Aeration (Addeddum #1)		107	31-Jan-14	06-Jun-14
FM.19.D1.1510	VWS Engineering and Fabrication Drawings	58	31-Jan-14	13-Feb-14
FM.19.D1.1515	VWS Purchasing	58	07-Feb-14	08-May-14
FM.19.D1.1522	VWS Fabricates	58	11-Apr-14	06-Jun-14
Second Train		118	10-Mar-14	27-Aug-14
Sludge Tank		96	10-Mar-14	25-Jul-14
FM.19.D1.1291	VWS Fabricates Tank (2 x RX450-1)	57	10-Mar-14	30-May-14
FM.19.D1.1296	VWS Manufactures Internals (2 x RX450-1)	57	24-Mar-14	13-Jun-14
FM.19.E1.1300	VWS Assembles Internals (2 x RX450-1)	5	07-Jul-14	11-Jul-14
FM.19.E1.1550	VWS Pre-Wiring & Continuity Check (2 x RX60-3)	5	14-Jul-14	18-Jul-14
FM.19.E1.1305	VWS Packages/CratesTank (2 x RX450-1) - Simplified Wrapping	5	21-Jul-14	25-Jul-14
Metal Precipitation Reactors		101	10-Mar-14	01-Aug-14
FM.19.D1.1316	VWS Fabricates Tank (2 x RX60-3)	67	10-Mar-14	13-Jun-14
FM.19.D1.1321	VWS Manufactures Internals (2 x RX60-3)	62	31-Mar-14	27-Jun-14
FM.19.E1.1325	VWS Assembles Internals (2 x RX60-3)	10	14-Jul-14	25-Jul-14
FM.19.E1.1330	VWS Packages/CratesTank (2 x RX60-3) - Simplified Wrapping	5	28-Jul-14	01-Aug-14
ACTIFLO		118	10-Mar-14	27-Aug-14
FM.19.D1.1341	VWS Fabricates Tank (1 x ACP-700R)	72	10-Mar-14	20-Jun-14
FM.19.D1.1346	VWS Manufactures Internals (1 x ACP-700R)	62	24-Mar-14	20-Jun-14
FM.19.E1.1350	VWS Assembles Internals (1 x ACP-700R)	9	23-Jun-14	04-Jul-14
FM.19.E1.1560	VWS Pre-Wiring & Continuity Check (1 x ACP-700R)	10	07-Jul-14	18-Jul-14
FM.19.E1.1355	VWS Packages/CratesTank (1 x ACP-700R) - Simplified Wrapping	5	21-Jul-14	25-Jul-14
FM.19.E1.1360	VWS Ships Second Train Tanks to Faro Site	5	04-Aug-14	11-Aug-14
FM.19.E1.4015	Payment 7-On Shipping of Second Train	1	12-Aug-14	12-Aug-14
FM.19.E1.4020	Payment 8-Upon receipt of Shipping Costs for Second Train	1	27-Aug-14	27-Aug-14
IWTS Package I Veolia - Installation & Construciton		74	09-Jun-14	12-Sep-14
Installation		74	09-Jun-14	11-Sep-14

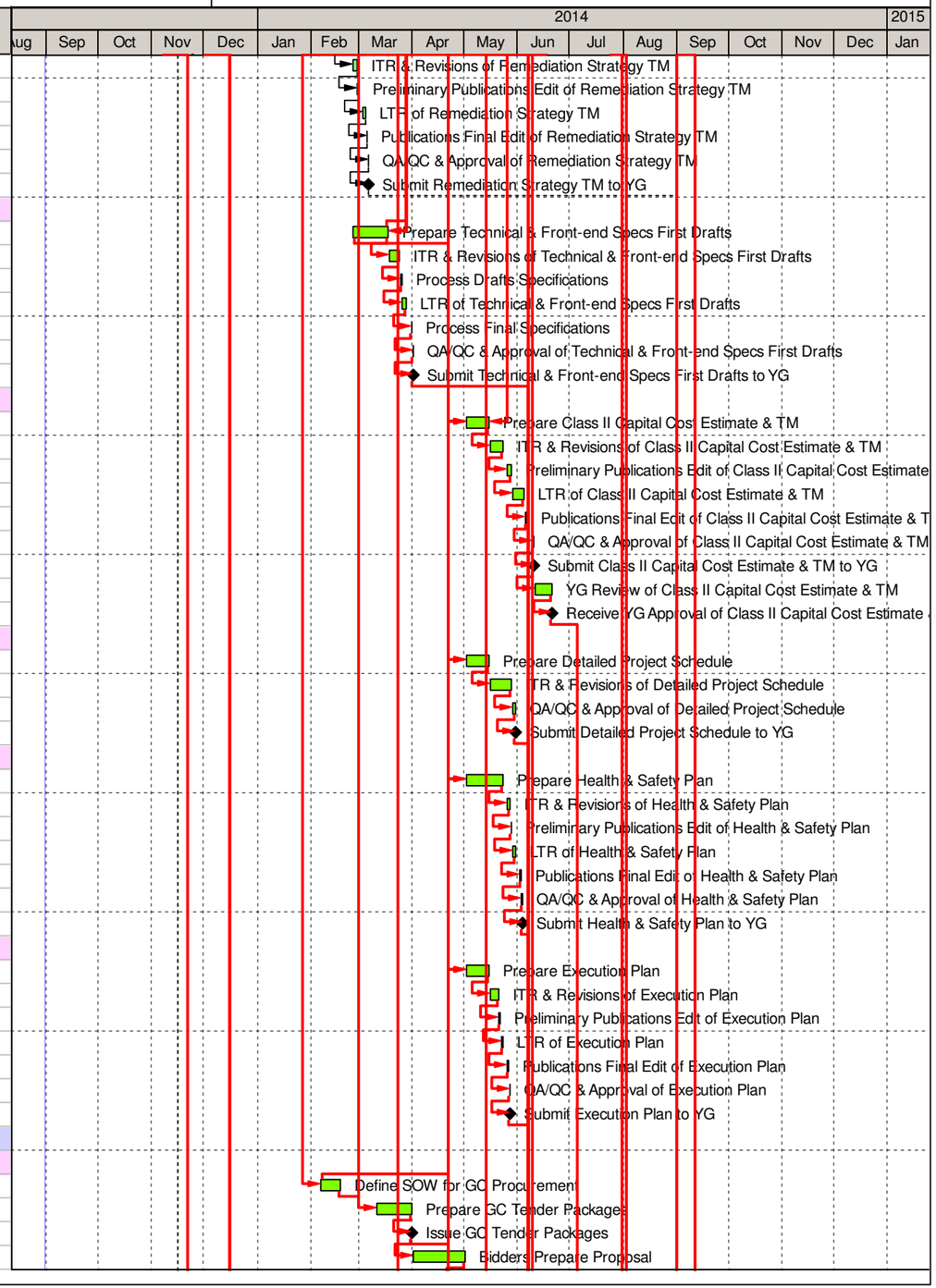


Activity ID	Activity Name	Original Duration	Start	Finish
FM.19.E1.1585	VWS Submits Lift Plans (if applicable)	0		09-Jun-14
FM.19.E1.1590	CH2M HILL Review of Lift Plans	6	10-Jun-14	16-Jun-14
FM.19.E1.1425	Install VWS Train 1 Equipment	25	20-Jun-14	25-Jul-14
FM.19.E1.1570	Receive, Inspect, Offload VWS Train I Equipment	3	20-Jun-14	24-Jun-14
FM.19.E1.4025	Payment 6-Upon Acceptance of Delivery of First Train	1	25-Jun-14	25-Jun-14
FM.19.E1.1435	Install Electrical	31	25-Jun-14	23-Jul-14
FM.19.E1.1440	Install Mechanical	31	25-Jun-14	23-Jul-14
FM.19.E1.1445	Install Hardware & Deck	31	25-Jun-14	23-Jul-14
FM.19.E1.1450	Install Ancillary Equipment (Elec Panels, Feed Pumps, pH Correction & Dosing, Etc)	31	25-Jun-14	23-Jul-14
FM.19.E1.1455	Install Instrumentation & Control	31	25-Jun-14	23-Jul-14
FM.19.E1.1460	Install Baker Tank	31	25-Jun-14	23-Jul-14
FM.19.E1.1465	Install Porta Batch	31	25-Jun-14	23-Jul-14
FM.19.E1.1470	Install Lime System	31	25-Jun-14	23-Jul-14
FM.19.E1.1475	Install Sludge Disposal	31	25-Jun-14	23-Jul-14
FM.19.E1.1580	Receive, Inspect, Offload VWS Train II Equipment	5	13-Aug-14	19-Aug-14
FM.19.E1.1430	Install VWS Train II Equipment	25	14-Aug-14	05-Sep-14
FM.19.E1.1500	Building Construction	25	19-Aug-14	11-Sep-14
FM.19.E1.4030	Payment 9-Upon Acceptance of Delivery of Second Train	1	19-Aug-14	20-Aug-14
Start-up & Commissioning		35	28-Jul-14	12-Sep-14
FM.19.E1.1485	Start-up & Commission Train I	14	28-Jul-14	05-Aug-14
FM.19.E1.1490	Start-up & Commission Train II	8	05-Sep-14	12-Sep-14
FM.19.E1.4035	Payment 10-Substantial Completion	1	11-Sep-14	12-Sep-14
IWTS Package II, Engineering, Procurement & Construction		177	13-Jan-14	25-Sep-14
CH2M HILL Engineering		111	13-Jan-14	20-Jun-14
Failure Mode Effects Assessment Technical Memorandum		19	24-Feb-14	21-Mar-14
FM.19.D1.1511	Prepare Failure Mode Effects Assessment TM	10	24-Feb-14	07-Mar-14
FM.19.D1.1516	ITR & Revisions of Failure Mode Effects Assessment TM	4	10-Mar-14	13-Mar-14
FM.19.D1.1520	Preliminary Publications Edit of Failure Mode Effects Assessment TM	1	14-Mar-14	14-Mar-14
FM.19.D1.1525	LTR of Failure Mode Effects Assessment TM	2	17-Mar-14	18-Mar-14
FM.19.D1.1530	Publications Final Edit of Failure Mode Effects Assessment TM	1	19-Mar-14	19-Mar-14
FM.19.D1.1535	QA/QC & Approval of Failure Mode Effects Assessment TM	1	20-Mar-14	20-Mar-14
FM.19.D1.1540	Submit Failure Mode Effects Assessment TM to YG	0	21-Mar-14	21-Mar-14
Basis of Design Technical Memoranda		20	13-Jan-14	07-Feb-14
FM.19.D1.1370	Prepare Basis of Design TM	4	13-Jan-14	16-Jan-14
FM.19.D1.1375	ITR & Revisions of Basis of Design TM	3	17-Jan-14	21-Jan-14
FM.19.D1.1380	Preliminary Publications Edit of Basis of Design TM	2	22-Jan-14	23-Jan-14
FM.19.D1.1385	LTR of Basis of Design TM	9	24-Jan-14	05-Feb-14
FM.19.D1.1390	Publications Final Edit of Basis of Design TM	1	06-Feb-14	06-Feb-14
FM.19.D1.1395	QA/QC & Approval of Basis of Design TM	1	07-Feb-14	07-Feb-14
FM.19.D1.1401	Submit Basis of Design TM to YG	0		07-Feb-14
Conduct Design		51	17-Jan-14	31-Mar-14
FM.19.D1.1405	Prepare Engineering Calculations	10	17-Jan-14	30-Jan-14
FM.19.D1.1420	Prepare Piping Design	15	17-Jan-14	06-Feb-14
FM.19.D1.1425	Prepare Electrical Distribution Design	15	17-Jan-14	06-Feb-14
FM.19.D1.1422	Finalize Piping Design	15	07-Feb-14	28-Feb-14
FM.19.D1.1427	Finalize Electrical Distribution Design	15	07-Feb-14	28-Feb-14
FM.19.D1.1410	Prepare Remediation Design	15	11-Feb-14*	04-Mar-14
FM.19.D1.1415	Prepare Grading Design	15	18-Feb-14	10-Mar-14
FM.19.D1.1417	Finalize Grading Design	15	11-Mar-14	31-Mar-14
Remediation Strategy Technical Memorandum		23	03-Feb-14	06-Mar-14
FM.19.D1.1546	Prepare Remediation Strategy TM	15	03-Feb-14	24-Feb-14



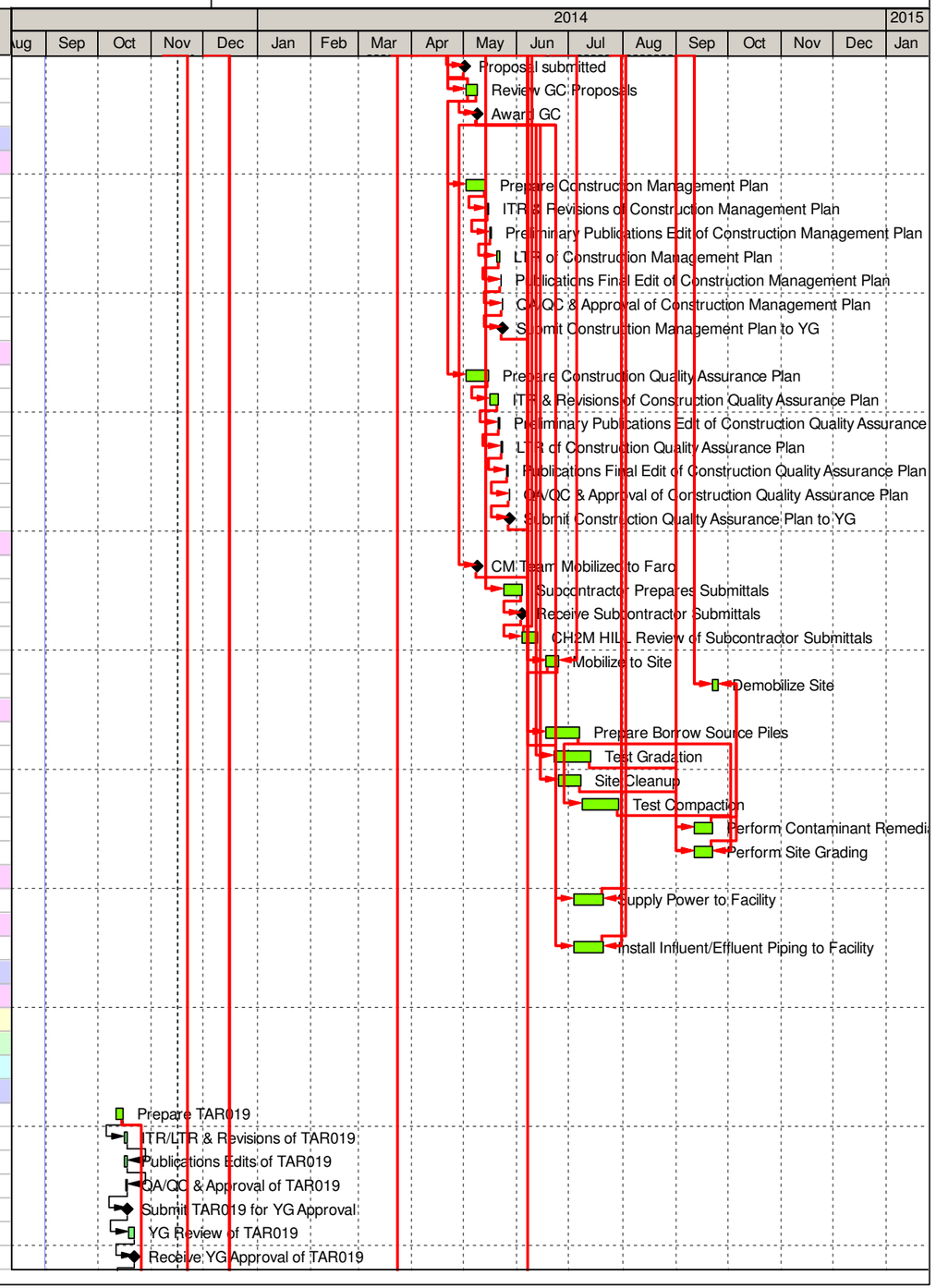
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Activity ID	Activity Name	Original Duration	Start	Finish
FM.19.D1.1550	ITR & Revisions of Remediation Strategy TM	3	25-Feb-14	27-Feb-14
FM.19.D1.1555	Preliminary Publications Edit of Remediation Strategy TM	1	28-Feb-14	28-Feb-14
FM.19.D1.1561	LTR of Remediation Strategy TM	2	03-Mar-14	04-Mar-14
FM.19.D1.1565	Publications Final Edit of Remediation Strategy TM	1	05-Mar-14	05-Mar-14
FM.19.D1.1571	QA/QC & Approval of Remediation Strategy TM	1	06-Mar-14	06-Mar-14
FM.19.D1.1575	Submit Remediation Strategy TM to YG	0		06-Mar-14
First Drafts of the Technical & Front-end Specifications		26	25-Feb-14	01-Apr-14
FM.19.D1.1441	Prepare Technical & Front-end Specs First Drafts	15	25-Feb-14	17-Mar-14
FM.19.D1.1446	ITR & Revisions of Technical & Front-end Specs First Drafts	5	18-Mar-14	24-Mar-14
FM.19.D1.1451	Process Drafts Specifications	1	25-Mar-14	25-Mar-14
FM.19.D1.1456	LTR of Technical & Front-end Specs First Drafts	3	26-Mar-14	28-Mar-14
FM.19.D1.1461	Process Final Specifications	1	31-Mar-14	31-Mar-14
FM.19.D1.1466	QA/QC & Approval of Technical & Front-end Specs First Drafts	1	01-Apr-14	01-Apr-14
FM.19.D1.1471	Submit Technical & Front-end Specs First Drafts to YG	0		01-Apr-14
Class II Capital Cost Estimate & Technical Memorandum		35	02-May-14	20-Jun-14
FM.19.E1.5000	Prepare Class II Capital Cost Estimate & TM	10	02-May-14	15-May-14
FM.19.E1.5005	ITR & Revisions of Class II Capital Cost Estimate & TM	5	16-May-14	23-May-14
FM.19.E1.5010	Preliminary Publications Edit of Class II Capital Cost Estimate & TM	3	26-May-14	28-May-14
FM.19.E1.5015	LTR of Class II Capital Cost Estimate & TM	5	29-May-14	04-Jun-14
FM.19.E1.5020	Publications Final Edit of Class II Capital Cost Estimate & TM	2	05-Jun-14	06-Jun-14
FM.19.E1.5025	QA/QC & Approval of Class II Capital Cost Estimate & TM	2	09-Jun-14	10-Jun-14
FM.19.E1.5030	Submit Class II Capital Cost Estimate & TM to YG	0		10-Jun-14
FM.19.E1.5035	YG Review of Class II Capital Cost Estimate & TM	8	11-Jun-14	20-Jun-14
FM.19.E1.5040	Receive YG Approval of Class II Capital Cost Estimate & TM	0		20-Jun-14
Detailed Project Schedule		20	02-May-14	30-May-14
FM.19.E1.5050	Prepare Detailed Project Schedule	10	02-May-14	15-May-14
FM.19.E1.5055	ITR & Revisions of Detailed Project Schedule	8	16-May-14	28-May-14
FM.19.E1.5060	QA/QC & Approval of Detailed Project Schedule	2	29-May-14	30-May-14
FM.19.E1.5065	Submit Detailed Project Schedule to YG	0		30-May-14
Health & Safety Plan		22	02-May-14	03-Jun-14
FM.19.E1.5070	Prepare Health & Safety Plan	15	02-May-14	23-May-14
FM.19.E1.5075	ITR & Revisions of Health & Safety Plan	2	26-May-14	27-May-14
FM.19.E1.5080	Preliminary Publications Edit of Health & Safety Plan	1	28-May-14	28-May-14
FM.19.E1.5085	LTR of Health & Safety Plan	2	29-May-14	30-May-14
FM.19.E1.5090	Publications Final Edit of Health & Safety Plan	1	02-Jun-14	02-Jun-14
FM.19.E1.5095	QA/QC & Approval of Health & Safety Plan	1	03-Jun-14	03-Jun-14
FM.19.E1.5100	Submit Health & Safety Plan to YG	0		03-Jun-14
Execution Plan		17	02-May-14	27-May-14
FM.19.E1.5105	Prepare Execution Plan	10	02-May-14	15-May-14
FM.19.E1.5110	ITR & Revisions of Execution Plan	2	16-May-14	20-May-14
FM.19.E1.5115	Preliminary Publications Edit of Execution Plan	1	21-May-14	21-May-14
FM.19.E1.5120	LTR of Execution Plan	2	22-May-14	23-May-14
FM.19.E1.5125	Publications Final Edit of Execution Plan	1	26-May-14	26-May-14
FM.19.E1.5130	QA/QC & Approval of Execution Plan	1	27-May-14	27-May-14
FM.19.E1.5135	Submit Execution Plan to YG	0		27-May-14
IWTS Package II - Procurement		62	07-Feb-14	08-May-14
Procurement - General Construction		62	07-Feb-14	08-May-14
FM.19.D1.1435	Define SOW for GC Procurement	7	07-Feb-14	18-Feb-14
FM.19.D1.1440	Prepare GC Tender Packages	15	11-Mar-14	31-Mar-14
FM.19.D1.1505	Issue GC Tender Packages	0		31-Mar-14
FM.19.E1.2235	Bidders Prepare Proposal	21	01-Apr-14	01-May-14



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Activity ID	Activity Name	Original Duration	Start	Finish
FM.19.E1.2240	Proposal submitted	0		01-May-14
FM.19.E1.1512	Review GC Proposals	5	02-May-14	08-May-14
FM.19.E1.1447	Award GC	0		08-May-14
Construction		101	02-May-14	25-Sep-14
Construction Management Plan		15	02-May-14	23-May-14
FM.19.E1.5140	Prepare Construction Management Plan	8	02-May-14	13-May-14
FM.19.E1.5145	ITR & Revisions of Construction Management Plan	2	14-May-14	15-May-14
FM.19.E1.5150	Preliminary Publications Edit of Construction Management Plan	1	16-May-14	16-May-14
FM.19.E1.5155	LTR of Construction Management Plan	2	20-May-14	21-May-14
FM.19.E1.5160	Publications Final Edit of Construction Management Plan	1	22-May-14	22-May-14
FM.19.E1.5165	QA/QC & Approval of Construction Management Plan	1	23-May-14	23-May-14
FM.19.E1.5170	Submit Construction Management Plan to YG	0		23-May-14
Construction Quality Assurance Plan		17	02-May-14	27-May-14
FM.19.E1.5175	Prepare Construction Quality Assurance Plan	10	02-May-14	15-May-14
FM.19.E1.5180	ITR & Revisions of Construction Quality Assurance Plan	2	16-May-14	20-May-14
FM.19.E1.5185	Preliminary Publications Edit of Construction Quality Assurance Plan	1	21-May-14	21-May-14
FM.19.E1.5190	LTR of Construction Quality Assurance Plan	2	22-May-14	23-May-14
FM.19.E1.5195	Publications Final Edit of Construction Quality Assurance Plan	1	26-May-14	26-May-14
FM.19.E1.5200	QA/QC & Approval of Construction Quality Assurance Plan	1	27-May-14	27-May-14
FM.19.E1.5205	Submit Construction Quality Assurance Plan to YG	0		27-May-14
Mob/Demob		130	08-May-14	25-Sep-14
FM.19.E1.5220	CM Team Mobilized to Faro	0		08-May-14
FM.19.E1.5225	Subcontractor Prepares Submittals	10	24-May-14	03-Jun-14
FM.19.E1.5230	Receive Subcontractor Submittals	0		03-Jun-14
FM.19.E1.5235	CH2M HILL Review of Subcontractor Submittals	8	04-Jun-14	12-Jun-14
FM.19.E1.5210	Mobilize to Site	8	17-Jun-14	24-Jun-14
FM.19.E1.5215	Demobilize Site	3	22-Sep-14	25-Sep-14
Site Preparation		91	17-Jun-14	22-Sep-14
FM.19.E1.1466	Prepare Borrow Source Piles	20	17-Jun-14	07-Jul-14
FM.19.E1.1610	Test Gradation	20	22-Jun-14	13-Jul-14
FM.19.E1.1456	Site Cleanup	12	25-Jun-14	07-Jul-14
FM.19.E1.1615	Test Compaction	20	08-Jul-14	29-Jul-14
FM.19.E1.1461	Perform Contaminant Remediation	10	11-Sep-14	22-Sep-14
FM.19.E1.1471	Perform Site Grading	10	11-Sep-14	22-Sep-14
Power Distribution Facility		16	03-Jul-14	21-Jul-14
FM.19.E1.1476	Supply Power to Facility	16	03-Jul-14	21-Jul-14
Piping (Influent, Effluent, Sludge)		16	03-Jul-14	21-Jul-14
FM.19.E1.1486	Install Influent/Effluent Piping to Facility	16	03-Jul-14	21-Jul-14
Governance & Management		135	11-Oct-13	31-Oct-14
Project Management		135	11-Oct-13	31-Oct-14
PDT TA Management		135	11-Oct-13	31-Oct-14
PDT TA019 Management		135	11-Oct-13	31-Oct-14
TAR Planning		135	11-Oct-13	28-Apr-14
TAC019		6	11-Oct-13	21-Oct-13
FM.19.A1.1005	Prepare TAR019	2	11-Oct-13*	15-Oct-13
FM.19.A1.1010	ITR/LTR & Revisions of TAR019	2	16-Oct-13	17-Oct-13
FM.19.A1.1270	Publications Edits of TAR019	2	16-Oct-13	17-Oct-13
FM.19.A1.1275	QA/QC & Approval of TAR019	1	17-Oct-13	17-Oct-13
FM.19.A1.1280	Submit TAR019 for YG Approval	0		17-Oct-13
FM.19.A1.1015	YG Review of TAR019	2	18-Oct-13	21-Oct-13
FM.19.A1.1020	Receive YG Approval of TAR019	0		21-Oct-13

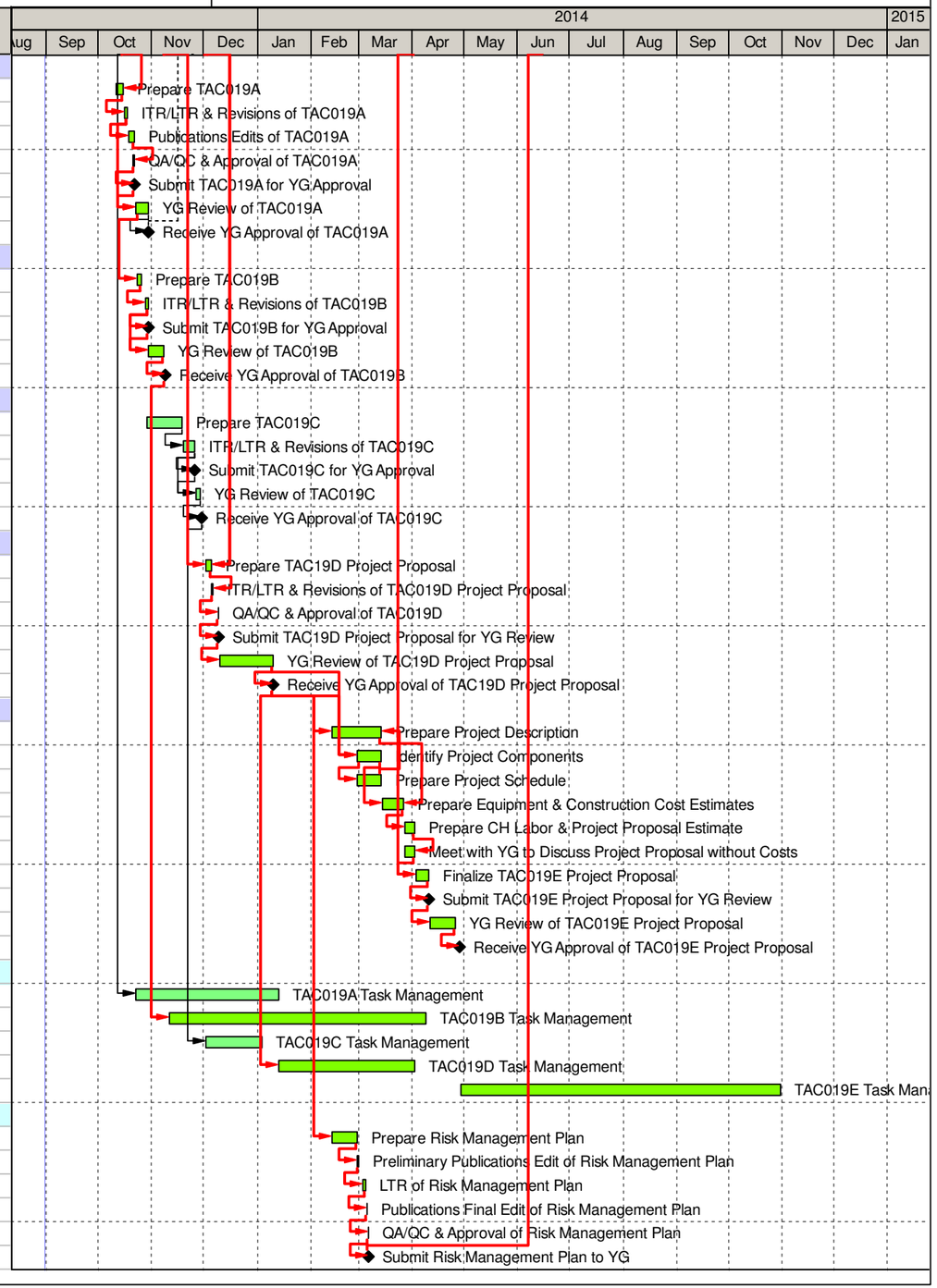


Faro Mine Remediation Project FY2013/14 Rebaseline

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Activity ID	Activity Name	Original Duration	Start	Finish
TAC019A		12	11-Oct-13	29-Oct-13
FM.19.A1.1025	Prepare TAC019A	2	11-Oct-13	15-Oct-13
FM.19.A1.1030	ITR/LTR & Revisions of TAC019A	2	16-Oct-13	17-Oct-13
FM.19.A1.1285	Publications Edits of TAC019A	2	18-Oct-13	21-Oct-13
FM.19.A1.1290	QA/QC & Approval of TAC019A	1	21-Oct-13	21-Oct-13
FM.19.A1.1295	Submit TAC019A for YG Approval	0		21-Oct-13
FM.19.A1.1035	YG Review of TAC019A	6	22-Oct-13	29-Oct-13
FM.19.A1.1040	Receive YG Approval of TAC019A	0		29-Oct-13
TAC019B		13	23-Oct-13	08-Nov-13
FM.19.A1.1050	Prepare TAC019B	3	23-Oct-13	25-Oct-13
FM.19.A1.1055	ITR/LTR & Revisions of TAC019B	2	28-Oct-13	29-Oct-13
FM.19.A1.1310	Submit TAC019B for YG Approval	0		29-Oct-13
FM.19.A1.1060	YG Review of TAC019B	7	30-Oct-13	07-Nov-13
FM.19.A1.1065	Receive YG Approval of TAC019B	0		08-Nov-13
TAC019C		24	29-Oct-13	29-Nov-13
FM.19.A1.1105	Prepare TAC019C	15	29-Oct-13*	18-Nov-13
FM.19.A1.1110	ITR/LTR & Revisions of TAC019C	5	19-Nov-13	25-Nov-13
FM.19.A1.1325	Submit TAC019C for YG Approval	0		25-Nov-13
FM.19.A1.1115	YG Review of TAC019C	3	26-Nov-13	28-Nov-13
FM.19.A1.1120	Receive YG Approval of TAC019C	0		29-Nov-13
TAC019D		27	02-Dec-13	10-Jan-14
FM.19.A1.1170	Prepare TAC19D Project Proposal	4	02-Dec-13*	05-Dec-13
FM.19.A1.1175	ITR/LTR & Revisions of TAC019D Project Proposal	2	05-Dec-13	06-Dec-13
FM.19.A1.1320	QA/QC & Approval of TAC019D	1	09-Dec-13	09-Dec-13
FM.19.A1.1180	Submit TAC19D Project Proposal for YG Review	0		09-Dec-13
FM.19.A1.1185	YG Review of TAC19D Project Proposal	5	10-Dec-13	10-Jan-14
FM.19.A1.1190	Receive YG Approval of TAC19D Project Proposal	0		10-Jan-14
TAC019E		50	13-Feb-14	28-Apr-14
FM.19.D1.1230	Prepare Project Description	20	13-Feb-14	13-Mar-14
FM.19.D1.1210	Identify Project Components	10	28-Feb-14	13-Mar-14
FM.19.D1.1215	Prepare Project Schedule	10	28-Feb-14	13-Mar-14
FM.19.D1.1235	Prepare Equipment & Construction Cost Estimates	9	14-Mar-14	26-Mar-14
FM.19.D1.1240	Prepare CH Labor & Project Proposal Estimate	5	27-Mar-14	02-Apr-14
FM.19.D1.1245	Meet with YG to Discuss Project Proposal without Costs	5	27-Mar-14	02-Apr-14
FM.19.D1.1250	Finalize TAC019E Project Proposal	6	03-Apr-14	10-Apr-14
FM.19.D1.1255	Submit TAC019E Project Proposal for YG Review	0		10-Apr-14
FM.19.D1.1260	YG Review of TAC019E Project Proposal	9	11-Apr-14	25-Apr-14
FM.19.D1.1265	Receive YG Approval of TAC019E Project Proposal	0		28-Apr-14
TA019 TM FY2013/14		129	22-Oct-13	31-Oct-14
FM.19.A1.1045	TAC019A Task Management	57	22-Oct-13	13-Jan-14
FM.19.B1.1070	TAC019B Task Management	103	11-Nov-13	08-Apr-14
FM.19.C1.1125	TAC019C Task Management	22	02-Dec-13	03-Jan-14
FM.19.D1.1195	TAC019D Task Management	57	13-Jan-14	02-Apr-14
FM.19.E1.1270	TAC019E Task Management	0	29-Apr-14*	31-Oct-14
Risk Management Plan		15	13-Feb-14	06-Mar-14
FM.19.D1.1616	Prepare Risk Management Plan	10	13-Feb-14	27-Feb-14
FM.19.D1.1625	Preliminary Publications Edit of Risk Management Plan	1	28-Feb-14	28-Feb-14
FM.19.D1.1630	LTR of Risk Management Plan	2	03-Mar-14	04-Mar-14
FM.19.D1.1635	Publications Final Edit of Risk Management Plan	1	05-Mar-14	05-Mar-14
FM.19.D1.1640	QA/QC & Approval of Risk Management Plan	1	06-Mar-14	06-Mar-14
FM.19.D1.1645	Submit Risk Management Plan to YG	0		06-Mar-14



Appendix C7
Project Management

APPENDIX C7

Project Management

On September 1, 2011, CH2M HILL Canada Limited (CH2M HILL) and the Government of Yukon (YG) entered into Master Services Agreement (MSA) C00010250, whereby CH2M HILL became the Project Design Team (PDT) for the Faro Mine Remediation Project (FMRP). In contracting the PDT, YG's intent was to engage a partner with whom to advance the Faro Mine Complex (FMC) through the planning and closure process in alignment with the five overarching project objectives. Under the MSA, the PDT is contracted through individual Task Authorizations to accomplish specific technical objectives in alignment with project needs. Outside of the technical authorizations, CH2M HILL provides overarching project management services for strategic planning and management support and day-to-day project operations and controls in support of successful delivery of the individual Task Authorizations. As such, project management under the PDT has both fixed and variable components.

C7.1 Current Condition

PDT project management systems have been developed and implemented; these have allowed for the successful delivery of approximately $22 Million (M) of technical work since contract award. These systems comprise the following project management tasks:

- Assembling and maintaining a complement of talented project support personnel committed to the FMRP and experienced in FMRP-specific requirements for: communications, technical writing, project controls, reporting and invoicing, quality management, and all other facets needed to deliver the project within budget and on schedule
- Managing and coordinating a diversified technical team (including subconsultants), which has been able to respond to the full breadth and depth of the FMRP's engineering and scientific needs
- Maintaining flexibility to adapt to directional changes as required
- Developing and maintaining the FMRP SharePoint site to coordinate the delivery of the project
- Constructing a resource-loaded schedule to allow for consistent and accurate forecasting and statusing
- Developing standard financial reporting tools
- Preparing a series of Project Management Planning tools to allow for consistent application of policies and procedures within FMRP-defined parameters, including:
    - Project Management Plan
    - Project Controls Plan
    - Site-wide Health and Safety Plan
    - Quality Management Plan
    - Change Management Plan

C7.2 Justification

The PDT has been contracted to support YG for the advancement of the FMRP through the engineering and regulatory aspects of Phase 2b of the project. Originally, based on the understanding that the existing engineering design was considered a 30-percent design, it was expected that the PDT role would amount to approximately CAD$5M of project expenditure each year. To date (following the realization that the existing design required additional effort to achieve 30 percent), the project delivery has resulted in expenditures ranging between CAD$250,000 and CAD$2M per month. As currently planned under the Medium Term Plan (MTP), the PDT could be involved in executing work that will result in expenditures exceeding $1M per week at times. To deliver the work already complete, and in light of changing project priorities and fiscal

constraints, the PDT has developed comprehensive and robust management systems. To successfully deliver the work pertaining to the PDT that is contained within the MTP, it will be necessary to maintain and, in some cases expand and refine these systems to maintain the level of project controls required by YG. Funding for the PDT program management function is planned to include both fixed and variable elements. This design will maintain the continuity of delivery capacity through years with reduced funding, such that it may be present and built upon to deliver work in years of increased expenditure.

C7.3 Description of Scope

Project management services under the PDT provide overarching support and management of the FMRP delivery, as contracted through the MSA. The services include:

- Overarching project management of the delivery team
- Coordination and management of the technical focus teams to maintain overall consistency and alignment with key objectives and performance indicators
- Semi-annual updating of the established management plans to assure that they remain relevant to the project direction and developments in scopes of work
- Implementation of project controls and associated reporting for all active TAs under the MSA. Specific tasks are as follows:
    - Providing monthly invoices – financial status and forecasts (trends)
    - Providing monthly Status Reports with updates on scope, schedule, budget, and deliverable status
    - Providing weekly/bi-weekly financial status reports with estimates of financial changes for YG reporting
    - Providing monthly estimate-at-complete/estimate-to-complete, schedule updating, and Earned Value calculations
    - Tracking and managing change, including change orders where scope, schedule or budget has changed
- SharePoint site support and maintenance
- Coordination, attendance, and facilitation of core team and subcontracted team member status meetings, and leadership team and Faro Project Execution Team (FPET) status meetings
- Attendance at YG meetings, as required. Assistance with the coordination of FMRP PDT/YG meetings and workshops, including those involving independent reviewers
- Contract and MSA management
- Performance of continual improvement actions such as audits, reviews, and lessons learned dissemination in the following areas:
    - Monthly/quarterly reviews of the project delivery and quality expectation adherence to assure strong performance
    - Reviews of the health and safety behaviours and actions during field work and, where necessary, office- based work to identify areas for improvement, and take actions for improved safety conditions
    - Quarterly corporate sponsor reviews with YG to evaluate project performance
    - Lessons learned development and dissemination, and participation in the FPET lessons learned processes

- Preparation and execution of the Affected Yukon First Nations (AYFN) and Yukoners Participation Plan, including consultation with YG and various other parties
- Provision of support to YG for Project Execution Planning, strategic planning, risk management, and miscellaneous activities

C7.4 Schedule Summary

The schedule for the Project Management task is a continuum beginning at the outset of the MSA and ending when the contract is complete. The task is bounded in scope and schedule within each fiscal year, to align with YG's contract limitations.

C7.5 Budget

The cost estimate for Project Management under the current MTP is based on the experience of the PDT to-date under the MSA, and in consideration of the type of work being planned for the duration of the MTP. For the purposes of this MTP, this estimate is considered a Class 3, with an accuracy range of +30%/-20%. While previous experience provides some level of cost certainty in this estimate, the work being planned is also substantially different in magnitude and scope from that previously conducted, and may affect the basis of estimate. Additionally, and as illustrated herein, the estimated amounts are contingent on the amount of work to take place in any given year of the MTP.

The FMRP under the MSA is a dynamic project, subject to variability in terms of the type or work and the schedule under which the work is performed. It has been through consistent communication and mutual understanding of the project vision that CH2M HILL has been able to successfully support the project to-date. In light of that "partnership"-based working relationship, the following cost estimate includes both a fixed project management element, required to maintain that consistency in communication and collective vision, and a variable element, which is required to deliver the amount of technical work planned for a given year.

C7.5.1 Basis of Estimate

The basis for this estimate is as follows:

The fixed costs for the Project Management task are as follows:

- The PDT Project Manager is full-time (100%) throughout the project
- The PDT Operations Lead is full-time (100%) throughout the project
- The PDT Technical Lead, Engineering Lead, and Regulatory Lead are 30%-(10% each) committed supporting PM-related functions throughout the FMRP, plus $10,000 travel expenses
- The PDT Corporate Sponsor is 8%-committed to the FMRP, plus $10,000 travel expenses.

Fixed costs are in place to provide YG with direct access to established resources, to maintain continuity of service and vision. These costs are estimated at $870,448 each year.

The variable costs for Project Management are a combination of the following functional labour and expense items, which would be expended in a variety of proportions, as needed, based on FMRP requirements:

- Project Controls – Cost Engineer, Scheduler, additional support as needed, travel as needed
- Accounting – Project Accountant(s)
- Publications – Deliverable Coordinator, Technical Editors, Document Processors, Reproduction Specialists
- Health and Safety – Health and Safety Manager
- Quality Assurance – Quality Manager, quality tracking and record keeping; travel expenses
- SharePoint – SharePoint Manager
- Miscellaneous – Project Delivery and Administrative Assistants

Variable costs are directly related to the annual PDT budgets for technical (that is, non-management) work planned and are estimated as 6-percent of that amount.

C7.5.2 Cost Estimate

The total cost estimate for Project Management described herein equals CAD $7,853,810. This estimate is detailed in Attachment C7-1 and summarized in Table C7-1.

TABLE C7-1

PDT Project Management – Cost Estimate

Faro Mine Remediation Project

WBS	Cost	2014/15	2015/16	2016/17	2017/18 [a]	Total
	Technical	$34,863,677	$17,376,097	$18,342,308	$2,284,875	$72,866,957
TBD	PM Fixed Cost	$870,448	$870,448	$870,448	$870,448	$3,481,792
TBD	PM Variable Cost	$2,091,821	$1,042,566	$1,100,538	$137,093	$4,372,017
	TOTAL PM	**$2,962,269**	**$1,913,014**	**$1,970,986**	**$1,007,541**	**$7,853,810**

[a] Fixed amount only maintained in the final year if necessary to maintain PDT management continuity, in preparation for additional PDT work in following years (i.e., Phase 2c).

C7.5.3 Assumptions

The following assumptions were made in preparing this cost estimate:

- The Project Management task does not include the costs for managing individual Task Authorizations including: Task Authorization Request preparation, Task Authorization invoicing, Task Authorization financial and schedule statusing, and other Task Authorization-related administrative tasks.
- All costs are in 2012 dollars and are based on 2012 MSA labour rates (C00010250).

C7.5.4 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are nonbinding and are provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, schedule implementation, and other variable factors. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions related to proper project evaluation and adequate funding.

Attachment C7-1
Cost Estimate Summary

ATTACHMENT C7-1

PDT Project Management Cost Estimate

Faro Mine Remediation Project - PDT Project Management Medium Term Plan

	Rate	Hrs	2014/15	2015/16	2016/17	2017/18	TOTAL
Technical Budget Estimate			$34,863,677	$17,376,097	$18,342,308	$2,284,875	$72,866,957
Fixed PM Costs							
PDT Project Manager	$206	1840	$379,040	$379,040	$379,040	$379,040	$1,516,160
PDT Operations Lead	$180	1840	$331,200	$331,200	$331,200	$331,200	$1,324,800
PDT Technical Leadership	$196	552	$118,192	$118,192	$118,192	$118,192	$472,768
PDT Corporate Sponsor	$232	138	$42,016	$42,016	$42,016	$42,016	$168,064
Total Fixed PM			$870,448	$870,448	$870,448	$870,448	$3,481,792
Total Variable PM Costs		6%	$2,091,821	$1,042,566	$1,100,538	$137,093	$4,372,017
Total PM			**$2,962,269**	**$1,913,014**	**$1,970,986**	**$1,007,541**	**$7,853,810**

Appendix D
Potential Work Packages

Appendix D1
Emergency Tailings Area
Seepage Interception System

APPENDIX D1

Emergency Tailings Area Seepage Interception System

D1.1 Work Package Description

The Emergency Tailings Area (ETA) contains some of the most highly contaminated groundwater and surface water in the Faro Mine Area. It is a major source of contaminant loading to the Rose Creek Alluvial Aquifer (RCAA). Sources of the contamination include the in-place tailings within the ETA and the Faro waste rock dumps (WRDs), which discharge through the Faro Creek Canyon (FCC) (AECOM Canada Ltd. [AECOM], 2009; SRK Consulting Engineers and Scientists [SRK], 2006a). A rudimentary surface water and seepage collection system (called a seepage interception system [SIS]), designed to partially capture and convey surface water flow, operates about 5 months of the year during warm weather periods. Surface and groundwater monitoring have demonstrated significant increases in contamination of acidity, sulphate, and zinc over the last 3 years, indicating breakthrough of acid rock drainage products and a decline in the buffering capacity of the WRD, the ETA tailings, and alluvial soils (Robertson GeoConsultants Inc. [RGC], 2012).

This work package provides an upgrade of the existing SIS at the ETA. This includes pumping and piping capable of year-round capture and conveyance for treatment, additional capture capacity, improved efficiency, and improvements to provide access for maintenance. This work will be implemented in a manner compatible with long-term closure plans for the site.

D1.2 Current Condition

This section provides a brief overview of the ETA, including location, SIS installation, contaminant loads, and relevant studies, followed by more detail on:

- Description of the existing ETA SIS
- Efficiency of the existing SIS collection
- Limitations of the existing ETA SIS configuration

D1.2.1 ETA Overview

The lower Faro Creek Valley was used for emergency storage of tailings during mining operations. The tailings are contained by topographic features to the south, the Faro WRD to the east, the Mill Building Area to the north, and the mine access road to the southwest. The ETA is shown in Photo D1-1 and on Figure D1-1. Surface water and groundwater contamination loading in the ETA is from the following sources (SRK, 2006a):

- Surface flow originating as toe seepage from the Main WRD in Old Faro Creek (near surface-water sampling location X23, shown on Figure D1-1)
- Groundwater flow from the WRD through highly permeable alluvial sediments in the historic Faro Creek valley upon which the ETA sits
- Surface water and groundwater flow impacts from the ETA tailings
- Runoff and seepage from the Mill Building Area, including the former concentrate load-out facility



PHOTO D1-1
Emergency Tailings Area (looking southwest from the Faro WRD). Water seeping from the base of the WRD corresponds to Location X23 on Figure D1-1.
Faro Mine Remediation Project

Natural drainage from the ETA is to the south, towards the FCC and the Rose Creek Tailings Area (RCTA). Old Faro Creek gains significantly along its length, with much of the groundwater contributions to the stream likely occurring between X23 and the mine access road (SRK, 2006a). The ETA seep, surface water, and groundwater sampling locations are shown on Figure D1-1. Table D1-1 summarizes pH, sulphate, and zinc information for different ETA water units.

Seeps discharging to the ETA at the base of the Main WRD, which form flowing surface water across the ETA in Old Faro Creek and Mill Canyon Creek, are highly impacted as evidenced by the water quality at surface-water sampling location X23, as shown in Table D1-1. Surface water quality at X23 has increasing contamination trends (RGC, 2012).

Groundwater in tailings and alluvium in the ETA is also highly impacted, and mine-related contamination is increasing. Iron concentrations are elevated in shallow ETA groundwater as well because of leaching from the tailings. Groundwater in bedrock within the ETA is less affected by mine waste seepage than the overlying alluvial channel (RGC, 2012). The bedrock aquifer is considered to be a relatively minor contributor for the ETA's contaminant mass flux.

Overburden and weathered bedrock groundwater quality and surface water quality downstream of the ETA in FCC is also highly impacted (locations P09-ETA2 and FCS-4), and the seasonal operation of the ETA SIS does not appear to be improving groundwater quality in these units (RGC, 2012). However, groundwater in deep bedrock downgradient of the ETA does not show indications of mine-related contamination based on data from monitoring well P09-ETA1 (RGC, 2012).

The 2005 and 2006 detailed flow monitoring and sampling along FCC (RGC, 2007) provide good insight regarding the areas of seepage gains (upwelling from groundwater) and losses (infiltration into natural soils and the tailings) between the ETA SIS and the Intermediate Pond.

In tracking seepage along the FCC monitoring points shown on Figure D1-1, RGC (2007) made the following observations:

- Toe seepage from the waste rock dumps (FCS-1 at X23) occurs year-round, with a decrease in seepage during winter base flow.
- Subsurface seepage from the ETA (FCS-3 at the downstream seepage face) flows year-round. Flow estimates ranged from 2.3 to 4.8 litres per second (L/sec) during the 2005 and 2006 monitoring periods. Water quality of this seepage was generally similar to that observed in the alluvial wells in the ETA; iron concentrations were consistently about one order of magnitude higher than in the WRD seepage entering the ETA.
- The two most reliable flow surveys (May and October 2005) suggest that incremental gains in stream flow along FCC (between FCS-3 and FCS-4) are very small (0.1 to 0.7 L/sec), suggesting only a very small (if any) groundwater discharge along FCC. The associated loading calculations support this hypothesis.
- The majority of seepage losses from the FCC surface water occur downstream from FCS-4, with most of the surface water losses occurring as the Faro Creek seepage flows over the coarse, dry tailings adjacent to FCS-5.
- Subsurface seepage discharging downstream from the ETA represents the primary source of contaminant loading during the winter base flow and a significant source of loading during the remainder of the year.

Evaluation of seepage losses between FCS-4 and FCS-7 (RGC, 2007) indicated that approximately 50 percent of the flow and, hence, approximately 50 percent of the metal load, was lost to the subsurface between these monitoring points. This indicates that a substantial portion of the flow and load bypassing the ETA SIS infiltrates into the subsurface and consumes metals attenuation capacity of the RCAA.

The zinc load discharged from the ETA was estimated to be approximately 35 to 80 tonnes in 2005 and 2006 and 131 tonnes in 2009. To put these metal loads from the ETA in perspective, they can be compared to estimated loads (as calculated by modelling) originating from the tailings in the RCTA. The Rose Creek tailings water and load balance study (RGC, 2005) estimated that the zinc load from the tailings in the RCTA to the RCAA from 2005 to 2010 would range from approximately 65 to 100 tonnes per year (tpy) for average conditions and 75 to 200 tpy for maximum conditions. This indicates that the ETA is a significant source of zinc to the aquifer. As described in Section D1.1.2, an SIS was installed to intercept the ETA surface water and seep contamination.

The flows that bypass the existing ETA SIS are transported down FCC. The metal loads exiting the ETA and bypassing the SIS have increased. A portion of the surface water flow bypassing the ETA SIS (and associated metal load) infiltrates into the alluvial material in FCC and into the tailings in the RCTA at the base of the FCC (and into the RCAA). The remaining portion of the surface water flow that bypasses the ETA SIS diverts to the Intermediate Pond. The metal loads that infiltrate in the FCC and tailings areas consume metals attenuation capacity of the RCAA.

Metal contamination in the RCAA is currently attenuated in the aquifer (largely by organic carbon in the aquifer matrix), and metals do not appear to have migrated downstream from the Intermediate Pond (SRK, 2006a). However, the attenuation capacity of the RCAA, particularly along the perimeter of the RCAA where the depth to bedrock is relatively shallow (for example, along the alignment of the FCC), is not fully quantified. However, it the attenuation capacity is finite, and capacity is being consumed by ongoing discharges from the ETA. This is demonstrated by increasing metals concentrations in the RCAA.

In 2010, an attempt was made to differentiate the major sources of contaminants in groundwater and surface water by using isotopic signatures (RGC, 2011a). The evaluation provided further insight into the fate of contaminants downgradient from the ETA. The following are key findings of the isotopic study:

- Faro Creek drainage appears to affect groundwater quality in the RCAA only along the northern side of Rose Creek Valley, and tailings seepage continues to affect groundwater quality on both sides of Rose Creek Valley immediately downgradient from the tailings beaches.
- Seepage stored in the Intermediate Pond does not appear to have an appreciable adverse impact on the RCAA.

Data presented in the most recent groundwater quality review (RGC, 2012) demonstrate that sulphate and zinc in groundwater are increasing in the RCAA, as shown on Figures D1-2 through D1-4. At groundwater well P0-06 in the secondary impoundment, sulphate concentrations have increased from less than 1,000 milligrams per litre (mg/L) to 4,000 mg/L from 2004 to 2011. Similarly, zinc concentrations have increased from near 1 mg/L up to 100 mg/L during the same timeframe. At groundwater wells P01-03 and X-24, located on the northern portion of the Intermediate Dam, sulphate concentrations have increased from near 1,000 mg/L up to 2,500 mg/L from 2004 to 2011. Similarly, zinc concentrations have increased from near 0.03 mg/L up to 0.1 mg/L during the same time frame. At P01-11, located at the northern end of the Cross Valley Dam (CVD), although zinc concentrations have remained relatively constant, sulphate concentrations have increased from 750 mg/L to greater than 1,500 mg/L from 2004 to 2011. Increase in sulphate can be considered a precursor of elevated metals because the sulphate is not attenuated by the same adsorption and precipitation mechanisms as the metals (RGC, 2011a).

