# Site Stabilization Plan for the Giant Mine Remediation Project

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Aboriginal Affairs and
Northern Development Canada

## EXECUTIVE SUMMARY

A Site Stabilization Plan has been developed to address the existing dangers at the Giant Mine site. The plan was developed in response to new information regarding on-site risks and the extended timelines of the regulatory process. This approach was identified as the best option to balance the on-site risks with process risks (e.g., legal, regulatory). This plan will demonstrate significant progress towards the remediation of the site.

There are three main categories of work proposed under the Site Stabilization Plan which include:

1. Site Stabilization
    a. Immediate Risk Mitigation
    b. Advanced Remediation of High Risks
2. Care and Maintenance
3. Essential Design Work

The first category of work in the plan is referred to as (1) Site Stabilization. This category is subdivided into two main areas of work, (a) *Immediate Risk Mitigation* and (b) *Advanced Remediation of High Risks.* Immediate Risk Mitigation work elements are the urgent efforts that will be targeted for completion within the first year. This work includes addressing the short-term risks associated with Baker Creek, addressing the shifting ground near the B1 Pit, as well as other smaller scale actions such as securing infrastructure, reducing the potential for inadvertent access to the site, and the removal of deteriorating materials that pose health and safety risks. The *Advanced Remediation of High Risks* are larger elements of the remediation project that need to proceed on an urgent basis in order to protect human health and safety as well as the environment. This work will include the demolition of the Roaster Complex, the evaluation of options to prevent mine flooding (i.e., potentially rerouting Baker Creek offsite), significant stabilization of the underground, and the lowering of the Mill Conveyor. These activities will be completed over the next two to three years. See APPENDIX 1 for photos of the mine site and the elements of the stabilization plan.

The next category of work is (2) Care and Maintenance. Beyond the basic elements associated with care and maintenance (e.g., daily operations, site security etc.), the work in this category also includes general capital and safety improvements. This work needs to be completed to maintain the stability and integrity of the site throughout the full remediation project. These activities include improving site infrastructure, code mandated upgrades to the site-wide electrical distribution systems as well as general repairs.

(3) Essential Design Work is the next main category of the plan. This includes continuing to develop preliminary and detailed designs for the key project

elements (e.g., the water treatment plant), the continuation and completion of the Freeze Optimization Study as well as the preservation of historical mine records. Other ongoing work includes regulatory approvals, consultations, as well as project management. [redacted]

To successfully implement the plan, a number of requirements will need to be met. The Project Team is working closely with the Department of Justice (DOJ) to develop a strategic implementation approach for the plan that respects the regulatory approvals process while proceeding with the urgent work that is required to address the dangers on the site. In addition, a communications/engagement strategy has been developed to secure the support of key partners and stakeholders. Both of these requirements are necessary in order successfully implement the Site Stabilization Plan.

[redacted] For an overview of the schedule for the plan, see APPENDIX 3.

## INTRODUCTION

This site stabilization plan has been developed in order to address the current dangers and high risks at the Giant Mine site (see APPENDIX 1, photo A). While working through the environmental assessment process, the project team determined that certain elements of the remediation project now require a more aggressive timeline in order to protect human health and safety and the environment. This requires several project elements to proceed on an urgent basis. As a part of ongoing risk management practices, the project maintains a risk registry of all of the potential risks that could occur on the site. This registry is reviewed on a regular basis by a team of expert engineers. In addition, the project team conducted a failure modes analysis to assess larger scale risks and how these impact safety, the environment and the project. As a result of these practices, the timeline of the regulatory process and the continually deteriorating site conditions, the stabilization plan was developed.

