Giant Mine
Remediation Project

The 2018-19 Annual Report of the Giant Mine Remediation Project

Crown-Indigenous Relations and Northern Affairs Canada
Relations Couronne-Autochtones et Affaires du Nord Canada

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Government of Northwest Territories
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Canada

ABOUT THIS REPORT

Welcome to the fourth annual report of the Giant Mine Remediation Project (GMRP). The report provides an overview of the GMRP's key activities and performance for the 2018-19 reporting year[1], focusing on environmental management, health and safety (H&S), and community involvement. This report's purpose is to verify that:

- defined project objectives are being met,
- the GMRP meets the requirements of the Environmental Agreement, and
- interested stakeholders, members of nearby communities and the broader public have accurate and timely information on the GMRP should the report be shared beyond the Giant Mine Oversight Board (GMOB), the independent oversight body established through the Environmental Agreement. (For additional information, see Environmental Agreement – Report Alignment.)

This report's content is largely shaped by the Environmental Agreement signed in June 2015, as well as by GMOB's feedback on previous reports. The content was also influenced by input collected from GMRP Team members. The report aligns with existing GMRP reporting obligations.

For additional information on the GMRP, please visit: www.giant.gc.ca.

A list of acronyms is provided in Appendix A.

Environmental Agreement – Report Alignment

A significant driver for the development of the GMRP Annual Report is the Environmental Agreement, the signing of which is a mandatory requirement per Measure 7 of *The Report of Environmental Assessment and Reasons for Decision* (MVRB, 2013). This agreement establishes an independent oversight body (i.e., GMOB) for the GMRP, and was signed in June 2015 by Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC; formerly Aboriginal Affairs and Northern Development Canada [AANDC]), the Government of the Northwest Territories (GNWT), the City of Yellowknife, the Yellowknives Dene First Nation (YKDFN), Alternatives North, and the North Slave Métis Alliance (NSMA).

Article 5 of the Environmental Agreement stipulates that "the Co-Proponents shall prepare, provide to GMOB and make available to the public an annual report on the Project each year," to be submitted to GMOB "no later than October 1 in each year," starting October 1, 2016 (the report addressing the 2015-16 fiscal year).

The Environmental Agreement specifies what content must be included in each annual report. The table below outlines each requirement and where the content can be found in this 2018-19 report.

[1] April 1, 2018 – March 31, 2019

Environmental Agreement Requirement	Section of Report
A summary of the Project's key operational activities and associated expenditures	Year in Review: Operational Summary
A summary of any other significant developments relating to the Project	Environment Health and Safety Community
A summary of the results or findings of all monitoring done for the Environmental Programs and Plans and a description of actions taken or planned to implement Adaptive Management	Environment Health and Safety
An assessment of the effectiveness of actions already taken to address the results or findings of all monitoring completed for the Environmental Programs and Plans	Environment: Air Environment: Water
A summary of any environmental or engineering studies conducted by the Co-Proponents in relation to the Project	Year in Review: Operational Summary Environment: Water; Land
A summary of any changes to, or plans for changes to, the Environmental Program and Plans	Not applicable for this reporting year
A summary of the environmental audits of the Project, and the Co-proponents' response to the audit	Year in Review: Operational Summary
A summary of any reportable spills, accidents or significant malfunctions, and a summary of the Co-Proponents' responses	Year in Review: Operational Summary Environment
A listing of regulatory inspections, reports or directions, and a summary of the Co-Proponents' response to any issues arising therefrom	Year in Review: Operational Summary
An analysis of trends in environmental effects data over time	Environment Health and Safety Community
A summary of significant public engagement activities, or matters raised as public concerns, and the Co-Proponents' responses	Community: Engagement
A summary of the Project's planned key operational activities for the coming year and associated planned expenditures, subject to the need to protect commercially sensitive financial information	Year in Review: Operational Summary In Closing
A summary of the progress of the Project, including with respect to the *Mackenzie Valley Resource Management Act* (MVRMA) Measures, MacKenzie Valley Environmental Impact Review Board (MVEIRB) Suggestions, and Co-Proponents' Commitments	Year in Review: Progress on Commitments Appendix B
References to all sources relied on by the Co-Proponents in coming to conclusions in the annual report	References
A plain language summary of the annual report	Plain Language Summary Appendix C

Addressing GMOB Recommendations

In the GMOB feedback on the 2017-18 report, it was noted that the report met the major requirements of the Environmental Agreement but it did not adequately enable the reader to quickly assess how the GMRP is progressing within the scope of the overall remediation schedule, management milestones, and past, present, and future budgets.

The table below provides the Project Team's response to GMOB's 2018-19 report recommendations.

GMOB Report Recommendations	GMRP Response in 2018-19
Provide a plain-language summary that is a stand-alone document	A plain language summary is provided as a stand-alone document and in Appendix C
Present in sequence the tables for activities, completed and planned	The Summary of Progress on page 9 provides a sequence for 2018-19 completed activities and planned 2019-20 activities
Present the budget and expenditure figures together (i.e. past expenditures next to planned and future budgets)	Section 2.1.10 presents the planned budget and actual expenditures for 2018-19, as well as the planned budget for 2019-20.
Include a more inclusive listing of employment by the Project, specifically how many people were directly employed by the Project Team in Yellowknife, Ottawa and elsewhere, as well as details of consultants and contracting authority employees	Section 5.3.2 provides separate employment statistics for those contracted by the Main Construction Manager (MCM) (Parsons Inc.) and those contracted by Public Services and Procurement Canada. In future reports, the GMRP will aim to provide employment by Region, contracting authority employees, and all consultants/advisors.

The GMRP Team will continue to work toward addressing the outstanding recommendations, as well as any further feedback on this year's report, and to continuously improve stewardship and transparency of our actions at the GMRP.

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MESSAGE FROM THE CIRNAC PROJECT LEADER – ADM, NORTHERN AFFAIRS ORGANIZATION

On behalf of the entire Giant Mine Remediation Project Team, I am pleased to present the fourth Annual Progress Report to the Giant Mine Oversight Board. This report provides our stakeholders and the public with a transparent, comprehensive record of our progress over the last year as we work towards advancing the Giant Mine Remediation Project. We are committed to following the mandate given to us by the Government of Canada to use public investment to spur economic growth, job creation, and to improve economic opportunity for Northerners and Indigenous Peoples. We will also use this opportunity to support the effort towards reconciliation and the renewed relationship between Canada and Indigenous Peoples based on recognition, rights, respect, co-operation, and partnership.

This fourth annual report builds on our prior submissions, with the benefit of input and advice from the Giant Mine Oversight Board and our other stakeholders. We will continue to communicate our progress, improve our engagement with, and reporting to, the public, and welcome feedback on our planning and management of the Giant Mine Remediation Project. Our goal is to achieve an outcome we can all be proud of that addresses the legacy left behind by Giant Mine, and benefits our Indigenous peoples, Northerners, and all Canadians through collaboration, sincere dialogue, and learning from each other to continually improve.

The Giant Mine Remediation Project Team looks forward to engaging with others throughout the project life cycle, seeking a collaborative approach that is inclusive and forward-looking. We hope our work, and the lessons we learn through it, will inform the management of other complex remediation projects and will allow the Government of Canada to adapt and improve both its management practices and decision-making processes related to resource extraction and land use in the North.

Serge Beaudoin

Serge Beaudoin, B.Sc., LL.L

Assistant Deputy Minister, Northern Affairs Organization

SUMMARY OF PROGRESS IN 2018-19 AND PLANS FOR 2019-20

In the closing section of the 2017-18 annual report, a table summarized the key activities planned for 2018-19. That table is reproduced here with the addition of a column providing a brief description of progress in 2018-19 relative to the plans for the year. This summary enables readers of this report to see whether the Giant Mine Remediation Project (GMRP) Team achieved what it planned, and, where it did not, to understand the reasons why.

Component	Plans for 2018-19	Progress in 2018-19	Plans for 2019-20
Operations			
Care and Maintenance (C&M)	The GMRP will transition all C&M activities, including the role of the Mine Manager, to the new MCM Parsons Inc. Parsons will be required to sub-contract all activities related to surface and underground care and maintenance, including Effluent Treatment Plant (ETP) operation and Emergency Medical Services/Site Security Services.	In July 2018, the Project transitioned into a new procurement strategy and hired Parsons Inc. (Parsons) to take on the role of the Mine Manager position for the Giant Mine. Sub-contracts were awarded under Parsons to operate and maintain all C&M activities on site including Surface and Underground Care and Maintenance, ETP operations, Site Security, and Emergency Medical Services. **Completed:** Reconstruction of the UBC Bridge, used to support C&M activities at the site, was completed and reopened to vehicle access in the spring 2018. **Advanced/Underway:** Maintaining site infrastructure, ongoing dust management activities, operating the ETP, continuing water and effluent monitoring, providing site security 24/7, completing underground repairs to existing chutes and head covers, replacing the existing C-shaft power feed.	Continue C&M in accordance with contract and regulatory requirements and site conditions.

Component	Plans for 2018-19	Progress in 2018-19	Plans for 2019-20
Site Stabilization	Complete backfilling of the last remaining high-risk stope complex (C5-09) as part of the Site Stabilization Plan (SSP). Complete an Open Pit Closure options analysis following the decision to fill the eight open pits. Examine freezing feasibility of contaminated backfilling material for B1 pit closure.	**Completed:** In May 2018, construction began on the C5-09 stope backfilling project and was completed in December, stabilizing the underground stope complex with approximately 70,000 m3 of material. This marked the final stage of the SSP. An options analysis report for the closure of the eight open pits was completed. **Advanced/Underway:** Three potential scenarios for in-pit disposal and associated freeze containment of waste were examined for B1 pit.	Implement a long-term monitoring plan to assess the integrity of the C5-09 backfill. Conduct further studies on backfilling materials and potential impacts to support the final open pit closure design. Conduct additional studies of different freezing/backfilling material options for B1 open pit.
Tailings Management and Monitoring Plan	Develop a Tailings Management and Monitoring Plan to define an approach to managing Tailing Containment Areas (TCAs) after completion of closure activities.	**Completed:** A Tailings Management and Monitoring Plan was developed, describing the approach and methods to monitor performance of TCAs' closure and maintenance activities.	Plans are under review as part of the GMRP regulatory process, as conducted by the Mackenzie Valley Land and Water Board (MVLWB).
Immediate Risk Mitigation	Review deteriorating infrastructure onsite through a Structural Assessment. Complete upgrades to the Akaitcho Deep Well Pump Station to improve the dewatering system. Inspect dams to assess water level restrictions and geotechnical considerations.	**Completed:** In July 2018, a Structural Assessment of on-site infrastructure was conducted showing no new signs of any buildings with immediate risk to people or the environment (a structural review of 19 buildings was conducted at the Giant Mine site). The improvements to the Akaitcho Deep Well Pump Station were completed using two submersible deep well pumps from surface. The pumps were tested at the end of March 2019. All tailings and water management dams were visually inspected in June 2018.	A structural assessment is not required (buildings rated Red, a high-risk category, to be reviewed in 2020-2021 and all buildings in 2022-2023). Begin operation and ongoing monitoring of the dual submersible deep well system. Implement new recommendations from the 2018-19 dam inspection, as appropriate. Commission and operate the new, dual submersible deep well pump system. Conduct the annual dam inspection.

Component	Plans for 2018-19	Progress in 2018-19	Plans for 2019-20
		Maintenance recommendations from previous annual dam inspections were monitored and updated.	Conduct the 10-year dam Safety review, as outlined in the Canadian Dam Association Guidelines for compliance.
Waste Management	Examine long-term options of arsenic waste management.	**Advanced/Underway:** The Project Team examined options for disposal of arsenic waste in Chamber 15, currently empty and identified as a potential disposal site for arsenic waste. The GMRP Team conducted a review of current climate change knowledge to support the design of Freeze Areas 1 and 2.	Conduct further studies, including costs to inform final waste disposal options and designs. Incorporate recommendations based on new climate change knowledge into future freezing designs.
Water Treatment Projects	Finalize the new water treatment plant (WTP) design to be built in approximately 2025. Assess the feasibility of treatment wetlands or other applicable passive and semi-passive surface water treatment technologies.	**Completed:** The GMRP Team assessed the feasibility of the new mine water intake system. **Advanced/Underway:** A water treatment pilot program was tested to demonstrate the successful treatment of water. An off-site pilot-scale passive treatment system design was developed, and constructed. The lab scale testing was completed off-site.	Summarize all activities and results from the pilot-scale passive treatment system testing program. Advance the final design for the WTP.
EA Measures			
Measures (a full list of measures and activities is provided in Section 2.0 and Appendix B)	Continue the Health Effects Monitoring Program sampling. Initiate the Stress Assessment (indirect stress effects study). Continue engaging on Site-Specific Water Quality Objectives (SSWQO) and complete final report. Continue engagement on	**Completed:** Health Effects Monitoring Program sampling analysis to develop baseline results was completed. The Closure and Reclamation Plan (CRP) was submitted, together with the Water Licence Application, to the MVLWB. **Advanced/Underway:**	Report the community baseline results from the Health Effects Monitoring Program and report all individual results to each participant with appropriate medical advice. Additional toenail sample analysis will be completed on individuals showing results in the top 5% of the population. Implement the Stress Study

Component	Plans for 2018-19	Progress in 2018-19	Plans for 2019-20
	long-term funding options and complete final report. Submit the Water Licence application package.	Extensive modelling was developed to demonstrate the ability to meet SSWQO. The Stress Study was initiated. The long-term funding options report was engaged on throughout 2018-19, with the creation of a sub-working group made up of members from the Giant Mine Working Group (GMRP WG). The report is being revised based on feedback from Stakeholders.	in 2019-2020. Finalize the long-term funding options report.
Environment			
Air	Continue air quality monitoring and dust suppression activities. A review of the Air Quality Monitoring Program (AQMP) to be conducted to ensure a robust program that continues to meet the needs of the GMRP and its stakeholders.	**Completed:** Air quality monitoring and dust suppression activities continued for 2018-2019 and will continue for 2019-2020.	Continue air quality monitoring, including ongoing community monitoring, and fenceline monitoring, with activity-specific monitoring conducted as applicable. Continue to ensure there is a sufficient stockpile of dust suppressant on site, and that water trucks are available to wet drying areas that could generate dust.
Water	Continue seasonal effluent treatment and year-round water quality monitoring. Run pilot treatment plant to test various adsorption media to exhaustion. Data will be collected to assist in the design of the new WTP. Conduct comprehensive modeling to inform Effluent Quality Criteria (EQC). Conduct Detailed design for the effluent outfall for a no-cooling option at	**Completed:** In the 2018 season, 354,618 m3 of effluent was treated and discharged from the Giant Mine site between August 8th and October 2nd. Concurrently, a pilot plant study was initiated and ran for approximately 43 days. Year-round water quality monitoring was conducted for underground minewater sample locations, with seasonal water quality monitoring conducted during the open water and	Continue monitoring treated effluent prior to and during discharge. Continue existing water quality monitoring (SNP, MDMER/EEM, OMP). Once the comprehensive EQC modelling has been completed, complete detailed design for the outfall (a no-cooling option) at the selected location in the vicinity of Baker Creek. Submit an application to the MVLWB for a Type A Water Licence for the Site.

Component	Plans for 2018-19	Progress in 2018-19	Plans for 2019-20
	Location A. Submit application for a new Type A Water Licence. Look at options to improve the clarification/filtration process of the existing ETP to meet new Metal and Diamond Mining Effluent Regulations (MDMER) requirements	discharge season at surface. Monitoring of minewater, surface water, and groundwater was conducted at the site in 2018 to meet regulatory and operational monitoring requirements, as well as to continue to collect baseline data to support ongoing modelling efforts and site characterization. The EQC Report was completed in January 2019. A pilot WTP was designed, constructed and operated. It demonstrated that the arsenic and antimony in the mine water can successfully be treated to meet Drinking Water Quality Objectives using iron co-precipitation followed by adsorption. **Advanced/Underway:** The application to the MVLWB for a Type A Water Licence was delayed to April 2019 at the request of stakeholders.	
Land	Continuing managing wastes on site. Dam Safety Review to be conducted.	**Completed:** Surface C&M continued to manage wastes on site (including monitoring and management of arsenic-impacted waste). The annual geotechnical inspections of all dams on site was completed during the month of July and preliminary scope of work was developed for the Dam Safety Review Assessment to take place in 2019-20. Submitted the final report of the Archaeological Impact Assessment (AIA) to the Prince of Wales Northern Heritage Centre.	Safely manage waste material stored on-site until full remediation can begin. Conduct additional work for input into the detailed design for the Giant Mine landfill cells. Re-evaluate the closure strategy for the deep contaminated materials.

Component	Plans for 2018-19	Progress in 2018-19	Plans for 2019-20
Biodiversity	Continue baseline monitoring (Long-term Monitoring Program - LTMP). Finalize Aquatic Effects Monitoring Program.	**Completed:** Monitoring continued to establish baseline conditions in Yellowknife Bay in 2018-2019, as well as continued monitoring during the annual bird activity survey. A study design for small mammal and vegetation survey was completed. The AEMP study design for Baker Creek was submitted in April 2019 as part of the Type A Water Licence, along with a conceptual study design for the Yellowknife Bay AEMP (which will be implemented when the Baker Creek AEMP moves out of the creek during commissioning of the WTP in approximately 2026). A draft Wildlife and Wildlife Habitat Management and Monitoring Plan (WWHMMP) was developed and submitted to the MVLWB with the water license submission The Baker Creek Ecosystem Synthesis report was completed.	Continue baseline monitoring (LTMP). Field investigation is to be completed in summer 2019 (starting in July) and reported by June 2020 to meet the Phase 6 EEM reporting requirements. Monitoring in Baker Creek will be undertaken according to the proposed Baker Creek AEMP Design Plan.
Health and Safety			
Occupational Health and Safety	Continue to oversee and manage occupational H&S through tracking of training and incidents.	The GMRP continued to track occupation H&S through the Northern Contaminated Sites Program internal management system on a quarterly and annual basis. **Completed:** There were nine moderate safety incidents. 3.25% of urinalysis samples were above the action level of 35 micrograms of arsenic	The GMRP will continue to track occupation H&S on a quarterly and annual basis and provide relevant H&S Training.

Component	Plans for 2018-19	Progress in 2018-19	Plans for 2019-20
		per litre of urine (µg/L). Employees and sub-contractors received 1822 hours of relevant H&S training, including first aid, wildlife safety, water safety, and fire response, as required by applicable regulations.	
Public Health and Safety	Undertake second round of sampling for Health Effects Monitoring Program. Initiate the stress assessment, including engagement for the development of an assessment tool (survey) and pilot testing of the survey.	**Completed:** Health Effects Monitoring Program sampling analysis to develop baseline results was completed. **Advanced/Underway:** The Stress Study was initiated.	Report community baseline results from the Health Effects Monitoring Program and report all individual results to each participant with appropriate medical advice. Additional toenail sample analysis will be completed on individuals showing results in the top 5% of the population The Stress Study will be implemented in 2019-2020.
Community			
Engagement	Engage on the Quantitative Risk Assessment (QRA), AIA, CRP, and the Water Licence. Determine ways to ensure traditional knowledge continues to inform planning. Develop a centralized system to catalogue stakeholder concerns. Continue existing engagement and outreach mechanisms.	**Completed:** The AIA engagement process was completed, from developing the assessment areas to the report back on the draft report. YKDFN Lands and Environment completed the second phase of the Traditional Knowledge study, funded by the GMRP. Engagement sessions held throughout the year focused on the QRA, the Water Licence, and Industry preparedness (Industry Day).	Engagement will focus on the Quantitative Risk Assessment, community and business outreach on procurement and contracting opportunities, socio-economic governance, Community-Based Monitoring, Baker Creek, Borrow sources, Perpetual Care Plan, and Stress Study.
Employment	Continue to track the total employment and employment by certain categories, namely	The GMRP continued to track employment as well as workforce training on a quarterly and annual basis.	The GMRP will continue to track employment as well as workforce training on a quarterly and annual basis,

Component	Plans for 2018-19	Progress in 2018-19	Plans for 2019-20
	Northern, Indigenous, Aboriginal Opportunities Considerations (AOC), and Women, and provide adequate training to ensure that employees are properly trained to perform their responsibilities.	**Completed:** 321 employees received a total of 7037 workforce training. The proportion of Northern employees, Indigenous employees, and AOC employees increased from previous years.	and will establish targets for employment and training, by engaging with the Socio-Economic Working Group, Socio-Economic Advisory Body, and the GMRP WG.
Procurement	Provide onboarding and orientation for the MCM. Through MCM, post tenders for C&M contract and environmental monitoring.	**Completed:** Onboarding and orientation of the MCM was completed by Q2 2018. The MCM tendered the C&M contract and tendered 17 additional contracts**.**	The GMRP will continue to track the total number of suppliers, the total value of contracts and the number of suppliers and value of contracts by these categories.

1.0 PROJECT OVERVIEW

The GMRP addresses the long-term containment and management of the arsenic trioxide waste, the demolition and removal of all surplus buildings on the surface, and the remediation or risk management of all impacted surface areas, such as soils and tailings ponds. It also includes water management and treatment. The overall objectives of the GMRP are to:

- minimize public and worker H&S risks;
- minimize the release of contaminants from the site to the surrounding environment;
- remediate the site in a manner that instills public confidence; and,
- implement an approach that is cost-effective and robust over the long term.

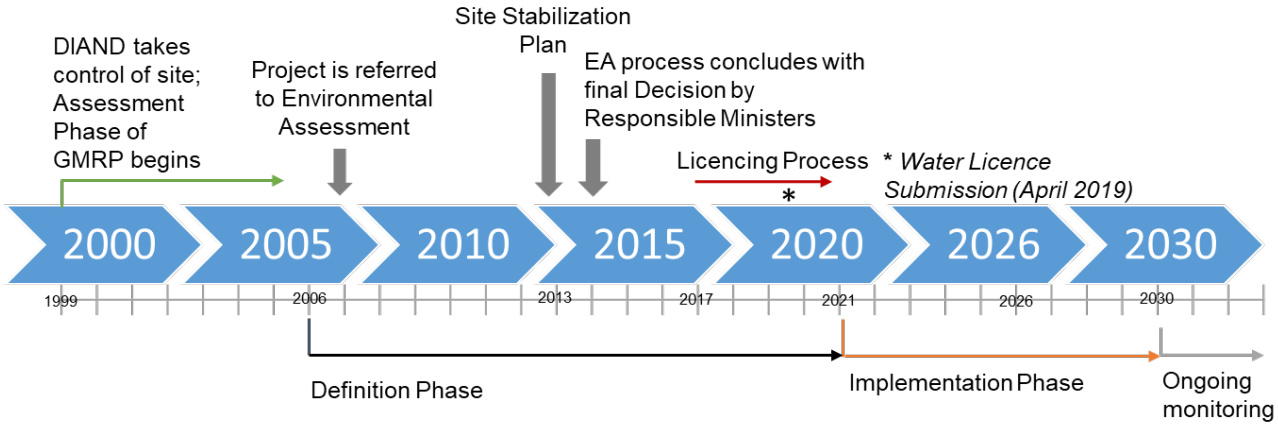
The successful remediation of the Giant Mine will yield the following outcomes:

- safeguard the H&S of Northerners;
- protect water, soils, flora and fauna at the Giant Mine site;
- reduce the federal liability associated with the site by using industry best practices for remediation in a cost-effective manner;
- improve relationships with local Indigenous groups;
- demonstration of federal commitment, which illustrates how economic development can be carried out without adversely affecting the environment; and,
- demonstration of federal leadership in complying with all applicable environmental Acts, Regulations, and standards.

Phases of the GMRP

Figure 1 illustrates the past, current and planned activities of the GMRP. Appendix D provides more information on the GMRP, including the mine's legacy and the GMRP's background, phases, management structure, integrated management system, and risk management approach.

Figure 1: GMRP Activities and Timeline



2.0 THE YEAR IN REVIEW: 2018-19 OPERATIONAL SUMMARY AND PROGRESS ON EA MEASURES

2.1 Operational Summary

The Project Team – which includes CIRNAC, Public Services and Procurement Canada (PSPC), and GNWT personnel – focused their activities in six main areas over the 2018-19 year (April 1, 2018 – March 31, 2019):

1. Completing construction work associated with the Site Stabilization Plan (SSP), which includes backfilling the outstanding stope complex C5-09;
2. Undertaking immediate risk mitigation activities (urgent works) as and when a need is identified, including power upgrades;
3. Ensuring ongoing C&M of the site;
4. Submitting the final Closure and Reclamation Plan (CRP) to meet the requirements of the Water Licence and Land Use Permit Application defined by the MVLWB;
5. Conducting studies and advancing surface design options; and,
6. Undertaking environmental and health monitoring and studies / baseline assessments.

In addition, the GMRP Team maintained an active risk identification and management program (described in Appendix D).

Project Expenditures
Expenditures for the project include personnel and operations and maintenance (C&M, risk mitigation activities and design). Actual expenditures in 2018-19 were $79,139,804. Further details on key expenditures are shown in Section 2.1.10.

2.1.1 Site Stabilization Plan (SSP)

Underground Stabilization Project

An important element of the Giant Mine CRP includes stabilizing stopes and other voids, which are areas that were hollowed out underground during mining operations as ore and rock material was removed. As part of the GMRP's ongoing risk management process, the Team identified underground areas that required immediate action to reduce risks to staff, the public, and the environment. Underground stabilization work started in 2013 and continued each year since. To address the risks of rock collapse or underground flooding, stopes were filled with a paste made from Giant Mine tailings, water, binder (cement), fly-ash, and, in some cases, inert rock material. Once the paste cures, it helps to stabilize the underground mine structure and prevent collapse.

In May 2018, the final stage of the SSP began construction, which primarily consisted of backfilling stope complex C5-09. Identified as high risk, the outstanding stope complex was particularly challenging to stabilize due to its size, the intricacy of the stope geometry, and the fact that arsenic chamber 9 is situated above it. Accordingly, the backfill material and construction methodology was carefully considered to plan appropriate stabilization approaches and account for a range of possible future scenarios. Between May and December 2018, the C5-09 backfilling program was carried out in three phases (Golder and Associates Ltd, 2019c):

- Phase 1: approximately 15,700 m^3 of paste was poured into stope C5-09, reaching an elevation of 21.5 m in the stope complex.
- Phase 2: approximately 16,700 m^3 of self-levelling concrete was poured between 21.5 m and 33 m to increase strength and stability in the central core of the stope complex.
- Phase 3: approximately 37,750 m^3 of paste was poured from the elevation of 33 m to the top of the stope complex.

Monitoring was completed throughout the three phases to compare the actual backfill rise with the expected backfill rise and to identify potential leakage. In December 2018, the backfill of stope complex C5-09 was successfully completed, with the final stope conditions meeting the criteria outlined in the technical specifications (Golder Associates Ltd, 2019a). The SSP is now finalized, marking a significant milestone for the GMRP. The other remaining stopes that have not been backfilled do not pose an immediate risk to public safety or the integrity of the underground; they will therefore be addressed through final remediation activities.

Key activities in 2018-19 included:

- successfully backfilling stope complex C5-09 with paste and self-levelling concrete;
- carrying out backfill quality and void fullness criteria quality assurance work during ongoing underground stabilization void backfilling processes; and,
- removing equipment associated with C5-09 backfilling activities after completion (Golder Associates Ltd, 2019a).

Next steps are:

- restoring tailing excavation areas during the spring of 2019; and
- developing a long-term monitoring plan, including validation drilling and in-situ sampling programs, to assess the integrity of paste and self-levelling concrete.

Open Pit Closure

Open pit closure is another component of the overall Giant Mine CRP. There are eight open pits on the Giant Mine site. As surface mining was conducted late in the mine life, the pits are currently open excavations with varying levels of connectivity to underground networks. All the open pits are located within the central valley where Baker Creek flows, two of which (A1 & A2 Pits) are in close proximity to Yellowknife Bay at the south end of the site (Golder Associates Ltd, 2018e). These open pits pose risks related to worker and/or public safety as well as to the environment, given the probability that Baker Creek may flood the area, affecting the underground. Therefore, the decision was made to fill the pits.

An Open Pit Closure Options Analysis Report was developed in 2018, which concluded the following actions should be carried forward to future studies (Golder Associates Ltd, 2018e):

- underground stabilization of stope areas below and adjacent to the pits;
- backfilling the pits with new quarried rock material to the A2 pit spill point elevation;
- using contaminated granular from the mine site to fill the remaining pit volumes (only applicable to the pits A1 and B1); and,
- contouring remnant pit high walls in select areas.

Next steps:

- carry out final checks on the potential negative impacts of the contaminated granular fill material on minewater quality as part of the final design.
- continue site borrow investigations, sampling, and testing to identify suitable borrow material for pit fill, where required.
- complete an options analysis on a pit-by-pit basis in order to complete pit closure designs.

B1 Pit Freezing Feasibility

As arsenic-containing stopes in Area 3 and 4 are adjacent to the B1 Pit, the freeze infrastructure for those areas requires the pit to be backfilled. This represents an opportunity to use contaminated surficial material to backfill the B1 Pit instead of creating new separate storage areas. In 2018, three potential scenarios for in-pit disposal and associated freeze containment of the waste sources were examined. The study concluded that freezing the contaminated surficial material in the B1 Pit is technically feasible, but there are several factors related to freeze configuration, constructability, and cost to consider (AECOM Canada Ltd, 2018c).

Next steps:

- compare costs for the B1 pit freezing of contaminated surficial material with costs for freezing Chamber 15.
- take into account all other disposal costs such as material handling/transport and modifications to Chamber 15 for top down access in the overall project planning and decision-making.

2.1.2 Tailings Management and Monitoring Plan

Tailings are ore residues left over after the process of separating the gold from the ore; they contain higher concentrations of arsenic (Giant Mine Remediation Project, 2019e). Over the operating life, most tailings were deposited into TCAs. In 2018-2019, a Tailing Management and Monitoring Plan was developed to define an approach to managing the TCAs after completion of closure activities (Giant Mine Remediation Project, 2019h). This plan does not include management and monitoring approaches during the current C&M phase or during the construction.

The Tailings Management and Monitoring Plan describes the approach and methods to monitor the performance of related closure measures and outlines the anticipated maintenance activities for the rehabilitation of the TCAs. An adaptive management approach has been adopted in response to uncertainties related to performance expectation. This approach will enable adaptive mechanisms when performance criteria and closure objectives are not met and will ultimately inform maintenance implementation if necessary.

Monitoring activities will address the main components of the TCAs' closure, such as the engineered cover, spillways, perimeter dams, temporary water management areas, and the reclaimed South Pond area. Monitoring activities will include using visual inspections, topographic surveying, sampling, and instrumentation.

Next steps:

- Cone Penetration Testing in the Northwest and North/Central Ponds. Geophysical investigation of the Foreshore Tailings and Nearshore Sediments to assist in the design of a preferred cover system.

2.1.3 Immediate Risk Mitigation

Infrastructure Review

The GMRP conducts a structural review of the numbered buildings at the Giant Mine site to assess risks associated with them and determine whether immediate action is required to mitigate those risks. A review was conducted in July 2018. Before that, the most recent reviews were carried out in 2014 and August 2017.

Key activities in 2018-19 included:

- A structural review was conducted on 19 buildings, using visual assessments to identify types of structural defects, signs of structural distress and deformations, and signs of material deterioration.

Results:

- During the review, each building was assigned a category based on its risk level. The results of the 2018 infrastructure assessment are summarized below (AECOM Canada Ltd, 2018a).

Table 1: Results of the 2018 Infrastructure Assessment

Risk Category	Description	Number of Buildings in 2018
Black	Risk of immediate structural failure	0
Red	Risk of structural failure within 5 years	10
Yellow	Risk of structural failure between 5 – 10 years	9
Green	Expect to last beyond 10 years	0
Not Reviewed	Buildings remote and difficult to access, missing, or demolished	126

The assessors noted that several buildings on site remain unsecured. Most are either small sheds with no purpose or are used to store small equipment such as sampling points or small pumps. Most buildings noted as unsecured in the 2014 inspection have now been locked and barricaded. Safety perimeters have been erected around all the selected buildings to prevent unauthorized access and to minimize risks to the safety of the mine staff (AECOM Canada Ltd, 2018a). Several buildings classified as Black in the 2014 report have been demolished and no building has been categorized as Black in the assessments conducted in 2017 and 2018. However, the condition of several buildings has noticeably worsened. The buildings showing a noticeable change are recommended to be reviewed every two years for reassessment and to help determine the rate of deterioration.

Following the August 2017 infrastructure action plan, the assessors recommended carrying out minor repairs to several buildings showing significant deterioration. The assessors concluded that these remedial and repair works can presumably be carried out by the Giant Mine maintenance staff with material sourced from location building supply stores or spare materials at Giant Mine. Additionally, watertight roof repairs are not considered strictly necessary unless the water entering would damage live electrical equipment (AECOM Canada Ltd, 2018a).

Next Steps:

- The assessors recommended the following:
    - buildings rated Red should be reviewed at a minimum every two years; and,
    - all buildings should be reviewed every four years.