The ETA has been the subject of a number of evaluations by SRK (SRK, 2006a-b), RGC (RGC, 2006, 2007, 2010, 2011b), Brodie Consulting Limited (BCL, 2010a-b), and CH2M HILL Canada Limited (CH2M HILL, 2011). These studies have evaluated flows and loads discharging from the ETA (SRK 2006a; RGC, 2006, 2007) and have also evaluated the efficiency of the current SIS (RGC, 2010, 2011b) and made recommendations for improved capture of ETA discharge (RGC, 2011b; BCL, 2010a-b). CH2M HILL reviewed current conditions in the fall of 2011 (CH2M HILL, 2011) and recommended proceeding with interim upgrades to improve capture efficiency and cold-weather conveyance to the Faro Pit.

TABLE D1-1
ETA Water Quality
Faro Mine Remediation Project

Material	Sulphate (mg/L)	Zinc (mg/L)	pH
Tailings	7,880-18,500	344-870	4.13-6.75
Alluvium	5,000-9,000	<0.005-1,000	4.0-7.0
Overburden	4,000-4,500	75-150	6.3-6.5
Weathered Bedrock	1,200-1,800	0.02-0.08	6.5-7.5
Bedrock	<0.5-2,000	<0.005-50	6.0-8.0
Surface Water (X23)	2,300-10,000	191-1,048	2.5-7.5
Surface water (FCS-4)	1,500-7,400	122-436	3.80-7.43

Notes:

Groundwater (except for the tailings unit) and X23 surface water quality information approximated from 2005 through 2011 data from figures in RGC, 2012.

FCS-4 surface water and tailings unit groundwater quality information from 2005 through 2012 data from Denison Environmental Services, 2012a.

D1.2.2 Description of the Existing SIS

In 2006, a rudimentary SIS was constructed at the southwest end of the ETA, just downgradient of the mine access road, as shown on Figure D1-1, to collect surface water runoff and seepage (from two prominent

seeps). The action was taken to intercept a portion of the ETA contaminant load that would otherwise travel to the RCTA (and RCAA). The SIS is operated during the ice-free seasons (RGC, 2010). RGC (2011b) estimates that the existing ETA SIS captures about 43 percent and 53 percent of the ETA's estimated total annual load of iron and zinc, respectively. Upgrades and year-round operation of the ETA SIS has been recommended to improve SIS capture efficiency and to reduce metal loading to the RCAA (RGC, 2011b; CH2M HILL, 2011).

Surface runoff from the ETA collects in a metal drop box immediately downstream from the mine access road culvert (location FCS-2). The ETA SIS manhole also collects subsurface seepage from the ETA in two sumps that isolate and collect the prominent seepage faces downgradient from the mine access road. These sumps (East Sump – FCS-3a and West Sump – FCS-3b) were constructed by excavating partially into the surficial soils and shallow, weathered bedrock and filling the excavations with coarse drain rock. The downstream side of these collection sumps was reportedly sealed by a liner. Seepage collected in these two rock-filled sumps is conveyed by gravity flow via separate 3-inch polyvinyl chloride pipes into the ETA SIS manhole (RGC, 2010).

The system was originally designed such that all seepage collecting in the manhole during the ice-free period was pumped uphill by either a 15-horsepower (hp) or a 30-hp sump pump to the 10-inch high-density polyethylene [HDPE] gravity line that discharges to the Intermediate Pond (this pipeline is no longer functional). In June 2010, the ETA SIS was upgraded to enable pumping of the collected seepage from the manhole to the water treatment plant (WTP) (via a 6-inch HDPE gravity line) while the WTP is operational (RGC, 2011b).

D1.2.3 Efficiency of ETA SIS

According to the 2009 review of the ETA SIS (RGC, 2010), the ETA SIS started up on May 4, 2009 and shut down on October 14, 2009. During this time, the system captured, on average, 7.9 L/sec, which represents 88 percent of the estimated total flow under the low-flow conditions monitored. The seepage bypassing the ETA SIS averaged 1.1 L/sec, representing 12 percent of the estimated seepage. The same analysis indicated 94 percent collection efficiency for zinc, even though the seepage collection was only 88 percent efficient because of the relatively low zinc concentrations in the seepage bypass. The ETA SIS intercepted an estimated 31.2 tpy zinc and 488 tpy sulphate in 2011 (Denison Environmental Services, 2012b).

Seepage bypassing the SIS has been observed immediately below the ETA SIS (CH2M HILL, 2011). This seepage flows along FCC (primarily on bedrock) directly to FCS-4, with little opportunity to re-infiltrate. Past evaluations have also concluded that additional bypass of seepage from the ETA via groundwater flow is likely relatively small because of the following: (1) the topographic drop in the FCC will likely cause seepage bypass in the shallow groundwater (in the overburden and upper weathered bedrock) to discharge to Faro Creek, (2) recent drilling suggests that deep bedrock is competent, and (3) deeper bedrock wells downgradient of the ETA (for example, P09-ETA1) indicate no impact from ETA seepage (RGC, 2010).

A review of the overall annual capture efficiency of the ETA SIS concluded that the system captured only about 43 percent and 53 percent of the estimated total annual load of iron and zinc, respectively (RGC, 2011b). Based on observed flows in 2009 and earlier year-round monitoring of seepage flow in the ETA and FCC, the seepage not collected during winter (192 days) is estimated to be approximately 126,800 cubic metres (m^3), which represents approximately 7.6 L/sec over that period.

D1.2.4 Limitations of the Current ETA SIS Configuration

The following limitations were identified for the ETA SIS:

- RGC (2011b) concluded that the current ETA SIS has a relatively high efficiency of seepage collection during the open-water season (capturing about 88 percent of total seepage); however, significant contaminant loading bypasses the ETA SIS during the prolonged winter shutdown (typically between mid-October and early May). As a result, the overall efficiency of seepage interception considering the entire calendar year is estimated to be on the order of 50 percent. The seasonal operation of the system is the main limitation.

- The operational period during which the ETA SIS can currently convey the collected seepage to treatment is dictated by the operating period of the WTP, which is largely a function of weather (the WTP only operates during summer months). The start date is dictated by the commencement of consistent non-freezing temperatures. The end date for operation of the WTP is based solely on the requirements to obtain a predetermined drawdown of the Faro Pit. In some years, the WTP ceases operation in August (but more typically in September), sometimes before cold weather is a factor.

D1.2.5 Justification for Action

The ETA SIS upgrade should be constructed as soon as possible for the following reasons:

- Delaying construction and seepage and surface water interception of a functional year-round collection and treatment system until implementation of the final closure and remediation plan will allow more than 350 tons of zinc to enter into the RCAA. This zinc load estimate assumes a 7-year period for preparation of the project proposal, design, and construction. ETA contamination introduces acidity to the RCTA and RCAA, which accelerates alkalinity reduction in RCTA and increases dissolved metal loads to RCAA.
- The ETA-related contamination is a significant source to RCAA (RGC, 2005), and capturing and treating the ETA source could help with the following:
  - Delay the need to activate the CVD SIS. (GoldSim modelling showed that achieving remediation goals will be challenging considering the very high capture efficiencies that would need to be achieved at the CVD to meet the downstream water quality goals, so reducing contamination loads to the RCTA and RCAA will be important to reduce risks to Rose Creek.)
  - Reduce the potential that a cutoff wall would be required associated with the CVD SIS to meet remediation goals, which would result in significant cost savings.
  - Reduce the contaminant mass, and potentially volume of water, needed to be captured at the CVD SIS.
- Capturing contamination at the ETA, close to the WRD source, is a more effective and sustainable method to aid site remediation rather than letting this contamination travel to the RCAA. This is consistent with final remedial action goals for the Faro Mine Complex as well.
- The proposed ETA SIS upgrade is compatible with all final ETA remedial options currently under consideration and will be a key component of the final ETA remedy.

Continued discharge of the ETA contaminant load (due to winter flows and bypass during ETA operation) into the RCAA will result in continued degradation of the aquifer, lowering of the aquifer pH, and increased contaminant loading (as described in Section D1.1.1).

D1.3 Description of Scope

This section describes the proposed ETA SIS upgrade. It includes a description of the primary considerations for the upgrade, a description of the general activities required to complete the scope, preliminary evaluations conducted to refine the conceptual design, and a general description of the conceptual design of the SIS that will be used as a basis for a Class 5 cost estimate.

D1.3.1 Basis of Design Assumptions

D1.3.1.1 Primary Considerations for ETA SIS Upgrade

The proposed scope of the ETA SIS upgrade includes the following primary considerations:

- Rebuilding the existing SIS or augmenting the existing SIS with additional capture capacity will be needed to improve efficiency of the system both laterally and vertically (the cutoff wall depth and design would be based on the results of the predesign geotechnical and geophysical investigations). This

SIS needs to include a robust surface water collection system to collect flows originating from X23 (at the base of the Faro WRD).

- SIS pumping will be performed year-round to capture the load that bypasses the current summer-only system and to reduce winter water management burden to care and maintenance (C&M) operations.
- Location of improvements will need to be upstream of the canyon but downstream of the mine access road because of maintenance access ease, compatibility with the final remedial solution, and the location of the highest load.
- The system needs to be designed to be easily cleaned out because of the large amount of iron precipitates and sediment that will accumulate.

Although a future Lower Guardhouse Creek SIS is planned north of the ETA, and the effluent from that SIS may need to be conveyed using the ETA SIS piping (to Faro Pit), the flows from this system are unknown and are not directly considered in the ETA SIS upgrade design.

If a new Faro WTP is constructed, ETA SIS piping would need to be routed to the new WTP at that time. Because the new Faro WTP design is not complete, piping to the new facility is not included in this interim ETA SIS upgrade design.

D1.3.1.2 Activities Required to Implement Scope

To implement the ETA SIS upgrade, the following activities are necessary:

- Perform a predesign geotechnical field investigation to identify the location and quality of bedrock and the location of overburden that will need to be excavated to construct a seepage cutoff wall and an access road for the construction and maintenance of the SIS and pumping system (described in Section D1.2.1.3).
- Perform review and revision, where required, of the existing hydrologic analysis of the ETA drainage basin to provide a basis for the detailed design of the SIS upgrade. A previous hydrology evaluation was presented in Appendix C of SRK 2006a.
- Perform a detailed design of the SIS including: surface water/seepage collection structure, pump, and pipeline.
- Construct the upgraded SIS and pipeline.
- Perform transition to adapt the design if needed.

D1.3.1.3 SIS Upgrade Design Assumptions

The conceptual design assumptions of the SIS upgrade is presented in this section (to support the cost estimate presented in Section D1.7). Figures D1-5 through D1-8 support the conceptual design. This conceptual design provides a basis for a Class 5 cost estimate and assumes year-round operation. Government of Yukon's (YG) C&M group/C&M operators will be closely involved in the detailed design process because they will be responsible for the operation and maintenance of the system. There are a number of open issues that will be addressed in the detailed design that have not been evaluated at this conceptual level. These are discussed in Section D1.4.

The SIS upgrade will include:

- A cutoff wall (conceptually designed as a gravity structure) located downgradient of the existing SIS and upstream of the narrow portion of the Faro Creek Canyon. This will be a concrete wall with a minimum unconfined compressive strength of 20 megapascals (3,000 pounds per square inch). Also, sulfate-resistant concrete may be required. The cutoff wall dimensions are provided in Figure D1-7. It is assumed 300 m^3 of material would need to be removed to install the cutoff wall (200 m^3 in the top excavation and 100 m^3 into the slightly weathered bedrock; assumes a 1V:1H cut slope).

- Depending on the permeability of the bedrock in the cutoff wall area (based on the packer test results), the cutoff wall depth may be increased to reduce seepage through the rock if needed.
- The access road will be extended to the new cutoff wall location. The access road to top of cutoff wall is assumed to include the following:
  - Length of 25 m
  - Width of 4 m
  - Two percent grade
  - 1V:2H cut/fill slopes
  - Surface with 150 millimetre aggregate base (volume of aggregate base is 16 m^3)
  - Volume of cut is 2,000 m^3
- Iron precipitates will be formed due to oxidation of the seepage water, and eroded tailings will be transported into the seepage collection basin. Access will be provided for clean out of the collection basin and sump. The access road to the bottom of the cutoff wall, stilling well, and pump is assumed to include the following:
  - Length of 70 m
  - Width of 5 m
  - Eighteen percent grade
  - 1V:2H cut/fill slopes
  - Surface with 150 millimetre aggregate base (volume of aggregate base is 55 m^3)
  - Volume of cut is 300 m^3
  - Volume of fill is 300 m^3
- New road culverts would be required at all road crossings and consist of 750 DN DR11 HDPE (five culverts are assumed with a length of 25 m each).
- The existing settling basin upstream of the main mine access road will be expanded to increase its current capacity by approximately one-third for settling out suspended solids prior to collection in the upgraded SIS. The excavation area would be 300 square metres (excavated 1-m deep) with a volume of 300 m^3. Excavation material is assumed to be hauled and disposed at the RCTA.
- One duty pump and one standby pump (at 150 hp each) will be required. The pumps will be placed in a stilling well with an associated sump adjacent to the cutoff wall. Pump and pipe size calculations are provided in Attachment D1-1. Pumps are anticipated to be mine-service, abrasion-resistant, multistage, submersible units mounted within a formed sump. To minimize the tendency for solids to collect around the pumps, the sump will be shaped to direct settleable solids into the pump inlets. Sump volume will be designed to provide a maximum of eight pump starts per hour, which amounts to approximately 4.5 m^3 of working volume between pump START/STOP cycles.
- Sea-Can will be installed at the ETA SIS containing pump controls.
- Transformers will be installed or upgraded as needed to meet power requirements for pump- and heat-traced pipelines. The power source for the existing pump station is a 300-kilovolt-ampere transformer bank.
- Instrumentation, alarms, and remote monitoring capability for pump operation will be included. An electrical distribution system is required for the pump station.
- The pipeline will be heat-traced and insulated. It will be configured such that the water collected from the SIS can be routed to the Faro Pit in the winter and either the WTP at the Mill Building or the Faro Pit in the summer. This will provide maximum operational flexibility.

- The pipeline will consist of the following components:
  - Approximately 1,975 m of 8-inch DR9 PE 4710 HDPE pipe (450 m associated with the pipeline from the SIS to the WTP and 1,525 m associated with the pipeline to high point above the Faro Pit).
  - Approximately 440 m of 14-inch DR 7.3 HDPE pipe for gravity flow of SIS effluent from high point to the Faro Pit based on a minimum slope of 0.0300, as discussed in Attachment D1-1 and shown on Figure D1-8.
  - Pipes will include insulation and heat tape (aluminum clad jacket); arctic insulation and manufacturing or equal is assumed.
  - Insulated/heated above-grade wood structures will be required for isolation and air valves, drain, vent pipe, and pig access. Three structures are assumed, as shown on Figure D1-8.
  - Approximately 100 m of existing gravity 6-inch HDPE pipe will be replaced with 12-inch DR 11 HDPE piping from the metal drop box to new seepage containment area. The pipeline should be setup for cleanout by hydrojetting.
- Pipeline surface protection from future traffic, pipeline thermal movement, and potential rock damage is suggested in areas along roadway edges and next to steep hillsides. This protection would be as follows:
  - **Traffic Barriers:** Install portable concrete barriers (that is, K-rails) on the traffic side.
  - **Thermal Movement:** Clear and grub, along the pipe alignment, an approximate 2-m-wide pad and install 0.305 m of compacted 1-inch minus material with a Type 1 geotextile matt on top with same width. The new pipe would be installed at the matt centerline.
  - **Rock Damage:** Install 750 DN DR11 HDPE casings in areas where rock damage could occur (assumes approximately 600 m of casing between Station 28+00 and Station 34+00).
- Iron precipitates will form in the pipeline; hence, the pipeline will be designed to include the ability to be pigged for removal of precipitates that accumulate. The internal thermal fusion beads will be removed from the HDPE pipe shortly after joint fusion to facilitate pigging and improve hydraulic capacity.

The flow capacity of the pipeline used in the conceptual design is 40 L/sec, with one pump running and one on standby. A detailed hydrologic evaluation is planned prior to the detailed design. To evaluate the conceptual sizing of pump and pipeline, the flow record at FCS-4 for the period of September 2005 through October 2006 was used to evaluate this proposed flow rate (RGC, 2007). This is the most complete flow record for the ETA. The two largest storm events during this period (May 4, 2006 and September 5, 2006) were used as the basis for the evaluation. There were several flow events during this period that were associated with WTP releases; however, these events were not related to storm events and were not included in this evaluation.

The flow event on May 4, 2006 had a peak flow of approximately 56 L/sec and duration of 2.5 hours where the flow was greater than 40 L/sec. The September 5, 2006 event had had a peak flow of approximately 147 L/sec and duration of 1.5 hours where the flow was greater than 40 L/sec. The estimated volume of the collection basin behind the cutoff wall is approximately 145 m^3. At a pumping rate of 40 L/sec, the May 4, 2006 storm would not have exceeded the capacity of the collection basin. At a pumping rate of 40 L/sec, the September 5, 2006 storm would have exceeded the capacity of the basin by approximately 165 m^3, and this volume of water would have been released. The estimated volume released is based on the assumption that the collection basin was empty at the start of the event. These potential release volumes are low compared with the total volume of water that has been historically collected at the ETA SIS. In 2008 and 2009, the ETA SIS collected 105,000 and 120,000 m^3 of water, respectively. Hence, the volume that would have been spilled during the 2005/2006 high-flow storm events would have been less than 0.2 percent of that captured by the ETA SIS in

2008. Note that if the collection basin were full at the start of the storm, the spill volume would have still been approximately 0.3 percent of that captured annually.

A number of items were identified by YG, Government of Canada, and its technical advisors as items that should be considered in either the conceptual or detailed design of the interim ETA remedy. These items are described as follows, along with how they will be handled:

- **Issue:** Consider the cost/benefit of soil cover for tailings to reduce infiltration/loading and improve erosion/sediment control. This issue also includes a question regarding the compatibility of the interim action with the final remedial solution for this area because it is uncertain if the tailings will be removed or covered.

  Approach: The total quantity of infiltration through the tailings in the ETA was estimated to be less than 0.1 L/sec. Hence, capping to reduce this infiltration was not carried forward in the conceptual design.

- **Issue:** Erosion of tailings causes sediment to accumulate in the existing SIS sump. One suggested potential additional approach to improve erosion control and reduce sedimentation is to construct a riprap-lined channel in the tailings.

  Approach: Lining Old Faro Creek in the tailings with riprap was not included in the conceptual design but may be further evaluated as part of the detailed design. The channel would have considerable sediment loading during construction. Also, it is likely that such a channel would need to be rebuilt in the short term and would not be part of the long-term plan.

- **Issue:** Diversion of clean water to reduce amount of water captured/treated and to keep clean water clean may have potential.

  Approach: The potential for clean water to be diverted around the ETA SIS was evaluated. The purpose of the clean water diversion would be to decrease the volume of water that would need to be collected and pumped from the SIS. The area with the greatest potential for clean water diversion is the relatively undisturbed land that is located to the southeast of the ETA. The area for this portion of the drainage was determined to be approximately 5 hectares. The exact area would depend on the specific alignment of a diversion channel. The overall drainage area for the ETA SIS was estimated to be approximately 94 hectares. Based on the relatively small area for potential clean water diversion (approximately 5 percent of the drainage area) and small potential for reduction in flows to the SIS, the construction of a clean water diversion channel was not included in the conceptual design.

- **Issue:** Optimization of seasonal aspects. There may be potential benefits to pumping to the pit year-round (mixing, dropping iron out); impact of ETA waters to Faro Pit is being considered in WTP design.

  Approach: The conceptual design is configured such that the water collected from the SIS can be routed to the Faro Pit in the winter and either the WTP at the Mill Building or the Faro Pit in the summer. This will provide maximum operational flexibility. This can be further evaluated in detailed design.

- **Issue:** SIS capacity is linked to water management (that is, when and how to let excess bypass, etc.). Winter flows are fairly well known and consistent, but summer flows are less well known and more variable. To deal with this uncertainty, an additional degree of safety, including a second pump and pipeline, may be worth considering.

  Approach: Sizing in conceptual design was based on 2005/2006 flow record at FCS-4. Detailed design will consider more thorough hydrology evaluation.

- **Issue:** Verifying source(s) of iron in the various seepage fronts at the ETA may guide mitigation measures.

  Approach: The conceptual design uses a collection location that is expected to collect essentially all of the ETA seepage. More detailed evaluation of the iron contributions from the different source waters (seeps,

groundwater, etc.) may help to guide decisions on the final remedy for the ETA (that is, whether the tailings be removed or covered). Hence, these evaluations will be deferred until formulation of the final ETA closure approach.

- **Issue:** Is there additional geotechnical characterization work required for a sump structure?

  Approach: A geotechnical investigation is included prior to the detailed design.

- **Issue:** Precipitate formation and sediments removal is a key problem for operations and maintenance. To address this, prior to the detailed design, the degree of precipitate formation in the existing system/pipes will be evaluated.

  Approach: Access is provided to the SIS collection basin in the conceptual design to allow for clean out. Additionally, pipelines are designed to include pigging.

- **Issue:** Cold-weather operation considerations in design, including possibly insulating the downstream side of the retaining structure to prevent the sump from freezing too deeply. The snow accumulation area may require additional logistical considerations.

  Approach: These are issues that will be considered in detailed design.

- **Issue:** Facility would benefit from instrumentation and alarms with remote monitoring capacity, especially with regard to winter operations.

  Approach: These items are included in the conceptual design through the inclusion of a cost allowance in the cost estimate. They will be evaluated further in the detailed design.

D1.3.1.4 Compatibility with the Final Remedy

The major components of the conceptual design are expected to be compatible with the final ETA remedy. The collection structure proposed in the conceptual design is located below all seepage and surface water flows from the ETA (assuming surface water flow from the collection basin will be diverted to the SIS). It will be an effective location for seepage interception for the final remedy.

A pipeline will be required in the final remedy for pumping water from the ETA SIS to the WTP and the Faro Pit. The pipeline included in the conceptual design is conservative and will handle the range of expected flows. This will be verified by conducting a hydrologic evaluation and using the results as a basis for the final design.

D1.3.2 Work Scope

D1.3.2.1 Predesign Field Investigation

A geophysical and geotechnical field investigation will be required to support the ETA SIS design.

Geophysical Investigation

Four 60-metre (m)-long seismic refraction lines would be run in the FCC to help define the competent bedrock contact in the area where the ETA SIS roads and cutoff wall will be constructed.

Geotechnical Investigation

A geotechnical investigation will be performed to support the detailed designed and will include the following:

- One boring will be drilled to a depth of 5 m near the bottom of the canyon (near the center of the planned cutoff wall) using a limited-access rig. The drilling should extend 3 m into bedrock. Rock core samples will be collected for geotechnical analyses.
- At least one packer test would be conducted within the bedrock of the boring for cutoff wall design to evaluate the permeability of the rock beneath the planned cutoff wall depth.

- An additional three borings or test pits would be drilled or dug to a depth of 5 m along the proposed access road alignments to investigate the depth to competent bedrock. Standard penetration tests will be performed, and samples will be collected for geotechnical analyses.

D1.3.2.2 Design Definition (Hydrologic Evaluation)

The design definition for the ETA SIS upgrade will include additional hydrological analysis to support the design. A regional hydrological analysis was completed as detailed in Appendix C of the *Anvil Mining Complex 2005 Seepage Investigation at the Emergency Tailings Area – 2005/06 Task 20e* (SRK, 2006a). The purpose of this analysis was to estimate the 100-year hydrograph for the proposed ETA SIS based on empirical relationships that were used to transpose flood data from regional stream flow gauging stations to the site. For the current analysis, this regional analysis will be updated based on new topographic and flow routing information as well as additional flow data collected both at regional stations and at the ETA. In addition, the sitewide hydrological model developed as part of TAR 006 will be further refined for the catchment tributary to the ETA to better estimate yearly fluxes of surface water at this location. The conclusions from the hydrologic analysis will be used to refine the pump and piping design for the ETA SIS upgrade.

D1.3.2.3 Conceptual Design (30%)

The conceptual design phase comprises the development of a more detailed system layout, process sizing, associated calculations, and information derived from early geotechnical explorations to evaluate foundation conditions and earth material types. During this phase, the associated risk identification, assessment, and mitigation elements are also determined. This phase typically engages all required engineering design disciplines (for example, civil, mechanical, and structural) to execute the design. The results of this phase are summarized and recorded in a conceptual design report that documents the criteria that will be used to complete the design. The conceptual design includes the following tasks:

- Identify major processes and equipment.
- Develop a list of required specifications.
- Complete alternative processes and economic evaluations, and select final equipment.
- Develop substantially complete process flow diagrams.
- Develop piping and instrumentation diagram drafts and preliminary sizing.
- Specify design criteria, including major equipment sizing calculations and construction materials.
- Estimate utility requirements.
- Complete a preliminary hazardous operability study.
- Develop construction architectural and civil specifications to 30 percent completion.
- Complete preliminary sketches and schematics showing major components.
- Develop performance and construction specifications to 30 percent completion.

During conceptual design, most of the important project decisions are established so the opportunity to affect the project design after this stage becomes somewhat limited. As a result, value engineering needs to occur before this phase is complete. Initial constructability, operability, construction sequencing, staging, and traffic control elements should also be considered during this phase.

The primary goal is to establish a sound basis for the project design and make key decisions before producing the drawings and specifications that will be included in the contract documents.

D1.3.2.4 Advanced Design (60%)

During the project's advanced design phase, the basis of design report is developed, and drawings and specifications are further developed and refined. This phase also engages other functional areas to participate in final constructability and operability reviews. The deliverables include the basis of design report, in-progress drawings, and a first draft of specifications or statements/scopes of work (SOWs). For projects with process elements, process-related drawings and specifications must be substantially advanced because process decisions

impact other disciplines so process changes that occur later may affect the project team's ability to complete the design on time and to specifications.

Deliverables include:

- Completed piping and instrumentation diagrams (to show pump controls)
- Process simulations/calculations
- Comprehensive equipment, line, and instrument lists
- Site plans, as well as typical sections
- Preliminary equipment specifications (datasheets)
- Other overall layouts that may affect process design (for example, hazardous area classification drawings, fire zone layouts, and safety components)

It is preferable that these drawings are finalized to the approved for design status, which means that they are complete apart from decisions that will be made during the detailed design phase (for example, regarding vents/drains and vendor data). At the end of the advanced design phase, drawings and specifications describe all project systems and layout requirements.

D1.3.2.5 Detailed Design (90%)

The project's detailed design phase results in 90-percent-complete detailed drawings and specifications. The scope of this phase includes the completion of the following, documented to the appropriate level of detail for the contracted design scope:

- Construction and tender documentation
- Engineering drawings
- Specifications
- Detailed SOWs
- Calculations

A final pre-tender review occurs for the detailed drawing and specification documents. Following this review, drawings and specifications are further developed and refined. The key detailed design deliverables are either bid- or tender-ready documentation for general bidding (as would be the case for a design/bid/build project) or construction-ready documentation for use in procuring subcontractors and equipment (as would be the case for a design/build project).

Detailed design documents are virtually complete, apart from final coordination and quality assurance and quality control reviews, which occur before the documents are issued for tender.

D1.3.2.6 Final Design (100%)

The project's final design phase considers vendor and contractor constraints and requirements and results in a full set of detailed design drawings and specifications. Barring unforeseen conditions, documents must include everything necessary to procure the intended scope, quality, and design without requiring change orders during construction. These drawings are used for "redline" revisions to produce as-built drawings at the end of construction.

D1.3.2.7 Procurement/Contracting

For the Faro Mine Remediation Project, procurement will follow the YG's established processes and will be supported by project management and construction management services. In this case, the procurement manager or construction manager (CM) will prepare specifications as part of the coordinated design process. They will leverage a procurement support team to assist YG with tender issue, tender evaluation (with emphasis on technical capabilities), and recommendations regarding contractors and subcontractors.

There are two approaches that YG could use to deliver these projects. Each alternative would minimize project costs and maximize effective implementation:

- **Option 1:** The CM is established as a separate contractual role, where YG issues the construction contract directly to the selected subcontractor(s).
- **Option 2:** The CM is established in a prime contractor position, and the construction manager issues the construction contract directly with the selected subcontractor(s). This is known as a construction management-at-risk (CM-at-risk) approach.

The ETA SIS work is best suited for the delivery model outlined in Option 2. Here the construction manager serves as consultant to the owner during the project's development and design phases and as a general contractor, or equivalent, during the project's construction phase.

This is a small-dollar project when compared with some of the other projects YG is proposing. A primary advantage to delivering this project with a CM-at-risk approach is that this type of approach provides the opportunity to begin construction before design is complete, making it possible to adjust the design during implementation (even though designs are 100 percent complete) if site conditions differ from those assumed during design. Required revisions after final design are especially likely for SISs where hydrogeological conditions often vary from those ascertained during the site assessment tasks. This is the best point in the schedule to integrate construction, equipment (for example, pumps), and controls because there is ready access to the designer who would be part of the construction management team. Option 2 provides flexibility and the adaptive management that is necessary if changed conditions exist.

D1.3.2.8 Permitting

Where projects are being constructed under Ministerial Direction and are therefore not subject to the *Yukon Environmental and Socio-economic Assessment Act* process, the permitting task includes obtaining permits or permissions that are not part of the process. The required permits for this package are not fully known, but they are expected to be those required to support construction activities likely to cause ground disturbance or water discharge impacts. Work performed must comply with all existing or potentially applicable Faro Mine Complex environmental and regulatory conditions. Construction permitting requirements would include these conditions, as well as air emissions, dust, and noise permitting, as well as plans to comply with these permits. This process culminates in the development of an Environmental Construction Management Plan.

D1.3.2.9 Construction

ETA construction scope is described in Section D1.2.1.3. Generally, ETA SIS construction work will include:

- Mobilization
- Survey and layout
- Construction of access road
- Construction of cutoff wall
- Construction of upstream settling basin including building a road to access the area
- Installation of sump and pump including: Sea-Can, controls, and electrical
- Installation of piping including: above-grade structures, protection, and heat tracing
- Demobilization

D1.3.2.10 Construction Management

The project's construction management task involves implementing the design plans and specifications, effectively managing the construction activities (main contractor and subcontractors), integrating activities, and maintaining the overall project schedule and budget. If YG holds the contract with the subcontractor, then YG is responsible for directing the work of the subcontractor. If the CM holds the contract with the subcontractor, then the CM is responsible for directing the work of the subcontractor.

The CM provides a single point of contact representing the owner's interests first and foremost. The SOW includes the following range of responsibilities:

- Assures the project is built in general accordance with the design plans and specifications
- Oversees quality assurance and quality control
- Assures health and safety plan compliance
- Assures that environmental management plans are adhered to during construction work
- Provides scheduling and cost control services
- Provides client with advice regarding engineering aspects of contractual issues that may evolve during construction
- Provides adaptive management advice if unexpected circumstances arise
- Requires that as–built drawings are completed and that any defects or warranty aspects are addressed

Overall, comprehensive CM services are used to integrate the various facets of the construction process, planning, design, procurement, construction, and commissioning and to provide standardized technical and management expertise on each project.

D1.3.2.11 Commissioning

Initial or cold commissioning follows on from construction as part of the contractor handover process. The SIS would be commissioned to determine optimal settings (e.g., water level controls) and to ensure that the individual components operate to specification, including pump rate testing and integrity testing of the overall system and its support infrastructure. This phase also includes any mechanical integrity inspection, dynamic testing, and construction punch lists completions prior to handover to the operations team.

D1.3.2.12 Transition

For the first year after completion of construction and initial "cold" commissioning (i.e., post substantial completion), certain activities will be required to ensure the operational effectiveness and efficiency of the SIS. These activities include handover to the operational team and final commissioning/shakedown where the system is operated with all processes in place to ensure that all components operate as an integrated system. In the case of the ETA SIS, the systems will be commissioned with contaminated water that is representative of what the system has been designed to pump. This is will ensure that system components are working as designed, instrumentation and control systems are functional and the capture effectiveness is as expected. This phase of commissioning will also extend to training operators and preparing operations manuals (including health and safety documentation), performance testing, completing commissioning punch lists, and guaranteeing that the system is compliant with warranty commitments.

During this period there may also be a need for (1) improvements to any PLC processes and programming (often needed to stabilize more complex operational processes such as the SIS), (2) minor civil works to enhance operation or improve safety or operability of the system, (3) identification of additional maintenance needs, (4) materials and wastes requirements, (5) SOP modification, and (6) any additional training needs identified during initial startup. Despite design to 100 percent, these needs often only become evident once construction is complete or during startup and shakedown period.

D1.4 Uncertainties

There are several uncertainties related to this interim action to upgrade the ETA SIS:

- The flow rate requirements for the pump and pipeline are based on limited hydrology data.
- The geotechnical conditions in the area for the proposed collection structure have not been verified.
- RCAA has unknown, assumed finite attenuation capacity, and the rate of attenuation decrease within RCAA is uncertain. The consumption of attenuation capacity will accelerate potential metal release to the aquifer. Recent data indicate groundwater below the CVD is slightly impacted due to zinc and moderately impacted due to sulphate and that concentrations are increasing and that the plume front is

migrating downgradient. Loading from the ETA consumes attenuation capacity, which leads to further downgradient migration of groundwater contamination.

These uncertainties will be addressed as follows:

- Prior to detailed design, the SRK hydrologic evaluation (SRK, 2006a; Appendix C) will be reviewed and modified as required and will be used along with site flow monitoring data at FCS-4 to provide a more robust evaluation of influent flow characteristics. Additionally, in detailed design, the configuration and capacity of the collection structure and water retention basin will be defined and provide an improved basis for sizing the pumps and pipeline.
- A geotechnical investigation will be performed prior to the detailed design to address uncertainties related to conditions in the areas where structures and excavations will be required (described in Section D1.2.2.1).
- Implementation of the interim ETA SIS upgrade and associated monitoring, as well as completion of design for CVD SIS will help address uncertainties about RCTA attenuation decreases and groundwater contamination increases and downgradient movement in RCTA by mitigating contamination loads to RCAA.

D1.5 Technical Risk Register

The technical risks associated with the Emergency Tailings Are SIS are detailed in the Technical Risk Register attached to the MTP as Appendix G.

D1.6 Schedule

The Milestone Schedule is in Appendix H. The basis for this schedule is the scope of work described in Section D1.2. This scope has been prepared as a feasibility-level design concept to support the MTP planning objectives.

D1.6.1 Milestone Schedule

The following is a general summary of the major milestones and salient components of the schedule. Refer to Attachment D1-2 for a detailed understanding schedule of the implementation of the work package.

The Milestone Schedule in (Appendix H) illustrates that the work package will commence with a field program initiated after freshet is complete when the existing ETA system is in full operation and the ground is firm enough to support seismic survey support and drilling equipment. Construction should be initiated after freshet is complete and when surface and seep water flows have subsided enough to be controlled by the existing ETA SIS or another temporary water-capture system in the construction area. Therefore, it is assumed construction will not start until June. All of the field investigations (including reporting) are assumed to occur in the 6-month period between April through September.

The preparation of the final (100-percent) design, any required permitting (to be confirmed), and procurement of a construction contractor will all be completed in the fourth quarter to sequence the initiation of construction activity for April 1.

D1.6.2 Schedule Constraints and Assumptions

The following constraints and assumptions have been made in the development of this schedule:

- It is assumed design work will continue during the client design review periods to facilitate design completion before the construction field season. It is assumed construction would not occur until the second field season after the predesign field investigation because of the time required to complete the design.
- Daylight hours in summer will allow for extended work shifts.

- Workers can work a maximum 28 days before having 7 days off (per Yukon Workers' Compensation Health and Safety Board limits).
- Any required permits or natural heritage and archaeology evaluations will not impact the schedule for construction.
- The construction season at the site is 6 months long and extends from April 1 to September 30.
- To the extent possible, this schedule has been developed in consideration of the constraints of the fiscal year funding requirements. In instances where tasks are shown as occurring across this date, it is understood that additional contracting requirements may be necessary.

D1.7 Cost Estimate

The cost opinions presented are based on information and experience from visits to the site, discussions with the current C&M contractor, and actual costs from working onsite during the CH2M HILL 2012 field investigation (late May to early October this year). Cost opinions are rough order-of-magnitude, with an expected accuracy of +100 to -50 percent (Class 5). Costs have not been escalated and are presented as 2012 costs.

D1.7.1 Basis of Estimate

The following points represent the basis upon which the provided cost estimate has been developed:

- The estimate uses 2012 CH2M HILL Master Service Agreement rates for professional services.
- Escalating factors impacting productivity have been applied where appropriate to field exploration costs and construction estimates for working conditions, access restrictions, site limitations, and logistics anticipated for the implementation of the described work package. These factors are based on actual measures recorded during the 2012 field implementation program at the site.
- Additional field work is based on the current understanding of data gaps.
- Design costs (concept through final design) are presented as labour and expenses estimates, developed as a percentage of construction costs (see table hereinafter for percentages).
- Permitting costs are presented as 1 percent of construction costs.
- Transition costs are presented as 1 percent of construction costs.
- Construction management and construction procurement and contracting costs are presented as fixed costs spread across five work packages. It is expected that construction activities will be occurring in each of the final 4 years of MTP. To maintain efficiency, a constant core construction management and procurement team has been estimated for each of those years in their entirety as the team completes one construction package and contracts the next.
- Construction costs were based on the concepts presented in SIS upgrade conceptual design presented in Section D1.2.1.3. The CH2M HILL Heavy Construction Systems Specialists, Inc. estimating system was used to build up the construction cost estimate with identified activities for construction.
- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document to account for items that may change between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors.
- Scope details and assumptions for construction are provided in the Heavy Construction Systems Specialists notes for each bid item.
- Unit rates for equipment and craft labor were localized to Yukon Territory.

- Production factors for current market conditions and location of the site were used in the buildup of the estimate.
- Markups were applied from historical experience with similar construction works.

D1.7.2 Supporting Documentation

The following sources of information were used in developing the cost estimates:

- Canadian Blue Book adjusted for Yukon project site location (central Yukon)
- 2012 Canadian labor rates from CH2M HILL Master Service Agreement (C00012050)
- 2012 Yukon fair wage schedule for craft labor
- Historical cost data and estimator judgment
- Productivity has been adjusted to account for current field conditions
- Association of Professional Engineers of Ontario (PEO). 2001. Guideline Schedule of Fees for Engineering Services.
- Association of Professional Engineers and Geoscientists Manitoba (APEGM). 2011. Guide for the Engagement of a Consulting Professional Engineer.
- Consulting Engineers of British Columbia and Professional Engineers and Geoscientists (CEBC/APEG). 2009. Budget Guidelines for Consulting Engineering Services

D1.7.3 Cost Estimate

The total cost estimate for the ETA SIS work package described herein is $4,901,218. This estimate is summarized with construction and professional services costs provided in Tables D1-2 and D1-3, respectively.

TABLE D1-2
ETA SIS – Construction Estimate
Faro Mine Remediation Project

	Labour	Expenses/Materials	Equipment	Subcontractor	Markup	Total [a]
TOTAL	$644,104	$1,436,110	$213,940	$328,830	$447,087	$3,070,071

[a] The costs presented in this report are contractor direct costs.

The component costs of this construction estimate and summarized in Attachment D1-1. Attachment D1-1, Construction Estimate Summary, shows a summary of the task descriptions plus markup by the contractor to get to a “bid or tender” cost estimate.

TABLE D1-3
ETA SIS – Professional Services Estimate
Faro Mine Remediation Project

Draft WBS	Phase	Labour [a]	Expense	Subcontractor	Total
01.01.01.02	Field Investigation	$85,690	$33,918	$161,162	$280,770
01.02.01.02.01	Design Definition	$38,530	-	-	$38,530
01.02.01.02.02	Conceptual Design (30%) [b]	$97,523	$13,000	-	$110,523
01.02.01.02.03	Advanced Design (60%) [b]	$90,155	$13,000	-	$103,155
01.02.01.02.04	Detailed Design (90%) [b]	$79,103	$13,000	-	$92,103

TABLE D1-3
ETA SIS – Professional Services Estimate
Faro Mine Remediation Project

Draft WBS	Phase	Labour [a]	Expense	Subcontractor	Total
01.02.01.02.05	Final Design (100%)[b]	$49,630	$13,000	-	$62,630
02.01.02.01.01	Procurement [c]	$269,335	-	-	$269,335
01.04.06.04	Permitting [d]	$15,507	-	$15,000	$30,701
02.01.02.02.03	Construction Management [e]	$781,998	-	-	$781,998
02.01.02.02.04	Commissioning [f]	$30,701	-	-	$30,701
02.01.02.03	Transition [g]	$5,701	-	$25,000	$30,701
	TOTAL	$1,544,067	$85,918	$201,162	$1,831,147

[a] Estimated based on assumed full time equivalents and materials cost.

[b] Design cost noted is a percentage of estimated capital construction costs (that is, 30% design costed at 3.6% of construction costs, 60% design costed at 3.36% of the construction costs, 90% design costed at 3% of construction costs, 100% design costed at 2.04% of construction costs).

[c] Procurement is $269,335 per construction project.

[d] Permitting is estimated to be 1% of construction cost.

[e] Construction management is $781,998 per construction project with a one-season duration.

[f] Commissioning is estimated to be 1% of construction cost.

[g] Transition estimated at 1% of construction cost.

The component costs of this professional services estimate are summarized in Attachment D1-2, Professional Services Estimate.

D1.7.4 Assumptions

The following assumptions were made during the preparation of this cost estimate:

- The estimated costs for engineering services were developed based on review of provincial association guidelines and recommendations for determining engineering fees. These included publications from the Consulting Engineers of British Columbia and Professional Engineers and Geoscientists (CEBC/APEG, 2009), the Association of Professional Engineers of Ontario (PEO, 2001), and the Association of Professional Engineers and Geoscientists Manitoba (APEGM, 2011).
- The cost estimate does not include cost consideration for administration of the work package (i.e., statusing, coordination and invoicing and management) which will vary throughout the duration of the work depending on whether the work focus is construction or professional services.
- The cost estimate does not include any markups to professional services (labour) or subcontractor and expense costs.
- Work described in the work package is a stand-alone effort. No accommodation or economy of scale with combining different work packages has been used in developing this opinion of cost.
- Pump and pipeline design assume a 40 L/sec pumping rate, which will be re-evaluated as part of the hydrologic evaluation to be conducted as part of the predesign work.
- Competent rock is defined as excavation refusal using a Cat 330D excavator.
- No royalties are included.
- Construction season has been assumed to be a maximum of 6 months available in the field, from April 1 through September 30.

- Construction work is scheduled to be performed in one construction season.
- 2012/2013 YG per diem and lodging rates have been applied. Available housing and lodging are available in the Town of Faro to accommodate all personnel required to accomplish the work or the allowed per diem and lodging costs are sufficient to for camp setup and operation.
- A 19 percent markup has been applied to contractor construction costs consisting of home office support, overhead, and profit (10 percent overhead, 9 percent profit).
- Bonds and insurance have been included at 3 percent of construction costs.
- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document, to account for items that may change between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors.

D1.7.5 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are nonbinding and are provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, schedule implementation, and other variable factors. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions related to proper project evaluation and adequate funding.

D1.8 Works Cited

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Attachment D1-1
Construction Estimate Summary

ATTACHMENT D1-1

Construction Cost Estimate Summary

Faro Mine Remediation Project – Emergency Tailings Area Seepage Interception System

Medium Term Workplan

BI #	BI Description	Units	Quantity	Labour	Permanent Materials	Construction Material	Equipment Operation Expenses	Subcontractors	Construction Equipment	Per Diem	Bond/ Insurance	Direct Total	Markup	Unit Price	Total
10	MOBILIZATION	LS	1	$ 29,407	$ -	$ 7,078	$ 13,308	$ -	$ 18,746	$ -	$ -	$ 68,538	$ 11,682	$ 80,221	$ 80,221
20	BONDS & INSURANCE	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 84,433	$ 84,433	$ 14,392	$ 98,825	$ 98,825
30	SUBMITTALS	LS	1	$ 15,589	$ -	$ 3,900	$ -	$ -	$ -	$ -	$ -	$ 19,489	$ 3,322	$ 22,811	$ 22,811
40	SURVEY	LS	1	$ -	$ -	$ -	$ -	$ 18,000	$ -	$ -	$ -	$ 18,000	$ 3,068	$ 21,068	$ 21,068
50	QC	LS	1	$ -	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ 5,000	$ 852	$ 5,852	$ 5,852
60	INSTALL ACESS RD TO CUT OFF WALL LOCATION	M	25	$ 11,718	$ -	$ 1,720	$ 5,634	$ -	$ 11,596	$ -	$ -	$ 30,668	$ 5,227	$ 1,436	$ 35,895
70	INSTALLATION OF CUTOFF WALL	M3	350	$ 69,806	$ 56,000	$ 18,598	$ 24,749	$ 60,060	$ 41,984	$ -	$ -	$ 271,197	$ 46,225	$ 907	$ 317,422
80	INSTALL ACCESS ROAD TO COLLECTION BASIN	M	70	$ 9,720	$ -	$ 1,100	$ 5,634	$ 4,750	$ 11,596	$ -	$ -	$ 32,800	$ 5,591	$ 548	$ 38,391
90	EXPAND BASIN	M3	300	$ 5,327	$ -	$ 594	$ 3,613	$ -	$ 7,958	$ -	$ -	$ 17,492	$ 2,982	$ 68	$ 20,474
100	PLACE 150 HP IN TO SITTING WELL	LS	1	$ 1,513	$ 130,330	$ -	$ 271	$ 77,355	$ 474	$ -	$ -	$ 209,943	$ 35,785	$ 245,728	$ 245,728
110	INSTALL 8" HDPE PIPE	M	1,975	$ 68,381	$ 121,677	$ 272,026	$ 28,000	$ 23,784	$ 65,685	$ -	$ -	$ 579,554	$ 98,785	$ 343	$ 678,338
115	INSTALL 14" HDPE PIPE	M	440	$ 14,273	$ 20,794	$ 151,196	$ 5,657	$ 7,375	$ 13,270	$ -	$ -	$ 212,565	$ 36,232	$ 565	$ 248,796
120	INSTALL SURFACE PROTECTION	LS	1	$ 27,549	$ 41,892	$ 26,280	$ 11,202	$ 82,505	$ 25,028	$ -	$ -	$ 214,456	$ 36,554	$ 251,010	$ 251,010
130	DECOMMISSION EXISTING SIS	LS	1	$ -	$ -	$ -	$ -	$ 50,000	$ -	$ -	$ -	$ 50,000	$ 8,522	$ 58,522	$ 58,522
200	DEMOBILIZE	LS	1	$ 13,749	$ -	$ 4,523	$ 6,450	$ -	$ 9,063	$ -	$ -	$ 33,784	$ 5,759	$ 39,543	$ 39,543
210	CLOSURE REPORTS	LS	1	$ 4,652	$ -	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ 6,152	$ 1,049	$ 7,200	$ 7,200
400	PER DIEM	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ 347,760	$ -	$ 347,760	$ 59,276	$ 407,036	$ 407,036
800	CONTINGENCY	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
900	FIELD GENERAL CONDITIONS	LS	1	$ 372,418	$ -	$ 21,273	$ 9,340	$ -	$ 8,542	$ 9,580	$ -	$ 421,153	$ 71,785	$ 492,939	$ 492,939
	TOTAL			$ 644,104	$ 370,693	$ 509,787	$ 113,857	$ 328,830	$ 213,940	$ 357,340	$ 84,433	$ 2,622,985	$ 447,087		$ 3,070,071

Notes:

BI = bid item

HDPE = high-density polyethylene

HP = horse power (pump)

LS = lump sum

m = metre(s)

m^3 = cubic metre(s)

QC = quality control

SIS = seepage interception system

Attachment D1-2
Professional Services Estimate

ATTACHMENT D1-2

Professional Services – Class 5 Estimate

Faro Mine Remediation Project – Emergency Tailings Area Seepage Interception System

Medium Term Workplan

	Task Name/Subtask/Activity	Principal	Senior III	Mid III	Junior II	Clerical	Labour Cost	Subcontracts ($)	Travel ($)	Expenses ($)	Total ($)
	Labour Rates	$ 232	$ 196	$ 154	$ 103	$ 77					
WBS	**Emergency Tailings Area SIS**										
01.01.01.02	**ETA Field Investigation**										
01.01.01.02.01	Geotechnical / Geophysical Investigation	12	236	131	136	32	85,690	161,162	10,218	23,700	280,770
	Subtotal Investigation	**12**	**236**	**131**	**136**	**32**	**85,690**	**161,162**	**10,218**	**23,700**	**280,770**
01.02.01.02	**Emergency Tailings Area SIS Design**										
01.02.01.02.01	**Design Definition**										
01.02.01.02.01.01	Hydraulic Analysis	24	60	24	140	40	38,530				38,530
	Subtotal Design Definition	**24**	**60**	**24**	**140**	**40**	**38,530**	**-**	**-**	**-**	**38,530**
01.02.01.02.02	Conceptual Design (30%)	42	124	158	237	190	97,523		10,000	3,000	110,523
01.02.01.02.03	Advanced Design (60%)	39	115	146	219	176	90,155		10,000	3,000	103,155
01.02.01.02.04	Detailed Design (90%)	34	101	128	192	154	79,103		10,000	3,000	92,103
01.02.01.02.05	Final Design (100%)	21	63	81	120	97	49,630		10,000	3,000	62,630
	Subtotal Design	**136**	**404**	**514**	**768**	**616**	**316,411**	**-**	**40,000**	**12,000**	**368,411**
01.04.06.04	**Permitting**	**7**	**20**	**25**	**38**	**31**	**15,701**	**15,000**			**30,701**
02.01.02.01.01	**Procurement**	**116**	**344**	**437**	**654**	**525**	**269,335**				**269,335**
02.01.02.02	**Construction Activities**										
02.01.02.02.02	Construction Management	337	997	1,269	1,898	1,523	781,998				781,998
02.01.02.02.03	Commissioning	13	39	50	75	60	30,701				30,701
	Subtotal Construction	**350**	**1,037**	**1,319**	**1,973**	**1,583**	**812,699**				**812,699**
02.01.02.03	**Transition**	**2**	**7**	**9**	**14**	**11**	**5,701**	**25,000**		**-**	**30,701**
	Grand Total	**648**	**2,107**	**2,460**	**3,722**	**2,838**	**1,544,067**	**201,162**	**50,218**	**35,700**	**1,831,147**

Notes:

ETA = Emergency Tailings Area

SIS = Seepage Interception System

WBS = work breakdown summary

Appendix D2
Intermediate Dam PMF Spillway

APPENDIX D2

Intermediate Dam PMF Spillway

The existing Intermediate Dam (ID) spillway does not have the capacity to safely pass a moderate or major flood event without potentially failing the dam. Failure of the ID would potentially result in an environmentally damaging discharge of metals-laden tailings to Rose Creek Valley, Anvil Creek, and Pelly River, and a significant or major loss of critical fish and wildlife habitat. Because of this threat to the environment, the ID is rated as "Very High" or "Extreme" risk, according to Canadian Dam Association (CDA) Dam Safety Guidelines (2007). The existing ID spillway does not have the capacity to safely pass a moderate or major flood event without potentially failing the dam and releasing the tailings to the downstream environment.

Although flood flows over the intermediate tailings surface would mobilize some tailings, the scale and consequence of this tailings loss would be minor compared to the tailings loss resulting from a breach of the ID.

This work package details the work required to design and construct a new probable maximum flood (PMF)-capacity spillway at the ID. The proposed initial construction at the ID includes only the spillway construction and does not include the ID dam raise required to increase the hydraulic head at the spillway to pass the entire Rose Creek watershed PMF. However, because the North Fork of Rose Creek is partially blocked by the haul road and the rock drain, the magnitude of the watershed PMF will be reduced until the haul road is removed, which is not anticipated to take place until the overall site remediation is well underway and the ID is raised. The initial spillway capacity would satisfy requirements for a dam with a "Very High," but not an "Extreme" risk classification.

A separate work package, Appendix C3, *Down Valley Interim Hydraulic Upgrades,* describes interim upgrades of the ID spillway and Rose Creek Diversion (RCD) so that they safely pass an approximately 500-year-return period flood event, which would significantly improve the safety of the ID in the short term.

D2.1 Current Conditions

Approximately 28.6 million cubic metres (m^3) of flotation-derived process tailings were deposited in the Rose Creek Tailings Area (RCTA) between 1969 and 1998 (CH2M HILL, 2012). The tailings are contained by a series of three dams (the Original, Secondary, and Intermediate dams) constructed across the Rose Creek Valley (Figure D2-1).

The Cross Valley Pond (CVP), downstream of the tailings impoundment dams, serves as a polishing pond for the treated effluent from the Faro Mine Water Treatment Plant. The ID is the major tailings impoundment structure and also contains any flood waters entering the intermediate tailings area. Any floodwater routed through the ID spillway flows into the CVP; once the storage capacity of the CVP is exceeded, water is routed through the Cross Valley Dam (CVD) spillway down into the Rose Creek Valley, where it flows into Rose Creek.

The tailings vary in thickness upstream to downstream and across the valley, with a thickness estimated as 5 to 10 metres (m) at the edges of the valley, a maximum thickness of more than 25 m upstream of the Secondary Dam, and a maximum thickness of 15 to 25 m upstream of the ID (SRK Consulting Canada Inc. [SRK], 2006). The maximum thickness of the original tailings is also estimated to be 20 to 25 m.

Analyses of Faro Mill production records and assays indicate that the tailings have an average concentration of lead, zinc, and copper equal to 0.8 percent, 1.3 percent, and 0.12 percent, respectively (Curragh Resources Limited, 1993). Oxidation of the sulfides results in production of low pH (acidic) water with elevated concentrations of sulfate, zinc, and other metals (Robertson GeoConsultants, 1996). These metals are toxic to aquatic and terrestrial life.