The work required under the plan has been divided into a number of different categories of work. The first category of work is referred to as (1) Site Stabilization. This category is subdivided into (a) *Immediate Risk Mitigation* and

(b) *Advanced Remediation of High Risks*. The work in the Immediate Risk Mitigation category will be conducted largely within the first year of the plan in order to address the most immediate site risks. The Advanced Remediation of High Risks category includes larger project elements that need to proceed on an urgent basis. These elements will be addressed in the next two to three years. The next main category of work is referred to as (2) Care and Maintenance. This category includes the basic care and maintenance of the site (e.g., security) as well as capital improvements. This involves work elements that are necessary to maintain site integrity and stability throughout the full remediation project.

The final category is (3) Essential Design Work. This is the work required to complete the preliminary and detailed design as well as establish cost estimates for the key project elements that will proceed in 2015 (e.g., the water treatment system, freezing of the underground chambers, mine record preservation). The remaining categories of work include regulatory approvals, consultations, as well as project management.

## COST ESTIMATES

Although this plan is specifically designed to address the dangers and high risks at the site, the nature of the site is such that new and unforeseen risks could quickly arise (e.g., decaying infrastructure). The project team continues to monitor these conditions and address them as required through existing risk management practices. Any evolving issues or changing circumstances have the potential to elevate certain remediation activities thus requiring more immediate action. [redacted]

[redacted]

## 1. SITE STABILIZATION

There are a number of urgent activities that are required to stabilize the site. These include actions that will improve the overall safety, security and integrity of the site. The two sub-categories of this work are (a) *Immediate Risk Mitigation* and (b) *Advanced Remediation of High Risks*.

### (a) Immediate Risk Mitigation

The work in this category is required to address the urgent dangers/risks and will take place within the first year of the plan (2011-2012).

One of the site elements requiring urgent attention is **Baker Creek**. Some of this work is in response to the Inspector's Direction [redacted] and must be completed prior to April 30, 2012. This involves covering the JoJo Lake tailings as well as making improvements to the banks in the affected region (see APPENDIX 1, photo B). Recent analysis has also shown that sections of the creek do not meet the 500-year flood scenario that is now required for safety purposes (standard was revised based on changing behaviour of the creek). Given the significant potential risk of flooding the mine, the plan also includes actions to increase bank levels and/or lower channel elevations in the areas of concern. [redacted]

Another prominent element of urgent work relates to the **B1 Pit Wall Stability**. The ground around the B1 pit has begun to settle and has produced a large sinkhole (see APPENDIX 1, photos C and D). This failure is located adjacent to the flood plain of Baker Creek. Significant failure could result in the flooding of the mine. There are significant consequences for human health and the environment in the event of the scenario where the mine floods. In this scenario the risks would include: the loss of the ability to pump contaminated mine water, the dissolving of a significant quantity of arsenic and the potential release into adjacent waterways (e.g., Baker Creek and ultimately Great Slave Lake), in addition there would be implications for underground stability. Investigations are currently underway to assess the conditions related to the ground failure surrounding B1 Pit. Preliminary assessments are evaluating whether this failure is linked to the issue of underground stability. Mitigation measures will be taken and are expected to include the removal of unstable fill and replacement with more solid material. Efforts will also include the construction of a berm between B1 Pit and Baker Creek. [redacted]

The plan also includes a number of smaller elements that will reduce on-site dangers and risks. These include the securing of infrastructure (e.g., C-Shaft), additional measures to reduce the potential for inadvertent public access (e.g., fencing, signage, berms), the removal of deteriorating materials (e.g., mill and warehouses), and general water management repairs (e.g., A1 Pit Ditch, C1 Pit Channel). [redacted]

**(b) Advanced Remediation of High Risks**

There are several project elements that are being considered as advanced remediation of high risks. These are the larger scale elements of the overall remediation plan that need to proceed in order to continue to protect human health and safety as well as the environment. Work on these elements will take place over the next two to three years. This timeline is necessary to allow the requisite contracting and design work to be completed in advance of operations.