Upgrades to the Akaitcho Deep Well Pump Station

The existing dewatering system at Akaitcho keeps the Giant Mine underground water levels within required limits. After four years of operation, it was observed that the dewatering system was discharging water at a decreased rate compared to when it was initially installed. This change could cause risks at the Mine Site. The GMRP Team assessed potential improvements to the Akaitcho Deep Well Pump Station to increase its reliability. In 2017, the Project Team decided to complete pumping station upgrades using two deep well submersible pumps located near the Akaitcho shaft (AECOM Canada Ltd., 2017).

Key activities in 2018-19 included:

- preparing the site: constructing drill pad and an access road;
- drilling wells from surface to intersect flooded mine workings;
- installing steel casing pipes in drill holes;
- placing a pre-made electrical building on the drill pad;
- installing submersible pumps in both deep wells with riser pipes;
- completing electrical and pipe connections on surface;
- installing and connecting High Density Polyethylene surface discharge pipe to existing mine discharge pipe to the Northwest Pond; and
- testing pumps at the end of March 2019.

Next Steps:

- commissioning into 2019-2020;
- mine inspector to approve electrical feed disconnect system; and
- start operating the dual deep well system.

Geotechnical Inspection of Dams

At the Giant Mine, dams are used for mine water management, surface water management, and tailings solids retention. Dams are inspected annually to assess water level restrictions and geotechnical considerations.

Key Activities in 2018-19 included:

- visually inspecting all tailings and water management dams at Giant Mine, conducted in June 2018;
- monitoring and updating of maintenance recommendations from previous Annual Geotechnical Inspections;
- summarizing preliminary findings and identifying recommendations for priority actions, during a meeting with representatives from PSPC, Golder, Deton'Cho / Nuna Joint Venture (DCNJV) and Parsons; and,
- inspecting Dam 1 to assess additional maintenance and investigating drilling since it will continue to function as part of the current ETP until the new WTP is operational.

Results indicate the following:

- Most of the dams do not require maintenance or additional monitoring.
- General observations included the ponding of water on dam crests, some minor deformation, and continuing occurrence of small sinkholes located on dam crests.
- In the most recent report (Golder Associates Ltd, 2018a), there are no new observations or recommendations related to dams; therefore, recommendations from previous reports (Golder Associates Ltd, 2018c; Golder Associates Ltd, 2018d) still apply.
- One of the eight recommendations from the 2017 Annual Geotechnical Report was not completed at the time of the inspection.

The 2018 Annual Geotechnical Report included several recommendations related to monitoring and operations.

Next Steps:

- The GMRP Team will consider the recommendations and implement as appropriate.
- The annual geotechnical inspection of dams will occur again in 2019-2020 to assess the condition of the dams.
- A Dam Safety review will be completed, in compliance with the Canadian Dam Association Guidelines.

2.1.4 Care and Maintenance (C&M)

Ongoing C&M at Giant Mine is critical to ensuring the current hazards at the site are managed to prevent harm to staff, to surrounding communities, and to the environment. The GMRP Team and the C&M contractors ensure the site is kept safe, secure, and in compliance with regulations by maintaining facilities, controlling and inspecting contaminated waste storage areas, managing minewater, and treating effluent on site. Parsons Inc. assumed the role of Mine Manager in summer 2018 and is responsible for maintaining the site until the completion of remediation activities. DCNJV continues to provide the C&M work required to keep the surface in a stable condition until remediation can move forward.

Key activities in 2018-19 included:

- preparing for spring freshet (the 2018 spring freshet occurred without incident);
- ongoing dust management activities (application of calcium chloride on roads and a dust control product (SoilTac) on tailings ponds);
- discharging treated effluent (354,618 m^3 of treated mine effluent discharged into the environment at Surveillance Network Program (SNP 43-1);
- continuing water and effluent monitoring and sampling to meet the SNP outlined in the former Water Licence and requirements of the current MDMER;
- continuing site security activities, as several areas on the site are identified as being a security risk (temporary security fencing and signage was designed and constructed in 2018 to reduce the risk of inadvertent trespassing at the site);
- conducting underground rehabilitation to existing chutes and head covers to reduce hazards to workers carrying out C&M work activities; and,
- replacing the existing C-Shaft power feed, since it was determined during an inspection that the containment system for the power feeder cables was not fit for services (there was risk of structural failure of the power cable hangers and C-Shaft timbers, both of which would result in the failure of the electrical supply) (Giant Mine Remediation Project, 2019e).
- bolting and screening of key travel ways underground.

2.1.5 UBC Bridge Repair

The UBC Bridge over Baker Creek was constructed in 2007. It is a single span timber deck bridge with steel girders (the superstructure). It was supported on concrete pile caps and steel pipe piles (the abutments or substructure). It was being used to support C&M activities at the site up until the fall of 2015. In October of 2015, the Interim C&M Mine Manager, DCNJV, noticed the abutments under the UBC Bridge deck had moved inward and rotated. The bridge was deemed unusable and CIRNAC ordered the bridge be closed pending an assessment.

A structural inspection of the bridge was conducted on January 13, 2016 and confirmed DCNJV's observations. Subsequently, a new design was developed in the 2017-18 fiscal year. The new design improves stability to the approach fills by using the bridge structure components to act as retaining walls, reducing lateral movement. A contract for the repair work was awarded in January 2018 and construction began in March 2018. No in-stream work was necessary to complete the bridge repairs.

Key Activities in 2018-19:

- Reconstruction was completed over the spring of 2018.The foundation system was replaced with an improved pile and cap design. Since the bridge's deck and steel girders were structurally sound, they were reused in the bridge's structural components.
- On May 23, 2018, the UBC Bridge was re-opened to vehicle access, reducing workers' travel time to the main underground access portal in the B2 Pit, as well as to other nearby west areas of the site.

2.1.6 Arsenic Waste Disposal Options

Long-term management of arsenic waste is one of the key components of the Giant Mine CRP. During the life of the mine, mining operations produced approximately 237,000 tonnes of arsenic trioxide waste, which are currently stored in 14 chambers and stopes (Giant Mine Remediation Project, 2018a). Chamber 15 had not been commissioned by the time mining operations stopped and is currently empty. The chamber has been identified as a potential disposal site for arsenic waste related to clean-up activities (Giant Mine Remediation Project, 2007).

In 2017, options for disposal of arsenic waste in Chamber 15 were examined. The assessment concluded that the use of drifts was the best option for delivering arsenic waste to Chamber 15 (Golder Associates Ltd, 2017). However, new findings indicated that the available volume of Chamber 15 is smaller than estimated in the 2017 report. In 2018, the GMRP Team conducted an updated assessment of the two preferable options, the use of drifts or drop raises, to deliver arsenic waste to Chamber 15 (Golder Associates, Ltd, 2018h). The updated report concluded that drop raises should be carried forward into the next stage of design as a positive and viable option.

Next steps:

- complete final characterization and volume estimation of waste that needs to be frozen.
- develop a detailed design of the raises concept.
- conduct a cost benefit and trade-off analysis to determine whether waste and highly-contaminated soil are best placed in the B1 Pit or Chamber 15, or a combination of both.

2.1.7 Freezing Design for Areas 1 and 2

In 2018, the GMRP Team conducted a review of current climate change documentation to support the advanced design of freeze Areas 1 and 2. Climate change is a critical risk factor for ground freezing systems at the Giant Mine site. As a result, changes in climate change predictions affect the design of such systems. The review included the following information:

- background of climate change data used in the project to-date;
- current climate change data; and,
- preliminary analysis and recommendations for integration of current climate change data for use in the advanced design of ground freezing.

Since new predictions indicate that the rate of warming in the Northwest Territories will be four to five times faster than the global rate with variable summer and winter offsets, the review concluded with the following recommendations (AECOM Canada Ltd, 2018d):

- investigating mitigation options with additional near surface thermosyphons for shallow chambers;
- including seasonal variation in any future design modelling;
- completing modelling to 100 years, or the maximum available data relating to climate change predictions; and,
- using the most current maximum projections for all analysis, which refers to the worst-case scenario or highest greenhouse gas concentration prediction.

2.1.8 Water Treatment Projects

Water Treatment Plant (WTP)

Management of contaminated water within the mine site is a key activity to reduce its impact on the environment. The ETP is currently operating seasonally to treat water collected on the site and pumped from the underground mine pool. Treated water is then discharged to Baker Creek, which ultimately flows into Great Slave Lake (AECOM Canada Ltd, 2019a). There are some limits to the current ETP design and operational life. As a result, a new WTP will replace the existing ETP to maintain water levels within the mine pool and treat the contaminants in the water. Minor adjustments will be made to the existing ETP and it will continue to operate until the new WTP is built (Giant Mine Remediation Project, 2019c).

Pumping System

The preliminary design of the new WTP includes the installation of minewater intake wells that will replace the current Akaitcho Deep Well Pump Station, recently improved as described in Section 2.1.2. This system is currently pumping contaminated water from the underground or collected from surface runoff, which is then stored in surface holding ponds throughout the year to await seasonal ETP treatment. A new system will be built in approximately 2025 near the C-shaft area in the core area of the Project site, using a new submersible pumping system similar to the existing Akaitcho Deep Well Pump Station. This system will operate year-round and no surface water storage will be required. A recent report assessed underground water quality and quantity, the feasibility design of the minewater intake, and the identified risks associated with the design assumptions behind the water intake wells for the C-Shaft zone (Golder Associates Ltd, 2018f).

Next steps:

- Additional work is underway to refine estimates of mine water fluctuation due to seasonal variation in infiltration.
- There is a need to understand the impact of refinement in the pits and tailings cover construction schedule and surface water diversion designs on maximum and minimum pumping capacities.

WTP Pilot Testing Program

Another part of the new WTP development consists of implementing a pilot testing program to determine if treated water quality can reliably meet the EQC and Measure 14 of the Environmental Assessment (EA) (i.e., 0.01 mg-As/L). The pilot testing program was completed during the summer of 2018 and demonstrated the ability to successfully treat water pumped from the mine pool on the Giant Mine site to the criteria GMRP will be required to achieve from the mine pool on the Giant Mine site. Key activities in 2018-19 included (AECOM Canada Ltd, 2019b):

- building on-site pilot testing assembly at the existing ETP; and,
- testing, commissioning, and operating the pilot testing assembly.

The testing period ended in November 2018 due to cold winter weather. Given some challenges faced during the construction and commissioning phases, the full scope of the original testing program was not completed. However, sufficient testing was completed for the Project's purposes, and key findings indicated that:

- the use of conventional water treatment processes for the removal of particulate and contaminates prior to the arsenic removal contactors is a suitable approach;
- arsenic removal media may be used to treat arsenic and antimony to achieve the target EQC;
- the exact selection of the arsenic removal media should be delayed until detailed design of the WTP is completed; and,
- disposal of the exhausted non-hazardous media produced during the long-term operation of the WTP can occur at the on-site landfill.

Based on performance data analyzed for the existing ETP, as well as results from the WTP pilot test program, the proposed WTP is expected to meet the objectives defined in the EQC. Therefore, the Project Team recommends to build a WTP with a firm capacity of 30 L/s and treatment ability to process water with an arsenic concentration of 0.01 mg-As/L, while receiving raw water with an estimated arsenic concentration of 100 mg-As/L (AECOM Canada Ltd, 2019a).

Site-Specific Passive Treatment System (PTS)

As part of the Giant Mine CRP, the GMRP Team assess the feasibility of treatment wetlands or other applicable passive and semi-passive surface water treatment technologies. At the Giant Mine site, a Passive Treatment System could remove arsenic as well as other parameters such as antimony, copper, lead, nickel, zinc, chloride, nitrate, and nitrite from the aquatic environment of Baker Creek.

In 2016, a study was conducted to assess the conceptual feasibility of a PTS. In 2017, a follow-up assessment was conducted to identify potential locations for a PTS at the site and to evaluate predicted long-term closure water chemistries and flow rates to inform PTS designs. Designs for bench- and pilot-scale testing were then developed and constructed. Treatment performance was achieved. The pilot-scale PTS operations started in April 2018.

Next steps:

- summarize all activities and results from commissioning and operations of the pilot-scale PTS in 2019.

2.1.9 Surface Design and Studies to Inform the Closure and Reclamation Plan

The GMRP Team has continued to advance several work packages related to the CRP for the site, including undertaking studies to gather information, engaging interested parties on the surface design options, and advancing engineering design for the CRP.

Studies

The below table lists environmental or engineering studies conducted in 2018-19 by the GMRP in relation to the project. It includes studies that were completed, as well as several that are still underway. Many of these studies are intended to provide information needed to inform closure design, while some are monitoring programs to ensure the safety of the surrounding communities during current site operations. Additional details on these studies can be found throughout the report.

Table 2: Studies Undertaken in 2018-19

Theme	Study / Report
Design	• Giant Mine Stope Complex C5-09 Stabilization Activities • Giant Pilot Off-Site Pilot-Scale PTS Interim Report • Open Pit Closure Options Analysis • Wide Infrastructure Assessment • Advanced Freeze Design: Climate Change Review • B1 Pit Freezing Feasibility Study • Chamber 15 Arsenic Waste Updated Disposal Options • Non-hazardous Waste Landfill - Preliminary Design Report • Pilot Plant Treatment Testing Program Summary • New Water Treatment Plant - Substantive Design and Cost Estimate Process Selection Report • General Design: Mine Water Intake Assessment Report • Tailings Management and Monitoring Plan • Annual Geotechnical Inspection

Theme	Study / Report
	• Quality Assurance Completion Report: Giant Mine - Interim Underground Stability Activities Paste Backfill Project 23 June to 12 December 2018 [Draft] • Departmental Representative Completion Report: Giant Mine - Stope Complex C5-09 Stabilization Activities 17 April 2018 to 22 February 2019 [Draft] • Giant Mine Site-Wide Infrastructure Assessment
Air	• Ambient Air Quality Monitoring Program Annual Report – 2018 [DRAFT]
Water	• Effluent Quality Criteria Report • Giant Mine 2018 MDMER/EEM Annual Report • Giant Mine Remediation Project - Groundwater Characterization • Giant Mine Remediation Project – Annual Water Monitoring Report 2018
Land	• Remedial Strategy for Contaminated Soil and Sediment • Giant Mine Archaeological Impact Assessment (AIA)
Biodiversity	• 2018 Giant Mine Bird Activity Survey [Technical Memorandum] • Finalized Wildlife and Wildlife Habitat Management and Monitoring Plan • Aquatic Effects Monitoring Program Design Plan - Baker Creek • Baker Creek Ecosystem Synthesis Report
Health & Safety	• Health Effects Monitoring Program (Health Study) • Human Health and Ecological Risk Assessment • Stress Assessment
Community	• Traditional Knowledge Study (GMRP-supported)

Closure and Reclamation Plan (CRP)

The CRP for the Giant Mine site has been developed to satisfy one of the submission requirements of the Water Licence and Land Use Permit Application, as defined by the MVLWB. The CRP is the culmination of the engagement and design work the Team has been working on since the Report of Environmental Assessment. It provides a description of the closure and reclamation of the Giant Mine Site by identifying the activities proposed to remediate the site and presents actions for the ongoing management and mitigation of environmental effects.

During 2017-18, the GMRP Team presented the scope of the CRP to the GMRP WG and the Giant Mine Advisory Committee (GMAC). High-level draft CRP concepts were then presented to the public at the Annual Public Forum in March 2018. During 2018-19, the GMRP Team incorporated input from a June and September engagement sessions into the CRP report, that was then finalized in January 2019. The Project provided the complete package to all stakeholders in February 2019, six weeks in advance of the official submission to the MVLWB, in order to give parties additional time to review [the CRP report was submitted together with a draft Water Licence application to the MVLWB in April 2019] (Giant Mine Remediation Project, 2019e).

Ongoing meaningful engagement with local Indigenous Governments or organizations and other affected parties has helped shape the final CRP. It is divided into ten major site components, and closure activities for each of the site components have been developed to ensure closure objectives are met. Once these activities are completed, monitoring programs will be implemented to confirm the success in meeting closure goals. Table 3 summarizes the closure activities for each major site components as outlined in the CRP. Other activities in 2018-19 that relate to the CRP are listed in Table 2, under studies related to design.

Table 3: Summary of closure activities (Giant Mine Remediation Project, 2019e).

Major site components	Closure activities
Underground mine workings	• Stabilizing the underground. • Closing openings to surface. • Maintaining the minewater level. • Creating a long-term access portal.
Freeze program	• Preparing the freeze area; and, • Freezing the ground.
Open pit mine workings	• Filling or partial filling the pits with clean rock and/or contaminated soil and waste rock.
Contaminated soils and sediments	• Excavating and safely disposing of contaminated soils. • Capping areas where contamination is deep. • Building a fence around areas with high arsenic concentrations in bedrock, forest, and wetlands. • Excavating and/or capping the nearshore sediments located near the Townsite and Marina area. • Excavating areas with tailings solids in the area near Dam 3 of the TCAs.
Baker Creek and surface water drainage	• Widening the Baker Creek area to handle larger flows without overflowing the banks of the creek. • Re-aligning portions of the creek. • Removing contaminated sediments along the entire Baker Creek.
Tailings Containment Areas	• South Pond relocation, consolidation with North and Central Ponds. • Placing waste in TCAs. • Contouring covers and surface contouring. • Constructing a spillway. • Completing dam improvements, • Building a Foreshore Tailings Cover.
Borrow material	• Some of the activities planned for closure, such as re-contouring pit slopes, re-aligning Baker Creek, and constructing spillways, will require excavation and blasting. The material generated from these activities will be used to meet some of the demand for borrow material. • The areas where borrow is to be excavated will be designed to limit the impact of borrow extraction on the surrounding landscape. • Where soil is exposed after the completion of excavation, native plants will be used to vegetate exposed areas and control erosion.
Water treatment plant and outfall systems	• Building a new WTP and treatment and release of water directly through an outfall into Yellowknife Bay.
Buildings and site infrastructure	• Removing around 101 structures remaining from mining activities. • Removing 25 areas of debris and stockpiled waste. • Removing utilities, site access roads, and fencing that are no longer needed.
Landfill	• Constructing a landfill on site for non-hazardous waste generated during active remediation.

2.1.10 Summary of Fiscal Year 2018-2019 Expenditures

Planned versus Actual Expenditures 2018-19

The planned versus actual expenditures for 2018-19 are outlined in the table below.

Table 4: Planned Versus Actual Expenditures

Category	Planned	Actuals
C&M	$17,103,381	$20,340,033.07
Regulatory	$602,500	$50,004.59
Consultation	$1,932,672	$3,100,632.98
Investigation & Assessment	-	$35,706.83
Remediation	$43,492,269	$43,657,668.98
Monitoring	-	-
Program Management	$10,467,351	$9,874,037.53
Totals	**$73,798,173**	**$77,058,083.98**

Multiple change requests account for the differential between planned and actuals – for example, the C5-09 stabilization project increased by over $5 million due to additional drilling, additional preventative measures to reduce risk of paste leakage, increased medical monitoring, and additional material quantities.

Planned Expenditures in 2019-20

The planned expenditures in 2019-20 are outlined in the table below.

Table 5: Planned Expenditures in 2019-20

Category	Operations and Maintenance	Grants and Contributions	Salary and EBP	Totals
C&M	$18,972,562			$18,972,562
Regulatory	$830,000			$830,000
Consultation	$112,400	$1,973,376		$2,085,776
Remediation	$10,398,557	$666,375		$11,064,932
Monitoring	$2,783,245			$2,783,245
Program Management	$6,473,128		$3,543,734	$10,016,862
Totals	**$39,569,891**	**$2,639,751**	**$3,543,734**	**$45,753,377**

2.1.11 Audits and Inspections in 2018-19

In 2018-19, there were sixteen external regulatory inspections of the GMRP. Additionally, contractors on-site conduct their own inspections to ensure workers maintain compliance with standard operating procedures, protocols, and standards. During the same fiscal year, there was no audits, although the GMRP continues to implement outstanding recommendations in response to the Environment, Health and Safety (EHS) Compliance Audit conducted in 2016, including improved site signage and security and updating environmental response plans for arsenic trioxide (Giant Mine Remediation Project, 2018b).

Regulatory Inspections

In 2018-19, sixteen inspections were conducted by external regulators – six by CIRNAC, four by Environment and Climate Change Canada (ECCC), two by Fisheries and Ocean Canada (DFO), and four by the Workers' Safety & Compensation Commission (WSCC). This compares to five inspections by external regulators in the previous year and six in 2016-17. The number of inspections per year is determined by the regulator based on a variety of factors including, but not limited to, the nature of work being undertaken at the site.

The 2018-19 regulatory inspections collectively identified 34 non-compliance incidents, notably during the Akaitcho Well Drilling inspection conducted by CIRNAC and the inspection on the Paste Batch Plant and Tailings Dam as well as the electrical review, both conducted by WSCC. The GMRP is committed to addressing any non-compliances as soon as possible and assigns responsibility and timelines for addressing any issues identified by any party. To this date, all non-compliance incidents have been addressed, except the ones related to the electrical review conducted by WSCC. Table 6 summarizes all the inspections performed during 2018-2019 with key findings and recommendations.

Table 6: Summary of Inspections Performed

Regulatory Body	Inspection Date	Inspection Type / Purpose	#of Non-Compliances	Findings / Recommendations
CIRNAC	12-Apr-18	Inspection to ensure compliance of the UBC Bridge project with the land use permit, water licence, and associated management plans	0	• No findings and/or recommendations were issued.
	12-Apr-18	Inspection to ensure compliance of the Akaitcho Well Drilling project with the land use permit, water licence, and associated management plans	7	• Numerous small hydrocarbon stains. • Requirement to report spills. • Three large double walled storage tanks located on the back of a flatbed truck. • Multiple containers and drip trays containing waste oil that was not sealed. • Numerous pieces of equipment that did not have drip trays placed under. • Operators appeared to be unfamiliar with the conditions

Regulatory Body	Inspection Date	Inspection Type / Purpose	#of Non-Compliances	Findings / Recommendations
				of the land use permit.
	24-Apr-18	Follow-up Inspection to the non-compliance discovered during the April 12th, 2018 inspection of the Akaitcho Well Drilling project	0	• No findings and/or recommendations were issued; all of the non-compliances were addressed and all site personnel appear to be knowledgeable of the conditions of the land use permit and associated management plans.
	30-Apr-18	Inspection to ensure compliance of the UBC Bridge re-construction with the land use permit, water licence, and associated management plans	0	• No findings and/or recommendations were issued.
	24-Aug-18	Annual water samples at discharge sampling location (SNP 43-1)	0	• No findings and/or recommendations were issued.
	21-Dec-18	Semi-close out inspection of C5-09 Project	N/A	• Project not completed at the time of the close-out inspection. Follow-up inspection required.
Environment and Climate Change Canada (ECCC)	17-Apr-18	Inspection of storage tanks system at Akaitcho drill pad	0	• No findings and/or recommendations were issued.
	13-Aug-18	Annual Metal & Diamond Mining Effluent Regulations (MDMER) sampling and regulatory review	0	• No findings and/or recommendations were issued.
		Brief review of PCB's disposal status	0	• No findings and/or recommendations were issued.
		Brief review of Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197)	0	• Product Transfer Areas questions raised by ECCC.
Fisheries and Ocean Canada (DFO)	11-May-18	Baker Creek Inspection	N/A	• GoC to determine the outcome of this inspection
	18-May-18	Baker Creek	N/A	• GoC to determine the outcome

Regulatory Body	Inspection Date	Inspection Type / Purpose	#of Non-Compliances	Findings / Recommendations
		Inspection		of this inspection
Workers' Safety & Compensation Commission (WSCC)	19-Jul-2018	Inspection on the Batch Plant and Tailings Dam	5	• Reinforce hygiene policies as employees were seen not wearing gloves in the area. • Ensure all workers use adequate Personal Protective Equipment (PPE) at all times. • No fencing or protective barrier to protect workers from tailings spill-over, and pinch points on conveyor moving parts. • Jersey barriers used to support the ramps to the feeders are not high enough to prevent a loader from driving off or tipping over the side of the access ramp. • Ensure that flammable materials and lube oil are stored separately. • Several fire extinguishers had not been inspected recently.
	20-Aug-18	Electrical Review	22	• Secure all electrical equipment. • Eliminate extension cords and flexible cords. • Maintain all equipment in safe and proper working condition. • Remove out of service equipment. • Add warning notices to distribution panels. • Limit access of distribution panels to only authorized personnel. • Not all electrical equipment used at the cement plant is approved. • Identify all electrical equipment. • Revise emergency pull-cord arrangement. • Connect the taps to the bottom tension wires in accordance with CEC 36-312.
	31-Oct-18	Review of the draft hygiene Inspection of the UBC bridge	0	• No orders were issued during both inspections, but a number of pending items were discussed in the close-out meeting.

In addition to these external regulatory inspections, as part of responsible operations the C&M contractor, as well as all contractors and subcontractors, also conducted their own internal inspections on a regular basis to ensure safe operation at the site. These internal inspections include daily site inspections by C&M staff and regular engineering inspections of major structures (e.g. dams, arsenic chamber bulkheads) and equipment. Non-conformances identified during internal inspections in 2018-19 were minor and promptly corrected.

2.2 Progress on EA Measures

The *Report of Environmental Assessment and Reasons for Decision* (Mackenzie Valley Review Board, 2013) listed 26 Measures that must be addressed, as well as 16 suggestions that may be implemented at the GMRP Team's discretion. The Team's immediate focus is to address the Measures with set timelines, and those with the biggest impact on the project scope. Measures completed to date deal with the negotiation of an Environmental Agreement and the creation of the GMOB (Measures 3, 4, 7, and 8), investigating and engaging stakeholders and the public in discussions of long-term funding options (Measure 6), and investigating options for Baker Creek (Measure 11). The summary below provides a highlight of the progress made in 2018-19. Appendix B provides a complete summary of progress against all EA Measures and Suggestions in 2018-19, as well as plans for the 2019-20 year.

Environmental Agreement and GMOB (Measures 3, 4, 7, and 8)

- The Environmental Agreement came into effect June 2015, which formalized requirements to meet Measures 3, 4, 7, and 8.
    - Measures 3 and 4: The GMRP provides ongoing funding to the GMOB to manage a research program.
    - Measures 7 and 8: The Environmental Agreement provided for the creation of the GMOB, which formed in the fall of 2015, and funding to fulfill the obligations outlined under Measure 8.

Quantitative Risk Assessment (Measure 5)

- The QRA was initiated in 2018 in consultation with potentially affected communities. The QRA engagement process involved the GMRP WG, NSMA, YKDFN, GMAC, and other groups.
- Key activities in 2018-2019 included:
    - The QRA Team met with the GMRP WG to introduce the QRA and validate the engagement approach.
    - Two two-day workshops were held with affected parties to identify and discuss risk scenarios and consequence categories. Additional engagement sessions focused on the consequences of risk scenarios and the risk acceptability thresholds to ultimately complete a quantitative assessment of the identified failure scenarios.
- In the fall of 2019, the results of the final QRA will be reviewed with interested groups and presented to the public.

Long-Term Funding Options (Measure 6)

- A draft report on long term funding options was provided to the GMRP WG for review in July 2017. Subsequently, an independent consultant was retained to develop and provide a revised report. A subcommittee of members from the GMRP WG was formed to provide feedback and input into the revised report.
- The report is currently in progress and is anticipated to be finalized in 2019.

Health Effects Monitoring Program (Measure 9)

- The Health Effects Monitoring Program was established in 2017. Dr. Laurie Chan, an independent researcher from the University of Ottawa, is leading the study. An Advisory Committee was established with representatives from Health Canada, GNWT Health-Office of the Chief Medical Officer, YKDFN, City of Yellowknife, NSMA, GMOB, and the GMRP, to provide recommendations on the design and implementation of the program.
- Public engagement was undertaken in 2017/18 to inform residents of the program, discuss the proposed study and obtain feedback. The program completed its baseline sample collection for Yellowknife, Ndilǫ and Dettah in 2018. Sample analysis is to be completed in 2019, with baseline results reported in May 2019 at a community meeting in Yellowknife.

  Section 4 provides more information about the Health Study.

Human Health and Ecological Risk Assessment (HHERA) (Measure 10)

- The HHERA was completed by Canada North Environmental Services (CanNorth). The HHERA was carried out with significant input from stakeholders, community members and traditional knowledge holders. This input included both the scope of the assessment and the implementation to better assess risks considering differences in traditional land use, food consumption, and lifestyles. The final report was released in January 2018.
- The GMRP is currently initiating a Stress Study, which was identified in an Appendix to the Report of EA. Preliminary scope discussions have occurred with affected parties. The purpose of the assessment is to evaluate the indirect effects of potential exposures to arsenic on wellness, particularly stress. Dr. Ketan Shankardass is the principal investigator of the Stress Assessment. Implementation of the study will take place 2019/20.

  Section 4 provides more information about the HHERA.

Developing Site-Specific Water Quality Objectives (SSWQO) (Measure 12)

- Water quality objectives (WQOs) specific to and protective of Yellowknife Bay were developed based on CCME Guidance and are presented in the EQC report. Extensive modelling was developed to support the development of EQC and demonstrate the Project's ability to meet WQOs. Modelling documentation is included in the EQC report along with prediction of future water quality in Yellowknife Bay.
- The WQOs will be met upon completion of the GMRP active remediation phase and will be met in the vicinity of the outlet of Baker Creek (see Measure 13), at the edge of a 200 m mixing zone (see Measure 15) that includes the GMRP's new WTP outfall and the influence of Baker Creek.

Addition of ion exchange process to proposed water treatment process to produce water treatment plant effluent that at least meets Health Canada drinking water standards (Measure 14)

- A pilot testing program was completed during the summer of 2018 to demonstrate the successful treatment of water pumped from the mine pool on the Giant Mine site.
- It is recommended that arsenic removal media is incorporated into the WTP process to treat for arsenic and antimony in order to meet the EQC.

Consideration of arsenic and any other contaminants of potential concern (Measure 15)

- All parameters of potential concern will meet relevant Canadian Drinking Water Guidelines at the edge of the mixing zone. WQOs specific to Yellowknife Bay have been developed to be protective of aquatic life and drinking water. All WQOs will be met at the edge of the mixing zone.
- Arsenic concentrations in Great Slave Lake beyond the edge of the mixing zone will not increase from present-day concentrations due to effluent discharge. See Measure 12 for more details on WQOs and supporting evidence.

Implement a comprehensive Aquatic Effects Monitoring Program (AEMP) (Measure 17)

- The Baker Creek AEMP Design Plan has been completed and provides a study design for monitoring through the transition period between approval of the Water Licence and re-location of the treated effluent discharge to Yellowknife Bay, to meet regulatory requirements and Water Licence commitments. It will be submitted with the Water Licence application (April 1, 2019), with approval sought at Licence issuance to allow for implementation.
- Development of a Draft Yellowknife Bay Conceptual AEMP Design Plan began in 2017-18 and was finalized in 2018-19 based on public review and comment and feedback from GNWT Environment and Natural Resources (ENR). It will be submitted as part of the Water Licence application package for informational purposes and will be further developed based on engagement and Water Licence process outcomes. The AEMP for Yellowknife Bay will be submitted for approval prior to implementation. As discharge moves to Yellowknife Bay in approximately 2026, the AEMP for Baker Creek will become the Yellowknife Bay AEMP. (There will not be two AEMPs concurrently.)

Freeze Design Options (Measure 18)

- The Report of EA Measure 18 directed the GMRP Team to conduct “a comprehensive QRA evaluating both wet and dry methods for the initial freezing design.” As per this measure, the GMRP Team, and a technical review by the Independent Peer Review Panel, compared the two methods for freezing. This assessment, as part of the Design Basis Report, concluded that the dry method worked just as well as the wet at reaching the target freeze temperature to ensure that the arsenic trioxide remains encapsulated in frozen rock, preventing contact with water flowing through the mine. In addition, if future technologies provide a better option for managing the arsenic trioxide dust, a dry freeze is easier to reverse than a wet one. This information was provided to the GMRP Team in the freeze design basis report, which was finalized in 2016-17. Engagement with the GMRP WG followed.
- A Plain Language Summary will be released to the public in 2019.

Develop conceptual design of tailings cover and objectives (Measure 22)

- In 2017-18, the conceptual tailings cover design was developed.
- During Surface Design Engagement (SDE), some affected parties preferred the selection of a non-vegetated tailings cover. The selection of a rock cover, as outlined in the CRP, addresses the concern of the cover being compromised by vegetation growth. As a result of input received during engagement and the selection of a rock cover, this measure has been addressed.

Tailings Management and Monitoring Plan (Measure 23)

- The Tailings Management and Monitoring Plan was completed in 2018-19 and will be part of the full Water Licence package.

3.0 ENVIRONMENT

3.1 Environmental Management

The C&M contractor, DCNJV, has in place an Environmental Management Plan, which includes Environmental Protection Plans (EPPs) for major components of the mine site, including:

- Materials and Equipment Handling (e.g. halocarbon management);
- Non-Hazardous and Hazardous Waste Management;
- Traffic Management;
- Erosion and Sediment Control;
- Water Management; and,
- Heritage Protection.
- Dust Management

These EPPs guide the management of each of the above components. For example, the EPP for water management includes details of how water is treated at the mine's ETP as well as a description and requirements of the different water monitoring and sampling programs.