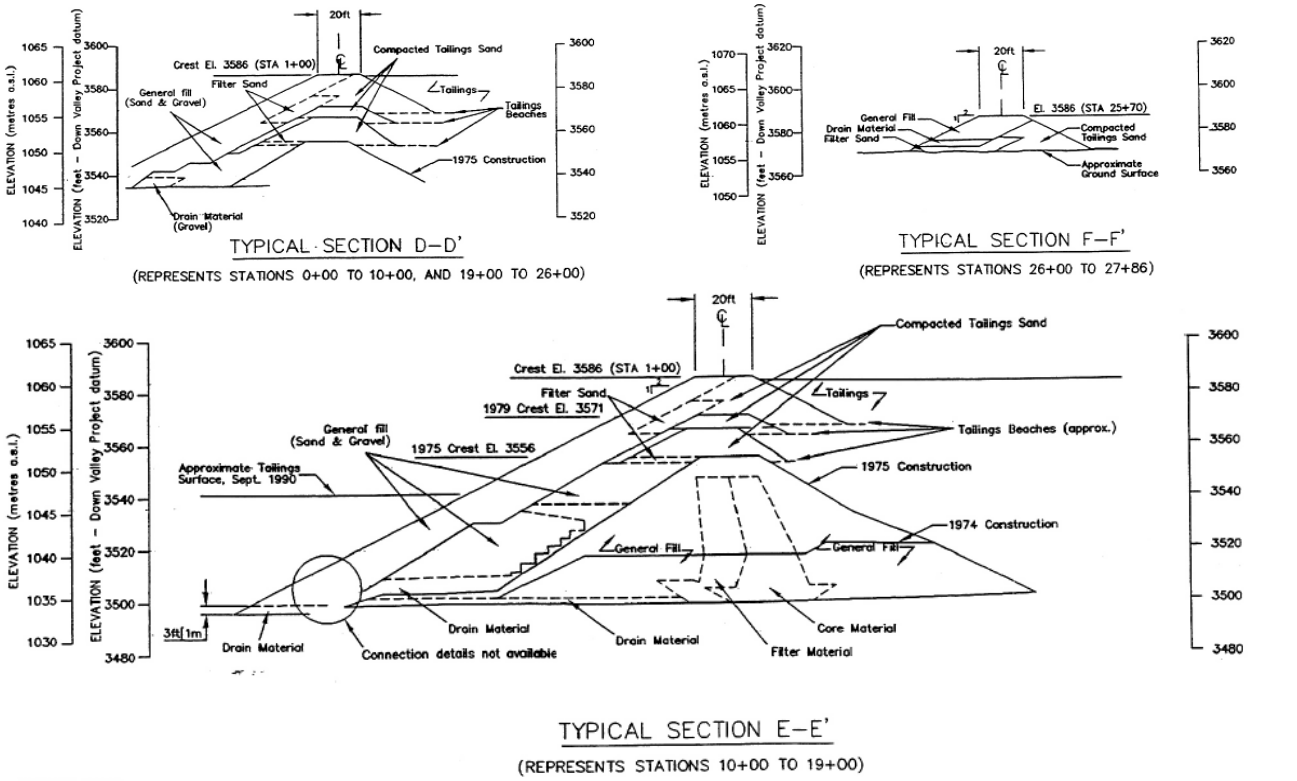


FIGURE D2-1
Rose Creek Tailings Area
Faro Mine Remediation Project

D2.1.1 Secondary Dam

Construction of the Secondary Dam began in 1974 and was completed in 1975. A failure of the Secondary Dam occurred in 1975, resulting in more than 200,000 m^3 of decant water and tailings discharged to the Rose Creek Valley. The spill was observed to move downstream several miles from the site (Williams, 1975). A survey conducted almost 30 years later indicated "obvious areas of killed and stressed vegetation" and "many areas of stressed vegetation and dead trees that appear to also have been impacted by the spill," (Gartner Lee Limited, 2004).

The West Limb of the Secondary Dam is defined as the curved portion of the dam that crosses the Rose Creek Valley in a roughly north-to-south direction. The East Limb is the portion of the Secondary Dam that is parallel to the south Rose Creek Valley wall. The West Limb was raised using centerline construction and compacted fill to a maximum height of 27 m, while the East Limb is a low retention dike that was constructed of compacted fill. Tailings were deposited behind this dam from 1975 until 1982 and then for approximately 5 months in 1986. Rose Creek was diverted to a channel that ran parallel to the south Rose Creek Valley wall and emptied into its original channel downstream from the Secondary Dam. Cross-sections and photos of the Secondary Dam are shown on Figure D2-2. Elevations shown on figures are in feet relative to the Down Valley Project datum. To convert to mean sea level datum (North American Datum 27), subtract 32.3 m (106 feet). To convert from feet to m, multiply by 0.3048 m per foot.



REFERENCES

1. Golder, Brawner & Associates Dwg. V74011, "Construction Carried Out to End of 1975"' Sept. 1975.
2. Golder Associates, Report No. 782-2736, "1978 Dyke Raising for the Tailings Retention Facility, Faro, Yukon Territory", April 1979, Figure 2 "Tailings Dam, 1978 Construction".
3. Golder Associates, Report no. 802-2024, "Construction Report, Cyprus Anvil Mining Corporation, 1980 Raising of the Tailings Dam, Faro, Yukon Territory", Appendix II, (Tender Drawings).

NOTES

1. All elevations are in feet relative to the Down Valley Project datum. To convert to sea level datum (NAD 27), subtract 106ft (32.3m). To convert from feet to metres, multiply by 0.3048m/ft.



FIGURE D2-2
As-built Cross Sections and Photographs of the Secondary Dam
Faro Mine Remediation Project

D2.1.2 Intermediate Dam

In 1981, the ID was constructed across the Rose Creek Valley to contain supernatant water and tailings solids. It was raised in 1988, 1989, and 1991 to a final crest elevation of 1,049.8 m above mean sea level (amsl), a maximum height of 32 m above the old Rose Creek stream channel elevation A typical section through the dam is shown on Figure D2-3. There is an emergency spillway channel on the right abutment, constructed as a rock-lined channel in natural overburden material.

Based on available drawings, the ID can be described as a zoned earthfill embankment with a sloping upstream low-permeability core and a downstream random fill shell. Granular filter zones were constructed on both sides of the core. The initial construction in 1981 made use of natural terrace material present across the valley. A drainage blanket was placed over this footprint downstream from the core and filter zone, extending to the toe of the planned final dam construction.

Upstream and downstream slopes are at 2 Horizontal (H):1 Vertical (V). A 20-m-wide berm was constructed on the downstream slope at about elevation 1034 m amsl, approximately adjacent to the polishing pond; therefore, the overall downstream slope is at 2.1H:1V. It is assumed that the purpose of the berm is to provide access to the blanket drain exit and to provide stability against drawdown loading from the CVP. There is a nominal cutoff for seepage reduction through the uppermost natural soils beneath the core of the dam. There is no deep foundation cutoff to reduce seepage through the permeable soils. Instead, the tailings on the upstream slope and foundation were relied on to reduce seepage to an acceptable level; the hydraulic gradient would be reduced because of longer seepage path through relatively thick layers of fine-grained tailings. The drains on the dam section are set to just above the design level of the polishing pond.

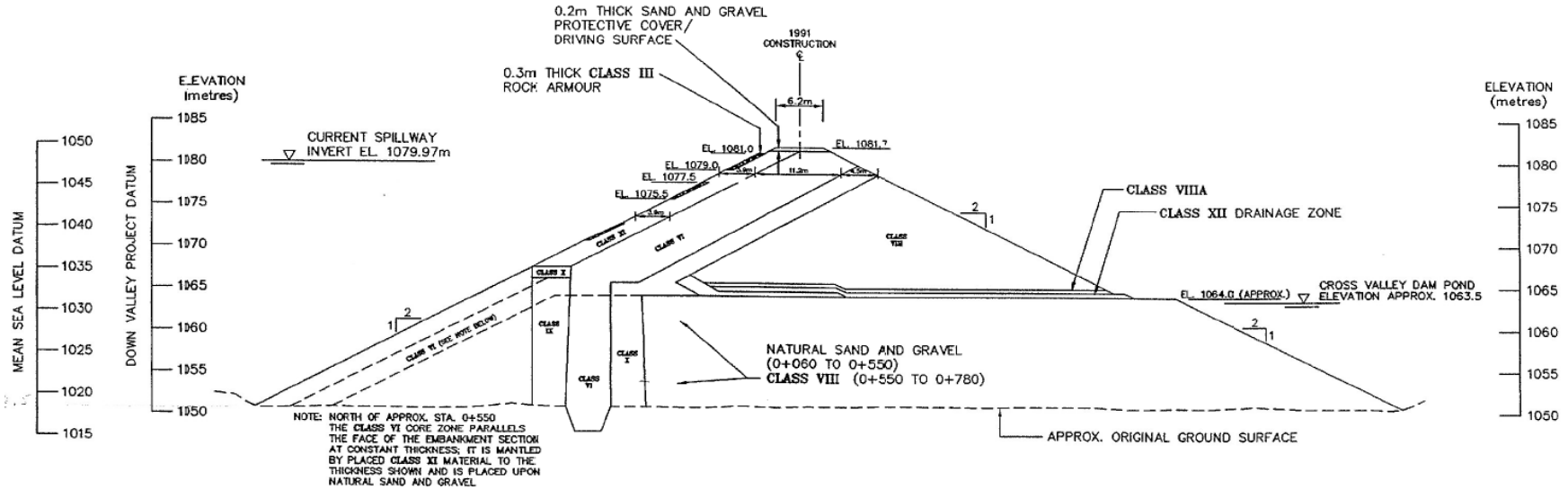
D2.1.3 Cross Valley Dam

The CVD was constructed as part of the Down Valley Project in the early 1980s, to expand the tailings disposal capacity in the Rose Creek Valley. The CVD retains a polishing pond downstream from the ID. Based on available drawings, the embankment can be described as a zoned dam with core and filters constructed as a conventional water-retaining dam with no retained tailings. Figure D2-4 shows the design section of the CVD without the seepage berm at the downstream toe. The seepage berm was constructed at a later date (after the original construction was completed) to control seepage that appeared near the toe of the dam. The crest of the dam is at elevation 1034 m amsl and the downstream toe is at elevation 1016 m amsl (nominal). The dam is approximately 500 m long, with a height of about 18 m above original grade.

The dam section consists of a central impervious core, supported by upstream and downstream granular shells at slopes of 2H:1V. The core and downstream shell are separated by a chimney drain that connects to a blanket drain that extends to the toe of the dam. There is also a filter/transition zone on the upstream side of the core, which acts as a crack filler. The central impervious core connects to a low permeability upstream blanket that extends beneath the upstream shell to 60 m upstream from the toe. The core was extended a few m into existing ground below the stripped grade. This nominal cut-off and the upstream blankets were designed to reduce seepage through the foundation soils. There are no other cut-offs extended into the pervious Rose Creek sediments.

D2.1.4 Emergency Spillways

The current spillways at the right abutments of the ID and the CVD are not sized to pass large floods. The ID spillway has a capacity equal to about 32 cubic metres per second (m^3/sec) when the pool reaches the top of the core zone, whereas the CVD spillway has a capacity equal to about 300 m^3/sec (nhc, 2006). The ID spillway discharges into the CVP. Once the CVP is filled, additional water is routed through the CVD spillway down into the Rose Creek Valley, where it flows into Rose Creek.





NOTES :

1. Embankment geometry cnd internal zoning as shown in Golder Associates Drawing 912–2402–3, Int. Dam Raising & C.V. Dam Toe Drain, Cross Section and Detailed Plan, Rev. 1, Aug. 8, 1991.
2. All elevations are referenced to Down Valley Project Datum. Subtract 32.3m from elevations shown to convert to mean sea level (NAD27) datum.
3. Refer to Golder Associates as built reports for detailed descriptions of material classes. General descriptions as follows :

CLASS VI	Dam Core (glacial till)
CLASS VII	Upstream Shell (silty sand and gravel)
CLASS VIII	Downstream Shell (sand and gravel)
CLASS VIIIA	Drainage Filter (sand and gravel)
CLASS IX	Upstream Filter (silty sand)
CLASS X	Downstream Filter (sand and gravel)
CLASS XI	Tailings Sand (fine to medium sand)
CLASS XII	Drainage Zone (gravel)

FIGURE D2-3

As-built Cross Sections and Photograph of the Intermediate Dam

Faro Mine Remediation Project

D2.1.5 Rose Creek Diversion

The RCD, on the south side of the valley, diverts clean water from the North and South Forks of Rose Creek around the RCTA. The RCD was constructed in two stages: an upstream section of the channel was completed in 1974 to carry clean water past the second tailings impoundment, and a longer downstream section was completed in 1981 in preparation for construction of the Intermediate Impoundment, downstream (west) of the secondary tailings impoundment. This second reach extended the diversion by about 3,800 m to the location where it discharges back into Rose Creek, downstream from the CVD.

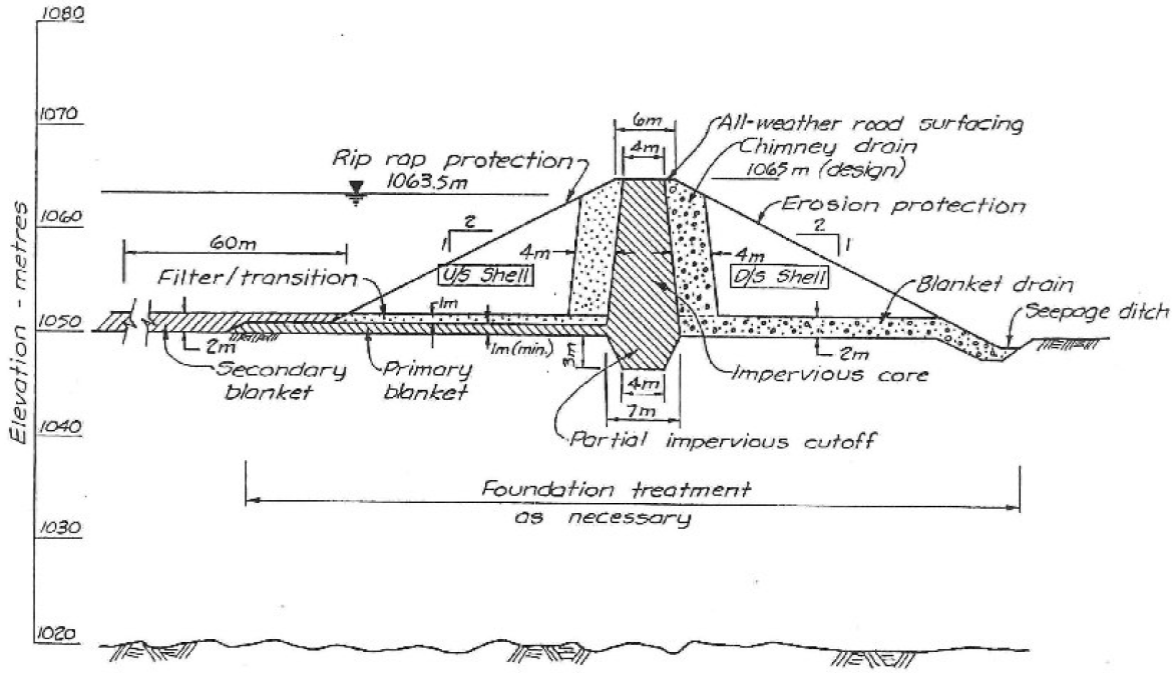




FIGURE D2-4
As-built Cross Section and Photograph of the Cross Valley Dam
Faro Mine Remediation Project

The existing diversion is approximately 4,700 m in total length. Rock weirs were constructed to reduce stream velocities and compensate for the grade difference between the RCD (0.2 percent) and the original Rose Creek Valley (2 percent). The weirs were designed on the basis of a 50-year flood event. The diversion was designed to carry a 50-year flood event (i.e., a flow of 79 m^3/sec), with 1 m of freeboard. The contingency design capacity, with no freeboard, was such that it would carry a 500-year flood event of 132 m^3/sec. Following a review of the RCD capacity in 2003, low sections of dike crest (as a result of settlement) were found (BGC, 2003), such that a 500-year event would have resulted in overtopping of the RCD dike. The low sections were subsequently raised by the required amount (BGC, 2005). After this raise, it was concluded that the existing RCD has a flow capacity sufficient to bypass stream flows of 140 m^3/sec, which is slightly more than the 500-year flood event (nhc, 2006). The flow from storm events exceeding the capacity of the RCD will discharge into the Intermediate Impoundment, and out through the ID spillway into the CVP.

A large storm event exceeding the capacity of the RCD will potentially fail the RCD dike, most likely by overtopping at the existing fuseplug / overflow weir location; however, it is also possible that the dike could fail by overtopping at other locations or through failure of some other mechanism, such as piping. Although hydraulic analyses suggest that the fuseplug / overflow weir should remain stable during the Inflow Design Flood (nhc, 2006), there is uncertainty in the way it was constructed. The downstream slope was noted as 20 percent, with median riprap size of 800 millimetres immediately downstream of the crest of the fuseplug and a cobble transition zone at 6 percent slope between the structure and the intermediate tailings (nhc, 2006). About 6.2 m^3/sec of flow of the 500-year flood event is estimated to occur through the fuseplug.

Once the RCD dike is breached, flood water would be conveyed over the intermediate tailings surface and through the ID spillway. Because the flow could be significantly larger than the capacity of the ID spillway, it has the potential to result in overtopping and breaching of the ID. Failure of the ID would likely result in discharge of a large volume of tailings to the environment. This is because the dynamic flow of a large amount of mobilized tailings is likely to overwhelm the storage of the CVP, such that it would run up and over the crest of the CVD, or would run through the CVD spillway. In both cases, the intermediate tailings would then be released into the Rose Creek Tailings Area downstream of the dam.

D2.2 Justification for Action

D2.2.1 CDA Dam Safety Guidelines

The ID contains over 26 million m^3 of copper-, lead-, and zinc-laden tailings toxic to aquatic and terrestrial life. The failure of the Secondary Dam in 1975 resulted in a loss of wildlife habitat, with little recovery evident more than 35 years later. It is also possible that there was a loss in fish habitat, but not as obvious. Failure of the ID could result in a significant or major loss or deterioration of critical fish or wildlife habitat downstream of the Faro Mine Complex, within Rose Creek and Anvil Creek, and possible extending to the Pelly River.

Based on threat to the environment and cultural values, the CDA dam safety guidelines, presented in Table D2-1 (2007), indicate that the ID should have a minimum dam classification of “Very High” risk and justifiably could have a dam classification of “Extreme” risk.

Appendix M provides CDA-recommended guidelines (2007) for required spillway capacity and stability under design earthquake conditions, based on the dam risk classification. For a dam rated as a “Very High” risk dam, the required Inflow Design Flood equals two-thirds of the flow between the 1,000-year-return-period flood event and the PMF flood event.

For the RCD, the 1,000-year flood event is an estimated 167 m^3/sec, and the PMF is an estimated 674 m^3/sec at the upper end of the RCD and 692 m^3/sec at the lower end of the RCD (nhc, 2004; nhc, 2006). These flows include runoff from the North Fork of Rose Creek (including flows from Faro Creek), the South Fork of Rose Creek, and the south slope above the RCD.

Klohn Crippen Berger (KCB, 2008) noted that the PMF and other flood estimates for the RCD do not include runoff from the catchment north of the RCTA. KCB further noted that this north-slope runoff will discharge into the tailings impoundment, so it has to be included with the flood waters that pass by the ID; that is, it is assumed that the RCD will breach during a PMF event and all the flood waters will have to be conveyed by the ID spillway. KCB (2008) made a rough estimate of the PMF for the north slope by proportional area, using a catchment of 12 square kilometres for the north slope compared to a total catchment at the lower end of the RCD of 217 square kilometres. Using these proportions, KCB estimated that the PMF for the north slope is 38 m^3/sec, so that the total PMF for all the catchment areas would be about 730 m^3/sec. Using a similar rationale for the 1,000-year flood event, the 1,000-year flood flows for the north slope would be 9.2 m^3/sec and the total 1,000-year flood would become 176 m^3/sec.

The Inflow Design Flood for a "Very High" risk dam is therefore an estimated 546 m^3/sec (equals two-thirds of the flow between the 1,000-year return period flood event and the PMF. For the ID, this required Inflow Design Flood is approximately 546 m^3/sec. For an "Extreme" risk dam, the spillway should have a capacity to pass the PMF event of approximately 730 m^3/sec for the ID. These estimated Inflow Design Floods assume that there are no upstream barriers in the watershed that could have an attenuating effect. Such barriers (haul road rock drain) will attenuate flow and reduce the IDF at the ID spillway so long as the barrier remains.

The existing ID spillway has a capacity of 32 m^3/sec, when the maximum water level is at the top of the dam's core. The top of core elevation is used to measure spillway capacity because flow above the top of the dam core elevation, and below the crest of the dam, has the potential to cause internal erosion of the non-core material, leading to internal erosion through piping, and dam failure.

Once the flow in the RCD exceeds 113 m^3/sec (nhc, 2006), the fuseplug/overflow would be overtopped and likely breached. Breaching of the RCD fuseplug would then result in overtopping and breaching of the ID. It is estimated that the system currently does not have adequate capacity to convey the 500-year IDF.

Table D2-1 shows estimated flood flows for different return periods for the case with the Haul Road rock drain and for the case without the rock drain. It is anticipated that the capacity of the new PMF spillway would be approximately 500 m^3/sec before raising the ID. By interpolating between the values in the table, it can be concluded that the build-out of a new PMF spillway structure without a dam raise would be able to provide sufficient spill capacity to meet the requirements for a "Very High" risk dam, and would approach the spill capacity for an "Extreme" risk dam as well, accounting for flood attenuation from the rock drain.

TABLE D2-1
Rose Creek Flood Flows for Different Return Periods
Faro Mine Remediation Project

	Estimated Flood Flow (m^3/s)		
Return Period [a]	**Without Haul Road Rock Drain**	**With Haul Road Rock Drain**	**Dam Classification**
500	137	123 [a]	NA
1,000	176	147 [b]	NA
PMF	730	577 [c]	Extreme Risk
1/3 between 1/1000 and PMF	345	290	High Risk
2/3 between 1/1000 and PMF	546	433	Very High Risk

Notes:
[a] Assume 20 percent attenuation of North Fork flood flows because of rock drain.
[b] Assume 30 percent attenuation of North Fork flood flows because of rock drain.
[c] Assume 40 percent attenuation of North Fork flood flows because of rock drain.
NA = not applicable

D2.2.2 Recommendation of the Independent Peer Review Panel and Technical Review Board

A workshop was conducted in August 2012 to review and evaluate the proposed closure alternatives for routing the PMF flood through the Rose Creek Valley. The workshop was attended by representatives from the Government of Canada as represented by Aboriginal Affairs and Northern Development Canada, and the Government of Yukon (YG), the Independent Peer Review Panel (IPRP), the CH2M HILL Technical Review Board (TRB), the Independent Engineer, and the Project Design Team (PDT). Based on these discussions, the IPRP provided the following recommendations:

- Build out the permanent PMF spillway structure as soon as reasonably possible.
- Because it will take significant time to design and construct the new spillway structure, other short-term improvements (including, but not limited to, the following) should be considered to decrease the risk of overtopping and breaching the ID:
  - Increasing the hydraulic capacity by increasing the width and depth of the existing spillway channel.
  - Increasing the height of the ID embankment crest by (1) installing a geomembrane to extend the core to the dam crest and (2) by adding a temporary crest berm.
  - Protecting the spillway channel from erosion by installing a reno orgabion mattress.
  - Increasing the RCD capacity by removing vegetation and raising the north dike.

Note that the tasks under the second bullet can be described as interim measures, which are described in further detail in Appendix C3, *Down Valley Interim Hydraulic Upgrades.* In the case that it is decided that the interim upgrades will not be implemented, the 2nd and 4th tasks in the 2nd bullet will be implemented as part of the PMF Down Valley hydraulic upgrades.

D2.3 Scope of Work

The Intermediate Dam PMF Spillway Work Package includes the following work elements:

- A new PMF spillway structure will be constructed. Because the dam would only be raised by using concrete traffic barriers as an interim measure, the structure would not initially be able to convey the full watershed PMF. However, it is estimated that the spill capacity of the new PMF spillway would be about 500 m^3/sec before raising the ID. If the flood attenuation by the rock drain is taken into account, the estimated reduced PMF equals approximately 577 m^3/sec. This estimate is based on a subjective estimate of the flood attenuation, assuming roughly 40 percent attenuation of flood flows in the North Fork of Rose Creek. The CVD spillway capacity will remain at 300 m^3/sec in the interim. The IPRP concluded that the risk of failing the CVD in the event of extreme flooding is acceptable in the short term, until the CVD spillway capacity can be increased.
- The scope of work for the ID Spillway Work Package assumes that the scope of work for the Down Valley interim hydraulic upgrades, listed below, has been completed:
  - Relocate existing piping and structures that have been placed within the ID spillway.
  - Increase the height of the ID embankment crest by (1) installing a geomembrane layer to extend the core to the dam crest and (2) adding concrete traffic barriers.
  - Increase the RCD capacity by removing vegetation, repairing raveled dike slopes, and filling in low spots on the dike crest.
  - Protect the spillway channel from erosion by installing gabion mattresses in the existing spillway channel

- Construction of the new spillway will require removal of the reno/gabion mattresses placed within the spillway.

Concepts for the new PMF spillway are shown in Figures 254 and 255. The new spillway will roughly follow the same alignment as the existing spillway. The conceptual side channel spillway consists of three elements: (1) a control structure consisting of a mass concrete structure with uncontrolled (ungated) 60-m-wide ogee crest, (2) a relatively steep discharge channel cut in rock and about 30 m wide, and (3) a terminal structure at the downstream end of the spillway consisting of a plunge basin or energy dissipater (60 m long, 40 m wide, and about 5 m deep) that will be lined with grouted riprap. A short exit channel will convey water from the plunge basin to the Cross Valley Pond.

The design will provide flexibility to allow continuation of a spillway chute (channel) to completely bypass the CVP and the CVD, in case this option is preferred to enlarging the CVD spillway.

In addition to constructing the new PMF spillway structure, a small increase in the spillway hydraulic capacity will be accomplished by installing a geomembrane between the dam core and the crest of dam to raise the effective crest height. To design the geomembrane installation, test pits will be excavated to confirm the depth to the top of the core material. Test pit excavation will also be useful in obtaining information of the stability of trench to install the geomembrane.

The following construction elements and quantities were developed in support of the conceptual design development:

- Excavation of the spillway: about 220,000 m^3. It can be assumed that half of this excavation quantity will be in rock and half in soil.
- Construction of a reinforced concrete wall that will separate the spillway channel from the ID embankment: estimate 3,470 m^2 of wall with an assumed thickness of 0.6 m (on average). The concept calls for a reinforced concrete wall, the bottom of which would extend to about 5 m below the bottom of the spillway discharge channel.
- Grouted riprap lining the plunge basin: estimate 9,800 m^3.
- Construction of control structure, which is a concrete gravity section with an ogee crest: estimated 1,770 m^3 of mass concrete (assume 20-milliPascal concrete for improved longevity).
- Rock reinforcement provided where poor rock is encountered: assume 250 m^3 of fiber-reinforced shotcrete or dental concrete.
- Spot rock bolts provided to reinforce rock: assume 500 bolts to a depth of 3 m.

D2.3.1 Geotechnical Field Exploration

Limited drilling has been completed in the ID spillway (KCB, 2008). Additional geotechnical investigation is required in support of the ID PMF spillway design, including the following work:

- Two seismic lines along the length of the spillway discharge channel (refraction survey)
- Five shallow borings to map the depth of bedrock
- Five diamond drill borings to map depth to bedrock and characterize the condition and quality of bedrock
- Packer testing in one of the borings to assess rock permeability at the control structure location

D2.3.2 Design Definition (Hydrologic Evaluation)

The design definition for the ID PMF Spillway Work Package will include hydraulic analysis to support the design. The following final design tasks are anticipated:

- Perform two-dimensional hydraulic modeling to route the PMF through the spillway to optimize the spillway size location, inverts, and required dam raise. Use the modeling to determine flow velocities.

- Perform seepage analyses to evaluate uplift forces at control structure and then perform stability analyses of the structure, including overturning and sliding stability.
- Calculate lateral earth pressures on reinforced concrete retaining wall.
- Perform scour assessment and design rock reinforcement measures.
- Design a plunge basin (energy dissipation structure) and assess the adequacy of the grouted riprap. Consider the need to use roller-compacted concrete at the energy dissipater.

D2.3.3 Conceptual Design (30 Percent)

The conceptual design phase comprises the development of a more detailed system layout, process sizing, associated calculations, and information derived from early geotechnical explorations to evaluate foundation conditions and earth material types. During this phase, the associated risk identification, assessment, and mitigation elements will also be developed. This phase will typically engage all required engineering design disciplines (e.g., civil, mechanical, and structural) to execute the design. The results of this phase will be summarized and recorded in a conceptual design report that documents the criteria that will be used to complete the design. The conceptual design phase includes the following tasks:

- Identify major processes and equipment.
- Develop a list of required specifications.
- Complete alternative processes and economic evaluations, and select final equipment.
- Specify design criteria including construction materials.
- Estimate utility requirements (moving existing piping in spillway).
- Develop construction architectural and civil specifications to 30 percent completion.
- Complete preliminary sketches and schematics showing major components.
- Develop performance and construction specifications to 30 percent completion.

During conceptual design, most of the important project decisions are established so the opportunity to alter the project design after this stage becomes somewhat limited. As a result, value engineering needs to occur before this phase is complete. Initial constructability, operability, construction sequencing, staging, and traffic control elements will be considered during this phase.

D2.3.4 Advanced Design (60 Percent)

During the project's advanced design phase, the basis of design report will be developed, and drawings and specifications further developed and refined. This phase will also engage other functional areas to participate in final constructability and operability reviews. The deliverables for this phase include the basis of design report, in-progress drawings, and a first draft of specifications or scopes or statements of work (SOWs). Deliverables will include the following:

- Site plans, including typical sections
- Preliminary equipment specifications (datasheets)
- Other overall layouts that may affect process design (e.g., hazardous area classification drawings, fire zone layouts, and safety components)

Drawings should be finalized before they are approved for design; that is, they should be complete apart from decisions that will be made during the detailed design phase (such as those regarding vents/drains and vendor data).

At the end of the advanced design phase, drawings and specifications will describe all project systems and layout requirements.

D2.3.5 Detailed Design (90 Percent)

The project's detailed design phase results in 90-percent-complete detailed drawings and specifications. The scope of this phase includes the completion of the following, documented to the appropriate level of detail for the contracted design scope:

- Construction and tender documentation
- Engineering drawings
- Specifications
- Detailed SOWs
- Calculations

A final pre-tender review will occur for the detailed drawing and specification documents. Following this review, drawings and specifications will be further developed and refined. The key detailed design deliverables will be either bid- or tender-ready documentation for general bidding (as would be the case for a design/bid/build project) or construction-ready documentation for use in procuring subcontractors and equipment (as would be the case for a design/build project).

Detailed design documents at this phase will be virtually complete, apart from final coordination and quality assurance and quality control reviews, which occur before the documents are issued for tender.

D2.3.6 Final Design (100 Percent)

The project's final design phase considers vendor and contractor constraints and requirements and results in a full set of detailed design drawings and specifications. Barring unforeseen conditions, documents will include everything necessary to procure the intended scope, quality, and design without requiring change orders during construction. These drawings will be used for "redline" revisions to produce as-built drawings at the end of construction.

D2.3.7 Procurement/Contracting

For the Faro Mine Remediation Project, procurement will follow YG's established processes and will be supported by project management and construction management services. In this case, the procurement manager or construction manager (CM) will prepare specifications as part of the coordinated design process. They will leverage a procurement support team to assist YG with tender issue, tender evaluation (with emphasis on technical capabilities), and recommendations regarding contractors and subcontractors.

YG could use one of two approaches to deliver these projects. Each would minimize project costs and maximize effective implementation:

- **Option 1:** The CM is established as a separate contractual role, where YG issues the construction contract directly to the selected subcontractor(s).
- **Option 2:** The CM is established in a prime contractor position, and the CM issues the construction contract directly with the selected subcontractor(s). This is known as a construction management-at-risk (CM-at-risk) approach.

The PMF Spillway Work Package is best suited for the delivery model outlined in Option 2. In this option, the CM would serve as consultant to the owner during the project's development and design phases and as a general contractor, or equivalent, during the project's construction phase.

D2.3.8 Permitting

Where projects are being constructed under Ministerial direction and are therefore not subject to the *Yukon Environmental and Socio-economic Assessment Act* process, the permitting task includes obtaining permits or permissions that are not part of the process. The required permits for this package are not fully known, but they are expected to be those required to support construction activities likely to cause ground disturbance or water discharge impacts. Work performed must comply with all existing or potentially

applicable FMC environmental and regulatory conditions. Construction permitting requirements would include these conditions, as well as air emissions, dust, and noise permitting, in addition to plans to comply with these permits.

This process culminates in the development of an Environmental Construction Management Plan.

D2.3.9 Construction (WBS 02.02.03.02.01)

The ID PMF spillway construction scope is described in Section D2.3, Scope of Work. The ID PMF spillway construction work will include the following:

- Mobilization
- Survey and layout
- Removal of reno/gabion mattresses in spillway
- Construction of the new spillway
- Demobilization

D2.3.10 Construction Management

The project's construction management task involves implementing the design plans and specifications, effectively managing the construction activities (main contractor and subcontractors), integrating activities, and maintaining the overall project schedule and budget. If YG holds the contract with the subcontractor, then YG is responsible for directing the work of the subcontractor. If the CM holds the contract with the subcontractor, then the CM is responsible for directing the work of the subcontractor.

The CM provides a single point of contact representing the owner's interests, first and foremost. The SOW includes the following range of responsibilities for the CM:

- Oversees that the project is built in general accordance with the design plans and specifications
- Oversees quality assurance and quality control
- Promotes health and safety plan compliance
- Adheres to environmental management plans during construction work
- Provides scheduling and cost control services
- Provides client with advice regarding engineering aspects of contractual issues that may evolve during construction
- Provides adaptive management advice if unexpected circumstances arise
- Requires that as–built drawings are completed and that any defects or warranty aspects are addressed

Overall, comprehensive CM services are used to integrate the various facets of the construction process, planning, design, procurement, construction, and commissioning, and to provide standardized technical and management expertise on each project.

D2.4 Work Breakdown Structure

See Appendix F: WBS for the potential Intermediate Dam PMF spillway work package.

D2.4.1 Uncertainties

Major uncertainties associate with this work package include the following:

- Subsurface conditions for new PMF spillway:
  - Rock mass quality
  - Erosion resistance
  - Permeability (to evaluate uplift and underseepage of control structure or concrete slabs)
- Functionality and hydraulic behavior of the new PMF spillway. This will be addressed through hydraulic modeling and geotechnical (scour) analysis to predict performance.

- Functionality of the existing fuseplug and potential overtopping of the RCD. This will be addressed through hydraulic modeling and geotechnical analysis to predict performance. Redesign and reconstruction of the fuseplug will not be addressed in this proposed work package.
- Actual attenuation of the North Fork of Rose Creek at the rock drain. This will be evaluated through hydraulic analysis and a conservative factor will be applied.
- Mobilization of tailings though the ID spillway during moderate to large storm events. This proposed work package does not address potential erosion and transport of the tailings during large storm events. This will be addressed within the 5-year planning period during preparation of the Project Proposal.
- Performance of the CVD impoundment and spillway if tailings are mobilized from the Intermediate Impoundment into the CVP.
- Requirements for use of the lime slurry plant to treat CVD impoundment polishing pond water. The lime slurry equipment will need to be removed from its current location within the ID spillway.

D2.5 Technical Risk Register

The technical risks associated with the Vangorda Creek Diversion are detailed in the Technical Risk Register attached to the MTP Work Breakdown Structure as Appendix G.

D2.6 Schedule

The Gantt chart schedule for the scope of work described previously is attached as Appendix H. The basis for this schedule is the scope of work described in Section D2.3. This scope has been prepared as a feasibility-level design concept to support the MTP work planning objectives; as such, this schedule is also considered preliminary and subject to change depending on contract award dates, and as initial milestones are met and scopes of work are confirmed and completed.

D2.6.1 Milestone Schedule

Section D2.6 as a whole presents a general summary of the major milestones and salient components of the schedule. Attachment D2-1 presents a detailed schedule of the implementation of the work package.

The Gantt chart schedule illustrates that the work package will be initiated by completing the review of the design work and cost estimates that have been completed to date. All of the field investigations are assumed to occur in 2 months (from May through June), with laboratory testing requiring 2 months and reporting requiring 2 months (included in the duration of the individual field investigation tasks). Since some of these tasks will overlap, the overall duration for the field investigations, including laboratory testing and reporting, is estimated 4 months.

The preparation of the final (100 percent) design, any required permitting (to be confirmed), and procurement of a construction contractor are all required to occur in Q4 to sequence the initiation of construction activity for April 1.

D2.6.2 Schedule Constraints and Assumptions

The following constraints and assumptions have been made in the development of this schedule:

- In support of the ID PMF Spillway Work Package, and as described in Section D2.3, additional geotechnical data will be collected to support the design. It is assumed that these data will be collected within a 2-month time period from May till June.
- The construction of the stilling basin is dependent on there being a potential borrow source in the vicinity of the construction work. It is expected that this source will be confirmed through the associated field investigation, but it may be advisable to develop this source in advance of the primary construction work.

- The construction phase of the work package involves four major construction elements: (1) construction of the mass concrete control structure, (2) excavation of the spillway channel, (3) construction of reinforced concrete retaining wall and (4) construction of the grouted riprap stilling basin. It is assumed that construction of the reinforced concrete retaining wall will require a double shift to accomplish.
- The construction season at the site is 6 months long, extending from April 1 to September 30.
- To the extent possible, this schedule has been developed in consideration of the constraints of the fiscal-year funding requirements. In instances where tasks are shown as occurring across this date, it is understood that additional contracting requirements may be necessary.
- It is assumed that procurement will be initiated to coincide with 60 percent design in order to have a full field season.
- Performance monitoring to identify needs for adaptation will only occur in the event of a flood event that causes the spillway to come into use; that is, in the case that the water from RCD will be rerouted over the tailings area and throughout the spillway.
- There is no operations and maintenance for this structure within the timeframe of this plan (2018), because it is unlikely to experience significant flooding within that timeframe

D2.7 Cost Estimate

The cost opinions presented herein are based on information and experience from visits to the site, discussions with the current Care and Maintenance Contractor, actual costs from working on-site during the CH2M HILL 2012 field investigation (late May to early October 2012) and information obtained from concept designs developed by SRK (2010). Cost opinions are rough order-of-magnitude (ROM), with an expected accuracy of +100 to -50 percent (Class 5). Costs have not been escalated and are presented as 2012 costs.

D2.7.1 Basis of Estimate

The following points represent the basis upon which the provided cost estimate has been developed:

- Raising of the dam crest, relocation of existing pipelines and structures from the ID spillway, and improvement to the RCD are assumed to have been completed as part of the Down Valley interim hydraulic upgrades.
- The estimate uses 2012 CH2M HILL Master Services Agreement rates for professional services.
- Escalating factors affecting productivity have been applied, where appropriate, to field exploration costs and construction estimates for working conditions, access restrictions, site limitations, and logistics anticipated for implementing the described work package. These factors are based on actual measures recorded during the 2012 field implementation program at the site.

  Permitting costs are presented as 1 percent of construction costs.
- Transition costs are estimated as 1% of construction costs
- Construction management and construction procurement and contracting costs are presented as fixed costs spread across five work packages. It is expected that construction activities will be occurring in each of the final 4 years of MTP. In order to maintain efficiency, a constant core construction management and procurement team has been estimated for each of those years in their entirety as the team completes one construction package and contracts the next.
- Construction costs were based on removal of gabion baskets and mattresses constructed from the Down Valley interim upgrades, which will precede the PMF spillway construction. After removal of the gabion baskets and mattresses, the PMF spillway construction will consist of the following tasks:
  - Excavation of 220,000 m^3 to increase the size of the existing spillway

  - Placement of rock bolts
  - Placement of 250 m^3 of fiber-reinforced dental concrete
  - Construction on the south side of the spillway along the north abutment of the dam of a concrete retaining wall (2,082 m^3) along the length of the spillway
  - Construction of a ogee concrete structure at the entrance of the spillway (1,770 m^3)
  - Production of 9,800 m^3 of riprap for plunge pool and energy dissipater construction and grouting of the riprap for the plunge pool
- The CH2M HILL Heavy Construction Systems Specialists, Inc.) estimating system was used to build up the construction cost estimate with identified activities for construction.
- Unit rates for equipment and craft labor were localized to Yukon.
- Production factors for current market conditions and location of the site were used in the buildup of the estimate.
- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document to account for items that may change between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors
- Markups were applied from historical experience with similar construction works.

D2.7.2 Supporting Documentation

The following sources of information were used in developing the cost estimates:

- *Canadian Blue Book* adjusted for Yukon project site location (central Yukon)
- 2012 Canadian labor rates from CH2M HILL Master Services Agreement (C00012050)
- 2012 Yukon fair wage schedule for craft labor
- Historical cost data and estimator judgment
- Productivity adjusted to account for current field conditions

D2.7.3 Cost Estimate

The total cost estimate for the ID PMF spillway work package described herein is $19,536,960. This estimate is summarized with construction and professional services costs provided in Tables D2-2 and D2-3 respectively.

TABLE D2-2
ID PMF Spillway – Construction Estimate
Faro Mine Remediation Project

02.02.03.02.01	Labour	Expenses/Materials	Equipment	Subcontractor	Markup	Total [a]
TOTAL	$2,352,906	$3,368,758	$2,168,993	$5,490,270	$2,001,103	$15,382,030

[a] The costs presented in this report are contractor direct costs.

The component costs of this construction estimate and summarized in Attachment D2-1. Attachment D2-1, *Construction Estimate Summary*, shows a summary of the task descriptions plus markup by the contractor to get to a bid or tender cost estimate.

TABLE D2-3
Intermediate Dam PMF Spillway – Professional Services Estimate
Faro Mine Remediation Project

WBS	Phase	Labour [a]	Expense	Subcontractor	Total
01.01.02.02	Field Investigation	$299,730	$70,000	$556,000	$925,730
01.02.02.03.01	Design Definition	$130,200	$30,000	$18,000	$178,200
01.02.02.03.02	Conceptual Design (30%) [b]	$540,754	$13,000	-	$553,754
01.02.02.03.03	Advanced Design (60%) [b]	$503,837	$13,000	-	$516,837
01.02.02.03.04	Detailed Design (90%) [b]	$448,461	$13,000	-	$461,461
01.02.02.03.05	Final Design (100%)[b]	$300,794	$13,000	-	$313,794
02.02.03.01.01	Procurement [c]	$269,335	-	-	$269,335
01.04.06.06	Permitting [d]	$103,821	-	$50,000	$153,821
02.02.03.02.02	Construction Management [e]	$781,997	-	-	$781,998
	TOTAL	**$3,576,289**	**$152,000**	**$624,000**	**$4,154,930**

[a] Estimated based on assumed full time equivalents and materials cost.

[b] Design costs (30%, 60%, 90% and 100%) are estimated at 12 % of the capital construction cost., i.e. 30% design costed at 3.6% of construction costs, 60% design costed at 3.36% of the construction costs, 90% design costed at 3% of construction costs, and 100% design costed at 2.04% of construction costs.

[c] Procurement is $269,335 per construction project

[d] Permitting estimated at 1% of construction cost

[e] Construction management is $781,997 per construction project with one season duration

The component costs of this professional services estimate are summarized in Attachment D2-2, *Professional Services Estimate.*

D2.7.4 Assumptions

The following assumptions were made during the preparation of this cost estimate:

- The estimated costs for engineering services were developed based on review of provincial association guidelines and recommendations for determining engineering fees. These included publications from the Consulting Engineers of British Columbia and Professional Engineers and Geoscientists (2009), the Association of Professional Engineers of Ontario (2001), and the Association of Professional Engineers and Geoscientists Manitoba (2011).
- The cost estimate does not include cost consideration for administration of the work package (i.e., statusing, coordination and invoicing and management) which will vary throughout the duration of the work depending on whether the work focus is construction or professional services.
- The cost estimate does not include any markups to professional services (labour) or subcontractor and expense costs.
- The work to relocate existing piping and structures within the ID spillway is assumed to have been completed as part of the Down Valley interim hydraulic upgrades.
- The work to increase the capacity of the RCD by removing vegetation, repairing raveled dike slopes, and filling in low spots on the dike crest is assumed to have been completed as part of the Down Valley interim hydraulic

- Work described in this work package is a standalone effort. No accommodation or economy of scale with combining different work packages has been used in developing this opinion of cost.
- Quantities used were based on conceptual design drawings prepared by CH2M HILL and included in this package.
- Riprap and other granular materials are available and can be developed within the project boundaries.
- No royalties are included.
- Construction season has been assumed to be a maximum of 6 months available in the field, from May through October.
- No blasting will occur for PMF spillway work because of risk to dam structures. It was assumed that about half of spillway excavation will be in overburden and half will be in phyllite rock. Based on limited existing information, the phyllite rock should be sufficiently weathered and jointed to be rippable by heavy equipment such as a D9-dozer.
- Quarry borrow proving and development is assumed to occur the year before construction of the PMF spillway construction.
- Construction work for the quarry borrow is scheduled to be performed in one construction season, with construction for the PMF spillway to be performed the following construction season.
- The schedule assumes double shift work at 10 hours per shift to accomplish the spillway work in one construction season.
- The schedule presented assumes overlapping of work items and an accelerated schedule with available construction season daylight hours, to accomplish the quarry borrow and PMF Spillway construction in two separate construction seasons.
- 2012/13 YG per diem and lodging rates have been applied. Either available housing and lodging are available in the Town of Faro to accommodate all personnel required to accomplish the work, or the allowed per diem and lodging costs are sufficient for camp setup and operation.
- Nineteen percent markup has been applied to contractor construction costs, consisting of home office support, overhead, and profit (10 percent overhead, 9 percent profit).
- Bonds and insurance have been included at 3 percent of construction costs.
- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document, to account for items that may change between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors.
- The estimate does not include maintenance or adaptation costs. The work is assumed to be completed near the end of the work planning, and additional effort will not be required.

D2.8 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are nonbinding and are provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, schedule implementation, and other variable factors. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding needs must be carefully reviewed before making specific financial decisions related to proper project evaluation and adequate funding.

D2.9 References

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Attachment D2-1
Construction Estimate

ATTACHMENT D2-1

Construction Cost Estimate Summary

Faro Mine Remediation Project – Intermediate Dam PMF Spillway

Medium Term Workplan

BI #	BI Description	Units	Quantity	Labour	Permenant Material	Construction Material	Equipment Operation Expenses	Subcontractors	Construction Equipment	Per Diem	Bond/ Insurance	Direct Total	Markup	Unit Price	Total
10	MOBILIZATION	LS	1	52,785	-	17,674	20,310	-	30,390	-	-	121,158	18,119	139,277	139,277
20	BONDS & INSURANCE	LS	1	-	-	-	-	-	-	-	423,037	423,037	63,265	486,301	486,301
30	SUBMITTALS	LS	1	15,589	-	3,900	-	-	-	-	-	19,489	2,915	22,404	22,404
40	SURVEY	LS	1	-	-	-	-	10,000	-	-	-	10,000	1,495	11,495	11,495
50	QC	LS	1	-	-	-	-	10,500	-	-	-	10,500	1,570	12,070	12,070
60	INSTALL SWPPP ELEMENTS	LS	1	6,810	-	2,792	1,369	-	1,439	-	-	12,410	1,856	14,266	14,266
70	PIONEER & ACCESS	LS	1	21,347	-	1,502	12,123	-	22,224	-	-	57,195	8,553	65,749	65,749
80	EXCAVATE SPILLWAY	M3	220,000	999,575	-	95,948	788,049	-	1,665,653	-	-	3,549,225	530,783	19	4,080,007
90	CONSTRUCT OGEE CNTRL STR	M3	1,770	-	-	-	-	1,823,100	-	-	-	1,823,100	272,643	1,184	2,095,743
100	PLACE ROCK BOLTS (3M)	EA	500	-	-	-	-	435,000	-	-	-	435,000	65,054	1,000	500,054
110	FIBER REINFORCED DENTAL CONC	M3	250	-	-	-	-	87,500	-	-	-	87,500	13,086	402	100,586
120	CONC RETAINING WALL	M3	2,082	-	-	-	-	3,124,170	-	-	-	3,124,170	467,216	1,725	3,591,386
130	MOB&SU ROCK PLANT	LS	1	4,757	-	495	3,121	-	4,939	-	-	13,312	1,991	15,303	15,303
135	PROCESS RIP RAP	M3	9,800	78,643	-	8,316	45,541	-	75,653	-	-	208,152	31,129	24	239,281
140	LOAD,HAUL PLACE RIP RAP	M3	9,800	255,312	-	26,400	138,633	-	298,640	-	-	718,984	107,523	84	826,507
145	GROUT RIP RAP	M3	9,800	34,309	166,920	12,454	8,522	-	18,857	-	-	241,061	36,050	28	277,112
300	DEMOBILIZATION	LS	1	30,163	-	6,024	11,619	-	17,404	-	-	65,209	9,752	74,961	74,961
310	CLOSURE DOCUMENTS	LS	1	4,228	-	1,500	-	-	-	-	-	5,728	857	6,585	6,585
400	PER DIEM COSTS	LS	1	-	-	-	-	-	-	1,455,600	-	1,455,600	217,683	1,673,283	1,673,283
800	CONTINGENCY	LS	1	-	-	-	-	-	-	-	-	-	-	-	-
900	FIELD GENERAL CONDITIONS	LS	1	849,389	-	67,258	40,872	-	33,796	3,201	5,582	1,000,097	149,563	1,149,660	1,149,660
				$ 2,352,906	$ 166,920	$ 244,261	$ 1,070,158	$ 5,490,270	$ 2,168,993	$ 1,458,801	$ 428,618	$ 13,380,927	$ 2,001,103		$ 15,382,030

Notes:

BI = bid item

EA = each

LS = lump sum

m = metre(s)

m^3 = cubic metre(s)

PMF = probable maximum flood

QC = quality control

Attachment D2-2
Professional Services Estimate

ATTACHMENT D2-2

Professional Services – Class 5 Estimate

Faro Mine Remediation Project – Intermediate Dam PMF Spillway

Medium Term Workplan

	Task Name/Subtask/Activity	Principal	Senior III	Mid III	Junior II	Clerical	Labour Cost	Subcontracts ($)	Travel ($)	Expenses ($)	Total ($)
	Labor Rates	$ 232	$ 196	$ 154	$ 103	$ 77					
WBS	PMF Spillway										
01.01.02.02	PMF Spillway Field Investigation										
01.01.02.02.01	Geotechnical Investigation	12	450	273	288	32	165,160	321,000	23,000	18,000	527,160
01.01.02.02.02	Borrow Source Investigation	12	360	221	240	32	134,570	235,000	14,000	15,000	398,570
	Subtotal Investigation	**24**	**810**	**494**	**528**	**64**	**299,730**	**556,000**	**37,000**	**33,000**	**925,730**
01.02.02.03	PMF Spillway Design										
01.02.02.03.01	Design Definition										
01.02.02.01.01.01	Develop Geotechnical Model	8	48		16	24	14,760		5,000	2,000	21,760
01.02.02.01.01.02	Seepage and Uplift of Control Structure	8	88		16	24	22,600		5,000	2,000	29,600
01.02.02.01.01.03	Review PMP and PMF	8	32		16	24	11,630		5,000	2,000	18,630
01.02.02.01.01.04	Hydraulic Analyses (Routing of Flood through Spillway)	8	100	80	16	24	37,280		5,000	2,000	44,280
01.02.02.01.01.05	Scour and Analyses of Discharge Channel	8	100	32	16	24	29,880			2,000	31,880
01.02.02.01.01.06	Dam Review Board	24	16	16	16	16	14,050	18,000			32,050
	Subtotal Design Definition	**64**	**384**	**128**	**96**	**136**	**130,200**	**18,000**	**20,000**	**10,000**	**178,200**
01.02.02.03.02	**Conceptual Design (30 %)**	233	690	878	1,313	1,053	540,754		10,000	3,000	553,754
01.02.02.03.03	**Advanced Design (60 %)**	217	643	818	1,223	981	503,837		10,000	3,000	516,837
01.02.02.03.04	**Detailed Design (90 %)**	193	572	728	1,088	874	448,461		10,000	3,000	461,461
01.02.02.03.05	**Final Design (100 %)**	130	384	488	730	586	300,794		10,000	3,000	313,794
	Subtotal Design	**773**	**2,288**	**2,912**	**4,354**	**3,495**	**1,793,846**	**-**	**40,000**	**12,000**	**1,845,846**
01.04.06.06	**Permitting**	**45**	**132**	**169**	**252**	**202**	**103,821**	**50,000**			**153,821**
02.02.03.01.01	**Procurement**	**116**	**344**	**437**	**654**	**525**	**269,335**				**269,335**
02.02.03.02	**Construction Activities**										
02.02.03.02.02	Construction Management	337	997	1,269	1,898	1,523	781,998				781,998
	Subtotal Construction	**337**	**997**	**1,269**	**1,898**	**1,523**	**781,998**				**781,998**
	Grand Total	**1,359**	**4,955**	**5,409**	**7,782**	**5,945**	**3,378,930**	**624,000**	**97,000**	**55,000**	**4,154,930**

Appendix D3
North Fork Rose Creek
Seepage Interception System

APPENDIX D3

North Fork Rose Creek Seepage Interception System

D3.1 Work Package Description

The North Fork of Rose Creek (NFRC) encompasses the alluvial valley and waste rock dumps (WRDs) north/northeast of the Haul Road, including the Zone II Pit, Zone II WRD, Zone II Outwash and the Northeast WRD (see Figure D3-1). Groundwater water data indicates an increase in contaminant discharge from the WRDs. This contamination is expected to increase over time as the WRD mature, presenting a threat to water quality within the NFRC.

