

APPENDIX E – PROJECT BRIEF

PROJECT BRIEF

This Project Brief is divided into two sections:

- 1) **Description of Project**
- 2) **Description of Services**

For standards relating to the service provisions herein please refer to the document “Doing Business with PWGSC – Pacific Region”. The standards in “Doing Business with PWGSC – Pacific Region” must be adhered to in conjunction with this scope of services.

DESCRIPTION OF PROJECT (PD)

PD 1 PROJECT INFORMATION

Canada intends to retain a firm of architects and engineers specializing in industrial and/or mining water treatment for the provision of the services required for this project.

- 1.1 **PSPC Project Title:** Permanent Water Treatment Plant (PWTP) for the Faro Mine Site (FMS)
- 1.2 **Location of the Project:** Faro, Yukon Territory
- 1.3 **PSPC Project Number:** R.112406.001
- 1.4 **Client / User:** Crown-Indigenous Relations and Northern Affairs Canada

PD 2 PROJECT IDENTIFICATION

2.1 Description

As part of the overall remediation plan for the Faro Mine Site (FMS), Yukon Territory, the existing Interim Water Treatment System (IWTS) serving the FMS requires replacement with a Permanent Water Treatment Plant (PWTP).

Canada requires the advancement and completion of a detailed design of the new PWTP, including Key Disciplines of geotechnical, water treatment process, mechanical, civil, electrical, and architectural design in accordance with the standard industry model for supply of such facilities. Detailed design will be based on the design basis developed as part of the 30% FMS remediation design.

Construction of the PWTP will be separately tendered by the Project’s Main Construction / Care & Maintenance Manager (MCM/C&M). Engineering support is also required during the finalization of tender documentation and tendering of the construction of the PWTP, to lead and provide expertise during the conduct of constructability reviews, facilitate industry understanding of the detailed design during the construction tendering period and to provide design quality assurance during construction and post-completion commissioning, initial operations and warranty period, to support ensuring the constructed facility meets the design objectives and functional and performance requirements for the PWTP.

As further set out in PD5 Program, scope of the detailed design for the complete PWTP facility includes all buildings, foundations, equipment, electrical installations, communication infrastructure, laboratory space (clean room lab and general use lab), washrooms, change rooms and administrative offices for up

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

to six operators/personnel, a 20-person meeting room and any other services or facilities and included conveyance features required for long-term operations of the PWTP.

Canada is seeking a qualified and experienced Engineering firm to provide services for the following phases:

1. Review of available information and documentation and conduct sufficient investigation of site conditions, as required to support development of the PWTP design.
2. Preparation of a detailed design and AACE Class 2 cost estimate for the PWTP as defined herein suitable for Issue For Tender (IFT), including definition of initial commissioning plan and plant operations manual, including draft Standard Operating Procedures.
3. Support for the finalization of a comprehensive tender document covering the scope of services and requirements for the MCM to acquire all requisite construction and related services to build the PWTP and ensure effective integration with associated site infrastructure and systems.
4. Assistance during the construction tender period to support site visit/presentation of the design to industry/community participants, respond to design-related questions, and may include provision of technical subject matter expertise and advice to the MCM in the evaluation of construction contractors.
5. Support to construction oversight, inspections, providing quality assurance.
6. Support to commissioning, including provisioning of a third-party Commissioning Authority, and including operations training, and support to warranty period oversight, inspections, providing quality assurance.

2.2 Schedule

The work will be undertaken in two (2) phases:

- Phase 1 Completion of Detailed Design, Class 2 Cost Estimate and related services (as set out in Appendix E, RS3).
- Phase 2 Delivery of Required Services (as set out in Appendix E, RS4-RS7). Timing for the commencement of Phase 2 is dependent upon the broader FMS Project schedule and would be initiated via a written Authorization process. It is anticipated that Phase 2 will take place over multiple years, spanning 2-3 construction seasons plus the follow-on 12 month warranty period.

Phase 1

The Consultant will deliver a final detailed design and Class 2 cost estimate no later than 10 months following Contract execution in accordance with the following milestones.

Consultant Milestone	Tentative Timeframe – Month Completed
Contract Award for Detailed Design	0
Initial Design Meeting	1
<i>[additional meetings / design review milestones to be inserted based on Consultant's plan]</i>	<i>To be inserted based on Consultant's schedule</i>
TRC Review	At approx. 30% Design - Tbc following Award
30% Design and initial draft cost estimate submitted for review	<i>To be inserted based on Consultant's schedule</i>

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

Consultant Milestone	Tentative Timeframe – Month Completed
TRC and IPRP Review	At approx. 60% Design - Tbc following Award
60% Design and refined draft cost estimate submitted for review	<i>To be inserted based on Consultant's schedule</i>
90% Design and Class 2 cost estimate submitted for review	<i>To be inserted based on Consultant's schedule</i>
Delivery of Detailed Design and Class 2 cost estimate	10 (no later than March 31, 2022)

Phase 2

As authorized by Canada, the Consultant will provide the required services (see RS4-RS7) in accordance with the then current remediation project schedule. Anticipated duration of services, which may be subject to change, is as follows:

Project Activity/Milestone	Anticipated Duration
Delivery of complete Construction Tender documentation by MCM (incorporating any required Consultant's inputs)	Tbc in accordance with MCM/ICM schedule
RFP for Construction issued by MCM	Est. 8 months
Construction Contract Awarded	Tbc in accordance with MCM schedule
On-Site Construction Begins (subject to Construction contractor's schedule)	Targeting 2024
Design Team Site reviews by Consultant	Monthly from commencement of construction to Substantial Completion
Substantial Completion	24 months following commencement of construction
Commissioning and Handover	Tbc in accordance with overall construction project schedule
Construction Warranty Period	12 months
Final Completion	Following conclusion of warranty period

PD 3 PROJECT BACKGROUND

The Faro Mine Complex (FMC) was once the largest open pit lead-zinc mine in the world and operated from 1969 to 1998. The Complex, located in the Yukon Territory, is approximately 25 square kilometers in size and is composed of 3 main areas: the Faro Mine Site, the Rose Creek Tailings area, and the Vangorda Plateau Mine Site. The FMC went into receivership after being abandoned in 1998. The mine is listed as one of the most contaminated sites in Canada and has the potential to leach large amounts of contaminants into the surrounding environment. Canada has now assumed the underlying financial responsibility and oversight associated with the remediation of the site.

This overarching FMS remediation project consists of the following 4 phases:

- Phase A – Selection of a remediation approach
- Phase B – Design and planning

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

- Phase C – Active remediation
- Phase D – Long-Term Operating and Maintenance

The FMS remediation project is currently in Phase B. A detailed remediation project proposal was submitted to the Yukon Environmental and Socio-Economic Assessment Board (YESAB) in the summer of 2019, and investigations and studies to support water licensing are underway. Subsequent to the completion of this assessment and refinement of the design, the Project anticipates advancing to regulatory review to support attainment of water licensing. The remediation is expected to be implemented over a period of approximately 15 years, followed by years of monitoring.

In 2014, based on then current remediation design, a 90% design was completed on behalf of the Yukon Government (YG) for a high-density sludge (HDS) plant with a capacity of 44,100 m³/ day. This work was undertaken by Jacobs Engineering (formerly CH2MHill) (see Attachments Fa & Fb). Plans to construct the plant designed in 2014 were put on hold in 2016 pending a revision of the FMS remediation plan, and completion of an Environmental Assessment and renewal of the Water License for the Project.

The current remediation design calls for a HDS plant with a capacity of 61,000 m³/day. As a result, it is necessary to review, adjust and refine the detailed design for the PWTP to support the overall FMS remediation design. It is anticipated that some parts of the 2014 detailed design could be re-used and other parts could be adapted.

In 2019, a PWTP design basis that is consistent with the current remediation plan was developed by SRK Consulting (see Attachment A) as part of the 30% design of the overall remediation plan for the FMS.

