

Giant Mine Remediation Project



Canada

SURFACE REMEDIATION AND MANAGEMENT OVERVIEW



**Giant Mine Remediation Project Environmental Assessment
Public Hearings – September 10-14, 2012**

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SURFACE REMEDIATION WILL IMPROVE:

- Baker Creek
- Open Pits
- Existing Tailings
- Contaminated Soils
- Debris and Demolition
- Air Quality

BAKER CREEK

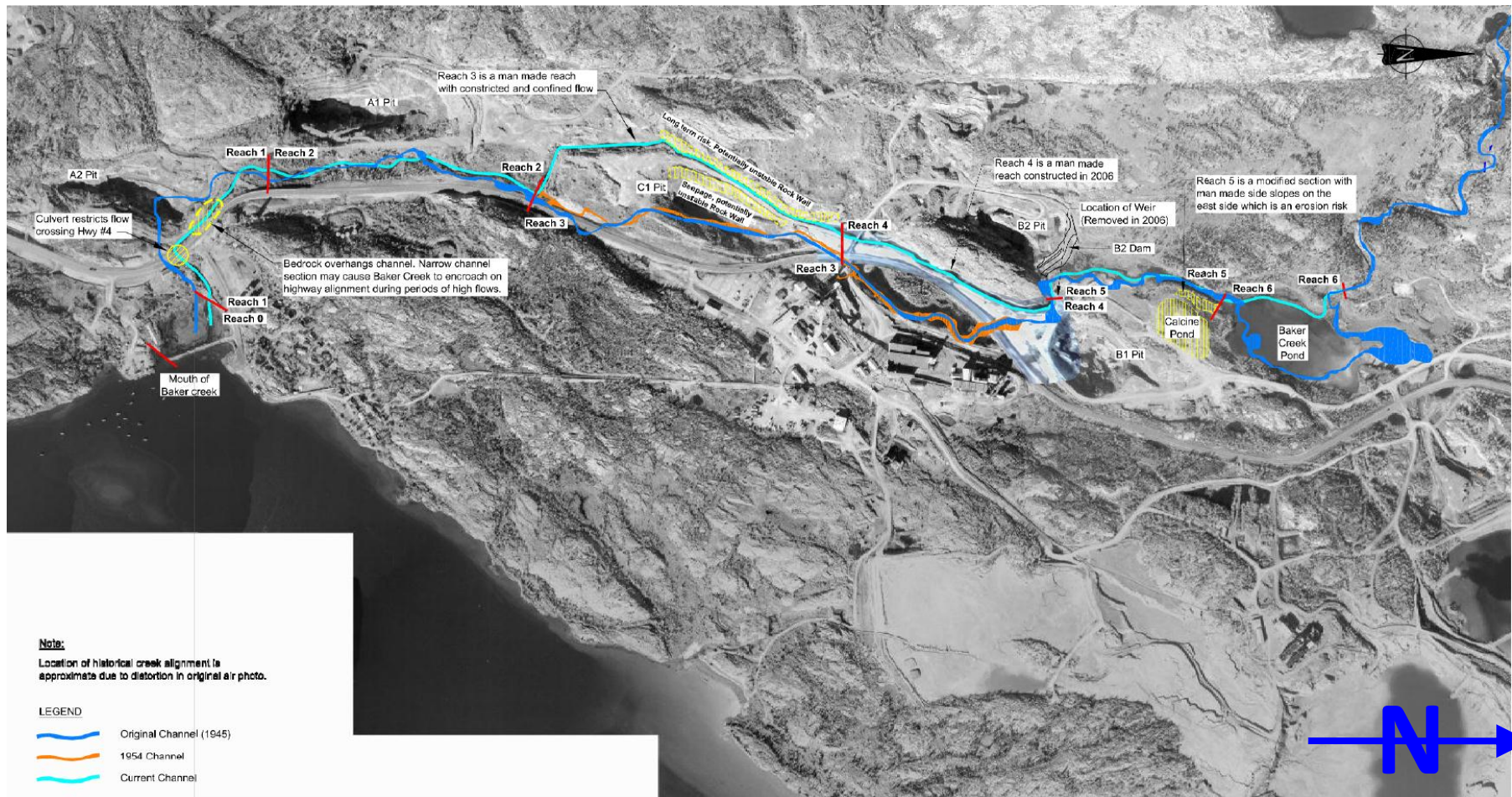
Assessments to date show there will be improved water quality in Baker Creek.



REMEDIATION OBJECTIVES

- Reduce flood risk:
 - Flow through site without spill to underground; increase physical stability of creek
 - Current criteria are 500-year flood flow event, with 2 m anchor ice, plus 1 m freeboard
- Minimize groundwater seepage to the underground
- Maintain a low flow channel for fish passage and habitat
- Enhance/restore fish habitat in Baker Creek
- Measures to result in positive change to flow regime & habitat

EXISTING AND HISTORICAL ALIGNMENTS

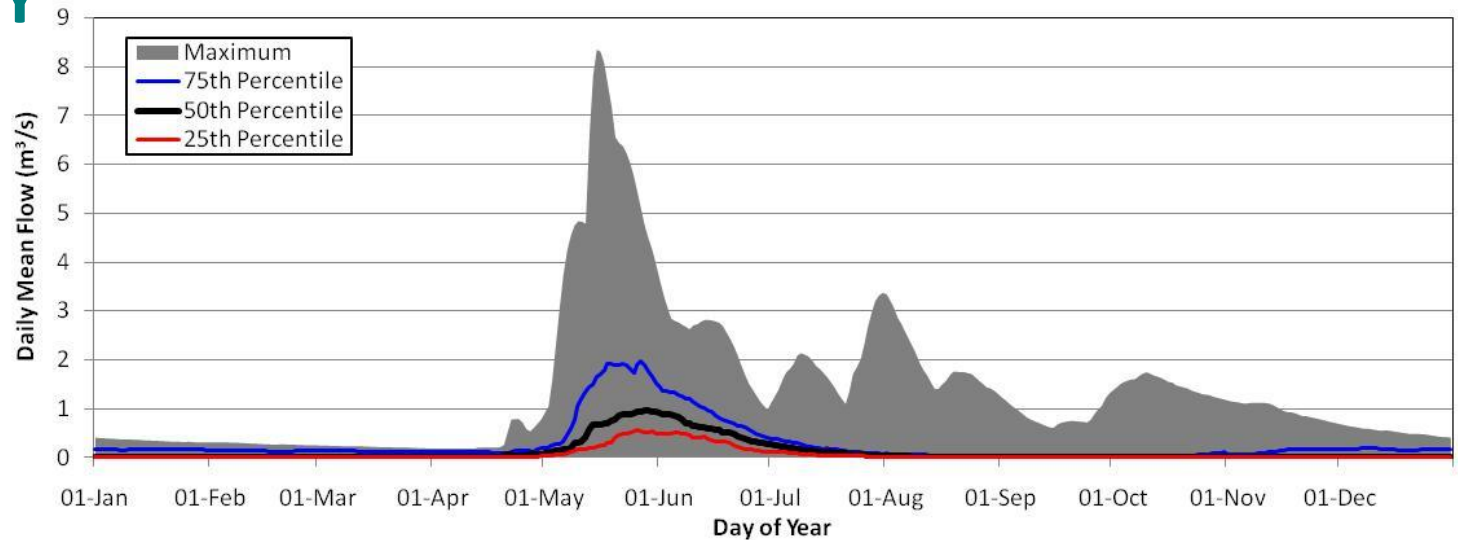


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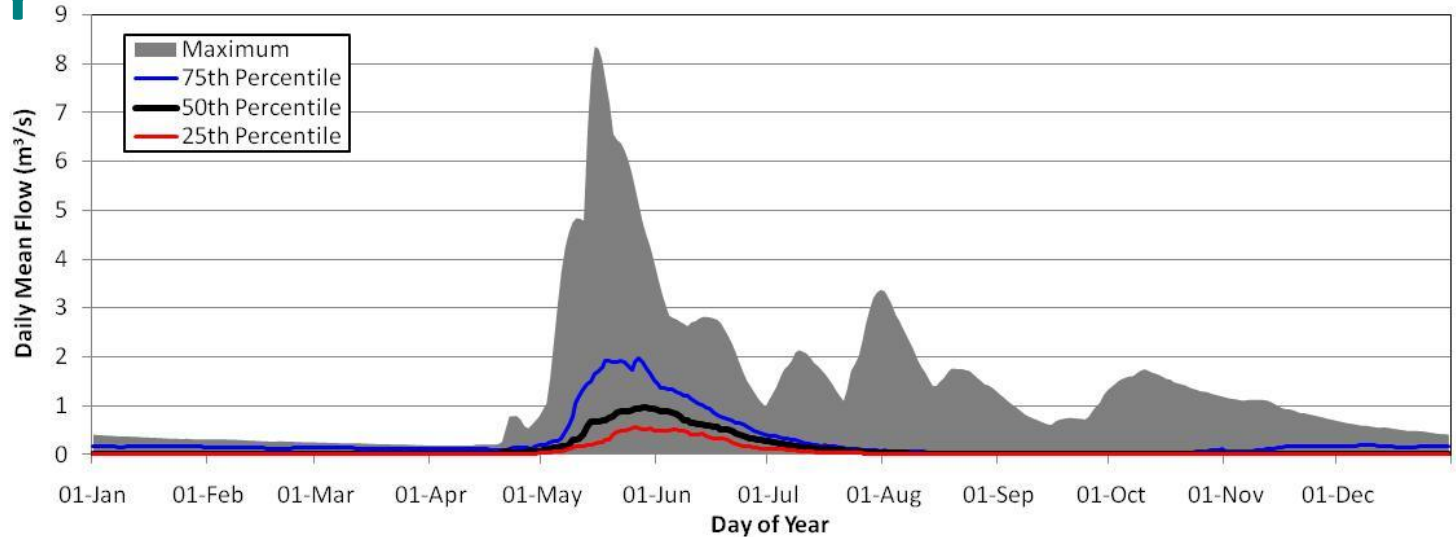