This work package includes a site investigation to address uncertainties in site conditions, analyses, design, and installation of a seepage interception system to capture contaminated groundwater migration to the NFRC. The work is subdivided into four categories: Zone II Outwash predesign field investigation, Zone II Outwash SIS conceptual design, Northeast WRD field investigation, and numerical modelling refinement/detailed design.

D3.2 Current Condition

D3.2.1 Background

Excavation of an extension of the Faro ore body immediately south of the Faro Pit (Zone II Pit) began in the late 1970s and continued through the early 1980s. Following excavation, the northern and western portions of Zone II Pit were backfilled with approximately 32 million tonnes of unclassified mine rock generated from stripping operations (Robertson GeoConsultants, Inc. [RGC], 1996). The south-eastern section of the pit was backfilled with approximately 8 million tonnes of non-acid generating waste rock. Between 1980 and 1990, waste rock was accumulated in the Zone II WRD. Waste rock consisted of predominantly schist and calc-silicates. The eastern portion of the WRD contains up to 10 percent sulphidic materials. There have been historical occurrence of contaminated water overflowing the perimeter of the pit and discharging to the NFRC, which is located immediately downgradient of the Zone II pit (RGC, 1996).

Since the early 1990s, the groundwater elevation in the Zone II Pit has been controlled by seasonal pumping to maintain depressed groundwater levels (at elevations between 1,110 and 1,115 metres [m] above mean sea level) and create groundwater storage capacity within the pit. The water pumped from the Zone II Pit was conveyed to the Faro Pit for temporary storage before treatment. Additionally, numerical modelling performed by RGC (1996) concluded that maintaining groundwater levels in the Zone II Pit at these elevations would prevent overflow from the former pit rim to the NFRC aquifer system. As the only seepage to the alluvial aquifer from the pit would be through competent bedrock, the quantity would be minimized under these conditions. During early mining operations, Faro Creek flows were diverted to a small stream channel which flowed over the Zone II ore body (RGC, 1996). Erosion of overburden and mineralized bedrock and subsequent deposition in the NFRC alluvial valley may be the origin of the Zone II Outwash fan. The extent of the Zone II Outwash is shown on Photo D3-1, and is primarily delineated based on sparse vegetation.

Construction of the Northeast WRD occurred between 1974 and 1979 (RGC, 1996). During this period approximately 38 million tonnes of waste rock were deposited. Mine rock deposited in this WRD were predominantly schists and calc-silicates with lesser amounts of sulphides, intrusives, and overburden.

The primary sources of contamination to the NFRC aquifer system include seepage from the Zone II Pit, Zone II WRD, seepage from the Northeast WRD, and leaching of mineralized materials in the Zone II Outwash. Contaminated groundwater has the potential to discharge to the NFRC, degrading surface water

quality. This work package provides a scope of work for field activities in the NFRC near the Zone II Outwash and Northeast WRD. Anticipated remedial activities include additional investigation of the physical hydrologic system, contaminant distribution in both the Zone II Outwash and near the Northeast WRD, and design and construction of an interim seepage interception system (SIS) at the Zone II Outwash that will intercept contaminated groundwater before discharge to the NFRC. A discussion of the site history and current setting, justification for additional work, scope of work, and remaining site uncertainties are provided in subsequent sections. Figure D3-1 presents the locations of the Zone II Outwash and the Northeast WRD area and the anticipated locations of the conceptual design and field investigation.

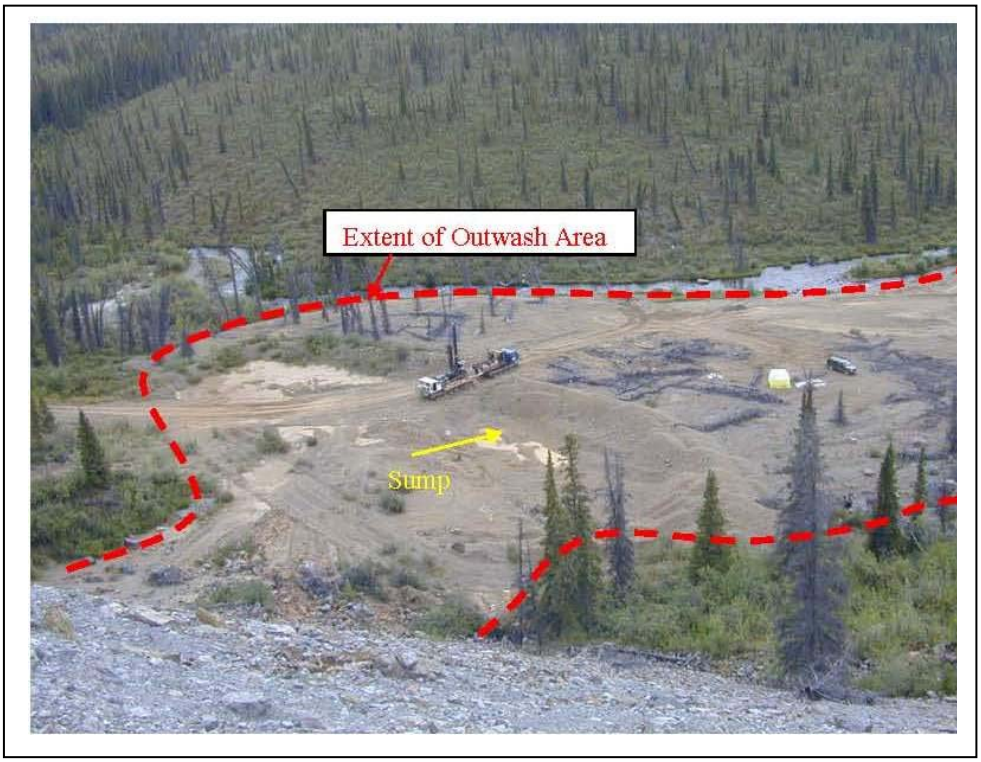


PHOTO D3-1
Zone II Outwash (SRK, 2007)
Faro Mine Remediation Project

D3.2.2 Hydrogeology

The general hydrogeology of the NFRC consists of alluvial materials overlying bedrock. Till may be present and form a low-permeability confining unit along the margins of the valley. Lithologic data are not currently available for the aquifer system near the Northeast WRD, but its lithology is assumed to be similar to that of the Zone II Outwash. The following three general hydrostratigraphic units have been identified by SRK Consulting Engineers and Scientists (SRK) (2010a) in the upper portion of the NFRC:

- A permeable alluvial deposit of variable thickness between 5 and 20 m
- A colluvium and till unit along the valley sides (a low-permeability unit between the alluvial deposit and bedrock, which is not present in the central portion of the valley [SRK, 2010a]).
- An underlying lower-permeability phyllite bedrock unit (a weathered horizon underlain by competent bedrock)

Sparsely vegetated outwash fan provides evidence of the historical failure of the slopes above the NFRC Zone II Outwash. Boring logs for the area indicate that locally, the hydrostratigraphic units described by SRK are overlain by 2 to 3 m of outwash (thickness varies across the site) and a relatively thin layer of organic sediments (SRK, 2007).

Aquifer testing data suggest that the hydraulic conductivity of the alluvial materials ranges from 0.1 to 135 metres per day, whereas the weathered bedrock ranges from 0.13 to 3.6 metres per day (SRK, 2009a-b, 2007; AECOM Canada Ltd. [AECOM], 2009). Note that these hydraulic conductivity values represent multiple hydraulic tests including rising/falling head slug tests, packer tests, and a constant rate pumping test. The higher values are those estimated from the 24-hour constant rate pumping test at RGC-PW3, a monitoring well located on the floodplain of the NFRC, and these values are considered most representative of the aquifer properties.

Groundwater within the WRDs flows eastward towards the NFRC alluvial valley (CH2M HILL, 2012). Historically, groundwater levels within the Zone II Pit were pumped seasonally to mitigate potential seepage from the pit to the Zone II Outwash area. Under these conditions, groundwater could periodically flow from the pit toward the NFRC when groundwater levels in the pit exceed 1,128.4 m above mean sea level during the non-pumping season. However, the current configuration of the system allows for year-round operation and any future subsurface releases from the pit should occur much less frequently than in the past. Groundwater flow in the NFRC is to the southwest, aligned with the valley orientation (AECOM, 2009; SRK, 2007). The hydraulic gradient is estimated to be 0.02 metres per metre, consistent with the channel gradient of NFRC (SRK, 2010a). The potentiometric surface adjacent to the upper end of the NFRC is shallow, with the water table identified within 2 m from the surface in wells installed in sand and gravel (SRK, 2010a).

Groundwater levels in the Zone II Outwash are no more than 5 m below ground surface (AECOM, 2009) and appear relatively stable. Groundwater levels exhibit very little variation, less than 1 m seasonally, and less than 2 m spatially, within the alluvium of the Zone II Outwash.

D3.2.3 Contamination Nature and Extent

Groundwater in the Zone II Pit (Well X26) is highly impacted with fairly stable zinc concentrations (RGC, 2012). Sulphate concentrations have been more variable since 2008, likely because of more aggressive pumping. Figure D3-2 presents time-series concentration plots (i.e., chemographs) for bedrock wells located within and immediately downgradient from the Zone II Pit. Meteoric water inputs are greater in spring; therefore, contaminant concentrations at well X26 tend to be lower because of dilution during these periods. In the Zone II Pit vicinity, several seeps are present along the face of the WRDs, but no seep locations are noted at the toe of the WRD in the immediate Zone II Outwash vicinity. It is possible that the lack of seeps in this area is because of groundwater extraction conducted to maintain the groundwater levels in the former Zone II Pit below the historic perimeter elevation. However, there are seeps observed both downgradient and upgradient of the Zone II Outwash areas (RGC, 2012). Historically, groundwater contamination from the Zone II Pit had the potential to migrate eastward, and potentially contribute contaminant loading to the NFRC alluvial aquifer and to the NFRC. Current groundwater level maintenance operations conducted within the Zone II Pit have eliminated the Zone II Pit from acting as a continuing source of contaminants to the NFRC alluvial aquifer and the NFRC itself.

Most groundwater both in the shallow alluvial and bedrock aquifers in the Zone II Outwash is moderately impacted (as defined in Section 6 of CH2M HILL, 2012), with some highly impacted groundwater near the toe of the WRD (BH2, BH6, and BH8). Figure D3-3 shows that concentrations have generally remained stable in Zone II Outwash wells over the monitoring period (RGC, 2012).

Three well pairs (BH12A/B, BH13A/B, and BH14A/B) are located at the toe of the Northeast WRD, screened mainly in weathered bedrock and deeper bedrock. Within the BH12A/B vicinity, Figure D3-4 shows a moderate increase of groundwater contaminant concentrations over the last 10 years, while concentrations at BH14A/B have increased significantly. Zinc concentrations up to about 10 milligrams per litre (mg/L) have been detected at the well pair closest to Zone II Outwash (BH14A/B). Mine-related contamination is expected to increase in the Northeast WRD area and additional investigation is required to evaluate the lateral and vertical extent of contamination (RGC, 2012).

D3.3 Justification for Action

Groundwater within the NFRC vicinity is impacted and the installation of an SIS and additional field investigation activities are planned based on the following:

- Although contaminant concentrations in the Zone II Outwash wells are relatively stable (see Figure D3-3), concentrations of zinc between 1 and 10 mg/L have been detected in many wells. Concentrations in excess of 10 mg/L have been detected in well BH2. As discussed in Section D3.5, there is uncertainty associated with the timing of future contaminant breakthroughs.
- As shown on Figure D3-4, groundwater quality has deteriorated significantly over the past 10 years downgradient of the Northeast WRD. High concentrations of zinc (sustained concentrations of 10 mg/L at BH14A since 2008) indicate breakthrough of highly impacted seepage from Northeast WRD.
- As shown in Table D3-1, recent surface water flow and dissolved zinc concentration data indicate that zinc loading generally increases between surface water sampling stations (R9 and R10) located upstream and downstream, respectively, from the Zone II Outwash. This suggests that the NFRC aquifer is contributing zinc loading to the NFRC. Furthermore, recent data (2005 through present) from surface water sampling station NF2, located immediately downstream from the Haul Road and rock drain, show increasing zinc concentration trends with detected concentrations as high as 120 micrograms per litre. These data further suggest that the NFRC aquifer is contributing significant zinc loading to the NFRC.

D3.3.1 Zone II Outwash Seepage Interception System Design Concept

This subsection outlines the conceptual design assumptions that comprise the basis of cost for the SIS at the Zone II Outwash. System design and costs will be refined based on the results of the predesign field data collection effort. The specific details for the SIS are provided in Table D3-2.

The basic design of the SIS will consist of a permeable trench with paired alluvial/bedrock aquifer extraction wells spaced equally along its length. The purpose of the permeable trench is to avoid breakthrough in capture because of heterogeneity of sediments in the alluvial aquifer system. The trench will generally be excavated to the alluvial/weathered bedrock contact and backfilled with coarse granular material (25 millimetre [mm] minus drainage gravel). It is currently assumed that the trench will have a typical depth of approximately 20 m below ground surface. The depth will be refined based on data collected during the field efforts. Although the Draft 4A Closure Plan specified screening the extraction wells across the alluvium/bedrock contact (5 m above and 5 m below), the current conceptual design includes pairs of wells screened within each of the aquifer systems. The purpose of isolating the screens is to optimize capture within each aquifer system. A single extraction well screened across both aquifers will likely draw the majority of groundwater from the alluvial aquifer, because of the higher permeability of these sediments, resulting in potentially less-effective capture of contaminated groundwater in the bedrock aquifer.

Preliminary groundwater modelling simulations suggest that the total inflow to the Zone II Outwash SIS will be approximately 6.3 litres per second (L/sec) (100 United States gallons per minute [USgpm]). It is assumed that the total SIS extraction rate will be divided equally among the extraction well pairs within each system. The Zone II Outwash SIS will have 4 extraction well pairs (with 3 horse power pumps in each well). The extraction wells will be instrumented with datalogging flow totalizers to monitor groundwater extraction rates over time.

The SIS conveyance systems were designed for a 10-year (continuous use) operational life. High density polyethylene (HDPE) pipe will be insulated and heat taped. Groundwater extracted from the well pairs will be pumped to a common pump station/header pipe. Groundwater from the Zone II Outwash SIS will be pumped approximately 390 m via a single 76.2 mm (3-inch) DR9 HDPE pipeline from the pump station and header pipe (at an elevation of approximately 1,105 m CGVD28 [Canadian Geodetic Vertical Datum of 1928]) to the junction with the conveyance from the potential Northeast WRD groundwater extraction wells (at an elevation of approximately 1,135 metres CGVD28). Profiles of the conveyance systems are presented on

Figure D3-8. At the junction, the two single 76.2 mm (3-inch) pipelines will be run uphill parallel to one another for approximately 335 m to the insulated heat structure at an elevation of approximately 1,176 m CGVD28. From the heat structure, groundwater will be conveyed for approximately 785 m via a single 203.2 mm (8-inch) DR9 HDPE pipeline to the Faro Pit receiving station (at an elevation of approximately 1,145 m CGVD28). Additional infrastructure requirements associated with construction of the conveyance system are provided on Figure D3-8.

Additional groundwater wells will be installed to monitor the performance of the Zone II Outwash SIS. These will include alluvial aquifer/bedrock well pairs upgradient and downgradient from the SIS. Wells used to monitor system performance will be instrumented with datalogging pressure transducers to evaluate changes in drawdown over time.

TABLE D3-1

Estimated Dissolved Zinc Loading to the North Fork of Rose Creek

Faro Mine Remediation Project

Date	Station	Measured Flow (L/s)	Dissolved Zinc Concentration (µg/L)	Dissolved Zinc Load (kg/d)	Station	Measured Flow (L/)s	Dissolved Zinc Concentration (µg/L)	Dissolved Zinc Load (kg/d)	R7 to R9 ΔZinc Load (kg/d)	Station	Measured Flow (L/s)	Dissolved Zinc Concentration (µg/L)	Dissolved Zinc Load (kg/d)	R9 to R10 ΔZinc Load (kg/d)
3/4/2009	R7	250	0.4	0.01	R9	186	0.8	0.01	0.00	R10	NM	NM	NA	NA
7/14/2009	R7	NM	NM	NA	R9	1,291	5.2	0.58	NA	R10	970	8.2	0.69	0.11
8/6/2009	R7	NM	NM	NA	R9	590	3	0.15	NA	R10	571	5.6	0.28	0.12
9/2/2009	R7	NM	NM	NA	R9	970	1.8	0.15	NA	R10	1,143	7	0.69	0.54
6/5/2010	R7	1,564	4.4	0.59	R9	1,097	5.6	0.53	-0.06	R10	1,964	8.7	1.48	0.95
7/8/2010	R7	1,146	5.2	0.51	R9	1,473	2	0.25	-0.26	R10	1,618	9.5	1.33	1.07
8/3/2010	R7	510	2.1	0.09	R9	1,063	3.5	0.32	0.23	R10	742	4.3	0.28	-0.05
9/1/2010	R7	602	19.7	1.02	R9	1,108	10.8	1.03	0.01	R10	760	17.3	1.14	0.10
10/19/2010	R7	376	7.2	0.23	R9	629	4.4	0.24	0.01	R10	537	8.6	0.40	0.16
11/10/2010	R7	320	21.3	0.59	R9	335	52.6	1.52	0.93	R10	339	26.8	0.78	-0.74
4/12/2011	R7	70	3	0.02	R9	35	8.5	0.03	0.01	R10	NM	NM	NA	NA
5/9/2011	R7	340	10.3	0.30	R9	423	7.2	0.26	-0.04	R10	NM	NM	NA	NA
7/21/2011	R7	1,954	11.6	1.96	R9	2,994	8.3	2.15	0.19	R10	2,749	8.7	2.07	-0.08
8/23/2011	R7	NM	NM	NA	R9	2,454	2	0.42	NA	R10	2,367	27.5	5.62	5.20
3/6/2012	R7	285	2.2	0.05	R9	263	0.9	0.02	-0.03	R10	NM	NM	NA	NA

Notes:

µg/L = micrograms per liter
kg/d = kilograms per day
L/s = litres per second
NA = not applicable
NM = not measured

TABLE D3-2
Zone II Outwash Subsurface Interception System Specifications
Faro Mine Remediation Project

Component	Detail
Permeable Trench Length	340 m
Permeable Trench Width	1.5 m
Permeable Trench Depth	15 to 20 mbgs
Number of Extraction Well Pairs	4
Extraction Well Pair Spacing	80 m
Alluvial Well Screen depth	10 to 15 mbgs
Bedrock Well Screen Depth	15 to 20 mbgs
Extraction Well Diameter	6-inch
Anticipated Total SIS Flow	6.3 L/s (100 USgpm)
Extraction Rate per Well Pair	1.6 L/s (25 USgpm)

Notes:
bgs = below ground surface
USgpm = United States gallons per minute
L/s = litres per second
m = metres

D3.4 Description of Scope

The following sections provide details regarding the proposed scope of work required to address uncertainties in site conditions, as well as to design and install an SIS to address contaminated groundwater migration to the NFRC. The work is subdivided into four categories: Zone II Outwash predesign field investigation, Zone II Outwash SIS conceptual design, Northeast WRD field investigation, and numerical modelling refinement/detailed design. Figures D3-5 and D3-6 present the layout of the Zone II Outwash SIS and the field investigation at Northeast WRD, respectively (also shown on Figure D3-1). Figure D3-7 presents profile sections of the trenches associated with the Zone II Outwash SIS, whereas Figure D3-8 presents profile views of the conveyance systems.

D3.4.1 Field Investigations

D3.4.1.1 Zone II Outwash Predesign Field Investigation

Predesign field activities include data collection efforts necessary to support the design of the SIS at the Zone II Outwash and to fill site data gaps identified in the Gap Assessment Report, Faro Mine Remediation Project (CH2M HILL, 2011). Proposed field efforts include the following:

- Install three new alluvial/bedrock monitoring well pairs at the northeastern/midpoint/southwestern extent of the proposed SIS alignment at Zone II Outwash (SIS alignment presented on Figures D3-1 and D3-5).
- Perform aquifer testing on newly-installed wells along the proposed SIS alignment to better characterize the hydraulic properties of the alluvial and bedrock aquifers.
- Conduct geophysical surveys along the proposed SIS alignment at the Zone II Outwash to characterize the bedrock topography.
- Conduct synoptic groundwater level surveys at existing and newly installed wells to better characterize the groundwater flow directions in both the alluvial and bedrock aquifers.
- Collect groundwater quality samples from new and existing monitoring wells to better characterize the lateral and vertical extent of contamination.

- Perform depth-specific groundwater sampling during the drilling of bedrock wells to refine the interpretation of the vertical contaminant distribution.
- If not executed during the 2012 field season, perform a potentiomanometer study along the NFRC to improve the characterization of groundwater/surface water interaction.
- Install three stilling well or shallow groundwater monitoring well pairs upstream from the Northeast WRD, between the Northeast WRD and Zone II Outwash, and downstream from Zone II Outwash. These wells will be instrumented with data-logging pressure transducers to evaluate temporal variations in groundwater/surface water interaction.
- Collect contemporaneous surface water quality and surface water flow measurements to evaluate changes in loading along the NFRC. These measurements will be performed during periods of the year when the stream can be accessed safely.

D3.4.1.2 Northeast Waste Rock Dump Field Investigation

Data regarding both the physical characteristics of the aquifer systems and the nature and extent of contamination near the Northeast WRD are currently insufficient to adequately evaluate the need for and/or design of a groundwater interception system. Rather than moving forward with design of an interim remediation system, the current effort focuses on characterization of the aquifer system and delineating the distribution of contamination.

As shown on Figures D3-1 and D3-6, the main fieldwork will consist of installation of temporary groundwater sample points. These locations will serve two main purposes: to characterize the subsurface lithology down to the weathered bedrock and to evaluate the distribution of groundwater quality. Borings will be advanced 5 m into the weathered bedrock with groundwater samples collected at 5 m intervals. The first phase of the drilling and sampling will proceed with the locations along the toe of the Northeast WRD. Additional locations have been selected downgradient of known contamination (BH12A/BH12B and BH14A/BH14B), along the NFRC, and to fill gaps in large geographic areas in-between. Field screening (pH and conductivity) will be conducted as groundwater samples are collected and the locations of subsequent sample points may be modified in order to optimize characterization.

For costing purposes, it is assumed that six new alluvial/bedrock monitoring well pairs will be installed following the temporary groundwater sampling effort. These wells will be included in future synoptic groundwater level surveys and groundwater quality sampling events. Furthermore, aquifer testing on select wells will be conducted to characterize the properties of the aquifer system near the Northeast WRD.

Also for costing purposes, it was assumed that the results of the groundwater investigation will result in the identification of up to two areas of significantly impacted groundwater that will require interception to protect the NFRC water quality. The interception system at each location will consist of two 15-m-deep alluvial groundwater extraction wells (screened from 5- to 15-m below ground surface) with a flow rate of 1.6 L/sec (25 USgpm) each. Groundwater extracted from the Northeast WRD wells will be pumped approximately 305 m via a single 76.2 mm (3-inch) DR9 HDPE pipeline from the pump station and header pipe (at an elevation of approximately 1,150 m CGVD28) to the junction with the conveyance from the Zone II Outwash SIS (at an elevation of approximately 1,135 m CGVD28). As discussed in Section D3.3.2, at the junction, the two single 76.2-mm (3-inch) pipelines will be run uphill parallel to one another for approximately 335 m to the insulated heat structure at an elevation of approximately 1,176 m CGVD28. From the heat structure, groundwater will be conveyed for approximately 785 m via a single 203.2 mm (8-inch) DR9 HDPE pipeline to the Faro Pit receiving station (at an elevation of approximately 1,145 m CGVD28). Additional infrastructure requirements associated with construction of the conveyance system are provided on Figure D3-8.

D3.4.2 Design Definition

D3.4.2.1 Seepage Interception System Design and Future Modelling Tool Refinements

Because of the significant uncertainties remaining regarding site hydrologic conditions, especially in the Northeast WRD area, additional groundwater modelling activities will be required to evaluate potential contaminant migration pathways and design necessary interception systems. The preliminary model that was used to evaluate the aquifer systems at the Zone II Outwash and Northeast WRD contains limitations based on the following uncertainties:

- Lack of heterogeneity representation (assumed isotropic subsurface in all directions)
- Lack of understanding of hydrogeology at the Northeast WRD
- No representation of weathered bedrock
- Uncertainty in the degree of hydraulic connection between the aquifer and the NFRC

The information collected in association with the additional field efforts will be incorporated into the preliminary groundwater model to refine the subsurface geologic representation. In particular, the hydraulic conductivity of the alluvial material in the vicinity of the Northeast WRD and the bedrock topography in that area will allow for a better estimation of required groundwater interception facilities and associated pumping rates. The bedrock drilling will allow for a better estimation of the depth of the weathered bedrock, which will be used to refine the vertical layering of the numerical model.

Following the update, the numerical model will be used to simulate operation of the SIS at Zone II Outwash and any required extraction system at the Northeast WRD, optimizing the effectiveness of the respective systems. Additional engineering and design work will be performed as necessary based on the outcome of these simulations.

D3.4.2.2 Conceptual Design (30%)

The Conceptual Design Phase comprises the development of a more detailed system layout with associated calculations or detailed modelling (such as groundwater modelling to locate wells and estimate flow rates). During this phase, the associated risk identification, assessment, and mitigation elements are also determined. This phase typically engages all required engineering design disciplines (e.g., civil, mechanical, and structural) to execute the design. The results of this phase are summarized and recorded in a Conceptual Design Report that documents the criteria that will be used to complete the design. The Conceptual Design includes the following tasks:

- Identify major processes and equipment
- Develop a list of required specifications
- Complete alternative processes and economic evaluations, and select final processes and equipment
- Develop piping and instrumentation diagram drafts and preliminary sizing
- Specify design criteria, including major equipment sizing calculations and construction materials
- Estimate utility requirements
- Complete a preliminary hazardous operability study (HAZOP)
- Develop architectural construction and civil specifications to 30 percent completion
- Complete preliminary sketches and schematics showing major components
- Develop performance and construction specifications to 30 percent completion

During Conceptual Design, most of the important project decisions are already established; therefore, the opportunity to affect the project design after this stage becomes somewhat limited. As a result, Value Engineering needs to take place before this phase is completed. Initial constructability, operability, construction sequencing, staging, and traffic control elements should also be considered during this phase.

The primary goal is to establish a sound basis for the project design, and make key decisions before producing the drawings and specifications that will be included in the Contract Documents.

D3.4.2.3 Advanced Design (60%)

During the project's Advanced Design Phase, the contents of the BOD Report are developed in more detail, and drawings and specifications are further developed and refined. This phase also engages other functional areas to take part in final constructability and operability reviews. The deliverables include an updated BOD, in-progress drawings, and a first draft of specifications or statements/scopes of work (SOW). Deliverables include the following:

- Completed piping and instrumentation diagram
- Results of detailed groundwater flow simulations
- Comprehensive equipment, line, and instrument lists
- Site plans, as well as typical geologic cross sections
- Preliminary equipment specifications (datasheets)
- Other overall layouts that may affect design (e.g., hazardous area classification drawings, fire zone layouts, and safety components)

It is preferable that these drawings are finalized to the Approved for Design status, meaning that they are complete apart from decisions that will be made during the Detailed Design Phase (e.g., regarding vents/drains and vendor data).

At the end of the Advanced Design Phase, drawings and specifications describe all project systems and layout requirements

D3.4.2.4 Detailed Design (90%)

The project's Detailed Design Phase results in 90 percent complete detailed drawings and specifications. The scope of this phase includes the completion of the following, documented to the appropriate level of detail for the contracted design scope:

- Construction and tender documentation
- Engineering drawings
- Specifications
- Detailed SOWs
- Calculations

A final pre-tender review takes place for the detailed drawing and specification documents. Following this review, drawings and specifications are further developed and refined. The key Detailed Design deliverables are either bid- or tender-ready documentation for general bidding (as would be the case for a design/bid/build project) or construction-ready documentation for use in procuring subcontractors and equipment (as would be the case for a design/build project).

Detailed Design documents are virtually complete, apart from final coordination, and quality assurance and quality control reviews, which take place before the documents are issued for tender.

D3.4.2.5 Final Design (100%)

The project's Final Design Phase considers vendor and contractor constraints and requirements, and results in a full set of detailed design drawings and specifications. Barring unforeseen conditions, documents must include everything necessary to procure the intended scope, quality, and design without requiring change orders during construction. These drawings are used for "redline" revisions to produce as-built drawings at the end of construction.

D3.4.3 Procurement/Contracting

For the Faro Mine Remediation Project, procurement will follow the Government of Yukon's (YG) established processes, and would be supported by Project Management and Construction Management (CM) services. In this case, the procurement manager or construction manager will prepare the specifications (as part of the coordinated design process). They will leverage a procurement support team to

assist YG with tender issue, tender evaluation (with emphasis on technical capabilities), and recommendations regarding contractors and subcontractors.

For delivery of the NFRC project the CM will be established in a prime contractor position, and the construction manager will issue the construction contract directly with the selected subcontractor(s). This is known as a CM-at-risk approach.

The NFRC work is best suited for this delivery model as this is a small-dollar project when compared with some of the other projects YG is proposing. A primary advantage to delivering this projects with a CM-at-risk approach is that this type of approach provides the opportunity to begin construction before design is complete, making it possible to adjust the design during implementation (even though designs are 100 percent complete) if site conditions differ from those assumed during design. Required revisions after final design are especially likely for SISs where hydrogeological conditions often vary from those ascertained during the site assessment tasks. This is the best point in the schedule to integrate construction, equipment (for example, pumps), and controls because there is ready access to the designer who would be part of the construction management team. This approach also provides flexibility and the adaptive management that is necessary if changed conditions exist.

D3.4.4 Permitting

Where projects are being constructed under Ministerial Direction, and are, therefore, not subject to the *Yukon Environmental and Socio-economic Assessment Act* process, the permitting task includes obtaining permits or permissions that are not part of the *Yukon Environmental and Socio-economic Assessment Act* process. The required permits for this package are not fully known, but they are expected to be those required to support construction activities likely to cause ground disturbance or water discharge impacts. Work undertaken will need to comply with all existing or potentially applicable Faro Mine Complex environmental and regulatory conditions. Construction permitting requirements would include these conditions, as well as air emissions, dust, and noise permitting, and plans to comply with these permits.

This process culminates in the development of an Environmental Construction Management Plan.

D3.4.5 Construction Activities

Construction activities consist of physical construction, construction management and commissioning. The scope of these activities is illustrated in the following sections.

D3.4.5.1 Construction

Construction comprises all phases of building the system or plant including site preparation, actual construction and system integration. NFRC construction scope is described in Section D3.2.1

D3.4.5.2 Construction Management

The project's Construction Management task involves implementing the design plans and specifications, effectively managing the construction activities (main contractor and subcontractors), integrating activities, and maintaining the overall project schedule and budget. For this project, the CM is responsible for directing the work of the subcontractor.

The CM provides a single point of contact representing the owner's interests first and foremost. The SOW includes the following range of responsibilities:

- Assures the project is built in general accordance with the design plans and specifications
- Oversees quality assurance/quality control
- Assures health and safety plan compliance
- Assures adherence to the Environmental Management Plans during construction works
- Provides scheduling and cost control services

- Provides the client with advice regarding engineering aspects of contractual issues that may evolve or arise during construction
- Provides adaptive management advice if unexpected circumstances arise
- Requires that as–built drawings are completed and that any defects or warranty aspects are addressed

Overall, comprehensive CM services are used to integrate the various facets of the construction process, planning, design, procurement, construction, and commissioning, and provide standardized technical and management expertise on each project.

D3.4.5.3 Commissioning (02.01.03.02.03)

Initial or cold commissioning follows on from construction as part of the contractor handover process. The SIS would be commissioned to determine optimal settings (e.g., water level controls) and to ensure that the individual components operate to specification, including pump rate testing and integrity testing of the overall system and its support infrastructure. This phase also includes any mechanical integrity inspection, dynamic testing, and construction punch lists completions prior to handover to the operations team.

D3.4.6 Transition (02.01.03.03)

For the first year after completion of construction and initial "cold" commissioning (i.e., post substantial completion), certain activities will be required to ensure the operational effectiveness and efficiency of the SIS. These activities include handover to the operational team and final commissioning/shakedown where the system is operated with all processes in place to ensure that all components operate as an integrated system. In the case of the NFRC SIS, the systems will be commissioned with contaminated water that is representative of what the system has been designed to pump. This is will ensure that system components are working as designed, instrumentation and control systems are functional and the capture effectiveness is as expected. This phase of commissioning will also extend to training operators and preparing operations manuals (including health and safety documentation), performance testing, completing commissioning punch lists, and guaranteeing that the system is compliant with warranty commitments.

During this period, there may also be a need for (1) improvements to any PLC processes and programming (often needed to stabilize more complex operational processes such as the SIS), (2) minor civil works to enhance operation or improve safety or operability of the system, (3) identification of additional maintenance needs, (4) materials and wastes requirements, (5) SOP modification, and (6) any additional training needs identified during initial startup. Despite design to 100 percent, these needs often only become evident once construction is complete or during the startup and shakedown period.

D3.4.7 Compatibility with Final Remedy

The Draft 4A Closure and Remediation Plan (SRK, 2010b) specified the following actions for the Zone II Outwash area: (1) relocation of outwash material to the sulphide cell; (2) breaching the haul road; (3) regrading the WRD and installing a low-permeability cover; (4) upgrading and relocating the NFRC into a lined channel away from the WRD slope; and (5) potentially implement system upgrades (such as bedrock grouting). Of these activities, relocation of outwash materials, regrading of the WRD, and upgrading and/or relocating the NFRC channel could significantly impact or compromise portions of the SIS infrastructure that are recommended herein. As such, these SIS and potential groundwater extraction wells that are proposed to mitigate mine-related contaminant impacts may not be consistent with the longer term remediation plan.

D3.5 Work Breakdown Structure

See Appendix F: Work Breakdown Structure (WBS).

D3.6 Uncertainties

The primary uncertainties and data gaps relating to the physical hydrologic system and contaminant distribution in the Zone II Outwash and Northeast WRD areas relate to aquifer properties of both the alluvial

and weathered bedrock aquifers, bedrock topography, and the lateral and vertical extent of contamination. Specific uncertainties include, but are not limited to the following:

- Saturated thickness of the alluvial aquifer
- Bedrock topography in the vicinity of the planned SIS
- Extent of hydraulic connection between the Zone II Pit and the Zone II Outwash, and the groundwater flux originating in the vicinity of the pit
- Spatial and temporal variation in groundwater/surface water interaction between the alluvial aquifer and the NFRC
- Three-dimensional distribution of fractured and weathered zones in the bedrock underlying the Zone II and Northeast WRD areas.
- Three-dimensional distribution of contaminated groundwater requiring capture (particularly near the Northeast WRD, where data are extremely limited)
- Timing and extent of contaminant breakthrough and potential impact to surface waters, fisheries, and environment
- Future contaminant concentrations in the groundwater seepage associated with the Zone II and Northeast WRDs

The primary uncertainties associated with the proposed remedial actions include the following:

- Necessity of groundwater interception along the Northeast WRD. Significant data gaps exist regarding the WRD materials between the wells at Zone II Outwash and the well clusters at the base of the Northeast WRD. If additional data suggest that there is significant seepage with elevated contaminant concentrations along the toe of the WRD between the two sites, additional groundwater interception or installation of an interim SIS may be required (increase in capital costs).
- The nature of groundwater/surface water interaction along the NFRC is not well understood. As additional data are collected and SIS performance is monitored, additional actions to hydraulically isolate the NFRC from the groundwater system (such as stream liners or slurry walls) may be required.
- Geochemical ramifications of combining extracted groundwaters with potentially dissimilar water qualities will be studied, particularly with regard to conveyance and associated maintenance.
- Uncertainties relating to the physical system (bedrock topography, saturated alluvial thickness, etc.), the nature and extent of groundwater and surface water contamination, and the interaction between the groundwater and surface water systems will be resolved by data collected during the field investigations described in Section D3.3.1. Uncertainties relating to contaminant breakthrough, future concentration trends, water budgets, and detailed SIS design will be resolved via a combination of fieldwork and numerical modelling.

D3.7 Technical Risk Register

The technical risks associated with the North Fork Rose Creek SIS are detailed in the Technical Risk Register attached to the MTP Workplan as Appendix G.

D3.8 Schedule

The Milestone Schedule for the scope of work described previously is provided in Appendix H: Milestone Schedule. The basis for this schedule is the scope of work described in Section D3.3. This scope has been prepared as a feasibility-level design concept to support the MTP workplanning objectives.

D3.8.1 Milestone Schedule

The following is a general summary of the major milestones and important components of the schedule.

The Milestone Schedule (Appendix H) illustrates that the work package will commence with a field program initiated after freshet is complete when the existing NFRC area is firm enough to support seismic survey support and drilling equipment. Construction should be initiated after freshet is complete so access to the area can be more easily accomplished. Therefore, it is assumed construction will not start until June. All of the field investigations (including reporting) are assumed to occur in the six-month period between April through September.

The preparation of the final (100 percent) design, any required permitting (to be confirmed), and procurement of a construction contractor will all be completed in Quarter 4 to sequence the initiation of construction activity for April 1.

D3.8.2 Schedule Constraints and Assumptions

The following constraints and assumptions have been made in the development of this schedule:

- Field work in NFRC (potentiomanometer and stream loading studies) should be conducted when the creek levels are low to: (1) allow access to wade in the stream to install equipment or take flow measurements; and (2) allow measurements and sample collection during baseflow conditions.
- It is assumed design work will continue during the client design review periods to facilitate design completion before the construction field season. It is assumed construction would not occur until the second field season after the predesign field investigation because of the time required to complete the design.
- Daylight hours in summer allows for extended work shifts.
- Workers can work a maximum 28 days before having 7 days off (per Yukon Workers' Compensation Board limits).
- Any required permits or natural heritage and archaeology evaluations will not impact the schedule for construction.
- The construction season at the site is 6 months in length and extends from April 1 to September 30.

To the extent possible, this schedule has been developed in consideration of the constraints of the fiscal year funding requirements. In instances where tasks are shown as occurring across this date, it is understood that additional contracting requirements may be necessary.

D3.9 Cost Estimate

The cost opinions presented are based on information and experience from visits to the site, discussions with the current Care and Maintenance Contractor, actual costs from working onsite during the CH2M HILL 2012 Field Investigation (late May to early October 2012) and from concept designs developed from Works Cited at the end of this document. Cost opinions are rough order-of-magnitude, with an expected accuracy of +100 to -50 percent (Class 5). Costs have not been escalated and are presented as 2012 costs.

D3.9.1 Basis of Estimate

The basis of the provided cost estimate has been developed from the following points:

- The estimate uses 2012 CH2M HILL Master Services Agreement rates for professional services.
- Escalating factors impacting productivity have been applied where appropriate to field exploration costs and construction estimates for working conditions, access restrictions, site limitations, and logistics anticipated for the implementation of the described work package. These factors are based on actual measures recorded during the 2012 field implementation program at the site.

- Design costs (concept through final design) are presented as labour and expense estimates developed as a percentage of construction costs (see Tables D3-3 and D3-4 hereinafter for percentages)
- Permitting costs are presented as 1 percent of construction costs.
- Transition costs are presented as 1 percent of construction costs.
- Additional field work is based on the current understanding of data gaps with an allowance for the need to gather additional geotechnical and geological, surface water, and groundwater information.
- Construction management, construction procurement, and contracting costs are presented as fixed costs spread across five work packages. It is expected that construction activities will be occurring in each of the final 4 years of MTP. In order to maintain efficiency, a constant core construction management and procurement team has been estimated for each of those years in their entirety as the team completes one construction package and contracts the next.
- The CH2M HILL Heavy Construction Systems Specialists, Inc. estimating system was used to build up the construction cost estimate with identified activities for construction.
- Scope details and assumptions for construction are provided in the CH2M HILL Heavy Construction Systems Specialists, Inc. notes for each bid Item.
- Unit rates for equipment and craft labor were localized to Yukon.
- Production factors for current market conditions and location of the site were used in the buildup of the estimate.
- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document, to account for items that may change between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors.
- Markups were applied from historical experience with similar construction works.

D3.9.2 Supporting Documentation

The following sources of information were used in developing the cost estimates:

- Canadian Blue Book adjusted for Yukon project site location (central Yukon)
- 2012 Canadian labor rates from CH2M HILL Master Services Agreement (C00012050)
- 2012 Yukon fair wage schedule for craft labor
- Historical cost data and estimator judgment
- Productivity has been adjusted to account for current field conditions
- Association of Professional Engineers of Ontario (PEO). 2001. Guideline Schedule of Fees for Engineering Services.
- Association of Professional Engineers and Geoscientists Manitoba (APEGM). 2011. Guide for the Engagement of a Consulting Professional Engineer.
- Consulting Engineers of British Columbia and Professional Engineers and Geoscientists (CEBC/APEG). 2009. Budget Guidelines for Consulting Engineering Services

D3.9.3 Cost Estimate

The total cost estimate for the NFRC SIS work package described herein is $9,915,193. This estimate is summarized with construction and professional services costs provided in Tables D3-3 and D3-4, respectively.

TABLE D3-3
North Fork Rose Creek SIS – Construction Estimate
Faro Mine Remediation Project

	Labour	Expenses/Materials	Equipment	Subcontractor	Markup	Total [a]
TOTAL	$1,353,107	$3,042,237	$650,031	$644,302	$956,120	$6,645,797

[a] The costs presented in this report are contractor direct costs.

The component costs of this construction estimate are summarized in Attachment D3-1. Attachment D3-1, *Construction Estimate Summary*, summarizes the task descriptions plus markup by the contractor to get to a "bid or tender" cost estimate.

TABLE D3-4
North Fork Rose Creek SIS – Professional Services Estimate
Faro Mine Remediation Project

DRAFT WBS	Phase	Labour [a]	Expense	Subcontractor	Total
01.01.01.03	Field Investigation	$291,670	$105,200	$618,000	$1,014,870
01.02.01.03.01	Design Definition	$258,780	$14,000	-	$272,780
01.02.01.03.02	Conceptual Design (30%) [b]	$226,249	$13,000	-	$239,249
01.02.01.03.03	Advanced Design (60%) [b]	$210,299	$13,000	-	$223,299
01.02.01.03.04	Detailed Design (90%) [b]	$186,374	$13,000	-	$199,374
01.02.01.03.05	Final Design (100%)[b]	$122,575	$13,000	-	$135,575
02.01.03.01.01	Procurement [c]	$269,335	-	-	$269,335
01.04.06.07	Permitting [d]	$16,458	-	$50,000	$66,458
02.01.03.02.02	Construction Management [e]	$781,998	-	-	$781,998
02.01.03.02.03	Commissioning [f]	$66,458	-	-	$66,458
02.01.03.03.03	Transition [g]	$13,658		$52,800	$66,458
	TOTAL	$2,520,562	171,200	$668,000	$3,269,396

[a] Estimated based on assumed full time equivalents and materials cost.

[b] Design cost (30%, 60%, 90%, and 100% design) estimated at 12% of estimated capital construction costs, i.e. 30% design costed at 3.6% of construction costs, 60% design costed at 3.36% of the construction costs, 90% design costed at 3% of construction costs, 100% design costed at 2.04% of construction costs.

[c] Procurement is $269,335 per construction project.

[d] Permitting is estimated at 1% of construction cost.

[e] Construction management is $781,997 per construction project with one season duration.

[f] Commissioning estimated at 1% of construction cost.

[g] Transition estimated at 1% of construction cost.

The component costs of this professional services estimate are summarized in Attachment D3-2, *Professional Services Estimate.*

D3.9.4 Assumptions

The following assumptions were made during the preparation of this cost estimate:

- The estimated costs for engineering services were developed based on review of provincial association guidelines and recommendations for determining engineering fees. These included publications from the Consulting Engineers of British Columbia and Professional Engineers and Geoscientists (CEBC/APEG, 2009), the Association of Professional Engineers of Ontario (PEO, 2001), and the Association of Professional Engineers and Geoscientists Manitoba (APEGM, 2011).

- The cost estimate does not include cost consideration for administration of the work package (i.e., statusing, coordination and invoicing and management) which will vary throughout the duration of the work depending on whether the work focus is construction or professional services.
- The cost estimate does not include any markups to professional services (labour) or subcontractor and expense costs.
- Work described in the work package is a standalone effort. No accommodation or economy of scale with combining different work packages has been used in developing this opinion of cost.
- The depth of the permeable trench is assumed to be 20 m. The actual depth may vary based on the results of subsequent drilling and seismic profiling to be performed at the site.
- The total flow rate for the Zone II SIS and conveyance system is assumed to be 6.3 L/sec. This flow rate may be adjusted during detailed design based on the analysis of both aquifer test data and seismic profiling.
- Four extraction wells to a depth of 15 m are assumed to be sufficient to intercept contaminated groundwater in the Northeast WRD area. Because of significant uncertainty in site conditions in this area, the number of well and their construction may change, which will impact this cost estimate.
- Four extraction wells in the Northeast WRD area are assumed to have a pumping capacity of 25 USgpm each. This flow rate is uncertain and may change based on the results of additional field investigation efforts.
- No royalties are included.
- Construction season has been assumed to be a maximum of 6 months available in the field, from April 1 through September 30.
- 2012/2013 YG per diem and lodging rates have been applied. Available housing and lodging are available in the Town of Faro to accommodate all personnel required to accomplish the work or the allowed per diem and lodging costs are sufficient to for camp setup and operation.
- Nineteen percent markup has been applied to contractor construction costs consisting of home office support, overhead, and profit (10 percent overhead, 9 percent profit).
- Bonds and Insurance have been included at 3 percent of the construction costs.
- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document, to account for items that may change between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors.
- The estimate does not include maintenance, adaptation, or operations costs. The work is assumed to be completed near the end of the work planning and additional effort will not be required.

D3.9.5 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are nonbinding and are provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, schedule implementation, and other variable factors. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding needs must be carefully reviewed before making specific financial decisions related to proper project evaluation and adequate funding.