The care and maintenance contractor currently operates the existing Interim Water Treatment System (IWTS) on site. The IWTS treats and discharges treated acid rock drainage and mine contact water collected across the mine site. A new Permanent Water Treatment Plant (PWTP) is required to support ongoing care and maintenance and reclamation activities as well as long-term operation of the site. The existing IWTS is intended to be decommissioned after the new PWTP has been constructed and is operating effectively.

PD 4 EXISTING DOCUMENTATION

Reference	Design Inputs	Available
SRK 2019, PWTP Conceptual Design		See Attachment A
SRK 2019, Volume I, Section 5 Project Description, 2019 Project Proposal Submission to the Yukon Environmental and Socio-economic Assessment Board (YESAB), Faro Mine Remediation Project	General information on the project and the permanent water treatment plant	<i>To be provided following Award.</i>
SRK 2019, Water Management Plan – Faro Mine Remediation Project	Water management strategies	<i>To be provided following Award.</i>
SRK 2019, <i>Water Treatment Plant Design Basis for Faro Permanent Water Treatment Plan</i>	Design treatment capacity	See Attachment B
AWT 2018, Faro Water Treatment Onsite HDS Pilot Plant Testing Report	Hydraulic residence time and reactor sizing Treatment performance and effluent quality objectives	See Attachment C

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

Reference	Design Inputs	Available
SRK 2021, Proposed PWTP Location	Proposed Plant Siting	See Attachment D
Documents related to the 2014 CH2M Canada Ltd. 90% design package		
<i>CH2M 2016, Water Treatment Plant – Plant Siting Cost Benefit Analysis Canada Ltd</i>	Water treatment plant location	<i>To be provided following Award.</i>
<i>CH2M 2014, Faro Treatment Plant Detailed Design Summary + 90% Drawing Package</i>	Power demand and building heating requirements	See Attachment Fa and Fb
<i>CH2M 2014, Faro Water Treatment Plant Geotechnical Design Report Addendum, 2013 Borrow Source and Quarry Investigation, Faro Mine Remediation Project</i>	Historic geologic and geochemical information on proposed borrow areas for the construction of the PWTP	<i>To be provided following Award.</i>
<i>CH2M 2012, Geotechnical Data Water Treatment Plant, Faro Mine Remediation Project</i>	Data and findings from historic geotechnical field exploration in support of the PWTP	<i>To be provided following Award.</i>
<i>CH2M 2012, Influent Characterization/Plant Capacity Phasing, Faro Mine Remediation Project</i>	Historic results of the influent characterization/plant capacity phasing assessment.	<i>To be provided following Award.</i>

PD 5 PROGRAM

As further set out in PD5 Program, scope of the detailed design for the complete PWTP facility includes all buildings, foundations, equipment, electrical installations, communication infrastructure, laboratory space (clean room lab and general use lab), washrooms, change rooms and administrative offices for up to six operators/personnel, a 20-person meeting room and any other services or facilities and included conveyance features required for long-term operations of the PWTP.

In addition, the scope of the PWTP design includes the following conveyance features:

- Conveyance/piping of treated effluent to an outlet structure located near Rose Creek in the Down Valley area (both pipeline and outlet structure is included in the scope);
- A feed water pumping system for conveying water from the Faro Pit to the PWTP;
- An internal recirculation pipe that can convey off-spec effluent back to the Faro Pit;
- A system for pumping high-density sludge to depth at Faro Pit; and
- Connections to other in- or outflows to/from the PWTP at the PWTP building envelope as specified in Table 1 (Battery Limits).

Major components of the PWTP detailed engineering design include (but are not limited to):

- Geotechnical evaluation and civil design of earth-works, excavations, levelling and surface preparation of the PWTP footprint;
- Lime building and foundation;
- Clarifier and foundation;
- Feed pumping system;

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

- Effluent pipe;
- Sludge handling and conveyance system;
- All water treatment unit operations such as reactors, lime slaking and dosing equipment, reagent circuits, effluent filtration system, etc.;
- Distributed Control System with remote operator access, alarm call-out functions that also has the capability to incorporate and manage input from remote seepage interception equipment (motors, instruments, actuators, etc.) installed by others across the Faro site; and
- Facilities for accommodating up to six operators/personnel such as washrooms, offices, lunch/break rooms, first aid room, etc.
- Facilities for accommodating a 20-person meeting room.
- 25m² allowance of un-programmed floorspace, with appropriate adjacency, for the potential addition of an additional reagent to the reactors.

Excluded from the scope of the detailed design are:

- The site wide electrical distribution system beyond a connection to the PWTP transformer electrical distribution system (the PWTP transformer is included in the design scope).
- Fresh water supply.

TABLE 1 – DESIGN BATTERY LIMITS

Item	Design Battery Limits
Building and Enclosures	All building or enclosures required to protect the water treatment plant equipment is included in the design scope.
Foundation	Geotechnical evaluation, design and specification of earth-works, excavations, levelling and surface preparation and foundation design is included in the design scope.
Electrical and Power	Tie-in to a high-voltage cable drop from a transmission pole located near the water treatment facility (pole is out of scope; cable and transformer is in scope)
Feed Water	<p>Feed water pump station installed in the Faro Pit Lake.</p> <p>High-voltage power supply from a pole near the feed water pump station will be designed by others. Cables and transformers are included in the design scope.</p> <p>Systems for conveyance of contact water from the Down Valley Area (DV-SIS) and the Emergency Tailings Area (ETA) SIS will be designed by others. However, external (outside of building envelope) tie-ins for the DV-SIS and ETA-SIS conveyance pipes must be included in the design along with piping, flow meters and flow controls required to convey the water to the feed water tank inside the PWTP. The feed water tank in the PWTP must be able to accommodate feed water from those two sources.</p>
Effluent	The effluent discharge pipe will terminate in an energy dissipation structure near the final discharge location in Rose Creek (30 m to 50 m setback). The water will flow from the energy dissipation structure into a designed channel that will enter Rose Creek. All elements of the effluent discharge system (pipeline, energy dissipation structures and final discharge channel) are included in the design scope. Internal recycling pipe for discharge of off-spec effluent to the surface of Faro Pit is included in the design scope.
Sludge Handling	Sludge discharge pipe that terminates at depth in the Faro Pit is included in the design scope.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

Item	Design Battery Limits
Fresh water	Buried connection to an on-site fresh-water intake well (fresh water for reagent make-up, gland water, wash-down and other general plant uses) to be located outside but near the building perimeter. A fresh water supply that ties into the buried connection suitable for use as (non-potable) freshwater in the plant's operations will be supplied by others. Note that freshwater (non-potable) will also be used for the washrooms and lunchroom fixtures.
Potable water	Potable water will only be required for safety showers and eye wash stations. Safety shower and eye wash stations shall be reservoir-style units that are not dependent on a steady supply of potable water. Note that bottled water will be provided for the plant operators consumption.
Instrument Air	Instrument air required for unit operations is included in the design.

The location of the PWTP on the site will be generally in alignment with the location identified in the site plan (see Attachment E), with the final footprint to be confirmed in the design process.

The Permanent Water Treatment plant (PWTP) is to treat all contact water collected at the FMS. The PWTP will use a high-density sludge (HDS) process which neutralizes acidic contact water and removes dissolved metals and other constituents. Treated effluent from the plant will be discharged to Rose Creek. Sludge produced by the treatment process will be pumped to depth in Faro Pit Lake for permanent disposal.

The normal operating season for the PWTP will be from early May to late October each year. The operating season may be shortened or extended depending on the inventory or flow of contact water requiring treatment but is not intended to operate between December and March. Plant start-up will normally commence each year in mid-April and winterization will be completed by late October.

The design treatment capacities for the PWTP are:

- Nominal treatment capacity: 61,000 m³/day
- Maximum hydraulic capacity: 75,000 m³/day

The design capacity of the lime slaking and dosing system is 6 tonnes/hour.