The following report sub-sections (**Air**, **Water**, **Land,** and **Biodiversity**) describe the key activities and results of these ongoing management programs, in addition to other assessments and monitoring as described in the LTMP summary below.

Long-term Monitoring Program (LTMP)
The LTMP is a combination of all monitoring components that are currently ongoing or will be required at Giant Mine. The Program includes both environmental components as well as structural monitoring that are required on site. The LTMP is used to determine baseline conditions, monitor existing performance, and inform the design process for remediation activities.

The components of the LTMP include regulatory and due diligence monitoring and can be separated into the following components:

Environmental	Structural
• Surveillance Network Program (SNP) • Metal and Diamond Mine Effluent Regulations (MDMER) including Environmental Effects Monitoring (EEM) Program • Operational Monitoring Program (OMP) (ETP, underground, annual site-wide bird survey) • Aquatic Effects Monitoring Program (AEMP) • Wildlife and Wildlife Habitat management and Monitoring Plan (WWHMMP) • Air quality – fenceline & community • Noise • Cumulative effects	• Freeze • Dams and seeps • Landfill • Pit stability • Tailings covers • Underground Structures • Baker Creek (icing)

LTMP is structured in three phases: pre-remediation, remediation, and post-remediation. The intent is for the LTMP to be operational for the lifetime of the project (100 years). Section 3 provides additional information on the individual components of the monitoring program. A new Type A Water Licence includes conditions related to monitoring and reporting for many of the above components.

Spills and Environmental Training

- **Spills, Accidents, and Significant Malfunctions:** There were a total of 15 environmental incidents resulting in 94 L spilled in 2018-19.
- **Environmental Training:** Employees received 367 hours of EHS Awareness Training and 314 hours of EHS Environmental Training which included spills response, mine rescue, and others.

3.2 Air

Activities undertaken at the Giant Mine site have the potential to release contaminants from the site into the air. Of primary interest are particulates carrying arsenic, asbestos, iron, lead, or dust. If these contaminants become airborne, they may be transported off-site and deposited elsewhere. To monitor and minimize air quality impacts, the GMRP Team has established an air quality monitoring program (AQMP) – including ongoing air quality monitoring on-site and in nearby communities – and actively manages air quality through dust suppression (e.g. application of calcium chloride on roads or dust suppressant on tailings).

2018-19 Highlights

- Results of the ambient air quality monitoring indicated the air quality of the airshed encompassing the GMRP was representative of regional and local air quality
- The GMRP Team used a new product for dust suppression (SoilTac), as a result of an options assessment initiated in 2015.

3.2.1 Air Quality Monitoring

The GMRP Team conducts real-time air quality monitoring of particulate matter (PM_{10} and $PM_{2.5}$) and analysis of arsenic, asbestos, iron, lead, and other contaminants in airborne dust at three levels: near specific activities taking place on the site, such as deconstruction or drilling; at the “fenceline” (site perimeter); and in the local community at three locations. This data helps the GMRP Team to:

- monitor concentrations of airborne contaminants;
- assess potential effects on the local air;
- establish whether these contaminants are the result of activities at the Giant Mine site; and,
- determine whether mitigation measures are required if air quality results exceed established Action Levels and criteria (summarized in Appendix D).

The GMRP aims to avoid contributing to exceedances of the thresholds for various air quality indicators, as measured by air quality monitoring stations within the community. In 2018, additional monitoring locations for PM_{10} and arsenic were deployed in association with the C5-09 Stope Stabilization program, and the fenceline and community monitoring programs continued as per usual. The final annual report was provided by SLR in March 2019 (SLR Consulting (Canada) Ltd, 2019).

The fenceline program monitors for dust around the perimeter of the site to ensure dust and contaminants are not being released from the GMRP. Nine stations with e-samplers are positioned in fixed locations to ensure consistent coverage of various wind directions. The stations run 24-hours a day throughout the work season (May – November).

Results

- To ensure the AQMP is robust and continues to meet the needs of the GMRP and stakeholders, the Team conducted a review of the AQMP in 2018-19 and determined that it continues to meet the needs of the GMRP.
- Results of the ambient air quality monitoring indicated the air quality of the airshed encompassing the GMRP was representative of regional and local air quality.
- The majority of particulate matter concentrations measured above the applicable criteria were likely caused by road dust from vehicle traffic at the community stations and bias from ice fog and low-lying fog at the fence line monitoring locations. Particulate matter above criteria was measured on two days where on-site activities were suspected of contributing to the measured concentrations.
- Trace metal results from 24-hour integrated fence line total suspended particles (TSP) samples measured above their respective Ontario Ambient Air Quality Standards (AAQS) as follows: three 24-hour arsenic concentrations, five 24-hour iron concentrations, and one 24-hour lead concentration. There were no on-site contributors identified on these days.
- No concentrations of nickel or antimony were measured above their respective Ontario AAQS during the reporting period at the fence line monitoring stations.
- There were no days at the community stations with concentrations above the following standards: continuous one-hour average PM2.5, 24-hour integrated PM10, 24-hour integrated arsenic from PM10 or TSP, trace metals from TSP, or asbestos. There were three days with continuous one-hour average PM10 concentrations above the 24-hour Ontario AAQS of 50 µg/m3 and one day with a 24-hour integrated measurement of TSP above the Guideline for AAQS in the Northwest Territories of 120 µg/m3. These concentrations occurred in May at the NDL community station (located in the YKDFN Ndilǫ community) and were attributed to road dust from vehicle traffic associated with the spring melting of snow and ice. Additionally, no NO_2 concentrations measured at the Niven community station (located in the Niven Lake subdivision near the intersection of Haener Drive and Moyle Drive in Yellowknife) were found to exceed the one-hour or 24-hour AAQS.

Next Steps

- The AQMP will continue, including ongoing community monitoring, and fenceline monitoring, with activity-specific monitoring conducted as applicable.
- To ensure the AQMP is robust and continues to meet the needs of the GMRP and stakeholders, a third-party review of the AQMP will be conducted in 2019-20.

More details on the air monitoring program, including real-time data and weekly reports are available on the NWT Air Quality Monitoring Network. You can also receive the weekly reports via email by requesting to be added to the distribution list by writing to aadnc.giantmine.aandc@canada.ca.

3.2.2 Dust Suppression

Dust suppression activities continue to take place at the Giant Mine site. Dust can be caused by many sources, particularly in dry climates such as Yellowknife. Dust detected at the site doesn't necessarily contain arsenic trioxide or other mining by-products. Real-time monitors that make up the AQMP use conservative criteria to ensure residents are not being exposed to unacceptable levels of contaminants from the activities occurring at the Giant Mine site.

The GMRP Team takes active measures to reduce dust from the site's tailings ponds and roads. These measures include communicating daily wind forecasts to GMRP Team members each morning, applying a dust control product to the tailings ponds, and wetting the tailings ponds.

In 2017, the GMRP Team began using Soiltac, a more effective dust suppressant for the tailings ponds than the product previously used (CIRNAC, 2018).

Results

- In 2019, all tailings ponds were inspected to confirm there was adequate dust suppressant (Soiltac) applied to all areas. As well, construction projects that accessed any portion of the tailings ponds were required to do regular applications to disturbed areas to eliminate the risk of dust events.

Next Steps

- The GMRP Team will continue to ensure there is a sufficient supply of dust suppressant on site, and that water trucks are available to wet drying areas that could generate dust (CIRNAC, 2018). Additional SoilTac is to be purchased (40,000 L) and applied to all tailings in 2019-20.

3.3 Water

To monitor and minimize water quality impacts, the GMRP has ongoing effluent and water quality monitoring on-site.

2018-19 Highlights

- Monitoring of minewater, surface water, and groundwater was conducted at Site in 2018 to meet regulatory and operational monitoring requirements, as well as to continue to collect baseline data to support ongoing modelling efforts and site characterization.
- The Effluent Quality Criteria Report was completed in January 2019.

3.3.1 Effluent, Surface Water and Groundwater Quality Monitoring

To protect the H&S of workers, the public, and the environment, water from the Giant Mine Site is treated at the on-site ETP before being discharged to the environment. The ETP system consists of various components including reaction tanks, a settling pond, and a polishing pond that are used – in this order – to treat the mine water. Discharged effluent water must meet standards set by the MDMER under the *Fisheries Act* and the GMRP has also committed to meeting the standards outlined in its former Water Licence. Part of the water quality monitoring program includes testing of effluent chemistry. If the level of arsenic in the water is near the maximum allowable limit, the Project Team stops the release of effluent to Baker Creek and recycles it back through the treatment plant.

Contaminated water is generated throughout the year and stored on-site in the Northwest Pond. Treatment of this water typically begins in June of each year, with discharge to the environment occurring between July and September, once the Arctic Grayling have left Baker Creek.

The Project Team undertakes effluent and water quality monitoring in and around the Giant Mine site via different programs in order to report on surface water, groundwater and underground mine water. These programs track parameters such as the volume of water pumped or discharged, water quality, and the performance of the ETP. The effluent and surface water quality monitoring encompass the programs outlined below. These programs are used to monitor existing performance and to inform the design process for remediation activities:

- Surveillance Network Program (SNP)
- Metal and Diamond Mining Effluent Regulations (MDMER) and Environmental Effects Monitoring (EEM) Program
- Operational Monitoring Program (OMP)
- Supplemental surface water and groundwater baseline data collection.

Parameters tested at all stations include standard general parameters (e.g., temperature, pH, conductivity, hardness), major ions, nutrients, and total and dissolved metals and metalloids. There are also specific station requirements for other tests such as cyanide, sulphide, hydrocarbons, and radium-226. Samples collected at SNP 43-1 must meet federal requirements under MDMER as well as the discharge criteria defined in the former Water Licence (N1L2-0043).

Annual Water Monitoring

The section below summarizes the monitoring activities. Appendix E provides a detailed table of the monitoring stations (Table 19). The main objectives for water monitoring at the Site in 2018 were to conduct operational and regulatory sampling and to support the GMRP as it transitions from the existing C&M phase into the active remediation/adaptive management phase (Golder Associates Ltd, 2019b).

Hydrology (water quantity):

- Hydrometric stations were operated for continuous water level measurements from spring (before freshet) to fall, and for water level surveys and flow measurements to establish a time series of seasonal streamflow. Data from the hydrology monitoring program provide supporting information for site characterization and operational monitoring.

Surface water and minewater quality:

- Minewater – Minewater quality was sampled underground as part of the OMP at sumps, mine pools, and bulkheads. Minewater samples were collected as part of a single sampling event in the Akaitcho wells installed in the fall of 2018. Minewater samples were also collected from the C-Shaft Void.
- Surface water – Surface water samples were collected to meet the requirements of regulatory and operational monitoring programs. These requirements include water quality and toxicity monitoring during effluent discharge at SNP 43-1 (end of pipe), along with sampling lakes, creeks, sumps, and TCAs for the SNP and OMP programs. Surface sampling also includes SNP stations where minewater is pumped to surface at the Akaitcho Shaft and Supercrest pumps. Additional sampling was also conducted in 2018 for baseline data collection and site characterization, including runoff and seep sampling during spring freshet at Site and water quality and toxicity sampling at Yellowknife River (reference area). Under-ice and open water sampling in Yellowknife Bay for water quality, toxicity, sediment quality, and plankton was also conducted to provide supporting data for the AEMP.

Groundwater:

- Shallow wells and drive points – Groundwater was sampled, and hydraulic head recorded, at a network of shallow monitoring wells and drive point locations to assess shallow groundwater conditions in the overburden and/or bedrock. The drive point locations are a new addition to the monitoring well network and were installed as part of the 2018 monitoring program in August.
- Deep multiport (MP) wells – Groundwater was sampled at selected ports, and hydraulic head recorded at each accessible port, at the deep MP wells to assess groundwater flow conditions in the deeper bedrock flow system.

Results

- In 2018, 411,932 m^3 of water was treated; 354,618m^3 of treated effluent was discharged into the environment at Baker Pond.

Hydrology:

- The model for Upper and Lower Baker was updated to better characterize flow at higher water levels.

Surface Water and Minewater Quality:

- Minewater samples results were consistent with results from 2017; results show a general increase in specific conductivity, turbidity, hardness, total dissolved solids (TDS), and total suspended solids with depth and a decrease in concentrations of aluminum and arsenic.
- Treated effluent quality was within all MDMER and Water Licence limits.
- At lake and creek stations sampled under the SNP, parameters above the applicable Canadian Water Quality Guidelines (CWQG) included fluoride, total aluminum, arsenic, copper, iron, and dissolved zinc, were observed.
- For stations upstream from effluent discharge, the highest total arsenic concentrations were found at Pocket Lake (SNP 43-22), with monthly averages of 1.5 to 1.6 mg/L. This reflects the location of Pocket Lake directly upwind from historical roaster stack emissions.
- At Baker Creek stations, arsenic was above CWQG in most samples. Metals concentrations did not show any change at the Baker Creek outlet (SNP 43-5) for time periods before discharge (June and July) compared to during and post discharge (August to October). Water quality in Baker Creek during discharge shows the influence of both surface water inputs (e.g. precipitation

and runoff) and treated effluent. Concentrations of TDS, sulphate, chloride, magnesium, and total arsenic were notably higher downstream from the ETP, both at Baker Creek Exposure Point and the Baker Creek outlet (SNP 43-5), compared to the upstream reference station (SNP 43-11).
- Sediment samples collected in September 2018 at Yellowknife Bay stations near the breakwater and proposed outfall had total arsenic concentrations above both the interim sediment quality guidelines (ISQG) and probable effects level . At most stations, total cadmium, chromium, copper, lead, and zinc concentrations were above applicable ISQG.

Groundwater:

- The water level was generally consistent for the shallow wells with some seasonal variability in the spring and the fall.
- At most locations, arsenic concentrations are consistent (or lower) than previous years, aside from at the Calcine Pond, where an increase was observed in 2018.

Next Steps

- It is recommended that more site visits be conducted around rainfall events in 2019 to capture peak flow conditions and further improve the hydrologic model for Baker Creek.
- Monitoring of the treated effluent will continue prior to and during discharge to ensure discharge limits defined in the former Water Licence and MDMER are met prior to discharge to the receiving environment.
- Existing water quality monitoring (SNP, MDMER/EEM, OMP) will continue to characterize the conditions on site and downstream of the site, which will enable these results to be used to assess potential site-related effects in the biota.
- OMP sample collection and analysis will continue at various surface water, groundwater, and underground water monitoring stations. The results will inform and confirm operational practices at the ETP and ensure that discharge from the ETP meets the requirements of the SNP, as well as inform water management practices on site.
- The proposed revised SNP will be finalized in 2018-2019 based on stakeholder feedback and was submitted with the Water Licence application.
- The GMRP Team is assessing ways to create a public library for stakeholders to access monitoring reports, while working within federal policies. It is anticipated that the SNP data files will be posted to the MVLWB in FY 2018-19. Until then, any document – including SNP data – is available by request to the Project Team.

3.3.3 Effluent Quality Criteria

The GMRP is proposing to build a new WTP (further described in Section 2.1.8), which will discharge directly to Yellowknife Bay. In addition, the CRP includes activities to stabilize the site, establish safe site conditions, and restore ecological processes. Several closure activities in combination are expected to reduce the release of arsenic and other contaminants of potential concern to the receiving environment (i.e., Baker Creek and Yellowknife Bay), particularly the construction of the new WTP.

In 2018-19, detailed modelling was completed to support setting EQC for the site and to understand the effects of closure activities on water quality in Baker Creek and Yellowknife Bay in the future. Modelling results were used to identify parameters that have the potential to adversely affect water quality in Yellowknife Bay (Giant Mine Remediation Project, 2019c).

Results

- A list of WQOs was developed for Yellowknife Bay, including generic aquatic life and drinking water quality guidelines, SSWQO, and literature values that apply in the receiving environment and are considered appropriate for protecting current and future water uses in Yellowknife Bay. EQC were set so that WQOs in Yellowknife Bay will be met 200 m from the WTP outfall.
- Treated effluent from the WTP must meet or be lower than the federal MDMER limits. In addition, it is a requirement of one of the EA Measures that arsenic be treated to the Canadian drinking water guideline of 0.01 mg/L.

Next Steps

- Additional modelling, monitoring, and laboratory studies are planned to address key assumptions and reduce uncertainties relevant to EQC.
- Focused monitoring underground and in-lake will continue to build a multi-year dataset and fill data gaps.
- The WTP intake location and elevation will be selected in 2019-20.
- Further testing and investigation will be conducted to further understand options and potential outcomes.
- Modelling results, proposed WQOs, and proposed EQC will be re-evaluated as more data become available over time.
- Once the comprehensive EQC modelling has been completed, detailed design for the outfall (a no-cooling option) at the selected location in the vicinity of Baker Creek will be completed.

3.4 Land

The GMRP Team undertook several activities to monitor and minimize impacts to land and to protect the H&S of the public and on-site workers. These activities included monitoring and management of arsenic impacted waste and completing the construction work associated with the SSP.

2018-19 Highlights

- Continued monitoring and management of arsenic-impacted waste on site.
- The backfilling of the C5-09 stope complex was completed on December 11, 2018 and marks the completion of construction work associated with the SSP (described in the Operational Summary section of this report).
- The Area 3 site has been selected as the preferred location for the non-hazardous waste landfill via the Landfill Siting Study, and engagement.
- The Remedial Strategy for Contaminated Soil and Sediment report was released in January 2019 and will support the CRP for Giant Mine.
- The Giant Mine AIA was conducted and completed in 2018-19 and identified four newly recorded archaeological sites and one newly recorded traditional use site.

3.4.1 Site Stabilization/Risk Mitigation

As described in the Operational Summary, the C5-09 Stope Stabilization was completed on December 11, 2018 with the final stope conditions meeting the completion criteria outlined in the technical specifications. This marks the completion of construction work associated with the SSP, a significant milestone achievement for the project.

3.4.2 Waste Management

In 2014, the decontamination and deconstruction of the Roaster Complex as part of the SSP produced hazardous waste, primarily arsenic- and asbestos-containing materials. The wastes were safely packaged in lined Transportation of Dangerous Goods bags and stored on site, held in shipping containers within an area secured by a chain-link fence. Runoff water from the storage area is collected and treated in the GMRP's ETP. Until the material can be appropriately disposed, the safest place to store it is on an already contaminated site, away from water and people. The materials have therefore remained on-site and continue to be appropriately cared for during 2018-19.

A preliminary design report was developed for the proposed non-hazardous waste landfill for the GMRP. The Area 3 site has been selected as the preferred location. The report addresses regulatory considerations pertaining to wastes and provides recommendations for further assessment to advance the design to the detailed design stage (AECOM Canada Ltd., 2018b).

Results

- The Area 3 site has been selected as the preferred location for the non-hazardous waste landfill.
- Non-hazardous wastes continued to be safely stored on site, within designated areas.
- There was continued monitoring and management of hazardous wastes.
- Run-off water from the hazardous waste storage area was collected and treated.

Next Steps

- Based on the preliminary design completed for the Giant Mine landfill cells, additional work items are recommended for input for detailed design.
- Hazardous waste safely packaged and stored on-site will remain until it can be appropriately disposed of, which may take several years.
- Waste material stored on-site will be safely managed until full remediation can begin.

3.4.3 Remedial Strategy for Contaminated Soil and Sediment

In support of the CRP, the GMRP Team evaluated and selected remedial / risk management strategies associated with contaminated soil and sediment at Giant Mine. In 2015-16, the SDE program was completed to support the development of remedial strategies. In 2017, a range of closure alternatives were evaluated and assessed, for Developed Areas, for the bedrock/forest/wetland terrain, and for Baker Creek, during a Contaminated Soils Workshop. The results of the June 2017 workshop were used as an input to the overall site material balance with regards to alternatives for disposal of contaminated soils or sediments.

In 2018-19, proposed remedial scenarios were developed for the deep contaminated materials identified in the following locations at Giant Mine: (i) former Mill Pond, (ii) former Calcine Pond, (iii) historical tailings placement in Area 4, and (iv) four pockets located within three Developed Areas (Mill Area, Tailings Retreatment Plant, and A2 Pit) (Golder Associates Ltd, 2019e; Golder Associates Ltd, 2019d).

Results

- The Remedial Strategy for Contaminated Soil and Sediment report was released in January 2019 and supports the CRP for Giant Mine.

Next Steps

- Further characterization of the pond water impacted areas, located down gradient of Dam 3, is required. As a result, a Reclamation Research Plan will be implemented for this area to collect further data associated with soil, surface water, groundwater, and sediment. This additional characterization data will inform the closure activities and criteria for the pond water impacted areas.
- PSPC/CIRNAC requested the re-evaluation of the closure strategy for the deep contaminated materials through the completion of a decision analysis workshop. The workshop, held in March 2019, evaluated practical remedial/risk management scenarios and identified the preferred closure strategy.

3.4.4 Archaeological Impact Assessment (AIA)

The Giant Mine AIA was conducted in 2018-19. It was led by the GMRP. The YKFDN and NSMA provided information, field assistance and knowledge, and Trailmark supported the work.[2]

In preparation and planning for the field component of the AIA, the GMRP met with numerous affected and interested parties, including: YKDFN (including the GMAC, the Elders Senate, and staff), an Elder from the NSMA, archaeologists at the Prince of Wales Northern Heritage Centre, members of the Yellowknife Historical Society and City of Yellowknife Heritage Committee. As well, Trailmark interviewed Elders and knowledge holders to identify past use areas and areas of high potential to produce a figure used to help guide the field component. Up to four members and/or representatives of the YKDFN participated in each day of the field investigation. Areas of high archaeological potential overlapping with areas of planned or potential areas of remediation were investigated. As well, previously recorded archaeological sites and traditional use areas were revisited.

The 2018 field program examined 21 proposed borrow sources, two soil remediation areas, four known archaeological sites, and eight known traditional use areas within the project area. Assessment consisted of pedestrian reconnaissance, visual inspection of ground surface exposures and shovel testing to document and evaluate archaeological and traditional use sites. Results of the AIA were presented to the GMRP WG and to YKDFN staff/representatives in fall 2018. A combined report back on the AIA results based on the draft AIA report to the wider YKDFN community took place in January 2019 (Giant Mine Remediation Project, 2019b).

Results

- No archaeological or traditional use sites were identified in 17 of the assessed borrow source areas and there are no further archaeological concerns with these developments.
- Four of the borrow source areas and the two soil remediation areas did contain archaeological or traditional use sites within or adjacent to their boundaries. This included three revisited and four newly recorded archaeological sites, as well as eight revisited and one newly recorded traditional use site.

Next Steps

- The GMRP has committed to altering the boundaries of the potential borrow area (potential source area 5) to ensure the remediation project does not disturb this important traditional use area. As well, the GMRP has committed to further archaeological work pending results from the ongoing traditional knowledge work of Trailmark and YKDFN, or if remediation activities in the future include areas not assessed during the 2018 AIA.
- The final report of the AIA is being submitted to the Prince of Wales Northern Heritage Centre for their approval and regulatory requirements in 2019.

[2] This work was carried out under Northwest Territories Class 2 Archaeologist Permit No. 2018-002 issued by the Prince of Wales Northern Heritage Centre (PWNHC), Government of Northwest Territories.

3.5 Biodiversity

The GMRP Team is undertaking activities to actively manage risks related to wildlife and to aquatic life, including establishing and undertaking studies on animals, plants, and habitat, as described below. Additional details on how wildlife has been considered in the remediation design will be provided in future, once the remediation design is further advanced.

2018-19 Highlights

- The annual site-wide bird survey was completed, and recommendations provided.
- A draft Wildlife and Wildlife Habitat Management and Monitoring Plan (WWHMMP) was developed.
- MDMER/EEM results were consistent with results from previous years.
- The Baker Creek AEMP Design Plan was completed.
- The Baker Creek Ecosystem Synthesis report was completed.

3.5.1 Site-wide Bird Survey

The annual site-wide bird activity survey was conducted to:

- identify current nesting sites in areas of active or upcoming spring and summer construction activities;
- identify site features that represent notable risks to birds; and,
- provide recommendations to reduce risks to birds and comply with relevant legislation.

Visual surveys were conducted on foot, with some stations being accessed by truck. In total, eight surveys were conducted in 2018. Each survey was completed to coincide with peak bird activity. Surveys were completed in early May and June (Golder Associates Ltd, 2018b).

Results

- Hazardous features of the site that may present a hazard to birds were identified.
- Recommendations were provided to reduce the risks to nesting birds on site and comply with relevant wildlife legislation.
    - Do not cover up the broken window on Building 19 (until the fall).
    - Leave window open on Building 122 to allow swallows to access their established nests.
    - Complete construction (filling in of pond) at Upper Mill Pond as soon as possible to prevent horned grebes from nesting in construction area. A bird deterrent was deployed in this area on June 6.
    - Assume that there are active nests under the UBC Bridge. The bridge can continue to be used but use caution if working beneath the bridge.
    - If any work is required on the Mill, Building 133, or Akaitcho core boxes before 13 August, a biologist should be consulted.
    - Keep door to main building at ETP closed to prevent bird access to building.

Next Steps

- Annual site-wide bird monitoring will continue in 2019-20.

3.5.2 Wildlife Monitoring

The annual Bird Nesting survey was conducted during the migratory bird season in 2018-19. As well, wildlife sightings and interactions were logged by DCNJV and the MCM and reported, as required.

A draft WWHMMP was developed in 2017-18. It was completed in 2018-19 in consultation with GNWT ENR and stakeholders and submitted as part of the water licence package.

The objectives of the WWHMMP include the following:

- document and mitigate effects to wildlife from the project remediation activities;
- describe the application of adaptive management for the protection of wildlife to project remediation activities;
- describe how the project will meet relevant guidelines and regulatory requirements; and,
- constitute part of the engagement with communities, regulatory agencies, and interested parties in wildlife mitigation and monitoring.

The objectives of the WWHMMP take into account investigations, studies and input from the GMRP Team, the GMRP WG (which includes GMOB), and input from the EA and SDE processes.

This WWHMMP incorporates learnings from the current C&M operations at the site. Some examples provided below include learnings from interactions with black bears and nesting birds at the site:

- Black bears are observed regularly within the lease area, and observations are documented and communicated to staff and contractors. Following a bear sighting, workers in the area are typically encouraged to work in pairs, stay vigilant, and avoid leaving food waste, and they can be accompanied by security staff if necessary. On occasion, GNWT ENR has deployed bear traps to manage habituated or problem bears on site and relocated the bears away from the site.
- Migratory birds have used structures at the site for roosting and nesting, leading to concerns for the safety of the nest if it was located in an area of frequent activity or on a structure scheduled to be demolished. Surveys of the site infrastructure for nesting birds were completed each spring to identify pre-nesting behaviour and the presence of nests. Nests identified were communicated to the Mine Manager, resulting in avoidance of the area until the chicks had fledged. In some instances, demolition was postponed, or schedules were altered to avoid disturbance to the nest. These processes are formalized and will be continued through the WWHMMP.

The scope of the WWHMMP expands spatially to the entire extent of the proposed project boundary and temporally to the duration and subsequent long-term C&M activities (Golder Associates Ltd, 2019g).

3.5.3 MDMER/Environmental Effects Monitoring (EEM)

The MDMER under the *Fisheries Act* requires metal mines to conduct EEM. This includes monitoring of effluent and surface water quality, toxicological testing of the treated effluent, and biological monitoring. These results are used to assess and identify any effects that may be caused by the treated effluent. The overall objective of these studies is to protect fish and fish habitat in order to protect fisheries and maintain the safe use of fish by people. Effluent and water quality are monitored annually during periods of discharge and these data are used to help interpret the effects observed in the fish and benthic invertebrates from Baker Creek (i.e., the results from the biological program that is completed every three years).

In 2018, the Project Team completed effluent characterization and surface water quality monitoring on three occasions to fulfill requirements of the regulations (Golder Associates Ltd, 2019f). Samples of treated effluent and surface water were analyzed for eight deleterious substances and pH as outlined in Schedules 3 and 4 of the MDMER, as well as the required parameters outlined in Schedule 5 (EEM) of the MDMER, and applicable site-specific parameters recommended by ECCC (2012). In addition, treated effluent was tested for acute and sub-lethal toxicity as required by the MDMER (Government of Canada, 2002).

Results

- Treated effluent was determined to be not acutely toxic as tested on samples.
- Sub-lethal toxic effects were observed for some toxicity test endpoints on one sample (August 14, 2018). Overall, results for this treated effluent sample are consistent with results from previous years.
- Treated effluent and surface water quality in the exposure and reference areas were tested. All scheduled parameters were below applicable MDMER requirements. Results were consistent with results from previous years.

Next Steps

- Annual effluent and surface water quality monitoring for the MDMER/EEM will continue in 2019-20.
- The study design for Phase 6 of the EEM was completed in 2018-19 and submitted to ECCC in December 2018 for review and comment, with a return to standard monitoring as per the recommendation in the Phase 5 report. The next field program is anticipated during the summer/fall 2019, with the Phase 6 report anticipated in June 2020 for submission to ECCC.

3.5.4 Aquatic Effects Monitoring Plan

The GMRP submitted an application to the MVLWB for a Type A Water Licence for the Site on April 1, 2019. An AEMP will be required under the new water licence. As described in the *Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development in the NWT* and the *Draft Guidelines for Aquatic Effects Monitoring Program,* four different types of documents are required to be submitted under the AEMP. These include a Design Plan, Annual Report, Re-evaluation Report, and Response Plan.

The GMRP is proposing to build a new WTP, which will discharge directly to Yellowknife Bay; however, until the new WTP is commissioned, the existing ETP will be used. The two different treatment plants discharge to different locations and so will have different monitoring requirements and different AEMP programs (that will run sequentially, not concurrently):

- Baker Creek AEMP (provisionally 2019 to 2026) – Existing ETP with discharge to Baker Creek, under status quo treated effluent discharge conditions.
- Yellowknife Bay AEMP (provisionally 2026 onwards) – Proposed new WTP with discharge into Yellowknife Bay.

Results

- The Baker Creek AEMP Design Plan has been completed and provides a study design for monitoring through the transition period between approval of the Water Licence and re-location of the treated effluent discharge to Yellowknife Bay, to meet regulatory requirements and Water Licence commitments.
- Development of a Draft Yellowknife Bay Conceptual AEMP Design Plan began in 2017-18 and was completed in 2018-19, based on public review and comment and feedback from GNWT ENR. It was submitted as part of the Water Licence package for informational purposes. Further engagement and stakeholder input will inform further development of the Yellowknife Bay AEMP, which will be submitted to the MVLWB for approval prior to implementation and commissioning of the WTP.

Next Steps

- Monitoring in Baker Creek will be undertaken according to the proposed Baker Creek AEMP Design Plan with Water Licence issuance.
- An EEM program will continue to run concurrently. It has been conducted since 2003, with five phases of monitoring completed to date. The Phase 6 EEM study design was submitted to ECCC in December 2018. Harmonization of the AEMP and EEM programs is proposed. Field investigation is to be completed in summer 2019 (starting in July) and reported by June 2020 to meet the Phase 6 EEM reporting requirements (Giant Mine Remediation Project, 2019a).

3.5.5 Baker Creek Ecosystem Synthesis

The lower reaches of Baker Creek have been heavily impacted by physical and chemical activities associated with Giant Mine. The Project Team developed a synthesis of available information related to the Baker Creek aquatic ecosystem. The report provides background information relating to Baker Creek and the Site, defines the spatial and temporal boundaries of the information provided, provides a general overview of historic aquatic ecosystem conditions, and describes the existing aquatic ecosystem at Baker Creek in terms of recent changes to the creek alignment, climate, hydrology, water temperature, water quality, sediment quality, aquatic life and habitat, benthic community, fish health, and tissue chemistry (Golder Associates Ltd, 2018g).

Results

- Data from the studies in the 1970s suggest the aquatic ecosystem of Baker Creek was severely damaged. These studies found no fish, no crustaceans, no insects, no rotifers, and very few benthic invertebrates inhabiting the area of Baker Creek downstream of the Mine. Based on laboratory and field tests, water from Baker Creek entering Yellowknife Bay was acutely toxic to fish.
- Since the implementation of better mining practices in the late 1990s and with the site undergoing closure and reclamation, improvements in the Baker Creek aquatic ecosystem have been documented.
- Baker Creek may currently be characterized as highly contaminated and altered but showing signs of a system in recovery. Remediation options such as removal of sediment and improvements in effluent quality should reduce the chemical loading to organisms and improve ecosystem health.

4.0 HEALTH AND SAFETY (H&S)

4.1 Occupational Health and Safety

CIRNAC provides oversight for occupational H&S, while PSPC provides oversight and manages contractors to ensure that they have in place a H&S plan, H&S procedures, and emergency response plans, and that contractors follow the procedures and report any H&S incidents.

The C&M contractor/MCM maintains overall H&S responsibility as the prime contractor at the Giant Mine. To ensure that on-site safety plans are implemented, there is a designated occupational H&S manager who organizes ongoing training and occupational H&S support for managers, supervisors and other employees.

2018-19 Highlights

- There were nine moderate safety incidents in 2018-19.
- The number of reported near misses decreased from 179 in 2016-17 to 99 in 2017-18 and 74 in 2018-19.
- 3.25% of urinalysis samples were above the action level of 35 micrograms of arsenic per litre of urine (µg/L) in 2018-19.
- The number of hours spent in training in 2018-19 increased from previous years, due to more physical and construction work being required on site compared to previous years.