D3.10 Works Cited

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Figures

FARO PIT

NORTHEAST
WASTE ROCK DUMP

ZONE II PIT

ZONE II
OUTWASH

N

0 100 200

METRES

BH13A/BH13B

P09-UN3

P09-UN1

P09-UN2

BH12A/BH12B

BH14A/BH14B

NORTH FORK ROSE CREEK

24+00

23+00

22+00

21+00

20+00

19+00

18+00

17+00

16+00

15+00

14+00

13+00

12+00

11+00

32+00

31+00

X26

BH8

BH7S

BH10A/BH10B

BH7D

BH1

BH2

SRK08-P12B

SRK08-P12A

A'

P05-04

BH4

BH6

RGC-PW3

BH5

A

LEGEND

- Anticipated Permeable Trench
- Anticipated Conveyance Pipeline To Extraction Wells
- Anticipated Extraction Well Pair
- Anticipated Conveyance Pipeline
- Exsiting Water Courses
- Existing Monitoring Well
- Planned Alluvial / Bedrock Monitoring Well Pair
- Planned temporary Groundwater Sample Location

NOTES:

1. Topography And Aerial Photo
   Prepared From Lidar Dated 10-03-11
   Horizontal Datum: NAD83 CSRS
   Vertical Datum: CGVD28 (HTv2.0)

FIGURE D3-1

Northeast Waste Rock Dump And Zone II Outwash Subsurface Interception System Pipe Routing

CH2MHILL

FILENAME: 107_Zone_II_Figure1.dgn PLOT DATE: 2012\10\16 PLOT TIME: 12:16:09 PM

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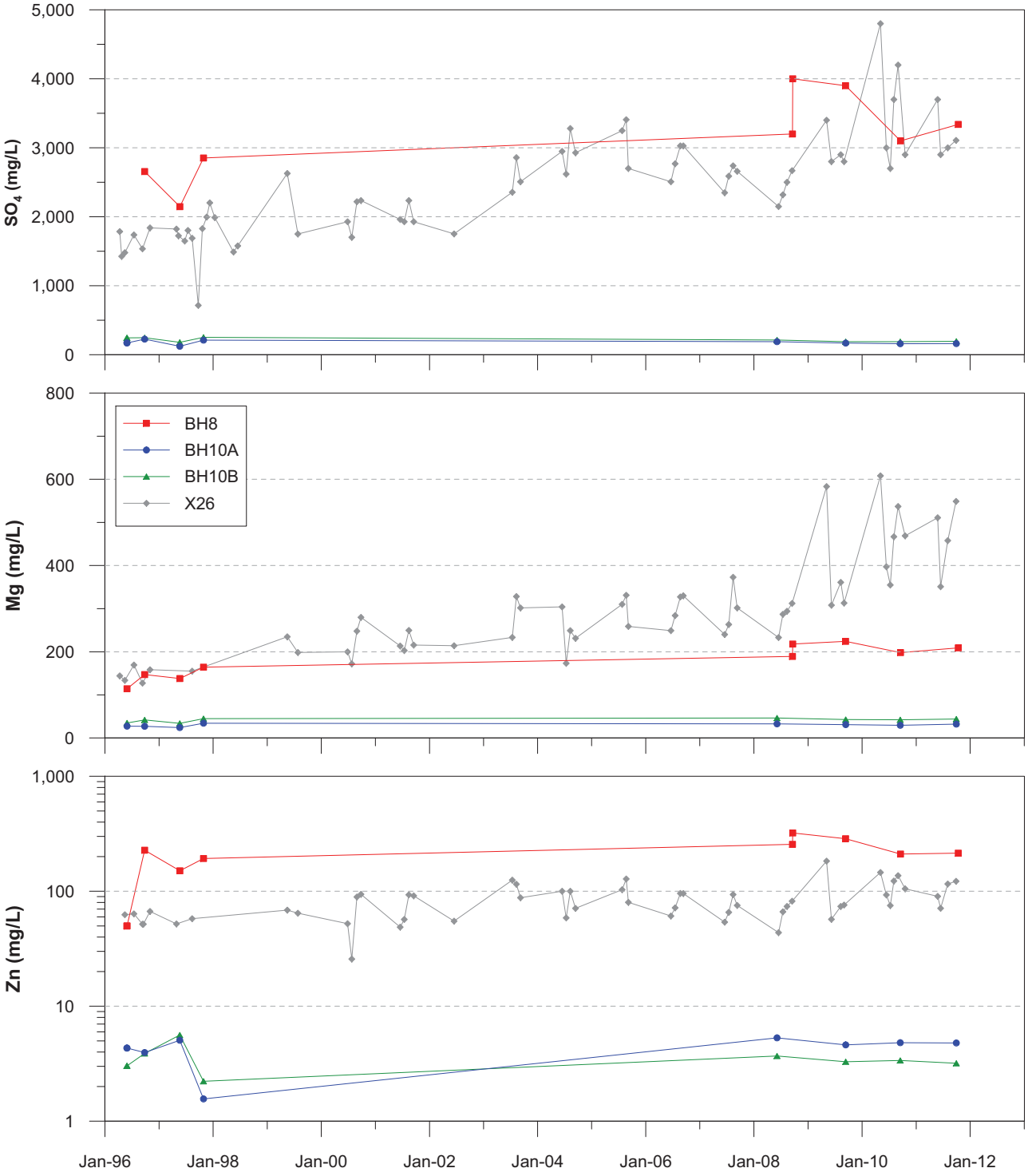


FIGURE D3-2
Time Trends for SO_4, Mg and Zn for Zone II Pit and Bedrock Wells
Faro Mine Remediation Project

Note:
Modified with permission from the Government of Yukon from Robertson GeoConsultants, Inc. 2012

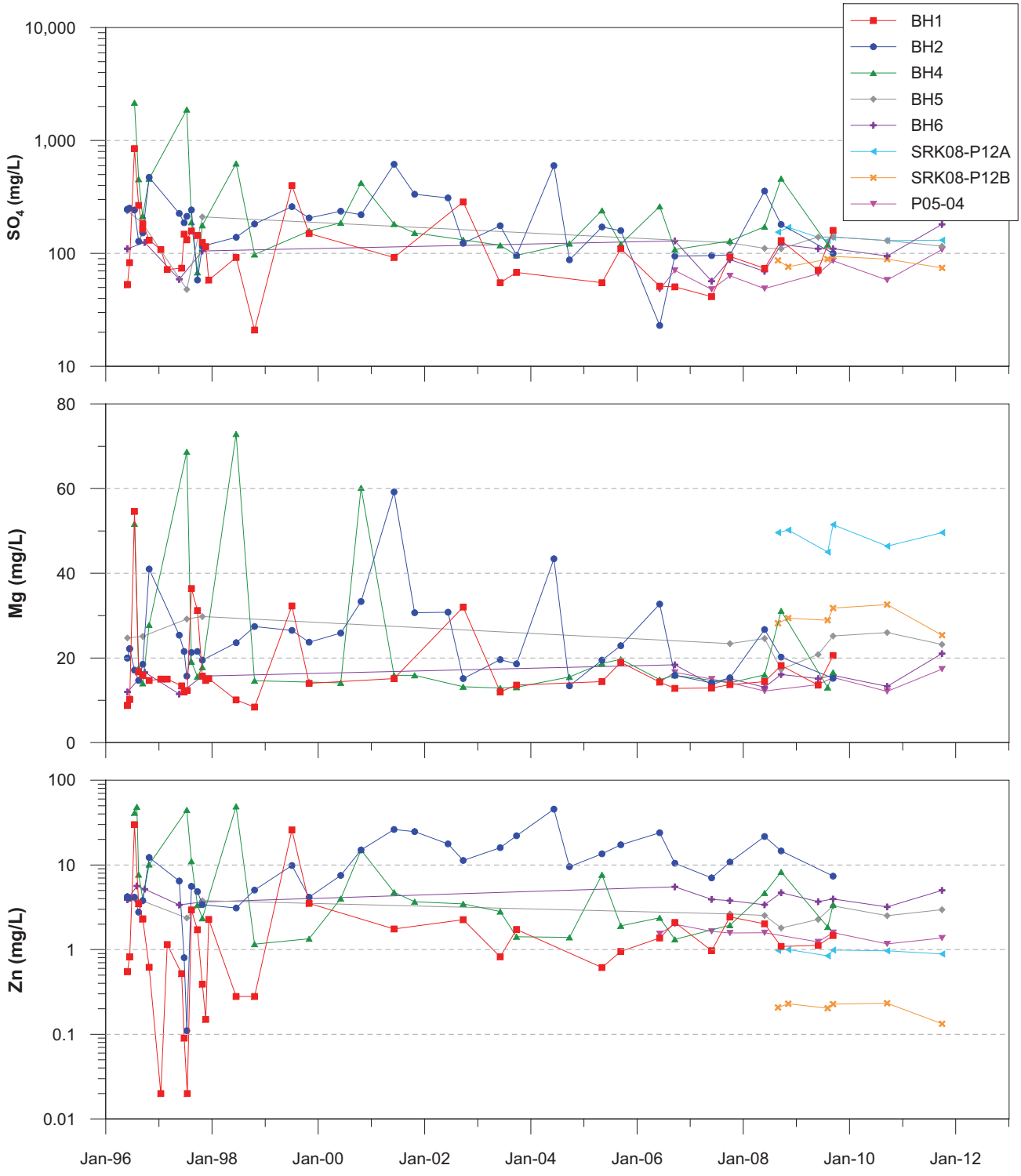


FIGURE D3-3
Time Trends for SO_4, Mg and Zn for Wells in Zone II Outwash Area
Faro Mine Remediation Project

Note:
Modified with permission from the Government of Yukon from Robertson GeoConsultants, Inc. 2012

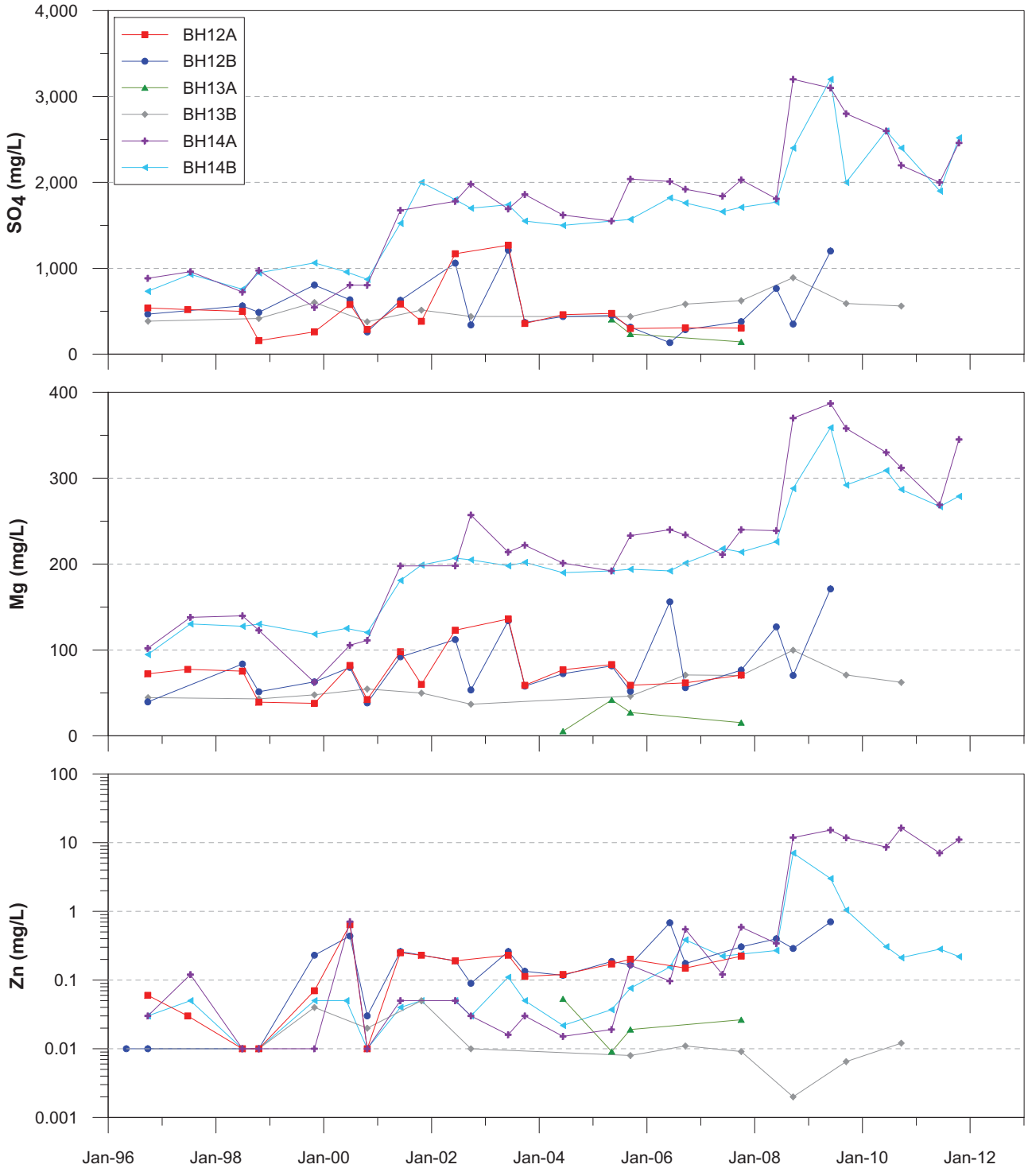
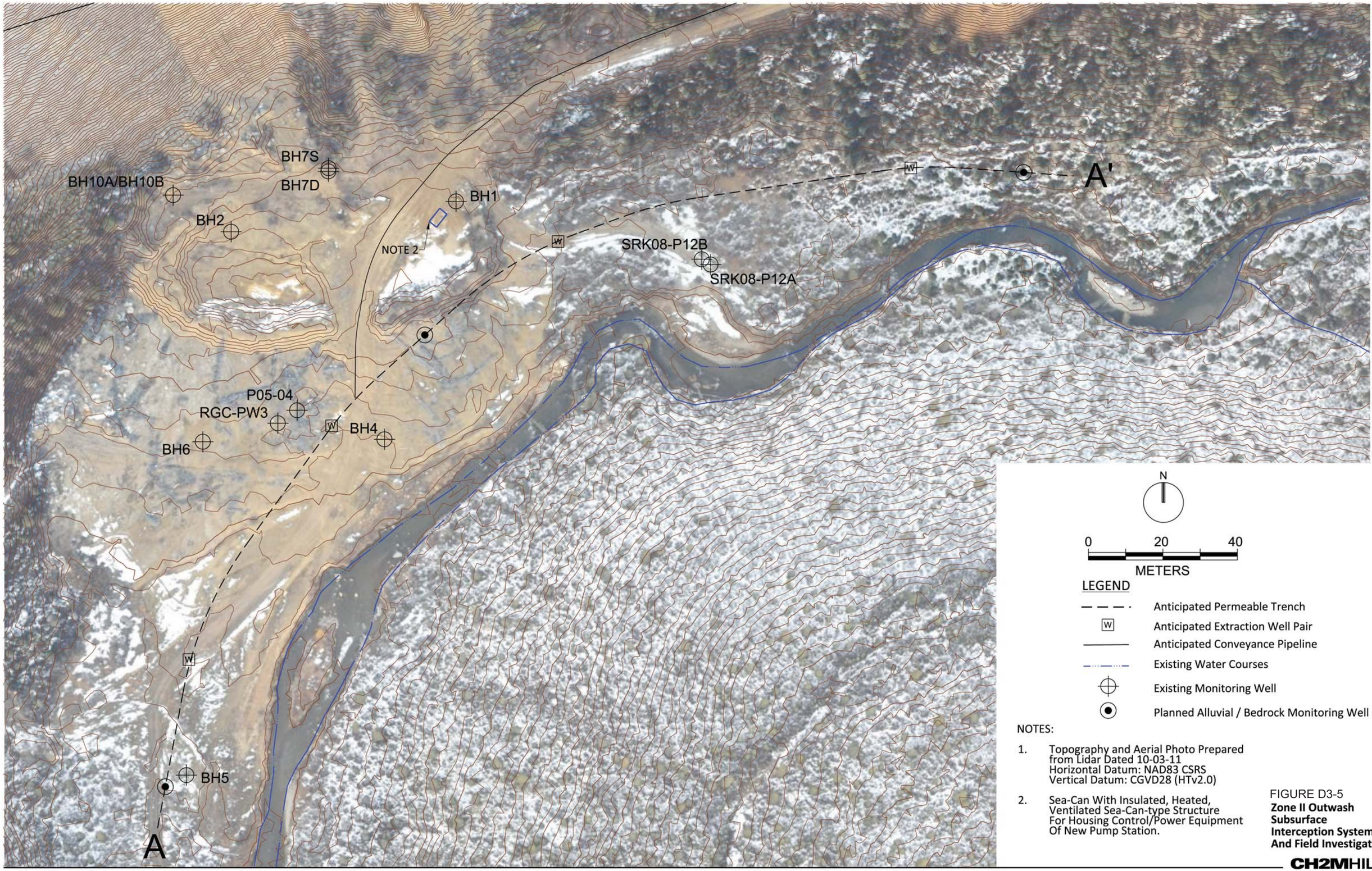


FIGURE D3-4
Time Trends for SO_4, Mg and Zn in Wells at the Toe of Northeast Waste Rock Dump
Faro Mine Remediation Project

Note:
Modified with permission from the Government of Yukon from Robertson GeoConsultants, Inc. 2012



LEGEND

- Anticipated Permeable Trench
- Anticipated Extraction Well Pair
- Anticipated Conveyance Pipeline
- Existing Water Courses
- Existing Monitoring Well
- Planned Alluvial / Bedrock Monitoring Well Pair

NOTES:

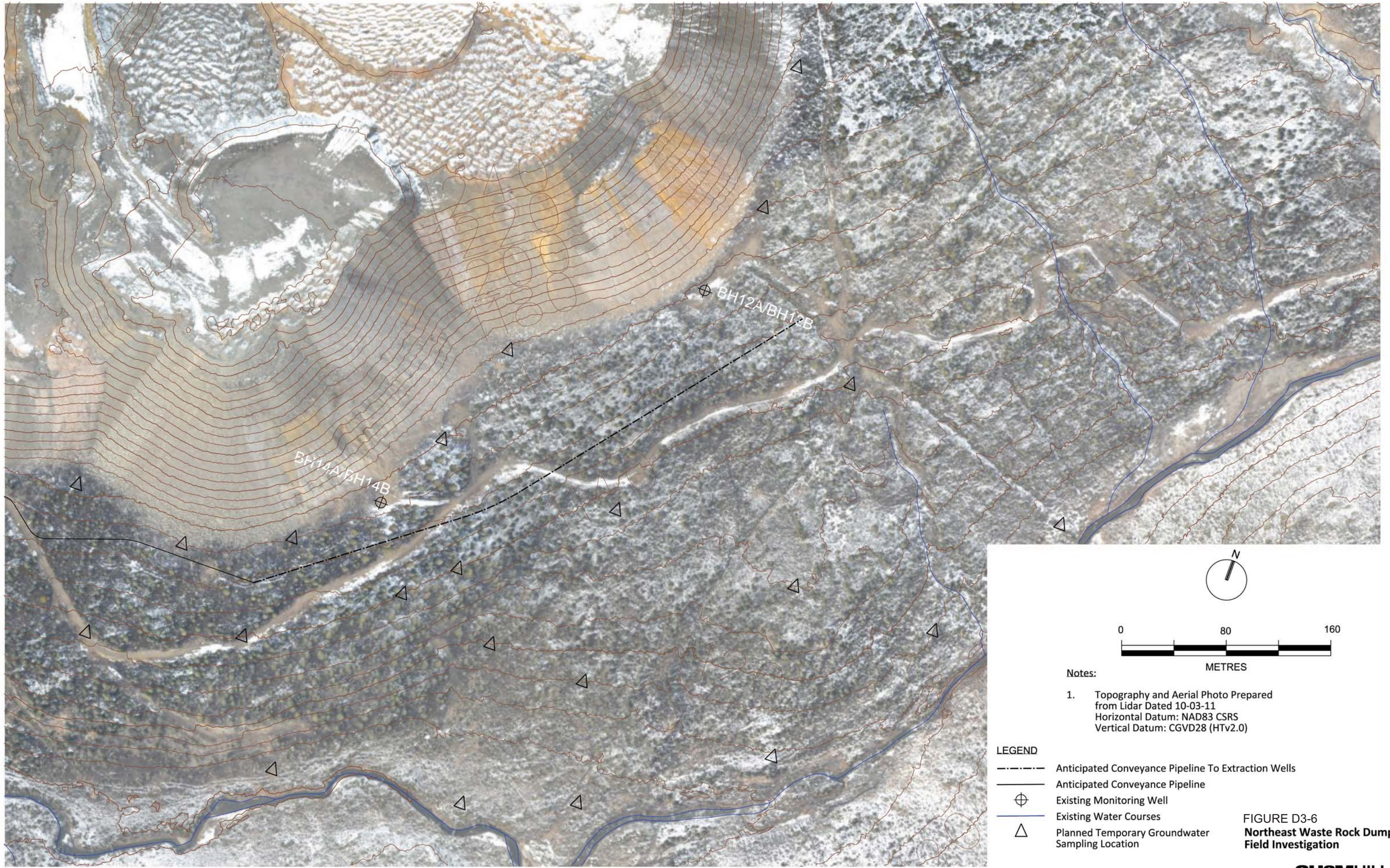
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   Vertical Datum: CGVD28 (HTv2.0)
2. Sea-Can With Insulated, Heated, Ventilated Sea-Can-type Structure For Housing Control/Power Equipment Of New Pump Station.

FIGURE D3-5
Zone II Outwash Subsurface Interception System And Field Investigation

CH2MHILL

PLOT TIME: 1:00:42 PM
PLOT DATE: 2012\11\14
FILENAME: 107_Zone_II_Figure2.dgn

© CH2M HILL



N

0 80 160

METRES

Notes:

1. Topography and Aerial Photo Prepared from Lidar Dated 10-03-11
Horizontal Datum: NAD83 CSRS
Vertical Datum: CGVD28 (HTv2.0)

LEGEND

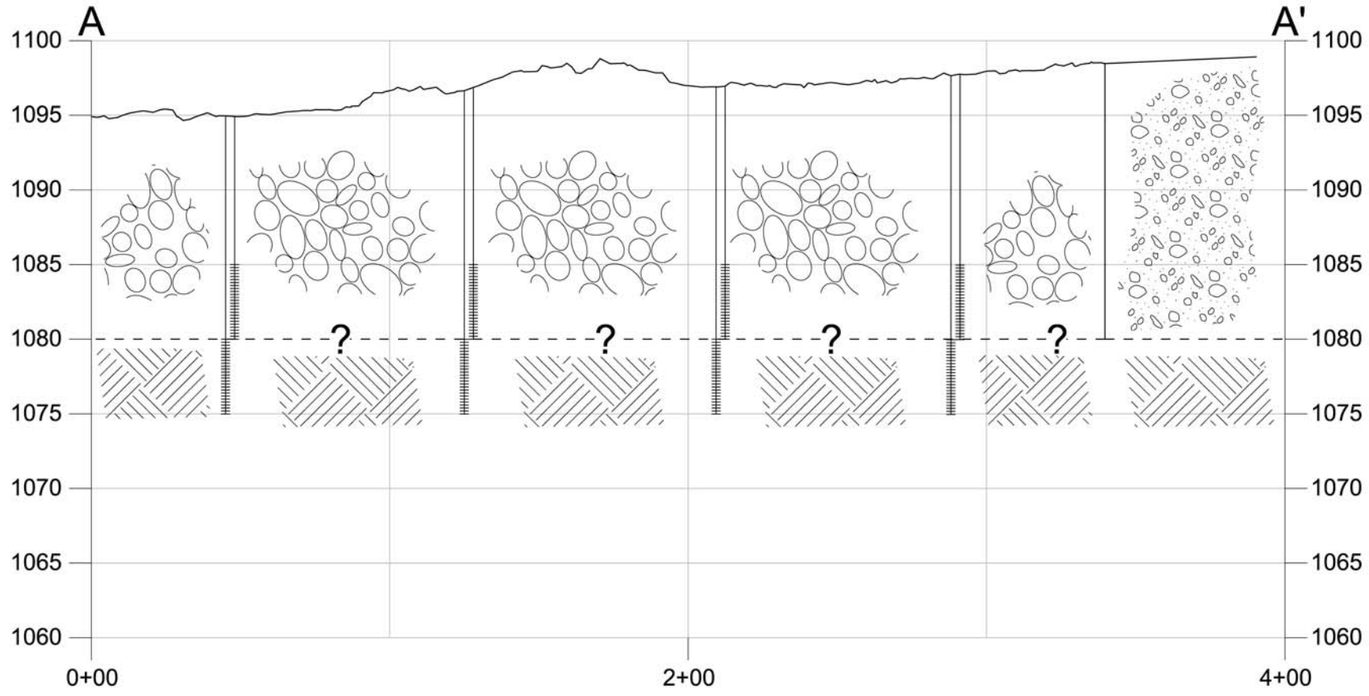
- Anticipated Conveyance Pipeline To Extraction Wells
- Anticipated Conveyance Pipeline
- Existing Monitoring Well
- Existing Water Courses
- Planned Temporary Groundwater Sampling Location

FIGURE D3-6
Northeast Waste Rock Dump Field Investigation

CH2MHILL

FILENAME: 107_Zone_II_Figure3.dgn PLOT DATE: 2012\11\14 PLOT TIME: 12:45:20 PM

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ZONE II OUTWASH TRENCH SECTION

LEGEND

- PERMEABLE TRENCH
- ALLUVIUM
- WEATHERED BEDROCK
- ORIGINAL GROUND
- EXTRACTION WELL PAIR

FIGURE D3-7
Anticipated Zone II Outwash Trench Section

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PLOT DATE: 2012\10\12
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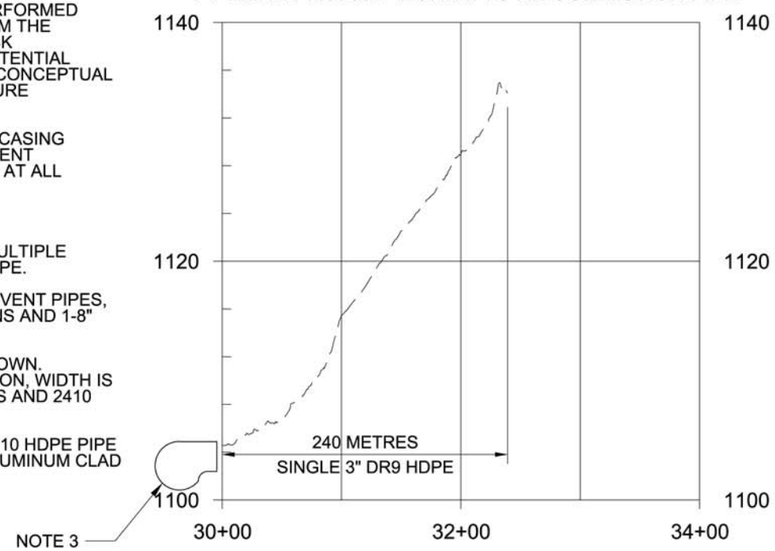
© CH2M HILL

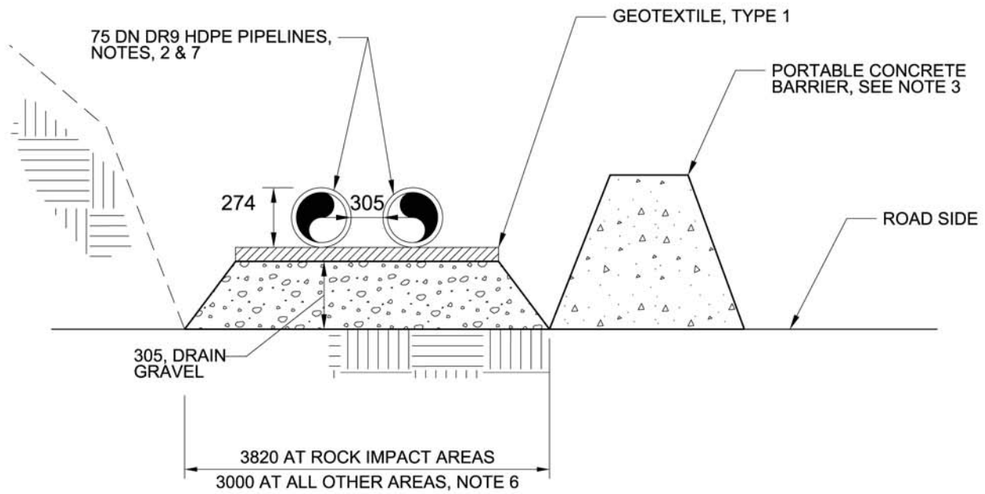
CH2MHILL

NOTES:

1. MORE TESTING WILL BE PERFORMED TO JUSTIFY A PIPELINE FROM THE NORTHEAST OUTWASH ROCK COLLECTION AREA. THIS POTENTIAL PIPELINE IS SHOWN IN THE CONCEPTUAL DESIGN FOR NOW TO CAPTURE ALL COSTS.
2. INSTALL 400 DN DR11 HDPE CASING WHERE REQUIRED TO PREVENT ROCK IMPACT DAMAGE AND AT ALL ROAD UNDER CROSSINGS.
3. INSTALL ALONG ROAD.
4. SEE PLAN FOR LOCATION MULTIPLE WELL STATION & HEADER PIPE.
5. STRUCTURE WILL INCLUDE, VENT PIPES, 2-3" PIG RECEIVING STATIONS AND 1-8" PIG LAUNCHING STATION.
6. DUAL PIPE PROTECTION SHOWN. FOR SINGLE PIPE PROTECTION, WIDTH IS 2540 IN ROCK IMPACT AREAS AND 2410 IN ALL OTHER AREAS.
7. INSULATED 75 DN DR9 PE 4710 HDPE PIPE WITH HEAT TAPE AND AN ALUMINUM CLAD JACKET.

PIPELINE PROFILE - ZONE II TO NE COLLECTION PIPE





DUAL PIPE ABOVE GRADE PROTECTION
NTS

PIPELINE PROFILE - NE COLLECTION SYSTEM TO FARO PIT

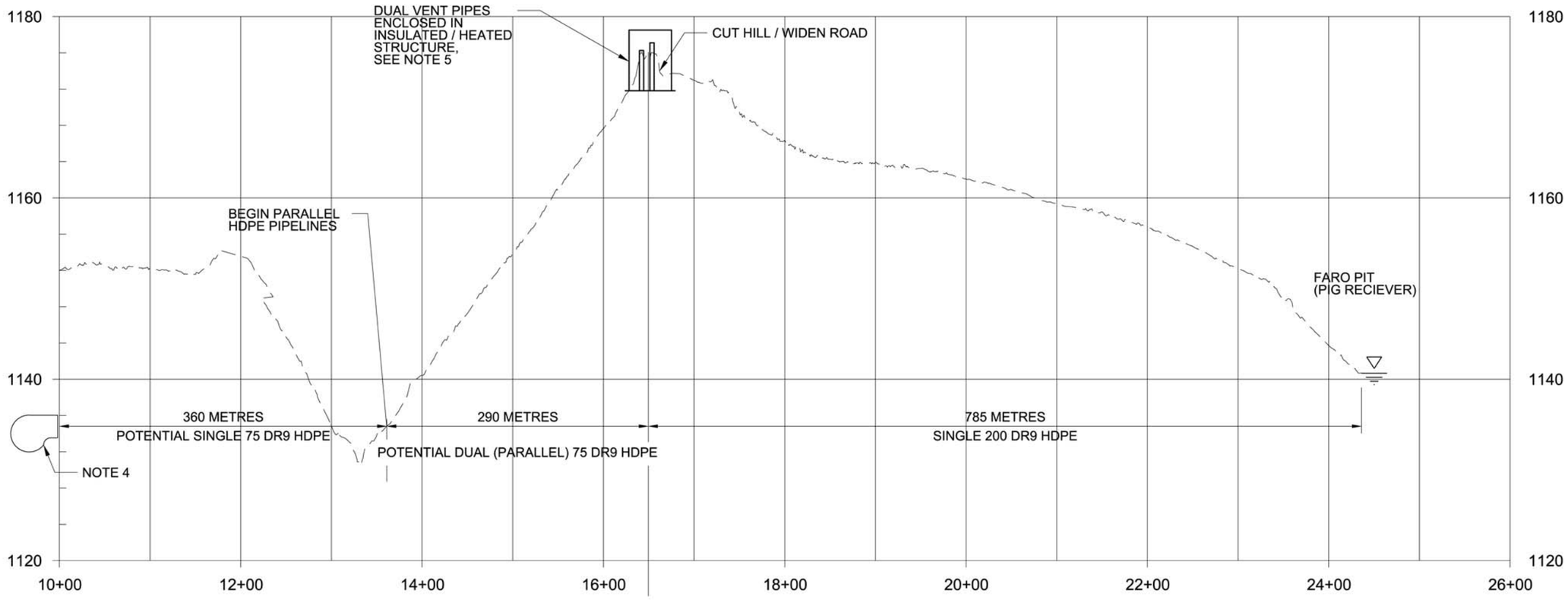


FIGURE D3-8
Anticipated Northeast Waste Rock Dump And Zone II Pipe Profiles

FILENAME: 107_Zone_II_Figure4.dgn PLOT DATE: 2012\10\12 PLOT TIME: 1:59:14 PM

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Attachment D3-1
Construction Estimate Summary

ATTACHMENT D3-1

Construction Cost Estimate Summary

Faro Mine Remediation Project – North Fork of Rose Creek SIS

Medium Term Workplan

Bid Item	Description	Units	Quantity	Labor	Permanent Material	Const Material	Eqp Oper Expenses	Subcontractors	Co Equipment	PER DIEM	BOND/INSUR	Direct Total	Markup	Unit Price	Total
10	MOBILIZATION	LS	1	$ 50,988	$ -	$ 24,709	$ 35,570	$ 250,000	$ 31,236	$ -	$ -	$ 392,503	$ 65,958	$ 458,461	$ 458,461
20	BONDS & INSURANCE	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 182,760	$ 182,760	$ 30,712	$ 213,472	$ 213,472
30	SUBMITTALS	LS	1	$ 15,589	$ -	$ 3,900	$ -	$ -	$ -	$ -	$ -	$ 19,489	$ 3,275	$ 22,764	$ 22,764
40	SURVEY	LS	1	$ -	$ -	$ -	$ -	$ 40,000	$ -	$ -	$ -	$ 40,000	$ 6,722	$ 46,722	$ 46,722
50	QC	LS	1	$ -	$ -	$ -	$ -	$ 25,000	$ -	$ -	$ -	$ 25,000	$ 4,201	$ 29,201	$ 29,201
60	INSTALL SWPPP ELEMENTS	LS	1	$ 18,726	$ -	$ 12,178	$ 3,766	$ -	$ 3,958	$ -	$ -	$ 38,628	$ 6,491	$ 45,119	$ 45,119
70	PIONEER & ACCESS	LS	1	$ 6,741	$ -	$ 693	$ 3,828	$ -	$ 7,018	$ -	$ -	$ 18,281	$ 3,072	$ 21,352	$ 21,352
80	MOB& SET UP SCREEN PLANT	LS	1	$ 4,757	$ -	$ 495	$ 3,121	$ -	$ 4,939	$ -	$ -	$ 13,312	$ 2,237	$ 15,549	$ 15,549
90	SCREEN & HAUL ROCK	M3	12,000	$ 169,733	$ -	$ 17,705	$ 96,531	$ -	$ 182,109	$ -	$ -	$ 466,077	$ 78,322	$ 45	$ 544,399
100	PREPARE PERMEABLE TRENCH SITE	LS	1	$ 14,435	$ -	$ 1,496	$ 7,648	$ -	$ 13,864	$ -	$ -	$ 37,443	$ 6,292	$ 43,735	$ 43,735
110	SET UP POLYMER SYSTEM	LS	1	$ 27,982	$ -	$ 10,470	$ 7,910	$ -	$ 12,557	$ -	$ -	$ 58,919	$ 9,901	$ 68,819	$ 68,819
120	EXCAVATE TRENCH-HAULTO WASTE SP	M3	12,000	$ 372,731	$ -	$ 132,380	$ 150,884	$ -	$ 270,747	$ -	$ -	$ 926,742	$ 155,734	$ 90	$ 1,082,476
130	PLACE PERMEABLE GRAVEL	M3	12,000	$ 52,966	$ -	$ 5,500	$ 22,043	$ -	$ 33,398	$ -	$ -	$ 113,907	$ 19,141	$ 11	$ 133,048
140	REMOVE POLYMER SYSTEM	LS	1	$ 3,707	$ -	$ 396	$ 1,036	$ -	$ 1,543	$ -	$ -	$ 6,681	$ 1,123	$ 7,804	$ 7,804
205	INSTALL EXTRACTION WELL PAIRS	M	140	$ 13,333	$ 294,746	$ 1,551	$ 38,219	$ 12,000	$ 1,107	$ -	$ -	$ 360,956	$ 60,657	$ 3,012	$ 421,613
210	PROVIDE POWER TO WELLS & HEATING	LS	1	$ -	$ -	$ -	$ -	$ 50,000	$ -	$ -	$ -	$ 50,000	$ 8,402	$ 58,402	$ 58,402
220	INSTALL PUMP STA HEADER PIPE	LS	1	$ 2,502	$ 5,000	$ 297	$ 551	$ -	$ 1,429	$ -	$ -	$ 9,779	$ 1,643	$ 11,422	$ 11,422
230	EXCAVATE GRADE FOR PIPE LINE	M3	1,675	$ 10,923	$ -	$ 1,155	$ 5,377	$ -	$ 8,047	$ -	$ -	$ 25,502	$ 4,285	$ 18	$ 29,787
240	GRAVEL&GEOTEXTILE FOR PIPE LINE	M	2,150	$ 22,044	$ -	$ 25,722	$ 6,453	$ -	$ 9,656	$ -	$ -	$ 63,874	$ 10,734	$ 35	$ 74,608
250	INSTALL PIPE LINE	LM	2,150	$ 53,931	$ 656,200	$ 6,402	$ 11,874	$ -	$ 30,804	$ -	$ -	$ 759,210	$ 127,581	$ 412	$ 886,791
260	INSTALL INSULATED HEAT STR	EA	2	$ 3,592	$ -	$ 8,396	$ 1,322	$ -	$ 2,519	$ -	$ -	$ 15,829	$ 2,660	$ 9,245	$ 18,489
270	CONNECT PIPELINE & HEADER	LS	1	$ 4,111	$ 2,500	$ 495	$ 551	$ 10,000	$ 1,429	$ -	$ -	$ 19,085	$ 3,207	$ 22,293	$ 22,293
280	INSTALL MONITORING WELL PAIRS	M	80	$ 7,660	$ 85,670	$ 891	$ 21,955	$ 7,302	$ 636	$ -	$ -	$ 124,115	$ 20,857	$ 1,812	$ 144,972
300	Northeast WRD Field Investigation	LS	1	$ 6,667	$ 116,558	$ 776	$ 19,109	$ -	$ 554	$ -	$ -	$ 143,663	$ 24,142	$ 167,805	$ 167,805
600	DEMOBILIZE	LS	1	$ 38,448	$ -	$ 20,134	$ 26,755	$ 250,000	$ 21,922	$ -	$ -	$ 357,260	$ 60,036	$ 417,296	$ 417,296
610	CLOSURE REPORTS	LS	1	$ 4,652	$ -	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ 6,152	$ 1,034	$ 7,185	$ 7,185
700	PER DIEM	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ 841,440	$ -	$ 841,440	$ 141,399	$ 982,839	$ 982,839
800	CONTINGENCY	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
900	FIELD GENERAL CONDITIONS	LS	1	$ 446,890	$ -	$ 67,418	$ 11,545	$ -	$ 10,559	$ 31,619	$ 5,040	$ 573,071	$ 96,301	$ 669,372	$ 669,372
	TOTAL			**$ 1,353,107**	**$ 1,160,674**	**$ 344,657**	**$ 476,047**	**$ 644,302**	**$ 650,031**	**$ 873,059**	**$ 187,800**	**$ 5,689,677**	**$ 956,120**		**$ 6,645,797**

Notes:

HDPE = high-density polyethylene

LS = lump sum

m = metre(s)

m^3 = cubic metre(s)

QC = quality control

SIS = seepage interception system

Attachment D3-2
Professional Services Estimate

ATTACHMENT D3-2

Professional Services – Class 5 Estimate

Faro Mine Remediation Project – North Fork of Rose Creek SIS

Medium Term Workplan

	Task Name/Subtask/Activity	Principal	Senior III	Mid III	Junior II	Clerical	Labour Cost	Subcontracts ($)	Travel ($)	Expenses ($)	Total ($)
	Labor Rates	$ 232	$ 196	$ 154	$ 103	$ 77					
WBS	North Fork Rose Creek Seeps Interception System (										
01.01.01.03	North Fork Rose Creek SIS Field Investigation										
01.01.01.03.01	Geotechnical Investigation	12	532	419	408	32	216,070	618,000	29,000	51,000	914,070
01.01.01.03.02	Stream Loading Survey		78	62	67		31,740		3,800	7,400	42,940
01.01.01.03.03	Potentiomanometer Study		36	148	136		43,860		5,000	9,000	57,860
	Subtotal Investigation	**12**	**646**	**629**	**611**	**32**	**291,670**	**618,000**	**37,800**	**67,400**	**1,014,870**
01.02.01.03	North Fork Rose Creek SIS Design										
01.02.01.03.01	Design Definition										
01.02.01.03.01.01	Interpretation of aquifer testing and field	8	40	80	160	40	41,580				41,580
01.02.01.03.01.02	Refine GW Model based on field data	8	140	160	320	80	93,060			1,000	94,060
01.02.01.03.01.02	Conduct design alternatives analyses	8	220	240	320	120	124,140		10,000	3,000	137,140
	Subtotal Design Definition	**24**	**400**	**480**	**800**	**240**	**258,780**	-	**10,000**	**4,000**	**272,780**
01.02.01.03.02	**Conceptual Design (30 %)**	98	289	367	549	441	226,249		10,000	3,000	239,249
01.02.01.03.03	**Advanced Design (60 %)**	91	268	341	510	410	210,299		10,000	3,000	223,299
01.02.01.03.04	**Detailed Design (90 %)**	80	238	303	452	363	186,374		10,000	3,000	199,374
01.02.01.03.05	**Final Design (100 %)**	53	156	199	298	239	122,575		10,000	3,000	135,575
	Subtotal Design	**321**	**951**	**1,210**	**1,809**	**1,452**	**745,497**	-	**40,000**	**12,000**	**797,497**
01.04.06.07	**Permitting**	7	21	27	40	32	16,458	50,000			66,458
02.01.03.01.01	**Procurement**	116	344	437	654	525	269,335				269,335
02.01.03.02	**Construction Activities**										
02.01.03.02.02	Construction Management	337	997	1,269	1,898	1,523	781,998				781,998
02.01.03.02.03	Commissioning	29	85	108	161	129	66,458				66,458
	Subtotal Construction	**366**	**1,082**	**1,377**	**2,059**	**1,653**	**848,456**				**848,456**
02.01.02.03	**Transition**	6	17	22	33	27	13,658	52,800			66,458
	Grand Total	**846**	**3,444**	**4,161**	**5,973**	**3,934**	**2,430,196**	**668,000**	**87,800**	**83,400**	**3,269,396**

Appendix D4
Hazardous Material Removal

APPENDIX D4

Hazardous Material Removal

A number of locations at the Faro Mine Complex (FMC) contain special and hazardous liquid and solid wastes requiring safe disposal. This Hazardous Material (HAZMAT) removal work package addresses the mitigation of potential risk to human health and the environment by arranging the offsite disposal of these wastes as a near- to mid-term planning objective. The prioritization of wastes to be removed in fiscal year (FY) 2012 and associated costs are currently being assessed; therefore, some of the waste included in this work package may be removed in FY2012. In the event that FY2012 removal work does occur, the costs for that waste removal effort can be credited against the cost outlined below.

D4.1 Background Information

At the request of the Government of Yukon, EBA Engineering Consultants Limited (EBA) has conducted two investigations at the site to complete the following primary tasks:

- Sampling, classification, and quantification of unknown soils and liquids in drums and tanks
- Destructive assessment of building materials suspected of containing asbestos and lead
- Visual assessment of building features suspected of containing polychlorinated biphenyls, ozone-depleting substances, and mercury
- Prioritization of wastes for removal as Level 1 (immediate concern to human health if contact occurs) or Level 2 (no immediate concern to human health if left undisturbed).

The results of these investigations are summarized in the following reports: *Hazardous Materials Classification – Faro Mine Site: EBA File: W23101482* (EBA, 2011) and *Hazardous Materials Classification – Faro Mine Site: EBA FILE: W23103015-01, Faro, Yukon* (EBA, 2012).

CH2M HILL conducted a site reconnaissance in September 2012, to gather additional information to prepare a scope of work and to develop a Class 5 cost estimate for removal of hazardous waste identified in the EBA HAZMAT Reports.

D4.1.1 Current Condition

There are 10 buildings, 2 site trailers, and multiple laydown areas on the site (see Figure D4-1). Throughout the site, there are various combinations of containerized solid and liquid wastes, including drums, tanks, and trailer tanks containing hydrocarbons, metals and glycol, as well as drums containing soil contaminated with metals. Many of the tanks and drums have been dumped in these areas, are lying or overturned in piles, and show signs of damage or deterioration (see Photos D4-1 and D4-2). These wastes are identified in the EBA HAZMAT Reports as high priority for removal based on imminent risk to human health and the environment.

The following wastes were identified in some buildings and around the Faro Mill by visual inspection or sampling and analysis:

- Petroleum hydrocarbons (transmission fluid, grease, heating oil, motor oil, hydraulic fluid, gasoline, tar)
- Miscellaneous chemicals (industrial cleaners, adhesives, solvents, acids, paints, process chemicals), batteries (various types and sizes), calcium chloride, methyl isobutyl carbinol, and glycol



PHOTO D4-1
Drums of Waste Adjacent to the Northwest Dump
Faro Mine Remediation Project



PHOTO D4-2
Drums of Waste at the Northern Barrel Stockpile
Faro Mine Remediation Project

D4.1.2 Justification for Action

EBA identified the removal of HAZMAT throughout the site as a high- priority task because they present imminent environmental and human health risks associated with potential contact exposure. In some cases, the material in these drums is leaking into the natural environment, creating long-term environmental concerns and a situation where environmental remediation costs will increase because of the potential spread of contaminants. The materials included in this work package are Level 1 and Level 2 priority wastes, as identified in the EBA HAZMAT Reports.

D4.2 Description of Scope

D4.2.1 Supplemental Waste Characterization

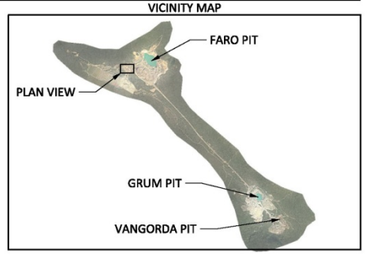
One of the main objectives of the EBA site investigation was to identify the contents and estimate the quantities of unknown containerized wastes found in large drum storage areas at the site. This objective was achieved by sampling the contents of these drums and inferring that the drums in each area contained similar wastes.

The scope of work includes supplemental characterization of wastes identified in the EBA HAZMAT Reports. Before mobilizing to the site to conduct the supplemental waste characterization, a detailed sampling plan outlining the areas requiring additional sampling and analyses will be developed and will generate a task-specific Health and Safety Plan that will include a prescription of minimum requirements for personal protective equipment. The following general field tasks will be performed during the supplemental waste characterization:

- Containerized liquid waste outside of the Vangorda/Grum Water Treatment Plant identified as hydrocarbons and metals (see Table D4-1, Item 2) will be sampled and analyzed, and the quantity of the waste will be verified.
- Containerized liquid waste at the Northern Barrel Stockpile identified as hydrocarbons, metals, and glycol (see Table D4-1, Item 3) will be sampled and analyzed, and the quantity of the waste will be verified.
- Containerized liquid waste at the Northwest Dump Area identified as water with hydrocarbons (see Table D4-1, Item 4) will be sampled and analyzed, and the quantity of the waste will be verified.
- Containerized liquid waste adjacent to the Northwest Dump Area identified as water with hydrocarbons, metals, and glycol (see Table D4-1, Item 5) will be sampled and analyzed, and the quantity of the waste will be verified.
- The quantity of waste oil within 4 tanks behind the Mill Building (see Table D4-1, Item 6) will be verified.
- The quantity of gasoline within the trailer tank behind the Mill Building (see Table D4-1, Item 7) will be verified.



VICINITY MAP



N

0 50 100

METRES

LEGEND

X Building Designation

— — Indicates Buildings not Currently On Site

——— Approximate Boundary of Laydown Areas

Building Key

1	Warehouse
2	Norcan Shop
3	Lube Storage Building
4	Mill Building
5	Cold Storage
6	Reagents Building
7	Crusher Building
8	Coarse Ore Bin
9	Guard House
10	Dry & Lunch Room
11	Loadout Building

Notes:
1. Aerial Photo shown dated August 2012.

Figure E8-1
Aerial View of the Faro Mine Complex
Faro Mine Remediation Project

CH2MHILL.

FaroMineComplexAerial_FigE8-1.dgn 2012\12\12 2:14:08 PM

FIGURE D4-1
Aerial View of the Faro Mine Complex
Faro Mine Remediation Project

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- Containerized liquid waste at the Drum Collection identified as methyl isobutyl carbinol (see Table D4-1, Item 8) will be sampled and analyzed, and the quantity of the waste will be verified.
- The quantity of glycol within the trailer tank behind the Mill Building (see Table D4-1, Item 9) will be verified.
- Containerized solid waste at upper bench above the Northwest Dump Area identified as soil with metals (see Table D4-1, Item 10) will be sampled and analyzed, and the quantity of the waste will be verified.

D4.2.2 Design Definition – Waste Management Planning

The results of the supplemental waste characterization will be used to create a waste management plan that will optimize transport logistics and minimize transport and disposal costs, identify regulatory requirements related to the transport and disposal of these wastes and meet the requirements of the waste-receiving facility for the types and quantities of wastes to be received.

TABLE D4-1
Hazardous Material Summary
Faro Mine Remediation Project

Item	Hazardous Material	Estimated Quantity	Location
1	Hydrocarbons and Metals	540 L (3 drums)	Laydown Area, South of the Mill Building
2	Hydrocarbons and Metals	Unknown (drums)	Vangorda/Grum Water Treatment Plant
3	Hydrocarbons, Metals and Glycol	36,000 L (200 drums)	Northern Barrel Stockpile
4	Water with Hydrocarbons	4,500 L (25 drums)	Northwest Dump Area
5	Water with Hydrocarbons, Metals and Glycol	10,080 L (56 drums)	Adjacent to the Northwest Dump Area
6	Waste Oil	25,400 L (drums and tanks)	Behind the Mill Building
7	Gasoline	6,200 L (trailer tank)	Behind the Mill Building
8	Methyl Isobutyl Carbinol	18,750 L (150 drums)	Drum Collection
9	Glycols	3,800 L (tank)	Drum Collection
10	Soil with Metals	7 m^3 (40 drums)	Upper Bench Above the Northwest Dump Area
11	Miscellaneous Liquid Wastes [a]	250 L (miscellaneous containers)	Warehouse
12	Miscellaneous Solid Wastes [b]	65 kg	Warehouse, Reagents Building, and Mill Building

[a] Miscellaneous containerized chemicals (less than 4 L per container) including: ammonium chloride, liquid and rubber cements, adhesives, industrial cleaners, solvents, acids, and fuel conditioners.

[b] Miscellaneous materials, including: graphite flakes, percol pellets, ammonium chloride and beryllium x-ray tubes.

kg = kilogram
L = litre
m^3 = cubic metres

D4.2.3 Procurement and Support Services

The scope of work includes procurement and project support activities provided by CH2M HILL for the removal of high-priority HAZMAT from the site, as follows:

- Preparation of a HAZMAT Plan and a detailed scope of work for the HAZMAT Removal contract
- Preparation of construction designs, project specifications, contract documents, and tender documents
- Bid evaluation and recommendation for award of the HAZMAT Removal contract

- Construction supervision, health and safety administration, and project management support during the removal of HAZMAT.

D4.2.4 Permitting

The permitting task includes obtaining permits or permissions that are not part of the *Yukon Environmental and Socio-economic Assessment Act* process. The required permits for this package are not fully known, but they are expected to be those required to support HAZMAT removal activities in the Yukon and Canadian jurisdictions in addition to any for the jurisdictions entered as part of the disposal process. Work undertaken will need to comply with all existing or potentially applicable Faro Mine Complex environmental and regulatory conditions.

D4.2.5 Construction - Hazardous Material Removal

A number of wastes in the EBA HAZMAT Reports are identified as lower priority for removal and require no immediate attention, providing the materials remain undisturbed.

The removal of HAZMAT is limited to the wastes identified in the EBA HAZMAT Reports, as summarized in Table D4-1. Transport and disposal of the wastes may include a combination of the following approaches:

- Removal of liquid wastes using a vacuum truck and delivery of wastes directly to a waste receiving facility
- Direct loading of containerized wastes onto flatbed trucks and delivery of wastes directly to a waste receiving facility
- Bulking of like solid wastes into roll off bins and like liquid wastes into totes, and delivery of wastes to a laydown area in Whitehorse for subsequent delivery to a waste receiving facility (i.e. to optimize transport logistics)

D4.2.6 Construction Management

CH2M HILL will provide construction management services for the duration of the HAZMAT removal activities, which includes the following responsibilities:

- Oversee and document work activities
- Oversee contractor compliance with the Occupational Health and Safety Act (OHSA), applicable regulations, and the Site Specific Health and Safety Plan
- Work with the contractor to confirm they adhere to the project specifications and achieves the contract requirements
- Manage and document changes to the contract and specification
- Track, manage, and communicate the project schedule, project costs, and changes with YG

D4.3 Uncertainties

D4.3.1 Transport and Disposal Costs

Based on the EBA HAZMAT Reports, there are significant uncertainties in costs for the handling, transportation, and disposal of hazardous waste because the quantities and compositions of the containerized wastes at the site are estimated based on a limited number of samples obtained to date. The characterization of more than 100,000 L of liquid waste from numerous containers is based on 13 samples obtained and submitted for analysis. Therefore, the information currently available does not necessarily permit a conclusion about how much waste bulking (i.e., combining of wastes) may be performed to reduce packaging and transportation cost. Given the location of Faro Mine Complex and the distance to an appropriate disposal centre, a reduction in the number of containers for handling and shipping will have a significant impact on lowering transportation costs. The act of material consolidation to reduce shipping costs can only be performed on wastes with similar chemical characteristics and no incompatibilities (i.e.,

like wastes). Conversely, the act of bulking materials could potentially cause a load of waste to be placed in a higher cost bracket at the disposal facility with greater volume, highlighting the importance of obtaining reasonable and reliable chemical data for the site.

D4.3.2 Disposal and Processing Capabilities Onsite

There is uncertainty in the quantity of wastes that will require offsite disposal because some of the wastes may be disposed directly onsite or processed and then disposed of onsite. Additional sampling and characterization is therefore required to determine the quantities and compositions of wastes to enable an assessment of the amount that will be required for removal and disposal offsite.

D4.4 Technical Risk Register

The technical risks associated with the Vangorda Creek Diversion are detailed in the Technical Risk Register attached to the MTP Workplan as Appendix G.

D4.5 Schedule

The Milestone Schedule for the scope of work described previously is provided as Attachment D4-1. The basis for this schedule is the scope of work described in Section D4.3. This scope has been prepared as a feasibility-level design concept to support the MTP work planning objectives.

Milestone Schedule. The following is a general summary of the major milestones and salient components of the schedule.

The Milestone Schedule (Appendix H) illustrates that the work package will begin with a field program initiated at the beginning of the FY. This program will confirm the understanding of the HAZMAT and how they will require disposal. Schedule Constraints and Assumptions

The following constraints and assumptions have been made in the development of this schedule:

- In order to complete the work before winter and within 1 FY, work will be awarded and initiated in April.
- Daylight hours in summer will allow extended work shifts.
- Workers can work a maximum 28 days before having 7 days off (in accordance with Yukon Workers' Compensation Health and Safety Board limits).
- Any required permits (to be determined) will not affect the schedule for construction.
- The construction season at the site is 6 months in length and extends from approximately April 1 to September 30 of each year

To the extent possible, this schedule has been developed in consideration of the constraints of the FY funding requirements. In instances where tasks are shown as occurring across this date, it is understood that additional contracting requirements may be necessary.

D4.6 Cost Estimate

The cost opinions presented herein are based on information and experience obtained from visits to the site, discussions with the current Care and Maintenance Contractor, actual costs from working onsite during the CH2M HILL 2012 field investigation (late May to early October 2012), and from the EBA HAZMAT Reports. Cost opinions are rough order-of-magnitude, with an expected accuracy of +100 to -50 percent (Class 5). Costs have not been escalated and are presented as 2012 costs.

D4.6.1 Basis of Estimate

The following points represent the basis upon which the provided cost estimate has been developed:

- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document to account for items that may change

between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors.

- The estimate uses 2012 CH2M HILL Master Services Agreement rates for professional services.
- The cost of the work could be reduced if some items identified as Level 1 priority are removed in FY2012.
- Escalating factors affecting productivity have been applied where appropriate to additional field investigation work costs and construction estimates for working conditions, access restrictions, site limitations, and logistics anticipated for implementing the work package. These factors are based on actual measures recorded during the 2012 Field Implementation Program at the site.
- Quantities and types of materials were obtained from the following reports: *Hazardous Materials Classification – Faro Mine Site: EBA File: W23101482* (EBA, 2011) and *Hazardous Materials Classification – Faro Mine Site: EBA FILE: W23103015-01, Faro, Yukon* (EBA, 2012)
- A detailed sampling plan will be developed outlining the areas that require additional sampling and analyses, and will generate a site-specific health and safety plan that will include a prescription of minimum requirements for personal protective equipment.
- Based on the current understanding of data gaps, additional field work may be needed to gather additional information regarding the nature, extent, and quantities of HAZMAT, and the development a HAZMAT Plan may be needed to allow safe sampling, analysis, and verification of quantities of waste identified onsite.
- If the waste sampling field program identifies waste characteristics that are significantly different from those in the EBA HAZMAT Reports (EBA, 2011; EBA, 2012), then the costs for waste handling and disposal may be different from those included in this estimate.
- Construction management, construction procurement, and contracting costs are presented as a bottom-up buildup of labor and expense costs for the work.
- Construction costs were based on transport and disposal costs quote from Clean Harbors.
- CH2M HILL's Heavy Construction Systems Specialists, Inc. estimating system was used to build up the construction cost estimate with identified activities for construction.
- Unit rates for equipment and craft labor were localized to Yukon.
- Production factors for current market conditions and location of the site were used in the buildup of the estimate.
- Markups were applied from historical experience with similar construction work.

D4.6.2 Supporting Documentation

The following sources of information were used in developing the cost estimates:

- Canadian Blue Book adjusted for Yukon project site location (central Yukon)
- 2012 Canadian labor rates from CH2M HILL Master Services Agreement (C00012050)
- 2012 Yukon fair wage schedule for craft labor
- Historical cost data and estimator judgment
- Productivity adjusted to account for current field conditions

D4.6.3 Cost Estimate

The total cost estimate for the HAZMAT Removal work package described herein is $545,788. This estimate is summarized with construction and professional services costs provided in Tables D4-2 and D4-3, respectively.

TABLE D4-2
Hazardous Waste Removal – Construction Estimate
Faro Mine Remediation Project

	Labour	Expenses/Materials	Equipment	Subcontractor	Markup	Total [a]
TOTAL				$277,633	$27,763	$305,396

[a] The costs presented in this report are contractor direct costs.

Attachment D4-1, *Construction Estimate Summary,* shows a summary of the task descriptions plus markup by the contractor to get to a "bid or tender cost estimate".

TABLE D4-3
Hazardous Waste Removal – Professional Services Estimate
Faro Mine Remediation Project

Draft WBS	Phase	Labour	Expense	Subcontractor	Total
01.01.04.01	Field Investigation	$99,650	$24,567	$41,685	$165,902
01.02.04.01.01	Design Definition	$13,410	-	-	$13,410
02.04.01.01.01	Procurement [a]	$15,720	-	-	$15,720
01.04.06.08	Permitting [b]	$7,270	-	$8,000	$15,720
02.04.01.02.02	Construction Management [a]	$30,540	-	-	$30,540
	TOTAL	$166,140	$24,567	$49,685	$240,392

[a] Estimated based on 10 percent of construction cost.