Contact water collected at the site is pumped into the treatment plant to the first lime reactor. Table 2 provides the estimated influent chemistry. Recycled sludge and lime are mixed together and added to the first reactor tank to increase the pH to around 9.6 to promote metal precipitation. From here the treated water overflows via gravity to a second reactor tank to achieve the desired total residence time of 60 minutes. The option to add lime to the second reactor will be available but not in use during normal operations. Both tanks will be aerated to oxidize ferrous iron and other reduced species. Lime will be slaked onsite and dosed to the process an estimated maximum rate of up to 1.2 kg/m³ of water treated.

The process solution will overflow to a clarifier where the sludge produced in the treatment process will settle. Flocculant will be added to promote settling of sludge. The clarifier overflow will be directed to effluent filtration units that will remove residual suspended solids. The design should include an option for bypassing the filter units. pH adjustment of the clarifier outflow using carbon dioxide (CO₂) will be required to keep the effluent within the expected discharge limits of 6.0 to 9.5. The effluent CO₂ dosing system should have the ability to lower the effluent pH down to 7. The final effluent must be monitored for pH, turbidity and indicator metals to ensure it meets discharge standards. The design must include a system for directing effluent to the Faro Pit Lake when effluent quality does not meet Water License effluent limits.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

The process is expected to generate a sludge with a density between 15% to 35% solids. The sludge is stable under neutral conditions and will be deposited at depth in Faro Pit Lake. In the absence of a new water license for the FMC at the time of commissioning and operation, the PWTP should target the effluent concentrations listed in Table 3 (AWT 2018). The design for the PWTP may need to adjust to changes that arise during water licensing. Any such changes will be considered as a change order.

To address future changes in effluent discharge regulations for various parameters, the design should allow for implementation of additional reagents such as ferric-based coagulants, sodium hydrosulphide or organo-sulphide reagents (hence the requirement for a 25m² allowance of un-programmed floorspace for the potential addition of an additional reagent to the reactors).

TABLE 2: ESTIMATED PWTP INFLUENT CHEMISTRY

Parameter*	Units	Average Feed Chemistry
pH	mg/L	6.4
Aluminum	mg/L	0.31
Antimony	mg/L	<0.005
Arsenic	mg/L	<0.005
Barium	mg/L	0.015
Beryllium	mg/L	<0.001
Bismuth	mg/L	<0.01
Boron	mg/L	<0.5
Cadmium	mg/L	0.04
Chromium	mg/L	<0.01
Cobalt	mg/L	0.33
Copper	mg/L	0.012
Iron	mg/L	59
Lead	mg/L	<0.002
Lithium	mg/L	0.083
Manganese	mg/L	23
Mercury	mg/L	<0.0005
Molybdenum	mg/L	<0.01
Nickel	mg/L	0.44
Selenium	mg/L	<0.001
Silicon	mg/L	4.4
Silver	mg/L	0.00025
Strontium	mg/L	1.1
Thallium	mg/L	0.00081
Tin	mg/L	<0.05
Titanium	mg/L	<0.05
Uranium	mg/L	<0.001
Vanadium	mg/L	<0.05
Zinc	mg/L	180
Zirconium	mg/L	<0.001
Calcium	mg/L	400
Magnesium	mg/L	280
Potassium	mg/L	9.9
Sodium	mg/L	26
Sulphate	mg/L	1,860

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP)
FARO YUKON

Parameter*	Units	Average Feed Chemistry
------------	-------	------------------------

TABLE 3: ESTIMATED LONG-TERM WATER TREATMENT PLANT EFFLUENT QUALITY

Parameter ¹	Units	Value
Sulphate	mg/L	1,860 ²
Aluminum	mg/L	0.050
Arsenic	mg/L	0.01
Cadmium	mg/L	0.00025
Cobalt	mg/L	<0.001
Copper	mg/L	<0.001
Iron	mg/L	0.026
Lead	mg/L	<0.001
Manganese	mg/L	0.104
Zinc	mg/L	0.072
Suspended Solids ³	%	15

Source: AWT 2018

¹ - Metal concentrations listed as dissolved metals

² - The effluent sulphate concentration is not expected to reach 1,860 mg/L until after complete onset of ARD. During the long-term operations and maintenance phase the sulphate concentrations in the pit, and therefore also in the treated effluent, is predicted to be well below 1,860 mg/L.

³ - Metal and Diamond Mining Effluent Regulations, Schedule 3, Table 1.

PD 6 CANADA'S REQUIREMENTS

Canada is seeking to engage an experienced engineering firm with the necessary expertise, capacity and resources to meet the Contract and Design Objectives and program requirements, complete the 90% detailed design (Tender Ready Construction Documents) of the PWTP facility for the FMS including Class 2 cost estimate, initial commissioning plan and plant operations manual, and provide design quality assurance and related support throughout the tendering, construction, commissioning and warranty period of operations.

The Consultant will:

- Review existing information and site conditions for all technical components, including civil (site preparation, including access road, foundation, grading, drainage, etc.), geotechnical, structural, electrical, mechanical, water treatment process, and architectural, while taking into consideration most current codes and climate change impact on foundation / permafrost.
- Prepare the detailed design and Class 2 cost estimate for the PWTP, including initial commissioning plan and plant operations manual. This work will progress iteratively and include leading formal Design Reviews at the 30% and 60% design level with Canada and its representatives,
- Lead a Hazard and Operational Analyses (HAZOPs) with Canada and its representatives, including the Interim Construction Manager (ICM) and C&M operator.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

- Support preparation for and participate in Technical Review Committee (TRC) meetings held between CIRNAC and Affected First Nations (AFN) communities and Yukon Government in review of designs for the FMC closure, providing support as a technical consultant and subject matter expert to present the PWTP design and assist CIRNAC in responding to questions and addressing community concerns. Presentation to the TRC is anticipated to occur at approximately the 30% and 60% design stage.
- Support preparation for and participate in review of the detailed design by CIRNAC's Independent Peer Review Panel (IPRP), providing support as a technical consultant and subject matter expert to present the design and assist CIRNAC in responding to questions and addressing technical issues in the further refinement of the design. Presentation to the IPRP is anticipated to occur at approximately the 60% design stage.
- Lead constructability reviews with the ICM and, following onboarding, the MCM to ensure finalization of the Issue-for-Tender (IFT) design and support preparation of the other required tender documentation for the tender of the construction contract for the PWTP.
- Provide technical expertise, guidance and support during the tendering of the construction contract, to present the design, support site visit/community meetings, assist in responding to industry questions, and providing subject matter expertise and review to the evaluation of construction contractors.
- Provide quality assurance on design through to Final Completion, including review, testing and inspections where required.
- Provide technical expertise, guidance and support during construction, commissioning, start-up of operations including training of operators and through the warranty period.