4.1.1 Health and Safety Incidents

GMRP tracks the number of major incidents, moderate incidents, minor incidents, and near misses on a monthly basis, and reports the incidents to the GMRP Directors and GMRP Team.

Results

Based on both CIRNAC and MCM incidents reports, there were no major safety incidents, and nine moderate incidents in 2018-19 (Table 7). This compares with one moderate incident in 2017-18, and no major or moderate incidents in the two previous years. However, most of the moderate incidents in 2018-19 are related to equipment incidents that did not involve injury to persons (associated with the construction work for the backfilling of the C5-09 stope); there were several doctor visits associated with construction.

The number of minor incidents in 2018-19 (11) increased from all previously reported years (five in 2017-18, two in 2016-17, and 10 in 2015-16). However, the number of reported near misses decreased from 179 in 2016-17 and 99 in 2017-2018 to 74 in 2018-19. All near misses are reviewed and appropriate corrective actions are implemented to reduce the risk of an incident occurring.

Table 7: H&S Incidents and Near Misses in 2018-19

Incidents and Near Misses	2018-19 Total
Major Incident: An incident resulting from activities performed at the site that results in a severe and irreversible disability, impairment, injury, illness or fatality to an individual or individuals.	0
Moderate Incident: An incident resulting from activities performed at the site that results in a reversible disability, impairment, injury or illness that temporarily alters the lives of an individual or individuals.	9[3]
Minor Incident: An incident resulting from activities performed at the site that results in injury or illness that inconveniences an individual or individuals.	11
Near Misses: An unplanned incident resulting from activities performed at the site that did not result in any disability, impairment, injury, illness or fatality, but had the potential to do so.	74

Figure 2 highlights the number of H&S Incidents from 2015-16 to 2018-19. The number of incidents is normalized by person-hours worked to enable comparison across years, when the amount of activity on site may differ. However, this normalization does not account for differences in the nature of activities undertaken from one year to another.

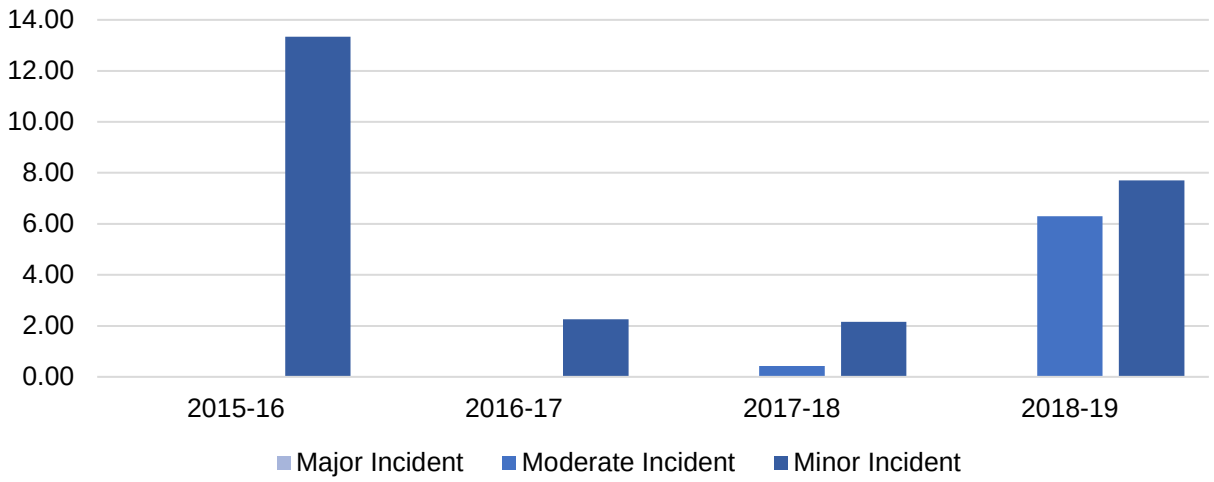


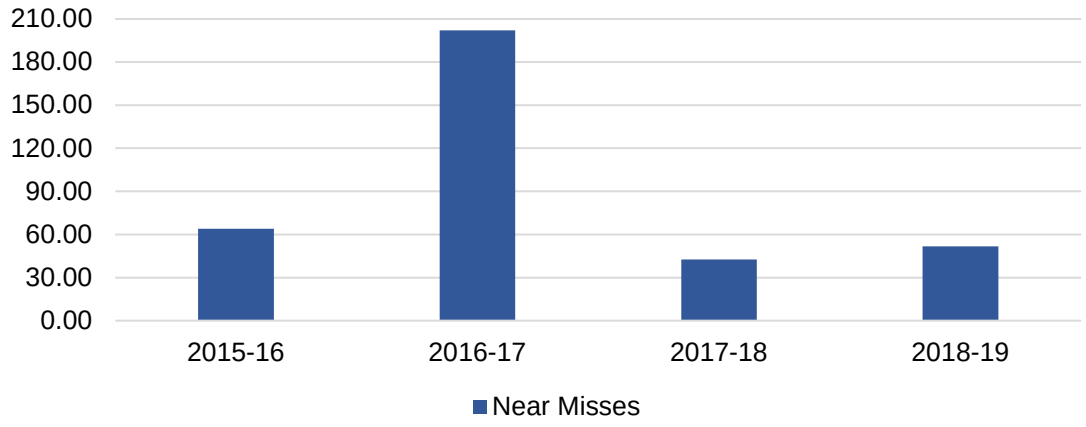
Figure 2: H&S Incidents per 200,000 Person-hours Worked, by year (2015-16 to 2018-19)

The number of Near Misses from 2015-16 to 2018-19 are presented in Figure 3 to facilitate the comparison per category across years, given the higher number of near misses in comparison with incidents. Additionally, the high number of near misses does not necessarily represent poor safety

[3] As noted above, this number includes equipment incidents as well as personal injuries.

performance, but could represent a strong safety culture, demonstrating high awareness of H&S concerns and a willingness to report those concerns.

Figure 3: H&S Near Misses per 200,000 Person-hours Worked from 2015-2016 to 2018-2019



Key Actions

- Incidents and near misses are discussed at daily safety meetings to review lessons learned, root causes and corrective measures.

Next Steps

- The GMRP Team will continue to track and report H&S incidents.

4.1.2 Monitoring of Arsenic Levels in Workers

In the 2018-19 reporting year, the GMRP Team monitored arsenic levels in the workers who spend time on-site by taking baseline urinalysis samples when workers start on site and then subsequent regular urinalysis samples (weekly samples if on-site full-time). Samples were compared against the Action Level of 35 micrograms of arsenic per litre of urine (µg/L) adopted by the WSCC.

Results

Table 8 below shows the total number of samples and the number of samples above the Action Level of 35 micrograms of arsenic per litre of blood. The percentage of samples above the action level (3,25%) is higher than it was in the previous year (1,8% in 2017-2018 and 2.6% in 2016-17). Although there is an increased emphasis from the Project Team and the C&M contractor on prevention, levels of arsenic in workers may also be influenced by the nature of work undertaken (i.e. how much arsenic-impacted material workers were exposed to in each year).

Table 8: Summary of Urinalysis Sampling and Results in 2018-19

Total samples	Number of samples above the Action Level (35 µg/L)	Percentage of samples above the Action Level (35 µg/L)
1938	63	3.25%

Key Actions

- For any urinalysis sample above the Action Level, the contractor notified WSCC, CIRNAC, and PSPC and investigated the root cause (e.g. diet, poor hygiene practices, inadequate procedures). The contractor then took immediate actions to reduce exposure to workers, such as improvement of dust control measures, adoption of more rigorous PPE procedures, re-training of staff on proper procedures, placing affected workers on limited duty to limit exposure to higher risk activities, or reassigning personnel to other duties (in the rare case of continued / recurring high levels of arsenic).
- Tracking of results that are below but nearing the Action Level also allows for identification of those workers who could benefit from preventive interventions, to avoid reaching the Action Level.

Next Steps

- The GMRP Team will continue to provide oversight and manage the health and safety of its employees and contractors through the established management system and associated H&S procedures, including urinalysis for on-site workers.

4.1.3 Health and Safety Training

The C&M contractor's occupational H&S manager ensures that employees and sub-contractors receive relevant H&S training, including first aid, wildlife safety, water safety, and fire response, as required by applicable regulations. Each year, all new employees are assessed to ensure they have the required training to complete their jobs safely and effectively. Workers involved in the underground stabilization project are trained on the hazards of arsenic and silica, the required PPE, and decontamination and work procedures.

Results

PSPC/CIRNAC and the MCM track the number of person-hours that employees and sub-contractors receive in training, as shown in Table 9.

Table 9: Total Hours of H&S Training Received by Employees and Contractors On-site

Health and Safety Training	2018-19 Total Hours
Hazardous Waste Operations and Emergency Response (HAZWOPER)	40
Workplace Hazardous Materials Information System (WHMIS)	185
First Aid	468
Wildlife Safety	81
Water Safety	66
Fire Response	51
Other (including propane awareness, drill training)	932
Total Training Hours	1823

Key Actions

- None to report.

Next Steps

- The GMRP Team will continue to track the type and amount of training received by employees and contractors to ensure that all employees receive the required training. The GMRP Team also shares this information with interested parties and stakeholders – such as the GMOB and the community – to assure them that on-site personnel are appropriately trained to do their job safely and effectively and are getting some training that is potentially transferable to other employment.

4.2 Public Health and Safety

Since the Government of Canada took over responsibility in 1999, the GMRP Team has monitored the site and ensured it is kept safe and secure through 24-hour-a-day C&M work. This work involves ensuring public safety through site security, suppressing dust, and managing minewater and effluent.

In response to Measure 9 of the Report of Environmental Assessment, the GMRP commits to working with other federal and territorial departments to design and implement a broad Health Effects Monitoring Program. In response to Measure 10 of the EA, the GMRP committed to evaluate the indirect effects of the project through a Stress Study.

2018-19 Highlights

- The Health Effects Monitoring Program, which determines current level of arsenic exposure in residents, completed its baseline sample collection for Yellowknife, Ndilǫ and Dettah in 2018. Sample analysis was completed in 2019 and baseline results were communicated in May 2019 during a community meeting in Yellowknife.
- The Stress Assessment plan was presented at the Giant Mine Working Group and the Giant Mine Advisory Committee and is currently being further developed for the fiscal year 2019-2020.

4.2.1 Health Effects Monitoring Program

The health effects monitoring program in Ndilǫ, Dettah and Yellowknife focuses on effects in people related to arsenic and other contaminants[4] that might result from the GMRP. The monitoring includes studies of baseline health and ongoing periodic monitoring, in accordance with Measure 9 of *The Report of Environmental Assessment and Reasons for Decision* (MVRB, 2013). The purpose of this baseline and ongoing monitoring is to ensure that the implementation of the CRP activities do not cause negative health impacts on the people of Yellowknife, Ndilǫ and Dettah and to adjust activities as necessary if adverse effects are discovered.

An Advisory Committee (HEMPAC) was established for the program with representatives from GNWT Health and Social Services, Health Canada, the City of Yellowknife, the YKDFN, the NSMA, GMOB and the Project Team. The committee meets monthly and provides advice to the program.

Dr. Laurie Chan, based at the University of Ottawa, is leading the monitoring program. To recruit participants to the program, the program Team mailed invitations to Yellowknife households, chosen by statistically-based random selection. Additional efforts were made to identify members of the YKDFN and the NSMA as participants. The monitoring program completed its baseline sample collection in 2018. Data collection included a lifestyle questionnaire as well as toenails, urine and saliva sampling to determine the participant's exposure to arsenic and other contaminants. There was a total of 2037 participants between Fall 2017 and spring 2018. Individual results were reported back to all the participants by mail, and a progress report summarized key results (Chan, et al., 2019).

Results

- lower urine total arsenic concentrations in the overall Yellowknife population than the general Canadian population.
- no difference in urine inorganic arsenic concentrations between the overall Yellowknife population and the general Canadian population.
- no difference in total urine arsenic concentrations between adults and children in all sampling groups.
- higher levels of inorganic arsenic in Yellowknife children aged 6 to 11 years old than in the general Canadian population of the same age.
- generally higher levels of urine inorganic arsenic and toenail arsenic in children, which levels decreased with age.
- lower urine total arsenic concentrations in adult YKDFN participants in comparison with the other sampling groups.
- higher inorganic arsenic concentrations in adult volunteer groups in comparison with the other sampling groups.
- lower urine total arsenic concentrations in NSMA children in comparison with the other sampling groups.
- higher toenail arsenic concentrations in participants who provided samples during the spring of 2018 than in individuals who participated during the fall of 2017, which suggests that there may be a seasonal variation in arsenic exposure. Further toenail analysis is being done to determine whether arsenic was absorbed through the toenail surface or through the circulatory system.

[4] Including antimony, cadmium, lead, manganese, and vanadium, which are being measured because other research and studies have shown that they are present at the Giant Mine site.

Next Steps

The next report will be published in May 2020. It will examine the relationships between diet and lifestyle variables, genetic information, the concentrations of metals in urine and the arsenic concentrations in the toenail, and results of the medical history and medical file analysis. All personal health information will be kept confidential.

The implementation schedule for the Health Study is as follows:

1. **2019-20:** Overall community baseline results reported, and all individual results reported to each participant with appropriate medical advice.
2. **2019-22:** Research Team and HEMPAC will implement the follow-up plan to promote healthy living and a healthy community.
3. **2022:** The Health Study Team will carry out follow up sampling for children participants.
4. **2027:** The Health Study Team will carry out follow up sampling with both adults and children participants.

For additional details on the Health Effects Monitoring Program, please refer to the Frequently Asked Questions on the program's public-facing website: http://www.ykhemp.ca/faqs.php .

4.2.2 Human Health and Ecological Risk Assessment (HHERA)

Since 2000, several human health and ecological risk assessments have been completed to determine the health and ecological risks from arsenic contamination associated with Giant Mine. *The Report of Environmental Assessment and Reasons for Decision* (MVRB, 2013) concluded that there were continued public concerns around human health due to the remediation of Giant Mine. In 2016, CanNorth was contracted to complete the HHERA for the Giant Mine.

In January 2018, the Government of Canada finalized the report on the Giant Mine HHERA (Canada North Environmental Services, 2018). The HHERA looked at exposure at the community level, while the ongoing, separate Health Effects Monitoring Program looks at individuals. The HHERA assessed potential exposure of residents of Ndilǫ and Dettah communities, the City of Yellowknife, Latham Island, those that reside along the Ingraham Trail, people that camp at the Fred Henne Campground, and those who swim at Long Lake. The results of the HHERA informed the CRP, that was finalized in 2019. The results and recommendations were summarized in the 2017-18 Annual Report and can be found in the CRP.

4.2.3 Stress Assessment

The direct effects of arsenic exposure are being evaluated through the HHERA as outlined above; however, Measure 10 of the EA requires the Project Team to also evaluate the indirect effects of potential exposures to arsenic on wellness, including stress.

Dr. Ketan Shankardass is the principal investigator to complete the Stress Assessment. The study plan has been presented to the GMRP WG and the Giant Mine Advisory Committee. Through this engagement and subsequent engagement with the YKDFN, the Team is working to further develop the plan for the fiscal year 2019-20.

Next steps

The GMRP Team will be creating a Stress Study Advisory Committee with stakeholders that will:

- provide technical expertise and advice in the development and implementation of the Stress Study;
- provide community perspective, expertise, advice and traditional knowledge in the development and implementation of the Stress Study;
- monitor the implementation of the Stress Study and provide input into refinement opportunities; and,
- provide advice on proposed communications for the Stress Study.

5.0 COMMUNITY

This section provides an overview of the relevant management and performance information that applies to the community engagement and socio-economic elements of Giant Mine.

5.1 Engagement

Engagement has always been a significant part of the GMRP, from the initial examination of remediation options, to the EA process and Site Stabilization work, to the more recent SDE and health-related studies. The GMRP vision for engagement is that, as a result of the GMRP communications and engagement program, the majority of stakeholders, affected parties - including First Nations communities, and residents of Yellowknife, Ndilǫ and Dettah, and special interest groups:

- are well-informed about the project;
- support the approach being taken to remediation;
- feel their party has the opportunity to be involved in the exchange of information with the GMRP;
- are confident that the GMRP is being well managed by the Government of Canada and GNWT; and,
- are optimistic about the future of the site. The GMRP Communications and Engagement Strategy for 2015-20, guides the approach to communications and engagement at the site (Giant Mine Remediation Project, 2019g).

Engagement since 2001 has focused on the following:

(2001-2003)	• Arsenic Trioxide Dust Remedial Option Selection
(2013-2016)	• Site Stabilization Program (decontamination and ceconstruction of the Roaster Complex and underground stabilization)
(2015-2017)	• Surface Design Engagement (SDE)
(2016-2017)	• New Water Treatment Plant Outfall Location
(2015-2018)	• Human Health and Ecological Risk Assessment (CanNorth 2018)
(2017)	• Baker Creek Alignment • Non-Hazardous Landfill Siting • Health Effects Monitoring Program
(2018)	• Quantitative Risk Assessment (Environmental Assessment) • Stress Study (Environmental Assessment) • Draft Water Licence Package Technical Sessions • Closure and Reclamation Plan Site Tour • Socio-economic Strategy • Archeology

In addition to these specific engagements, working groups are a key way for the GMRP Team to engage with key affected parties in a meaningful way, both to provide information and to solicit input. Working groups include the GMOB, GMAC, GMRP WG, and the HEMPAC.

Table 10 below provides additional information on these groups, as well as other organizations that receive updates on the GMRP and provide input to the Team.

Table 10: Types of Engagements and Frequency of Meetings (Giant Mine Remediation Project, 2019g)

Engagement Committees	Frequency
Giant Mine Working Group *Primary Purpose*: An opportunity to provide a forum for interested parties to discuss and make recommendations on technical, operational, and project activities regarding the remediation of Giant Mine. The GMRP also will engage this forum on updates to environmental management plans and programs. *Primary Participants*: City of Yellowknife, NSMA, Alternatives North, YKDFN, ECCC, DFO, Health Canada, GMOB, PSPC	Monthly meetings (face-to-face)
Giant Mine Advisory Committee *Primary Purpose*: An opportunity to express concerns about the project, provide recommendations, and to receive updates from the GMRP. *Primary Participants*: Members of the Yellowknives Dene First Nations	Monthly meetings (face-to-face)
North Slave Métis Alliance *Primary Purpose*: An opportunity to discuss key initiatives, provide recommendations and provide annual updates. *Primary Participants*: NSMA members	Monthly meetings (face-to-face)
YKDFN Chiefs and Council *Primary Purpose*: An opportunity to provide an annual update to YKDFN Chief and Council and provide recommendations to the GMRP. *Primary Participants*: YKDFN Chief and Council	Annual meetings (face-to-face)
City of Yellowknife Staff *Primary Purpose*: Working level meetings with senior City staff to create an open dialogue and address questions on topics such as permitting and future land use. *Primary Participants*: City of Yellowknife Senior Staff	Monthly staff meetings with Directors (face-to-face)
City of Yellowknife Mayor and Council *Primary Purpose*: An opportunity for the project Team to attend regular City Council meetings and the Municipal Services Committee, to give updates on the project and answer questions. Media and the public are often present. *Primary Participants*: GNWT, CIRNAC, City of Yellowknife Mayor and Council	GMRP Team attends every six months
YKDFN Elders Senate *Primary Purpose*: An existing YKDFN body that gives advice to the chiefs and councils and provides Traditional Knowledge to the project as and when needed. *Primary Participants*: YKDFN elders	GMRP Team meetings upon request

Engagement Committees	Frequency
Health Effects Monitoring Program Advisory Committee *Primary Purpose*: An opportunity for member groups to contribute to the development and implementation of the monitoring program by utilizing their health expertise and knowledge of regional and community level issues. *Primary Participants*: GNWT, GNWT Health and Social Services, CIRNAC, Health Canada, YKDFN, NSMA, GMOB, and City of Yellowknife, with additional support from Institute for Circumpolar Health Research	Monthly meetings
Great Slave Sailing Club *Primary Purpose*: An opportunity to inform the Sailing Club of activities at Giant Mine and discuss concerns, as the club holds a lease on the Giant Mine site. *Primary Participants*: Board of Directors and members of the Sailing Club	Annual meetings (face-to-face)
Yellowknife Historical Society *Primary Purpose*: A venue to discuss issues such as the Society's lease on the site and opportunities to preserve the heritage of the Giant Mine. *Primary Participants*: Board of Directors of the Yellowknife Heritage Society	Annual meetings (face-to-face)
Back Bay Community Association *Primary Purpose*: An opportunity to inform residents to activities at the Giant Mine site and to obtain feedback. *Primary Participants*: Includes homeowners in the Back Bay area of Yellowknife	Upon request
Socio-economic Advisory Body *Primary Purpose*: The Socio-economic Advisory Body's mandate is to provide direction and guidance to the Socio-economic Working Group as act as senior government champions for the implementation of the Socio-economic Working Group's approach. To ensure that members of the group will be able to address organizational barriers to implementing the Socio-economic Strategy and provide strategic advice to the working group. *Primary Participants*: City of Yellowknife, Citizen Services Yukon and Northwest Territories, PSPC, GNWT, Canadian Northern Economic Development Agency (CanNor), CIRNAC, YKDFN.	Quarterly meetings
Socio-economic Working Group *Primary Purpose*: Responsible for coordinating activities related to the implementation of the Socio-economic Strategy, sharing information, and seeking opportunities to improve collaboration. Responsible for briefing the Senior Project Committee and the Socio-economic Advisory Body as required. *Primary Participants*: CIRNAC, GNWT, PSPC, CanNor, Parsons.	Additional details to come in subsequent versions

2018-19 Highlights

- The GMRP Team continued its engagement of key affected parties through the established working groups, including the GMOB, GMAC, and GMRP WG.
- Specific engagement sessions in 2017-18 focused on the QRA and the Water Licence.
- Key decisions made based on input from engagement sessions included the expansion of membership to the Socio-Economic Advisory Body, expansion of the Terms of references for the Socio-economic Working Group, and changes and adjustments to several of the documents submitted as part of the Water Licence Package.
- Regular communications continued (e.g. e-newsletter, website, Twitter account, public service announcements, media briefings and responses to inquiries, school presentations).

The CRP for the Giant Mine site is the culmination of the engagement and design work the Team has been working on since the Report of Environmental Assessment. The GMRP Team issued the draft CRP in June 2018, with community engagement sessions throughout 2018-19.

There were also engagements on the QRA, AIA, the draft Water Licence package, and the Stress Study (described in Section 5.1.1 below).

The GMRP Team is engaged in continual learning and improvement in all aspects of its operation, including communications and engagement. The Team assesses the effectiveness of its communications through various means, such as gathering feedback from the public and keeping a media log to track inquiries and topics. The Team also tracks the number and type of engagement activities planned and achieved.

5.1.1 Engagement and Events

In 2018-19, the GMRP Team undertook or participated in 43 engagement activities and events, aligned with and in support of Project or related activities. This is down slightly from 50 engagement events in 2016-17 and 59 in 2017-18.

Key GMRP engagement activities in 2018-19 included:

Archeology – (2018)
An Archeological Impact Assessment was conducted in July 2018 with field assistance by members/representatives of the YKDFN, with a focus on areas of high archaeological potential that overlapped with areas of planned or potential remediation activities. Areas of high archaeological potential were identified through desktop studies as well as based on input from Traditional Knowledge holders and interested parties. NSMA members/representatives also took part in the AIA in July 2018.

Quantitative Risk Assessment (QRA) (Environmental Assessment) – (2018)
The QRA engagement process has involved the GMRP WG, the NSMA, the YKDFN, the GMAC, and other groups. Over the last fiscal year, the Project has completed a series of engagements that have included:

- introducing the QRA and validating the engagement approach;
- identifying and discussing risk scenarios and appropriate consequence categories;
- discussing specific consequences associated with the previously identified risk scenarios;
- understanding and determining risk acceptability thresholds; and,
- discussing how to incorporate Traditional Knowledge and Traditional Land Use into the QRA.

Further engagement is expected in 2019-20 to identify scenarios that will be carried forward into the quantitative aspect of the QRA process, which would be analyzed over the summer and presented in fall 2019.

Stress Study (Environmental Assessment) – (2018)
Two engagement meetings with NSMA and YKDFN were conducted to work with affected parties to further refine the survey component of the study, along with a number of meetings with the GMRP WG. Further work is underway with the YKDFN.

Draft Water Licence Package Technical Sessions – (2018)
Three days of technical workshops took place with affected parties.

Closure and Reclamation Plan Site Tour – (2018)
Conducted three site tours with affected parties YKDFN (20 members participated) and NSMA (approximately 10 people participated) and the GMRP WG.

Water Licence Pre-submission Engagement – (2018)
In June 2018, the GMRP Team held a community session outlining the contents of its Water Licence application and the big-picture aspects of the closure plan. In September 2018, the GMRP Team held technical workshops to further discuss key topics of interest identified by affected parties in review of the key documents provided over the summer of 2018. These workshops included a project overview and detailed technical sessions on: tailings, pits, borrow, contaminated soils, underground, nonhazardous waste landfill/waste, freeze, water treatment and outfall, and Baker Creek, as well as a water-focused monitoring overview.

Industry Day (2018)
GMRP hosted an Industry Day in November 2018 in Yellowknife. Presentations focused on: the scope of the project, including a technical overview of the site and the planned remediation activities; Parsons' Socio-economic Strategy; the main work packages over Term 1 (2018 - 2022) and Term 2 (2022 - 2030), as well as employment needs; the procurement approach for the project, including key steps and components; the Procurement Strategy for Aboriginal Business; and, Aboriginal Opportunities Consideration.

The GMRP Team also participated in the following events:

- Geoscience Forum (Annual Event) – The attendees of the Annual Yellowknife Geoscience Conference are a concentrated group, working within the field of mining and petroleum.
- Spring Trade Show – For the past several years, the GMRP Team has held a booth at the Yellowknife Spring Trade Show in May.
- Public Forum – Since 2010-11, the GMRP Team has been holding an annual public forum.

In addition to the above regularly scheduled meetings, the Team provides updates on GMRP activities and progress through multiple communication techniques (Giant Mine Remediation Project, 2019f), including:

- e-newsletter: Sent regularly to more than 302 email addresses and posted on the GMRP website;
- website (www.giant.gc.ca);
- Twitter account (@GiantMine and @MineGiant);
- media briefings and responses to media requests
    - There were 23 media interactions, including interviews and requests for information, in 2018-19;
- responses to unforeseen events;
- topic-specific public service announcements, as required;
- school presentations; and,
- topic-specific engagements, as appropriate.

Key Stakeholder Concerns

The GMRP Team captures stakeholder concerns through their meeting minutes, the GMRP's Consultation Log, emails, and other correspondence. The GMRP Team endeavours to respond in a timely manner. Key concerns raised in 2018-19 were as follows:

Concern	GMRP Response
Arsenic Trioxide Dust Inventory (GMOB letter – Jan 2019): - GMOB requested the complete GMRP inventory of arsenic trioxide currently stored at the SGS Canada Inc. facility	The GMOB may have access to all samples of arsenic trioxide in the GMRP's custody at the SGS facility.
Employment and Contracting Statistics (GMOB – Jan 2019): - GMOB raised concerns about how we are tracking statistics when it comes to employment and contracting numbers; there was concern how the statistics were different between the Annual Report and what was presented at a City Council meeting.	The historical contracting and employment statistics cannot be compared to the Annual Report statistics, since they span 11 and eight years, respectively. Total contract value from 2006-2017 was provided to GMOB, as well as employment data from 2007 to 2017.
Terms of Reference (TOR) for the GMRP Socio-economic Advisory Body and sub-groups (GMOB letter – Feb 2019): - GMOB raised concern about different aspects of the TOR, including transparency, composition, and focus (too much focus on employment/ procurement and not enough on social)	The Socio-economic Advisory Body approved adjustments to the TOR to allow for all minutes to be made available and to expand the composition of the Body to include the Alternatives North and NSMA (YKDFN and the City of Yellowknife were added as members in fall 2018). The GMRP has focused on employment and procurement in the early stages of implementation of the Socio-economic Strategy; by working in partnership with others, GMRP can create a range of related benefits (e.g. skills development, economic diversification)
Measure 6 Report	As a result of concerns raised in 2017-18 regarding the

Concern	GMRP Response
- GMOB and others expressed concern with the original Measure 6 report in 2017-18; Stakeholders were dissatisfied with the level of detail in the initial Draft of the Measure 6 Report.	level of detail in the report Measure 6 Report, GMRP brought in a consultant to further develop the report. Deloitte was engaged to write the report, and a committee of working group members was created in order to help steer the work that the consultant was undertaking. Several meetings were held with the committee to come up with the final report, which will be issued in 2019-20.

Next Steps

Engagement activities in 2019-20 will focus on the Quantitative Risk Assessment, community and business outreach on procurement and contracting opportunities, socio-economic governance, Community-Based Monitoring, Stress Study, Perpetual Care Plan, engagement sessions dedicated to borrow sources, and Baker Creek design.

The GMRP will continue to host community forums for YKDFN, NMSA and Yellowknife, to engage with the external advisory bodies, and to communicate in a frequent and transparent manner via the established channels (e.g. e-newsletter, website, Twitter, radio, school outreach).

5.2 Incorporation of Traditional Knowledge (TK)

The YKDFN have developed and shared extensive knowledge of the Giant Mine site and surrounding area. Engagement with YKDFN is part of the 26 measures listed in the *Report of Environmental Assessment and Reasons for Decision* (Mackenzie Valley Review Board, 2013) to mitigate negative environmental impacts, and address public concerns. As a result, incorporating Traditional Knowledge (TK) into planning and work on site is a requirement for obtaining the Water Licence. While some TK has been incorporated in GMRP activities to date (e.g. to help determine the best time of year to deconstruct buildings), the Team acknowledges that there is a need for continual improvement. In 2017-18, the GMRP funded Phase 1 of a TK study that researched the ways in which the GMRP has incorporated TK. In 2018-19, YKDFN Lands and Environment conducted Phase 2 of the TK Study, which aimed at documenting YKDFN knowledge, values, priorities, concerns, perceptions of risk, and understanding of impacts to past and current land use (Yellowknives Dene First Nation & Trailmark Systems, 2019). Ultimately, the goal of this research is to:

- enable the inclusion of YKDFN knowledge and perspectives into mine management and risk assessment in the GMRP CRP; and,
- support YKDFN values and future land use aspirations.

Key Findings

To achieve these objectives, YKDFN Lands and Environment conducted semi-structured interviews with 15 YKDFN members during the summer of 2018, based on their experience with the Giant Mine through previous employment at the mine site, involvement in the reclamation or remediation process, having heavily used the area in the past, having experienced direct impacts by the mine, and/or a combination of these factors. Interview analysis highlighted the following key findings:

- Local Knowledge and views related to the Giant Mine and its remediation have not significantly changed over time, as results from this study are consistent with results from previous engagements with YKDFN community members.
- Current GMRP-related engagement efforts to rehabilitate relationships with the YKDFN may not be meeting the expectations of YKDFN members.
- Research participants unanimously called for compensation related to both the cost of financial and health impacts.
- Participants indicated that there is a need for acknowledging, addressing, and seeking to correct historical wrongs through both an apology and payment of compensation, to alleviate feelings of mistrust and resentment.
- The Giant Mine is associated with trauma in the individual lives of YKDFN members as well as in the community.

YKDFN participants raised a wide range of concerns related to the exposure to contaminants, the safety of plants and wildlife for human consumption, the ability to pursue land-based traditional activities, perceived contaminant risks as opposed to science-based assessments, youth engagement in GMRP and CRP activities, and Giant Mine's legacy.

Key Recommendations

- improve engagement and communication efforts;
- offer space for YKDFN members to share their experiences and express their views in ongoing discussions;
- promote youth engagement in the GMRP and CRP;
- provide compensation for the mine's negative financial impacts such as the need to pay for water delivery or additional supplies to travel further away for traditional land-based activities;
- provide compensation for the mine's negative impacts on community and individual well-being and health;
- build capacity for YKDFN to be included in decision-making processes;
- guide and shape remediation, monitoring and decision-making processes with YKDFN knowledge and views;
- address, through the GMRP and the CRP, all the impacts and mine-related issues reported by YKDFN members; and,
- promote ongoing public awareness of the impacts caused by the Giant Mine and the GMRP ongoing activities.

5.3 Procurement and Employment

2018-19 Highlights

- The GMRP awarded the MCM contract to Parsons Inc. (Parsons) in December 2017; Parsons assumed the role of Mine Manager on July 1, 2018.
- Two new governance bodies were established to help advance socio-economic priorities – a Socio-economic Working Group and a Socio-economic Advisory Body.
- In terms of hours worked, Indigenous and AOC employment was higher in 2018-19 than in 2017-18, but similar or lower than 2016-17 and 2015-16 results. The proportion of Northern employees also increased in 2018-19 (38%, up from 24% in 2017-2018), but was lower than previous years. Female employment was higher than the previous three years (22% in 2018-2019).
- The proportion of expenditures with Northern suppliers was higher in 2018-2019 than in 2017-2918 (55% up from 47%) but was lower than previous years (64% in 2016-2017 and 68% in 2015-2016). The proportion spent with AOC suppliers was lower in 2018-19 than the previous two years (28% in 2018-19 and 35-31% in previous years). Contracts with Indigenous suppliers decreased as a proportion of total spending since last year (from 45% in 2016-17 and 41% in 2017-18 to 27% in 2018-19).