[b] Permitting and procurement each estimated at 5 percent of construction cost

The component costs of this professional services estimate are summarized in Attachment D4-2, *Professional Services Estimate.*

D4.6.4 Assumptions

The following assumptions were made during the preparation of this cost estimate:

- Work described in the work package is a standalone effort. No accommodation or economy of scale with combining different work packages has been used in developing this opinion of cost.
- The cost estimate does not include cost consideration for administration of the work package (i.e., statusing, coordination and invoicing and management) which will vary throughout the duration of the work depending on whether the work focus is construction or professional services.
- The cost estimate does not include any markups to professional services (labour) or subcontractor and expense costs.
- Quantities used were taken from the following reports: *Hazardous Materials Classification – Faro Mine Site: EBA File: W23101482* (EBA, 2011) and *Hazardous Materials Classification – Faro Mine Site: EBA FILE: W23103015-01, Faro, Yukon* (EBA, 2012).
- Each sample that EBA collected from a drum storage area and analyzed is representative of the contaminants present in the drums in the area, as suggested in the EBA HAZMAT Reports.
- Drums containing waste will be loaded directly onto a transport truck and shipped to an appropriately-licensed waste receiving facility.
- Drums in poor condition will be placed in overpacks before being loaded for transport.
- Removal of waste oils and other hydrocarbons identified in the EBA HAZMAT Reports are included in the estimate (i.e., onsite processing of these wastes is currently not planned).

- Cost opinions on the HAZMAT removal effort have been provided by a nationally recognized waste handling contractor based on worst-case scenarios for the containerized solid and liquid waste present onsite (i.e., providing the highest concentrations of all contaminants in the soil and water samples analyzed, as summarized in the EBA HAZMAT Reports).
- No royalties are included.
- Construction season has been assumed to be a maximum of 6 months available in the field, from April 1 to September 30.
- No per diems have been applied to the construction costs.
- Nineteen percent markup has been applied to contractor construction costs, consisting of home office support, overhead, and profit (10 percent overhead, 9 percent profit).
- Bonds and insurance have not been included in construction costs.
- The construction cost estimate presented in this work package does not include contingency. Required contingencies are presented elsewhere in this planning document, to account for items that may change between preparing the estimate and construction, such as changes in design criteria, site conditions, construction challenges, or other unknown factors.

D4.6.5 Clarifications

This cost opinion is budgetary in nature and, as such, is suitable for budget planning only. Cost opinions are nonbinding and are provided for discussion and planning purposes. The cost opinions provided have been prepared to guide project evaluation of the information available at the time of preparation and the current level of project definition. The actual cost of the project will depend on the level of definition required, selected scope of work, actual labour and material costs, competitive market conditions, schedule implementation, and other variable factors. Therefore, the final project costs will vary from the opinions presented in this work package. Project feasibility and funding needs must be carefully reviewed before making specific financial decisions related to proper project evaluation and adequate funding.

D4.7 References

EBA Engineering Consultants Limited (EBA). 2012. *Hazardous Materials Classification – Faro Mine Site: EBA File: W23103015-01, Faro, Yukon*. August.

EBA Engineering Consultants Limited (EBA). 2011. *Hazardous Materials Classification – Faro Mine Site: EBA File: W23101482*. December.

Attachment D4-1
Construction Estimate Summary

ATTACHMENT D4-1

Construction Cost Estimate Summary

Faro Mine Remediation Project – Hazardous Waste Removal

Medium Term Workplan

BI #	BI Description	Units	Quantity	Labor	Permenant Material	Const Material	Eqp Oper Expenses	Subcontractors	Co Equipment	Direct Total	Markup	Unit Price	Total
10	MOBILIZATION	LS	1	$ -	$ -	$ -	$ -	$ 20,000	$ -	$ 20,000	$ 2,000	$ 22,000	$ 22,000
20	BONDS & INSURANCE	LS	1	$ -	$ -	$ -	$ -	$ 8,870	$ -	$ 8,870	$ 887	$ 9,757	$ 9,757
30	SUBMITTALS	LS	1	$ -	$ -	$ -	$ -	$ 5,000	$ -	$ 5,000	$ 500	$ 5,500	$ 5,500
40	HYDROCARBONS AND METALS	L	9,540	$ -	$ -	$ -	$ -	$ 10,780	$ -	$ 10,780	$ 1,078	$ 1	$ 11,858
50	HYDROCARBONS, METALS AND GLYCOL	L	36,000	$ -	$ -	$ -	$ -	$ 40,680	$ -	$ 40,680	$ 4,068	$ 1	$ 44,748
60	WATER W/HYDROCARBONS	L	4,500	$ -	$ -	$ -	$ -	$ 5,085	$ -	$ 5,085	$ 509	$ 1	$ 5,594
70	WATER W/HYRDOCARBON, METALS & GLYCCOL	L	10,080	$ -	$ -	$ -	$ -	$ 11,390	$ -	$ 11,390	$ 1,139	$ 1	$ 12,529
80	WASTE OIL	L	25,400	$ -	$ -	$ -	$ -	$ 28,702	$ -	$ 28,702	$ 2,870	$ 1	$ 31,572
90	GASOLINE	L	6,200	$ -	$ -	$ -	$ -	$ 7,006	$ -	$ 7,006	$ 701	$ 1	$ 7,707
100	METHYL ISOBUTYL CARBINOL	L	18,750	$ -	$ -	$ -	$ -	$ 21,188	$ -	$ 21,188	$ 2,119	$ 1	$ 23,306
110	GLYCOL	L	3,800	$ -	$ -	$ -	$ -	$ 4,294	$ -	$ 4,294	$ 429	$ 1	$ 4,723
120	SOIL W/METALS	M3	7	$ -	$ -	$ -	$ -	$ 12,920	$ -	$ 12,920	$ 1,292	$ 2,030	$ 14,212
130	MISCELLANEOUS CONTAINERS	L	250	$ -	$ -	$ -	$ -	$ 1,248	$ -	$ 1,248	$ 125	$ 5	$ 1,372
140	TRANSPORTATION & DISPOSAL	LD	8	$ -	$ -	$ -	$ -	$ 80,000	$ -	$ 80,000	$ 8,000	$ 11,000	$ 88,000
150	REPORTING & TASK CLOSURE	LS	1	$ -	$ -	$ -	$ -	$ 20,470	$ -	$ 20,470	$ 2,047	$ 22,517	$ 22,517
160	CONTINGENCY	LS	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	TOTAL			$ -	$ -	$ -	$ -	$ 277,633	$ -	$ 277,633	$ 27,763		$ 305,396

Attachment D4-2
Professional Services Estimate

ATTACHMENT D4-2

Professional Services – Class 5 Estimate

Faro Mine Remediation Project – Hazardous Waste Removal

Medium Term Workplan

	Task Name/Subtask/Activity	Principal	Senior III	Mid III	Junior II	Clerical	Labour Cost	Subcontracts ($)	Travel ($)	Expenses ($)	Total ($)
	Labor Rates	$ 232	$ 196	$ 154	$ 103	$ 77					
WBS	Hazardous Material Removal										
01.02.04.01	Field Investigation										
01.02.04.01.01	HAZMAT Survey and Characterization	4	155	310	200		99,650	41,685	12,567	12,000	165,902
	Subtotal Investigation	4	155	310	200	-	99,650	41,685	12,567	12,000	165,902
01.02.04.01	Design										
01.02.04.01.01	Design Definition										
01.02.04.01.01.01	Develop Disposal Approach	5	20	40	15	8	13,410				13,410
	Subtotal Design Definition	5	20	40	15	8	13,410	-	-	-	13,410
01.04.06.08	Permitting	3	9	12	18	14	7,270	8,000			15,270
02.04.01.01	Procurement	7	19	25	37	30	15,270				15,270
02.04.01.02	Construction (Hazmat Removal)										
02.04.01.02.02	Construction Management	13	39	50	74	59	30,540				30,540
	Subtotal Construction	13	39	50	74	59	30,540	-	-	-	30,540
	Grand Total	32	243	436	344	111	166,140	49,685	12,567	12,000	240,392

Appendix E
Minister's Determination Re: Faro Mine Complex Reclamation and Closure Activities

Yukon
Environment

Box 2703, Whitehorse,
Yukon Y1A 2C6

Minister's Determination

(Subsection 37(1) of *Waters Act*)

Re Faro Mine Complex Reclamation and Closure Activities

A. Statement of Facts

1. On April 21, 1998, Deloitte & Touche Inc. was appointed by the Ontario Superior Court of Justice as interim receiver ("Interim Receiver") for the Faro Mine Complex (the "Mine") on behalf of Anvil Range Mining Corporation.

2. The Interim Receiver has focused on care and maintenance at the Mine, ensuring that the water flowing from the Mine meets the requirements of Water Licence QZ03-059.

3. On February 28, 2009, the Interim Receiver will be discharged by court order of the Ontario Superior Court of Justice, recognized by the Supreme Court of Yukon, from its responsibilities at the Mine. The assets and real property related to the Mine will be distributed according to the court order.

4. The Mine contains, or is adjacent to waters that include Faro Creek, Rose Creek, and Vangorda Creek (the "Surrounding Waters").

5. Due to the past operations and practices at the Mine, water has accumulated and been stored in pits at the Mine known as the Faro, Grum, and Vangorda pits (the "Waste Water"). The Waste Water is highly contaminated because it contains elevated concentrations of heavy metals and acids.

6. Due to the instability of the dams and diversion channels at the Mine, there continues to be a risk that the Waste Waters may release from the pits and thereby deposit waste into the Surrounding Waters

B. Reasonable Grounds for Belief

I, Kevin McDonnell, acting on behalf of the Minister of the Department of Environment, have reasonable grounds to believe, based upon the facts above, that:

a. the works related to the use of waters or deposit of waste at the Mine have been permanently abandoned; and

b. that a danger to persons, property and the environment may result due to the past operation and the abandonment of the works at the Mine.

C. Measures to be Taken

I hereby authorize officials or agents of the Assessment and Abandoned Mines Branch, Department of Energy Mines and Resources, Government of Yukon ("Abandoned Mines") to use the following reasonable measures to prevent, counteract, mitigate, or remedy any resulting adverse effect on persons, property, or the environment, and in particular the Surrounding Waters:

1. Access the Mine and surrounding area, with the exception of any place being used as a temporary or permanent private dwelling-place.

2. Collection, testing, treatment, and discharge of treated Waste Water.

3. Maintaining, upgrading, inspecting and improving the diversions and dams at the Mine.

4. Re-sloping and covering and/or relocating waste rock to prevent further contamination of any of the waters at or around the Mine;

5. Construction of a water treatment plant at the Mine.

6. Any such other activities either directly or indirectly related to the use of waters or deposit of waste in waters that are necessary in order to undertake any of the above.

This determination is effective as of the date of signature.

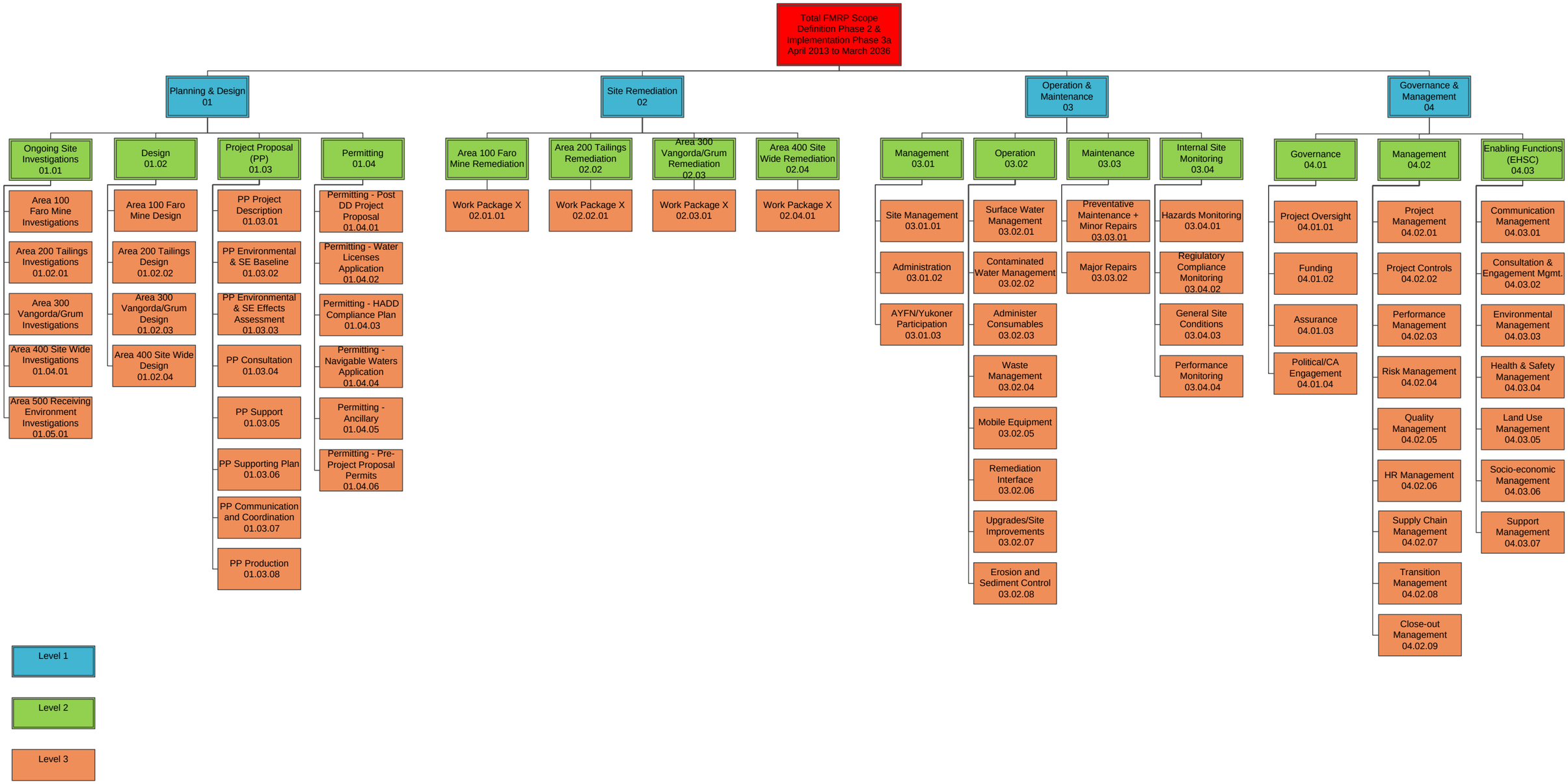
Feb 27/09
Date of Signature

Kevin McDonnell
Director,
Water Resources Branch
Department of Environment,
Government of Yukon

Appendix F
Work Breakdown Structure

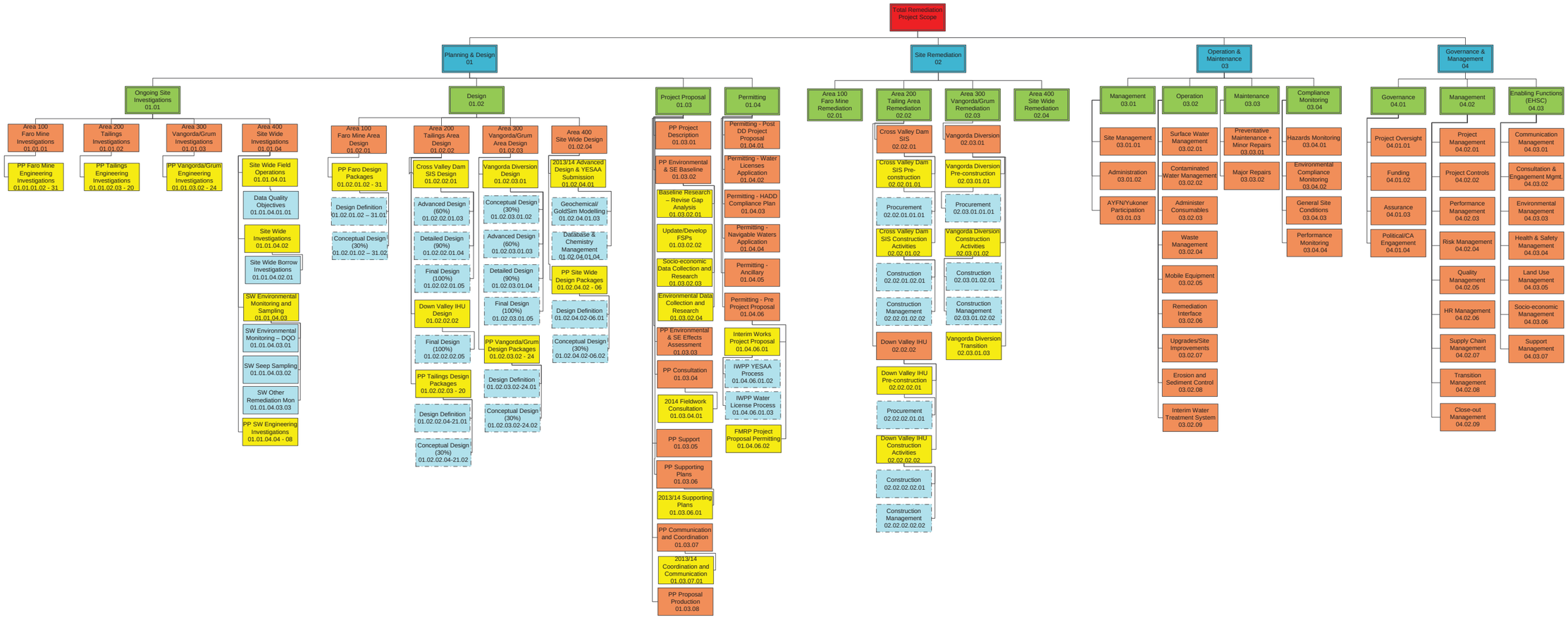
Appendix F1
Overall Work Breakdown Structure

Faro Mine Remediation Project: Master WBS



Appendix F2
MTP Work Breakdown Structure

Faro Mine Remediation Project: Medium Term Plan
Work Breakdown Structure



Appendix G
Technical Risk Register

Faro Comprehensive Risk Assessment Summary by Feature Type

Years: 2012-13; Quarters: Q1, Q2, Q3; Annual Review *: Yes; Risk Class: Very High, High, Moderately High, Moderate, Low;

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Buildings/tanks/structures											
	21 Refueling Stations and Above Ground Tanks										
		21.2 Diesel spill	Diesel spill while refueling site vehicle (2,000 L)	Quotes received for installation of new diesel tank Diesel system reviewed Training and follow spill response procedure 2012 Q1 - No change	2012-13	Q2*	Environmental Impacts	Minor	Possible	Moderate	
	22 Site Buildings										
		22.1 Mill Structural Failures	Structural failures of mill building (support structures, stairs, overhead features, lighting, roof supports and roof, railings, remnant mill pipes and features, etc.), or by impact of existing condition (ie. not necessarily failure) could cause injury or death to site staff and/or contractors	2012 third party safety audit (TEES)complete Semi-annual roof inspection and annual structural inspection with revised scope. Scope for each past structural inspections were limited in one way or another. Further inspection would require comprehensive scope change, but securing a structural engineer to sign off on the safety of the entire mill structure may continue to be a challenge. Areas of use are demarcated; no access allowed to potentially unsafe areas. 2012 Q2 *** Structural inspection complete in 2011 Visual inspections, H/S plans for contractors, site safety policies, gatehouse *(Reference documents)* 2012 Q1 - No change	2012-13	Q2*	Human Health and Safety	Major	Unlikely	Moderately High	Uncertainty still exists around H&S of the mill. Further in depth investigation of structural integrity would be required in order to reduce risk classification. Despite the repaired areas of roof being inspected, roof is still leaking. Building continues to age; there is difficulty in conducting a comprehensive assessment of all building components and it may be impractical to do so.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Buildings/tanks/structures											
	22 Site Buildings										
		22.2 Unauthorized access to Mill buildings by public	Unauthorized access/entry to mill buildings by public leads to serious injury/fatality.	2012/10/01 - Off treatment seasons, security to be 7 days a week, 10 hours/day. All access to mill buildings to be secured. 2012 Q2 Q1 - Review of access points to buildings on site during operating season; mitigation plan to be developed; surface lease option under review for general limitation to site acccess Review of security of buildings; make improvements to restricting access, see previous pit access 2012 Q1 - No change	2012-13	Q2*	Human Health and Safety	Major	Unlikely	Moderately High	Mitigation is still being implemented. Further investigation into fencing around building or additional barriers that align with standard industry practice required in order to reduce risk classification.
		22.4 Unauthorized access to Crusher and Coarse Ore buildings by public	Unauthorized access to Crusher and Coarse Ore buildings by public leads to serious injury or fatality.	Current mitigation: signage, hard barriers at openings of coarse ore building, tire barriers for primary crusher, and additional security during off-treatment season. Improvements currently being implemented to improve barriers to access. 2012 Q2	2012-13	Q2*	Human Health and Safety	Major	Unlikely	Moderately High	Further investigation into fencing around building or additional barriers that align with standard industry practice required in order to reduce risk classification.
	23 Concentrate Loadout										
		23.1 Exposure to lead concentrate	Human health risks associated with exposure to lead concentrate	Risk has been mitigated; Layer of gravel and signs 2012 Q1 - No change	2012-13	Q2*	Human Health and Safety	Low	Unlikely	Low	
	24 Site Analytical Laboratory										
		24.7 Explosion in lab	Explosion caused by compressed gas (nitrogen, acetylene) leads to injury and property damage	2012 Q2: acetylene bottle removed from lab and stored in safer location. WHMIS trained staff, storage has been improved (excess acetylene tanks are stored in secure cages outside of Bay 11 and non-combustible gasses (Ar, N) are stored in secure cage outside of lab). 2012 Q1 - No change	2012-13	Q2*	Human Health and Safety	Major	Very Unlikely	Moderate	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Dams											
	1 Intermediate Dam										
		1.1 Seismic event breaching Intermediate Dam/CVD	Earthquake induced liquefaction leading to failure of both Intermediate Dam (ID) and the CVD and a release of contaminated water and up to 10-20% of volume of tailings. ID meets Maximum Credible Earthquake. *** Former: Seismic event breaching Intermediate Dam/CVD and releasing water and tailings into environment; currently does not meet MCE or PMF	Further investigation/assessment of foundation conditions completed in 2010-2011 (Special Considerations refer to impact on traditional land use) 2012 Q1 - Dam Safety review scheduled for 2013	2012-13	Q2*	Consequence Costs	Critical	Very Unlikely	Moderately High	
					2012-13	Q2*	Environmental Impacts	Major	Unlikely	Moderately High	Referencing Alternatives Evaluation and Risk Analyses of the RCTA.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Dams											
	1 Intermediate Dam										
		1.2 PMF event exceeds the capacity of the Intermediate Dam spillway	A Probable Maximum Flood (PMF) event exceeds the capacity of the Intermediate Dam spillway resulting in a loss of the Intermediate Dam with release of contaminated water and a third of the total volume of tailings to the Cross Valley Pond, breaching the Cross Valley Dam and release of contaminated water and tailings to the receiving environment. Assumptions: Current Intermediate Pond spillway capacity is 32 m^3/s to the dam core. A PMF event passed entirely through the spillway is estimated at 500-550 m^3/s (this takes into account attenuation provided by the North Fork Rose Creek rock drain). This volume is 3 times what it would take to fill the IP in approximately 2 hours depending on the existing volume of water in the IP when the event occurs (Email: 2012 10 25 CH2M, JS to KT), and at which point the IP spillway capacity would be overwhelmed. The Cross Valley spillway capacity is 300 m^3/s, which is also less than the volume of the PMF flow. ***** Hydraulic event (flood by incident catchment scenario) of greater than 20m3 per/s (spillway capacity with pipeline) causing a breach of the Intermediate Dam (water and tailings), with reduced water elevation in pond (more towards very unlikely)	Declutter spillway (relocate discharge line?) Mitigation included as part of the closure plan *(Need reference documents)* 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Critical	Very Unlikely	Moderately High	Occurs once every 1000-10,000 years Cost based on estimated $40M+ for rebuild of two dams, $25M for tailings clean up.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
					2012-13	Q2*	Environmental Impacts	Major	Very Unlikely	Moderate	Occurs once every 1000-10,000 years Tailings release would have a medium-term impact on ecosystem function.
					2012-13	Q2*	Human Health and Safety	Moderate	Very Unlikely	Low	Consideration given to long term effects based on downstream effects of contamination. Occurs once every 1000-10,000 years

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
		1.3 A 500- to 1000-year return period flood event exceeds the capacity of the Intermediate Dam spillway	A 500- to 1000-year return period flood event exceeds the capacity of the Intermediate Dam spillway resulting in a breach of the Intermediate Dam with a release of contaminated water and 10-20% of the total volume of tailings to the Cross Valley Pond. The Cross Valley spillway releases contaminated water to the environment, but the tailings are contained in the Cross Valley Pond. Assumptions: Current Intermediate Pond spillway capacity is 32 m^3/s to the dam core. A 1:500 year flood event is estimated at 135 m^3/s (this takes into account attenuation provided by the North Fork Rose Creek rock drain). This volume of flow would fill the IP in approximately 2 hours depending on the volume of water in the IP when the event occurs (Email: 2012 10 25 CH2M, JS to KT), at which point the IP spillway capacity would be overwhelmed. The Cross Valley spillway capacity is 300 m^3/s, which would be able to contain the 1:500 year flow. ********** Former: Any mechanism of failure (physical failure, but also incl 1: 500 yr flood) of the RCDC that results in inflow greater than IP spillway capacity resulting in breach of Intermediate and Cross Valley Dams and release of water and tailings (downstream into the Pelly River) (see 11.	H&S: Prepare emergency action plan and incorporate into site operations plan. EI and CC: Implement interim hydraulic capacity upgrades (CH2M HILL, in progress) 2012 Q2 *** Mitigation included as part of the closure plan (Special Considerations refer to impact on traditional land use) 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Critical	Unlikely	Moderately High	Occurs once every 100-1000 years Estimated cost to rebuild dam is $25M.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	Occurs once every 100-1000 years There would be a dilution factor to the contaminated water released from the CVP. The severity increases if tailings are released.
					2012-13	Q2*	Human Health and Safety	Minor	Unlikely	Low	Consideration given to long term effects based on downstream effects of contamination.
		1.4 Piping failure of Intermediate Dam	Piping failure of Intermediate Dam causing partial or full breach of dam and release of contaminated water and 10 - 20% volume of tailings into the Cross Valley Pond, with probable release of contaminated water, but no release of tailings. Assumption: Piping failure does not occur during a flood event, which results in larger impacts to the environment. Cross Valley Dam does not fail.	Ongoing monitoring as per geotechnical monitoring plan; Monitoring plan reviewed through Annual Geotechnical Monitoring Inspection 2012 Q1 - No change Further investigation/assessment of foundation conditions completed in 2010-2011 *(Need reference documents)*	2012-13	Q2*	Consequence Costs	Critical	Unlikely	Moderately High	Rebuild of dam estimated to be in the range of $25M.
					2012-13	Q2*	Environmental Impacts	Major	Unlikely	Moderately High	Severity of environmental impact increases if Cross Valley Dam fails and results in a loss of tailings into the receiving environment. Severity of environmental impact may decrease if it occurs during a flood event with no loss of CVD.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
		1.5 IP capacity exceeded	High snow/freshet (1:50 yr range; severe snow pack + 2 highest precip months - May, June), without pumping capacity for IP leading to overflow of IP via spillway, and release of water into the CVD and subsequently the environment. Assumption: discharge to receiving environment does not create acutely toxic conditions; CVD also at capacity due to freshet	Existing pumping system has been modified, reliability of pumping system increased, water inventory reduced, back up system to pump to Faro Pit exists. Continued monitoring of capacity of the system; improved throughput for water treatment plant 2012 Q1 - No change	2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	Review of water management strategy has been completed for 2012. Targets for this year have been met.
		1.6 Damage to IP dam due to exposure of rip rap	Bottom edge below IP rip rap exposed, eroding or damaging the dam (ice plucking)	Golder report 2011 - recommendation to continue monitoring 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Possible	Moderate	
		1.7 Erosion impairs access or performance of dam	Erosion and slumping on downstream face of IP dam impairs access or performance of dam	Ongoing monitoring as per geotechnical monitoring plan; Monitoring plan reviewed through Annual Geotechnical Monitoring Inspection 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Unlikely	Moderate	
	2 Cross Valley Dam										
		2.1 Seismic event occurs resulting in a breach of the Cross Valley Dam	Seismic event occurs resulting in a breach of the Cross Valley Dam and release of treated water and sludge; seasonally, could affect the ecosystem, fish habitat, etc	Addressed in closure plan; piping considered, but has low probablity - not a significant consequence; hydraulic failure connected to RCD failure Add to Annual Geotechnical Inspection 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Unlikely	Moderate	
					2012-13	Q2*	Environmental Impacts	Moderate	Unlikely	Moderate	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	4 Little Creek Dam										
		4.1 ***Dam failure (seismic event)	***More info required on "seismic event". Dam failure (seismic event) resulting in a breach of the dam and release of contaminated water in to Vangorda Creek (up to XXXXXX litres of water released) Seismic capacity unknown, further investigation required. Assume protective up to MCE standards.	Maintain low water levels (2 to 3 metres below spillway invert); Water elevations are monitored; water is pumped to Vangorda Pit on regular basis Further investigation/assessment of dam condition Ongoing monitoring as per geotechnical monitoring plan; Monitoring plan reviewed through Annual Geotechnical Monitoring Inspection 2012 Q1 - discuss likelihood at annual risk assessment; chance that likelihood is inflated	2012-13	Q2*	Consequence Costs	Moderate	Possible	Moderately High	More investigation required with respect to construction of the dam to reduce likelihood.
					2012-13	Q2*	Environmental Impacts	Moderate	Possible	Moderately High	More investigation required with respect to construction of the dam to reduce likelihood.
		4.3 Dam failure due to extreme inflow	Dam failure due to extreme inflow leading to breach of dam (overflow via culvert spillway designed for 1:200yr flood event; limited volume of water due to short duration)	Water elevations are monitored; water is pumped to Vangorda Pit on regular basis 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Unlikely	Moderate	Severity based on estimate of $500K to $2.5M to rebuild dam.
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	
		4.4 Dam failure due to extreme inflow, breach of dam	Dam failure due to extreme inflow leading to breach of dam and release of contaminated water (culvert spillway (designed for 1:200yr flood event) exceeded & dam is breached; vol. of water more than spillway)	Ongoing monitoring as per geotechnical monitoring plan; Monitoring plan reviewed through Annual Geotechnical Monitoring Inspection 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Unlikely	Moderate	Severity based on estimate of $500K to $2.5M to rebuild dam.
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	Severity reduced due to dilution of contaminated water with extreme inflow.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	5 Vangorda Water Treatment Plant Clarification Pond Dyke										
		5.1 Slope failure releases sludge into Vangorda Creek	Slope failure from unexpected geotechnical issue (piping, foundation and seepage) - water released with sludge into Vangorda Creek	Ongoing monitoring as per geotechnical monitoring plan; Monitoring plan reviewed through Annual Geotechnical Monitoring Inspection 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Unlikely	Moderate	
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	
		5.2 Blockage of decant overtops dyke	Decant plugs, continued discharge of water into the pond fills pond, breaches dyke (no spillway)	Examine installation of an overflow/spillway Previously overestimated; there would have to be no oversight in order to get to this situation; monitoring is term of C&M contract 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Unlikely	Moderate	
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	6 Rose Creek Diversion Dyke										
		6.1 Debris flow blocks channel	Debris flow originating in the tributaries to the west of RCDC blocks the channel, causing Rose Creek to flow into the tailings impoundment, filling the Intermediate Pond leading to overtopping and failure of the Intermediate Dam with a release of contaminated water and 10-20% of the total volume of tailings to the Cross Valley Pond. The Cross Valley spillway releases contaminated water to the environment, but the tailings are contained in the Cross Valley Pond. Assumptions: Contaminated water released through the Cross Valley spillway, but no release of tailings into the receiving environment. Rose Creek Diversion originally designed to pass 135 m^3/s, but actual capacity is less than this because original analysis did not account for freeboard or wave action. Current Intermediate Pond spillway capacity is 32 m^3/s to the dam core. Current Cross Valley spillway capacity is 300 m^3/s.	Aerial hazard survey with YGS planned.(TBD) 2012 Q2	2012-13	Q2*	Consequence Costs	Critical	Unlikely	Moderately High	Repair of dam estimated cost $25M.
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	Severity of risk would increase with the failure of CVD and the release of tailings into the environment.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
		6.2 Slope failure overtops RCDC	Slope failure of the Diversion Dyke (from various initiating events) resulting in outflow to intermediate impoundment and exceedance of Intermediate Dam spillway capacity, leading to overtopping and failure of the Intermediate Dam with a release of contaminated water and 10-20% of the total volume of tailings to the Cross Valley Pond. The Cross Valley spillway releases contaminated water to the environment, but the tailings are contained in the Cross Valley Pond. Assumptions: Contaminated water released through the Cross Valley spillway, but no release of tailings into the receiving environment. Rose Creek Diversion originally designed to pass 135 m^3/s, but actual capacity is less than this because original analyis did not account for freeboard or wave action. Current Intermediate Pond spillway capacity is 32 m^3/s to the dam core.	Long term mitigation: Implement selected closure option Short Term Mitigation: Monitoring and maintenance, term of Care and Maintenance contract 2012 Q2 Monitoring and maintenance Review scope of monitoring program and adjust if necessary Overestimation of likelihood in previous year. 2012 Q1 - No change	2012-13	Q2*	Environmental Impacts	Critical	Unlikely	Moderately High	
		6.3 Ice blockage overtops RCDC	Ice formation over extended length of time in the channel leading to overtopping into Intermediate Pond leading to overtopping and failure of the Intermediate Dam with a release of contaminated water and 10-20% of the total volume of tailings to the Cross Valley Pond. The Cross Valley spillway releases contaminated water to the environment, but the tailings are contained in the Cross Valley Pond. Assumptions: Rose Creek Diversion originally designed to pass 135 m^3/s, but actual capacity is less than this because original analyis did not account for freeboard or wave action. Current Intermediate Pond spillway capacity is 32 m^3/s to the dam core. Current Cross Valley spillway capacity is 300 m^3/s.	Long term mitigation: Implement selected closure option. 2012 Q2 Short term Mitigation: Monitor and remove ice if necessary; term of C&M contract 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Critical	Unlikely	Moderately High	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	Severity of risk would increase with the failure of CVD and the release of tailings into the environment.
		6.4 Seismic event causes failure of RCD Dike	Seismic induced failure of the RCD Dike over a 50 to 100 m portion of channel leads to discharge (low volume - low velocity) of water into the IP. Water with slightly elevated concentrations of zinc (minimal suspended solids) fills the IP, flows out via IP Spillway, into and out of the CVD and into the receiving environment. Assumptions: Period of uncontrolled discharge within the 1 to 7 day range. Duration depends upon size of breach and time of year (volume of Rose Creek flow and storage in IP). Part of dike built partly in frozen conditions; strength of dike not known.	Magnitude of seismic induced failure required.	2012-13	Q2*	Consequence Costs	Moderate	Possible	Moderately High	Further investigation of consequence cost may reduce/increase risk classification.
26 Secondary Dam											
		26.2 Seepage through Secondary Dam causes contamination in RCDC	Seepage through Secondary Dam causes contamination in RCDC leading to water quality issue	2012 Q2 - Long term mitigation: Cutoff wall constructed in Rose Creek Diversion. Short term mitigation: Determine whether seepage volume impairs Rose Creek water quality. 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Possible	Moderate	Further investigation of seepage load necessary to reduce risk classification.
					2012-13	Q2*	Environmental Impacts	Minor	Possible	Moderate	
29 Sheep Pad Pond Dam											
		29.1 Failure of dam releases treated water and sediments	Failure of dam by any mechanism leading to treated water and sediments being released into Vangorda Creek; some impact would be evident	Discharge from pond can be rerouted into ditch going to Vangorda Pit 2012 Q1 - No change	2012-13	Q2*	Environmental Impacts	Minor	Possible	Moderate	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Diversions											
	7 Faro Creek Diversion - Pit										
		7.1 Failure of pit wall below channel	Failure of pit wall below channel by any mechanism leading to Faro Creek flowing into pit for a period of approx 8 weeks. Assumptions: 8 weeks to regain control of creek to divert around pit wall failure, with all equipment and materials available on site. Seepage to the North Fork of Rose Creek not a significant threat if repair of the diversion is performed in a reasonable time period, such as before the pit overtops the ~1158m level (pit levels currently maintained @ ~1141m), which would take many months for even very large inflows. Pit walls not likely to contribute additional contaminant load compared to current conditions.	Investigate option for emergency pumping system and pipeline requirements as well as alignment for pipeline to be stationed . Investigate requirements for further seepage reduction from the Faro Creek Diversion in to the Faro Pit; confirm seepage volumes into Faro Pit. 2012 Q2 Ongoing monitoring as per geotechnical monitoring plan; Monitoring plan reviewed through Annual Geotechnical Monitoring Inspection 2012 - during high risk times of year (high flow), equipment is on standby and located near the top of the diversion. Ongoing monitoring.	2012-13	Q2*	Consequence Costs	Moderate	Possible	Moderately High	Geotechnical annual inspection report (2012)indicates that pit wall regression is stable.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	8 Vangorda Creek Diversion										
		8.2 Ice, floods damages flume	Ice formation and flood events that causes damage to flume (happens often)	Need engineer to review diversion design and recommend interim mitigation (3-5 years) prior to final diversion design and construction. 2012 Q2 Response: Repair flume as necessary Long term: Build a new diversion Daily checks to ensure no blockage in diversion; monitoring is a term of C&M contract 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Likely	Moderate	Risk event causes extensive damage beyond repairs required through O&M.
		8.3 Failure of VCD, pit wall failure	Failure of VCD due to pit wall collapse resulting in Vangorda Creek flowing into Vangorda Pit, filling and overflowing the pit and the eventual discharge of contaminated water only to Vangorda Ck channel. Assumptions: Vangorda Diversion designed for a 1:100 year event with an instantaneous peak flow of 10 m^3/s. At average maintained water level (1185 masl) there is approximately 4.8 million m^3 of capacity to final spill elevation of 1130 masl. At 10 m^3/s this would only require 5.6 days to fill. At 20 m^3/s (2 X 1:100 year event) time to fill is 2.8 days. At 30 m^3/s (4 X 1: 100 year event) time to fill is 1.4 days. From starting elevation of 1090 masl, discharge of 2.2 m^3/s for 15 straight days would input 3 million m^3 of water into pit and reach final spill elevation.	Geotechnical study underway into to determine pit wall stability. Monitoring program to be developed for regular monitoring. 2012 Q2 Road cut/fill; increase berm; to be completed 2011; Eng to validate return period of the interim mitigation Response: Repair flume as necessary Long term: Build a new diversion Follow-up: Response plan required (consider pit wall failure, northwest wall) Previously overestimated the cost to repair(2010) Continued uncertainty regarding cost to repair or upgrade ie. full remediation or repair (2011) 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Critical	Unlikely	Moderately High	Diversion destroyed; new diversion channel required.
					2012-13	Q2*	Environmental Impacts	Moderate	Unlikely	Moderate	Diversion destroyed; new diversion channel required.
					2012-13	Q2*	Human Health and Safety	Low	Possible	Low	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
		8.4 Collapse or Failure of Drop Structure	Any collapse or failure of drop structure causes total blockage resulting in water overflowing road access and into the Vangorda Pit (not including peak flows, which is included in failure of VCD event). Environmental impact due to erosion of road and sediments entering the receiving environment.	During non-peak flows, estimated at maximum 220 days to fill Vangorda Pit. Need to inspect current drop structure and formulate mitigation plan for repair of drop structure. Review technical memo by CH2M HILL for accurate time frames. 2012 Q2 *** Daily checks to ensure no blockage in diversion; monitoring is a term of C&M contract 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Likely	Moderately High	Previous 2004 failure: separation of main feed culvert into dropbox caused collapse to occur.
					2012-13	Q2*	Environmental Impacts	Minor	Likely	Moderate	
		8.5 Exceedence of VCD Capacity	Flood event greater than the capacity of the diversion allows water to flow into Vangorda Pit without overflowing the pit. Assumptions: Vangorda Diversion designed for a 1:100 year event with an instantaneous peak flow of 10 m^3/s. At current water level (1180 masl) there is approximately 4.8 million m^3 of capacity to final spill elevation of 1130 masl. At 10 m^3/s this would only require 5.6 days to fill. From starting elevation of 1090 masl, discharge of 2.2 m^3/s for 15 straight days would input 3 million m^3 of water into pit and reach final spill elevation. Under conditions > 1:100 year event without diversion failure, discharge would still be directed to Vangorda Pit through overflow spillway at headworks.		2012-13	Q2*	Consequence Costs	Minor	Likely	Moderate	
					2012-13	Q2*	Environmental Impacts	Minor	Likely	Moderate	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	27 Faro Creek Diversion - Valley upstream of waste rock dumps above pit										
		27.1 Flood event exceeds capacity of Faro Creek Diversion	A flood event exceeds the capacity of the Faro Creek Diversion resulting in Faro Creek draining into the pit for a temporary period of time. (2-8 weeks)	Response: Fix and repair the dyke and/or install a pipe Follow-up: check inventory of pipe supplies on site Env consequence minimal Daily checks to ensure no blockage in diversion; monitoring is a term of C&M contract 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Likely	Moderate	
		27.2 Flood event exceeds capacity of FDC	Flood event exceeds capacity of channel, flows into pit for 6-8 weeks.	Addressed in closure plan 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Possible	Moderate	
	30 Rose Creek Diversion										
		30.1 Flood event breaches RCD	Flood event causes a breach of RCD Dyke leading to a breach of Int dam and release of tailings and water. Assumptions: Rose Creek Diversion originally designed to pass 135 m^3/s, but actual capacity is less than this because original analysis did not account for freeboard or wave action. Current Intermediate Pond spillway capacity is 32 m^3/s to the dam core. Current Cross Valley spillway capacity is 300 m^3/s. See Rose Creek Diversion Dyke and Intermediate Dam for other types of flood events.	Remediation planned for early in the closure plan schedule Ongoing monitoring as per geotechnical monitoring plan; Monitoring plan reviewed through Annual Geotechnical Monitoring Inspection 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Critical	Unlikely	Moderately High	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Infrastructure											
	18 Faro Water Treatment Plant (Mill)										
		18.1 Water treatment required in shoulder season	Failure to meet water quality or volumetric quantity targets results in a treatment requirement during shoulder seasons	Investigate possibly of backup generator for site. 2012 Q2 Assessment of cold weather operation requirements at both plants Determine true cost, negotiate with YEC for rates if appropriate Increase flow capacity of mill 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Possible	Moderately High	Assumption: hoarding and heating requirements would be extensive. An extensive power outage would close operations, damage equipment.
		18.2 Water Treatment Plant Major Equipment Failure	Thickener or clarifier equipment fails and cannot be repaired. Cannot meet treatment requirements until scheduled replacement of water treatment plant. Assumption: no water treatment occurs until new water treatment plant built. Environmental consequence is assumed to span time frame until new water treatment plant is operable and Faro Diversion does not fail. ***confirm water volumes	Short Term: (Prior to fiscal year 2013-2014)structural evaluation of thickener and clarifer. Investigate options for repairs to ensure reliable operation until new treatment plant constructed. Long term: Replacement of water treatment plant. 2012 Q2 Operational changes to employ other thickeners and or Cross Valley Pond Follow-up: Assess timing of new water treatment plant installation (determination of factors and issues limiting the functionality of the current plant) 2010-2011 - Change operational procedure to run system in parallel. 2012 Q1 - mitigation plans in development through operational risk assessment	2012-13	Q2*	Consequence Costs	Critical	Likely	Very High	Assumption: Replacement of WTP required in order to treat water. WTP design to be completed 2013-2014; construction to begin in 2014-2015; online in 2016-17. Tests indicate that thickener and clarifier are both leaking; progressive deterioration of structural components required for water treatment.
					2012-13	Q2*	Environmental Impacts	Minor	Possible	Moderate	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
		18.4 Water treatment plant is unable to meet water quality or volumetric quantity requirements	Water treatment plant unable to treat additional volumes of water (from ETA, NFRC, existing or new seepage collection location) and may not be able to treat progressively increasing contaminant load while maintaining current volume and discharge standards until scheduled replacement of plant. Assumption: non-compliant water beyond capacity of WTP is stored in Faro Pit and not discharged.	Long term: Replace water treatment plant. Short term: Add thickener deflection ring and repair overflow launder. Need data showing increase in contamination. (TEES/YG) 2012 Q2 2010-2011 - Change operational procedure to run system in parallel. 2012 - Risks corroborated by CH2M March 2012 assessment (supported by IPRP) leading to acceleration of water treatment plant replacement, and development of interim mitigation measures. Costs for WTP have been revised to over $40 Million placing consequence in critical	2012-13	Q2*	Consequence Costs	Critical	Likely	Very High	Assumption: Some repairs/upgrades could be implemented in order to continue to treat water but may not be at full throughput capacity. Replacement of WTP required in order to treat all water. WTP design to be completed 2013-2014; construction to begin in 2014-2015; online in 2016-17.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	19 Mine Power Distribution System (Faro)										
		19.1 Failure of power supply	Failure of power supply for one to seven days resulting in a loss of power to critical systems including the Faro Water Treatment Facility during operating season which causes no treatment of water.	No power to Faro from Whitehorse; tie in of Faro Mine Complex to the town of Faro's standby generator. For other possible scenarios refer to Emergency Management Plan (TEES). 2012 Q2 Response plan to backup power requirements for entire site developed in 2010-2011. Follow-up: Working with YEC to assure Faro backup generator comes online or to move back-up generator to site when needed 2012 - letter to YEC to figure out power requirements and obligations to FMC	2012-13	Q2*	Consequence Costs	Moderate	Likely	Moderately High	Range of mitigation solutions; highest cost driver of severity choice. NEED EXAMPLE
		19.2 Worker fatality from aged electrical distribution sytem	Worker fatality resulting from condition/operation of the electrical distribution system	2012 Q2 - Need for comprehensive review of Faro Mine Complex electrical distribution system in preparation for closure. 2010 - Switch gear cleaned; Arc Flash study complete 2010 - Protocols reviewed for operation of switch gear related to capacity of electrical staff 2012 Q1 - No change	2012-13	Q2*	Human Health and Safety	Major	Unlikely	Moderately High	Recent WCB investigations have identified unsafe components. Comprehensive review of entire system is required to reduce risk classification.
		19.3 Theft of copper results in fatality	Fatality of public caused by unauthorized access and interaction with power distribution system, most likely due to theft of copper.	Reference site access/security risk event(s). 2012 Q2 Maintain security 2012 Q1 - further building access restrictions will provide additional mitigation	2012-13	Q2*	Human Health and Safety	Major	Unlikely	Moderately High	Increased security to 7 days a wk/10 hrs a day. Reduced exposure risk after treatment season due to power shut off to non-utilized areas.
	20 Vangorda Pit Pumping System										
		20.1 Pipeline rupture	Rupture of pipe line leads to discharge of contaminated water into receiving environment	2009 - Event has been mitigated - ditch under pipeline routed to pit 2012 Q1 - No change	2012-13	Q2*	Environmental Impacts	Moderate	Very Unlikely	Low	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	32 Vangorda water treatment facility										
		32.1 Water quality issue, results in extended treatment season	Some water quality issue, results in extended treatment into shoulder seasons	Assessment of cold weather operation requirements at both plants Determine true cost, negotiate with YEC for rates if appropriate 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Possible	Moderate	
	35 Mobile Equipment										
		35.1 Equipment failure	Aging equipment failure reduces ability of C&M operator to respond to site maintenance, operations and emergency situations.	Preventative maintenance plan is in place; equipment evaluation has been completed; contractual requirement for C&M operator to ensure that equipment is available; 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Almost Certain	High	Assumption: leasing of new equipment as per contract terms. Assumption: cost accrued on annual basis.
	36 Intermediate Pond Pumping System										
		36.1 Water level in the Intermediate Pond is higher than can be managed by current pumping system	Water level in Intermediate Pond is higher than can be managed by current pumping system resulting in release of contaminated water into the receiving water environment through the CVP. Assumption: risk event caused by loss of power, loss of barge, pump failure, DVTP down, inundation of water due to heavy freshet.	2012 Q2: 2 Godwin pumps can be used to pump from the IP to the Faro Mill or Faro Pit. Refer to Emergency Management Plan (TEES, 2012). Currently investigating requirement for critical spares as well as system to convey water from the IP to the Faro Pit. Also investigating need to add Styrofoam to barge pontoons for buoyancy compensation and water displacement.	2012-13	Q2*	Environmental Impacts	Minor	Possible	Moderate	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Open Pits											
	9 Faro Main Pit										
		9.1 Unauthorized access to pit wall leads to injury or fatality (Fall Hazard)	Unauthorized access to pit wall leads to injury or fatality (Fall Hazard)	Pit berms are currently being rebuilt if necessary. Additional signage will be installed. Other possible access points to be investigated and signed. Security in off-season is increased. 2012 Q2 Controlled site (no public access) Investigate options for preventing public access Public awareness Consider improvement to alternative routes Consider berm Signage around pit has been installed at major access points 2012 Q1 - Surface lease being option investigated wrt to limitation to general site access 2012 Q1 - Explore implementation of berms around pit walls as part of 5 year risk reduction¿	2012-13	Q2*	Human Health and Safety	Major	Unlikely	Moderately High	No historical access issues, low unauthorized public traffic to area, reference points still clear in low visibility areas. However, additional barriers/signage/preventative berms or other works to be investigated to align with standard industry practices to reduce risk classification.
		9.2 Decrease in water quality of Faro Pit	Water quality in Faro Pit decreases (e.g., increased acidity, contaminants) exceeding the threshold the plant can treat requiring a change to the treatment process	Response: Monitoring trends 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Unlikely	Moderate	
		9.3 Rockfall in vicinity of pit walls	Rockfall in vicinity of pit walls causes injury or death.	Additional rockfall hazard assessment needed for site. Training for environmental monitoring staff to recognize risks for potential rockfall. 2012 Q2 Rockfall hazard assessment along Faro Pit access ramp completed in 2010-2011 2012 Q1 - No change	2012-13	Q2*	Human Health and Safety	Major	Unlikely	Moderately High	Rockfall assessment has been completed for area along Faro Pit access road. Similar assessments should be completed for the those areas close to the Grum and Vangorda pit walls that may be affected by rockfall.
		9.4 Faro Pit water leaks to Zone II pit	Leakage of Faro Pit water to Zone II due to oxidation and permeability of rock leads to inability to keep up with pumping rates required to maintain Zone II water elevation	Response: Isotope investigation to look at source of water into Zone II; identify if seasonal trend exists 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Unlikely	Low	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
					2012-13	Q2*	Environmental Impacts	Moderate	Unlikely	Moderate	
	10 Vangorda Open Pit										
		10.1 Deterioration of pit water quality	Deterioration of water quality leading to additional pumping and treatment costs	Part of closure plan 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Low	Likely	Moderate	
		10.2 Unauthorized access to pit wall leads to injury or fatality (fall hazard)	Unauthorized access to pit wall leads to injury or fatality (fall hazard)	Pit berms are being constructed as necessary Additional signage will be installed. Other possible access points to be investigated and signed. Security in off-season is increased. 2012 Q2 Controlled site (no public access) Investigate options for preventing public access Public awareness Consider improvement to alternative routes Consider berm Signage around pit installed 2012 Q1 - Surface lease being option investigated wrt to limitation to general site access 2012 Q1 - Explore implementation of berms around pit walls as part of 5 year risk reduction¿	2012-13	Q2*	Human Health and Safety	Major	Unlikely	Moderately High	No historical access issues, low unauthorized public traffic to area, reference points still clear in low visibility areas. However, additional barriers/signage/preventative berms or other works to be investigated to align with standard industry practices to reduce risk classification.
		10.3 South pit wall failure	South pit wall failure destroys transformer for Vangorda Pit pumping	Monitor, relocate transformer if required Follow-up: Response plan required 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Low	Likely	Moderate	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	11 Grum Open Pit										
		11.1 Failure of Grum Pit wall	Grum Pit wall instability leads to loss of power lines.	2012 Q2 - power lines closest to pit have been de-energized. 2010 - increased monitoring of pit wall stability Ongoing monitoring as per geotechnical monitoring plan; Monitoring plan reviewed through Annual Geotechnical Monitoring Inspection Long term: Finalize location of new water treatment plant 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Low	Likely	Moderate	Geotechnical monitoring on-going. Power issue mitigated as line has been decommissioned. Loss of power line poles not of concern. 2012 Q2
		11.2 Access to Grum Pit leads to injury or fatality (fall hazard)	Access to Grum Pit leads to injury or fatality (fall hazard)	Response: Investigate options for preventing public access Public awareness Consider improvement to alternative routes Plan to install berm Signage around pit installed 2012 Q1 - Surface lease being option investigated wrt to limitation to general site access 2012 Q1 - Explore implementation of berms around pit walls as part of 5 year risk reduction¿	2012-13	Q2*	Human Health and Safety	Major	Unlikely	Moderately High	No historical access issues, low unauthorized public traffic to area, reference points still clear in low visibility areas. However, additional barriers/signage/preventative berms or other works to be investigated to align with standard industry practices to reduce risk classification.
		11.3 Grum Pit filling above recommended elevation	2012 - Pit filling above recommended elevation (no pumping, pit wall failure, failure of Grum Interceptor Ditch) causes release of non-compliant water to the environment, by entering the shallow aquifer in the till.	2012 Q1 - Grum Pit pumping system in scoping phase with anticipated commissioning in 2013 Q1	2012-13	Q2*	Consequence Costs	Minor	Likely	Moderate	
					2012-13	Q2*	Environmental Impacts	Minor	Possible	Moderate	Pumping system development in progress reduces likelihood. Any water entering the shallow aquifer will likely daylight in Grum Creek seep and be captured by Grum V-15 prior to entering Vangorda Creek (receiving water environment). 2012 Q2