The Consultant is responsible for ensuring that the following codes, standards or authorities are incorporated and/or performed where applicable:

- Applicable Codes, Standards and Authorities – latest edition of:
 - *Yukon Waters Act*
 - National Building Code of Canada
 - PPI (Plastic Pipe Institute) Handbook,
 - ASTM standard D 3350, "Standard Specification for Polyethylene Plastic Pipe and Fittings Materials"
 - ASME B31.3 - Process Piping
 - ASME 16.5 – Flanges
 - ASME 16.9/ 16.11 – Fittings
 - CSA C22.1, Canadian Electrical Code
 - CSA Z462, Workplace Electrical Safety
 - NEMA MG1, Motors and Generators
 - Institute of Electrical and Electronics (IEEE)
 - National Fire Protection Association (NFPA)
 - Electrical and Electronics Manufacturers Association of Canada (EEMAC)
 - National Electrical Manufacturer Association (NEMA)
 - American National Standards Institute (ANSI)
 - Underwriters Laboratories of Canada (ULC)
 - Canadian Occupational Safety and Health Administration (OSHA)
 - Yukon Occupational Health & Safety Regulations, in particular Part 9 - Electrical Safety and Part 15 – Surface and Underground Mines or Projects
 - CSA Z320, Building Commissioning
 - Any other applicable requirements.
- Design Documents
 - National Master Specification (NMS) format.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

- Signed and sealed final, 100% complete design Drawings (pdf and native format) and specifications by the appropriate professional discipline engineer registered to practice in the Yukon Territory.
- Review of Shop Drawings, product data and samples, as required, for compliance with design or design intent.
- Review of As-Built Drawings and Specifications for compliance with constructed design.
- Design Drawings and signed and sealed Record Drawings delivered in accordance with the PSPC National CADD Standard.
- Design Quality
 - Implementation of a quality management system to ensure the quality of the design.
 - Define quality objectives and measures for the design, construction and operation of the PWTP (Design Quality Plan), inclusive of any and all referenced quality manual or procedures, and any updates thereto.
 - Define the means by which the quality of the work will be monitored and measured.
 - Perform review of construction, commissioning and warranty work for compliance with final design and applicable codes, standards and authorities.

PD 7 OBJECTIVES

General

The overall objectives for the remediation of the FMS are to:

- 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; and
- Manage long-term site risk in a cost effective manner.

The design and ultimate construction and operations of the PWTP will be a key contributor to the achievement of the overall Project objectives.

Contract Objectives

In support of the above, the Consultant shall ensure that the following Contract Objectives are met:

- Timely and comprehensive design of the PWTP facility meeting the design objectives and program requirements as set out in PD5 including the effluent concentrations (and as may be updated in accordance with the water license or changes in site conditions) for the PWTP as well as any other modifications that may be necessary to achieve the overall project objectives;
- Timely review and subject matter input to construction tendering, construction progress, commissioning and operations of the PWTP until it meets the design performance requirements.

7.1 Quality

7.1.1 Design Principles

Canada expects the Consultant to ensure a high standard of engineering and architectural design, based upon recognized contemporary design principles. All design elements, planning, architectural, engineering and landscaping, must be fully co-ordinated and consistent in adherence to good design principles.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

The Consultant will be responsible for the quality of the design, and will implement the Design Quality Plan, perform and cause to be performed all required engineering and architectural services in compliance with the Design Quality Plan.

The Consultant will provide overall management of the Consultant's Team from a quality control perspective.

7.1.2 Design Objectives

The Consultant shall ensure that the following Design Objectives are met:

- Design based on the 2019 Remediation Conceptual Design and site water management plan, with recommendations as appropriate for PWTP process improvements that will lead to enhanced performance, including value-engineering.
- Architectural design (character, massing, scale and materials) that is complementary to and fits within the site and surrounding landscape and environment.
- Design to meet or exceed relevant regulatory requirements, including any adjustment thereto during the life of the Contract;
- Quality of materials shall be commensurate with the type of building and shall be cost effective. Avoid experimental materials. Take into account total life-cycling of the PWTP;
- Ensure adequate flexibility in design to support additional capacity and to appropriately address evolving site conditions over the life span of the PWTP (50 years at a minimum), and where practicable, beyond;
- Design is appropriate to and effectively supports the on-going safe operation and use of the facility by PWTP operations and maintenance personnel, as well as appropriate accommodation of visitors to the facility.
- Design provides for long-term, cost effective and sustainable operation and performance of the PWTP, providing consistent effluent quality under the varying conditions of load; optimizing quality based on technologies used.
- Systems and processes used provide a long service life, readily replaceable parts, expandability and flexibility, ideally minimizing long-term operations and maintenance costs, reflecting or reducing the projected operating costs in the cost plan. This is to be achieved by compliance with the Energy Budget, selection of equipment, requiring the minimum of operating personnel, and building finishes and equipment for easy maintenance, etc.

7.2 Sustainable Development

The project is to be implemented in an environmentally responsible manner.

The Canadian Federal Government has a series of initiatives to ensure that sustainable development principles are built into the policy of all federal organizations. Public Services and Procurement Canada (PSPC) and Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC), like all federal organizations, are required to have a Sustainable Development Strategy (SDS). Real Property Services Branch of PSPC has developed their Strategy Plan that sets out principles, goals and actions for integrating sustainable development principles into its policies and operations.

Canada is targeting effluent concentrations that are applicable to this project and the PWTP design and operation shall comply with these, and as may be adjusted over the course of the Contract in accordance with Yukon Water License requirements, amongst others.

7.3 Code Compliance

The Consultant will observe all codes, regulations, by laws and decisions of "Authorities Having Jurisdiction", although, by default, the NBC must be followed as a general rule. In cases of overlap, the

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

most stringent will apply. The Consultant shall identify other jurisdictions appropriate to the project with the approval of Canada.

The Consultant will ensure that the design of the PWTP complies with the applicable codes, regulations and other requirements of Authorities Having Jurisdiction and as set out herein.

7.4 Risk Management

A risk management strategy is crucial for Project Management and integrates project planning into procurement planning. All the stakeholders of a project will be an integral part of the risk management strategy, culminating in an integrated project team. Specific services required for project delivery are outlined in Required Services (RS3-RS7).

For the PWTP, the construction contractor will carry the risk for construction. The Consultant must advise Canada regarding the potential and anticipated risks to the project and assist in mitigating those risks with the project team.

7.5 Health and Safety

Throughout the performance of the work, the Consultant must at all times abide by all then current public health directives related to COVID-19, which may include but is not limited to: ensuring Consultant personnel use and maintain adequate Personal Protective Equipment (PPE), maintaining physical distancing requirements, implementing virtual/remote work arrangements where practicable, and undertaking such other measures as may be required to protect the health and safety of the Consultant's personnel and other Project participants.

In the event the Consultant must attend the site during the detailed design phase, the Consultant must abide by the site health and safety requirements established by the Care and Maintenance operator currently responsible for health and safety at site in addition to any Consultant-specific health and safety requirements.

Upon mobilization, the MCM/C&M will assume the role of the Constructor and mine manager, taking responsibility for health and safety at site and providing construction management services and day to day site management. The Consultant must abide by the site health and safety requirements established by the MCM/C&M in addition to any Consultant-specific health and safety requirements.

PD 8 ISSUES

The Consultant shall work in close consultation with Canada and the Technical Advisor (SRK Consulting) to ensure its resulting detailed design for the PWTP facility reflects the PWTP design basis and is effectively integrated with the overall remediation design for the FMS.

The PWTP will be required to treat the increasing volume and deteriorating quality of water at the FMS. Accordingly, and in keeping with a due diligence approach, the Detailed Design must be completed within 10 months of contract award to enable approvals, tendering and construction to proceed expeditiously when required.

The review of the Yukon Environmental and Socio-Economic Assessment Act (YESAA) assessment for the FMRP will occur during the course of the contract. Outcomes of the assessment process may influence aspects of the PWTP design. The Consultant shall ensure it adjusts and refines the Detailed Design and specifications to in a manner that addresses such design changes. Such adjustments, if required post-March 31, 2022, will be considered as part of Phase 2. In addition, when water licensing is obtained, the Consultant will be required to adjust and refine the Design and specifications to meet or

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

improve upon the final water license requirements. Any design changes required due to the outcome of the YESAA assessment and/or water license requirements will be considered a change order.

The Project's MCM/C&M is anticipated to be in place on site coinciding with the completion of the Detailed Design. Initially the Consultant will lead and work with the Project's ICM in the conduct of design reviews, constructability reviews and HAZOPs. Ultimately, the MCM/C&M will be responsible for implementing the selected design through a third-party construction contractor. The Consultant must lead and work in collaboration with the MCM/C&M to support the timely completion of any additional constructability reviews and finalization of any tendering documentation required to obtain the necessary goods and services to construct the PWTP.