5.3.1 Socio-Economic Strategy and Implementation to Deliver Socio-Economic Benefits

CIRNAC and the GNWT are committed to promoting socio-economic benefits and supporting reconciliation efforts with Indigenous peoples of Canada. To date, the GMRP has delivered economic benefits to the region through procurement and employment. In preparation for the Remediation Implementation Phase of the Project, the GMRP plans to be more deliberate and strategic in its approach to maximize economic benefits.

The Project Team developed a Socio-economic Strategy in 2016-17 and will be publicly releasing an updated version in 2019-20 [released in Sept 2019]. The overall aim of the strategy is to maximize socio-economic benefits and deliver on the socio-economic commitments and requirements within guiding policies and other requirements. To accomplish this goal, the strategy involves three distinct streams of activity:

- providing access to employment and procurement opportunities;
- supporting capacity and skills development; and,
- anticipating, monitoring and mitigating negative impacts.

Potential barriers to strategy implementation include insufficient Northern and Indigenous workforce capacity and fluctuating Northern and Indigenous business/contracting capacity.

To enhance coordination and preparedness for socio-economic benefits, the Project Team established the following advisory and coordinating bodies in 2018-19:

- **Socio-economic Advisory Body**: The Socio-economic Advisory Body provides strategic advice to the Socio-economic Working Group and acts as senior government champions for the implementation of the Socio-economic Working Group's approach. The Advisory Body is chaired by the Northern Contaminated Sites Program Executive Director and is comprised of senior level representatives from federal, territorial, municipal, and Indigenous partners.
- **Socio-economic Working Group**: The Socio-economic Working Group coordinates and integrates socio-economic activities for the Project. This working group shares information and seeks opportunities to improve collaboration, as well as reports to and seeks advice from the Senior Project Committee and the Socio-economic Advisory Body on the implementation approach. It meets on an as needed basis, and is comprised of Team members who represent CIRNAC, PSPC, the GNWT, CanNor, Parsons, and the City of Yellowknife.

The GMRP also supported the hiring of a Community Liaison through funding provided to the YKDFN.

Key Activities related to the Socio-economic Strategy in 2018-19

Parsons Assumes Role of MCM

In December 2017, the GMRP awarded the MCM contract to Parsons Inc. (Parsons), a key partner in carrying out the socio-economic approach since Parsons will play an important role in contributing to socio-economic benefits. Parsons is working to maximize local workforce in its core staff (10 staff on average, 19 staff at its peak) as well as through the sub-contracts it will award for remediation project work. Most of the opportunities will come from the sub-contracts issued by Parsons.

What the MCM's role involves:

- Managing the entire remediation of the site and tendering subcontracts accordingly for remediation work, this will begin in 2021.
- Developing the implementation plan (project work packages and schedule) and advising on the scheduling, sequencing, and constructability of various components of the remediation plan.
- Managing work packages according to schedule and monitoring and reporting regularly on progress.

Most economic benefit opportunities will be accessed through the sub-contracts issued by Parsons. Parsons will be encouraged to apply the following Government of Canada procurement tools to maximize Northern Indigenous procurement:

1. **Aboriginal Opportunities Considerations (AOC):** AOC applies evaluation criteria to quantifiable commitments such as percentage of labour force that are local Indigenous peoples. Incentives and penalties are applied to encourage firms to meet or exceed commitments outlined in their proposal.
2. **Procurement Strategy for Aboriginal Business (PSAB):** Where adequate Indigenous capacity exists, PSAB sets aside procurements for Indigenous business bidders only.

Contract Requirements for the Main Construction Manager and Status in 2018-19

Requirement	Details	Status
Indigenous Benefits Plan	Develop an Indigenous Benefits Plan that includes the following: • Labour Capacity Study to understand skills and availability of the local workforce – to be updated at key milestones. • Procurement Plan that outlines how procurement tools (see text below), work packaging and sequencing will maximize socio-economic benefits.	Underway.
Yellowknife Storefront Office & Website	Establish a storefront office that is centrally located and accessible to the public and develop and maintain a website to: • share information about existing and upcoming contracts; • provide training on procurement and contract requirements; • post contractors' employment opportunities; and, • provide links to other relevant training and development programs.	Yellowknife office: complete • Moved in the office on March 1, 2019. • Office open to the general public as of March 1, 2019 Website: complete • Website went online July 3, 2018. • http://giantminerp.ca/
Economic Development Officer	Establish an Economic Development Officer position based out of Yellowknife office that is responsible for developing and carrying out the Indigenous Benefits Plan	Economic Development Officer (EDO) position filled. The EDO, Louie Azzolini, is focused on: • preparing a detailed database of Yellowknife area businesses; • working with local training providers (e.g. Aurora College) on student sponsorship and training opportunities; • working closely with the Tłı̨chǫ Investment Corporation, Denesoline Corporation, NSMA and the Det'on Cho Corporation to discuss upcoming procurement opportunities and needs; and. • reaching out to local businesses to notify them of available contracting opportunities associated with GMRP work packages.

Requirement	Details	Status
Indigenous Community Database	In partnership with YKDFN, NSMA and Tłı̨chǫ, the MCM's Aboriginal Community Liaison will develop a database of local Indigenous persons that are interested in employment at the Giant Mine site.	The Aboriginal Community Liaison, Lisa Colas, is focused on: • preparing for second round of door to door visits in Dettah and Ndilǫ communities, anticipated to begin in Q1 of 2019-20. First round of door to door visits in Dettah and Ndilǫ communities was complete in 2018. • Collaborating with YKDFN's Economic Development Officer and CIRNAC to develop a database workplan outlining the data collection process and purpose of this database. Workplan to be complete in Q1 of 2019-20.
Reporting on Socio-economic Benefits	Reporting on Key Performance Indicators such as, among others: • Parsons and sub-contractors' Northern, Indigenous and female employment; • provisions for Northern and Indigenous employees and contractors; and, • value of contracts to Northern and Northern Indigenous suppliers.	CIRNAC is working with PSPC and Parsons to identify best methods of sharing Key Performance Indicators data securely and quickly.

PSPC and the GMRP Team will meet regularly with Parsons to ensure the above requirements are fulfilled. The GMRP will also establish an Indigenous Benefits Plan Monitoring and Advisory Committee. This committee will review how Parsons implements its Indigenous Benefits Plan and will provide advice and guidance on how to address barriers to improve performance. An **Indigenous Benefits Plan Monitoring and Advisory Committee** is to be established in 2019-20 or early 2020-2021. The Committee will review the Key Performance Indicator results and provide advice and guidance to the Project on how to address barriers and improve performance.

Next Steps for the Implementation of Socio-economic Actions

GMRP and Parsons Inc. will continue to advance the socio-economic approach in 2019-20 by:

- Holding business preparedness meetings with Indigenous governments and economic development corporations, Northern business organizations, and the City of Yellowknife, in collaboration with territorial and federal government partners, to:
    - share information on project timelines and the procurement approach;
    - refine understanding of local interests for upcoming work packages; and,
    - identify how GMRP and Parsons can support local participation.
- Completing the Indigenous Benefits Strategy, with an evergreen Skills Inventory - based on local community surveys.
- Developing a training plan in discussion and coordination with the GNWT and training providers, including the Mine Training Society and Aurora College.

- Holding a Capacity Building Information Session to provide an opportunity for residents and businesses to learn about and connect with relevant capacity building, training, and associated funding programs and organizations.
- Establishing targets for a select set of Key Performance Indicators.
- Establishing the Indigenous Business Plan Monitoring and Advisory Committee.
- Undertaking regular engagement with stakeholders, local businesses and governments (e.g. GNWT, City of Yellowknife) to ensure adequate coordination across the parties to maximize GMRP's socio-economic benefits.

5.3.2 2018-19 Employment and Procurement Results

5.3.2.1 Employment Statistics

The GMRP tracks the total employment and employment by certain categories, namely Northern, Indigenous, AOCs, and Female employees. Table 11

Table 11 shows the employment statistics for Parsons and its contractors for 2018-19. Table 12 shows the employment statistics for CIRNAC contractors, including the C5-09 stope contract which was contracted before Parsons took over as MCM.

Table 11: Total Number of Persons and Total Person Hours (Parsons + contractors) for 2018-19, by Category

Employee type[5]	Total # persons *(incl. contractors)*	Total person-hours	Persons as % of all employees	Person-hours as % of all person-hours
Northern employees	138.0	67,801	54%	65%
Southern employees	107.0	36,243	42%	35%
Indigenous employees	70.0	35,220	28%	34%
AOC employees[6]	70.0	35,220	28%	34%
Female employees	57.0	21,019	22%	20%
TOTAL	**254.0**	**104,044**	**100%**	**100%**

*Note: nine employees could not be categorized due to errors in reporting

[5] Note that these categories may overlap (e.g. a single employee may simultaneously be counted as Northern, Indigenous, AOC, and female – or a combination or subset thereof) and that this information may not be available for all employees). For this reason, the totals indicated in the bottom row of the table do not represent the sum of the preceding rows.
[6] All AOC employees are Indigenous employees under Parsons data collection methodology.

Table 12: Total Number of Persons and Total Person Hours (CIRNAC contractors) for 2018-19, by Category

Employee type[7]	Total # persons *(incl. contractors)*	Total person-hours	Persons as % of all employees	Person-hours as % of all person-hours
Northern employees	116	58,493	20%	32%
Southern employees	457	123,157	80%	68%
Indigenous employees[8]	36	18,387	6%	10%
AOC employees	33	16,886	6%	9%
Female employees	196	41,182	34%	23%
TOTAL	**573**	**181,650**	**100%**	**100%**

*Note: 17 employees could not be categorized due to errors in reporting

The following figures highlight key trends of the Total Number of Persons and Total Person Hours, by Category, for 2015-16 to 2018-19 (Figure 4 and Figure 5). These results represent the combined data reported by both CIRNAC and Parsons. Northern employment increased in 2018-2019, while it was previously trending downward year over year. However, female employment decreased since last year, while it was trending up in previous years. There is no discernable trend for Indigenous and AOC, likely due to high variability since they represent a small proportion of overall employment.

[7] Note that these categories may overlap (e.g. a single employee may simultaneously be counted as Northern, Indigenous, AOC, and female – or a combination or subset thereof) and that this information may not be available for all employees. For this reason, the totals indicated in the bottom row of the table do not represent the sum of the preceding rows.
[8] Unlike Parsons' data, AOC employees were not consistently categorized as Indigenous employees in CIRNAC's data; therefore, there is a difference in statistics. However, it can be assumed that all AOC employees are also Indigenous (i.e. the values should be the same).

Figure 4: Persons as % of all Employees by Category from 2015-16 to 2018-19

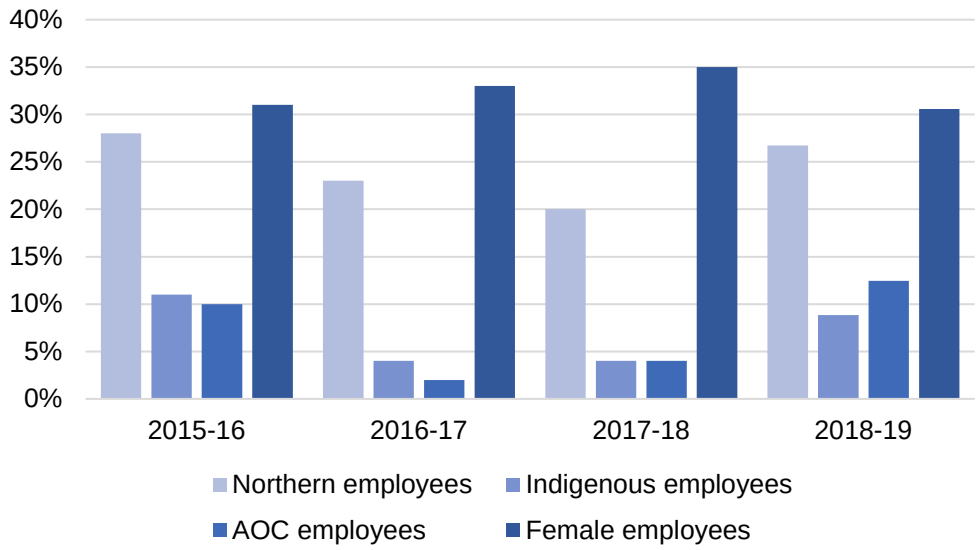
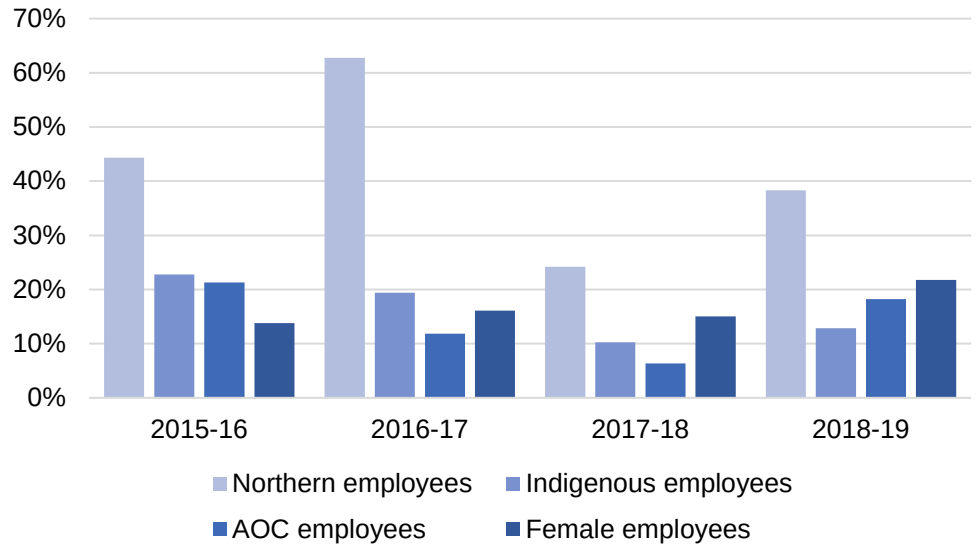


Figure 5: Percentage of Person Hours by Category from 2015-16 to 2018-19



5.3.2.2 Major Procurements

Contracts Awarded between April 1, 2018 and March 31, 2019

Major work packages awarded by Parsons in 2018-19 include:

- $12,560,396 – Contract awarded to Procon/Det'on Cho Joint Venture for Underground Care and Maintenance.
- $7,360,549 – Contract awarded to Det'on Cho Nuna Joint Venture for Surface Care and Maintenance.
- $1,855,255 – Contract awarded to Det'on Cho Scarlet Security Services for Site Security.
- $1,642,419 – Contract awarded to Nahanni Construction Limited for the Akaitcho Pump Installation.
- $1,343,600 – Contract awarded to SLR Consulting Ltd. for Air Quality Monitoring.
- $1,219,713 – Contract awarded to Boart Longyear for Tailings Drilling.
- $1,001,101 – Contract awarded to Pure Elements Environmental Solutions for the ETP Operations
- $132,579 – Contract awarded to Pure Elements for the Pilot WTP.
- $662,184 – Contract awarded to Det'on Cho Medical Solutions for Emergency Medical Services
- $484,896 – Contract awarded to Unifar Canada Limited for materials.
- $377,985 – Contract awarded to Denesoline Ryfan Limited for the C-Shaft Power Feeders Installation.

5.3.2.3 Suppliers Statistics

The GMRP also tracks the total number of suppliers, the total value of contracts and the number of suppliers and value of contracts by three categories: Northern, Indigenous and AOC.

Table 13 provides the supplier statistics of Parsons and Table 14 provides the supplier statistics for CIRNAC for 2018-19. The GMRP also tracks purchase of goods and services by supplier category, namely Northern, Indigenous, and AOC.

The proportion of expenditures with Northern suppliers this year (55%) increased from 2017-2018 (47%) but is lower than in 2016-17 (64%). The proportion spent with AOC suppliers this year (28%) decreased from previous years (35% in 2017-18 and 31% in 2016-17). Contracts with Indigenous suppliers (27%) decreased from 41% in 2017-18, and 45% in 2016-2017. Overall, the total number of suppliers (990) increased in 2018-19 from 474 in 2017-2018 and 546 in 2016-17. This increase is likely due to more construction and physical works occurring on the site compared to the previous years.

Table 13: Total Number of Suppliers and Total Value of Contracts Parsons for 2018-19, by Category[9]

Supplier type[10]	# suppliers	$ spent	% of total $ spent
Northern suppliers	153	$22,237,205	80%
Southern suppliers	103	$5,607,887	20%
Indigenous suppliers	59	$16,658,670	60%
AOC suppliers	59	$16,658,670	60%
TOTAL	**258**	**$27,845,477**	**100%**

Table 14: Total Number of Suppliers and Total Value of Contracts by CIRNAC for 2018-19, by Category[11]

Supplier type[12]	# suppliers	$ spent	% of total $ spent
Northern suppliers	275	$12,114,832	35%
Southern suppliers	430	$20,024,692	57%
Indigenous suppliers	5	$5,307	<1%
AOC suppliers	13	$855,728	2%
TOTAL	**732**	**$34,896,501**	**100%**

*Note: 11 suppliers could not be categorized due to errors in reporting.

The following figures highlight the Total Number of Suppliers and Percent of Total Value of Contracts, by Category, for 2015-16 to 2018-19. These results represent the combined data reported by both CIRNAC and the MCM. Figure 6 indicates that the number of Northern suppliers, Indigenous suppliers, and AOC suppliers has increased since 2015-16. Figure 7 demonstrates that the percentage of total value spent on Northern, Indigenous, and AOC suppliers has decreased, since 2015-16.

[9] The tracking of suppliers in Quarters 2-4 was more detailed than in the first Quarter (e.g. the Q2-4 statistics include line items for all purchases by a sub-contractor (e.g. hotel, taxi); whereas the line items in Q1 at the sub-contractor level (e.g. SRK consulting).
[10] Note that these categories may overlap (e.g. a single supplier may simultaneously be counted as Northern, Indigenous, and AOC – or a combination thereof) and that category information was not available for all suppliers. For these reasons, the totals indicated in the bottom row of the table do not represent the sum of the preceding rows.
[11] The tracking of suppliers by CIRNAC sub-contractors was very detailed (e.g. taxi, meals, materials, airlines, hotels, etc.).
[12] Note that these categories may overlap (e.g. a single supplier may simultaneously be counted as Northern, Indigenous, and AOC – or a combination thereof) and that category information was not available for all suppliers. For these reasons, the totals indicated in the bottom row of the table do not represent the sum of the preceding rows.

Figure 6: Total Number of Suppliers from 2015-16 to 2018-19

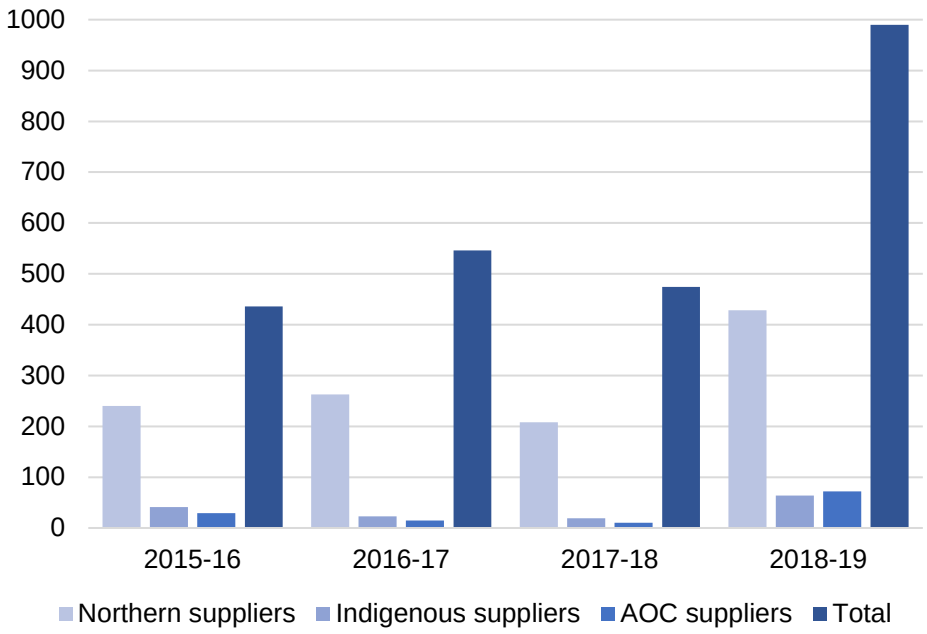
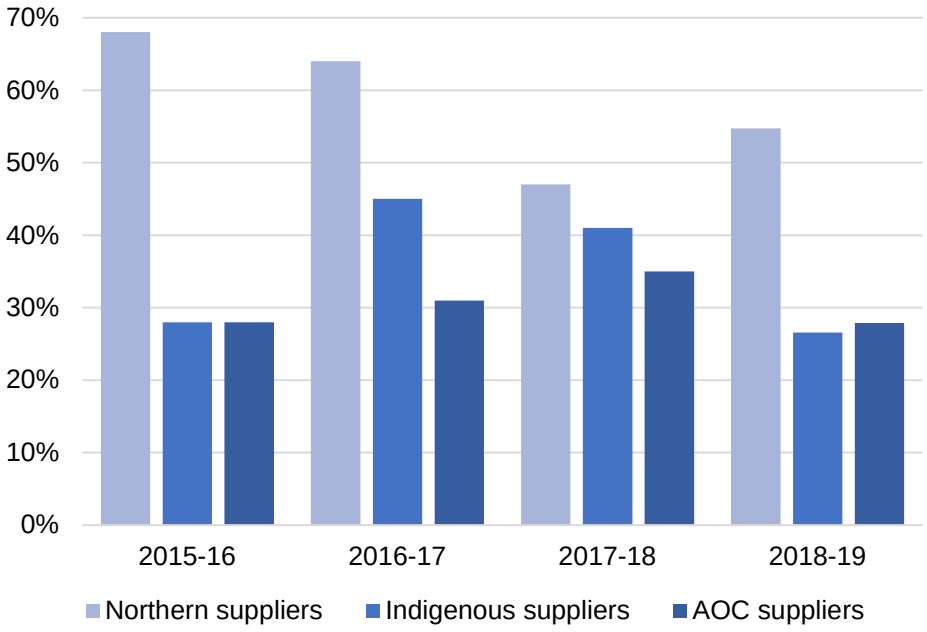


Figure 7: Percent of Total $ Value Spent from 2015-16 to 2018-19



5.4 Training and Capacity Building

2018-19 Highlights

- In 2018-19, total workforce training increased overall, but remained relatively consistent across the categories (Northern, Indigenous, AOC and Female employees).
- The GMRP continued to fund the YKDFN Dechita Nàowo Giant Mine Remediation Training Program.

In addition to the occupational H&S training, GMRP contractors are required to ensure that employees are properly trained to perform their responsibilities. Contractors deliver workforce training, including site orientations. The inclusion of AOC in contracts ensures Indigenous employment and capacity building is considered and implemented where possible by all GMRP contractors.

In 2018-19, the workforce training included CANN/AMM Drug and Alcohol Training, High Angle Rescue, Mine Training, and Loader Training. Additionally, the GMRP tracks its workforce training by number of people who have participated in training exercises, as well as the number of person hours. Based on statistics reported by both CIRNAC and the MCM, workforce training for 2018-19 is summarized in

Table 15, organized by category of Northern, Indigenous, Women and Total.[13]

In 2018-19, workforce training provided to AOC employees (73) and Indigenous employees (46) increased from previous years. Workforce training for female (75) and northern employees (116) also increased. These increases reflect the total number of people trained, which also increased from 2017-18 (138) to 2018-19 (321). The overall increase is likely due to more construction and physical works occurring on the site compared to the previous years.

[13] The total does not reflect the sum of the other categories because there is overlap between the categories and the total includes all workforce training (e.g., non-Northern).

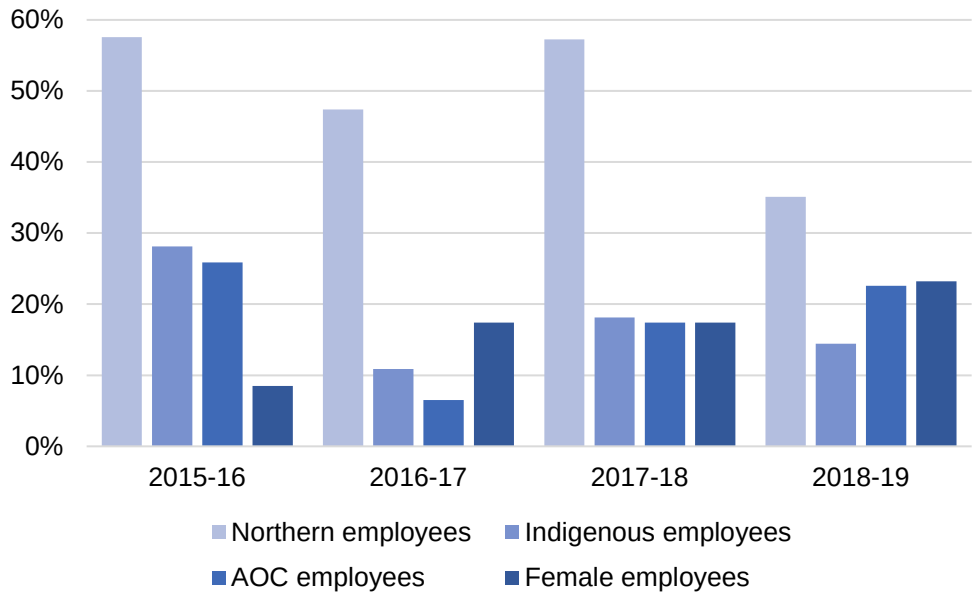
Table 15: Total Number of People trained and Total Person Hours of Training in 2018-19, by Category

Workforce training[14]	Total # persons	Total person-hours	Persons as % of all employees	Person-hours as % of all person-hours
Northern employees	112	3675	35%	52%
Southern employees	168	3294	53%	47%
Indigenous employees	46	3202	14%	46%
AOC employees	72	3215	23%	46%
Female employees	74	1496	23%	21%
TOTAL	**319**	**7037**	**100%**	**100%**

*Note: 9 employees from the MCM statistics and 17 employees from CIRNAC statistics couldn't be categorized due to errors in reporting

Figure 8 highlights the percentage of people trained by employee category, for 2015-16 to 2018-19. Although the overall number of people trained for each employee group increased since 2015, the proportion of Northern and Indigenous employees trained decreased over the years.

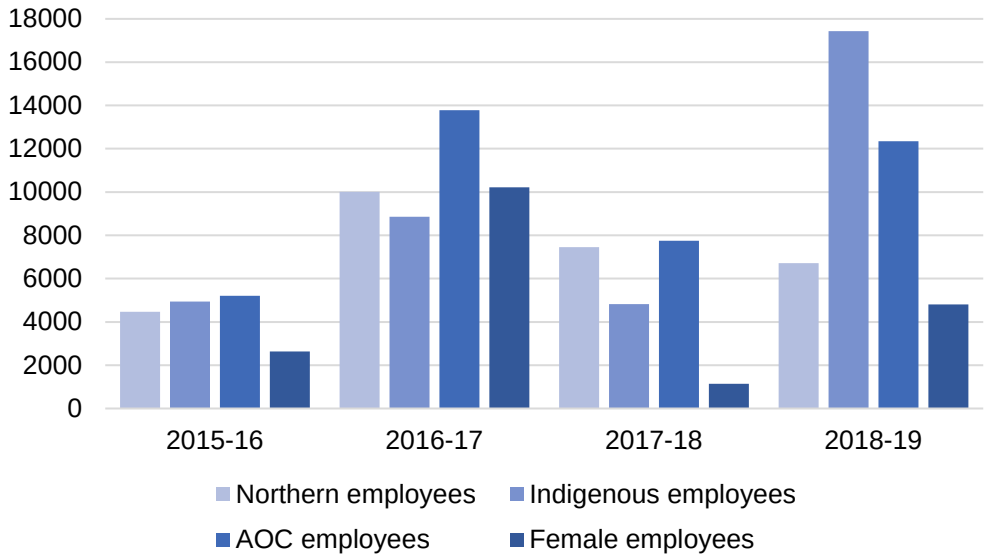
Figure 8: Percentage of People Trained by Employee Group from 2015-2016 to 2018-2019



[14] Note that these categories may overlap (e.g. a single employee may simultaneously be counted as Northern, Indigenous, AOC, and female – or a combination or subset thereof) and that some employees fit into none of these categories. For both of these reasons, the totals indicated in the bottom row of the table do not represent the sum of the preceding rows.

Figure 9 highlights the number of person-hours of training by employee group from 2015-2019. The number of person-hours of training is normalized by person-hours worked to enable comparison across years, since the total number of training hours may significantly differ over the years. The number of person-hours of training for Indigenous and AOC employees increased significantly since 2015. However, there is no discernable trend for Northern and female employees over the years.

Figure 9: Number of Person Hours of Training per 200,000 Person-hours Worked by Employee Group from 2015-16 to 2018-19



Dechita Nàowo

Through a Contribution Agreement, the GMRP funded the YKDFN Dechita Nàowo Training Program in 2018-19. Training delivered in 2018-19 included:

- BEAHR Module 1 – Environmental Core Skills (13 participants)
- BEAHR Module 2 – Environmental Remediation Program (Essentials of Contaminated Sites remediation) (13 participants)
- Environmental Monitoring (15 participants)
- Heavy Equipment Operator Hands-on Training (15 participants)
- Predator Defense and Shotgun Handling (12 participants)
- Class 3 Drivers License and Air Brakes (7 participants)

6.0 IN CLOSING

In 2018-19, the GMRP made important strides towards completion of the CRP and preparation of the application package for a Water Licence, while continuing site operations (C&M), immediate risk mitigation activities, community engagement, and health studies.

The GMRP will continue to prepare annual reports that describe the progress and performance of the GMRP. In the spirit of continual improvement, we welcome your comments on this report and how it can be enhanced in the future.

For more information or to provide comments on the report, please contact: Natalie Plato, GMRP Deputy Director, natalie.plato@canada.ca, 867-669-2838.

7.0 REFERENCES TO ALL SOURCES RELIED UPON

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APPENDICES

Appendix A – List of Acronyms

Appendix B – Progress on EA Measures and Suggestions

Appendix C – Plain Language Summary

Appendix D – Project Overview and Risk Tables

Appendix E – Additional Information on Monitoring Parameters

APPENDIX A – LIST OF ACRONYMS

AAQS	Ambient Air Quality Standard
AIA	Archaeological Impact Assessment
AOC	Aboriginal Opportunities Considerations
ADM	Assistant Deputy Minister
AEMP	Aquatic Effects Monitoring Program
AQMP	Air Quality Monitoring Program
C&M	Care and Maintenance
CanNor	Canadian Northern Economic Development Agency
CanNorth	Canada North Environmental Services
CIRNAC	Crown-Indigenous CanNor Relations and Northern Affairs Canada
CRP	Closure and Reclamation Plan
CWQG	Canadian Water Quality Guidelines
DCNJV	Deton'Cho / Nuna Joint Venture
DFO	Fisheries and Oceans Canada
DG	Director General
EA	Environmental Assessment
ECCC	Environment and Climate Change Canada
EDO	Economic Development Officer
EEM	Environmental Effects Monitoring
EHS	Environment, Health and Safety
EHSC	Environment, Health, Safety and Community
EQC	Effluent Quality Criteria
EPP	Environmental Protection Plan
ETP	Effluent Treatment Plant
FOS	Freeze Optimization Study
GMAC	Giant Mine Advisory Committee
GMOB	Giant Mine Oversight Board
GMRP	Giant Mine Remediation Project
GMRP WG	Giant Mine Remediation Project Working Group
GNWT	Government of the Northwest Territories
GNWT ENR	Government of the Northwest Territories Environment and Natural Resources
H &S	Health and Safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEMPAC	Health Effects Monitoring Program Advisory Committee
HHERA	Human Health Ecological Risk Assessment
ISQG	Interim Sediment Quality Guidelines
LTMP	Long-term Monitoring Program
MCM	Main Construction Manager
MDMER	Metal and Diamond Mining Effluent Regulations
MVEIRB	Mackenzie Valley Environmental Impact Review Board
MVLWB	Mackenzie Valley Land and Water Board
MVRMA	Mackenzie Valley Resource Management Act
NAO	Northern Affairs Organization

NCSB	Northern Contaminated Sites Branch
NCSP	Northern Contaminated Sites Program
NSMA	North Slave Metis Alliance
OMP	Operational Monitoring Program
PMC	Project Management Committee
PMT	Project Management Team
PPE	Personal Protective Equipment
PTS	Site-Specific Passive Treatment System
PSAB	Procurement Strategy for Indigenous Business
PSPC	Public Services and Procurement Canada
QRA	Quantitative Risk Assessment
RBAL	Risk-Based Action Levels
SDE	Surface Design Engagement
SNP	Surveillance Network Program
SPAC	Senior Project Advisory Committee
SSP	Site Stabilization Plan
SSWQO	Site-specific Water Quality Objectives
TCAs	Tailing Containment Areas
TDS	Total Dissolved Solids
TK	Traditional Knowledge
TOR	Terms of Reference
TSP	Total Suspended Particulates
WHMIS	Workplace Hazardous Materials Information System
WQOs	Water Quality Objectives
WSCC	Workers' Safety and Compensation Committee
WTP	Water Treatment Plant
WWHMMP	Wildlife and Wildlife Habitat Management and Monitoring Plan
YKDFN	Yellowknives Dene First Nation

APPENDIX B – PROGRESS ON EA MEASURES AND SUGGESTIONS – DETAILED TABLES

This appendix provides supplemental details about progress toward achieving the Measures stipulated via The Report of Environmental Assessment and Reasons for Decision (Mackenzie Valley Review Board, 2013), *and plans for 2019-20. Throughout these tables, "the Project" refers to the GMRP. The language in the Measure column is drawn directly from The Report of Environmental Assessment and Reasons for Decision* (Mackenzie Valley Review Board, 2013).