The largest element of this work is the demolition of the **Roaster Complex**. This building complex is highly contaminated with arsenic dust and asbestos (see APPENDIX 1, photos e and f). Recent assessments of the complex continue to identify degrading conditions of the buildings, including the deterioration of the mortar on the stack, loose cladding and exposed edges of the walls and roof. The demolition of this complex is being undertaken to prevent injury or death from falling cladding, partial building collapse, and/or arsenic and asbestos exposure to workers or the public. [redacted]

One of the highest risks to the site and the remediation project is the flooding of the mine caused by Baker Creek. As noted above, there are significant human health and environmental consequences in the event of a serious flood at the Giant Mine. This plan includes an **Evaluation of Options to Prevent Flooding**. This evaluation will assess permanent solutions for Baker Creek including onsite realignment or potentially re-routing the creek offsite. Reducing or eliminating the flow of water across the mine site would significantly reduce on-site risks. The plan includes expenditures for geotechnical investigations and assessments of the possible options for Baker Creek in the first year. [redacted]

Linked to the risk of flooding is the issue of **Underground Stabilization**. Assessments and investigations continue to identify several areas of the underground mine that require stabilization. Some of the rock above the underground chambers has been found to be thinner than previously thought. In other areas the bulkheads, the concrete plugs that contain the arsenic within the chambers, continue to require support and stabilization. The dangers associated with an underground failure are significant as the ground could collapse near Baker Creek which could result in the flooding of the mine. [redacted] An underground collapse resulting in arsenic being released into deeper portions of the mine could also put the viability of the frozen block method at risk. This would potentially require a new approach for the remediation of that element of the site. To address these significant risks, stabilization activities would be completed in strategic locations throughout the underground. [redacted] This will be the beginning phase of the larger and more costly underground work that will continue as a part of the full remediation efforts beyond this site stabilization plan.

The **Mill Conveyor** is another significant on-site danger that requires remediation. The mill conveyor is a large wood and steel structure that crosses an active travel path on the site (see APPENDIX 1, photos g and h). Recent assessments noted signs of structural instability and shifting. This presents a

significant risk to on-site workers who pass underneath the conveyor several times daily. The structure is adjacent to the Freeze Optimization Study (FOS) infrastructure, and also acts as a fire continuation pathway between buildings. To address these risks, sections of the conveyor would be lowered and set aside for future remediation as a part of the larger project. [redacted]

## 2. CARE AND MAINTENANCE

The next category of the plan is care and maintenance. To continue the daily operations on the site, the project spends an annual amount on basic care and maintenance. This work requires nearly 30 full-time site staff and includes all aspects of keeping the deteriorating site in regulatory and environmental compliance (e.g., site assessments, site security). [redacted]

In order to maintain the stability of the site, there are also requirements to make general improvements and upgrades to the existing infrastructure. These efforts are needed to provide safe and efficient operations, as well as prepare the site for full remediation. These activities include maintaining and upgrading site-wide electrical systems, replacing and repairing infrastructure and equipment (e.g., pumps, motors, boilers) as well as general facility repairs (e.g., Effluent Treatment Plant – tank liner replacement, B2 Dam). [redacted]

## 3. ESSENTIAL DESIGN WORK

In order to develop and further the understanding of the complexities of some of the project elements, the continuation of the engineering and design work is required before proceeding to full remediation. This includes the work on the design for the remainder of the underground work, the freezing of the arsenic chambers and the water treatment system. [redacted]

A significant contribution to the final design will be made through the continuation and completion of the FOS. The study is now operational, but research and trials need to continue in order to establish the most effective and efficient process that will be used for freezing each of the underground arsenic chambers. This research will involve an extensive number of trials on the test chamber including flooding, freezing and thawing. The trials will also include the final steps required to effectively cap and freeze the chambers. The conclusion of the next phase of the FOS will result in one frozen arsenic chamber and the results of the work inform the approach that will be used for freezing the remaining chambers. [redacted]

[redacted]