Effective cost estimating and cost control is of prime importance. The Class 2 cost estimate shall be prepared using detailed unit cost with forced detailed take-off, providing an expected accuracy range within -15% to + 20%. The standard of acceptance for this format is in accordance with AACE International Recommended Practice. Cost estimates shall have a summary plus full back-up showing items of work, quantities, unit prices and amounts.

Construction activities for the PWTP will be confined to the existing mill site and the pipeline corridor to and from Faro Pit Lake and to the receiving environment at (see Attachments D and E). Erosion and sediment control plans will be necessary and will be the responsibility of the construction contractor.

Site visits required in initial stages of the work to complete field data collection, geotechnical investigations, survey or other design siting works may be impacted by local, regional and national travel restrictions. Work activities will also require the Consultant and its team to implement enhanced health and safety protocols, including but not limited to the provisioning of adequate PPE for all Consultant personnel, maintaining physical distancing, enabling virtual/remote work where practicable, following jurisdictional quarantine requirements, and other measures as may be required in accordance with then current public health guidelines.

PD 9 SERVICES

The Consultant is responsible to provide the services of all disciplines required to complete the work, which may include, but is not limited to the following Key Disciplines:

- Geotechnical engineering
- Water treatment process engineering
- Mechanical engineering
- Civil engineering
- Structural engineering
- Architecture
- Electrical engineering

DESCRIPTION OF SERVICES (PA / RS)

PA 1 PROJECT ADMINISTRATION

INTENT

The following administrative requirements apply during all phases of project delivery.

1.1 Project Management

Technical Project Authority

The Technical Project Authority is the departmental officer directly concerned with the project and responsible for its progress. The Technical Project Authority is the liaison between the Consultant, the Technical Advisor (see below), the TRC and IPRP, and other contractors supporting the project (such as: the Care and Maintenance operator, the ICM, the MCM/C&M, the construction contractor(s), the environmental monitoring contractor, etc.).

The Technical Project Authority administers the project and exercises continuing control over the Consultant's work during all phases. Unless directed otherwise by the Technical Project Authority, the Consultant obtains all federal, territorial and municipal requirements and approvals necessary for the work.

Contracting Authority

The Contracting Authority is directly concerned with the management and administration of the Contract and the Consultant's compliance and delivery in accordance with the Contract terms.

The Contracting Authority monitors and exercises continuing control over the Contract schedule, claims for payment, any changes required, and acts as an escalation point for matters related to the Consultant's performance that cannot be satisfactorily resolved at the working level.

Consultant Project Management

The Consultant will manage the design of the in scope components of the PWTP and ensure overall integration of the PWTP detailed design with out of scope components from a technical and quality perspective, ensuring effective coordination and direction of the work of all Consultant disciplines including the work of any sub-consultants and specialists.

The Consultant will be required to report and provide routine submissions to Canada related to on-going project management.

1.2 General Project Deliverables

Where deliverables and submissions include summaries, reports, drawings, plans or schedules, one (1) copy shall be provided in electronic format unless otherwise specified.

1.3 Lines of Communication

The Consultant shall work in close consultation with the Technical Project Authority who will provide direction and final approvals for technical deliverables.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

Where there is a requirement for a change to the design, whether arising from Design Review meetings, reviews, or other evolving requirements (e.g., water license requirements), the Technical Project Authority will be responsible for arranging input and attendance of the Technical Advisor, project stakeholders and other project participants, to support overall integration and collaboration.

Any change to the scope of the Contract is within the authority of the Contracting Authority. The Project Technical Authority is responsible to liaise with the Contracting Authority to identify and assess any potential changes to the Contract.

During Phase 2, the Consultant shall work in close collaboration with the MCM and any commissioning agent. The Consultant will identify any change required to the methods or outputs of the construction contractor to Canada who is responsible to liaise with the MCM and construction contractor on any potential change prior to implementation.

1.3.1 Technical Advisor

The Technical Advisor (SRK Consulting) is responsible for the completion of the conceptual water treatment process design for the PWTP (see Attachment A) and the 60% remediation design for the FMS.

The Technical Advisor will work in collaboration with the Consultant to support overall integration of the PWTP design with the overall remediation design for contact water management onsite and will participate regularly in design review phases.

1.4 Media

The Consultant shall not respond to requests for project related information or questions from the media. Such inquiries are to be directed to Canada.

1.5 Meetings

The Consultant shall schedule and lead all meetings and site visits required to execute all elements of the Design Quality Plan.

In addition to meetings led by the Consultant, as set out in RS 3-7, the Consultant shall attend bi-weekly online technical meetings with CIRNAC and its Technical Advisor, and integration meetings with CIRNAC, the ICM and Care and Maintenance operator and, following onboarding, the MCM.

1.6 Project Response Time

It is a requirement of this project that the Key Team Members of the successful proponent (including personnel, and any sub-consultants or specialist firms) be personally available to attend meetings as required or respond to inquiries within 2 business days.

1.7 Submissions, Reviews and Approvals

Project Team Reviews – Canada, Technical Advisor

- Submission Format: reports, drawings and specifications, presentation (with visual aid material, e.g., PowerPoint), evaluations, minutes of meetings, responses to queries, issues, plans, update status reports, etc. – via email in MSOffice editable format and editable PDF.
- Submission Schedule: Submissions are reviewed when completed work has been forwarded to the Technical Project Authority, in accordance with the approved Consultant's schedule.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

- Number of Submissions:
 - Reports, drawings and specifications, presentation (with visual aid material, e.g., PowerPoint), evaluations, plans, update status reports, etc. – As per Contract and until approval has been received.
 - Minutes of Meetings, Responses to queries, evaluations – One (1), and perhaps two (2) if clarifications, revisions or corrections are requested.

Technical Review Committee (TRC) Review

The Technical Review Committee (TRC) is made up of representatives of CIRNAC, Affected First Nations (AFN) and the Yukon Government (YG) and provides technical assurance to the Project. The TRC engages GC project, engineering and environmental resources, as well as external technical experts to review and make recommendations to support suitable definition and incorporation of technical requirements through all phases of planning, design and implementation.

The TRC will participate regularly in design phases and review of key deliverables.

The TRC will review the Consultant's design submittals at the 30% and 60% design level. The Consultant shall attend coordination meetings with the TRC (one at each of the approximately 30% and 60% design level) to assist them in understanding design intent and respond to technical clarifications and issues. The Consultant is required to respond to comments issued by the TRC that relates to the Design and track how the comments were addressed (or were not required to be addressed) by elements of the Design.

Independent Peer Review Panel (IPRP) Review

The Independent Peer Review Panel (IPRP) is a group of independent technical subject matter experts in the areas of Mine waste, contaminants, water treatment, reclamation and associated engineering and environmental requirements. The IPRP provides a neutral, third party review, assistance, comment and advice on the technical merits of the design, for the purpose of assuring the owner, regulators and/or stakeholders that the design is feasible, appropriate, sound, safe, and will achieve the Project objectives in a compliant manner.

The IPRP will participate in design review at the 60% design level.

The Consultant shall attend a coordination meeting with the IPRP to assist them in understanding design intent and respond to technical clarifications and issues. The Consultant is required to respond to comments issued by the IPRP that relates to the Design and track how the comments were addressed (or were not required to be addressed) by elements of the Design.

HAZOP Analysis and Constructability Review

HAZOP Analysis and Constructability Reviews will be led by the Consultant as a formally facilitated process, and attended by representatives of Canada, the Technical Advisor, ICM, and C&M plant operations personnel.

The Consultant shall provide a plan for and conduct HAZOP Analysis at the 30% and 60% Design levels, (or when draft Piping and Instrumentation Diagrams (P&IDs) have been developed and again when P&IDs have substantially been completed). The Consultant shall also provide a plan for and conduct Constructability Review twice during Design development, providing a formal report following the conduct of each review.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

The Consultant shall arrange for and facilitate these meetings, providing meeting notifications, preparing and distributing agendas, recording the issues and decisions and preparing and distributing minutes. Submission format, Schedule, Expected Turnaround Time and Number of Submissions will be as set out in the Consultant's proposal.