Table 16: Giant Mine EA Measures Tracking Table (as of February 2019)

#	Measure	Status	GMRP Comments on Status
1	To prevent the significant adverse impacts on environment and the significant public concern from the proposed perpetual timeframe, the Project will proceed only as an interim solution, for a maximum of 100 years.	No Action Required	The closure period is 100 years as outlined in the CRP.
2	Every 20 years after the beginning of Project implementation, the Developer will commission an independent review of the Project to evaluate its effectiveness to date, and to decide if a better approach can be identified. This will: 1. consider results of the ongoing research 2. be participatory in nature 3. follow the requirements of procedural fairness and be transparent in nature. If the periodic review identifies a better approach that is feasible and cost-effective, the Developer will further study it, and make the study and its results of the study public.	Future action required	The Environmental Agreement outlines the process through which the GMRP is required to commission an independent review of the Project every 20 years, beginning after Project implementation. The Agreement ensures the independent review of the Project is conducted in a manner that considers ongoing research results, is participatory and transparent in nature and follows the requirements of procedural fairness. The GMOB is to provide advice in the design of the independent review.
3	To facilitate active research in emerging technologies towards finding a permanent solution for dealing with arsenic at the Giant mine site, the Developer will fund research activity as advised by stakeholders and potentially affected Parties through the GMOB. The ongoing funding for this research activity, and	Complete	The Environmental Agreement provides a commitment of funding for the Oversight Body (which will be known publicly as the GMOB to manage a research program as required by Measure 3. Initial funding flowed for this measure as of 2015-16.

#	Measure	Status	GMRP Comments on Status
	additional resources required to manage its coordination, will be negotiated and included as part of the Environmental Agreement specified in Measure 7 and will make best use of existing research institutions and programs. The GMOB will ensure through the research activity that, on a periodic basis: 1. reports on relevant emerging technologies are produced; 2. research priorities are identified; 3. research funding is administered; 4. results of research are made public, and 5. results of each cycle are applied to the next cycle of these steps.		
4	The GMOB will provide the results of the research funded by the Developer to the periodic reviews of the Project described in Measure 2. If better technological options are identified through the funded research in-between these periodic 20-year reviews, these will be reported publicly by the GMOB to the Parties, the Developer and the Canadian public. The Developer will consider these technologies and make decisions regarding their feasibility. The Developer will make any such decisions public.	Complete	GMOB prepared a report with the assistance of Arcadis Canada to review and assess the viability of current technologies relevant to the management of arsenic trioxide in September of 2017, which is publicly available. GMOB hosted a research workshop in March 2018 and is currently negotiating an MOU with the University of Waterloo for TERRE-NET researchers to establish a formal research relationship with respect to finding a permanent remediation solution for the arsenic trioxide dust stored at the Giant Mine site.

#	Measure	Status	GMRP Comments on Status
5	In order to mitigate significant adverse impacts that are otherwise likely, the Developer will commission an independent QRA to be completed before the Project receives regulatory approvals. This will include: 1. explicit acceptability thresholds, determined in consultation with potentially affected communities 2. an examination of risks from a holistic perspective, integrating the combined environmental, social, health and financial consequences. 3. possible events of a worst-case/ low frequency high consequence nature 4. additional considerations specified in Appendix D of the Report of EA From this, the Developer will identify any appropriate Project improvements and identify management responses to avoid or reduce the severity of predicted unacceptable risks.	Underway	An independent consultant (Wood) was retained in 2018 to complete the QRA. A separate consultant was retained to develop the engagement component (Stratos). To date the QRA Team has prepared and presented an overall Methodology and Engagement Strategy to the GMRP Working Group and adjusted this strategy based on input; held multiple public sessions on risk identification, consequence criteria and acceptability thresholds. A final report will be provided mid 2019. Results will be presented to the public and carried forward in future versions of Management Plans and Design and Construction Plans as required.
6	The Developer will: • investigate long-term funding options for the ongoing maintenance of this Project and for contingencies, including a trust fund with multi-year up front funding, • involve stakeholders and the public in discussions on funding options; and, • make public a detailed report within three years that describes its consideration of funding options, providing stakeholders with the opportunity to comment on the report.	Underway	A draft report on long term funding options was provided to the GMRP Working Group for review in July 2017. Subsequently, an independent consultant (Deloitte) was retained to develop and provide a revised report. A subcommittee of members from the GMRP Working Group was formed to provide feedback and input into the revised report. The report is currently in progress and is anticipated to be finalized in 2019.

#	Measure	Status	GMRP Comments on Status
7	The Developer will negotiate a legally-binding environmental agreement with, at a minimum, the members of the Oversight Working Group, and other appropriate representative organizations, to create an independent Oversight Body (GMOB) for the GMRP. These negotiations will build on the existing discussion paper and draft environmental agreement of the Giant Oversight Working group. This GMOB will exist for the life of the Project unless otherwise agreed by the Parties to the Environmental Agreement. Every effort will be made to have the GMOB in place as early as possible. The negotiations will make significant progress within six months of the Ministers' EA decision or proceed to mediation. The Developer will cover any mediation costs. The environmental agreement will include a dispute resolution mechanism to ensure compliance with the agreement and a stable funding mechanism for the GMOB.	Complete	Through negotiations with the six affected parties (GNWT, CIRNAC, Alternatives North, the NSMA, the YKDFN, the City of Yellowknife) an Environmental Agreement was signed in June 2015. This Agreement established the mandate for a GMOB. Details of the Board's mandate are included in the Giant Mine Environmental Agreement and Society's by-laws found on the GMOB's website.
8	The activities of the oversight body will include: • keeping track of monitoring activities by the Developer and the results of those activities, including water quality and aquatic effects monitoring, health monitoring and other monitoring; • considering the adequacy of funding for the Project and ongoing research; • providing advice to the Developer, regulators and government on ongoing improvements in monitoring and Project management to prevent risks and mitigate any potential impacts; • sharing the oversight body's conclusions with the general public and potentially affected communities in a culturally appropriate manner	Complete	The Environmental Agreement provides for the creation of the Oversight Board and funding to fulfill these obligations going forward. Article 3 of the Environmental Agreement outlines the mandate of the GMOB. The GMRP continues engaging with GMOB staff and directors through various engagement initiatives and venues, further described in the Engagement Plan.
9	The Developer will work with other federal and territorial departments as necessary to design and implement a broad health effects monitoring program in Ndilǫ, Dettah and Yellowknife focusing on arsenic and any other contaminants in people which might result from this Project. This will include studies of baseline health effects of these contaminants and	Underway	The Health Effects Monitoring Program was established in 2017. Dr. Laurie Chan, an independent researcher from the University of Ottawa, is leading the study. An Advisory Committee was established with representatives from Health Canada, GNWT Health-Office of the Chief Medical Officer, YKDFN, City of Yellowknife, NSMA, GMOB, and the GMRP, to provide recommendations on the design and implementation of the program. Public engagement was undertaken in 2017/18 to

#	Measure	Status	GMRP Comments on Status
	ongoing periodic monitoring. This will be designed with input from: • Health Canada, GNWT Health and Social Services and the Yellowknife medical community; and • The Yellowknives Dene and other potentially affected communities. The organization conducting the monitoring will provide regular plain language explanations of the monitoring results in terms that are understandable to lay people, and communicate this to potentially affected communities in a culturally appropriate manner.		inform residents of the program, discuss the proposed study and obtain feedback. The program completed the second year of participant sampling in 2018/19. Participants will receive results in 2019/20.
10	The Developer will commission a comprehensive quantitative human health risk assessment by an independent, qualified human health risk assessor selected in collaboration with Health Canada, the Yellowknives Dene, the City of Yellowknife, and the Developer. This human health risk assessment will be completed before the Project receives regulatory approvals. It will: 1. Include a critical review of the 2006 Tier II human health risk assessment and the previous screening reports; 2. Consider additional exposures and thresholds (as specified in Appendix F of the Report of EA); 3. Decide whether a Tier III risk assessment is appropriate; 4. Provide a plain language explanation of the results in terms that are understandable to the general public, and communicate this to potentially affected communities in a culturally appropriate manner; 5. Provide interpretation of results and related guidance; and 6. Inform the broad health effects monitoring program (described in Measure 9 above). The Developer may conduct the human health risk assessment concurrently with the QRA described in	Underway	The HHERA was completed by Canada North Environmental Services. The HHERA was carried out with significant input from stakeholders, community members and traditional knowledge holders. This input included both the scope of the assessment and the implementation to better assess risks considering differences in traditional land use, food consumption, and lifestyles. The final report was released in January 2018. The GMRP is currently initiating a Stress Study, which was identified in an Appendix to the Report of EA. Preliminary scope discussions have occurred with affected parties. Implementation of the stress component will take place 2019/20.

#	Measure	Status	GMRP Comments on Status
	Measure 5. Based on the results of this human health risk assessment, and on any existing results of the health effects monitoring program (described in Measure 9 above), the Developer will, if necessary in response to this information, identify, design and implement appropriate design improvements and identify appropriate management responses to avoid or reduce the severity of any predicted unacceptable health risks. Also, footnote #133 in the Report of EA (Appendix D) is revised to read, in its entirety, "Including inference of causality and pathologies deducted from any available health studies."		
11	The Developer, with meaningful participation from the Oversight Body and other parties, will thoroughly assess options for, and the environmental impacts of, diversion of Baker Creek to a north diversion route previously considered by the Developer or another route that avoids the mine site and is determined appropriate by the Developer. Within one year of the project receiving its water license, a report outlining a comparison of options including the current on-site realignment will be provided to the appropriate regulatory authorities, the Oversight Body and the public. Once informed by the advice of the Oversight Body and regulatory authorities, the Developer will determine and implement the preferred option. In doing so, the Developer will consider the advice of the Oversight Body, regulatory authorities, and the public, and will ensure that the primary considerations in selecting an option are to: a) minimize the likelihood of Baker Creek flooding and entering the arsenic chambers, stopes and underground workings, and b) minimize the exposure of fish in Baker Creek to arsenic from existing contaminated sediments on the mine site, surface drainage from the mine site or tailings runoff. If off-site diversion is selected, the Developer will seek required regulatory	Complete	A comprehensive evaluation of diversion alternatives was undertaken and documented in the Baker Creek Diversion Alternatives Evaluation Report. The assessment included an evaluation of alignment options based on environment, society and feasibility. Alignment options were evaluated during the SDE Process. The draft Baker Creek Diversion Alternatives Report and recommended alignment was presented to the Giant Mine Working Group in June 2017, which included GMOB. The report was also presented for input to the YKDFN GMAC in October 2017. Affected parties were supportive of the report's recommended outcome and alignment route. GMOB provided a letter noting "In our opinion the Report effectively demonstrates that an off-site diversion of Baker Creek is undesirable from a number of perspectives....Overall , GMOB is comfortable with the results of the evaluation and the conclusion that an on-site alignment of Baker Creek is preferable."Actions taken as part of the Baker Creek design to address a) include:providing Baker Creek with geomorphic channel including floodplain conveyance; designing closure channel and floodplain conveyance for floods up to and including the Probable Maximim Flood (PMF), sealing underground mine openings to surface to mitigate potential for inundation and uncontrolled flow to the underground mine during extreme events and placing pit fills in a manner to provide additional flood protection;Actions taken as part of the Baker Creek design to further address b) include: removing tailings, where present from Baker Creek and removing fine sediments, where present, from Baker Creek.

#	Measure	Status	GMRP Comments on Status
	approvals to implement the diversion within five years of receiving its water license.		
12	To prevent significant adverse impacts on Great Slave Lake from contaminated surface waters in the existing or former channel of Baker Creek, should it be re-routed to avoid the mine site, the Developer will ensure that water quality at the outlet of Baker Creek channel will meet SSWQO based on the CCME *Guidance on the Site-Specific Application of Water Quality Guidelines in Canada.*	Complete	Water quality objectives (WQOs) specific to and protective of Yellowknife Bay were developed based on CCME Guidance and are presented in the EQC report. Extensive modelling including a site model in GoldSim, a near field model of the mixing zone (CORMIX) and a 3D Model of Yellowknife Bay (GEMSS) were developed to support the development of EQC and demonstrate the Project's ability to meet WQOs. Modelling documentation is included in the EQC report along with prediction of future water quality in Yellowknife Bay. The Water Quality Objectives will be met upon completion of the GMRP active remediation phase and will be met in the vicinity of the outlet of Baker Creek (see Measure 13), at the edge of a 200 m mixing zone (see Measure 15) that includes the Project's new WTP outfall and the influence of Baker Creek.
13	The Developer will design and, with the applicable regulators, manage the Project to ensure that, with respect to arsenic and any other contaminants of potential concern, the following water quality objectives are achieved in the vicinity of the outlet of the existing or former channel of Baker Creek, should it be re-routed to avoid the mine, excluding Reach 0: a) Water quality changes due to discharge from the former channel of Baker Creek will not reduce benthic invertebrate and plankton abundance or diversity; b) Water quality changes due to discharge from the former channel of Baker Creek will not harm fish health, abundance or diversity; c) Water quality changes due to discharge from the former channel of Baker Creek will not adversely affect areas used as drinking water sources, d) Water quality changes due to discharge from the former channel of Baker Creek will not adversely affect any traditional or recreational users; and, e) There is no increase in arsenic levels in Great Slave Lake due to discharge from the former channel of Baker Creek beyond the parameters described in Measure 12.	Complete	Measure 13 a) through d) are satisfied by selecting Water Quality Objectives for Yellowknife Bay that are protective of aquatic life and drinking water. Arsenic concentrations in Great Slave Lake, beyond the edge of the mixing zone (200 m from breakwater), will not increase from present-day concentrations as demonstrated in the EQC report and supporting documentation (see Measure 12).

#	Measure	Status	GMRP Comments on Status
14	The Developer will add an ion exchange process to its proposed water treatment process to produce WTP effluent that at least meets Health Canada drinking water standards (containing no more than 10µg/L of arsenic), to be released using a near shore outfall immediately offshore of the Giant mine site instead of through the proposed diffuser. The Developer will achieve this concentration without adding lake water to dilute effluent in the treatment plant.	Complete	The new WTP will include ion-exchange technology as part of the treatment process and will discharge effluent meeting the criteria of 10 ug/L of Arsenic. The outfall location was identified through stakeholder engagement and options analysis and will be located nearshore of the Giant site in the vicinity of Baker Creek. No diffuser is proposed.
15	The Developer and regulators will design and manage the Project so that, with respect to arsenic and any other contaminants of potential concern: 1. Water quality at the outfall will meet the Health Canada Guidelines for Canadian Drinking Water Quality; and, 2. The following water quality objectives in the receiving environment are met: a) Water quality changes due to effluent discharge will not reduce benthic invertebrate and plankton abundance or diversity at 200 metres from the outfall; b) Water quality changes due to effluent discharge will not harm fish health, abundance or diversity; c) Water quality changes due to effluent discharge will not adversely affect areas used as drinking water sources; and, d) There is no increase in arsenic levels in Yellowknife Bay water at 200 metres from the outfall: and, e) There is no increase in arsenic levels in Yellowknife Bay sediments at 500 metres from the outfall	Complete	All parameters of potential concern (POPC) will meet relevant Canadian Drinking Water Guidelines (DWG) at the edge of the mixing zone. Water Quality Objectives specific to Yellowknife Bay have been developed to be protective of aquatic life and drinking water and all WQOs will be met at the edge of the mixing zone. Arsenic concentrations in Great Slave Lake, beyond the edge of the mixing zone will not increase from present-day concentrations due to effluent discharge. See Measure 12 for more details on WQOs and supporting evidence.
16	Before construction, the Developer will model re-suspension of arsenic from sediments and resulting bioavailability in the vicinity of the outfall. If the modeling results indicate that the outfall may resuspend arsenic from sediments, the Developer will modify the outfall design until operation does not cause resuspension of arsenic from sediment.	Underway	GMRP is taking a more protective approach and mitigating the potential of sediment resuspension through design of a sediment cover, rather than modelling.
17	Before operating the outfall, the Developer will design	Underway	An AEMP Design Plan for Baker Creek and a Conceptual AEMP

#	Measure	Status	GMRP Comments on Status
	and implement a comprehensive aquatic effects monitoring program that is sufficient to determine if the water quality objectives listed in Measure 15 are being met. This program will: 1. at a minimum, be able to identify any accumulation of arsenic over time in the water, sediment or fish in the receiving environment; 2. include appropriate monitoring locations near N'dilo, in Back Bay and in Yellowknife Bay, with a focus on areas in the vicinity of the outfall and areas used by people; 3. include the establishment of a baseline for aquatic effects in Back Bay before beginning Project construction and installation of the outfall; 4. be developed according to AANDC *Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories, June 2009*, with corresponding action levels and management response framework.		Design Plan for Yellowknife Bay have been developed in concordance with applicable guidelines.
18	Prior to preparing chambers and stopes for freezing, the Developer will conduct a comprehensive QRA evaluating both wet and dry methods for the initial freezing design, with respect to current risks and implications for future removal. This will include an evaluation of potential effects of the proposed freezing and wetting method on the thawing or frozen excavations, and potential impacts of ongoing design changes prior to implementing the Project. The Developer will release a plain language report to the public describing its considerations and the resulting design.	Underway	The Freeze Design basis report was finalized in 2016 and included an evaluation of wet vs dry, resulting in the selection of the dry method. A Plain Language Summary has been drafted and will be released to the public in 2019-20.
19	Considering the results of the risk assessment described in Measure 18, the Developer will not adopt any method of freezing that significantly reduces opportunities for future arsenic removal or other remediation by future technologies.	Complete	The Freeze Design Basis Report was finalized in 2016 and included an evaluation of wet vs dry. The Project is proceeding with the dry method, which combined with a passive freezing approach will allow for reversibility if needed. Closure Objective F2 and associated closure criteria address reversibility in the CRP.
20	The Developer will conduct all major demolition and construction activities with the potential to release large amounts of dust or contaminants into the air	Future Action Required	The Dust Management and Monitoring Plan defines wind levels for carrying out site activities as well as requirements for timing of activities including demolition to be carried out during times of forecasted low

#	Measure	Status	GMRP Comments on Status
	when wind directions will minimize the chances of dust and contaminants blowing into the City of Yellowknife, Dettah and N'dilo.		winds and in a direction to minimize potential impacts to local communities. As well, the site wide Air Quality Monitoring Plan (AQMP) is an existing and ongoing program that was designed to adapt to changing activities on site, and will incorporate all suitable measures and activities to mitigate the risks of exposure to contaminated dust throughout the life of the project.
21	The Developer will collect dust and contaminant level data from soil and vegetation in the vicinity of major reclamation activities before and after major demolition or construction activities to serve as a baseline for any related adaptive management activities that may follow.	Future Action Required	As was conducted during the Roaster Complex deconstruction, air quality monitoring (including activity-specific) as per the AQMP will be conducted for all major reclamation activities (both before and after) with adaptive mitigative measures applied as required. Activity specific monitoring such as dust and contaminant level data from soil and vegetation in the vicinity of major reclamation activities will be identified in the specific construction plans.
22	The Developer will conduct a study to determine appropriate depth of the tailings cap and B1 pit cover, in consultation with Environment Canada and responsible regulators, to verify that the depth proposed will ensure the tailings cap and B1 pit cover are not compromised by vegetation growth. The Developer will provide a report of this study to the MVLWB before it issues a water license for the Project.	Underway	During SDE some affected parties preferred the selection of a non-vegetated tailings cover. The selection of a rock cover as outlined in the CRP addresses the concern of the cover being compromised by vegetation growth. As a result of input received during engagement and the selection of a rock cover, this measure has been addressed.
23	The Developer will work cooperatively with responsible regulatory authorities and interested Parties in the development and submission of a Tailings Management and Monitoring Plan prior to receiving regulatory approvals. This plan will not only identify potential issues for the management of tailings but will also identify mitigation measures to prevent problems related to the tailings cap failure, and will include consideration of the B1 pit cover as applicable.	Complete	A Tailings Management and Monitoring Plan has been developed.
24	The Developer will physically prevent all-terrain vehicle access to the tailings cap and B1 pit cover to prevent the surface from being eroded or otherwise compromised. The Developer will monitor the effectiveness of this prevention, and will take any additional management measures as necessary to prevent all-terrain vehicle access.	Future Action Required	The selection of a coarse rock cover will prevent the surface from being eroded or comprised through ATV access. Closure objective T6 addresses this in the CRP.

#	Measure	Status	GMRP Comments on Status
25	The Developer will work cooperatively with responsible regulatory authorities and interested Parties in the development and submission of an Air Quality Management Plan which incorporates an ongoing air quality monitoring program. This ongoing monitoring program will include all previously identified on-site air quality monitoring stations and one off-site air quality monitoring station near Niven Lake. At a minimum, ambient concentrations of NO2 and PM2.5 will be monitored at the Niven lake site. Total suspended particulate and metal concentrations will be monitoring at the on-site locations. This AQMP will identify action levels and trigger additional management and mitigation activities, if required.	Underway	The AQMP comprises eight site perimeter stations and three community stations. The parameters NO2 and PM2.5 are included at the community stations, including Niven. The AQMP, in conjunction with the Dust Management and Monitoring Plan, identifies action levels which trigger additional management and mitigation measures as required.
26	In conjunction with Measure 10 above, the Developer will consider the results of the comprehensive human health risk assessment, and consult with the YKDFN and City of Yellowknife when determining suitable end uses of the site, to ensure that those proposed uses do not pose a health risk to people, including toddlers.	Underway	The HHERA was completed in 2018 and results were presented to the YKDFN, the City of Yellowknife and other affected parties. The constraints to end land use are presented in the CRP. The Engagement Plan outlines the extensive number of engagement activities that have taken place on the HHERA and the CRP. The Project Team will continue to work with its municipal, territorial and federal counterparts to communicate site risks and end land use constraints.

Table 17: Giant Mine EA Suggestions Tracking Table (as of February 2019)

#	Suggestion	Status	GMRP Comments on Status
1	The Developer should consult with surrounding communities, including Dettah, Ndilǫ and the City of Yellowknife, prior to finalizing its Project design, so that design improvements may be incorporated to address any remaining concerns.	Underway	The extensive engagement completed since the EA is documented in the CRP, Engagement Plan and the Engagement Log. This includes the SDE process and regular ongoing engagement through the Giant Mine Working Group, the YKDFN GMAC and other engagement venues.
2	The Developer should create a monument as a memorial to the impacts of past contamination from Giant Mine on Indigenous communities and the environment.	Underway	The Project has committed to a monument as this was widely supported by affected parties during SDE, however the details of exactly what and where the monument would go were not discussed during SDE. The Project will engage on this with affected parties prior to finalizing the details of the monument and communicate this decision to the public.

#	Suggestion	Status	GMRP Comments on Status
3	To encourage widespread learning from and remembering of the experiences of the Giant Mine, the Developer, in conjunction with the GNWT Department of Education, Culture and Employment, should: 1. develop an education resource unit on the impacts of Giant Mine on the land and on people, including impacts on Indigenous peoples, and 2. distribute this resource unit for use within the school curriculum across Canada.	Underway	GMRP is working with the YKDFN to provide the GNWT Education, Culture and Employment with materials (Grade 10 Northern Studies) to be included in student-led inquiry exercises.
4	The Federal Contaminated Sites Action Program should develop a policy framework and guidance for the perpetual care and management of remediated contaminated sites.	Underway	A Perpetual Care Plan is a requirement under the Environmental Agreement. Under the Agreement, a draft will be available by June 2020. The Project will begin engagement in 2019-20.
5	To ensure long-term funding throughout the life of the Project, the Developer should create an independently managed self-sustaining trust fund with multi-year up-front funding for the ongoing maintenance of this Project and for contingencies. A third-party expert should independently manage this trust fund. Annual reports on the condition of the fund should be provided to stakeholders and the public.	Outside of the Project scope	This suggestion is linked to the outcome of Measure 6. A final report as required under Measure 6 will be completed in 2019/20. A response to this suggestion is outside the mandate of the GMRP, however the Project Team will ensure the report is provided to the relevant department(s) in the Government of Canada and continue to work with our counterparts in the federal system to ensure long-term funding is in place throughout the life of the Project.
6	To reduce public concern about the multiple roles of AANDC in this Project and to increase public confidence, AANDC should produce guidelines to clarify reporting structures to ensure that Project inspectors, advisors and managers employed by the federal government can perform their duties objectively and without undue pressure from within the federal government. These should be made available to the public within six months of Ministerial acceptance of this Report of Environmental Assessment.	Outside of the Project scope	A response to this suggestion is outside the mandate of the GMRP, however the existing Treasury Board Values and Ethics Code for the Public Sector is available to the public at http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=25049
7	Based on the results of the health risk assessment described in Measure 10, the appropriate government authorities should remediate garden and playground soils where arsenic concentrations exceed current guidelines for urban soils in Canada.	Outside of the Project scope	The remediation of garden and playground soils is out of scope of the GMRP. The Project continues to cooperate with relevant federal and territorial agencies to share information.
8	The Developer should consider the Trail Human and Environmental Health Committee as a model for the development of the health program.	Complete	The Health Effects Monitoring Program has incorporated lessons learned and similar concepts from that of the Trail BC Monitoring Program.

#	Suggestion	Status	GMRP Comments on Status
9	During its review of the diversion of Baker Creek, the Department of Fisheries and Oceans should consider the habitat loss of the existing Baker Creek and decide on any habitat design requirements for the diversion to the extent it deems appropriate. Any resulting habitat compensation requirements should be applied on the new diversion.	Future Action Required	The GMRP is working with the Department of Fisheries with respect to habitat loss and compensation. Discussions have occurred in 2018 and will continue in 2019. The GMRP, is committed to engage with the Working Group, GMAC, and the affected parties to determine the appropriate habitat design requirements are incorporated into the final design of Baker Creek.
10	The Developer should investigate the potential advantages and disadvantages of adding an engineered wetland to the Project to reduce arsenic in surface drainage. This investigation should include possible locations in the channel that formerly contained Baker Creek and in the Baker Creek diversion. On completion, the Developer should make a public report of the results of this investigation and of any resulting changes to Project design. This should be completed before a water license is issued for the Project.	Future Action Required	A Research and Reclamation Plan entitled Passive and Semi Passive Treatment systems is an Appendix to the CRP. This plan outlines research undertaken to date on engineered wetlands and the proposed further steps to investigate the feasibility and potential effectiveness of applying passive and semi-passive treatment systems (PTSs) on the Giant site.
11	To manage the risks of airborne exposure of contaminated dust from deconstruction of buildings or other structures on site, the Developer should: • prepare a dispersion model of dust plume given typical wind direction and speed • define the meteorological window of opportunity to describe acceptable wind conditions to eliminate the potential for a dust cloud release and transport of surrounding communities. • consult a meteorologist to develop a sound model of weather conditions, to indicate when winds are steady and not gusting, blowing to the north • stop if winds change or any dust controlling equipment fails	Underway	The Air Quality Monitoring Plan (AQMP) is an existing and ongoing program that was designed to adapt to changing activities on site, and will incorporate all suitable measures and activities to mitigate the risks of exposure to contaminated dust throughout the life of the project. Activity-specific monitoring and mitigations measures will be a part of specific Construction Plans, including deconstruction of buildings.
12	To prevent impacts on people from potentially harmful contaminant releases from deconstruction of buildings or other structures on site at the Giant Mine site, the Land and Water Board should specify allowable wind directions and wind speeds in degrees, to ensure that contaminated structures are not demolished during blustery multi-directional winds at ground level.	Outside the Project Scope	The Air Quality Monitoring Plan (AQMP) is an existing and ongoing program that was designed to adapt to changing activities on site, and will incorporate all suitable measures and activities to mitigate the risks of exposure to contaminated dust throughout the life of the project. Activity-specific monitoring and mitigations measures will be a part of specific Construction Plans, including deconstruction of buildings.
13	The Developer should investigate options for filling in the pits, in consultation with the City of Yellowknife and YKDFN.	Complete	The option to fill pits was investigated and outlined in the Open Pits Options Assessment Report. Pit filling options were evaluated and engaged on during the SDE, where there was support from most affected parties to fill pits. As outlined in the CRP, the pits will be filled or partially filled.

#	Suggestion	Status	GMRP Comments on Status
14	The Developer should consider the baseline conditions for existing fish habitat in Back Bay (including a fish habitat assessment in the area of the foreshore tailings and the aquatic effects baseline required in Measure 17) and develop a foreshore tailings cover design and foreshore tailings monitoring and mitigation plan for review by the Department of Fisheries and Oceans pursuant to habitat provisions of the *Fisheries Act*.	Future Action Required	Fish Habitat surveys of the foreshore tailing areas, the near shore contaminated sediments and the outfall area in Yellowknife Bay began in 2018 and will continue in 2019/20. This work will inform and be presented in the Project's application for DFO Authorization. A conceptual level AEMP for Yellowknife Bay has been developed.
15	The Developer should consult with the City of Yellowknife in the design of any landfill on the Giant Mine site.	Future Action Required	Engagement sessions occurred with the City of Yellowknife through the Giant Mine Working Group to present the proposed locations and other details of the on-site landfill, resulting in support of the proposed location in the CRP. Future design details will be made available for review by affected parties through construction plans.
16	The Developer should consult with Indigenous groups with respect to reduced traditional use cumulatively resulting from the proposed Project in combination with contamination from Giant Mine. This should occur prior to finalizing Project design, so that design improvements may be used to address any remaining concerns.	Underway	The extensive engagement completed by the project is documented in the CRP, Engagement Plan and Engagement Log. A Traditional Knowledge Study is underway with both NSMA and YKDFN and the outcomes of that work will further inform future versions of Management Plans Design and Construction Plans as required.

APPENDIX C – PLAIN LANGUAGE SUMMARY

7.1 Introduction to the Giant Mine Remediation Project

The Giant Mine is a former gold mine located within the City of Yellowknife, Northwest Territories (NWT), about 5 km north of the city centre. The site lies within the asserted traditional territory of Indigenous communities: the Akaitcho Territory Dene First Nations, the extended Monfwi (Môwhì Gogha Dè Nîîtåèè) and the Northwest Territory Métis Nation. The Giant Mine was in operation from 1948 to 2004 and left behind large amounts of contaminants including arsenic trioxide dust.

The Giant Mine Remediation Project (GMRP or the Project) is jointly managed by the Government of the Northwest Territories and the Government of Canada. Together, these two governments manage the site to protect human health and the environment while they plan how they will clean up the site.

The Giant Mine operated from 1948 to 2004. When the owners went bankrupt, Canada became responsible for the site and the contamination left behind. This includes approximately 16 million tonnes of tailings and 237,000 tonnes of arsenic trioxide waste.

7.2 About the Annual Report

The Project team is committed to keeping interested parties informed about Project progress, activities, and plans. The team engages and shares information throughout the year in several ways. One way is through submitting an Annual Report to the Giant Mine Oversight Board.

The report describes what has happened on the site and the activities in support of planning the clean up that took place over one federal fiscal year. A fiscal year is the budget year of the federal government, which is from April 1 to March 31.

In the annual report, the team provides a detailed explanation of activities, important findings, and future plans so interested parties can keep track of the Project's progress.

The Project team needs to prepare an annual report as part of the terms of the Giant Mine Remediation Project Environmental Agreement. The Agreement also guides what information the Project must include in the report. The Giant Mine Oversight Board then reviews the report each year and provides comments to the Project team. This process will continue to shape the report's format and content going forward.

This document is a plain language version of the full annual report, which provides additional details about progress in 2018-19. The 2018-19 Annual Report is the fourth for the Giant Mine Remediation Project. It covers the period of time from April 1, 2018 to March 31, 2019. Activities and updates related to the Project after March 31 will be covered in the next year's report.

7.3 Planning the Remediation of Giant Mine & Project Status

In 2007, the Giant Mine Remediation Project team submitted a Water Licence application to the Mackenzie Valley Land and Water Board. The application included a remediation plan that addressed all aspects of the underground and surface clean-up of the mine. The City of Yellowknife referred this plan to Environmental Assessment. The assessment process was completed in 2014. It included a Report of Environment Assessment with 26 measures the Project team must complete. The measures included developing a new clean-up plan, called a Closure and Reclamation Plan .