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Tailings and Sediments											
	16 Intermediate Tailings Impoundment										
		16.1 Extreme wind erosion of tailings	Extreme wind erosion leads to offsite tailings contamination which affects health of local environment (humans, vegetation, wildlife).	2012 Q2 - C&M operator currently investigating other options for tailings dust control. Additional mitigation: sampling restricted when tailings dust is airborne and evident; inclusion in site training. Short term - use tackifier Remediate as per closure plan 2012 Q1 - No change	2012-13	Q2*	Environmental Impacts	Moderate	Likely	Moderately High	
					2012-13	Q2*	Human Health and Safety	Minor	Very Unlikely	Low	Human exposure to event is minimal due to sparse population downwind of tailing impoundment; restricted access.
		16.2 IP water quality is detrimental to water fowl	IP water quality is detrimental to water fowl	Desktop study is complete; effects of low pH water or high metal concentrations on migratory water fowl have not been documented. 2012 Q2 Implement desktop study and follow up on recommendations Continue ongoing observations 2012 Q1 - No change	2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	17 Vangorda WTP Sediments (Sludge) and Storage Area										
		17.1 Sludge production exceeds current clarification pond capacity	Sludge production exceeds current clarification pond capacity	Pumping and treating from VG pit on a yearly basis allows for clearing of sludge from clarification pond on a yearly basis. Review operational sludge management strategy (new clarification pond, soil tubes, sludge removal by pump/pipeline) 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Unlikely	Low	
		17.2 Current sludge storage capacity on Grum Overburden pile is exceeded	Current sludge storage capacity on Grum Overburden pile is exceeded, requiring interim solution before closure	2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Likely	Moderate	
					2012-13	Q2*	Environmental Impacts	Low	Likely	Moderate	
	25 Faro Treatment Plants Sediments (Sludge) Containment Cell										
		25.46 Sludge production exceeds current sludge storage capacity	Sludge production exceeds current sludge storage capacity	2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Unlikely	Low	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Waste Rock											
	12 Faro Rock Dumps										
		12.1 Physical failure of dump	Physical failure of dump with run out into North Fork Rose Creek leading to water quality issues	Visual monitoring 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Unlikely	Low	
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	
		12.2 Contaminated seeps require collection	On-going seepage testing results in a requirement to collect and treat additional contaminated water prior to planned remediation. Assumption: S-Wells type interception system implemented.	2012 Q2 - seepage testing on-going. Contaminant loading and volumetric input to water treatment plant should be considered. 2011-2012 - implement change to monitoring program to respond to last year's results Receiving environment monitoring Assess options for Guardhouse Creek water management 2012 Q1 - seeps monitoring program conducted by PDT; need to confirm that investigation for new seeps occurred.	2012-13	Q2*	Consequence Costs	Moderate	Likely	Moderately High	Historical evidence cause for bump in likelihood.
		12.3 S-wells system not meeting current objectives.	S-wells system not meeting current objectives resulting in release of contaminated water to the environment. Failure may be mechanical or due to inefficient capture of contaminated water.	Review of S-Wells SIS complete. Further investigation required to improve capture from shallow aquifer well and trench. Emergency Backup plan to power system in place. (Refer to Emergency Management Plan (TEES,2012)) 2012 Q2 Regular monitoring as term of current C&M contract. S-wells evaluation report completed in 2011 summer. 2012 Q1 - review of 2011 performance of S-wells Seepage Interception System currently in progress	2012-13	Q2*	Consequence Costs	Moderate	Unlikely	Moderate	Assumption: replacement of entire system.
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	Assumption: If there is a complete S-well failure, backup secondary pumping system can be put in place to capture seeps.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	13 Vangorda Rock Dump										
		13.1 Vangorda Dump toe berm fails	Vangorda Dump - Toe berm stability - fails and contaminated water is released to Vangorda Creek	Confirm results of water balance with CW (DR). 2012 Q2 In Progress: Assess water conditions within rock dump 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Moderate	Unlikely	Moderate	Assumption: results of water balance suggest minimal likelihood of uncontrolled release of contaminated water.
					2012-13	Q2*	Environmental Impacts	Moderate	Unlikely	Moderate	Assumption: results of water balance suggest minimal likelihood of uncontrolled release of contaminated water.
		13.2 Low oxygen in enclosed space	Injury or fatality resulting from low oxygen available in enclosed space (instrumentation sheds used for waste rock cover trials).	Confirm use of instrumentation sheds no longer needed. Sheds to be removed. 2012 Q2 Confirm required standards and ensure protocols in place. Find out what procedures are at other sites 2012 Q1 - No change	2012-13	Q2*	Human Health and Safety	Major	Very Unlikely	Moderate	Waste rock cover trials no longer conducted.
		13.3 Increased flow out of Vangorda waste rock pile	Increased flow out of the Vangorda waste rock pile releases contaminated water but is contained within Little Creek Pond.	Confirm results of water balance with CW. (DR) 2012 Q2 In Progress: Assess water conditions within rock dump 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Unlikely	Low	Assumption: results of water balance suggest minimal likelihood of uncontrolled release of contaminated water.
		13.4 Contaminated seeps require collection	On-going seepage testing results in a requirement to collect and treat additional contaminated water prior to planned remediation. Assumption: S-Wells type interception system implemented.	2012 Q2: Seepage testing on-going. Current ground water monitoring indicates increasing sulfate concentration. Zinc concentrations still low. Contaminant loading and volumetric loading to water treatment plant to be considered. 2011-2012 - implement change to monitoring program to respond to last year's results Receiving environment monitoring 2012 Q1 - seeps monitoring program conducted by PDT; need to confirm that investigation for new seeps occurred.	2012-13	Q2*	Consequence Costs	Moderate	Possible	Moderately High	
					2012-13	Q2*	Environmental Impacts	Minor	Possible	Moderate	

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Waste Rock											
	14 Grum Waste Rock Dump										
		14.1 Seepage from Moose Pond contaminates Vangorda Creek	Seepage from Moose Pond (or bypassing it), flows into Vangorda Creek exceeding its allowable water quality limits.	Annual geotechnical monitoring as well as frequent on-going regular geotechnical monitoring. 2012 Q2 2012 Q1 - GSC constructed and modifications completed to prevent discharge of runoff from Grum Waste Rock Dump into Grum Creek in 2011 Q1, Q2; V-15 pumping/piping system constructed in 2011 Q3; trigger level currently being developed. Pumping/piping system to capture contaminated water at Grum V-15 and pipe to VG Pit Construct Grum Sulphide Cover Investigate local passive treatment	2012-13	Q2*	Consequence Costs	Minor	Unlikely	Low	Pumping system procured and installed in 2011.
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	
		14.2 Contaminated seeps require collection	On-going seepage testing results in a requirement to collect and treat additional contaminated water. Assumption: S-wells type interception system is implemented.	Need continual monitoring around Grum Waste Rock Dump to identify and characterize contaminated seeps. 2012 Q2 Review monitoring program to respond to last year's results Remediation plan Receiving environment monitoring 2012 Q1 - PDT conducting seep monitoring program; need to confirm investigation for new seeps	2012-13	Q2*	Consequence Costs	Moderate	Possible	Moderately High	Contaminated seeps are currently being managed/monitored; maturation of the waste piles will result in increases in contamination.
		14.3 Grum Sulphide Cell excessive flushing of ARD products	Grum Sulphide Cell excessive flushing of ARD products; 100,000m3 fresh waste rock exposed to spring freshet; proposed seepage system (Grum V-15) is inadequate	2012 Q2 - Grum Sulphide Cell and V-15 construction complete. No flushing occurred. 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Low	Unlikely	Low	Grum Sulphide Cell and V-15 construction complete. No flushing occurred.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Waste Rock											
	14 Grum Waste Rock Dump										
					2012-13	Q2*	Environmental Impacts	Low	Unlikely	Low	Grum Sulphide Cell and V-15 construction complete. No flushing occurred.
		14.4 Contaminated Surface water release from Grum Rock Dump	Contaminated Surface water containing TSS and/or zinc from Grum Waste Rock Dump released eventually enters Vangorda Creek (receiving water environment).	2012 Q2 - Ground preparation and round 2 revegetation completed. On-going erosion monitoring and surface water collection. 2012 Q1 - water management upgrades completed in 2011 Q2,Q3 to reduce cover erosion and prevent release of water to Grum Creek (all water collected and pumped to Vangorda Pit) ***need to revise risk class	2012-13	Q2*	Consequence Costs	Minor	Possible	Moderate	Water management to prevent release in all cases with the exception of the 1: 200 or greater rain on snow event.
					2012-13	Q2*	Environmental Impacts	Minor	Possible	Moderate	
		14.6 Continued seepage through Grum waste rock dump	Continued seepage through Grum waste rock dump discharging into Moose Pond leading to exfiltration to Vangorda Creek at unacceptable levels	2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Minor	Unlikely	Low	
					2012-13	Q2*	Environmental Impacts	Moderate	Unlikely	Moderate	
		14.7 Catastrophic failure of Moose Pond	Catastrophic failure of Moose Pond leading to contamination of Vangorda Creek	2012 Q2 - Annual geotechnical inspections and regular geotechnical monitoring on-going. 2012 Q1 - GSC constructed and modifications completed to prevent discharge of runoff from Grum Waste Rock Dump into Grum Creek in 2011 Q1, Q2; V-15 pumping/piping system constructed in 2011 Q3; trigger level currently being developed; Klohn Crippen inspected structure and provided recommendations for monitoring (reduced reliance on Moose Pond for water management).	2012-13	Q2*	Environmental Impacts	Minor	Possible	Moderate	Mitigation measures have reduced risk classification.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Waste Rock											
	15 Grum Ore Transfer Pad										
		15.1 Contaminated seeps require collection	On-going seepage testing results in a requirement to collect and treat contaminated water to prevent discharge into west Vangorda Creek. Assumption: S-Wells type interception system is implemented.	2012 Q2 - Seepage monitoring on-going. Need continual monitoring around Grum Ore Transfer Pad to identify and characterize contaminated seeps. Run-off control ditches constructed. 2012 Q1 - up to 25 mg/L Zn-D contaminated runoff discovered during freshet; V17 was still compliant; current C&M contractor to construct runoff collection system Improve seepage monitoring Assess options of sulphide ore removal Trigger: Monitor sampling results at V17	2012-13	Q2*	Consequence Costs	Moderate	Possible	Moderately High	
					2012-13	Q2*	Environmental Impacts	Minor	Likely	Moderate	
	31 Grum Overburden Pile										
		31.1 High TSS flow from Grum Overburden Pile	Earthworks on Grum Overburden Pile leads to inability to deal with high TSS flow	Earthworks implemented to address residual drainage issues on the south side of Grum Overburden pile Sediment control program (modification to Sheep Pad Pond, flocculent addition) and diversion to Vangorda and Grum pits. 2012 Q1 - Earthworks not planned for Grum Overburden Pile; Risk class to be modified (lowered) during annual review	2012-13	Q2*	Consequence Costs	Minor	Unlikely	Low	No earthworks planned for Grum Overburden Pile
					2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	No earthworks planned for Grum Overburden Pile

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
Water											
	28 Contaminated water and Seepage										
		28.1 Poor water quality in Cross Valley Pond	Cross Valley Pond poor water quality (elevated zinc) prevents discharge through the pond and requires change to water management strategy, resulting in inability to store/release treated water.	No short term solution. Long term: drain, clean pond and/or build filters for new water treatment plant. 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Critical	Possible	High	Assumption: drain, clean pond of all residual sludge; filters for the new WTP would have to be constructed sooner than expected; too many unknowns to accurately predict costs (past anecdote indicates very costly)
		28.2 Hydrocarbon contamination	Historic hydrocarbon contamination results in requirement to pre-treat water	2012 Q2 - No evidence of hydrocarbons in water. 2012 Q1 - No change Follow-up: water treatment strategy	2012-13	Q2*	Consequence Costs	Minor	Unlikely	Low	Risk was based on a single event likely due to earthworks disturbing hydrocarbon plume in the ETA valley. Hydrocarbons have not impacted water treatment process since earthworks have been completed.
		28.3 Surface water quality causes adverse health effects to water fowl	Surface water quality causes adverse health effects to water fowl	2010 - Desktop study complete; continued monitoring recommended Continue ongoing observations 2012 Q1 - No change	2012-13	Q2*	Environmental Impacts	Minor	Unlikely	Low	

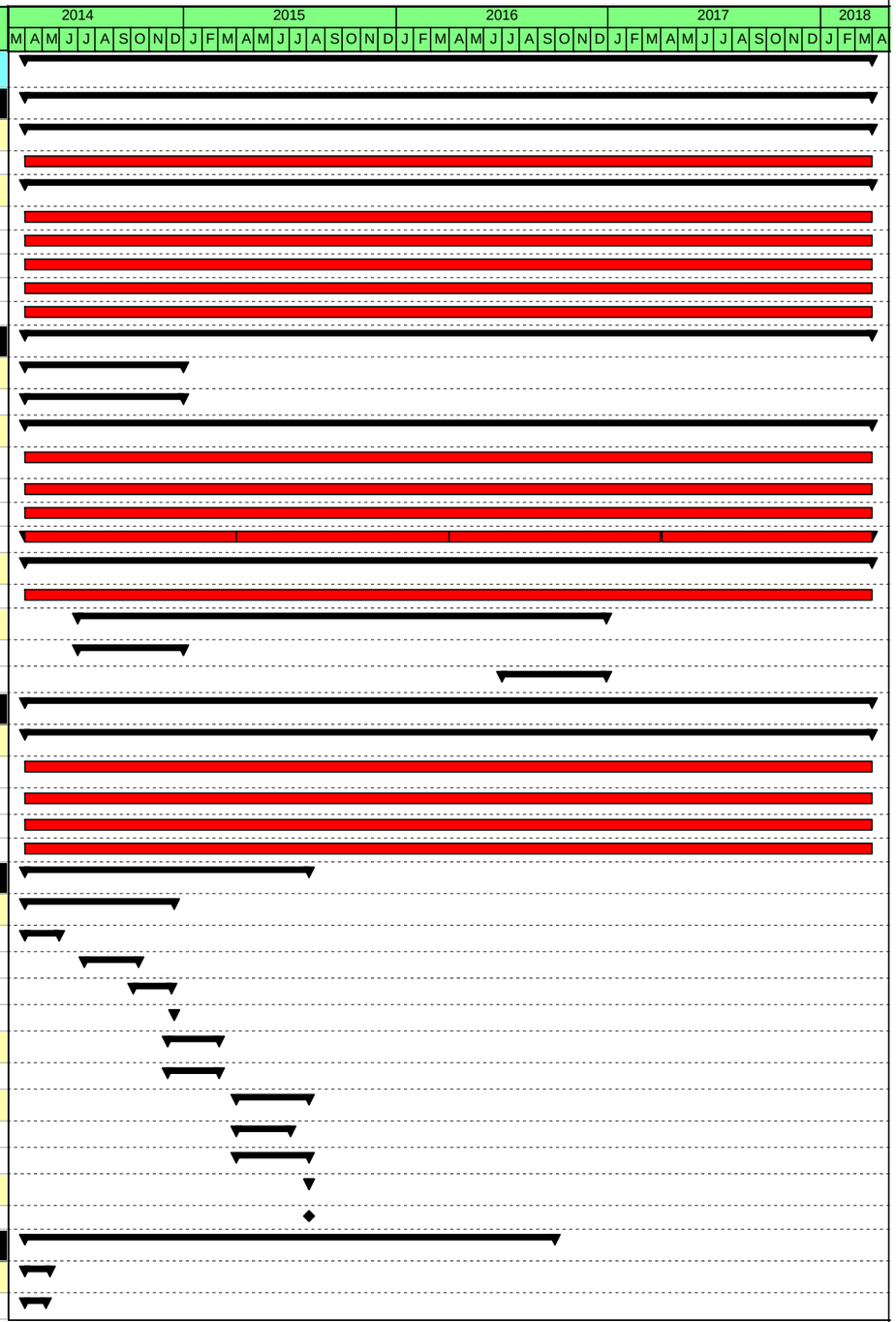
Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
		28.4 Contaminated water appears below Cross Valley Pond	Contaminated water appears in wells below Cross Valley Pond resulting in non-compliant water released to receiving environment.	2012 Q2 - continued ground water and surface water monitoring; PDT currently drilling wells to characterize aquifer which will inform the seepage interception system design (these wells may be used as pumping wells, additional wells may be installed as necessary); prepare design plans and enable works for seepage interception system installation. Electrical power has been installed to Intermediate Pond area. Need to consider water treatment plant capacity to treat CVD water. Review AMP trigger; ensure contingency mitigation plan exists for interim solution. (PDT) 2012 Q1 - No change	2012-13	Q2*	Consequence Costs	Major	Possible	High	Drilling below the CVD in 2012 Q2 encountered ground water with elevated concentrations of zinc (0.2 and 0.23 mg/L) and sulfate.
					2012-13	Q2*	Environmental Impacts	Major	Possible	High	Tritium testing planned for ground water to determine relative age and thus, potential source of impacted water from wells.
	34 Activities on water bodies										
		34.1 Worker fatality or injury from water/ice related incidents	Worker breaks through the ice and/or falls into water resulting in injury or death.	Operational procedures, PPE, and awareness training for working on ice/water required. 2012 Q1 - No change	2012-13	Q2*	Human Health and Safety	Major	Possible	High	Risk event has occurred in recent years in other locations. Despite mitigation training, operational procedures, PPE and rescue plans, working on water/ice is an inherently risky activity. Recent incidents at other locations have increased the risk classification.

Feature Type	Feature	Risk Event	Risk Event Description	Mitigation Strategy	Fiscal Year	Quarter	Consequence Type	Severity	Likelihood	Risk Class	Risk Rationale
	37 Emergency Tailings Area										
		37.1 Contaminated seepage from ETA	Contaminated seepage from Emergency Tailings Area enters Rose Creek aquifer depleting attenuation capacity resulting in release of contaminated water into the environment downstream of the Cross Valley Dam. ETA estimated to contribute approximately half of contaminant load entering the Rose Creek aquifer.	Interim Mitigation strategy: design and implement year round collection and pumping system. Long Term Mitigation Strategy: TBD 2012 Q2	2012-13	Q2*	Consequence Costs	Major	Possible	High	Justification for risk classification: Early implementation of ETA collection system would likely reduce overall costs related to the collection and treatment of contaminated water from the Cross Valley seepage interception system.
					2012-13	Q2*	Environmental Impacts	Moderate	Possible	Moderately High	

Appendix H
Medium Term Plan Milestone Schedule

Appendix **: Medium Term Plan Schedule

#	WBS	Activity Name	Budgeted Total Cost	Duration	Start	Finish
1	**Total**		$156,871,163	1025	01-Apr-14	30-Mar-18
2	**Fixed Scope**		$67,473,810	1025	01-Apr-14	30-Mar-18
3	**Operations & Maintenance (O&M)**		$39,600,000	1025	01-Apr-14	30-Mar-18
4	MTP.03	Care & Maintenance FY2013/14	$39,600,000	1025	01-Apr-14	30-Mar-18
5	**Governance & Management**		$27,873,810	1025	01-Apr-14	30-Mar-18
6	MTP.04	YG Staff & Advisory	$13,400,000	1025	01-Apr-14	30-Mar-18
7	MTP.04	YG PM Infrastructure	$2,140,000	1025	01-Apr-14	30-Mar-18
8	MTP.04	Communications	$480,000	1025	01-Apr-14	30-Mar-18
9	MTP.04	PDT Integrated Team	$4,000,000	1025	01-Apr-14	30-Mar-18
10	MTP.04	PDT Project Management	$7,853,810	1025	01-Apr-14	30-Mar-18
11	**Committed Works**		$24,424,976	1025	01-Apr-14	30-Mar-18
12	**Planning & Design**		$300,000	188	01-Apr-14	31-Dec-14
13	MTP.01.01.04.01.01	Data Quality Objectives Process	$300,000	188	01-Apr-14	31-Dec-14
14	**Operations & Maintenance (O&M)**		$23,058,336	1025	01-Apr-14	30-Mar-18
15	MTP.03	Site Wide Monitoring Program	$3,460,000	1025	01-Apr-14	30-Mar-18
16	MTP.03	Heavy Equipment Replacement	$2,540,000	1025	01-Apr-14	30-Mar-18
17	MTP.03	Adaptive Management Works	$6,055,000	1025	01-Apr-14	30-Mar-18
18	MTP.03.02.07.01	AMW: Interim Water Treatment System (IWTS)	$11,003,336	1025	01-Apr-14	30-Mar-18
19	**Governance & Management**		$716,640	1025	01-Apr-14	30-Mar-18
20	MTP.04	Grum Building Lease	$716,640	1025	01-Apr-14	30-Mar-18
21	**Project Execution Plan**		$350,000	636	02-Jul-14	28-Dec-16
22	MTP.04	Conceptual Project Execution Plan Update	$50,000	126	02-Jul-14	31-Dec-14
23	MTP.04	Preliminary Project Execution Plan	$300,000	129	01-Jul-16	28-Dec-16
24	**AYFN Participation**		$6,400,000	1025	01-Apr-14	30-Mar-18
25	**Project Management**		$6,400,000	1025	01-Apr-14	30-Mar-18
26	MTP.04	AYFN Participation - Selkirk First Nation	$1,600,000	1025	01-Apr-14	30-Mar-18
27	MTP.04	AYFN Participation - Ross River Dena Council	$1,600,000	1025	01-Apr-14	30-Mar-18
28	MTP.04	AYFN Participation - Liard First Nation	$1,600,000	1025	01-Apr-14	30-Mar-18
29	MTP.04	AYFN Participation - Kaska Dena Council	$1,600,000	1025	01-Apr-14	30-Mar-18
30	**Cross Valley Dam SIS**		$959,877	335	01-Apr-14	04-Aug-15
31	**Cross Valley Dam SIS Design**		$486,568	178	01-Apr-14	15-Dec-14
32	MTP.02.02.01.01.03	Advanced Design (60%)	$88,467	41	01-Apr-14	30-May-14
33	MTP.02.02.01.01.04	Detailed Design (90%)	$236,965	64	14-Jul-14	14-Oct-14
34	MTP.02.02.01.01.05	Final Design (100%)	$161,136	48	06-Oct-14	11-Dec-14
35	MTP.02.02.01.01.05	Final Design Control Point	$0	0	15-Dec-14	15-Dec-14
36	**Cross Valley Dam SIS Pre Construction**		$23,049	60	03-Dec-14	02-Mar-15
37	MTP.02.02.01.01.01	Procurement	$23,049	60	03-Dec-14	02-Mar-15
38	**Cross Valley Dam SIS Construction Activities**		$450,260	85	01-Apr-15	04-Aug-15
39	MTP.02.02.01.02.01	Construction	$374,394	64	01-Apr-15	03-Jul-15
40	MTP.02.02.01.02.02	Construction Management	$75,866	85	01-Apr-15	04-Aug-15
41	**Cross Valley Dam SIS Transition**		$0	0	04-Aug-15	04-Aug-15
42	MTP.02.02.01.03	Handover to C&M Operator	$0	0	04-Aug-15	
43	**Down Valley Interim Hydraulic Upgrades**		$5,955,742	635	01-Apr-14	30-Sep-16
44	**Down Valley IHU Design**		$100,582	30	01-Apr-14	14-May-14
45	MTP.01.02.02.02.05	Final Design (100%)	$100,582	25	01-Apr-14	07-May-14



Summary | Critical Remaining Work | Milestone
Remaining Work | Actual Work

Task filter: Four Year Plan
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Appendix **: Medium Term Plan Schedule

#	WBS	Activity Name	Budgeted Total Cost	Duration	Start	Finish
46	MTP.01.02.02.02.05	Final Design Control Point	$0	0	14-May-14	14-May-14
47	**Down Valley IHU Pre-Construction**		$188,769	43	01-Apr-16	31-May-16
48	MTP.02.02.02.01.01	Prepare Contract Documents	$75,141	16	01-Apr-16*	22-Apr-16
49	MTP.02.02.02.01.01	Select Best Value Subcontractor	$89,244	15	25-Apr-16	13-May-16
50	MTP.02.02.02.01.01	Execute Subcontract	$24,384	12	16-May-16	31-May-16
51	**Down Valley IHU Construction Activities**		$5,666,391	87	01-Jun-16	30-Sep-16
52	MTP.02.02.02.02.01	Construction	$4,930,458	61	01-Jun-16	25-Aug-16
53	MTP.02.02.02.02.02	Construction Management	$735,933	87	02-Jun-16	30-Sep-16
54	**Down Valley IHU Transition**		$0	0	30-Sep-16	30-Sep-16
55	MTP.02.02.02.03	Handover to C&M Operator	$0	0	30-Sep-16	
56	**Vangorda Diversion**		$12,610,188	704	01-Apr-14	05-Jan-17
57	**Vangorda Diversion Design**		$1,140,539	250	01-Apr-14	31-Mar-15
58	MTP.01.02.03.01.02	Conceptual Design (30%)	$342,161	56	01-Apr-14	20-Jun-14
59	MTP.01.02.03.01.02	Conceptual Design Control Point	$0	0	30-Jun-14	30-Jun-14
60	MTP.01.02.03.01.03	Advanced Design (60%)	$319,351	56	02-Jul-14	19-Sep-14
61	MTP.01.02.03.01.04	Detailed Design (90%)	$285,135	57	01-Oct-14	19-Dec-14
62	MTP.01.02.03.01.05	Final Design (100%)	$193,892	55	02-Jan-15	20-Mar-15
63	MTP.01.02.03.01.05	Final Design Control Point	$0	0	31-Mar-15	31-Mar-15
64	**Vangorda Diversion Pre-Construction**		$188,769	316	02-Jan-15	31-Mar-16
65	MTP.02.03.01.01.01	Phase 1 Procurement (Borrow Area Development)	$94,385	62	02-Jan-15	31-Mar-15
66	MTP.02.03.01.01.01	Phase 2 Procurement (Vangorda Diversion CN)	$94,384	43	02-Feb-16*	31-Mar-16
67	**Vangorda Diversion Construction Activities**		$11,181,384	429	01-Apr-15	02-Dec-16
68	MTP.02.03.01.02.01.03	Phase 1 Construction	$1,751,315	196	01-Apr-15	12-Jan-16
69	MTP.02.03.01.02.01.04	Phase 1 Construction Management	$419,230	218	02-Apr-15	11-Feb-16
70	MTP.02.03.01.02.02.03	Phase 2 Construction	$7,753,156	175	01-Apr-16	01-Dec-16
71	MTP.02.03.01.02.02.04	Phase 2 Construction Management	$1,257,683	199	01-Mar-16	02-Dec-16
72	**Vangorda Diversion Transition**		$99,496	25	02-Dec-16	05-Jan-17
73	MTP.02.03.01.03	Transition	$99,496	23	02-Dec-16	05-Jan-17
74	MTP.02.03.01.03	Handover to C&M Operator	$0	0		05-Jan-17
75	**Interim Works Project Proposal**		$500,000	290	01-Apr-14	29-May-15
76	**YESAA Project Proposal**		$170,000	250	01-Apr-14	31-Mar-15
77	MTP.01.03.06.01.02	Interim Works YESAA Process	$70,000	104	01-Apr-14	29-Aug-14
78	MTP.01.07	Interim Works Consultation & Engagement	$40,000	250	01-Apr-14	31-Mar-15
79	MTP.01.08	Interim Works Coordination & Technical Guidance	$60,000	250	01-Apr-14	31-Mar-15
80	**Interim Works Water Licence Process**		$330,000	290	01-Apr-14	29-May-15
81	MTP.01.03.07.01.03	Prepare Permit Applications for Interim Works (e.g. WLA)	$0	165	01-Apr-14	26-Nov-14
82	MTP.01.03.07.01.03	Interim Works Water Licence Process	$330,000	125	27-Nov-14	29-May-15
83	**Advanced Design & Remediation Project Proposal**		$38,546,570	1025	01-Apr-14	30-Mar-18
84	**Ongoing Field Investigations**		$14,492,372	548	01-May-14	30-Oct-15
85	**Design**		$15,737,142	529	01-Aug-14	31-Aug-16
86	MTP.01.02.04.01	Develop FMRP Design Definition and Concepts	$5,811,616	125	01-Aug-14	30-Jan-15
87	MTP.01.02.04.02.01	Prepare Initial FMRP 30% Engineering Designs	$5,563,529	103	02-Feb-15	30-Jun-15
88	MTP.01.02.04.02.02	Refine 30% Designs to Address ESE Effects	$4,361,997	301	02-Jul-15	31-Aug-16
89	**Project Proposal**		$8,250,253	1025	01-Apr-14	30-Mar-18
90	MTP.01.03.01	Project Description	$99,724	426	02-Feb-15	30-Sep-16
91	MTP.01.03.02	Environmental & SE Baseline	$3,266,384	375	01-Apr-14	30-Sep-15

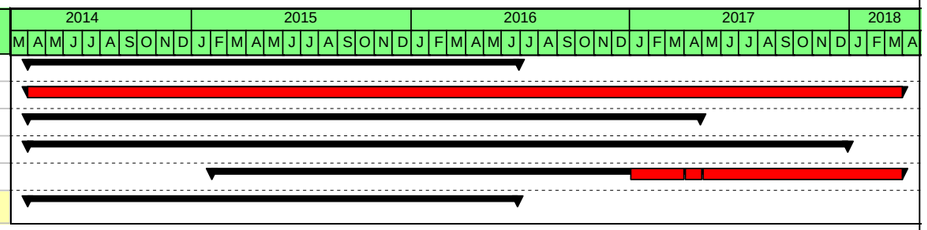


Summary | Critical Remaining Work | Milestone
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Appendix **: Medium Term Plan Schedule

#	WBS	Activity Name	Budgeted Total Cost	Duration	Start	Finish
92	MTP.01.03.03	Environmental & SE Effects Assessment	$1,927,156	569	01-Apr-14	30-Jun-16
93	MTP.01.03.04	Consultation & Engagement	$292,094	1025	01-Apr-14	30-Mar-18
94	MTP.01.03.05	Project Proposal Supporting Plans	$651,802	785	01-Apr-14	28-Apr-17
95	MTP.01.03.06	Project Proposal Communication & Coordination	$844,460	960	01-Apr-14	29-Dec-17
96	MTP.01.03.07	Proposal Production	$1,168,633	816	02-Feb-15	30-Mar-18
97	**Permitting**		$66,804	566	01-Apr-14	27-Jun-16



Summary
Remaining Work
Critical Remaining Work
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Appendix I
Project Budget Summary

Appendix I: Project Budget Summary

		2014/15				2015/16				2016/17				2017/18				Medium Term Plan Totals
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
A1. FIXED SCOPE (FPET)	**Estimate Class**																	
1. Care & Maintenance	O&M			$9,900,000				$9,900,000				$9,900,000				$9,900,000		**$39,600,000**
2. YG Staff & Advisory Costs	O&M			$3,350,000				$3,350,000				$3,350,000				$3,350,000		**$13,400,000**
3. YG PM Infrastructure Costs	O&M			$535,000				$535,000				$535,000				$535,000		**$2,140,000**
4. Communications	O&M			$120,000				$120,000				$120,000				$120,000		**$480,000**
5. PDT Integrated Team	O&M			$1,000,000				$1,000,000				$1,000,000				$1,000,000		**$4,000,000**
6. PDT PM Costs	3			$2,962,269				$1,913,014				$1,970,986				$1,007,541		**$7,853,810**
Annual Totals A1: Fixed Costs (FPET)				**$17,867,269**				**$16,818,014**				**$16,875,986**				**$15,912,541**		**$67,473,810**
A2. FIXED SCOPE DESIGN ALLOWANCE (FPET)	**% based on Class**																	
1. Care & Maintenance Design Allowance	10%			$990,000				$990,000				$990,000				$990,000		**$3,960,000**
2. YG Staff & Advisory Costs Design Allowance	10%			$335,000				$335,000				$335,000				$335,000		**$1,340,000**
3. YG PM Infrastructure Costs Design Allowance	10%			$53,500				$53,500				$53,500				$53,500		**$214,000**
4. Communications Design Allowance	10%			$12,000				$12,000				$12,000				$12,000		**$48,000**
5. PDT Integrated Team Design Allowance	10%			$100,000				$100,000				$100,000				$100,000		**$400,000**
6. PDT PM Costs Design Allowance	10%			$296,227				$191,301				$197,099				$100,754		**$785,381**
Annual Totals A2: Fixed Costs Design Allowance (FPET)				**$1,786,727**				**$1,681,801**				**$1,687,599**				**$1,591,254**		**$6,747,381**
A3. FIXED SCOPE CONTINGENCY (AANDC)	**% based on Class**																	
1. Care & Maintenance Contingency	10%			$990,000				$990,000				$990,000				$990,000		**$3,960,000**
2. YG Staff & Advisory Costs Contingency	10%			$335,000				$335,000				$335,000				$335,000		**$1,340,000**
3. YG PM Infrastructure Costs Contingency	10%			$53,500				$53,500				$53,500				$53,500		**$214,000**
4. Communications Contingency	10%			$12,000				$12,000				$12,000				$12,000		**$48,000**
5. PDT Integrated Team Contingency	10%			$100,000				$100,000				$100,000				$100,000		**$400,000**
6. PDT PM Costs Contingency	20%			$592,454				$382,603				$394,197				$201,508		**$1,570,762**
Annual Totals A3: Fixed Costs Contingency (AANDC)*				**$2,082,954**				**$1,873,103**				**$1,884,697**				**$1,692,008**		**$7,532,762**
ANNUAL TOTALS A1+A2: Fixed Costs including Design Allowances (FPET)				**$19,653,996**				**$18,499,815**				**$18,563,585**				**$17,503,795**		**$74,221,191**

B1. COMMITTED WORKS (FPET)	**Estimate Class**					
1. Grum Building Lease	2	$176,640	$180,000	$180,000	$180,000	**$716,640**
2. Site Wide Monitoring Program (environmental/geotechnical)	5	$865,000	$865,000	$865,000	$865,000	**$3,460,000**
3. DQO Process	3	$300,000	$0	$0	$0	**$300,000**
4. Project Execution Plan (PEP)	3	$50,000	$0	$300,000	$0	**$350,000**
5. Replacement Costs for Heavy Equipment	3	$635,000	$635,000	$635,000	$635,000	**$2,540,000**
6. Adaptive Management Works (AMW) (10-15% of C&M costs)	4	$1,600,000	$1,485,000	$1,485,000	$1,485,000	**$6,055,000**
7. AMW: Interim Water Treatment System (IWTS)	3	$8,003,336	$1,000,000	$1,000,000	$1,000,000	**$11,003,336**
Annual Totals B1: Committed Works (FPET)		**$11,629,976**	**$4,165,000**	**$4,465,000**	**$4,165,000**	**$24,424,976**
B2. COMMITTED WORKS DESIGN ALLOWANCE (FPET)	**% based on Class**					
1. Grum Building Lease Design Allowance	5%	$8,832	$9,000	$9,000	$9,000	**$35,832**
2. Site Wide Monitoring Program Design Allowance	30%	$259,500	$259,500	$259,500	$259,500	**$1,038,000**
3. DQO Process Design Allowance	10%	$30,000	$0	$0	$0	**$30,000**
4. Project Execution Plan Design Allowance	10%	$5,000	$0	$30,000	$0	**$35,000**
5. Replacement Costs for Heavy Equipment Design Allowance	10%	$63,500	$63,500	$63,500	$63,500	**$254,000**
6. Adaptive Management Works Design Allowance	15%	$240,000	$222,750	$222,750	$222,750	**$908,250**
7. AMW: Interim Water Treatment System (IWTS) Design Allowance	10%	$800,334	$100,000	$100,000	$100,000	**$1,100,334**
Annual Totals B2: Committed Works Design Allowance (FPET)		**$1,407,166**	**$654,750**	**$684,750**	**$654,750**	**$3,401,416**
B3. COMMITTED WORKS CONTINGENCY (AANDC)	**% based on Class**					
1. Grum Building Lease Contingency	15%	$26,496	$27,000	$27,000	$27,000	**$107,496**
2. Site Wide Monitoring Program Contingency	70%	$605,500	$605,500	$605,500	$605,500	**$2,422,000**
3. DQO Process Contingency	20%	$60,000	$0	$0	$0	**$60,000**
4. Project Execution Plan Contingency	20%	$10,000	$0	$60,000	$0	**$70,000**
5. Replacement Costs for Heavy Equipment Contingency	20%	$127,000	$127,000	$127,000	$127,000	**$508,000**
6. Adaptive Management Works Contingency	35%	$560,000	$519,750	$519,750	$519,750	**$2,119,250**
7. AMW: Interim Water Treatment System (IWTS) Contingency	20%	$1,600,667	$200,000	$200,000	$200,000	**$2,200,667**
Annual Totals B3: Committed Works Contingency (AANDC)*		**$2,989,663**	**$1,479,250**	**$1,539,250**	**$1,479,250**	**$7,487,413**
ANNUAL TOTALS B1+B2: Committed Works including Design Allowances (FPET)		**$13,037,142**	**$4,819,750**	**$5,149,750**	**$4,819,750**	**$27,826,392**

Appendix I: Project Budget Summary

		2014/15				2015/16				2016/17				2017/18				Medium Term Plan Totals
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
C1. AYFN PARTICIPATION COSTS (FPET)	**Estimate Class**																	
1. AYFN Participation Funding - Ross River Dena Council	O&M			$400,000				$400,000				$400,000				$400,000		**$1,600,000**
2. AYFN Participation Funding - Liard First Nation	O&M			$400,000				$400,000				$400,000				$400,000		**$1,600,000**
3. AYFN Participation Funding - Selkirk First Nation	O&M			$400,000				$400,000				$400,000				$400,000		**$1,600,000**
4. AYFN Participation Funding - Kaska Dena Council	O&M			$400,000				$400,000				$400,000				$400,000		**$1,600,000**
Annual Totals C1: AYFN Costs (FPET)				**$1,600,000**				**$1,600,000**				**$1,600,000**				**$1,600,000**		**$6,400,000**
C2. AYFN PARTICIPATION COSTS DESIGN ALLOWANCE (FPET)	**% based on Class**																	
1. AYFN Participation Funding Design Allowance - Ross River Dena Council	10%			$40,000				$40,000				$40,000				$40,000		**$160,000**
2. AYFN Participation Funding Design Allowance - Liard First Nation	10%			$40,000				$40,000				$40,000				$40,000		**$160,000**
3. AYFN Participation Funding Design Allowance - Selkirk First Nation	10%			$40,000				$40,000				$40,000				$40,000		**$160,000**
4. AYFN Participation Funding Design Allowance - Kaska Dena Council	10%			$40,000				$40,000				$40,000				$40,000		**$160,000**
Annual Totals C2: AYFN Costs Design Allowance (FPET)				**$160,000**				**$160,000**				**$160,000**				**$160,000**		**$640,000**
C3. AYFN PARTICIPATION COSTS CONTINGENCY (AANDC)	**% based on Class**																	
1. AYFN Participation Funding Contingency - Ross River Dena Council	10%			$40,000				$40,000				$40,000				$40,000		**$160,000**
2. AYFN Participation Funding Contingency - Liard First Nation	10%			$40,000				$40,000				$40,000				$40,000		**$160,000**
3. AYFN Participation Funding Contingency - Selkirk First Nation	10%			$40,000				$40,000				$40,000				$40,000		**$160,000**
4. AYFN Participation Funding Contingency - Kaska Dena Council	10%			$40,000				$40,000				$40,000				$40,000		**$160,000**
Annual Totals C3: AYFN Costs Contingency (AANDC)*				**$160,000**				**$160,000**				**$160,000**				**$160,000**		**$640,000**
ANNUAL TOTALS C1+C2: AYFN Costs including Design Allowances (FPET)				**$1,760,000**				**$1,760,000**				**$1,760,000**				**$1,760,000**		**$7,040,000**

ANNUAL TOTALS A1+B1+C1: Fixed Scope, Committed Works & AYFN Participation Costs (FPET)	**$31,097,245**	**$22,583,014**	**$22,940,986**	**$21,677,541**	**$98,298,786**
AL TOTALS A1+A2, B1+B2, C1+C2: Fixed Scope Committed Works & AYFN Costs including Design Allowances (FPET)	**$34,451,138**	**$25,079,565**	**$25,473,335**	**$24,083,545**	**$109,087,583**
ANNUAL TOTALS A3+B3+C3: Fixed Scope, Committed Works & AYFN Costs Contingencies (AANDC)*	**$5,232,617**	**$3,512,353**	**$3,583,947**	**$3,331,258**	**$15,660,175**
	2014/15	**2015/16**	**2016/17**	**2017/18**	

Appendix I: Project Budget Summary

		2014/15				2015/16				2016/17				2017/18				Medium Term Plan Totals
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
E. DOWN VALLEY INTERIM HYDRAULIC UPGRADES (DVIHU)																		
1. Field Investigation																		
2. Design Definition																		
3. Conceptual Design (30%)																		
4. Control Point Review & Approval - Conceptual Design																		
5. Detailed Design (60-100%)																		
6. Control Point Review & Approval - Detailed Design		x																
7. Procurement																		
8. Construction																		
9. Construction Management																		
10. Handover to C&M Operator																		
ANNUAL TOTALS D1: DVIHU Interim Works Costs (FPET)	**5**				**$100,582**				**$0**				**$5,855,160**				**$0**	**$5,955,742**
ANNUAL TOTALS D2: DVIHU Design Allowance (FPET)	**30%**				**$30,175**				**$0**				**$1,756,548**				**$0**	**$1,786,723**
ANNUAL TOTALS D3: DVIHU Contingency (AANDC)*	**70%**				**$70,407**				**$0**				**$4,098,612**				**$0**	**$4,169,019**

F. CROSS VALLEY DAM SIS (CVD SIS)																		
1. Field Investigation																		
2. Design Definition																		
3. Conceptual Design (30%)																		
4. Control Point Review & Approval - Conceptual Design (includes IPRP)																		
5. Detailed Design (60-100%)																		
6. Control Point Review & Approval - Detailed Design (includes IPRP)				x														
7. Procurement																		
8. Construction (enabling works/ road and power)																		
9. Construction Management																		
10. Handover to C&M Operator																		
ANNUAL TOTALS F1: CVD SIS Interim Works Costs (FPET)	**5**				**$509,617**				**$450,260**				**$0**				**$0**	**$959,877**
ANNUAL TOTALS F2: CVD SIS Design Allowance (FPET)	**30%**				**$152,885**				**$135,078**				**$0**				**$0**	**$287,963**
ANNUAL TOTALS F3: CVD SIS Contingency (AANDC)*	**70%**				**$356,732**				**$315,182**				**$0**				**$0**	**$671,914**

G. VANGORDA CREEK DIVERSION (VCD)																		
1. Procurement Field Investigation																		
2. Field Investigation																		
3. Design Definition																		
4. Conceptual Design (30%)																		
5. Control Point Review & Approval - Conceptual/Assessment-ready Design (includes IPRP)		x																
7. Procurement (rip rap development)																		
8. Construction (rip rap/borrow development)																		
9. Construction Management (borrow development)																		
10. Detailed Design (60-100%)																		
11. Control Point Review & Approval - Detailed Design (includes IPRP)				x														
12. Procurement (diversion)																		
13. Construction (diversion)																		
14. Construction Management (diversion)																		
15. Transition																		
16. Handover to C&M Operator																		
ANNUAL TOTALS G1: VD Costs (FPET)	**5**				**$1,234,924**				**$2,430,224**				**$8,945,040**				**$0**	**$12,610,188**
ANNUAL TOTALS G2: VD Design Allowance (FPET)	**30%**				**$370,477**				**$729,067**				**$2,683,512**				**$0**	**$3,783,056**
ANNUAL TOTALS G3: VD Contingency (AANDC)*	**70%**				**$864,447**				**$1,701,157**				**$6,261,528**				**$0**	**$8,827,132**

ANNUAL TOTALS D1 to G1: Interim Works + VD Costs (FPET)					**$1,845,123**				**$2,880,484**				**$14,800,200**				**$0**	**$19,525,807**
ANNUAL TOTALS D1+D2, E1+E2, F1+F2, G1+G2 : IW + VD Costs including Design Allowances (FPET)					**$2,398,660**				**$3,744,629**				**$19,240,260**				**$0**	**$25,383,549**
ANNUAL TOTALS D3 to G3: IW + VD Contingencies (AANDC)*					**$1,291,586**				**$2,016,339**				**$10,360,140**				**$0**	**$13,668,065**

Appendix I: Project Budget Summary

		2014/15				2015/16				2016/17				2017/18				Medium Term Plan Totals
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
H. ADVANCED DESIGN & REMEDIATION PROJECT PROPOSAL (AD&RPP)																		
1. Permitting																		
2. Ongoing Field Investigations																		
3. Design Engineering																		
4. Project Description																		
5. Environmental Baseline Data Collection & Research																		
6. Socio-economic Baseline Data Collection & Research																		
7. Environmental and Socio-economic Effects Assessment																		
8. Consultation and Engagement																		
9. Project Proposal Supporting Plans																		
10. Project Proposal Communication and Coordination																		
11. Draft Proposal Prep																		
12. Draft Control Point Review												x						
13. Finalization of Project Proposal																		
14. Final Control Point Review													x					
15. Adequacy Review														not budgeted				
ANNUAL TOTALS H1: AD&RPP Costs (FPET)	**5**			**$24,277,890**				**$12,477,641**				**$1,524,136**				**$266,903**		**$38,546,570**
ANNUAL TOTALS H2: AD&RPP Design Allowance (FPET)	**30%**			**$7,283,367**				**$3,743,292**				**$457,241**				**$80,071**		**$11,563,971**
ANNUAL TOTALS H3: AD&RPP Contingency (AANDC)*	**70%**			**$16,994,523**				**$8,734,349**				**$1,066,895**				**$186,832**		**$26,982,599**

I. INTERIM WORKS PROJECT PROPOSAL (IWPP)						
1. Working Documents						
2. Baseline Research & Data Collection						
3. Effects Assessment & Project Refinement						
4. Supporting Documents						
5. Main Document						
6. Interim Works Consultation & Engagement						
7. Interim Works Coordination & Technical Guidance						
8. Interim Works YESAA Process						
9. Interim Works Water Licence Process						
ANNUAL TOTALS I1: IWPP Costs (FPET)	**5**	**$500,000**	**$0**	**$0**	**$0**	**$500,000**
ANNUAL TOTALS I2: IWPP Design Allowance (FPET)	**30%**	**$150,000**	**0**	**$0**	**$0**	**$150,000**
ANNUAL TOTALS I3: IWPP Contingency (AANDC)*	**70%**	**$350,000**	**$0**	**$0**	**$0**	**$350,000**

ANNUAL TOTALS D1 to I1: Interim Works, VD, AD&RPP and IWPP Costs (FPET)	**$26,623,013**	**$15,358,125**	**$16,324,336**	**$266,903**	**$58,572,377**
S D1+D2, E1+E2, F1+F2, G1+G2, H1+H2, I1+I2: IW, VD, AD&RPP and IWPP Costs including Design Allowances (FPET)	**$34,609,917**	**$19,965,562**	**$21,221,637**	**$346,974**	**$76,144,090**
ANNUAL TOTALS D3 to H3: IW, VD, AD&RPP & IWPP Contingency (AANDC)*	**$18,636,109**	**$10,750,688**	**$11,427,035**	**$186,832**	**$41,000,664**

ANNUAL TOTALS: All Costs A1 to I1 (FPET)	**$57,720,258**	**$37,941,139**	**$39,265,322**	**$21,944,444**	**$156,871,163**
ANNUAL TOTALS: All Costs including Design Allowances A1+A2 to I1+I2 (FPET)	**$69,061,055**	**$45,045,127**	**$46,694,972**	**$24,430,519**	**$185,231,673**
ANNUAL TOTALS: All Contingencies A3 to I3 (AANDC)*	**$23,868,726**	**$14,263,041**	**$15,010,982**	**$3,518,090**	**$56,660,839**
HIGH END OF RANGE - TECHNICAL RISK EVENT CONTINGENCY as per Section 3.4 (based on Year 1 Total)*	**$5,891,333**	**$5,891,333**	**$5,891,333**	**$5,891,333**	**n/a**
LOW END OF RANGE - TECHNICAL RISK EVENT CONTINGENCY as per Section 3.4 (based on Year 1 Total)*	**$1,248,667**	**$1,248,667**	**$1,248,667**	**$1,248,667**	**n/a**
	2014/15	**2015/16**	**2016/17**	**2017/18**	

TOTAL FPET Budget, Medium Term Plan (All Costs & Design Allowances)			**$185,231,673**
Potential Total Medium Term Plan Requirement based on Year 1 Class Estimates/Contingencies*	**$156,871,163**	**to**	**$241,892,512**

*NOTES: 1) All values in 2012 dollars. 2) * Annual contingencies shown are an expression of uncertainty for each year and are based at time of writing on Year 1 class estimates. Class estimates are expected to be refined as the work of the Term progresses and annual contingency requirements should decrease as certainty increases. 3) Medium Term Plan contingency totals shown are not expected cumulative expenditures over the Term but rather "upset limits" should risk events occur and push contingency expenditures to the upper limit of the class estimate uncertainty range consistently throughout the Term (i.e. the Medium Term Plan contingency total reflects a "worst case scenario" in each and every year of the Plan). 4) The technical risk event contingency for each year shown is based on minimum and maximum Year 1 values as per Section 3.4; over the period of the Medium Term Plan the probabilities and consequences of some of the risks described will change, thereby changing the technical risk event contingency requirements and range.*

Appendix J
Affected Yukon First Nation and Yukoner Participation Contract Strategy

Yukon
Energy, Mines and Resources
Assessment and Abandoned Mines

Yukon First Nation & Yukoner Participation Contract Strategy

Introduction

In accordance with the requirements of the Yukon Devolution Transfer Agreement (DTA), the Yukon Government Contracting Policy, and in line with the policy objectives of the Northern Contaminated Sites Program and the Government of Canada Contracting Policy, Assessment and Abandoned Mines (AAM) has chosen to adopt a three-pronged strategy to enable affected Yukon First Nations (YFN) and Yukoners to capitalize on the opportunities provided by projects and contracts associated with the remediation of abandoned Type II Mines in the Yukon Territory.

This strategy requires Contractors engage with YFNs and Yukoners to develop specific Participation Plans that align with the basic requirements of the overall Participation Strategy. Contractor performance against the agreed upon outcomes of their specific Participation Plan becomes a key performance indicator for management of the work.

Developed in 2008 with the Chiefs of the Selkirk First Nation and Ross River Dena Council, the overall Participation Strategy was first applied to the Care and Maintenance contract at the Faro Mine Complex (FMC). Subsequently, it has been adopted by AAM for inclusion in all major contracts where reasonable opportunities for YFN and Yukoner participation exist.

A) Principles of the Participation Strategy

1) Minimum Participation Levels will be prescribed within RFPs/Contracts

While the minimum levels of YFN and Yukoner participation will be prescribed within RFPs and resulting Contracts as binding obligations upon the selected Contractor, the specific methods by which these opportunities are to be achieved by the Contractor are not. This distinction allows the Contractor to achieve (at a minimum) the level of outcomes prescribed within the RFP/Contract in a manner that is entirely aligned to the successful completion of the specific work requirements, while ensuring that the Contractor retains maximum accountability for results within the Contract. In other words, YG is maintaining the position within RFPs/Contracts that it will deliberately not dictate to the Contractor the *specific measures* it must take to ensure its compliance with the Participation Strategy (as these decisions are best left to the Contractor), but rather manage Contractor performance against the agreed upon Participation Strategy outcomes.

Further, the minimum participation levels to be prescribed within RFPs/Contracts are opportunities for meaningful YFN and Yukoner participation within the Contracts, aimed at realizing to the fullest extent

possible the economic development priorities identified by YFNs and Yukoners themselves. As opportunities, the full realization of economic benefits will ultimately be dependent upon the willingness and ability of YFN/Yukoner people and businesses to cost effectively provide operationally required goods and services to the Contractor, in accordance with standard business practices.

2) Scope of Proposed Participation Opportunities

The scope of participation opportunities within the proposed YFN and Yukoner Participation Strategy fall within three (3) key areas:

a) Opportunities for Training/Capacity Building with YFN and Yukon peoples, businesses and communities, related to contract work requirements;

b) Opportunities for Contracting/Sub-Contracting with YFN and Yukon businesses, to support Contract work requirements; and

c) Opportunities for Direct Employment of YFNs and Yukoners by the Contractor, for completion of Contract work.

The specific opportunities for participation within each Contract will be established from the perceived optimal alignment between the needs and requirements of the governments and the Contractor for the successful completion of the Contract work requirements, the capacity of YFNs and Yukon businesses and communities to engage in identified opportunities and the YFN and Yukoner stated priorities for participation and capacity development directly related to Contract work.

A misalignment of contract participation outcomes with Government/Contractor needs and YFN and Yukoner capacity and priorities has the potential to result in the establishment of an ineffective Participation Plan within the resulting Contracts. This strategy has been developed specifically to avoid mandating the delivery of opportunities that support neither meaningful nor long-term benefit to either YFN and Yukoners and/or the Contractor. Such an outcome under a Contract would serve to undermine confidence in the governments' intentions for the inclusion of the Participation Plan element within the Contract, as it would fail to achieve the outcomes envisioned by the governments, and can thus result in wasted opportunity and an ineffective use of public funds.

This method of aligning Participation outcomes with the positions of all parties and, as defined in Section B below, provides the opportunity to "get it right" – to maximize opportunities for the participation of YFN and Yukoners and their businesses and communities within Contract, in a manner that also fully supports the achievement of meaningful and effective outcomes for the Contractor and the Governments related to the work.