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HYDROLOGY



HYDROLOGY

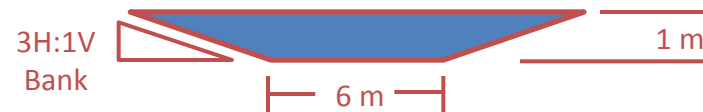


Baker Creek Flood Regime

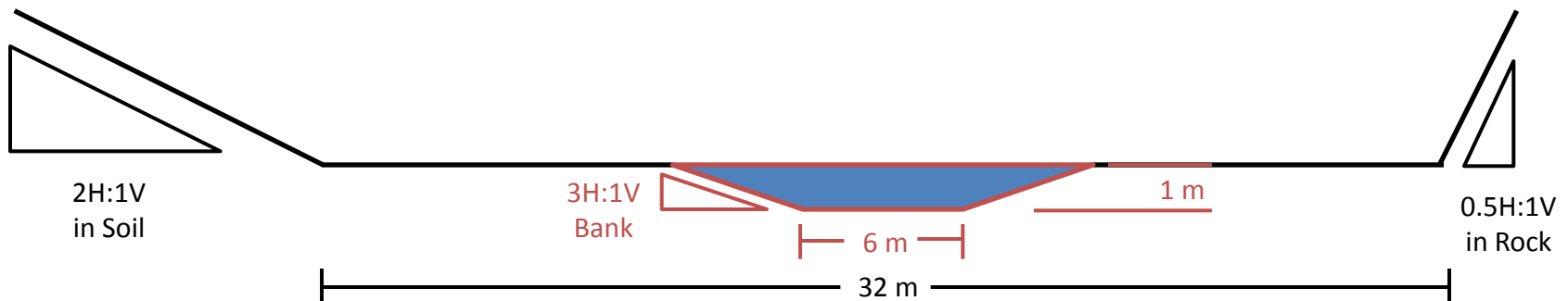
Return Period (years)	Estimated Flood Discharge (m³/s)
2	1.7
10	5.4
50	10.8
100	13.8
200	17.3
500	25.0
Probable Maximum Flood	~200

- Spring 1991, at 8.45 m³/s - greatest recorded flow (since 1968)
- Mean annual flow - about 6.8 million m³
- Anchor ice formation observed in recent years, particularly in Winter 2010-11.

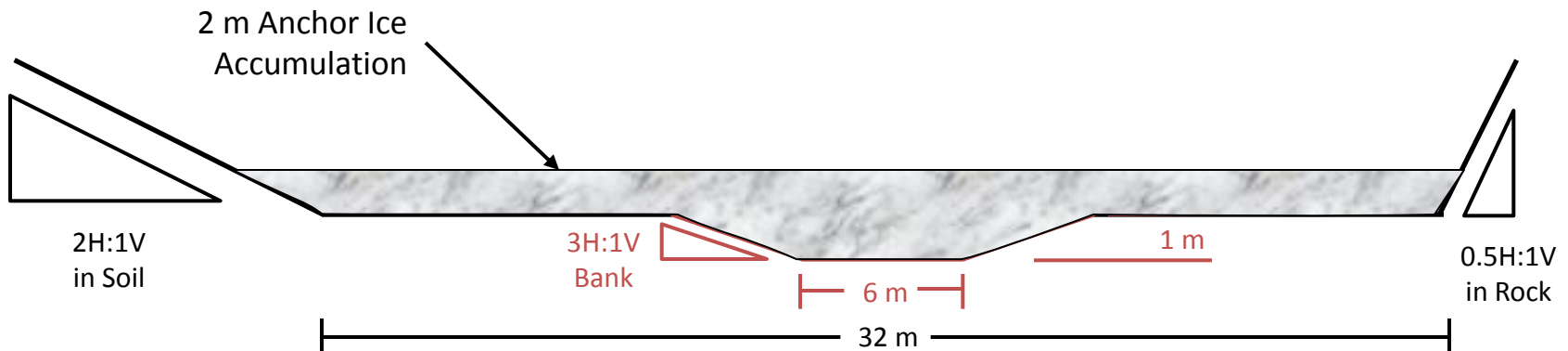
CHANNEL DESIGN



CHANNEL DESIGN



CHANNEL DESIGN



2 m Anchor Ice Accumulation

1:500 year Flood Flow

2H:1V in Soil

3H:1V Bank

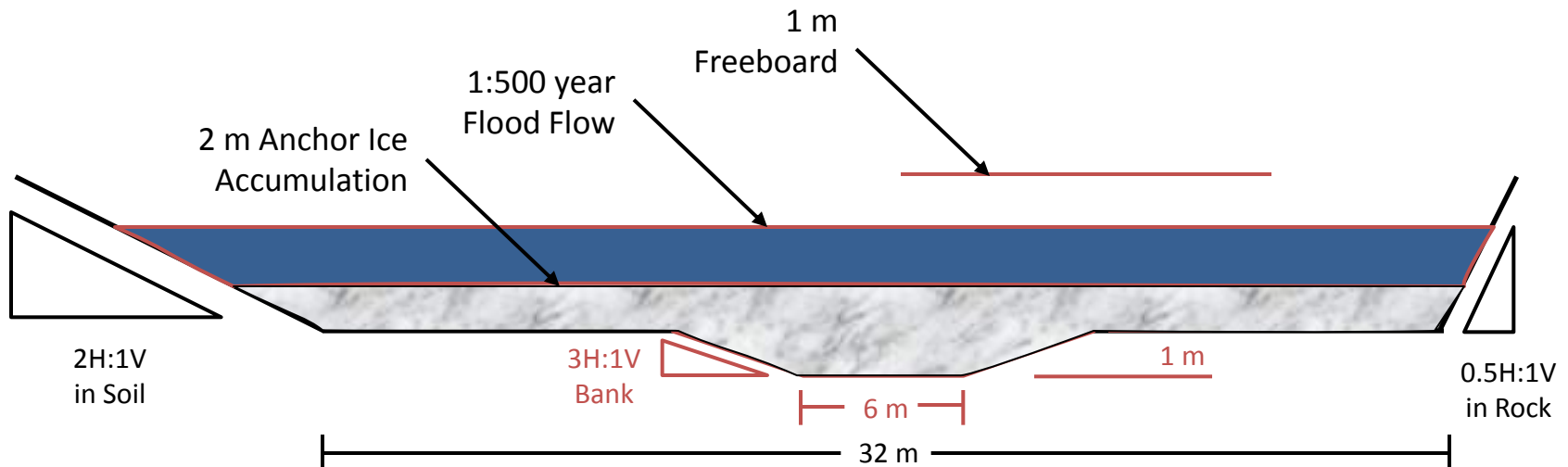
6 m

1 m

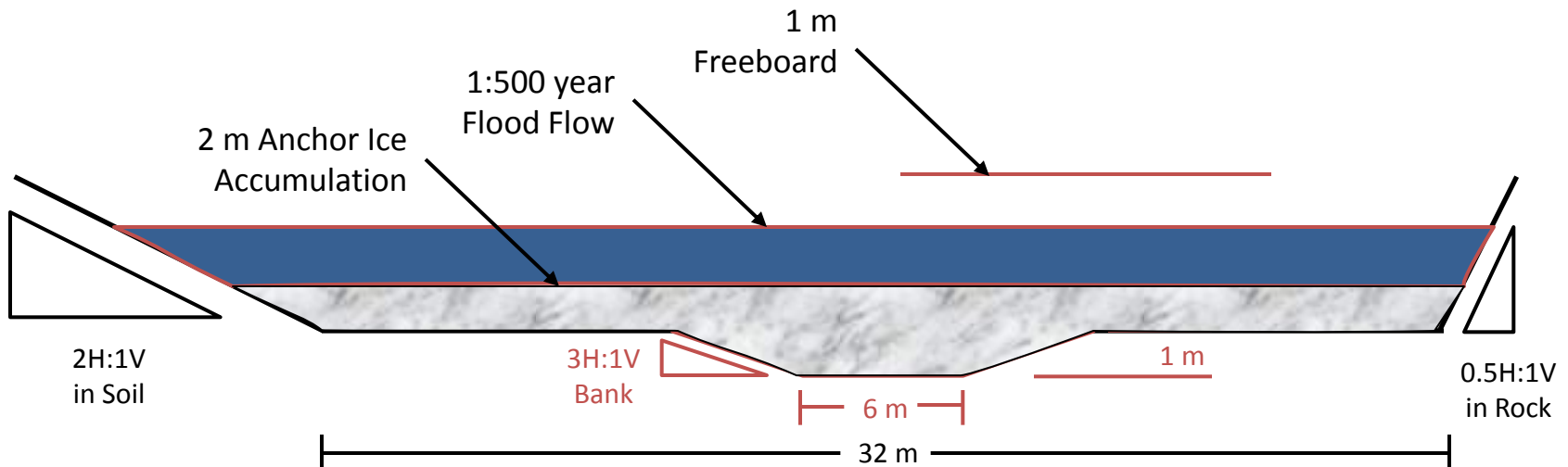
0.5H:1V in Rock

32 m

CHANNEL DESIGN



CHANNEL DESIGN



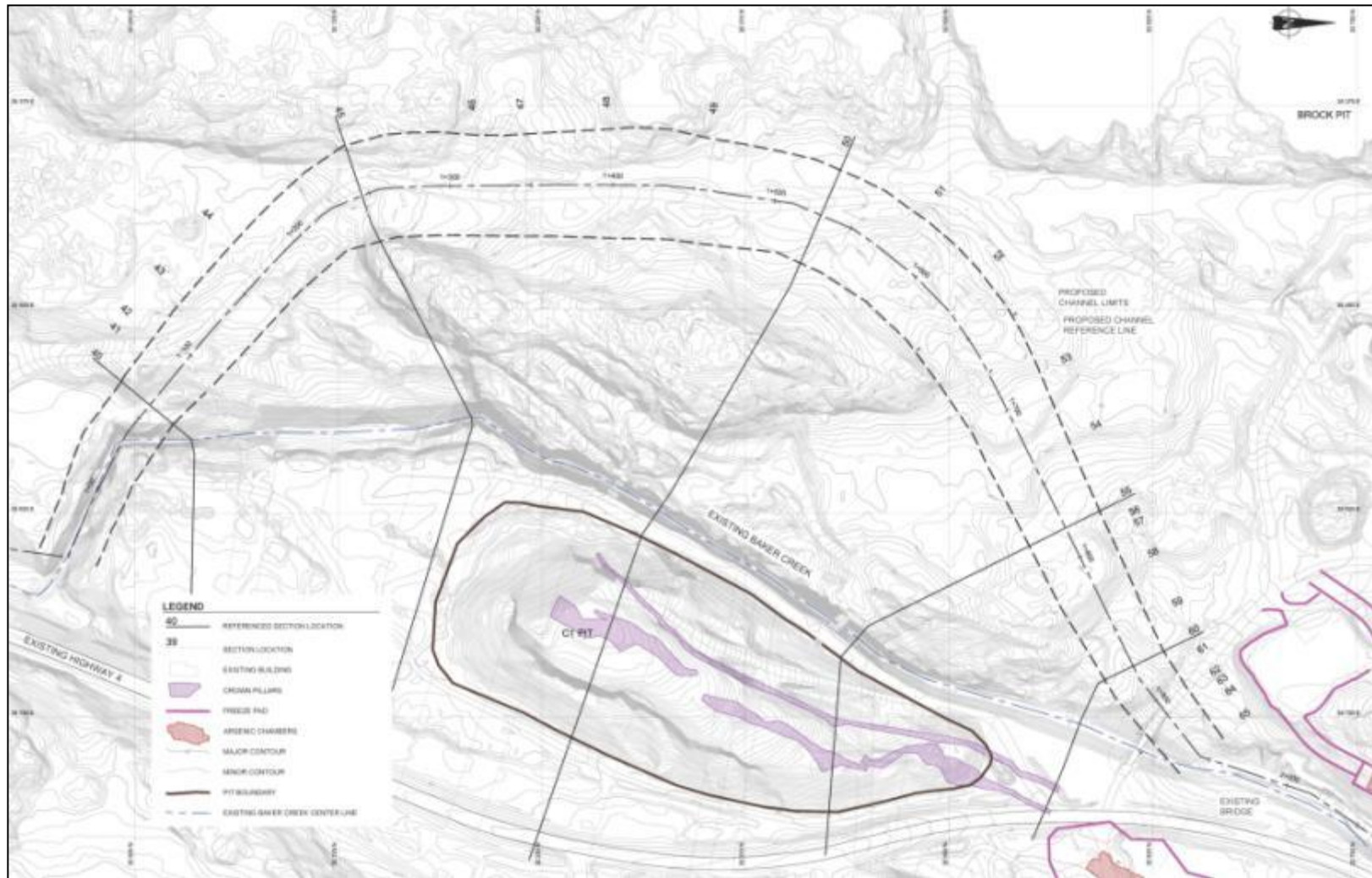
- Channel geometry and materials are based on local geomorphology investigation