The Closure and Reclamation Plan is the result of extensive engagement and design work done by the Project team since the Report of Environmental Assessment. In 2017-18, the Project team discussed the

draft CRP with the Giant Mine Working Group and the Giant Mine Advisory Committee. High-level concepts of the plan were also presented to the public at the Annual Public Forum in March 2018. The Project team incorporated input from those engagement sessions and completed the plan.

In April 2019, the Project Team submitted the new plan and supporting documents to the Mackenzie Valley Land and Water Board. These documents form the Project's Water Licence application and Land Use Permit application to the Board. More information on the Closure and Reclamation Plan and regulatory applications will be part of the 2019-20 Annual Report.

7.4 Key Engagement

Engagement is an important and valued part of the Giant Mine remediation process. In 2018-19, the Project team continued its regular engagement with key affected parties through avenues such as:

- the Giant Mine Oversight Board;
- the Giant Mine Advisory Committee;
- the Giant Mine Working Group; and,
- the annual forums.

Specific engagement sessions were also held to focus on:

- the Archaeological Impacts Assessment;
- the Health Effects Monitoring Program;
- the Stress Study;
- the Quantitative Risk Assessment;
- industry preparedness (Industry Day);
- the Water Licence application; and,
- the Closure and Reclamation Plan.

The Project team also undertook significant engagement to complete the Traditional Knowledge study. This study was completed by the Yellowknives Dene First Nation in 2019. It documents the Yellowknives Dene First Nation's: knowledge; values; priorities; concerns; perceptions of risk; and, understandings of impacts to past and current land use.

In 2019-20, engagement will continue. This engagement will focus on:

- the Qualitative Risk Assessment;
- Socio-Economic Strategy implementation;
- the Stress Study;
- Baker Creek design; and,
- borrow sources.

7.5 Progress on Environmental Assessment Measures

Since the Report of Environmental Assessment in 2014, the Project has completed and advanced many Environmental Assessment measures. The Project team's immediate focus are the measures with set timelines and those with the biggest impact on the scope of the project.

In 2018-19, the Project completed baseline sample analysis for the Health Effects Monitoring Program and initiated the Stress Study. The draft report on Long Term Funding Options has also been revised. It will be finalized in 2019-20.

In addition, the Project continued or began working on several measures that are included in the Project's Water Licence application. Progress in 2018-19 included:

- developing Site-Specific Water Quality Objectives, which are presented in the Effluent Quality Criteria Report;
- completing a pilot testing program for treating water;
- completing the designs for the Aquatic Effects Monitoring Program in Baker Creek and Yellowknife Bay;
- developing a plain language summary of the Freeze Design Options report (report finalized in 2016-17);
- completing the Tailings Management and Monitoring Plan; and,
- ongoing engagement and identification of risk scenarios for the Quantitative Risk Assessment.

Further details are provided on each of these elements below.

7.5.1 Health Effects Monitoring Program and Stress Study

The Health Effects Monitoring Program will establish current (baseline) levels of arsenic and other contaminants of concern in people's bodies. This means it had to take place before the cleanup starts. During remediation, the participants will provide samples again. New results will be compared to the baseline results. This will make sure the remediation activities do not negatively impact people's health.

Laurie Chan of the University of Ottawa lead the design and is leading how the program is carried out. In 2018-19, the monitoring program established residents' current levels of exposure to arsenic and other contaminants to compare levels during remediation has begun. Baseline sample collection was completed in 2018. Samples of toenails, urine, and saliva were collected. Participants were also given a lifestyle questionnaire that will help Dr. Chan's team learn more about the exposure levels. In total, 2037 residents of Yellowknife, Ndilǫ, and Dettah participated. In 2019, participants were given their individual results. As well, a progress report summarizing primary group findings was prepared. The Program Team will present the group results to the public in 2019. Follow-up sampling will occur in five or ten (10) years, depending on the age of participants.

The scope of the stress study is still under development. However, it will:

- evaluate indirect effects on health from stress related to the possibility of arsenic exposure; and,
- include engagement with affected community members.

Participants in the engagement will help develop a survey to measure and analyze stress effects. Wilfrid Laurier University's Dr. Ketan Shankardass is leading this study.

7.5.2 Long-Term Funding Options

The Environmental Assessment included a measure for the Project to look at long-term funding options for costs of ongoing maintenance and contingencies for the site. A draft report reviewing different options was provided to a sub-committee of the Giant Mine Working Group for review in July 2017. The Project then hired a consultant to further develop the report with input gathered from the subcommittee. The final report will be released in the summer of 2019.

7.5.3 Site-Specific Water Quality Objectives

Measures 12 and 15 direct the Project team to determine specific water quality objectives to meet in Yellowknife Bay after remediation. The Project team developed these objectives, setting levels that will protect aquatic life and drinking water. These objectives are presented in the Effluent Quality Criteria report, finalized in January 2019.

7.5.4 Water Treatment Plant

Environmental Agreement Measure 14 directs the Project to build a new water treatment plant. This new treatment plant needs to be able to operate all year and to treat water to drinking water standards for arsenic. The new plant will replace the current effluent treatment plant on site. The current plant only operates seasonally. To plan for building the new plant, in summer 2018, the Project conducted a pilot testing program. The pilot program determined how water can be successfully treated to meet the requirements for the new plant during remediation.

7.5.5 Aquatic Effects Monitoring Program

Aquatic Effects Monitoring Programs are being developed to meet Measure 17. These programs will monitor and reduce effects to aquatic life downstream of where treated water is discharged. The first Aquatic Effects Monitoring Program will take place from 2019 to 2026 in Baker Creek, while effluent is still being discharged from the current treatment plant. The Project completed a draft monitoring plan for after 2026, once water is discharged from the new water treatment plant.

7.5.6 Freeze Design

Measure 18 directs the Project team to study the different risks for both wet and dry methods of freezing the arsenic trioxide in the underground chambers and stopes. The Project compared the two methods for freezing in an independent study. The study found the dry method works as well as the wet method. Both were able to reach the target freeze temperature that will keep arsenic trioxide enclosed in frozen rock, preventing contact with any water flowing through the mine. In addition, if future technologies can address the arsenic trioxide dust, a dry freeze is easier to reverse. A Freeze Plain Language Report was drafted in 2017-18 but it needed more work throughout 2018-19. The final report will be shared in 2019-20.

7.5.7 Tailings Management and Monitoring Plan

The Tailing Management and Monitoring Plan was developed in 2018-19 to address Measure 23. The Plan describes which closure methods the Project will use to manage tailings (the ore leftover after the gold was removed) in Tailings Containment Areas and how it will monitor the areas to make sure they are working as designed after remediation. The Tailings Management and Monitoring Plan was completed in 2019. It is part of the full Water Licence Package.

7.5.8 Quantitative Risk Assessment (QRA)

The Quantitative Risk Assessment was initiated in 2018 in consultation with potentially affected communities. The Quantitative Risk Assessment RA engagement process involved the Giant Mine Remediation Project Working Group, the North Slave Metis Alliance, the Yellowknives Dene First Nation, the Yellowknives Dene First Nation Giant Mine Advisory Committee, and other groups. In 2018-2019 the QRA Team met with the GMRP WG to introduce the QRA and validate the engagement approach and held two (2) two-day workshops with affected parties to identify and discuss risk scenarios and consequence categories. Additional engagement sessions focused on the consequences of risk scenarios and the risk acceptability thresholds to ultimately complete a quantitative assessment of the identified failure scenarios.

7.6 Ongoing Site Management

While the Project plans the long-term cleanup of the Giant Mine, it also undertakes activities to keep the site safe and stable. These efforts include:

- maintaining the site;
- treating water;

- managing risks;
- conducting repairs;
- monitoring the environment;
- suppressing dust; and,
- planning for emergencies.

The following highlights some of the key activities in 2018-19.

7.6.1 Care and Maintenance

Ongoing care and maintenance at Giant Mine is important to make sure current risks at the site are managed to prevent harm to staff, surrounding communities, and the environment. In 2018-19, the Project continued care and maintenance activities to keep the site stable and safe until remediation can begin. These activities included:

- preparing for the spring freshet;
- operating the Effluent Treatment Plant;
- conducting ongoing monitoring and sampling of water and effluent;
- reducing dust from roads and tailings;
- maintaining site infrastructure and roads;
- maintaining the underground travel ways (including underground repairs to existing chutes and head covers to reduce hazards to workers);
- providing full time on-site emergency medical services;
- providing site security at all times (including constructing temporary security fencing and installing signs on several areas identified as security risks); and,
- conducting weekly inspections of the Material Storage Area.

7.6.2 UBC Bridge Repair

The UBC Bridge is a bridge over Baker Creek. It was built in 2007 to support care and maintenance activities. In 2015, a contractor noticed the bridge abutments had shifted and rotated, putting the structure at risk. The bridge was then closed so it could be assessed, and the Project determined the bridge needed to be repaired. A new design was developed in 2017-18. Construction began in March 2018. In spring 2018, the UBC Bridge was successfully repaired and re-opened to vehicles.

7.6.3 Site Stabilization

Since 2013, the Project has been working to keep the site stable. This includes work to make the underground more stable. The work that could not wait until remediation was captured in a Site Stabilization Plan. The Plan identified several hollowed-out areas created during mining operations that needed to be backfill so they did not collapse. At the start of 2017-18, all but one of these high-risk areas had been filled. The outstanding area, called stope complex C5-09, was done last because its size, shape, and location made it the most challenging to stabilize. Work to address it began in May 2018, when the Project drilled holes to deliver the paste backfill. Once holes were in place, different mixtures of tailings and cement were delivered through the drill holes into the complex. This took place from June to December 2018. A total of 70,000 m^3 of paste and concrete material was needed to complete the work. This final backfill completed the Site Stabilization Plan activities.

7.6.4 Infrastructure Review

Every few years, the Project examines buildings at the site to see if they are putting people on site at risk. If they cannot wait for remediation to be removed because of these risks, the Project team takes action. In July 2018, AECOM examined 19 buildings on site for signs of distress, deformation, or deterioration. No buildings were at risk of immediate structural failure. However, the assessors found 10 buildings at risk of

structural failure within five years. They recommended those buildings be reviewed every two years. All other buildings will be reviewed every four years.

7.6.5 Akaitcho Deep Well Pump Station Upgrade

The Akaitcho Deep Well Pump Station pumps water out of the underground at the Giant Mine. This is done to manage the level of water so it stays well below where the arsenic trioxide is store. After four years of operation, the pump system was working at a slower rate. This could potentially cause risks at the site. In 2017-18, the Project developed a plan to upgrade the Station. In 2018-19, the Project began construction of the gravel pad needed to drill holes and to access the pump. Over the winter months, the Project installed new pumps and an electrical building to power them. The new pumps were turned on in March 2019. The final tasks to complete this activity will take place in 2019-20.

7.6.6 Dam Inspections

Dams are used to manage mine and surface water on the site, and to retain solids from the tailings. Every year, the dams are inspected for safety and to assess water levels. In 2018-19, the Project conducted a visual inspection of all tailings and dams. The team also implemented recommendations from previous annual inspections and monitored the results. Golder Associates Ltd (Golder) completed the June 2018 annual inspection. During the week of the inspection, the Yellowknife-area saw an abnormal amount of rain. Cracks, leaks, erosion, and settlement were observed at the dams. As a result, Golder recommended more maintenance activities.

7.7 Progress on Planning Clean-Up Activities

While managing the site, the Project team continues to plan the long-term clean-up of the Giant Mine. This work includes:

- engaging with stakeholders and interested parties;
- gathering information through various studies;
- doing more design work on different parts of the remediation plan; and,
- developing monitoring programs.

Progress in 2018-19 included:

- An Open Pit Closure Options Analysis, which looked at different options for backfilling the eight open pits at the site.
- An update of options for disposing arsenic waste in Chamber 15, which is currently empty and has been identified as a potential site for arsenic waste;
- A review of current information related to climate change and how the changes in predictions will affect the freeze designs.
- The start of a pilot testing program of a passive treatment system (e.g. engineered wetland) to remove contaminants from water (a passive treatment system does not use power and is easier to maintain than an active treatment system).

7.8 Health and Safety

Health and safety on site are very important to the Project team. The Project keeps track of how many incidents and near misses happen each month. The team then reports this information to the Project Director. There were nine (9) moderate incidents and eleven (11) minor incidents on site in 2018-19. There have been no major incidents on site since 2015, but the number of moderate and minor incidents increased compared to previous years. The number of reported near misses decreased from 179 in 2016-

17, to 99 in 2017-18, and to 74 in 2018-19. Incidents and near misses are discussed at daily safety meetings. This is so workers can review lessons learned, identify root causes, and take corrective measures to prevent future incidents.

The Project also monitors arsenic levels in workers on site. In 2018-19, there were 63 instances when urine samples were above the accepted level, out of 1938 samples taken. This number was higher than previous years (1.8% in 2017-18 and 2.6% in 2016-17). This could be because of the type of work happening on site; that is, the work needed this year meant workers had more exposure to arsenic-impacted materials.

When a worker's urine sample is above the accepted level, the Project take immediate action. This includes taking steps to reduce the worker's exposure, which may mean changing the type of work they do until their levels return to below the accepted level. The Project also investigates the cause of the exposure.

In addition, the Care and Maintenance contractor ensures employees and subcontractors receive relevant health and safety training. This includes first aid, wildlife safety, water safety and fire response, as required by applicable regulations.

7.9 Environment

The Project has an Environmental Management Plan that guides how each major component of the site is managed. The Project is also planning how it will manage and monitor the site during remediation and after it is completed. Currently, the Project has several active monitoring programs in place for key environmental issues. The Project's Long-Term Monitoring Program is a combination of all monitoring components that are currently ongoing or will be required at Giant Mine. This includes environmental components and structural monitoring.

Environmental	Structural
• Surveillance Network Program • Metal and Diamond Mine Effluent Regulations including Environmental Effects Monitoring Program • Operational Monitoring Program (Effluent Treatment Plant, underground, annual site-wide bird survey) • Aquatic Effects Monitoring Program • Wildlife and Wildlife Habitat management and Monitoring Plan • Air quality – fenceline & community • Noise • Cumulative effects	• Freeze • Dams and seeps • Landfill • Pit stability • Tailings covers • Underground Structures • Baker Creek (icing)

The Long-Term Monitoring Program is used to:

- determine baseline conditions;
- monitor current conditions and performance of management programs; and
- inform the design process for remediation activities.

The Project monitors air quality on a regular basis. In 2018-19, the air quality monitoring program was reviewed to make sure it meets Project and stakeholder needs. Results of the review indicated that the air quality where the Project's air emissions are located is similar to regional and local air quality. This review will be updated in 2019-20. The Project also continued its dust suppression activities so residents are not exposed to unacceptable levels of contaminants from the activities occurring at the Giant Mine site.

The Project continues to treat effluent (liquid waste) at the site's Effluent Treatment Plant. The effluent is treated to meet the criteria in the former mine's Water Licence, as well as to criteria that complies with relevant regulations. In 2018, the Project treat 411,934 m^3 of water and 354,618 m^3 of treated effluent was discharged into the environment. Tests showed the treated effluent met requirements before it was discharged.

In 2018-19, other key Project activities to keep people and environment safe included monitoring and managing hazardous and non-hazardous waste, looking at options for how to address contaminated soil and sediment during remediation, and conducting an Archaeological Impact Assessment. As part of the Archaeological Impact Assessment, the team examined many sites around the Project area with participants from the Yellowknives Dene First Nation and the North Slave Metis Alliance. The assessment identified archaeological and traditional use sites located in or beside remediation areas.

Monitoring and reducing impacts on wildlife and aquatic life are other important activities on site. In 2018-19, key activities included completing the annual site-wide bird survey, completing the Baker Creek Aquatic Effects Monitoring Program, and finalizing the Wildlife and Wildlife Habitat Management and Monitoring Plan. This Plan was included with the Water Licence application. Environmental Effects Monitoring was conducted to identify if there are any negative effects on aquatic life caused by the treated effluent. Results were similar to previous years' results with no significant concerns.

7.10 Socio-economic

The Giant Mine Remediation Project works to deliver social and economic benefits to Indigenous and Northern communities while protecting the environment and people's health. On July 1, 2018, Parsons Inc. (Parsons) assumed the role of Main Construction Manager. Parsons is responsible for maintaining the site until remediation activities are completed. Additionally, Parsons uses several tools to help the Project team achieve their socio-economic goals. This includes subcontracting to Indigenous and Northern businesses and incorporating criteria into all tenders that encourage employment, training, and apprenticeships for Indigenous workers.

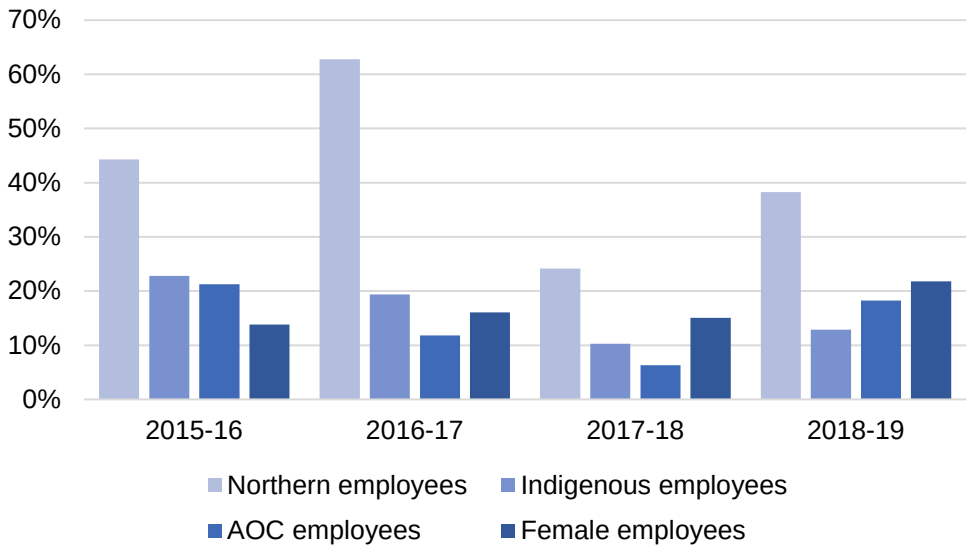
The Project tracks total employment and employment by certain categories. This includes:

- Northern workers;
- Indigenous workers,
- how Aboriginal Opportunities Considerations[15] commitments during procurement are being met; and,
- Female workers.

In terms of hours worked, Indigenous and Aboriginal Opportunities Considerations employment was higher in 2018-19 than in 2017-18, but similar or lower than 2016-17 and 2015-16 results. The proportion of Northern employees also increased in 2018-19 (38%, up from 24% in 2017-2018), but was lower than previous years. Female employment was higher than the previous three years (22% in 2018-2019).

[15] AOC is used by procurement officers to review proposals and evaluate the commitments made by firms, such as the percentage (%) of labour force that is local Indigenous peoples. Incentives and penalties are applied to encourage firms to meet or exceed commitments outlined in their proposal.

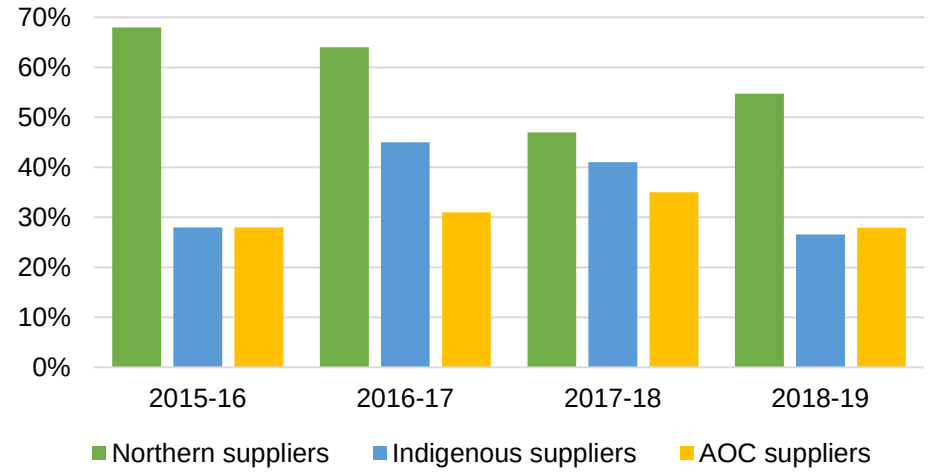
Percentage of Person Hours by Category from 2015-16 to 2018-19



The proportion of expenditures with Northern suppliers was higher in 2018-2019 than in 2017-2918 (55% up from 47%) but was lower than previous years (64% in 2016-2017 and 68% in 2015-2016).

The Project also tracks suppliers by type, specifically Northern, Indigenous and Aboriginal Opportunities Considerations. In 2018-19, the proportion of money spent on contracts increased for Northern suppliers. Of the $63 M spent on suppliers, 55% went to Northern businesses. This percentage increased compared to 2017-2018 (47%) but decreased compared to previous years. The proportion spent with Aboriginal Opportunities Considerations suppliers was lower in 2018-19 than the previous two years (28% in 2018-19 and 35-31% in previous years). Contracts with Indigenous suppliers decreased as a proportion of total spending since last year (from 45% in 2016-17 and 41% in 2017-18 to 27% in 2018-19).

Percent of Total $ Value Spent from 2015-16 to 2018-19



Two new governance bodies began to meet in 2019: a Socio-Economic Working Group and a Socio-Economic Advisory Body. The Socio-economic Working Group, with team members from federal, territorial and municipal governments, shares information and works to advance socio-economic activities for the Project. The Socio-economic Advisory Body provides advice to the Socio-economic Working Group and acts as senior government champions; its members include senior level representatives from federal, territorial, municipal, and Indigenous partner organizations.

In 2016-17, the Project team finalized a Socio-Economic Strategy for the Project. The Strategy's goal is to maximize socio-economic benefits to Indigenous peoples and Northerners in the remediation phase of the Project. The Project will release an updated Strategy to the public in 2019. In 2018-19, the Project team developed a draft set of Key Performance Indicators to monitor the socio-economic impacts of the Project. The team plans to finalize these indicators and develop a set of targets for the Project in 2019-20. The Project will work closely with the Socio-Economic Working Group to set these targets.

In 2018-19, in support of meeting Project socio-economic goals, Parsons opened its Yellowknife office, got its website up and running, and helped plan and organize an Industry Day. Parsons will continue to work on establishing relationships with local Northern and Indigenous businesses, working closely with partners to communicate contracting opportunities.

7.11 In Closing

In 2018-19, the Project made important strides to complete the Closure and Reclamation Plan and submit its Water Licence application. This was done while continuing to keep the site safe and stable to protect human health and safety and the environment, as well as moving continuing to engage with stakeholders and partners on the Project.

The Project will continue to prepare annual reports about its progress and performance, and to develop a plain language summary of its annual reports.

For more information or to provide comments, please contact:

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867-669-2838.

APPENDIX D – PROJECT OVERVIEW

Giant Mine Legacy

The Giant Mine is located close to Yellowknife's city centre (about five kilometres from the north end) and within the asserted traditional territory of the Akaitcho Territory Dene First Nations, within the extended Monfwi (Môwhì Gogha Dè Nîîtåèè) boundary as defined in the Tłı̨chǫ Land Claim and Self Government Agreement, and adjacent to, or on the boundary of, the Interim Measures Agreement Area of the Northwest Territory Métis Nation.

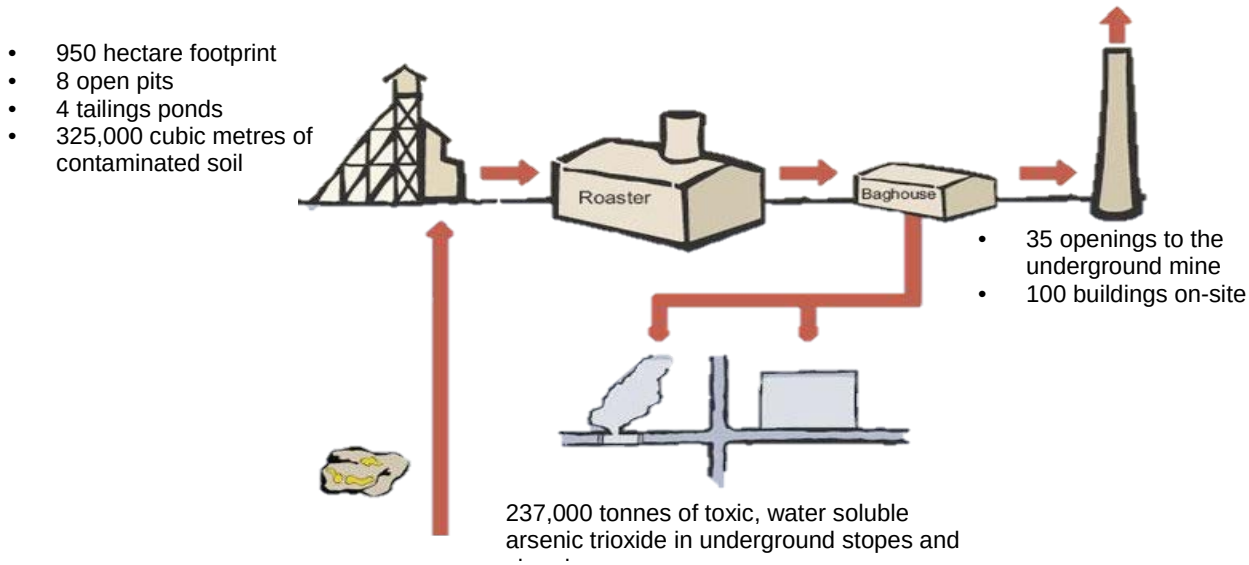
Between 1948 and 2004 when the Giant Mine was operational, it produced over 220,000 kilograms (7 million ounces) of gold. To release the gold, arsenopyrite ore had to be roasted at extremely high temperatures, which also released arsenic rich gas, a highly toxic by-product. During the mine's first several years of operation (1948-1950), arsenic was released directly into the air, resulting in human health impacts, including two deaths, and the contamination of local soil and vegetation. The introduction of pollution control equipment in the 1950s reduced arsenic air emissions dramatically but resulted in the by-product of arsenic trioxide dust (which is approximately 60% arsenic). The collection and storage of this dust has amounted to approximately 237,000 tonnes and is stored on-site in underground stopes[16] and chambers.

Arsenic trioxide dissolves in water and is dangerous to both people and the environment. If left unmanaged, the dust stored at Giant Mine could gradually dissolve and arsenic concentrations in groundwater would increase substantially. The contaminated groundwater would make its way into local water bodies downstream of the site, particularly Great Slave Lake.

In addition to the significant risk posed by the storage of arsenic trioxide waste, there are other legacy concerns at the site. The recovery of gold produced approximately 14 million tonnes of tailings[17] that contain arsenic. During the first few years of operations, tailings (flotation tailings) were discharged uncontrolled into a valley leading to Yellowknife Bay. Commonly referred to as the "historic tailings area", residual tailings are still present at the site. Arsenic-contaminated soils exist across the site, and there are more than 100 buildings on-site, many of which are contaminated with arsenic and asbestos. Eight open pits and 35 openings to the underground mine also represent safety hazards.

[16] Large underground spaces created during the mining process.
[17] Ground rock and process effluents that are generated as a waste slurry in the mining process.

Figure 10: Giant Mine Site



The Remediation of Giant Mine

Background

In 1999, the Government of Canada took over responsibility for Giant Mine after the mine's last owner went bankrupt. After Canada took over responsibility, the biggest concern was the arsenic trioxide dust stored underground. The site became the subject of several studies, workshops, community engagement sessions, and the work of experts to find a solution for the dust. From a possible 56 different management alternatives for dealing with the arsenic trioxide waste, the list was narrowed down to the 12 most viable options. Following this extensive community engagement period, the 12 options were further refined to two options: one which would keep the arsenic trioxide waste in the ground while limiting its movement ("leave in") and another that would involve removing it and storing it above ground ("take it out"). These two options were presented to the public by the GMRP Team at several community meetings and public information workshops. Based on feedback from public workshops, and the recommendations of the Technical Advisor and the Independent Peer Review Panel, the "leave-in" option was selected and the frozen block method[18] of immobilizing the arsenic trioxide was incorporated into the remediation plan for Giant Mine.

In 2007, the GMRP submitted a Water Licence application to the MVLWB for the remediation of the site. While the MVLWB determined that the project should advance directly to the regulatory process, the Yellowknife City Council voted unanimously to refer the project to EA, as the mine is within the boundaries of the City.

[18] An explanation of the frozen block method is available online. For more information, see https://www.aadnc-aandc.gc.ca/eng/1100100027422/1100100027423 and https://www.aadnc-aandc.gc.ca/eng/1100100023281/1100100023292

The EA processes involve very thorough public and technical reviews. For the GMRP, the assessment took seven years to complete and included a Developers Assessment Report[19], the Freeze Optimization Study (FOS), five days of technical sessions, five days of public hearings, more than 400 information requests and hundreds of meetings and discussions with stakeholder groups, the YKDFN , and the public.

On August 14, 2014, the Responsible Ministers issued their Decision of Environmental Assessment, and stipulated 26 legally-binding Measures, many of which must be completed before a Water Licence for the GMRP will be issued, which would allow the GMRP to proceed to remediation. These 26 Measures help focus the GMRP Team's work for the next phase of engagement, design and decision-making. Section 3 includes additional information on the status of each Measure.

Throughout the EA process and until remediation can begin, the GMRP Team monitors the site and ensures it is kept safe and secure through 24-hour-a-day C&M work. This work involves ensuring that the mine remains in compliance with relevant environmental regulations, ensuring site security and public safety, maintaining facilities, suppressing dust, and managing mine water and effluent. The Team also conducts risk mitigation activities and studies related to the remediation program (see Section 4.3 of this report for more detailed information on risk and studies).

Freeze Optimization Study

Since 2011, the Project Team has conducted a FOS to gather information about the freeze option, such as power requirements and rates of freezing. The FOS showed that a passive freezing system (using thermosyphons) can be used to achieve the same results as a fully active system (where a mechanical pump is used to circulate fluid). The FOS also showed that the chambers and stopes will remain safely frozen when cooled to a temperature of minus-five degrees Celsius, and it demonstrated how the efficiency of the design could be improved by freezing multiple stopes as one block. This information is incorporated into the updated remediation plan to freeze the remaining stopes and chambers.

General Freeze Gap Analysis

The Frozen Block Method will safely manage the arsenic trioxide waste at Giant Mine. Safety was the most important factor in choosing the frozen block method to address the arsenic trioxide waste. The safest way to manage the waste is to freeze it where it is, undisturbed, and prevent it from contaminating the underground water.

This involves cooling the surrounding rock to create a frozen block, or a shell. Freezing the arsenic trioxide dust and the surrounding rock will isolate the dust from the environment. Water will not seep in or out of the frozen zones, preventing the release of arsenic.

Freezing the arsenic trioxide in place is the best strategy for managing the arsenic for the long-term to protect people and the environment. Of all the options considered, it offers the fewest risks. Freezing the arsenic has the lowest risk of:

- harming worker and community health and safety;
- releasing arsenic into the environment; and,
- releasing arsenic over the long term.

[19] The Developer's Assessment Report was developed based on the direction provided in the Review Board's Terms of Reference for the Environmental Assessment; the report identifies and assesses any likely adverse environmental effects that might be caused during the implementation of the Remediation Project, the selected mitigation measures and a monitoring framework.

Removing the waste would be unsafe for the workers and for the nearby communities. In addition, it is not possible to get all the waste out of the chambers and stopes, meaning this area would require additional levels of management. Removed waste would also need to be stored, creating another contaminated area.

This decision came after three years (2001-2003) of extensive scientific and technical research, and community consultation. The Project Team considered 56 options for managing the arsenic. Twelve were studied in detail. Finally, the frozen block method was chosen based on:

- scientific evidence;
- community input; and,
- support from the Independent Peer Review Panel

While the EA concluded the frozen block method was the most appropriate technical solution currently available, it also determined that emerging technologies should continue to be investigated. The GMOB is tasked with supporting research into technical approaches that could serve as a permanent solution. More information is available on their website at www.gmob.ca/research-program/.

There are five stopes and 11 chambers on the site that workers will freeze using the Frozen Block Method. Stopes are large, irregular-shaped spaces left underground when the gold-bearing rock was mined out. The chambers were built to contain the arsenic trioxide dust. Chambers have a more uniform, rectangular shape than stopes. Arsenic trioxide dust was pumped into the five stopes and 10 of the chambers. The last chamber will hold arsenic-impacted waste after site remediation. Freezing the arsenic trioxide will occur in stages over a number of years. This will ensure the chambers, stopes and surrounding rock are completely frozen, at minus-five degrees Celsius or lower.

The GMRP Team will achieve the freezing by using a passive system. This system uses tall, metal tubes called thermosyphons. Thermosyphons draw and expel heat from the ground, using pressurized carbon dioxide. When heated below ground, the carbon dioxide rises as a gas. This gas then cools above ground and becomes a liquid, which – because it is heavier – drops back down underground, warms up, and becomes a gas that rises again. Because of this ongoing cycle, thermosyphons do not need an external source of power to keep the ground frozen.