REQUIRED SERVICES

ACRONYMS

AACE	Association for the Advancement of Cost Engineering
ANSI	American National Standards Institute
ARD	Acid Rock Drainage
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AFN	Affected First Nations
CADD	Computer Aided Design and Drafting
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CSA	Canadian Standards Association
CT	Current Transformer
DV	Down Valley
EEMAC	Electrical and Electronics Manufacturers Association of Canada
ETA	Emergency Tailings Area
FMC	Faro Mine Complex (includes the Faro Mine Site, the Rose Creek Tailings area, and the Vangorda Plateau Mine Site)
FMS	Faro Mine Site
GC	Government of Canada
GI	General Instructions
HDS	High-Density Sludge
ICM	Interim Construction Manager
IEEE	Institute of Electrical and Electronics
IFT	Issue for Tender
IPRP	Independent Peer Review Panel
IWTS	Interim Water Treatment System
MCM/C&M	Main Construction/Care & Maintenance Manager
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NRFC	North Rose Fork Creek

**DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP)
FARO YUKON**

OSHA	Canadian Occupational Safety and Health Administration
PA	Project Administration
PD	Project Description
P&ID	Piping and Instrumentation Diagrams
PPI	Plastic Pipe Institute
PSPC/PWGSC	Public Services and Procurement Canada / Public Works and Government Services Canada
PT	Potential Transformer
PWTP	Permanent Water Treatment Plant
RS	Required Services
SIS	Seepage Interception System
SRE	Submission Requirements and Evaluation
TRC	Technical Review Committee
ULC	Underwriters Laboratories of Canada
VAC	Volts Alternating Current
WTP	Water Treatment Plant
YESAB	Yukon Environmental and Socio-Economic Assessment Board
YESAA	Yukon Environmental and Socio-Economic Assessment Act
YG	Yukon Government

RS 1 N/A

RS 2 N/A

RS 3 DETAILED DESIGN

- 1.1. Detailed design of the PWTP requires a comprehensive package of drawings that illustrate the architectural, geotechnical, structural, civil, water treatment process, electrical and mechanical systems, materials, and such other elements as may be required, integrated with the overall site contact water management design. As discussed above, CH2M Canada Ltd. issued a 90% design package for a HDS water treatment plant for the FMC in February 2014. The design and associated drawings generally meet the design basis described above, although the size of reactors, clarifier, lime slaker and some piping require modification. Irrespective of any design changes, the drawing package is representative in form and content of a detailed HDS plant design.
- 1.2. The Consultant shall design and prepare Issue for Tender design documents that conform to the 2019 Design Basis, program requirements as set out in PD5, and Design Principles and Objectives.
- 1.3. For Detailed Design, the following applies:
 - 30% refines the major design components of the PWTP in context of the overall site design for the selected WTP option. It affirms optimum value for money and the Design Criteria and Design Basis;

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

- 60% indicates substantial technical development of the PWTP - well advanced architectural and engineering plans, details, schedules and specifications. It includes design and engineering documents that are developed based on conceptual engineering results. It is used for the basis of the detailed design, overall project execution planning as well as Environmental Assessment submission and approval. Its main outputs are comprehensive site characterization, fatal flaw elimination, basis for cost and schedule planning, supporting documentation for licenses and permits applications, Issued for Design (IFD) drawings and specifications, and locking down the scope through a final Work Breakdown Structure (WBS). Other deliverables include a coordination and control schedule (Level 2) and budget cost estimate – AACE Class 3 (-20 to +30%);
- 90% is the submission of complete Tender Ready documents including; updated Cost Plan and Project Schedule; and support data, studies, calculations, etc. The design is refined and plans, specifications and detailed estimates are created. It includes the development of all required construction documents, specifications and drawings up to IFT (Issued for Tender) stage, detailed quantity take-offs for material procurement, quality control/ assurance requirements, finalization of the project implementation plan (construction plan and schedule), and draft Basis of Payment tables for the construction tender package. The Detailed Design is intended to fully implement the approved design basis to a level of detail suitable for bidding purposes, while confirming the design's constructability. Other deliverables include a master work package schedule (Level 3) and budget cost estimate – AACE Class 2 (-15 to +20%), development of the initial commissioning plan and plant operations manual, including draft Standard Operating Procedures.

1.4. The Consultant will provide:

- 1.4.1. Review of background information, studies, including 2014 detailed design and 2019 design basis;
- 1.4.2. Arrange for and conduct a site geotechnical investigation and report;
- 1.4.3. Conduct field data collection, other site investigations, topographic survey, siting and all other inspection necessary to prepare the Detailed Design (assuming having Key Design Discipline leads attend three (3) two-day meetings (plus travel) on site over the course of Design Development). The Consultant should make allowances for potential quarantine requirements in effect for the Yukon Territory);
- 1.4.4. Risk Assessment – document review and technical risk assessment, identifying any risks together with impact and associated mitigation measures for design and construction activities;
- 1.4.5. Expand and clarify the design basis, including the intent for each design discipline:
 - Present the design materials to the project team, design review team and other committees, as set out in PA 1.7 and as indicated by the Project Technical Authority;
 - For design reviews, the Consultant shall schedule and lead online meetings throughout the design development phase every two (2) weeks. Such meetings shall include the Project Technical Authority and other representatives as identified by Canada. The Consultant shall identify additional parties required for each meeting, which may include, but is not limited to, representatives of the Technical Advisor, and/or other contractors and third parties supporting the project. The Consultant shall arrange for and facilitate these meetings, providing meeting notifications, preparing and distributing agendas, recording the issues and decisions and preparing and distributing minutes within three (3) business days of the meeting.
 - Analyze the constructability of the PWTP and advise on the construction process and duration;

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

- Provide a list and draft specification sections of all National Master Specification sections to be used. Submit outline specifications for all systems and principle components and equipment. Provide in the outline specifications manufacturers' literature about principal equipment and system components proposed for use in the PWTP.
- 1.4.6. Plan and conduct HAZOP analysis, in accordance with PA 1.7, at each of the 30% and 60% design levels, as a formally facilitated activity and including representation from Canada, the Technical Advisor, the ICM, and Care & Maintenance contractor, delivering a formal HAZOP Report following each session. Track mitigations and design recommendations identified during the HAZOP and document how each mitigation measure and design recommendation has been addressed in the final Design.
- 1.4.7. Plan and conduct constructability reviews, in accordance with PA 1.7 during the design phase including representation from Canada, the Technical Advisor, the ICM, Care & Maintenance contractor, and plant operations personnel, to ensure the effective operation of designed elements. Track design recommendations and other risk mitigation measures identified and document how each recommendation and risk mitigation measure has been addressed in the final Design.
- 1.4.8. Develop Technical Specifications and Detailed Design Drawings including the following:
 - Functional and spatial relations;
 - Site plan, including scope of all site development, grades/contours, site servicing, setbacks, civil and landscaping;
 - Identify all applicable statutes, regulations, codes and by-laws in relation to the design of the project and perform code review and analysis to ensure design compliance;
 - Design of all structural and foundation systems;
 - Design of all mechanical systems, fire protection, plumbing, HVAC and special controls;
 - Design of all electrical, lighting, data, communications, and security systems;
 - Design of special construction systems, energy standards and conservation initiatives, demolition and integration issues;
 - Design of special features and detailed descriptions;
- 1.4.9. Provide Design Drawings for all disciplines including:
 - Applicable reference drawings of the existing site;
 - Determine equipment sizing and provide equipment layout drawings;
 - Electrical single line drawings;
 - Provide process flow diagram, calculations, elevations, and hydraulic grade line diagram;
 - Detailed design calculations;
 - Construction schedule that includes Gantt Chart and anticipated task times;
- 1.4.10. Review the design basis treatment system details including proposed operational technology and ensure the Consultant's Detailed Design is fully integrated with the overall site design;
- 1.4.11. Identify the proposed major materials of construction and equipment;
- 1.4.12. Define/refine performance-based criteria. Plant is to incorporate redundancy criteria in the unit processes.
- 1.4.13. Participate in reviews with Canada and other parties, as indicated in section PA1
- 1.4.14. Provide technical expertise and support appropriate to the submission of proposals to all Regulatory processes (e.g., Yukon Environmental and Socio-economic Assessment Act, Yukon Waters Act, etc.).
- 1.4.15. Refine and finalize the detailed design and associated Drawings in accordance with water licensing application guidance.
- 1.4.16. Iteratively prepare and refine the cost estimate at each detailed design milestone.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

- 1.4.17. Prepare a Class 2 cost estimate following Canada's review and incorporation by the Consultant of feedback into the 90% Detailed Design, including:
- All assumptions and exclusions;
 - Line items for equipment, materials, rentals;
 - General condition costs;
 - Mark-ups.