In order to preserve and utilize all mine site information, all paper documents and records at the site need to be digitized. Operations at the site began in 1948, and as a result, much of the key information that details the underground elements of the mine exists only on paper. This information is critical to the responsible custodianship of the site over the long term and will be an invaluable engineering tool as the project moves into detailed design. [redacted]

The final element of this category of work is detailed design. The detailed design stage follows the completion of preliminary design. The objective is to develop contract ready documents that can be used for the full scale remediation of the site. [redacted]

## ONGOING ACTIVITIES

To support all of this work, the project team will need to continue with a number of activities. These efforts will maintain the effective operation of the existing activities and also prepare the site to proceed to full remediation as quickly and as efficiently as possible. These categories of expenses include regulatory approvals, consultations and engagement as well as project management. [redacted]

## IMPLEMENTATION REQUIREMENTS

In order to successfully implement the site stabilization plan, a number of requirements need to be met. The first is the establishment of a strategic approach that will be developed through direct consultations with the Department of Justice. This approach will be designed in a way that respects the regulatory process while allowing the Project Team to proceed with the urgent work required to address the on-site dangers and risks.

A communications strategy has also been developed for the rollout of the Site Stabilization Plan. The Project team, in consultation with the Department of Justice, has developed a plan that would introduce the site stabilization plan to key partners and stakeholders. Timely and effective communication is essential to obtaining the support of key groups and individuals. This includes early and ongoing engagement and dialogue with the co-proponent of the project, the Government of the Northwest Territories (GNWT), the Mackenzie Valley Land and Water Board as well as the Mackenzie Valley Environmental Impact Review Board. Early engagement is also required with regulators (e.g., Environment

Canada, Department of Fisheries and Oceans, Aboriginal Affairs and Northern Development Canada inspectors), as well as the interveners that are participating in the environmental assessment, including the City of Yellowknife, affected First Nations communities and non-governmental organizations. The messaging of the plan focuses on the fact that action is being taken in order to protect human health and safety as well as the environment. [redacted]

[redacted]

[redacted]

Although beneficial to the overall remediation to the site, the relocation of Highway 4 (The Ingraham Trail) is outside the control of the Project Team. The responsibility and management of the relocation rests solely with the GNWT. The relocation would reduce public access to the site and allow for the safer demolition of highly contaminated infrastructure (i.e., the Roaster Complex). The project team continues to actively encourage the GNWT-led initiative to ensure that it takes place as soon as possible.

## CONCLUSION

The site stabilization plan has been developed in order to demonstrate that every reasonable measure will be taken to address on-site dangers and risks in order to protect human health and safety as well as the environment. The successful implementation of this plan would result in significant progress being made towards the remediation of the Giant Mine site. In collaboration with the Department of Justice, the project team will work to develop the necessary strategic approach that respects the regulatory approvals process while proceeding with the urgent work that is required. [redacted]

[redacted]