Thermosyphons are commonly used to keep ground frozen. For example, thermosyphons are used in the parking lot of the Legislative Assembly in Yellowknife. There, they prevent the natural permafrost from thawing. Thermosyphons are also used to maintain frozen core dams at the BHP Ekati Diamond Mine.

When the system is in place, the frozen blocks should stay frozen indefinitely. Even without thermosyphons, once frozen, the solid ice block would take more years to melt. Thermosyphons do not need power. Instead, they use the cold air in winter to cool the ground. As a precaution, thermometers will monitor the ground and air temperatures. If the blocks start to thaw, the GMRP would take actions to refreeze the ground either through an active freeze system or additional thermosyphons.

Climate change was also taken into consideration. The technical advisor's calculations show that the system will work even if the region's average temperatures go up several degrees. Sophisticated equipment will monitor the site on an ongoing basis. The GMRP Team will make adjustments to maintain the frozen areas.

Major Phases of the GMRP

The overall approach to the GMRP is divided into four major phases. The first phase was **project assessment**, which included initiating care and maintenance, understanding all of the risks and complexities of the Site and identifying remediation options. This phase began in 1999 and ended in 2006.

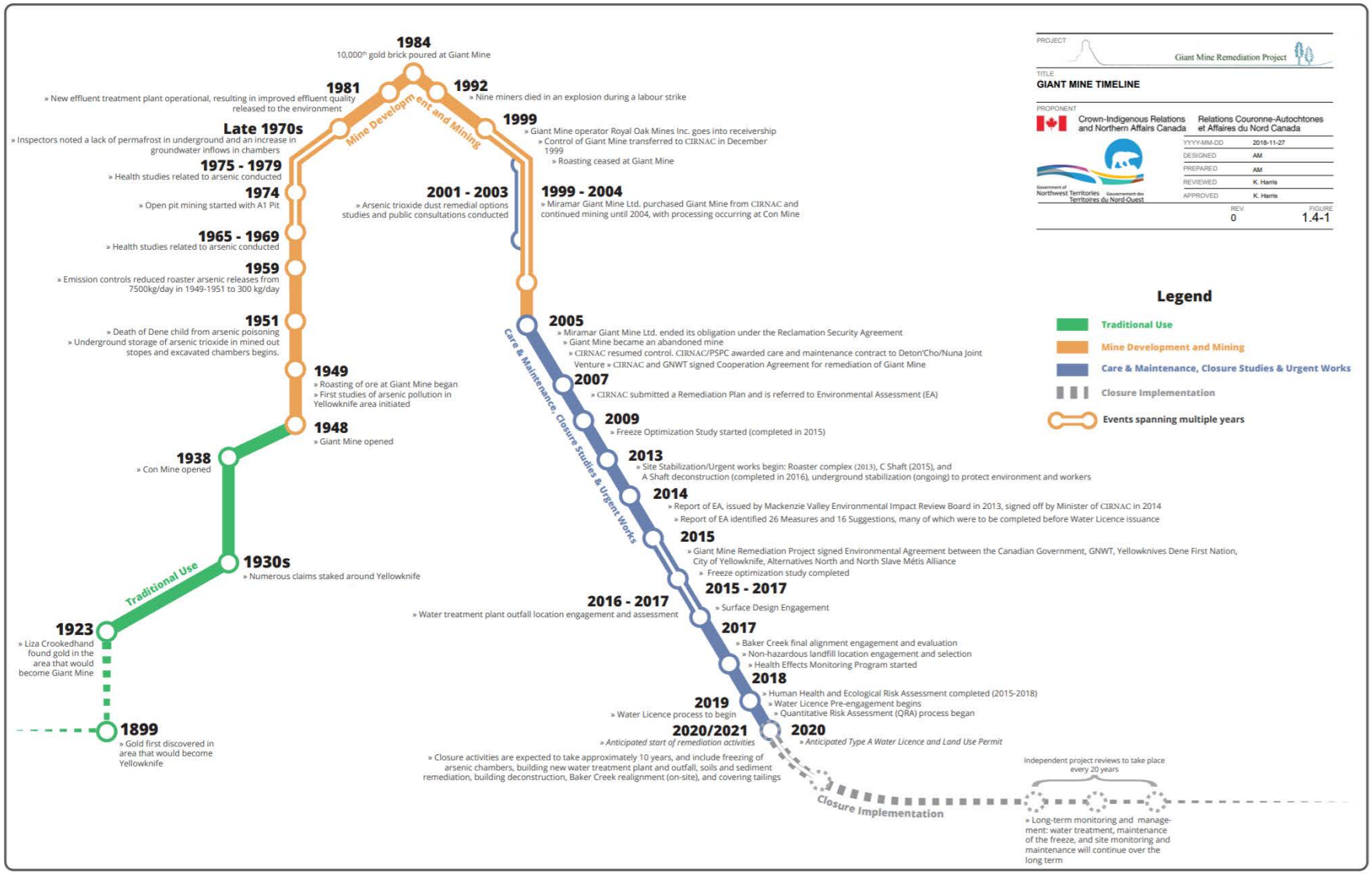
The second and current phase is referred to as **project definition.** As a result of the Measures coming out of the EA, this phase is now projected to last until 2021. It is during this phase that the EA was completed, the detailed remediation plan is being developed and all permits and licences will be obtained. This phase has also involved addressing urgent health and safety risks and several remediation elements that were intended to be completed in the third phase of the project, such as the deconstruction of the Roaster Complex (structures where ore was roasted at high temperatures to extract gold) (see Section 2.3 for more detailed information).

The third major phase is referred to as **project implementation** and is when the majority of the remediation work will be completed. This includes a variety of activities including the containment of approximately 237,000 tonnes of arsenic trioxide dust by freezing 15 underground chambers, capping 95 hectares of tailings, demolishing over 100 mine buildings and infrastructure, as well as constructing and operating a waste water treatment facility to treat arsenic contaminated mine water, to name a few. This phase is currently projected to take place between 2021 and 2030 and represents the majority of activity and costs associated with the remediation project.

The final phase of the project is **monitoring and maintenance**. This is the longest phase as it is projected to begin in 2030 and to last for at least 100 years. This phase has the lowest level of activity but will include elements such as post-remediation adaptation, water treatment, long-term monitoring and infrastructure renewal as required.

Figure 11 showcases the timeline of Giant Mine since 1899.

Figure 11: Giant Mine Timeline

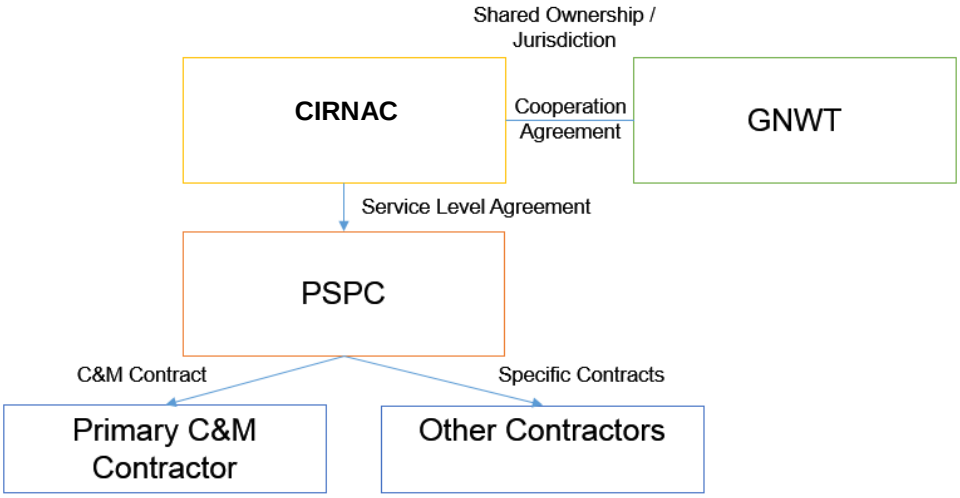


Management of the GMRP

Project Team
CIRNAC and the GNWT share jurisdiction for the site and jointly oversee the remediation through a Cooperation Agreement. CIRNAC currently has care and control of the Site and has retained the support of PSPC for the management of the site through the C&M contractor and management of the implementation of the GMRP.

Figure 12 shows the management structure for the GMRP.

Figure 12: Management Structure for the GMRP



The key members of the GMRP Team are:

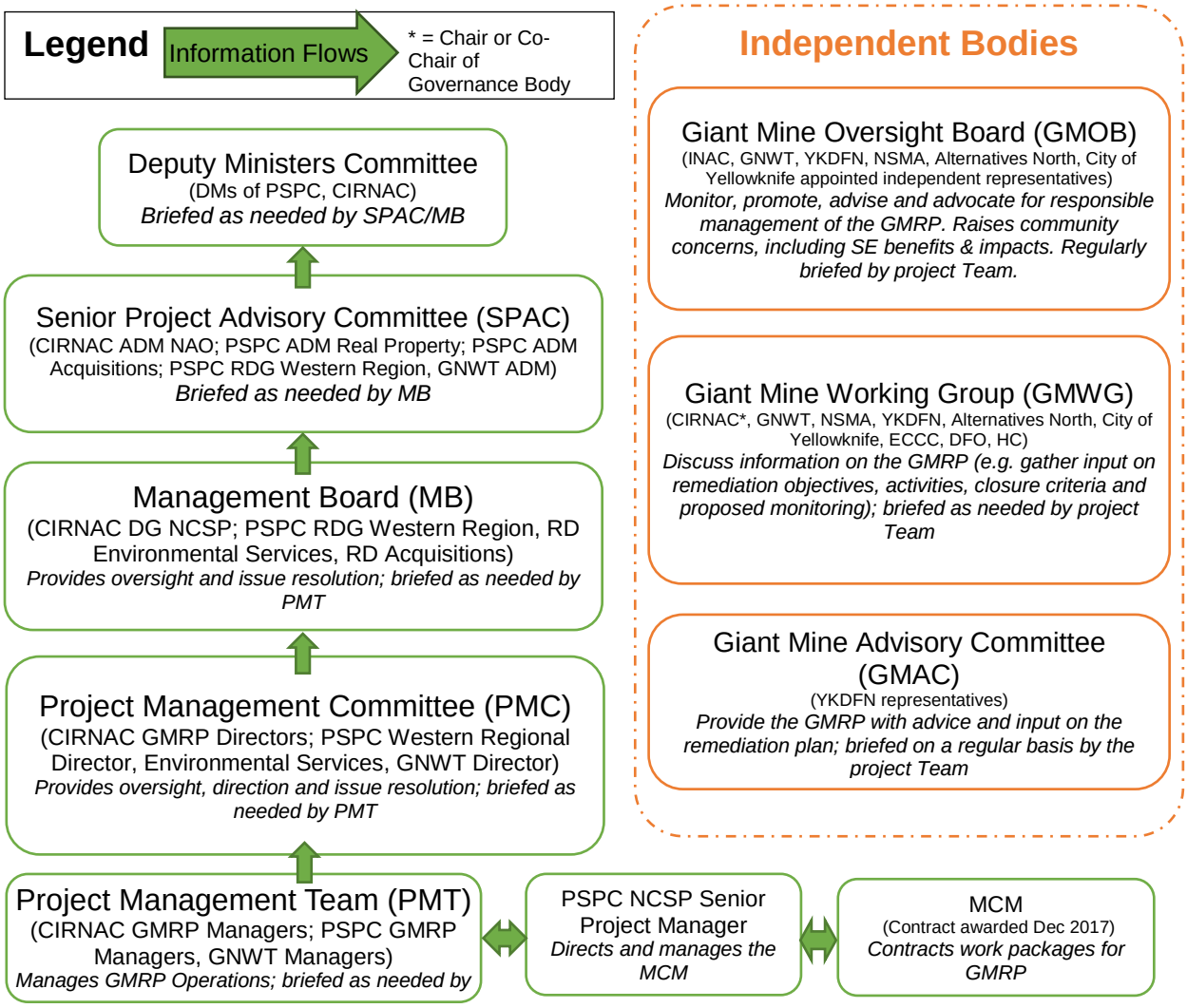
a. Project Leader: Assistant Deputy Minister, Northern Affairs Organization (ADM NAO);
b. Project Sponsor: Director General, Northern Contaminated Sites Branch (DG, NCSB);
c. CIRNAC Project Director Deputy Director; and
d. Project Implementation Team, including the CIRNAC Senior Project Leads and Project Leads and the PSPC Senior Project Managers, Project Managers, and GNWT representative.

The Assistant Deputy Minister (ADM) of the Northern Affairs Organization (NAO) of CIRNAC is the **Project Leader** and is accountable to the CIRNAC Deputy Minister (DM) for the overall delivery of the GMRP. The Project Leader is also accountable for the project liability and the use of funds. The **Project Sponsor's** role is to ensure that project objectives are established early in the project and maintained throughout to project completion. The Project Director reports to the Project Sponsor and is supported by the **Project Implementation Team** – a combination of CIRNAC, PSPC, and GNWT personnel.

Project Governance

A joint CIRNAC - PSPC project governance structure has been established to provide oversight, direction, and advisory services to the Project Team. The governance and management of the GMRP is also supported by external, independent and technical reviews, provided by multiple groups, such as the GMOB, which was formed in 2015, the Giant Mine Community Alliance, and the Independent Peer Review Panel. Figure 13 shows the governance structure of the GMRP.

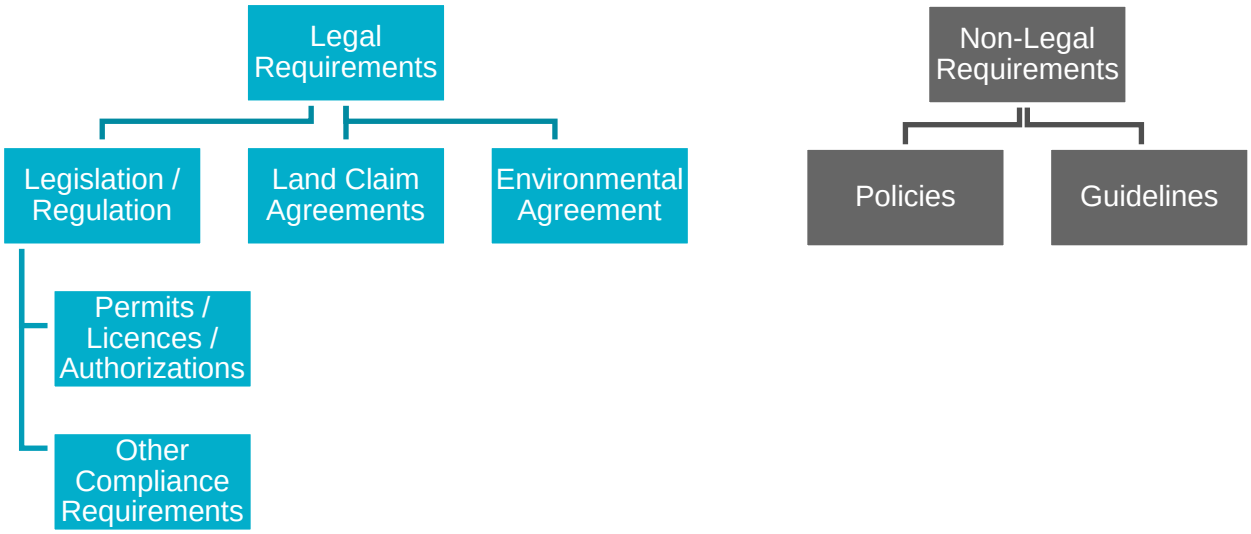
Figure 13: Governance Structure of the GMRP



Obligations of the GMRP

The activities and operations of Giant Mine are regulated through various pieces of legislation and guided by other non-legal requirements, as demonstrated in the below figure (**Figure 14**).

Figure 14: Obligations of the GMRP



The GMRP occurs in an area covered by the *Tłı̨chǫ Land Claims and Self Government Agreement* and CIRNAC meets its specific obligations by providing Indigenous employment and Indigenous business opportunities (see Section 5.2 for more information). As of 2014-15, the Akaitcho First Nation was in negotiations with the GNWT for a comprehensive land agreement; they signed an Interim Measures Agreement in 2001. Should the land claim be settled in the Akaitcho territory during the GMRP's lifecycle, the GMRP will work within the provisions set out in the agreement to meet its obligations.

A significant legal instrument for the GMRP is the Environmental Agreement, which established an independent oversight body (GMOB). The Environmental Agreement was signed in June of 2015. Signatories included CIRNAC, the GNWT, the City of Yellowknife, the YKDFN, Alternatives North, and the NSMA.

A key regulatory instrument for environmental management is a Type A Water Licence, issued by the MVLWB under the *Mackenzie Valley Resource Management Act*, *Northwest Territories Waters Act* and *NWT Water Regulations*. CIRNAC will apply for a Type A Water Licence for the implementation phase of the GMRP. Currently, CIRNAC voluntarily manages water on the site consistent with the standards specified in a historical Type A Water Licence (expiry 2005), issued to a former operator of the site. In March 2013, the GMRP received a Type B Water Licence from the MVLWB for the SSP (the Roaster Demolition and Underground Stabilization work are under this licence).

Integrated Management System

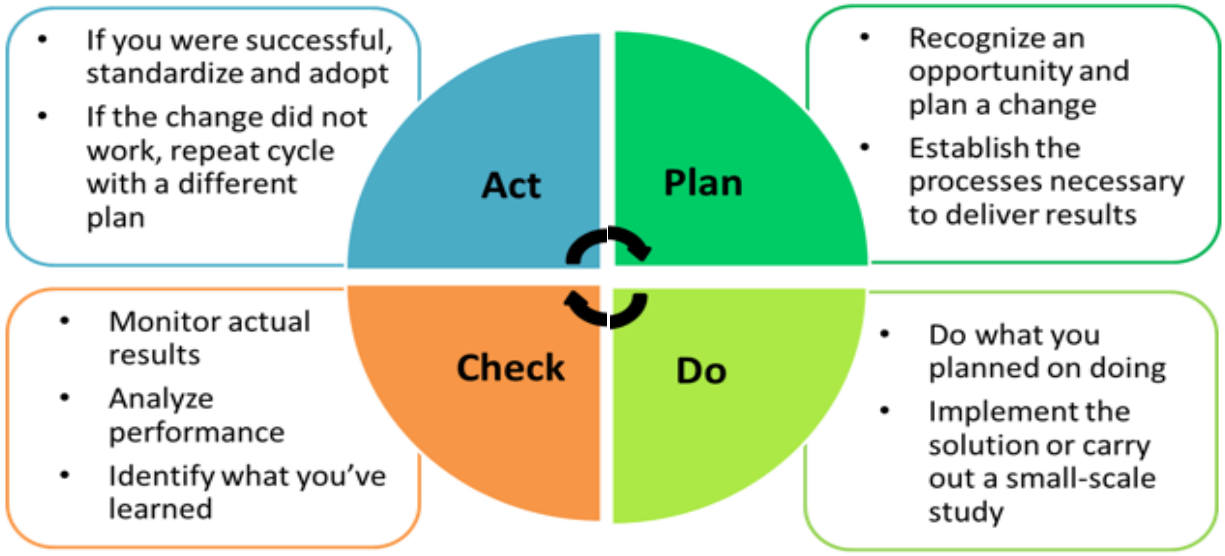
GMRP has an integrated Environment, Health, Safety and Community (EHSC) Management System[20], which improves the management of key environment, health, safety and social issues at the Site. A management system is a process of systemizing how things are done – it is a series of processes and procedures for ensuring activities are performed correctly, consistently, and effectively to meet objectives

[20] The GMRP EHSC Management System is in alignment with internationally recognized standards in order to enable a single integrated approach (specifically, the ISO 14001:2004 Environmental Management Systems standard and the OHSAS 18001: 2007 Occupational Health and Safety Management Systems standard).

and to drive continual improvement. The EHSC Management System provides the foundation for the GMRP to:

- identify and manage risks;
- track performance; and
- ensure continual improvement through a “plan-do-check-act” approach.

Figure 15: EHSC Management System



Key parts of the GMRP EHSC Management System include a **Policy**[21], which provides direction and sets commitments for the management of environment, health, safety and community for the GMRP, as well as a **Manual** that acts as a roadmap for the whole system by describing roles and responsibilities, procedures and requirements. The Management System also includes specific procedures and requirements within Environmental Management Plans and Health and Safety Standard Operating Procedures.

Project Risks and Mitigation

Risk management has been an important and ongoing management activity for the GMRP since 2002-03. Risk is about uncertainties, or unknowns, and how these could impact the objectives of the GMRP, such as the objective to minimize impacts to the environment. Risk management involves identifying and understanding risks, ranking them (which ones are low or high), and taking steps to prevent risk events from happening or to reduce their impact if they do happen. Organizations with strong risk management processes are better prepared to anticipate, avoid or reduce the impact and/or likelihood of risk events, should they occur.

[21] Giant Mine Remediation Project: Environment, Health, Safety and Community Policy: https://www.aadnc-INAC.gc.ca/eng/1340835251072/1340835309566

The GMRP has a risk management procedure and process[22] which it uses to reduce risks to acceptable levels (e.g., legacy risks; see text box) and to manage risks which may increase with increased project activity (e.g., project activity risks; see text box).

Examples of GMRP Risks

1. **Legacy Risks**: risks related to the infrastructure (e.g., dams) and environmental conditions (e.g., underground chambers) left by the former mining operation that could have human health and environmental impacts. Examples include: the release of arsenic trioxide from the underground chambers, or the injury or death of a trespasser from falling into a mine opening.
2. **Activity Risks**: risks related to the remediation project and the activities involved in reducing the legacy risks. These risks include risks to scope, budget, schedule, health and safety of workers and the surrounding environment. Examples include: delays in advancing work (and associated cost impacts), health and safety impacts to workers while conducting remediation activities (e.g., moving earth), and air pollution due to dust from remediation work.

There are many examples of how risk management has informed project decision-making. When the risk management process was first implemented in 2002-03, the identification of various public access risks led to the implementation of a range of site security measures to prevent unauthorized entry to the Site. More recently, the identification of significant risks related to the Roaster Complex, Baker Creek, and underground chamber instability led to the development of a SSP– a set of remediation measures (including the demolition of the Roaster Complex) that were approved and implemented ahead of schedule to minimize impacts to human health and safety and the environment. An overview of current legacy and activity risks for the GMRP, and associated risk treatment activities, is presented below.

Risk Profile Summary – 2018-19

This section provides a summary of the GMRP 2018-19 risk profile. The information is from the GMRP Risk Register (a large excel file) and summarizes the number of risks by status (i.e. active, closed), number of risks by category (e.g. dams), the distribution of risks across levels (e.g. low, moderate), the distribution of risks across types (active vs legacy), the active risk drivers, and the historical profile since 2010.

A more detailed summary report is available under separate cover. The detailed summary report describes each active risk, its driver, level, and treatment.

(Giant Mine Remediation Project, 2019d)

[22] GMRP's risk management procedure and process aligns with best practice and the international risk management standard CAN/CSA-ISO 31000-10 (R2015).

Figure 16: GMRP Risk Profile Summary

Figure 17: Active Risks by Level

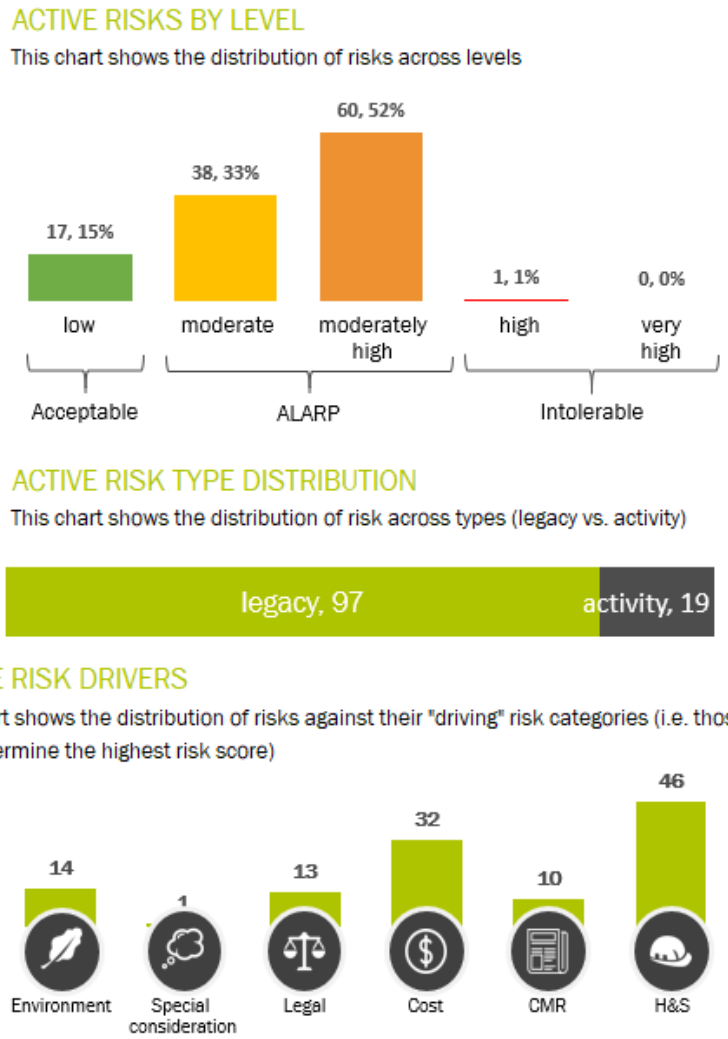
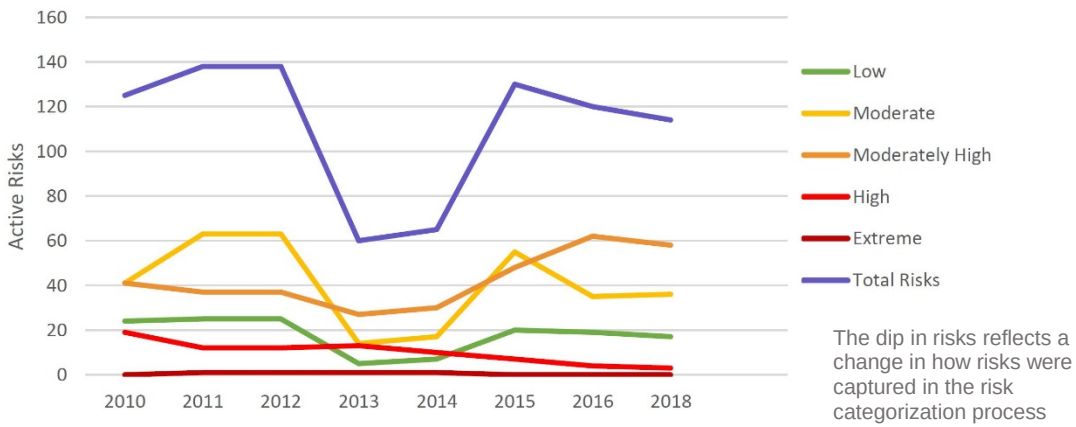


Figure 18: Historical Risk Profile

This chart graphs the historical risk numbers by level and type as entered on the Risk History Tab



APPENDIX E – ADDITIONAL INFORMATION ON MONITORING PARAMETERS

C.1 Air Quality Monitoring Program (AQMP)

The GMRP Team is committed to maintaining air quality parameters below the protective thresholds set by the AQMP and listed below.

Table 18: AQMP Air Quality Criteria (SLR Consulting (Canada) Ltd, 2019)

Analyte	Source[23]	Averaging Period	Guideline / Standard Concentration (µg / m^3 unless otherwise specified)
Total suspended particulates (TSP)	[3]	24 hr	120
	[3]	Annual	60
Particular matter less than 10µm (PM_{10})	[1]	24 hr	50
Particular matter less than 2.5µm ($PM_{2.5}$)	[2]	24 hr	28
Nitrogen dioxide	[3]	1 hr	213 (ppb)
	[3]	24 hr	106 (ppb)
Arsenic (As)	[1]	24 hr	0.3
Iron (Fe)	[1]	24 hr	4
Lead (Pb)	[1]	24 hr	0.5
Nickel (Ni)	[1]	24 hr	0.2
Antimony (Sb)	[1]	24 hr	25
Asbestos as fibre > 5µm in length	[1]	24 hr	0.04 fibres/cm^3
Fence line – TSP Risk Based Action Level (RBAL)*	[4]	15-minute	333
Fence line – PM_{10} RBAL*	[4]	15-minute	159

* Derived from toxicological references for the hypothetical on-site worker/trespasser, chronic criterion based on protection against both an incremental carcinogenic risk of 1 x 10-5 (Health Canada, 2004) using the Health Canada Inhalation Unit Risk Factor.

[23] SOURCES: [1] Ontario Ambient Air Quality Criteria (December 2016), [2] Canadian Council for Ministers of the Environment (2015) Canadian Ambient Air Quality Standards, [3] Guideline for Ambient Air Quality Standards in the Northwest Territories (February 2014), [4] Health Canada 2004.

C.2 Water Quality Monitoring

The GMRP Team undertakes effluent and water quality monitoring in and around the Giant Mine site via different programs in order to report on surface water, groundwater and underground minewater. These programs track parameters such as the volume of water pumped or discharged, water quality, and the performance of the ETP.

Table 19: Water Quality Monitoring Station Locations and Frequency (Golder Associates Ltd, 2019b)

ACTIVE WATER MONITORING STATIONS 2018-19				
STATION	**PROGRAM**	**LOCATION**	**SAMPLE TYPE**	**FREQUENCY**
SNP 43-1	SNP MDMER/EEM OMP	ETP discharge	Autosampler (daily/weekly) Grab (monthly)	Water Quality: Daily (OMP) Weekly (SNP and MDMER/EEM) during discharge Monthly (MDMER/EEM) during discharge Toxicity: Acute (MDMER/EEM) – Monthly during discharge Sub-lethal (MDMER/EEM) – Quarterly during discharge
SNP 43-5	SNP	Baker Creek, prior to entering Yellowknife Bay	Grab	Water Quality: Weekly during open water Toxicity (AEMP): July, sublethal
SNP 43-11	SNP MDMER/EEM	Baker Creek, upstream of SNP 43-1 (instream reference area)	Grab	Water Quality: Monthly SNP Monthly MDMER/EEM during discharge only Toxicity (AEMP): July, sublethal
Baker Creek Exposure Point	MDMER/EEM	Baker Creek, downstream of discharge point, at junction of Reaches 5 and 6	Grab	Monthly during discharge
SNP 43-12	SNP	End of the breakwater at the outlet to Baker Creek to Back Bay (sampled from the Great Slave Sailing Club)	Grab	Water Quality: Weekly during open water Toxicity: June – Yellowknife Bay program
SNP 43-15	SNP	Outflow of Trapper Lake	Grab	Monthly during open-water season and periods of flow

ACTIVE WATER MONITORING STATIONS 2018-19				
STATION	**PROGRAM**	**LOCATION**	**SAMPLE TYPE**	**FREQUENCY**
SNP 43-16	SNP	Trapper Creek below the Northwest Pond tailings dams (Dam 21A, B, C, and D) and above the confluence of Trapper Creek and Baker Pond/Baker Creek	Grab	Monthly during open-water season and periods of flow
SNP 43-17	SNP	Minewater from the Supercrest area at 750L (overflow of high-test line to Northwest Pond)	Grab	Weekly when pumps are active
SNP 43-21	OMP	Akaitcho Shaft pumping minewater from underground to Northwest Pond	Autosampler	Weekly year-round and corresponding with SNP 43-1 during discharge
SNP 43-22	OMP	Pocket Lake	Grab	Monthly during open-water season
SMP-1	SNP	Sump for South Pond	Grab	Monthly during open-water season
SMP-2	SNP	Sump on north end of Northwest Pond	Grab	Monthly during open-water season
SMP-3	SNP	Sump on north end of North Pond	Grab	Monthly during open-water season
SMP-4	SNP	Sump downstream of Dam 1 and Polishing Pond	Grab	Monthly during open-water season
SMP-5	SNP	Sump south of B2 Pit near Brock Pit	Grab	Monthly during open-water season
SWP-1	OMP SNP (start-up)	Polishing Pond	Grab	<u>Water Quality:</u> One week prior to the start of discharge, then weekly during discharge Monthly during open water <u>Toxicity:</u> One week prior to the start of discharge
SWP-2	OMP	Settling Pond	Grab	Weekly during discharge
SWP-3	OMP	West shore of North	Grab	Monthly during open-water season
SWP-4	OMP	East shore of Northwest Pond	Grab	Monthly during open-water season
SWP-5	OMP	Northeast shore of South Pond	Grab	Monthly during open-water season

Note: Discharge occurred from August 9 – October 2, 2018 and open water was June 5 – October 23, 2018.

Parameters tested at all stations include standard general parameters (e.g., temperature, pH, conductivity, hardness), major ions, nutrients, and total and dissolved metals and metalloids. There are also specific station requirements for other tests such as cyanide, sulphide, hydrocarbons, and radium-226. Samples collected at SNP 43-1 must meet federal requirements under MDMER as well as the discharge criteria defined in the former Water Licence (N1L2-0043).