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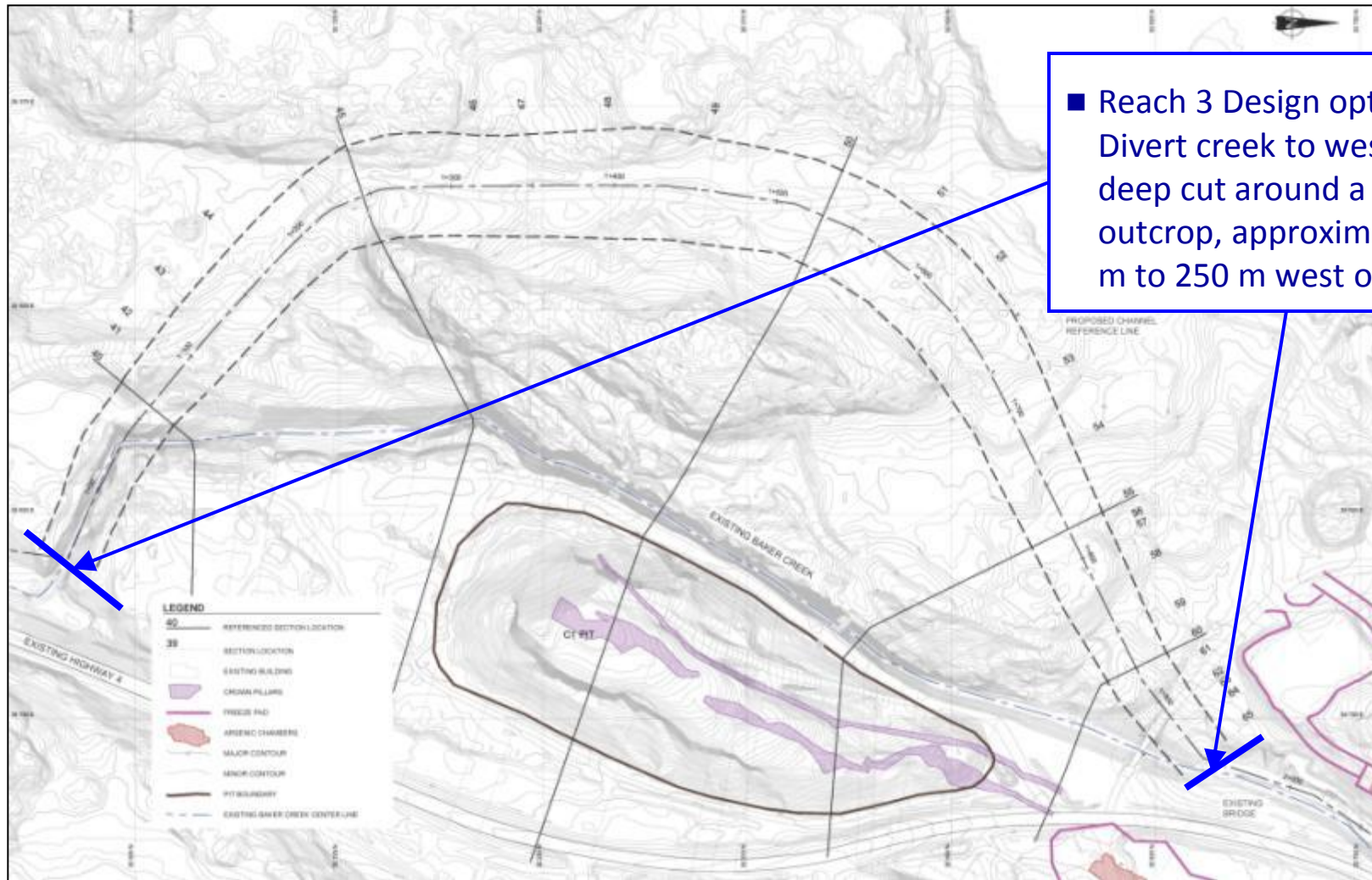


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REMEDIATION ELIMINATES FLOOD RISK



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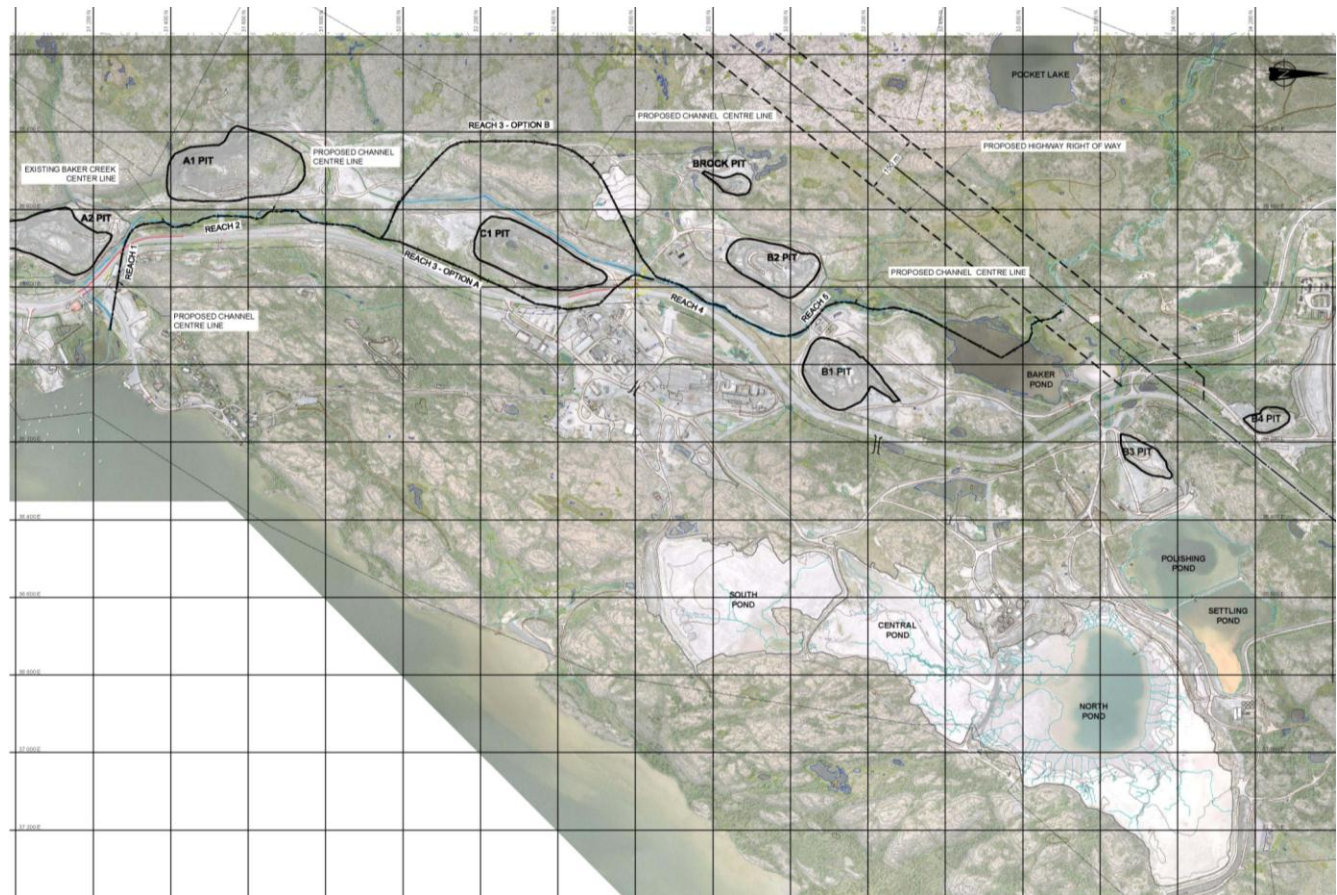
- Reach 3 Design option:
Divert creek to west in
deep cut around a bedrock
outcrop, approximately 100
m to 250 m west of C1 Pit.

BAKER CREEK SEDIMENT STUDY

- Review sediments in creek to determine extent of contaminated sediments and tailings in creek:
 - to provide input for DFO, EC
 - to provide data to make informed decisions.
- Decision on creek remediation requires input from DFO and other parties before moving forward.

PROJECT INTERACTION

GNWT
Highway
realignment
does not
interfere
with Baker
Creek.