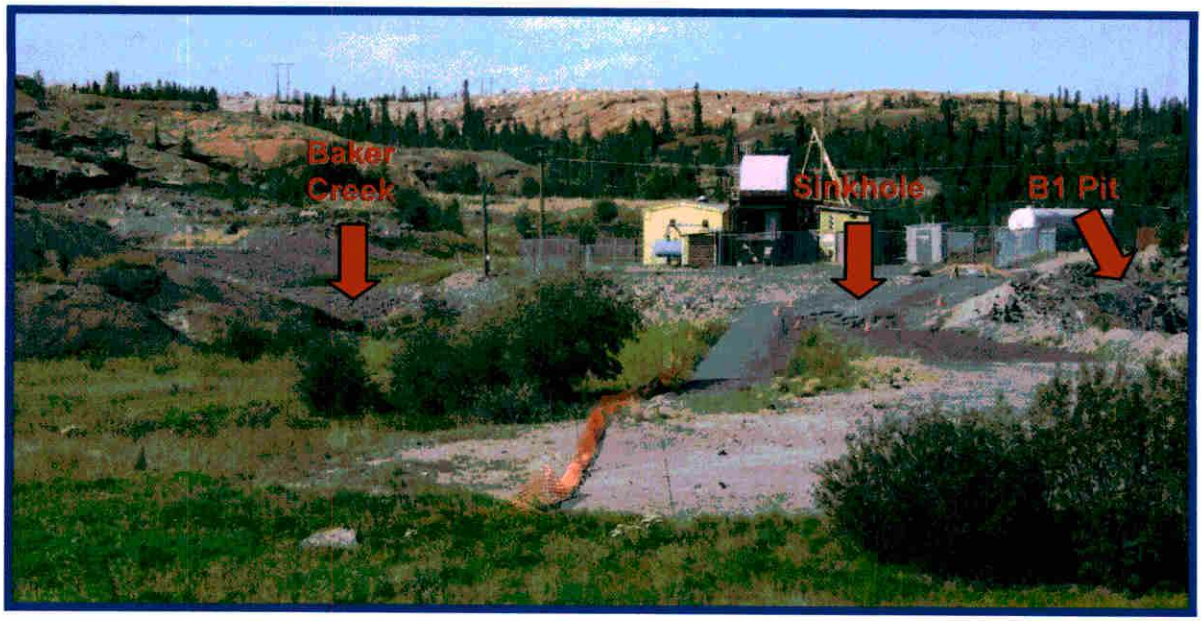
## APPENDIX 1 – Photos of the Giant Mine Site

### (A) Site Overview

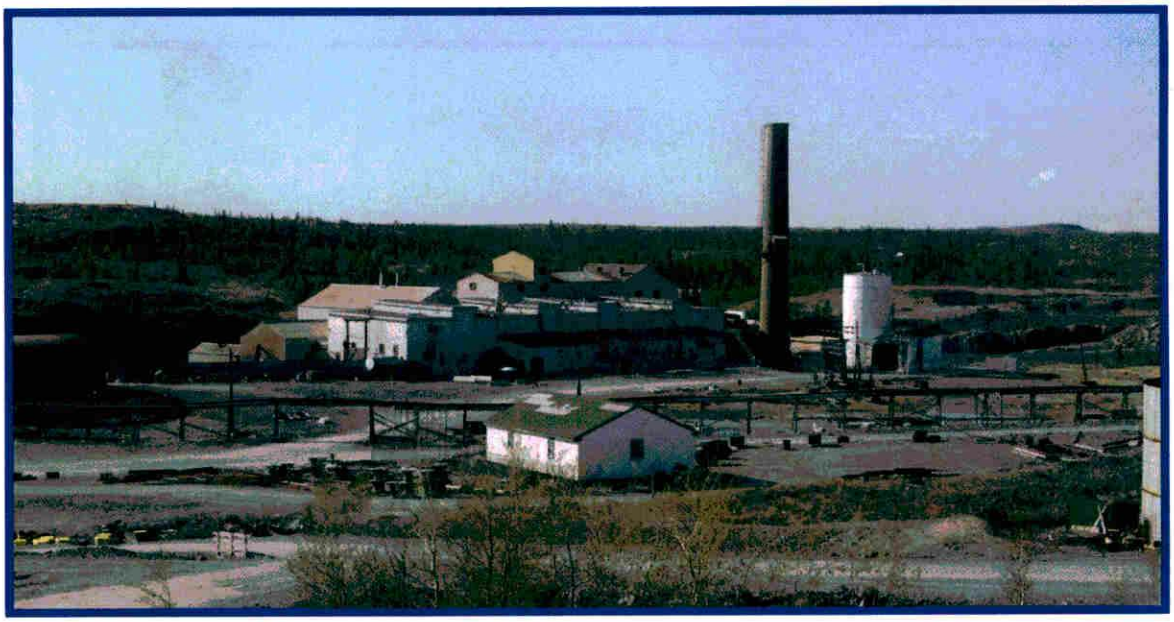
### (B) Baker Creek – Jojo Lake Tailings