1.5. Specific Scope and Activities:

1.5.1. Architectural:

- 1.5.1.1. Site Plan showing the general layout of treatment operations, building(s) and proposed features, traffic pattern, grading, parking, landscaping.
- 1.5.1.2. Options for architectural design of building(s).
- 1.5.1.3. Cross sections through the site to show the relationship of buildings to proposed ground elevations.
- 1.5.1.4. Floor plans showing all accommodation required, including all necessary circulation areas, any stairs, etc. (if applicable), and ancillary spaces anticipated for service use.
- 1.5.1.5. Furniture, Fixtures and Equipment plans.
- 1.5.1.6. Elevations of all exterior building facades showing all doors and windows accurately sized and projected from the floor plans and cross sections. Indicate clear floor and ceiling levels and any concealed roof levels.
- 1.5.1.7. Cross Sections through the building(s) to show any floor levels, room heights, inner corridor or court elevations, etc.
- 1.5.1.8. Detail Sections of walls or special design features requiring illustration and explanation including fireproofing methods.

1.5.2. Structural

- 1.5.2.1. Complete structural specifications and drawings, including foundations, retaining structures, in-ground and above ground structures, and all associated structural plans, sections and details. Structural Drawings are to be separate from the Architectural sheets. Include a copy of the site report on which the design is based.

1.5.3. Mechanical:

- 1.5.3.1. Site plan showing general arrangement of all process equipment and piping 2" and greater, and connection to water supply, drains and connections to utility services, including all key invert elevation.
- 1.5.3.2. Detailed tank and equipment drawings, pipe supports, walkways, staircases and other supports and mechanical structures.
- 1.5.3.3. Prepare a 3D model that shows layout of all major piping, equipment and structural elements.
- 1.5.3.4. Proposed ventilation, cooling and heating systems showing sizing, locations, and all major equipment layouts in mechanical and process rooms.
- 1.5.3.5. Drawings of plumbing system, showing routing and sizing of major lines and location of pumping and other equipment where required.
- 1.5.3.6. Required fire protection systems showing major components.
- 1.5.3.7. Describe the mechanical systems to be provided and the components of each system.
- 1.5.3.8. Describe the perceived operation of the mechanical systems.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

- 1.5.3.9. Describe the building systems control architecture.
 - 1.5.3.10. Explain what acoustical and sound control measures are to be included in the design.
 - 1.5.3.11. Provide energy analysis and energy budget in accordance with the requirements of the Greening Government Strategy. Provide information of all internal and external energy loads in sufficient detail to determine the compatibility with site services, approved design basis and energy budget.
 - 1.5.3.12. Provide analysis of selected equipment and plant with schematics and calculations sufficient to justify the economy of the selected systems.
 - 1.5.3.13. Explain the expected functions of the operation staff.
- 1.5.4. Electrical:
- 1.5.4.1. Provide instrumentation and control equipment and strategy for treatment processes.
 - 1.5.4.2. Process and Instrumentation Diagram to show required level of Supervisory Control and Data Acquisition.
 - 1.5.4.3. Provide proposed lighting requirements.
 - 1.5.4.4. Identify energy savings requirements.
 - 1.5.4.5. Provide drawings showing advanced development of the following:
 - Single line diagram of the power circuits with their metering and protection, including:
 - Complete rating of equipment.
 - Ratios and connections of CT's and PT's.
 - Description of relays when used.
 - Maximum short circuit levels on which design is based.
 - Identification and size of services.
 - Connected load and estimated maximum demand on each load centre.
 - 1.5.4.6. Electrical plans with:
 - Floor elevations and room identification.
 - Legend of all symbols used.
 - Circuit numbers at outlets and control switching identified.
 - All conduit and wire sizes except for minimum sizes which should be given in the specification.
 - A panel schedule with loadings for each panel.
 - Telephone conduits system layout for ceiling/floor distribution.
 - 1.5.4.7. Riser diagrams for lighting, power, telephone and telecommunication cable systems, fire alarm and other systems.
 - 1.5.4.8. Elementary control diagrams for each system.
 - 1.5.4.9. Schedule for motor and controls.
 - 1.5.4.10. Complete lighting layout and fixture schedule clearly indicating methods of circuiting, switching and fixture mounting.
 - 1.5.4.11. Electric heating layout and schedule.
 - 1.5.4.12. Provide the following data:
 - Total connected load.
 - Maximum demand and diversity factors.
 - Sizing of standby load.
 - Short-circuit requirements and calculations showing the ratings of equipment used.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

1.5.5. Commissioning

- 1.5.5.1. Define operational and process control requirements, including any permissible operational adjustments thereto, to define Commissioning Requirements in compliance with CSA Z320 and all applicable standards.
- 1.5.5.2. Prepare a commissioning Brief describing major commissioning activities for process, mechanical, electrical and integrated system testing.

1.5.6. Process:

- 1.5.6.1. Plan, section and select details of each unit treatment operation and supporting components to indicate requirements.
- 1.5.6.2. Size the major process equipment
- 1.5.6.3. PWTP layout
- 1.5.6.4. Identify options for major equipment for each unit treatment operation.
- 1.5.6.5. Identify options for materials of construction for all major components.
- 1.5.6.6. Hydraulic Grade Line Diagram.
- 1.5.6.7. Process Flow Diagram.
- 1.5.6.8. Piping and Instrumentation Diagram.
- 1.5.6.9. Operational plan requirements.
- 1.5.6.10. Training and turnover requirements.

1.5.7. Geotechnical

- 1.5.7.1. Complete sufficient field investigation necessary to support the detailed design, including testing and conduct of geotechnical site assessment including ensuring appropriate siting for the location of the PWTP and structures, with a focus on long term ground stability in relation to climate change impact on foundation, including:
 - Evaluate the potential for permafrost to influence geotechnical stability and design;
 - Determine soil composition, presence of ice lenses and depth of bedrock;
 - Provide foundation design options for the PWTP and structures;
 - Provide geotechnical assessment report including results and analysis of onsite testing, discussion, conclusions, and recommendations. Detail all deficiencies, potentials, and constraints related to the project.

- 3.5.7.2 Geotechnical Complete sufficient field investigation necessary to support the detailed design, Develop a monitoring program to track building movement. Clearly identify the frequency and location of monitoring. This program should be readily administered by Canada and site operational personnel and inexpensive to administer over the longer-term.