BAKER CREEK REMEDIATION ACTIVITIES WILL:

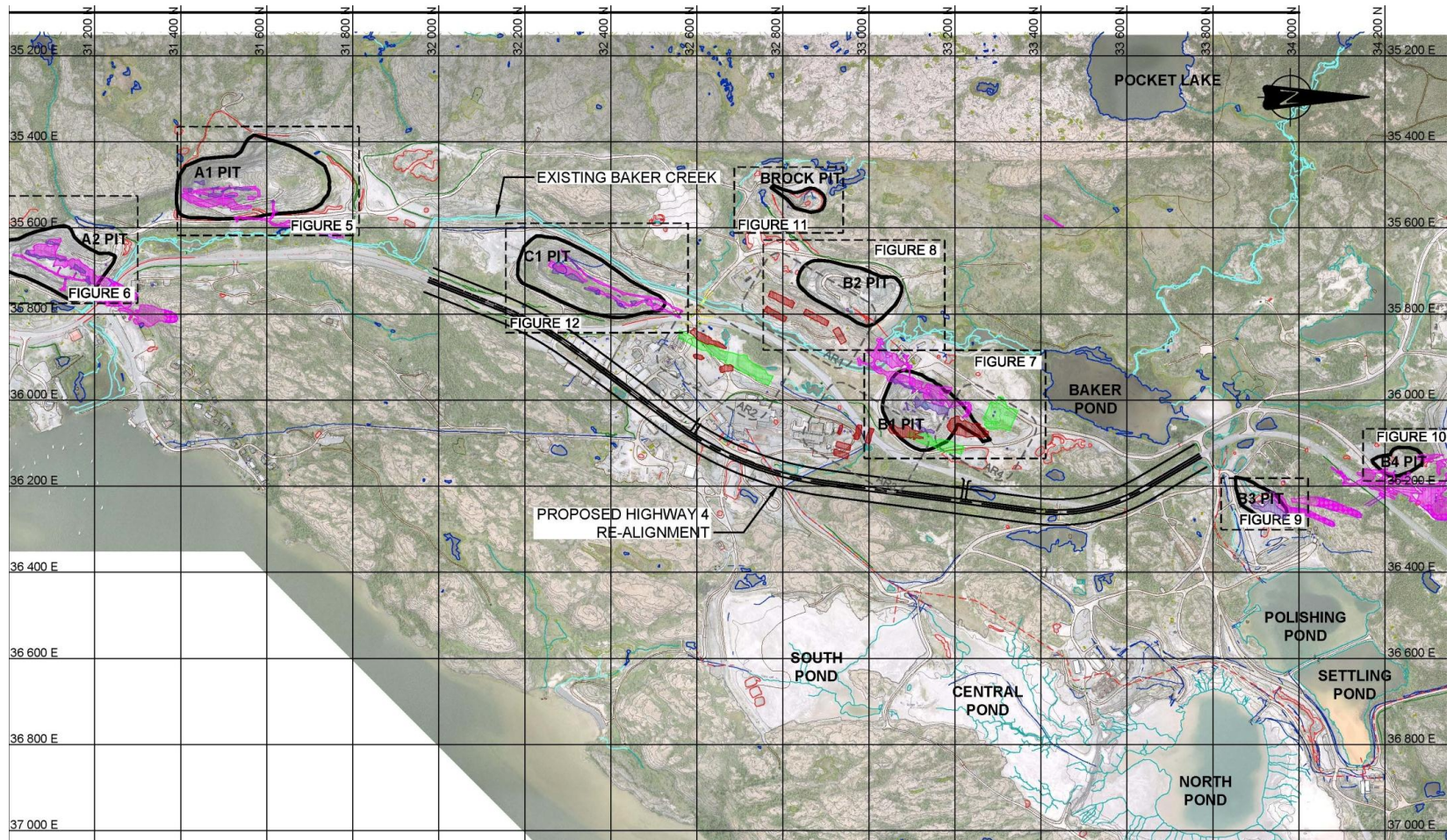
- Increase physical stability.
- Reduce flood risk to mine.
- Consider stakeholder input to Baker Creek options.

OPEN PITS

Remediation activities will improve public safety.



OPEN PIT LOCATIONS



OPEN PIT RISK REMEDIATION PLAN

- Minimizing risk to:
 - public health and safety by restricting access to pits;
 - the environment; and
 - sensitive and critical infrastructure near pits.
- Accomplished by standard Canadian practices:
 - Limiting or restricting public access to the open pits
 - Fencing and/or berms
 - Placement of appropriate signage
 - Backfilling of specific open pits, or portions thereof where necessary, to enhance longer term stability and manage drainage and assist the freeze program.
 - Capping openings to surface.

OPEN PIT REMEDIATION WILL:

- Increase public safety
- Restrict public access
- Freeze contaminated soil in B-1 pit

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TAILINGS WILL BE COVERED

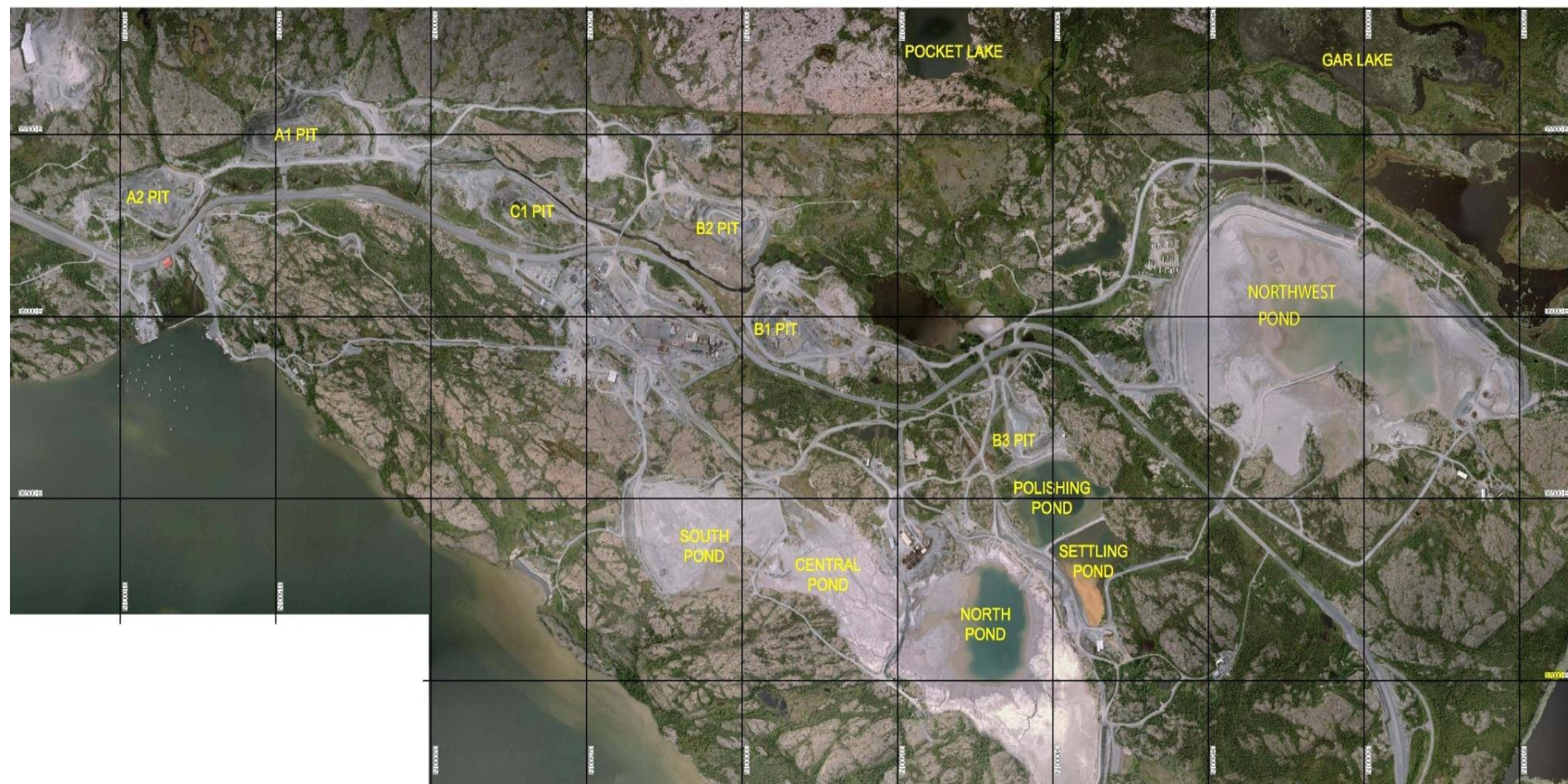


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SITE PLAN



REMEDIATION WILL:

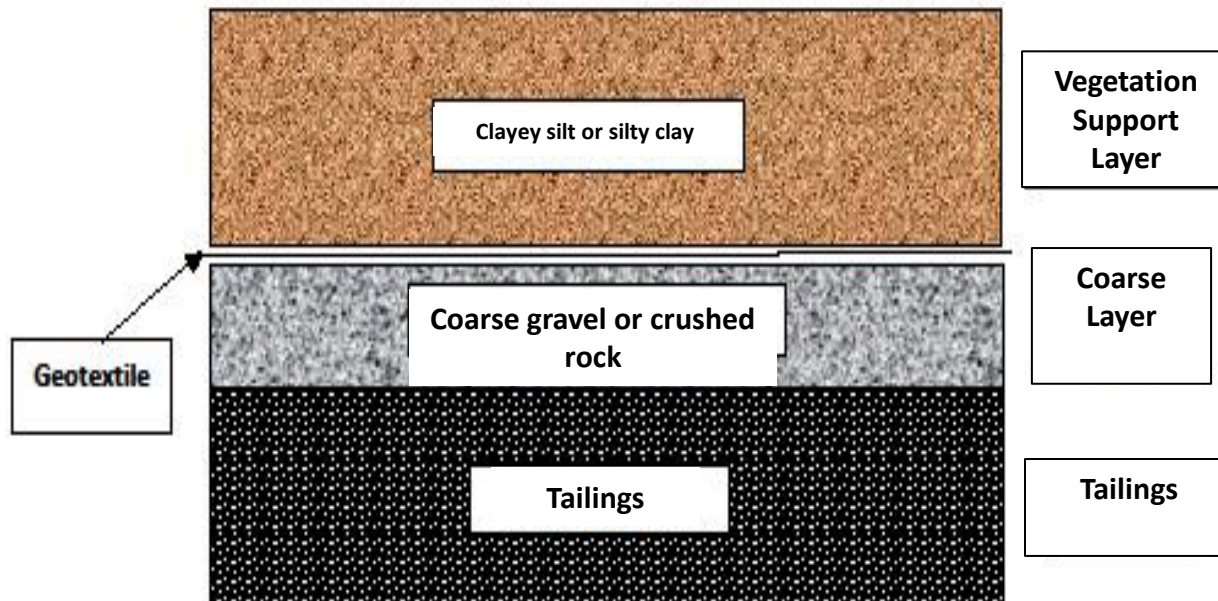
- Isolate tailings from contact with humans and wildlife.
- Allow potential future uses of the areas and these uses would be discussed with stakeholders.
- Use borrow sources on site.
- Address historic foreshore tailings.

POTENTIAL BORROW SOURCES ON SITE, LIMITING IMPACT OF PROJECT TO MINE LEASE AREA

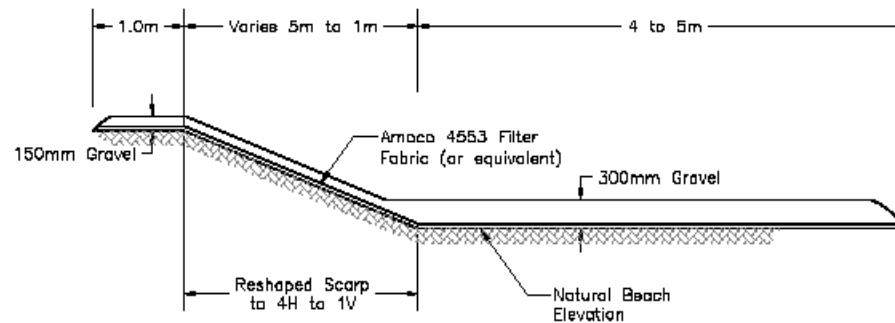


TAILINGS COVER

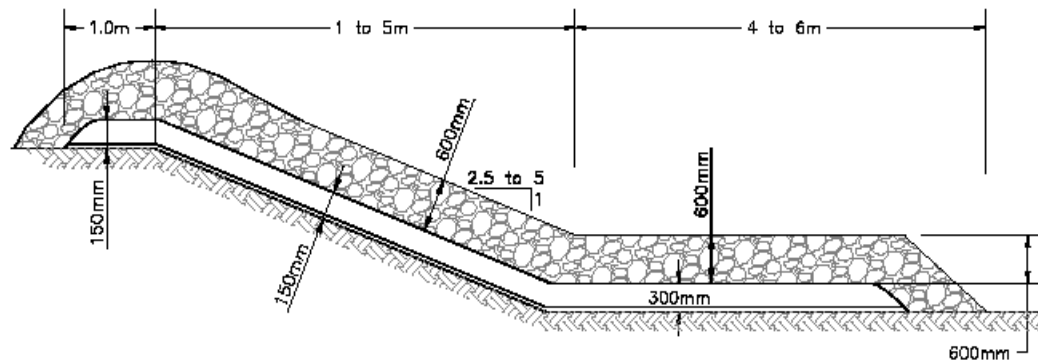
- Vegetative growth layer developed from on site borrow
- Coarse layer constructed from rock from on-site quarries
- Tailings surface will be re-graded prior to placing cover



EROSION PROTECTION TO FORESHORE TAILINGS



**TYPICAL CROSS SECTION
GRAVEL AND FILTER LAYER**
NOT TO SCALE



**TYPICAL CROSS SECTION
RIP RAP PLACEMENT**
NOT TO SCALE

TAILINGS REMEDIATION WILL

- Isolate tailings from direct contact by humans and wildlife.
- Make area available for other uses – the end-use to be determined with input from stakeholders (e.g. YKDFN, GNWT, City)

CONTAMINATED SOILS AND MINE WASTE ROCK

Allows for future uses of the site which will be discussed with stakeholders.



GNWT INDUSTRIAL STANDARD

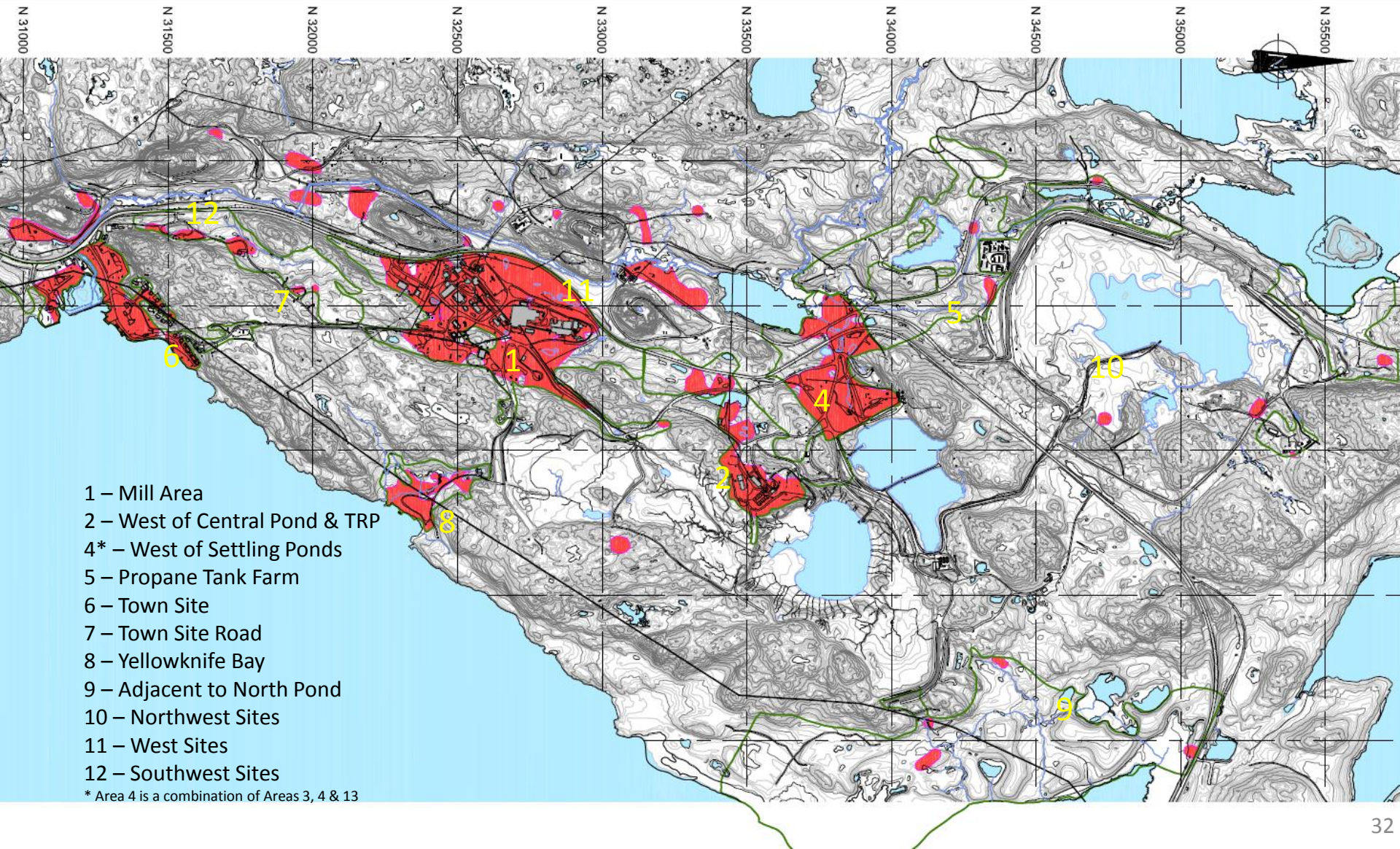
- Remediate overall site to GNNT industrial standards
- Backfill soils into frozen zone in B1 Pit
- Improve quality of the site surface conditions



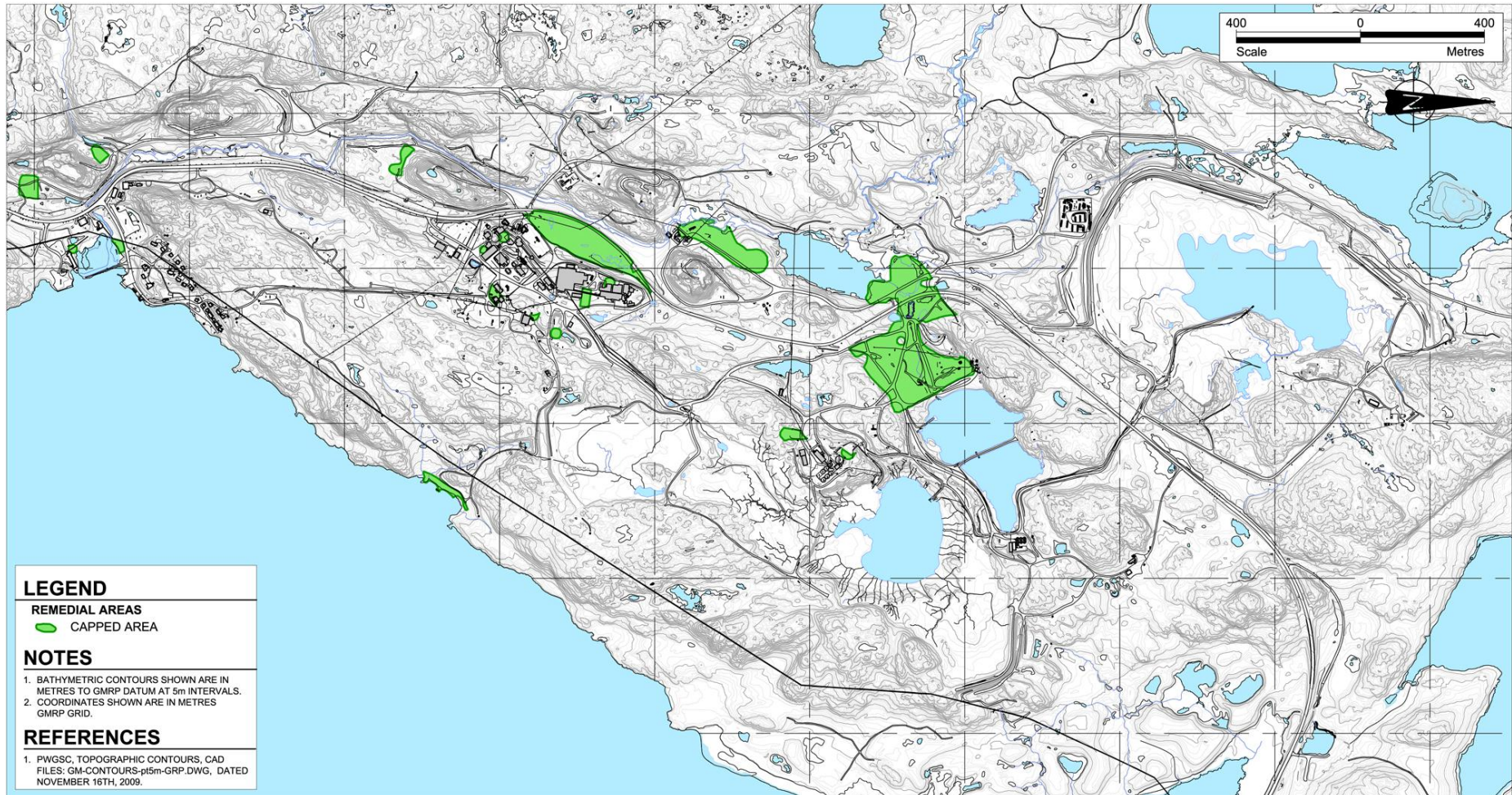
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REDUCED FOOTPRINT



OPPORTUNITIES FOR RE-USE OF MATERIAL

- Incorporate as fill to support Tailings Containment Area (TCA) cover.
- Place in B1 Pit.
- Use as intermediate cover in landfill.

REMEDIATION WILL

- Remove contaminated soil and waste rock with arsenic above the GNWT industrial standard (up to 2m depth).
- Cover any remaining contaminated soil greater than 2m depth.
- Resulting arsenic levels on surface will be low enough to support:
 - industrial uses everywhere
 - other uses in most places.

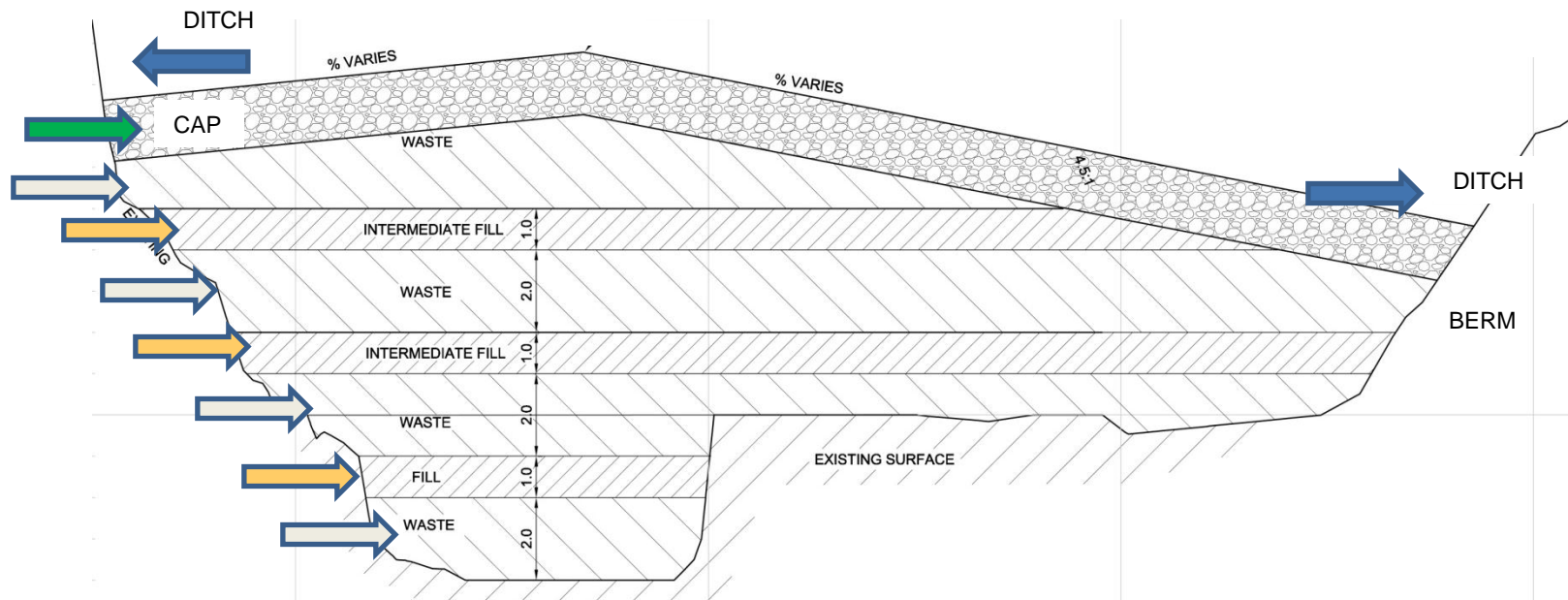
DEMOLITION OF MINE INFRASTRUCTURE ELIMINATES SITE HAZARDS

- Engage interested parties to preserve historic buildings where possible
- Recover hazardous building materials located in structures and underground
- Demolish all structures and utility lines with no future use
- Decontaminate materials prior to disposal offsite or in on-site landfill
- Collect all surface debris



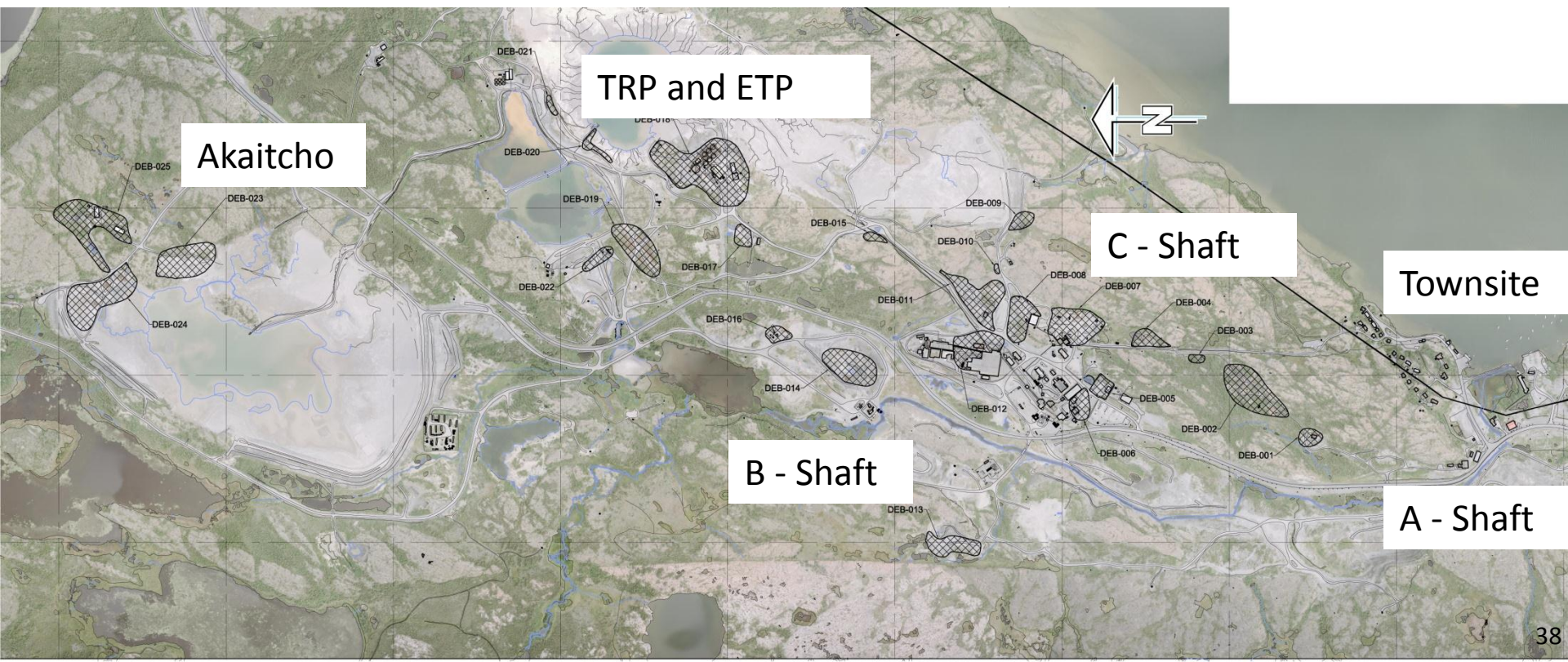
MANAGING WASTE

- Construction of a waste disposal facility (on site landfill)
 - Onsite disposal of all non-hazardous and asbestos materials
 - Re-use mine waste rock for intermediate fill
 - Water treatment plant sludge disposal in dedicated cell
- Roaster complex and other arsenic trioxide wastes will be placed in frozen block in B1 pit and underground.



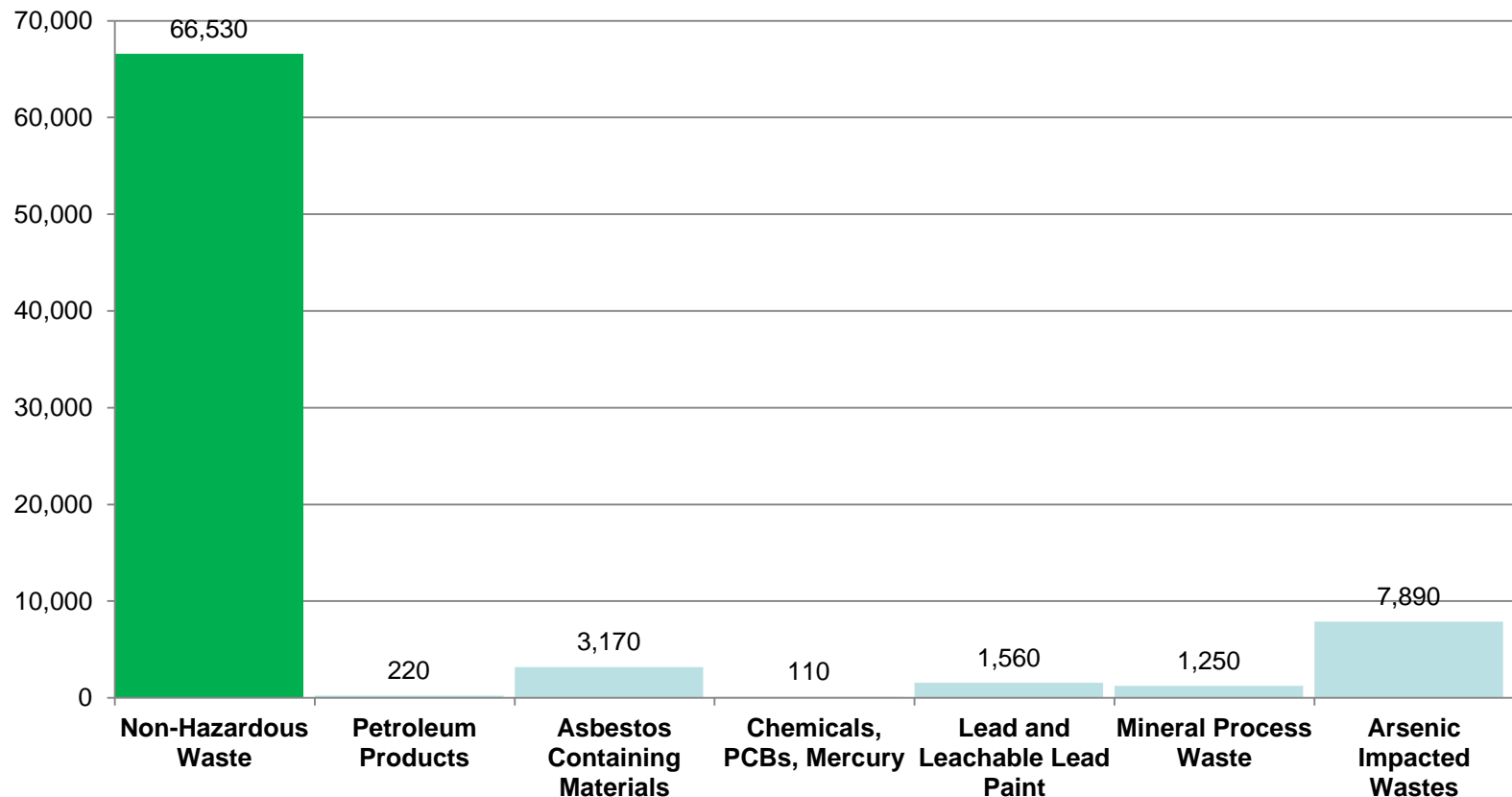
ELIMINATE PHYSICAL HAZARDS IN SCATTERED AREAS

23 identified surface debris areas



NON-HAZARDOUS WASTE MAJORITY OF SURFACE DEBRIS

Summary of Waste Generated during Building Deconstruction (m³)



ON AND OFF SITE WASTE MANAGEMENT

Waste Type	Location
Non-hazardous	On-Site - Engineered Landfill, Central Pond
Asbestos	On-Site - Engineered Landfill
Semi Processed Ores from Crusher, Conveyor and Mill Buildings	On-Site – Tailings Pond
PCB/Chemicals/Petroleum Products	Off-Site - Approved Facility
Leachable Lead Painted Materials	Off-Site - Approved Facility
Arsenic Trioxide Dust	Frozen Block
New Water Treatment Plant Sludge	On-Site landfill

CURRENT DESIGN CONCEPT FOR LANDFILL



ROASTER COMPLEX DEMOLITION - PROTECT HUMAN HEALTH AND SAFETY

- Risks
 - Exposed arsenic trioxide in flues and loose asbestos
 - Observed movement in flue support columns
 - Corrosion and openings in roaster building
- Planning
 - Specifications under development to be ready to mitigate the risks

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HIGH RISK ROASTER COMPLEX – ACCELERATED DEMOLITION



DEMOLISHING MINE INFRASTRUCTURE WILL:

- Eliminate physical and chemical risks.
- Increase public safety.
- Result in no adverse impacts through long-term management of demolition wastes.

AIR QUALITY ASSESSMENT

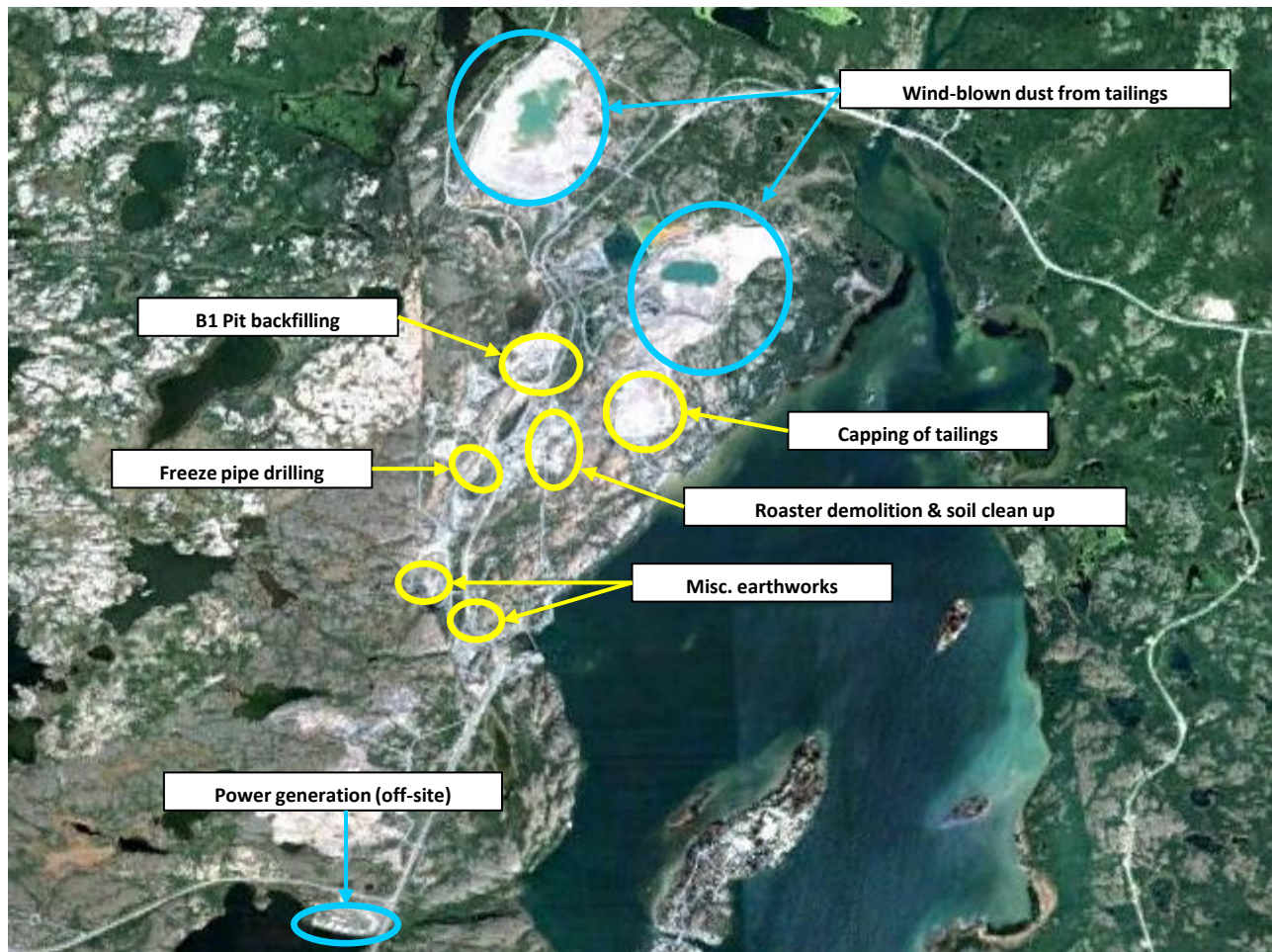
IMPROVEMENTS TO AIR QUALITY

- Air quality after remediation improved and sources of tailings dust eliminated.
- Main effects on Air Quality will occur during remediation phase (short-term).
- Mitigative measures in place.

AIR QUALITY ASSESSMENT

- Detailed assessment on Project effects on Air Quality was undertaken using CALPUFF/CALMET modelling package.
- Assessment of air quality included multiple sources:
 - remediation activities occurring at the same time at several locations; plus
 - Jackfish Power Plant operating at 18 MW output year round (3 MW for GMRP; 15 MW for City).

SOURCES IN AIR QUALITY ASSESSMENT



EMISSION SOURCES

- Haul truck & equipment movement
- Material handling
- Windblown dust

to air

TSP, PM₁₀, PM_{2.5},
As

- Haul truck & equipment tailpipe exhaust
- Jackfish Power Plant

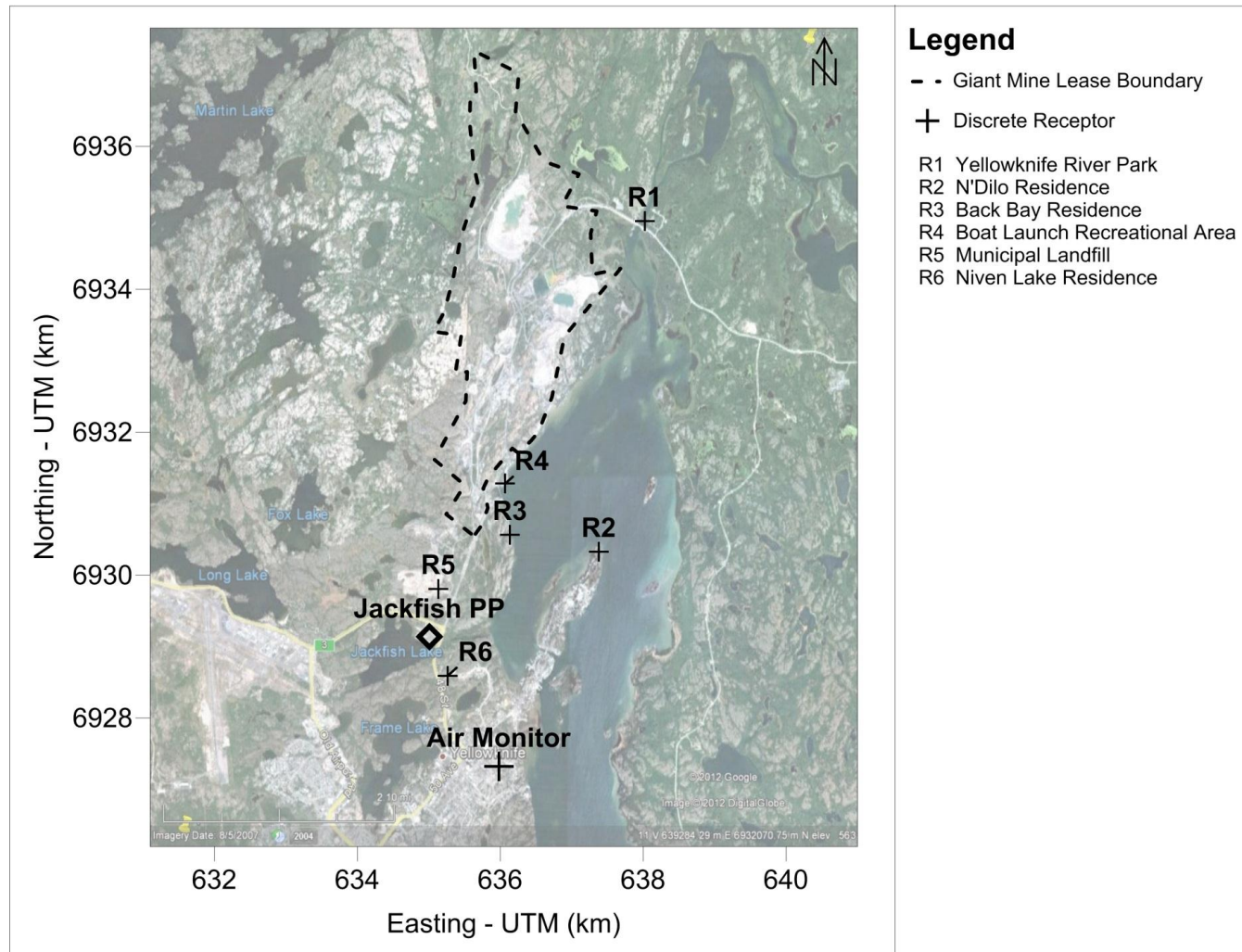
to air

NO_x, SO₂, PM_{2.5}

PUBLIC EXPOSURE ON/OFF SITE

- Model was run in hourly time steps using meteorological data from 2007.
- Model was run:
 - with six discrete Off-site Receptor locations; and
 - for hikers on the existing Ingraham Trail alignment through the Giant Mine site.
- Predicted contaminant levels were compared to Ambient Air Quality Criteria (AAQC).

OFF-SITE RECEPTOR LOCATIONS



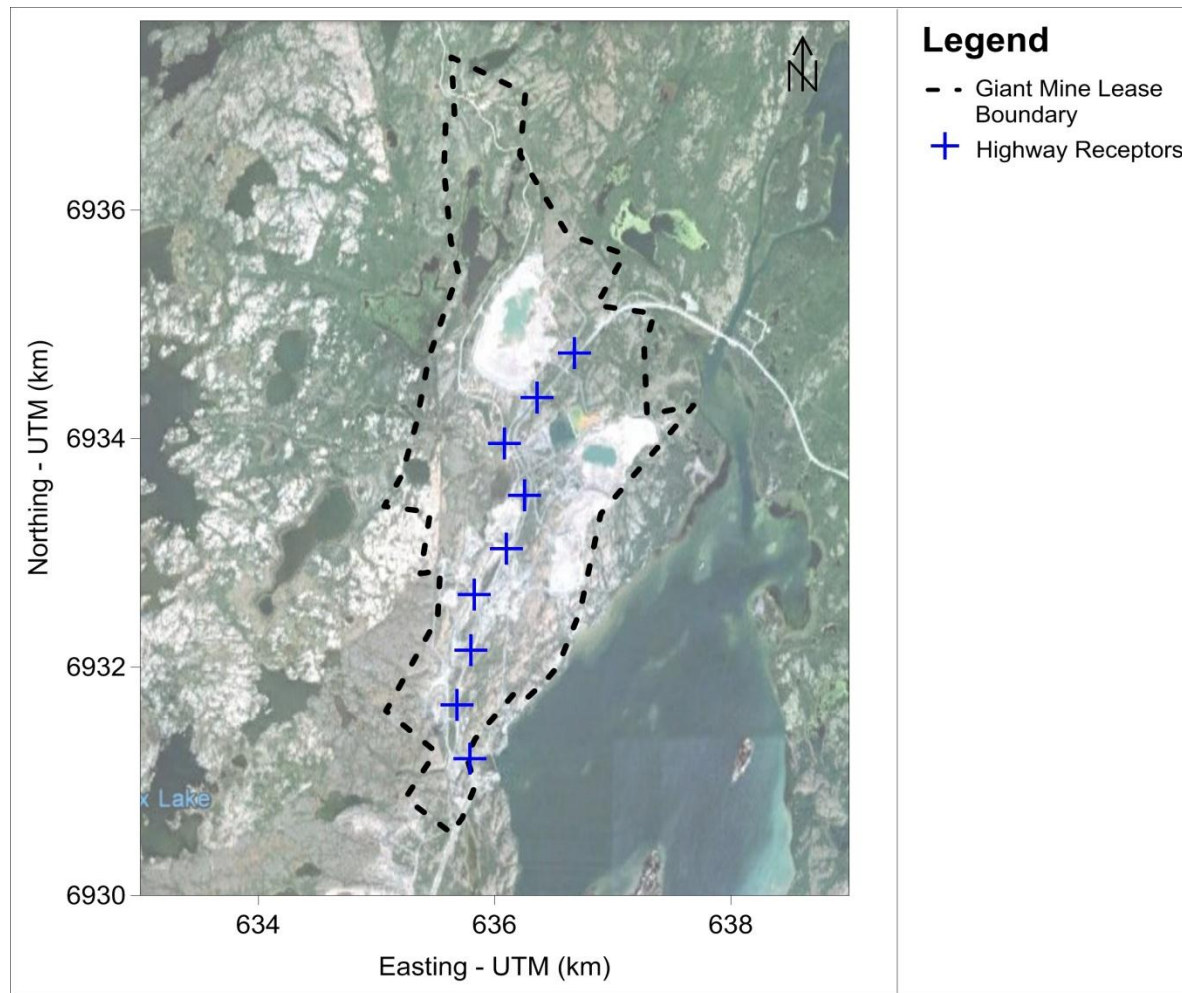
FINDINGS AT OFF-SITE RECEPTORS

- Low compared to Canadian guidelines
 - No exceedances of Ambient Air Quality Criteria (AAQC) were predicted for TSP, PM₁₀, As, and SO₂ at any of the receptor locations.
 - Very low probability of exceeding the one-hour NO₂ and 24-hour PM_{2.5} AAQC at the R6 (Niven Lake) receptor location only at the maximum rate of power output from Jackfish Power Plant of 18 MW.
 - At the typical operating rate of 12 MW of the Jackfish Power Plant, no exceedances of AAQC were predicted at any of the receptor locations.

MONITORING AND MITIGATION

- GNWT has provided GMRP modelling results to the NWT Power Corporation and are discussing options to mitigate potential exceedances and if necessary, monitoring
- Mitigation measures, such as reducing power requirements for the GMRP, can be implemented during peak power demand periods

HIKER EXPOSURE ALONG INGRAHAM TRAIL



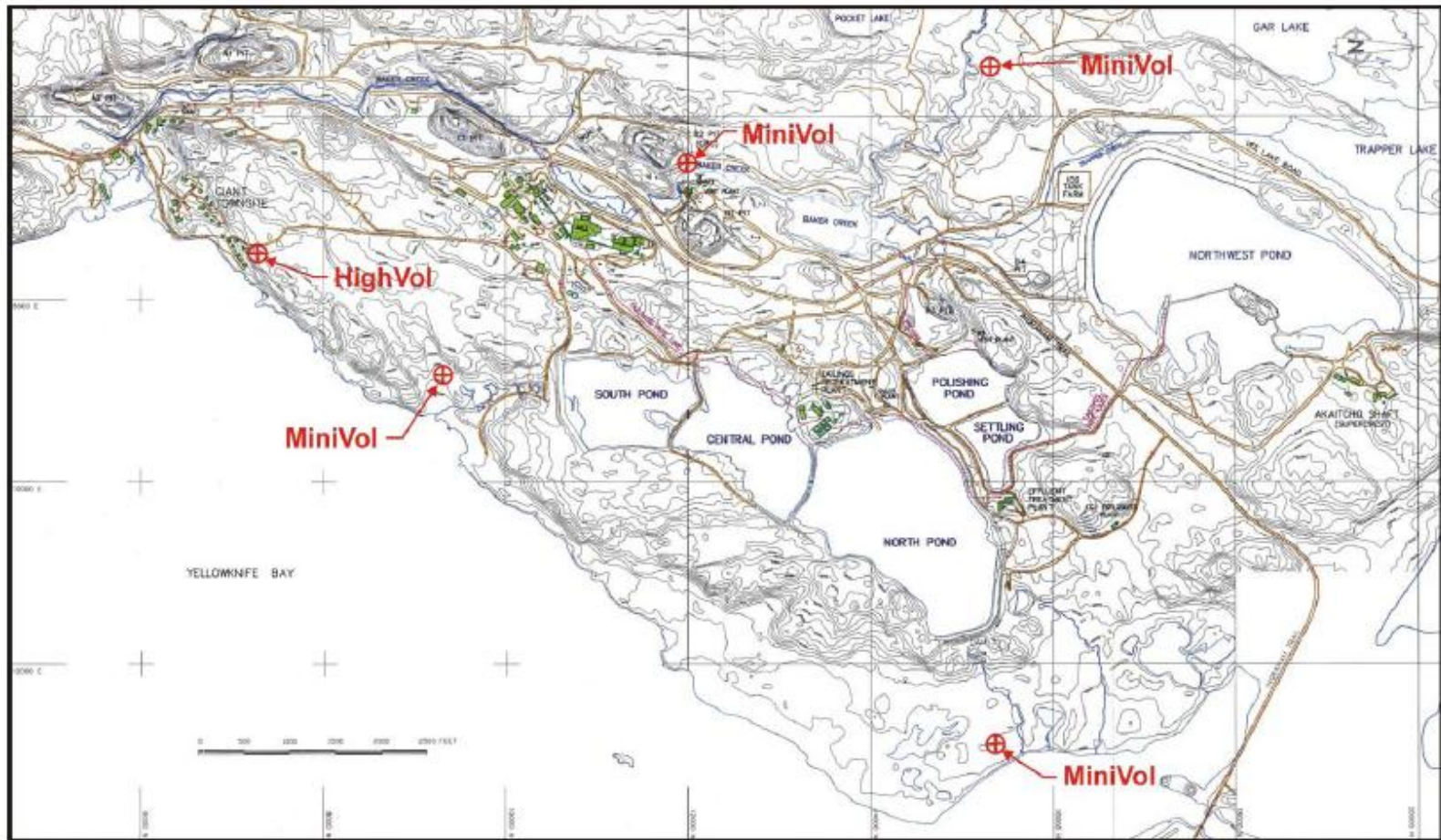
FINDINGS FOR HIKER ON INGRAHAM TRAIL

- Low compared to published guidance in the open literature:
 - PM_{2.5} exposure predicted to fall consistently below the incremental exposure criterion;
 - Very low probability of exceeding the Arsenic exposure criterion for non-carcinogenic effects under high wind conditions; and
 - can be mitigated by suspension of remediation activities, as per normal practice
 - Arsenic exposure consistently below the carcinogenic benchmark under all modeled conditions.

AIR QUALITY MONITORING

- Air quality monitoring of TSP and metals has been in place at the Giant Mine since 2004. Ambient air quality monitoring is also performed by the GNWT in Yellowknife.
- The existing air quality monitoring program will be modified and incorporated into an Air Quality Environmental Management Plan (EMP) prior to remediation.
- Air Quality EMP will identify action levels that trigger additional management actions, if required.
- Site-wide air quality monitoring will be continued until surface remediation activities are complete and for three years thereafter.

PROPOSED AIR QUALITY MONITORING STATIONS



AIR QUALITY DURING REMEDIATION ACTIVITIES

- Pose minimal risks to the public in the Yellowknife study area (off site)
- Pose minimal risks to members of the public while hiking or biking on Ingraham Trail (on site)

AIR QUALITY POST REMEDIATION

- Air quality will be improved by eliminating dust from tailings and other sources