3) Contractual Obligation

The proposed Participation elements within RFPs/Contracts are obligations that the governments are imposing upon the resulting Contractor as part of its contractual requirements, to be fulfilled in undertaking the required work. As the Participation elements are prescribed within the RFP, they are incorporated within the resulting Contract statement of work. The Contractor is thus contractually obligated to undertake the measures it deems necessary to provide the Participation opportunities defined therein, and to meet or exceed the prescribed minimum levels of Participation.

In response to the RFP, the eligible Bidders (and thus the resulting Contractor) will be required to certify their understanding of this binding obligation and, should they be selected for the Contract, their commitment to undertake the obligations outlined within the Participation Plan component of the Contract. In addition, the eligible Bidders (and thus the resulting Contractor) will be required to certify a binding obligation that, if selected for the Contract, they will work directly with YFN and Yukoners to establish the details of their approach and specific measures to be undertaken to meet the Contract Participation commitments following Contract Award. This proposed approach will be requested from the eligible Bidders in their proposals.

The parties will review the Participation component of the Contract periodically, and any necessary adjustments made in order to achieve the prescribed outcomes, embodying a cooperative approach. On an annual basis during the period of the Contract, the Implementation Plan for the Participation component will be presented by the Contractor to the YG Contracting Authority for final approval, and will be incorporated by written agreement within the Contract.

4) Monitoring of Contractor Compliance with Contractual Obligations

During the period of each Contract, the Contractor will be required to present written quarterly reports with respect to Participation and to review progress against the specific approaches and measures established within the Implementation Plan for the Participation component. These reports will be incorporated into AAM's reporting framework.

As noted above, an annual review and formal adjustment to the Implementation Plan for the Participation component will take place between the Contractor and any YFNs, with results presented to the YG Contracting Authority, to report on and (if necessary) formally adjust the measures and approaches within the Contract.

If the contract is less than one year in duration, intervals for reporting will be stipulated in the Contract and agreed to by both the YG Contracting Authority and the Contractor.

5) Prescribed Levels of Proposed Participation Opportunities

As detailed within Section B below, the levels of proposed Participation (i.e. specific percentages and amounts of Participation required to be achieved by the resulting Contractor) will be prescribed in the Contract based on the contract scope, dollar value and the known levels of capacity of YFNs, Yukoners and the Contractor.

If the contract extends beyond one year, it will be expected that the Contractor will be required to demonstrate reasonable progression in the levels of participation in each participation area with each subsequent year.

6) Flexibility to respond to the Contract Work Requirements and Local Capacity

Within each of the levels of Participation prescribed within each Area identified in Section B below (Training/Capacity Building, Contracting/Sub-Contracting and Direct Employment), the Contract will

provide for the ability to adjust the specific approaches and measures to be undertaken by the Contractor, including some ability to transfer Participation Opportunities among the sub-areas within each of Training/Capacity Building, Contracting/Sub Contracting and Direct Employment; and between Contracting/Sub-Contracting and Direct Employment, reflective of the specific Contract work requirements being undertaken and changes in the capacity of YFN and Yukoners to participate; as may occur over time.

The use of Participation "transfers" is designed to enable the achievement of overall Participation outcomes defined within the Contract, without unduly penalizing or restricting the Contractor in relation to Participation elements outside of its control (i.e. changes in work requirements or local capacity).

Notwithstanding this important and required amount of flexibility, the transfer of Participation outcomes within the Area of Training/Capacity Building to other Areas (i.e. Contracting/Sub-Contracting and/or Direct Employment) is not permitted. It was determined that the Training/Capacity Building outcomes are a strategic long-term priority, therefore these specific opportunities cannot be transferred, off-set or otherwise diluted in any way.

As noted above, any such transfer adjustments would be subject to the review and ultimate approval of the YG Contracting Authority.

7) Right of First Refusal and Transfer of Opportunity reflective of Local Capacity

In fulfilling the Participation commitments prescribed within the Contract, the Contractor shall be required to provide any opportunity first to a qualified affected YFN person and/or business.

In compliance with the YG Contracting Policy, in addition to providing opportunities for affected YFNs' peoples, businesses and communities, the Participation Plan component of the Contract is also required to provide Participation Opportunities for Yukon peoples and businesses.

During the period of the Contract, should the Contractor be unable to fulfill its contractual obligations relative to the Participation outcomes prescribed for affected YFNs due to the absence of local capacity to participate or other factors outside of the Contractor's control, subject to the prior written approval of the YG Contracting Authority, any unfulfilled Participation Opportunities will then be presented to Yukon peoples/businesses as part of the Contractor's discharge of its Yukon Participation commitment.

Any such transfer of Participation Opportunities among Participant groups (affected YFNs to Yukon peoples/businesses) is contingent upon the successful completion of the review and ultimate approval of the YG Contracting Authority. In support of as-required measures during the period of the Contract to maintain compliance with environmental and operational requirements, the Contractor will enjoy absolute flexibility to determine those work requirements it chooses to contract for, versus those for which it will utilize employed staff. Furthermore, it will also be entirely within the Contractor's discretion to determine which contract and/or employment opportunities it chooses to present to YFN and/or Yukon people and/or businesses, based on an assessment of its own operational requirements. In keeping with the principles outlined above, the Participation obligations of the Contract will in no way

dictate to the Contractor "*how*" the required outcomes are to be met, only that within each year of the Contract they be met through close cooperation with YFNs and Yukoners, and the application of best effort on the part of the Contractor.

8) Achieving BOTH Maximum Participation and Best Value within the Contractor Selection Process

A fundamental and strategic component of all YG Contracts that include a Participation Plan component involves the attainment of balance between the oft-perceived competing objectives of maximum participation and the attainment of best value for money. The Governments' overall strategy has been to structure its competitive bid solicitations in such a way so as to simultaneously achieve both objectives. By taking care to align participation elements with bona fide government and contractor needs, YG is seeking via the RFP process to select Contractors capable of fulfilling the prescribed Participation requirements, while at the same time allowing the Contractor enough operational flexibility to ensure that these obligations can be met without unduly inflating the cost of the work, thereby preserving the attainment of best value.

B) Specific Proposed Participation Outcomes

The following Areas represent the proposed Participation outcomes to be prescribed within RFPs/Contracts. In compliance with YG's obligations to maintain fairness in the competitive procurement process, specific language/wording to be used within RFPs/Contracts, including levels of participation, is deliberately not included below. Participation outcome levels will be prescribed within the RFPs/Contracts with reasonable progression on an annual basis should the Contract extend beyond one year.

YFNs have identified a priority and capacity for Participation in Training/Capacity Building in the following areas. These areas are well-documented skill sets currently required by companies involved in the resource development sector within the Yukon.

- Heavy Equipment Operation;
- Site Management;
- Water Treatment Operations;
- Water Sampling;
- Environmental Monitoring; and
- Site Security.

The Participation outcome for Training/Capacity Building will be expressed in RFPs/Contracts as a number of training days to be delivered over all Training/Capacity Building requirements under the Contract. Based on an assessment of its own needs, and the Participation outcomes it is obligated to deliver, the Contractor will work with YFNs and Yukoners to define a specific Training/Capacity Building Plan aimed at addressing these needs. The joint presentation of this Plan will be included within the Contract subject to the approval of the YG Contracting Authority.

Area 1) Training/Capacity Building:

In fulfilling its obligations, the Contractor may request the transfer of Participation Opportunities between sub-Areas A to C below, subject to consultation with, and review and approval of, the YG Contracting Authority.

1a) In-classroom/On-site Training/Skills Development:
Obligation: Minimum number of classroom/on-site Formal Hours to be delivered. This includes formally delivered topical training on subject matter areas/procedures/requirements related to the Contract work;

and/or

1b) Formal (Paid) and Informal (Unpaid) Apprenticeships:
Obligation: Minimum number of days in Formal Paid Apprenticeships and number of days in Informal Unpaid Apprenticeships. This may include Formal Apprenticeship or job shadowing/mentoring of positions held by Contractor site personnel;

and/or

1c) Formal Certification Programs:
Obligation: Minimum dollar-value commitment by the Contractor to cover the costs of one or more Formal Certification Programs for one or more persons, for each year of the Contract work. This may include costs incurred to obtain trades certifications required for the Contract services.

Area 2) Contracting/Sub-Contracting
The obligation of the Contractor will be to establish and maintain contact with YFN and Yukoner businesses to identify opportunities and to place contracts for goods and/or services required on-site for the completion of the Contract. In addition, the Contractor will be required to provide supplier development/business development training to business sub-contractors for spin-off or unrelated contract opportunities within the Contractor's supply chain. Specific measures will be proposed by the Contractor in consultation with YG, but may include administrative enhancements, systems development, and business process engineering measures. The latter may also be undertaken outside of the Contract.

The affected YFNs have identified capacity and priority for Participation in Contracting/Subcontracting opportunities in the following areas:

- Fuel supply and delivery;
- Diesel supply and delivery;
- Lubricant supply and delivery;
- Heavy Equipment Operations;
- Water Treatment Operations; and
- Equipment lease and maintenance/expediting (interest expressed in developing capacity in the latter).

The Participation outcomes for Contracting/Sub-Contracting will be expressed within RFPs/Contracts as a percentage of the overall dollar-value of the Contract requirements established for all requirements, each year, under the Contract.

Should the dollar value of the Contract requirements increase over the life of the Contract, the agreed %-values would remain fixed, however, the net effect could be an increase in the actual dollars spent by the Contractor in contracting/subcontracting with YFN and Yukoner businesses.

A definition, similar to that contained within the federal Procurement Strategy for Aboriginal Business, will be established within the Contract as to how a business is defined as either a YFN business or Yukon business, for the purpose of identifying whether contractor/sub-contractor engagements contribute towards the Contractor's commitment for this Area.

Terms and conditions will also be included within the Contract relating to the requirement to identify contractors/sub-contractors and establish contracts in an ethical and non-conflicted manner aimed at achieving best value. A two-way appeal mechanism to the YG Contracting Authority will be established for YFNs/Yukoners and for the Contractor to identify any unfair practices (e.g. suspected collusion, price fixing, monopolistic practices, etc.) that arise over the life of the contract, for review and, if required, investigation and/or appropriate remedy.

In the event that the Contractor, through best efforts, and completion of the consultation and review/adjustment process, is unable to fulfill its Participation commitment to YFNs in this area, the Contractor may request a transfer to Area 3 Direct Employment. Should Contractor best efforts and completion of the consultation and review/adjustment process result in the inability to fulfill the transferred Participation outputs to YFNs within this area, the Participation opportunity may be transferred to the Yukon Participant group, pending the approval of the YG Contracting Authority.

Area 3) Direct Employment

Based on the Contractor's own determination of its needs vis-à-vis the use of paid employees (as opposed to the use of contractors/sub-contractors) to undertake the Work, the Contractor will be required to employ a minimum percentage of its full-time-equivalent (FTE) positions using the services of YFN peoples and Yukoners, in positions required on-site for the completion of the Contract.

The affected YFNs have identified a desire to participate in Direct Employment opportunities in the following areas:

- Payroll/Administration;
- Trades (Welding, Millwrighting, Electrician);
- Professional (Lab Analysis, Water Treatment Operations, Plant Operations);
- Site Security;
- Community Liaison to support employment; and
- Following completion of training/capacity building under Area 1, Site Management.

The Participation commitment for Direct Employment will be expressed in the RFP/contract as a percentage of the overall hours of direct employment for the Contract requirements established for all requirements, each year, under the contract.

In fulfilling its obligations under the Contract, the Contractor may request the transfer of Participation Opportunities between Area 2 Contracting/Sub-Contracting and Area 3 Direct Employment only, subject to consultation with, and review and approval of, the YG Contracting Authority.

In the event that the Contractor, through best efforts and completion of the consultation and review/adjustment process, is unable to fulfill its Participation commitment to YFNs in this area, the Contractor may request a transfer to Area 2 Contracting/Sub-Contracting. Should Contractor best efforts, and completion of the consultation and review/adjustment process result in the inability to fulfill the transferred Participation commitment to YFNs in this area, the Participation opportunity may be transferred to the Yukon Participant group, pending the approval of the YG Contracting Authority.

Appendix K
Grum Building Lease

Appendix K1
Lease Agreement between the Town of Faro and CH2M HILL

LEASE AGREEMENT

This lease agreement (this "Lease") is made as of May 1, 2012, by and between Town of Faro, Yukon Territory, Canada (“Lessor”), andCH2M HILL Canada Limited (“Lessee”).

1. Location. Lessor hereby leases to Lessee

   - Administration Building
   - Warehouse Building

   of interior, heated and cooled space the (the "Property”) located at the Faro Mining site - Vangorda/Grum Pit area, (the "Premises”).

2. Term. The term of this lease shall be for a term of 12 months, commencing on _____ 1, 2012.

3. Rent/No Deposit. Lessee shall pay to Lessor, the sum of $150,000.00 for the use of the Administration Building and the Warehouse Building from _____ 1, 2012 through _____, 2013. Payment will be made in two installments. First installment will be due by _____, 2012. Second installment will be due by _____, 2012.

   Lessee shall not be required to provide any security deposit but will remain liable for any damages as set forth under this Lease.

4. Signs. All signs will be submitted to Lessor for approval, which shall not be unreasonably withheld.

5. Use. The Property shall be used for conducting the daily operations, planning and direction of exploration field work and any associated businesses which may reasonably arise of Lessee’s engineering and construction business. Lessor agrees that it shall not disturb the Lessee's quiet enjoyment of the Property provided no default has occurred.

6. Taxes. Lessor shall pay all advalorem taxes assessed against the Property. Lessee shall pay all personal property taxes duly assessed against Lessee’s personal property located on the Property.

7. Utilities. Lessee shall pay for all utilities which it consumes at the Premises.

8. Maintenance. Lessor shall be responsible for all maintenance of the grounds and improvements at the Premises including but not limited to the foundation, structural components, landscaping, roof, exterior doors and walls, windows, plumbing, heating, air conditioning, and electrical systems associated with the Premises. Lessee shall be responsible for routine maintenance of the interior of the Premises including walls, doors, floors, ceilings, and light bulbs. If however, any interior maintenance problem arises which is due to structure or faulty construction, Lessor shall be responsible for its repair. Lessee agrees to return the Premises to Lessor at the expiration of the term of the Lease in the same or similar condition as existed upon the Lease Commencement, except for ordinary wear and tear. See Attachment A for explanation of Lessor and Yukon Government’s arrangement to cover the first $10,000 of costs.

9. Improvements. Lessee shall not construct improvements or additions to the Premises without the written consent of the Lessor. Lessor agrees, however, that as part of Lessee’s business that certain fixtures and equipment will have to be installed at the Premises and hereby consents to these reasonable installations.

10. Laws. Lessor will keep the premises in a safe condition and will comply at all times applicable laws, regulations, or ordinances.

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11. Access. Lessee will permit the Lessor and/or its agents or authorized representatives to enter upon the Premises at all reasonable times during reasonable business hours with advance written notice for the purpose of inspecting it and without disrupting Lessee's business operations.

12. Insurance. Lessor shall maintain property insurance on the Property, but Lessee shall be responsible for maintaining $2,000,000 Commercial General Liability and $1,000,000 tenant legal insurance.

13. Casualty. If all or a portion of the Premises is damaged or destroyed by fire or other casualty or taken by eminent domain, to the extent that Lessee is unable to conduct its reasonable and ordinary business operations, either party may terminate this Lease with 30 days' written notice, or Lessor may restore the Premises to its former condition as soon as practical but within 30 days, and during this restoration period, the rent payments shall abate from the date of the casualty until the Premises is restored. All insurance proceeds and eminent domain damages, compensation and award shall be the property of Lessor.

14. Entire Agreement. This Lease contains the entire understanding and agreement between the parties and supersedes all prior negotiations, understandings, and agreements between the parties.

15. Amendments and Waiver. This Lease, or any of its terms, may be amended, terminated, or waived only by an instrument in writing signed by the parties.

16. Successors/Assignment. This Lease shall be binding upon and inure to the benefit of the respective successors and permitted assigns of the parties. No party may assign any of its rights or obligations under this Lease without the written consent of the other party, except Lessee may assign its rights to its affiliates or to the Yukon Government.

17. Governing Law. This Lease shall be governed by the laws of the Yukon Territory, Canada.

18. Notices. All notices shall be deemed given when provided in writing, delivered by certified mail, or overnight delivery (trackable) and addressed to the party as follows or as designated in writing by a party. . Notices may be emailed or fax, if followed by hardcopy.

To Lessor:

Town of Faro
P.O. Box 580
Faro, Yukon, Y0B 1K0

Attn: Tom Lie
Chief Administrative Officer

To Lessee:

CH2M HILL Canada Limited
Attn: Corporate Real Estate
9191 S. Jamaica Street
Englewood, CO 80112
USA
Fax: 720.286.8357
Email: Lisa.Loprino@CH2M.com

and

CH2M HILL Canada Limited
Attn: Nancy Sielaff/Contract Admin
1400, 1100 - 1st Street SE
Calgary, AB T2G 1B1

Phone: 403.407.6318
Fax: 720.286.8106
Email: nsielaff@ch2m.com

This Lease, including all Attachments hereto,

- Attachment A - Attachment A –Responsibilities of the Town of Faro and Yukon Government

The parties executed this Lease as of the above date.

Lessor:		**Lessee:**	
Town of Faro		**CH2M HILL Canada Limited**	
By:	_____	By:	_____
Date:	_____	Date:	_____
	Print Information Below:		
Name:	_____	Name:	_____
Title:	_____	Title:	_____
Address:	_____	Address:	_____
City, Province	_____	City, Province	_____
Phone:	_____	Phone:	_____
Facsimile:	_____	Facsimile:	_____
Email:	_____	Email:	_____

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Attachment A –Responsibilities of the Town of Faro and Yukon Government

Lease of Administrative Building and Warehouse Building located at the Vangorda/Grum Pit area, Yukon Mine.

Town of Faro Responsibilities:

- Lease the 2 buildings to CH2M HILL Canada Limited
- Responsible for the costs of any repairs, upgrades or improves after an initial $10,000.00 has been invested by the Yukon Government
- Maintain safe buildings (structure) as per Territorial standard for occupation.
- Provide property insurance for the buildings (shell) and any property owned by the Town of Faro.
- Agrees to transfer lease to Yukon Government if required.

Yukon Government Responsibilities:

- Responsible for the costs of any repairs, upgrades or improves up to $10,000.00. Costs after $10,000 are the responsibility of the Town of Faro.
- Initial cleaning of buildings.
- Verify that buildings are to Territorial standard for occupation.
- All doors, windows and locks are to be in good repair.
- Have maintenance and or repairs done by a licensed company to certify the HVAC system is operating and providing good air quality.
- Isolate the downstairs washrooms from the HVAC system
- Isolate the downstairs washrooms from entry. Preferably locked and key not to be in CH2M HILL's possession.
- Provide electricity to both buildings
- Provide any office furnishings that are currently located in the buildings.
- Where possible, remove any equipment, materials, etc left by others.

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Appendix K2
Trailer Rental Costs

Faro 2012 Field Operations Administrative Trailer ROM Costs

(ver. 20120210a)

ADMINISTRATIVE TRAILERS					Remarks
Unit Size	**Qty**	**5 MONTHS**	**12 MONTHS**	**24 MONTHS**	
10 X 40	4	98,700	117,360	137,520	
Office Furniture - rent	1	4,600			
Office Furniture - own	1		6,800	6,800	
Temp Power supply (one time)					
Furnish & set Pole	1	1,032	1,032	1,032	
Handle ,Excv & BF Pole	1	856	856	856	
Power drop & Pannel	1	6,680	6,680	6,680	
Run Lines & Hook ups	1	1,848	1,848	1,848	
Remove System	1	1,200	1,200	1,200	
Set Office Furniture	1	1,700	1,700	1,700	
Stairs,rail,landing (5 ea)	1	920	920	920	
Walk Way Connectors	1	1,880	1,880	1,880	
	Subtotal:	119,416	140,276	160,436	
	Markup 5%:	5,971	7,014	8,022	
	TOTAL:	125,387	147,290	168,458	
WASHROOM TRAILER (required regardless)					
12 X 32 RESTROOM	1	46,025	65,080	108,580	
Propane tank rental (yrly only)	1	150	150	300	
Propane & Delivery	1	7,600	9,880	19,760	
Water (Bulk)	1	27,900	37,665	75,330	Assumes no reduction for winter months
Water Tank (allow for 2 tanks)	1	3,000	3,000	3,000	
Sewage Pickup	1	20,000	27,000	54,000	
Plumb WT to Toilet Trlr	1	960	960	960	
	Subtotal:	105,635	143,735	261,930	
	5% markup	5,282	7,187	13,097	
	TOTAL:	110,917	150,922	275,027	

Appendix L
Resourcing

APPENDIX L

Resourcing

Yukon
Energy, Mines and Resources
Assessment and Abandoned Mines

At the time of drafting, Canada, as represented by AANDC and YG, share responsibility for the execution of the Project as co-proponents. However, work is currently underway to review this management approach; in particular, the decision to combine both governments in a co-proponent role and be co-signatories to all permits and authorizations (Borbey, 2010).

YG has established a FPET, located in Whitehorse and made up of YG employees and consultants. The current organizational structure of this team was reviewed and approved by the Faro Management Board; however, this structure has been amended to represent the nature and extent of resources required to successfully implement the Medium Term Plan (provided in Table L-1 and Figure L-1). This team holds the responsibility for executing the major scope components of this plan. A companion team in Ottawa, made up of AANDC employees and under the umbrella of the Contaminated Sites Program, is responsible for the execution of a concurrent work plan. Jointly, both groups are accountable to the Faro Management Board for progress and performance against these plans as presented by the Faro Project Director (YG) and Faro Project Sponsor (AANDC).

Approval of the Medium Term Plan provides the certainty required to complete the resourcing of the FMRP. When based upon an annual cycle, long-term planning around resource needs proved extremely challenging; evolution to a phased planning approach addresses many of the fundamental reasons behind these challenges and mitigates the risks associated with them. While the organizational approach of the FPET will continue to evolve and adapt to meet the future needs of the Project, full project resourcing is projected to be completed following plan approval. For the Medium Term, this process will predominantly rely on utilizing embedded resources provided by the PDT.

TABLE L-1
Current Organization Structure
Faro Mine Remediation Project

Position	Roles and Responsibilities	Current Incumbent
Faro Project Director	• *See governance section*	Stephen Mead
Project Assistant	Provides direct assistance to the Project Director in areas including, but not limited to: • Document review and approvals • Execution Plan development • Meeting and conference preparation • Project reporting • Issues management • Community engagement	Emilie Hamm
Project Manager: O&M	• Lead and direct overall site operations and maintenance • Long-term strategic site planning • Strategic integration with Remediation Group • Fulfilling O&M reporting requirements • Interface with AYFN on relevant matters with respect to the FMRP • Interface with financial, contracting and legal services • Procurement of C&M Contractor • Management of assets, environmental condition, operations and maintenance	Kaori Torigai

TABLE L-1
Current Organization Structure
Faro Mine Remediation Project

Position	Roles and Responsibilities	Current Incumbent
Operations Lead	• Management of contaminated water • Overall mine site management, delegated to site authority • Health and safety on site • Operation of water treatment plant and equipment on site • Interface with C&M Contractor's Operations staff • Operations planning and control, with respect to budget, schedule, and scope • Integration of new water treatment plant and other newly constructed works	Vacant – proposed embedded resource sourced from CH2M HILL
Maintenance Lead	• Discipline lead for process, electrical/ instrumentation, mechanical, and civil • Interface with C&M Contractor's Maintenance staff • Maintenance planning and control, with respect to budget, schedule, and scope • Necessary emergency work and repairs • Preventative maintenance	Vacant – proposed embedded resource sourced from CH2M HILL
Manager of Site Assets	• Management of mobile assets (e.g., plant, equipment, and vehicles) • Management of stationary assets (e.g., buildings) • Materials management with respect to spares and consumables • Maintenance of inventory control systems • Logistical support in the form of documents, drawings, or manuals	Kim Stehelin
Manager of Environmental Condition	• Oversight of environmental conditions at FMC • Integration of Environmental Monitoring Program for O&M and overall closure planning • Interface with O&M Contractor and Environmental Monitoring Contractor • Environmental integration of new assets	Vacant – proposed embedded resource sourced from CH2M HILL
Operations Advisor	• Issue-specific technical input and advice on aspects of site operations	Consultant support as needed
Head of Engineering	• Under development	Vacant – proposed embedded resource sourced from CH2M HILL
Project Manager: Engineering Support and Site Investigations	• Under development	Karen Furlong
Senior Project Manager: Execution	• Planning – Coordinate annual and phase work planning for all FMRP activities – Participate in strategic planning, including AYFN /Yukoner participation and project-wide delivery strategies – Participate in total project work planning (phase, multi-phase) – Participate in and/or assist Project Director with other planning activities, as required • Risk Management • Procurement – Responsible for planning and management of procurement approaches for delivery of Remediation Work Packages – Proposal and tender evaluation and recommendation for award – Work with Contracts group in preparation of Requests for Proposal, Requests for Qualifications, calls for tender, Standing Offer Agreements, purchase orders, and contracts – Conduct debriefings for unsuccessful proponents – Participate in bid challenge and other dispute resolution processes, as required • Implementation – Ensure successful organization, coordination and delivery of all Remediation Work Packages and other Work in the Remediation/ Execution stream	Deborah Pitt

TABLE L-1
Current Organization Structure
Faro Mine Remediation Project

Position	Roles and Responsibilities	Current Incumbent
	– Management-level integration with all other Project streams, particularly Engineering and O&M (Medium Term) – Day-to-day management, troubleshooting and course correction • Project Controls – Ensure adequate and accurate scope, schedule and budget control through the Project Controls group – Cost and schedule forecasting for planning purposes • Quality Management – Ensure all government-mandated quality assurance and quality control processes are implemented and standards met – Encourage, enable and support continual quality improvements in all aspects of FPET operations – Ensure gathering and provision of applicable data and intelligence, perform strengths, weaknesses, opportunities, and threats (Strengths, Weaknesses, Opportunities, Threats [SWOT]) analysis, and lead development and/or improvement of quality management processes and systems • Team Coordination – Coordination and/or management of all required resources from FPET, AANDC, PDT, technical advisors, and IE to meet objectives of work in the Remediation and Execution stream • Reporting – Performance and Progress Reporting - Review and provide feedback on reporting outputs from all Project streams, as compiled by Project Assistant – Recommend reports to Project Director for approval and manage subsequent delivery to recipient agencies – Prepare and present performance and progress reports to Senior Management and others, as required • Provide assistance to and relief for Project Director, as required	
Project Controls Manager	• Cost control, with respect to cost forecasting, day-to-day cost management, and administration of change control processes • Schedule control, with respect to schedule planning, day-to-day schedule management and administration of change control processes • Trend analysis through earned value analysis, monitoring of cost and schedule performance, and alerting relevant Project Manager of issues requiring resolution • Claims Management through claims quantification and administration of claims processes • Contribution to mandated reporting to AANDC and YG • Participate in presentation of performance and progress reports to Senior Management and others, as required	Vacant – proposed embedded resource sourced from CH2M HILL
Project Controls Assistant	• Management and maintenance of cost tracking tools and assist Project Controls Manager with cost management tasks • Management and maintenance of schedule tracking tools and assist Project Controls Manager with schedule management tasks • Assist Project Controls Manager with preparation of project controls-related reporting • Provide assistance to and relief for Project Controls Manager, as required	Katrina Wohlfarth
Project Manager: Remediation	• Participate in annual work planning for entire scope of remediation works • Detailed planning of assigned Remediation Work Packages and assist in long-range work planning • Manage procurement approaches for delivery of assigned Remediation Work Packages • Proposal and tender evaluation and recommendation for award	Dustin Rainey

TABLE L-1
Current Organization Structure
Faro Mine Remediation Project

Position	Roles and Responsibilities	Current Incumbent
	• Work with Contracts group and Senior Project Manager – Execution in the preparation of Requests for Proposal, Requests for Qualifications, calls for tender, Standing Offer Agreements, purchase orders, and contracts • Participate in debriefings for unsuccessful proponents • Participate in bid challenge and other dispute resolution processes, as required • Ensure successful delivery of all assigned Remediation Work Packages • Implement FMRP, with respect to day-to-day management, troubleshooting, and course correction • Work with Project Controls group to ensure adequate and accurate scope, schedule, and budget control for assigned Work Packages; • Contribute to cost and schedule forecasting for planning purposes • Contribute to mandated reporting to AANDC and YG and participates in presentation of performance and progress reports to Senior Management and others, as required • Provide assistance to and relief for Senior Project Manager – Execution, as required	
Project Officer: Remediation	• Implementation of FMRP, by assisting in activities associated with implementation of Remediation Work Packages and assuming responsibility for delegated tasks • Assist Project Manager – Remediation with project controls-related tasks • Assist Project Manager – Remediation with preparation of project-related reporting • Provide assistance to and relief for Project Manager – Remediation, as required	Vacant
Quality and Integration Manager	• Implementation and management of government-mandated quality assurance and quality control processes • Coordinate gathering and compilation of applicable data/intelligence, participate in SWOT analysis and participate in development and/or improvement of quality management processes and systems • Act as day-to-day interface with IE • Provide operational interface among Remediation and Execution, Engineering, and O&M streams, as required • Contribute to mandated reporting to AANDC and YG • Participate in presentation of performance and progress reports to Senior Management and others, as required	Vacant
Project Assistant: Performance and Progress Reporting	• Coordinate and compile reporting outputs of all applicable Project streams for review of Senior Project Manager – Execution before recommendation to Project Director • Manage and troubleshoot delivery of reports to receiving entities • Maintain associated digital document libraries (i.e., SharePoint) • Participate in preparation and presentation of performance and progress reports to Senior Management and others, as required • Provide necessary operational assistance to Senior Project Manager – Execution and the Remediation and Execution Team, as required	Alistair Maitland
Manager of Faro Support Services	• Supervision of finance, contracting, communications and administrative staff • Management of financial reporting, budgeting and procurement requirements • Ensure financial information, including budgeting and reporting requirements for YG and Canada, are met • Provide research and analysis of information and reports in support of FMRP • Management of financial, records and information databases	Vacant
Financial Officer	• Supervision of Finance staff • Prepare monthly, quarterly, and annual financial reports for YG and Canada • Audits and verifies accuracy of financial information • Manages financial database	Levi Larkin-Boyle
Finance Assistant	• Audits invoices for compliance against contracts or payment authorizations • Reconciliation of various financial transactions • Provides data entry function of financial transactions	Stephanie Pozzo
Finance Assistant	• Audit invoices for compliance against contracts or payment authorizations • Reconciliation of various financial transactions • Provide data entry function of financial transactions	Vacant

TABLE L-1
Current Organization Structure
Faro Mine Remediation Project

Position	Roles and Responsibilities	Current Incumbent
Contracting Officer	• Supervise Contract staff • Evaluate procurement requirements • Prepare tender documents for review and distribution • Advise and assist with evaluation of tenders • Prepare contract documents for approval and signature • Maintain and update templates for tenders and contracts	Carenn Kormos
Contracting Officer	• Supervise Contract staff • Evaluate procurement requirements • Prepare tender documents for review and distribution • Advise and assist with evaluation of tenders • Prepare contract documents for approval and signature • Maintain and update templates for tenders and contracts	Monique Raitchey
Contract Assistant	• Prepare tender and contract documents • Administer contractor requirements • Provide data entry function for contract transactions	Geena Grossinger
Communications Officer	• Develop and implement information strategies and plans • Develop communications tools • Organize and implement promotional material and campaigns • Responsible for ensuring public participation and consultation needs are met	Brigitte Parker

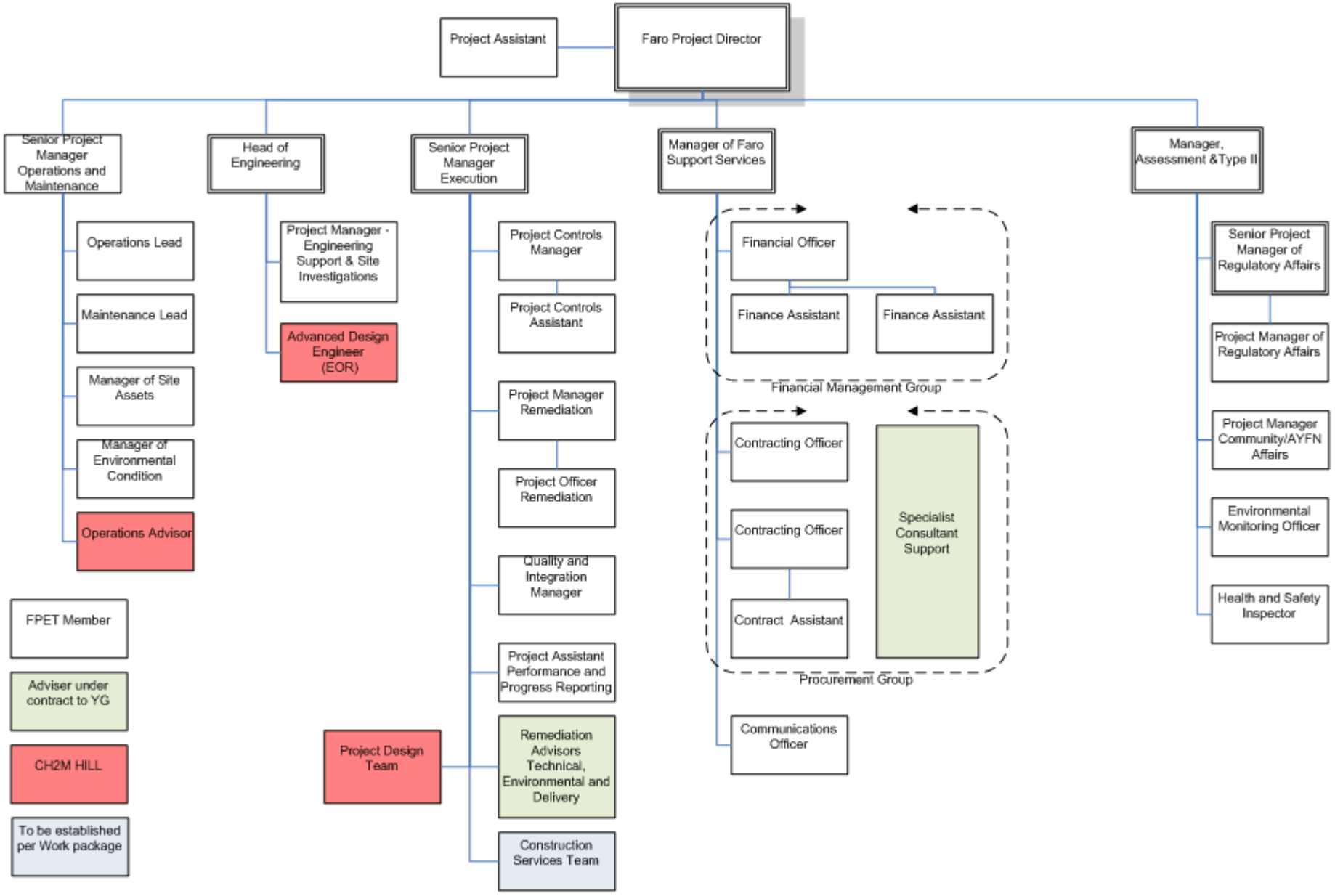


FIGURE L-1
Organizational Structure to Support Medium Term Plan
Faro Mine Remediation Project

Appendix M
Medium Term Plan Scoping

Appendix M1
Final Review Comments – Rose Creek Tailings Area Workshop, Faro Mine Remediation Project (IPRP, 2012)

TECHNICAL MEMORANDUM

TO: **Mr. Peter Mackenzie, P.Eng., Aboriginal Affairs and Northern Development Canada (AANDC)**

FROM: **Independent Peer Review Panel (IPRP)**
Review Team Participants – Andy Robertson, Randy Knapp, Ian Hutchison, Kenneth Raven.

DATE: **September 18, 2012**

RE: **Final Review Comments – Rose Creek Tailings Area Workshop, Faro Mine Remediation Project**

INTRODUCTION

On August 29 and 30, 2012 the Independent Peer Review Panel for the Faro Mine Remediation Project met with CH2MHill Project staff, CH2MHill Technical Review Board, Yukon government representatives and federal government as represented by Aboriginal Affairs and Northern Development Canada in the offices of CH2MHill offices in Burnaby, British Columbia.

The purpose of the 2-day workshop was to:

- present the alternatives under review by CH2MHill for the Rose Creek Tailings Area;
- present the results of the potential failure modes and effects analysis, risk assessment, and cost estimates;
- receive feedback from the Yukon government, AANDC and the IPRP regarding the risk assessment; and
- attempt to obtain general consensus for a selected alternative.

The IPRP was represented by Andy Robertson, Randy Knapp, Ian Hutchison and Kenneth Raven. Electronic copies of relevant CH2MHill reports including the *Draft Report on Alternatives Evaluation and Risk Analyses for the Rose Creek Tailings Area, Faro Mine*, and *the Final Gap Assessment Report, Faro Mine Remediation Project* were provided to the IPRP in advance of the 2-day workshop.

The three alternatives presented by CH2MHill for the Rose Creek Tailings Area that were the main subject of the workshop, include:

- Alternative 1 – Routing of the full Probable Maximum Flood (PMF) through a modified (widened and deepened) Rose Creek Diversion (RCD) with no flow entering the tailings storage area.

- Alternative 2 – Channelling of flows greater than the 500-year flood over the top of an overflow weir and into a single, large, armoured channel (the side channel) designed to carry the difference between the PMF and the 500-year flood flow. The side channel would run parallel and immediately adjacent to the RCD, principally founded on soil and bedrock, with the north dyke dividing the RCD and the proposed side channel. Construction of energy dissipation structures to control erosion and an improved spillway to route the flow across the tailings and around the intermediate dam (ID) are central elements of this Alternative.

- Alternative 3 – Routing of flows that exceed the 500-year flood up to the PMF flood over an overflow weir structure into the Rose Creek tailings Area (RCTA) and over a covered tailings surface via a single wide riprap-lined swale (about 120 m wide and 1.5 m deep) dedicated to containing the flood flow until a pool has formed that would be able to dissipate the energy during the flood peaks. Construction of an improved spillway around the ID is also a central element of this Alternative.

The IPRP recognizes that it is currently a pivotal time for decision making concerning remediation alternatives and appreciates the opportunity of assisting Faro Remediation Project staff and territorial and federal governments in refining and selecting remediation alternatives for the Faro Mine site.

In addition, the IPRP was asked at the workshop to comment on down valley hydraulic mitigations presented by CH2MHill at the workshop.

FINDINGS AND RECOMMENDATIONS

The following statements comprise the findings and recommendations of the IPRP concerning the alternatives evaluation as given in the CH2MHill reports and the presentations made by CH2MHill at the workshop.

1. Based on the information available the three alternatives for addressing the PMF at the RCTA would appear to represent the plausible and feasible range of alternatives for routing of the PMF around/through the Rose Creek Valley.

2. The risk analyses and assessment process for the three Alternatives for RCTA was a useful platform for understanding the relative risks and potential failure modes, where failure is understood to be defined as release of tailings from the RCTA.

3. The inclusion of the side channel into Alternatives 2 and 3 is a major engineering improvement to the earlier alternatives developed in the Draft Closure and Remediation Plan developed by SRK Consulting Engineers and Scientists in 2010.

4. The IPRP considers that Alternatives 2 and 3 are variants on one remediation alternative and that a preferred Alternative for the site could be developed based on

engineering optimization of Alternatives 2 and 3 with the intent of maximizing cost effectiveness and selecting the parts of both Alternatives that best accommodate RCTA site conditions.

5. Recognizing the need to select a preferred Alternative for passing PMF flows through Rose Creek Valley, we recommend that such decisions need to consider all of the potential interactions such decisions may have with other elements of remediation of the Faro Mine site. Such potentially interactive remediation elements include surface water management, groundwater collection systems, tailings covers, spillway designs and role of the Cross Valley Dam (CVD). In order to address this concern, the design of these other remediation elements should be taken to a level that demonstrates feasibility and definitive layouts.

6. The IPRP considers that the risks of failure for Alternative 1 may be underestimated (i.e., landslides and ice blockages). Based on historical community concerns and risk mitigation requirements, Alternative 1 should include a PMF spillway at the ID, comprehensive erosion protection measures in the RCD channel between the ID and downstream discharge point, and consideration of a fish ladder. Otherwise, Alternative 1 may be perceived as potentially posing a threat of catastrophic failure to the ID.

7. The IPRP considers that the risks of failure for Alternatives 2 and 3 may be overestimated with respect to the environmental impacts of tailings erosion (Type 1 and Type 2 tailings releases). The IPRP is of the opinion that Type 1 releases should not be considered a failure mode under extreme runoff conditions, and Type 2 releases under similar conditions should be considered of low significance. Under PMF conditions, these losses may well be indistinguishable from background and only a small fraction of losses from other waste management facilities at the site (e.g., erosional losses from the waste rock dumps).

8. The CH2MHill analyses of the alternatives for routing the PMF through Rose Creek Valley assume that the Cross Valley Dam is removed. The IPRP continues to recommend that the Cross Valley Dam be retained, if for no other reason than to provide an emergency water storage facility to accommodate groundwater discharges to surface during upsets and power outages to the main RCTA seepage collection system. In addition, the Cross Valley Dam could provide for some sedimentation of tailings eroded during extreme runoff events.

9. The proposed ground support systems to allow tailings excavation and replacement described as part of Alternative 2 for supporting the side channel is a major engineering improvement. However, the IPRP questions whether this approach is necessary and cost-effective. Alternative approaches such as incremental loading with/without wick drains and soil improvements using compacted sand/stone columns may achieve the necessary ground strengths at lower costs.

10. Information needed to refine Alternatives for passing the PMF through Rose Creek Valley includes:

    - Tailings depths and properties in the area of the proposed side channel section to determine deformation properties/strengths and to optimize the cut and fill design.

    - Thermal regime and stability of the up-slope materials (soil and bedrock) on the north-facing slope of the RCD and underlying the RCD to further assess potential for landslide plugging of the RCD and potentially the proposed side channel.

    - Ground conditions in the areas of proposed spillways around the ID and the CVD to optimize design.

REVIEW COMMENTS – DOWN VALLEY HYDRAULIC MITIGATIONS

1. The current spillway system at the Intermediate Dam does not meet the Canadian Dam Association (CDA)- Dam Safety Guidelines for "Very High Hazard" classification for which the consequences of a failure would be a "significant/major loss or deterioration of important/critical fish or wildlife habitat for which restoration or compensation in kind is possible but impractical". The current spillway system is reported to have a capacity of approximately 30-40 m^3/s, which is less than the maximum flow that has been measured in RCD and would have to be passed in the event of RCD blockage. It is also far less than the 674 m^3/s PMF protection that is required (this assumes the haul road rock drain is removed).

2. We have been told that it may take from 10 to 15 years to install the final long-term spillway capacity. This period is consistent with an operating period rather than a temporary construction period and the IPRP considers the CDA Guidelines are applicable. The IPRP notes that the annual potential for flood exceedance for the RCD channel is about 1 in 300 (this is a rough estimate). For a 15 year service life the probability of failure could be as high as 1 in 20 or 5% which is unacceptable for a structure of this classification.

3. We therefore recommend that immediate attention be given to upgrading the spillway capacity of the ID as soon as possible. Our preferred approach is to build out the final spillway that is capable of handling the PMF. Initially this should be at least for the catchment area that currently drains to the RCD including the attenuation provided by the haul road rock drain (provided this is retained). The IPRP notes that the hazard classification for CVD is "significant" resulting in a flood design criteria of 1 in 100 to 1 in 1000, which the IPRP understands is closer to the current capacity – which should be verified and addressed appropriately.

4. Since it takes time for design and contractor mobilization and obtaining budget approvals, other short-term improvements should be considered that lead to a significant reduction in the current risk. A range of cost-effective measures selected from the modified list of those presented by CH2MHill in the workshop (see Attachment A) should be further evaluated and a list of feasible options that together achieve an acceptable risk reduction should be implemented expeditiously.

Attachment A – Potential ID Flood Capacity Improvement Options (CH2MHill 3/30/20120 modified by IPRP)

- Increase hydraulic capacity of spillway
  - Install trench fitted with erodible fuse plug
  - Increase width and depth of current spillway cut
  - Provide more regular bottom surface of channel (concrete slab, etc.)

- Increase height of embankment crest
  - Engineer as necessary (e.g. geosynthetic core extension), thermal cover to prevent piping and allow higher flood level
  - Add temporary crest berm

- Protect spillway channel from erosion (Reno/gabion mattress, etc.)

- Increase capacity of RCD
  - Remove vegetation
  - Raise north dyke (fill hollows, add temporary berm for protection at design flow; i.e. freeboard)
  - Identify and remove constrictions?

- Continue routine inspections and repairs as necessary (RCD, Spillway)

Appendix M2
Comments on Medium Term Hydrogeology Work Plans (RGC, 2012)

Consulting Engineers and Scientists for the Mining Industry
Suite 640, 580 Hornby St., Vancouver BC, Canada V6C 3B6
Phone (604) 684-8072 Fax (604) 684-8073
www.robertsongeoconsultants.com

October 16, 2012

Yukon Government
Faro Project Management Team
Assessment and Abandoned Mines

Attention: Deborah Pitt

RE: Comments on Medium Term Hydrogeology Work Plans, Anvil Range Mining Complex, YT REV 0

Deb,

As requested, this brief letter report summarizes my comments on the medium term (5 year) work plans developed by CH2MHILL ("CH2M") related to the design of seepage interception systems for the Anvil Range Mining Complex, YT.

The comments summarized here are based on several discussions the writer has held via teleconference with representatives from YG and from CH2M between September 6 and October 1, 2012.

In brief, three hydrogeology-related projects have been identified by CHM2 and YG to be considered for inclusion in the 5-year plan:

- Cross Valley Dam Seepage Interception System ("SIS")
- Emergency Tailings Area SIS
- North Fork Rose Creek/ Zone 2 Outwash Area

A general rationale for, and overview of, the proposed scope for those three projects was provided in a power point presentation prepared by CH2M entitled "2012-9-21- scope extract ETA NFRC CVD-jspitzley-final.pdf". The rationale and scope of these projects was subsequently discussed in more detail in project-specific teleconference meetings.

In the following, the writer provides general comments and recommendations on these proposed medium-term projects (in order of priority).

1 Cross Valley Dam Seepage Interception System ("SIS")

The CVD SIS was briefly discussed in a teleconference call between Deborah Pitt, John Spitzley and the writer on October 1. The writer fully supports the inclusion of the proposed CVD SIS project into the 5 year work plan for the following reasons:

- The CVD SIS represents a critical element in the ARMC closure plan ("final line of defense"; major inflow to WTP) requiring careful study and design
- There is some potential that contaminant breakthrough in the Rose Creek aquifer at the CVD could occur over the next 5-10 years that could lead to potential exceedances in water quality objectives in Rose Creek (at X16)
- The design of a SIS in the Rose Creek Valley Aquifer is sufficiently complex (deep wells, large pumping volumes, year-round operation) that a design should be completed well in advance of an immediate need for such an SIS.

The writer is in general agreement with the proposed scope of work, specifically:

- Alignment of SIS downstream of CVD
- Completion of Field Work in 2012/13 (Drilling, Hydraulic Testing)
- Design of SIS (including optional cutoff wall) in 2013/14 (Flow Modeling)
- IPRP review, EA, Procurement in 2014/15
- Site preparation in 2014-2016

CH2M noted that a fence-of-wells (without a cutoff wall) would likely be proposed for the medium term (should "rapid construction" be required). However, the writer recommends that the option of a cutoff wall (at least in the high-permeability sediments) be given adequate consideration (even for a medium term implementation) as this may significantly reduce the amount of groundwater to be intercepted.

The writer also recommends that adequate consideration be given in the context of the CVD SIS design to:

- The study of the distance over which groundwater discharges to Rose Creek downstream of the toe of the CVD (using field monitoring and numerical modeling)

- Review of the most appropriate location for the surface water compliance point (currently X16) and
- Finalization of the definition of surface water quality objectives in Rose Creek (required for setting performance targets for a CVD SIS which will influence the design).

In the writer's opinion, the design of the CVD SIS should be given the highest priority among the three proposed medium term projects.

2 Emergency Tailings Area SIS

The ETA SIS project was first discussed in a teleconference call on September 6 attended by representatives from YG (Deborah Pitt), CH2M (Peter Lawson, David Bunte, BT Thomas) and the writer. Subsequently, a second teleconference call was held on September 7 with John Brodie, engineer for AANDC. The writer also supports the inclusion of this project into the 5 year work plan for the following reasons:

- The current ETA SIS captures only about 50-60% of the (high) contaminant load from the ETA area into the Rose Creek valley (e.g. RGC, 2010, 2011); the majority of contaminant load from the ETA SIS not being collected ("by-pass") occurs during the winter shut-down period when the ETA seepage is allowed to run into the Intermediate tailings impoundment;
- Groundwater quality in the RCAA is gradually deteriorating, in particular on the north side of the valley; it is likely that ETA seepage by-passing the ETA SIS is contributing to the observed increase in contaminant load observed in the RCAA

The scope of work for the medium term design of the ETA SIS was discussed at length during the teleconference meetings. All participants agreed that the following scope should be included in the medium term design (see email from D. Pitt to group dated September 12 for more details):

- Year round pumping to capture the estimated 40% of load that bypasses the current summer-only system and to reduce winter water management burden to C&M operations;

- Rebuilding of existing collection system or augmenting existing collection system with additional capture capacity, to improve efficiency of the system both laterally and vertically to existing competent bedrock only (surface water collection system); and
- Location of improvements will be upstream of the canyon due to ease of access for maintenance, compatibility with final remedial solution and the fact that most of the load is encountered there.

The following additional points were raised by the writer during the discussions and should be considered during the medium term design of the ETA SIS:

- The writer supports a single collection point (downstream of mine access road) for interim (medium term) solution
- Current and historic monitoring data indicate that most of the contaminant load daylights at the top of the Faro Creek Canyon. Therefore, a shallow interception system located at the top of the canyon (near the existing manhole) and keyed into shallow, weathered bedrock should be adequate to remove most, if not all, of the contaminant load (i.e. grouting of bedrock should not be considered for medium term design)
- Potential measures to reduce erosion of the ETA tailings (and associated sediment transport into the ETA SIS) should be evaluated as part of the medium-term design of the ETA SIS

3 North Fork of Rose Creek / Zone II Outwash Area

The potential scope of work for the North Fork Rose Creek (NFRC)/Zone 2 Outwash Area was discussed in a teleconference call on October 1 attended by representatives from YG (Deborah Pitt), CH2M (John Spitzley) and the writer. In the writer's opinion, this NFRC project is less urgent than the other two projects discussed above. However, this project should also be included into the 5 year work plan because:

- To the best of my knowledge the NFRC is considered fish habitat and there is a potential for future exceedance(s) of water quality objectives in this stream reach

due to the proximity of potential contaminant sources (the backfilled Zone 2 pit, NE WRD and Intermediate WRD) to the NFRC

- Additional hydrogeological studies and monitoring in the NFRC area will be required to further evaluate the design of the NFRC SIS and the requirement of raising the NFRC (as proposed in the current project description, see SRK, 2010)
- A preliminary review of surface water quality data from NFRC showed some recent increases in zinc (at R10 and NF2) which could potentially indicate a gradual increase in contaminant loading (Note: these trends are NOT conclusive at this point due to the relatively short period of consistent monthly monitoring and QA/QC issues with some of the WQ data)

Based on the material provided and discussions with John Spitzley, the primary objective of the NFRC project in the 5-year plan would be to develop an interim design of a groundwater interception system which could be implemented in the medium term, if required. The following general work schedule is currently been envisioned:

- 2013 & 2014: additional field work in NFRC area (drilling & monitoring; study of NFRC-GW interaction)
- 2015: Analysis & Design of SIS options for NFRC (modeling)
- Early 2016: Submit Design of Interim SIS for regulatory approval and implementation (if and when required)

The writer is in general agreement with the proposed scope and scheduling. Monitoring should continue during this study period to ensure that surface water quality in the NFRC remains stable and meets all current water quality guidelines. The above project schedule may, however, have to be accelerated if water quality time trends indicate that a seepage interception system could be required earlier than in 2016.

In addition, the writer has the following recommendations for work to be included in the NFRC project in the 5 year plan:

- Additional monitoring wells should be installed upgradient of the Zone 2 outwash area (near the toe of the NE WRD but also closer to the NFRC) to evaluate the contaminant load from the NE WRD (at present and into the future);

- The lateral (east-west) extent of the zinc plume in the alluvial aquifer underlying the NFRC should be studied by test pitting, drilling and/or geophysics
- The interaction of the NFRC with the underlying aquifer should be evaluated along the reach between R7 and the rock drain using (i) synoptic stream surveys, (ii) hydraulic gradient measurements and (iii) load balance calculations. Field monitoring of hydraulic gradients between the stream and the underlying groundwater table should be completed at different times of the year to capture the seasonal variations in the SW-GW interaction.
- A contaminant load balance should be developed for the NFRC area to explain the current groundwater quality (low sulphate & TDS, moderately elevated zinc) and surface water quality in the NFRC
- During the design phase (modeling), alternative alignments of seepage interception systems should be evaluated, including aligning a fence of pumping wells perpendicular to the NFRC valley (say downstream of the Zone 2 outwash area, near R10)

4 Closure

We trust that the information provided in this letter report meets your requirements.

Please contact the undersigned if you have any questions regarding the content of this report or require further information.

Best regards,

ROBERTSON GEOCONSULTANTS INC.



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5 References

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RGC (2004), Initial Review of Groundwater Quality downstream of the Faro, Grum, and Vangorda WRDs, Yukon Territory. Memo prepared for SRK, July 2004.

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