3.5.8 Civil

- 3.5.8.1 Map surface water drainage;

- 3.5.8.2 Design an appropriate site drainage system for the PWTP site, including surface water storage, providing for positive drainage away from the building perimeter. Consult with the Technical Project Authority, Canada's representatives and the Technical Advisor to determine the best location for surface and roof water runoff in alignment with the overall remediation design for the FMS.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

RS4 CONSTRUCTION DOCUMENTS

- 2.1. The PWTP construction will be tendered and managed by the MCM/C&M. The Consultant shall support the finalization of all documentation required to complete the tendering process.
- 2.2. The Consultant will provide:
 - 2.2.1. Support to the final integration of the detailed design package into ready-to-tender construction documents by the MCM/C&M through leading integrated design meetings (assuming every two (2) weeks) incorporating input on material selection, building systems and equipment, constructability at the FMC site, coordination issues between construction disciplines and design disciplines, etc.
 - 2.2.2. Finalize construction drawings and technical specifications for the tender package, including finalized Basis of Payment tables and Material Take-Offs.
 - 2.2.3. Provide other design-related input on other tender package documents, including but not limited to design schedules and construction durations, and review tender package documents to support alignment of the entirety of the package with the overall design requirements.
 - 2.2.4. Provide input into the Risk Plan.
 - 2.2.5. Document, in consultation with the MCM/C&M, the preliminary commissioning program requirements in report format, including finalization of the design and operating standards.

RS5 CONSTRUCTION TENDERING PERIOD

- 3.1. As required by Canada during the tendering of the construction contract by the MCM/C&M, the Consultant shall support the successful conduct of the tender, evaluation and award processes to support ensuring clarity to potential constructors of the design and specifications, and to assist in the process resulting in the selection of a qualified construction contractor.
- 3.2. The Consultant will provide:
 - 3.2.1. Presentation, including delivery of associated visual materials (e.g., PowerPoint, etc.), of the finalized detailed design for the PWTP and associated specifications at community meetings, industry information sessions or Bidder conferences/site visits held prior to or during the tendering period (assuming one (1) trip to site with the appropriate Key Disciplines, comprised of a joint site tour including industry and AFN community representatives).
 - 3.2.2. Technical review, subject matter expertise and support in drafting of responses to questions received from potential construction Bidders to ensure overall clarity of requirements.
 - 3.2.3. Subject matter expertise, technical review and support in evaluation of submissions received in response to the construction tender. This may include factual subject matter guidance or opinions, and/or may include assistance in evaluation of submissions against the technical requirements of the tender, including documentation of the same.

RS6 CONSTRUCTION

- 4.1. The Consultant shall provide technical expertise and quality assurance support to Canada during the construction of the PWTP by the PWTP construction contractor to provide assurance of design performance through construction and support assurance of compliance of construction to design principles, objectives and performance requirements.
- 4.2. The Consultant will:

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

- 4.2.1. Schedule and lead integration meetings, every two (2) weeks with the MCM, construction contractor, Canada, and, as appropriate, representatives of trades and suppliers, to clarify detailed design and performance requirements and resolve issues. This shall include a monthly online progress meeting with Canada, followed two (2) weeks later by site visit and on-site integration meeting by the required Design Disciplines for inspection and Design Quality Assurance (assuming 2 to 3 days on site per site visit, and 3 site visits per Key Discipline over the multi-year construction period, assuming 24 months).
- 4.2.2. Support resolution of any permitting issues, as appropriate.
- 4.2.3. Review any additional detail drawings to support clarification and interpretation and review shop drawings prepared for the construction works to verify conformance to the detailed design.
- 4.2.4. Develop and provide signed and sealed Issue for Construction (IFC) drawings incorporating construction tender addenda, clarifications and changes accepted by Canada.
- 4.2.5. Provide full-time on-site inspection capability throughout the Construction period, supporting the MCM/C&M in the conduct of inspections to provide design quality assurance and support in responding to Site conditions/issues, providing technical expertise and support to verification of the constructed works against the original design intent and performance requirements; drawing upon the expertise of the required Design Disciplines as appropriate. As appropriate, consideration should be given to the participation of plant operations personnel in periodic inspection activities of key operational components of the PWTP to support ensuring the design as constructed meets operability requirements. The Consultant shall ensure the results of any inspections are provided to Canada who is responsible for coordination of any changes required with the construction contractor(s) and MCM. For clarity, the Consultant shall not direct the construction contractor(s)/MCM to modify their work.
- 4.2.6. Summarize design observations and results of inspections in narrative format and assist in responding to questions on the same.

RS7 COMMISSIONING, STARTUP, OPERATING AND TURNOVER/TRAINING, WARRANTY AND CLOSE-OUT

- 5.1. The Consultant shall provide technical expertise and quality assurance support to the MCM/C&M and any commissioning agent during all commissioning and start-up activities undertaken by the PWTP construction contractor to support assurance of compliance with commissioning requirements, including (but not limited to):
 - 5.1.1. Provide and commission control (PLCs, HMIs, DCS and local controllers) programs.
 - 5.1.2. Perform necessary and required inspections to ensure that completed installations are in accordance with the latest engineering and design information and specifications.
 - 5.1.3. All electrical wiring is installed and terminated in accordance with design documents.
 - 5.1.4. All mechanical equipment and piping are installed in accordance with design documents and manufacturers specifications.
 - 5.1.5. All instrumentation devices are installed and calibrated in accordance with design documents.
 - 5.1.6. Direct and supervise testing personnel.
- 5.2. The Consultant shall provide technical expertise and quality assurance support during start-up of operations, initial turn-over training and in completion of the warranty period to support assurance of that operational and performance requirements are met.

DESIGN OF THE FARO MINE PERMANENT WATER TREATMENT PLANT (PWTP) FARO YUKON

5.3. The Consultant shall participate in regular project meetings (assuming every week) to report on status, issues and resolutions, in accordance with the schedule established by the MCM

5.4. The Consultant will:

- 5.4.1. Finalize definition and documentation of commissioning procedures.
- 5.4.2. Assist in preparation and implementation of quality management processes for on-going operations.
- 5.4.3. Review and verify the contents of operating manuals, including standard operating procedures, for compliance to requirements and support assurance that operating personnel have all information required to understand and optimally operate the PWTP's systems.
- 5.4.4. Review As-Built Drawings prepared by the MCM/construction contractor to verify accuracy.
- 5.4.5. Provide signed and sealed Record Drawings are ensuring their accuracy.
- 5.4.6. Support the establishment of test criteria and procedures and support the conduct of acceptance testing to verify performance requirements and acceptance criteria are met.
- 5.4.7. Provide technical guidance and assistance in the preparation and conduct of initial training for operational personnel to support ensuring proper operation and maintenance of PWTP systems, integrations, and infrastructure to meet compliance and performance requirements.
- 5.4.8. Review and evaluate established quality assurance programs to support assurance of adequacy for operations. Provide support to the Project in review of Project and/or independent assessment of readiness for turnover and operations start-up, including as required assistance in documentation of quality issues, non-conformances or deficiency reports and the status of their resolution, and verification that drawings and operational documentation has been approved and released.
- 5.4.9. Prepare an oversight plan or strategy for the start-up of operations, which will include on site presence and support to initial commissioning and start-up (assuming three (3) weeks) providing coaching and knowledge transfer to plant operations personnel to arrive at stabilized on-going operations, and capability to conduct periodic quality assurance monitoring on various operations to verify compliance with documented procedures and opportunities for improvement.
- 5.4.10. Support the conduct of warranty period inspections, including providing ad hoc on-site support to troubleshoot and resolve issues (assuming 4 ad hoc visits), two (2) detailed inspections each with 2-3 days on site during the 12 month warranty period, and a final warranty inspection to assist in verifying achievement of the requirements for Final Completion prior to the end of the warranty period. This should assume 2 days per Key Discipline.
- 5.4.11. Summarize observations and results of all inspections in narrative format and assist in responding to questions on the same.
- 5.4.12. Support ensuring the establishment, implementation and documentation of formal quality control procedures, including timely quality problem identification, reporting, assessment, correction and documentation processes.
- 5.4.13. Following Final Completion participate in a Technical Lessons Learned session led by the MCM/C&M to evaluate successes, issues, changes associated with the PWTP work package, including review and confirmation of any associated lessons learned report.