**(C) B1 Pit**

**(D) B1 Pit**



**(E) Roaster Complex**



**(F) Roaster Complex (Flues)**

**(G) Mill Conveyor**

**(H) Mill Conveyor**

# APPENDIX 3 - Schedule for Site Stabilization Plan

| | 2011 - 2012 | | | | 2012 - 2013 | | | | 2013 - 2014 | | | | 2014 - 2015 | | | | 2015 - 2016 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| **SITE STABILIZATION** | | | | | | | | | | | | | | | | | | | | |
| ***Immediate Risk Mitigation*** | | | | | | | | | | | | | | | | | | | | |
| **Baker Creek Improvements** | | | | | | | | | | | | | | | | | | | | |
| Design / Tender | | ■ | | | | | | | | | | | | | | | | | | |
| Construction | | | ■ | ■ | | | | | | | | | | | | | | | | |
| **A1 Pit Ditch Upgrades** | | | | | | | | | | | | | | | | | | | | |
| Design / Tender | | ■ | | | | | | | | | | | | | | | | | | |
| Construction | | | ■ | ■ | | | | | | | | | | | | | | | | |
| **B1 Pit Wall Stability** | | | | | | | | | | | | | | | | | | | | |
| Design / Tender | | ■ | | | | | | | | | | | | | | | | | | |
| Construction | | | ■ | ■ | | | | | | | | | | | | | | | | |
| **Mill Cladding, Access Prevention,** | | | | | | | | | | | | | | | | | | | | |
| Design / Tender | | ■ | | | | | | | | | | | | | | | | | | |
| Construction | | | ■ | ■ | | | | | | | | | | | | | | | | |
| ***Advanced Remediation of High Risks*** | | | | | | | | | | | | | | | | | | | | |
| **Roaster Complex Demolition** | | | | | | | | | | | | | | | | | | | | |
| Design / Develop RFP | | ■ | ■ | | | | | | | | | | | | | | | | | |
| Acquisitions | | | ■ | ■ | ■ | | | | | | | | | | | | | | | |
| Demolition | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | |
| **Evaluation of Options to Prevent Flooding** | | | | | | | | | | | | | | | | | | | | |
| Investigations / Options Analysis | | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | |
| Design / Develop RFP | | | | ■ | ■ | ■ | | | | | | | | | | | | | | |
| Acquisitions | | | | ■ | ■ | ■ | ■ | | | | | | | | | | | | | |
| Construction | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| **Underground Stabilization** | | | | | | | | | | | | | | | | | | | | |
| Investigation / Design / Develop RFP | | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | |
| Acquisitions | | | ■ | ■ | | | | | | | | | | | | | | | | |
| Construction (CM-I & Major) | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| **Mill Conveyor Collapse** | | | | | | | | | | | | | | | | | | | | |
| Design / Tender | | ■ | | | | | | | | | | | | | | | | | | |
| Construction | | | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | |
| **CARE AND MAINTENANCE** | | | | | | | | | | | | | | | | | | | | |
| Design of Capital Improvements | | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | |
| Construction | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | |
| **ESSENTIAL DESIGN WORK** | | | | | | | | | | | | | | | | | | | | |
| Completion of Preliminary Design | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| Freeze Optimization Study (FOS) | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | |
| Mine Record Preservation | | ■ | ■ | ■ | | | | | | | | | | | | | | | | |
| **KEY POLICY & REGULATORY MILESTONES** | | | | | | | | | | | | | | | | | | | | |
| Environmental Assessment Approval | | | | | | | | | | | ■ | | | | | | | | | |
| Water Licence Approval | | | | | | | | | | | | | | | | ■ | | | | |
| **FULL SCALE REMEDIATION** | | | | | | | | | | | | | | | | | | | | |
| Acquisitions | | | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | |
| Detailed Design | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |
| Construction | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ |