

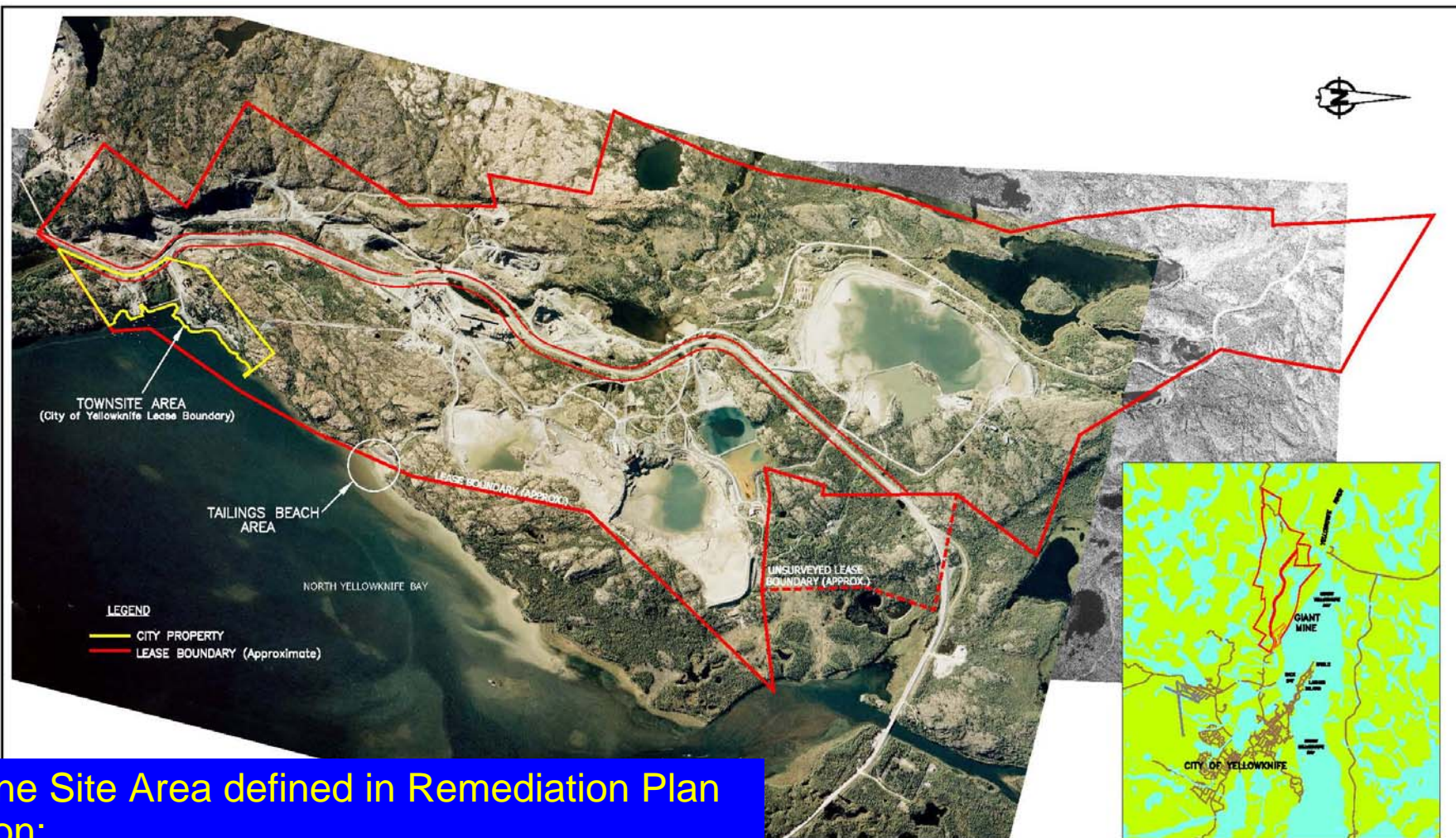


Giant Mine Remediation Project

Giant Mine Joint Interim Remediation Project Office



- Giant Mine History
 - Operated from 1948 - 2004
 - 7.6 million ounces gold
 - Processing of gold ore by roasting resulted in 237,000 tonnes arsenic trioxide dust now stored underground
 - Arsenic contamination on surface
- 1999 - Royal Oak assigned into Receivership – transferred through INAC to Miramar Giant Mine Ltd.
- 2005 - Miramar Giant Mine Ltd. assigned into bankruptcy
- Royal Oak Lease area now under the care of INAC/PWGSC
- Mineral rights withdrawn
- Surface lands administered by GNWT, MACA





Mine Site Area defined in Remediation Plan is on:

- NWT Commissioner's Land
- Within Yellowknife City Limits
- Includes Town Site
- Traditional Akaitcho lands
- TliCho Monfwi economic measures

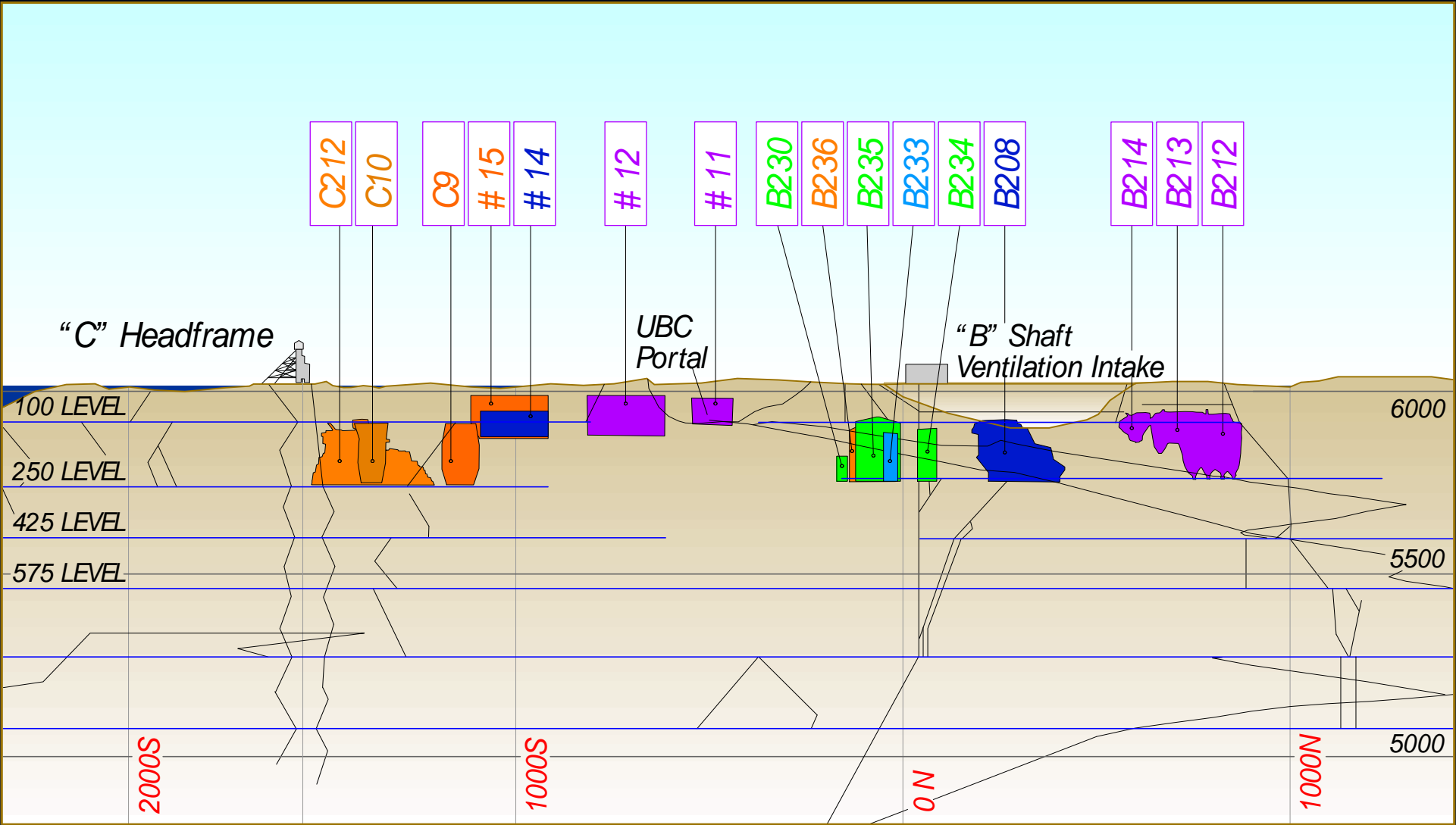
 SRK Consulting <i>Engineers and Scientists</i>		Giant Mine Remediation Plan			
		Site Location			
 Indian and Northern Affairs Canada	PROJECT NO. 1C1001.013	DATE Jan. 2006	APPROVED MDR	FIGURE 1.1.1	



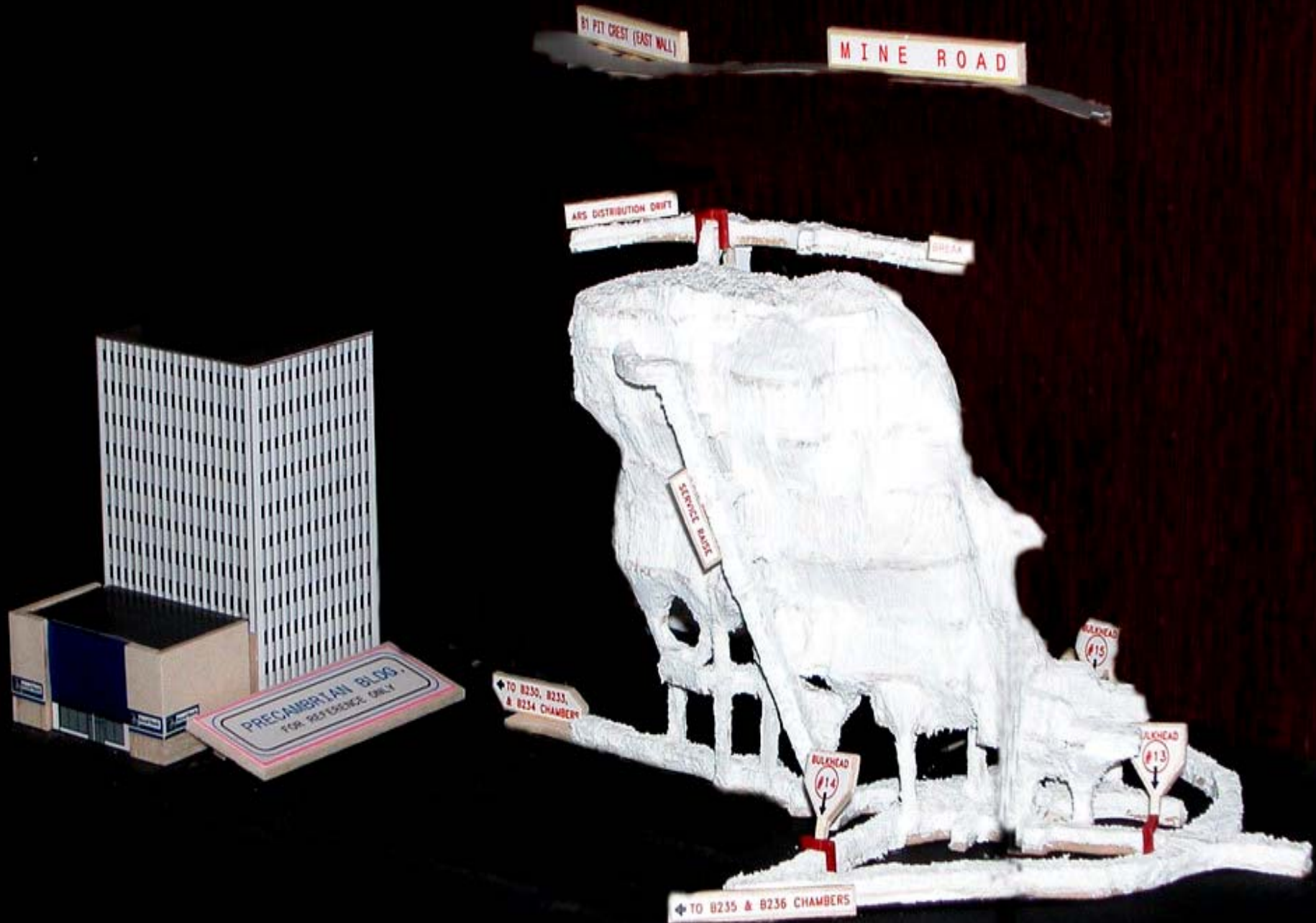
Giant Mine Looking North

Photo Credit
Paul Vecsei

Arsenic trioxide dust in underground storage is enclosed completely in rock – all access drifts sealed by cement bulkheads



Arsenic Chambers Long Section: 10 Chambers & 5 Stopes



Interim Activities



Necessary Interim Activities at the Site

- Abandoned site with environmental concerns and physical hazards that must be managed through interim activities
- Can not allow sub-surface to flood because of arsenic trioxide dust in underground storage because of environmental concerns (Current Remediation Plan could not be implemented)



Necessary Interim Activities

Main Components

- Water management:
 - Pumping mine water
 - Surface contaminated water collection systems
 - Maintenance of pumps/piping and underground access
 - Seasonal operation of Effluent Treatment Plant
- Maintenance of underground and surface infrastructure
 - Heating systems
 - Mine Ventilation Systems
 - Electrical distribution systems
 - Surface and underground mine equipment maintenance
 - General site housekeeping
 - Miscellaneous repair
- Seasonal application of dust suppressant on tailings and roads
- Site Security
- Bulkhead inspections
- Annual geotechnical inspections of dams
- Inspections and required work under NWT Mine Health and Safety Act
- Sampling and reporting in compliance with Metal Mining Effluent Regulations of Fisheries Act



Necessary Interim Activities - Recommended additional investigation and optimization work

- INAC considers it necessary to complete a freeze optimization task during EA:
 - Freeze modeling completed
 - Confirmation of modeling required from field test to elaborate and further inform EA
 - Will provide detailed information required for detailed engineering design
 - Address leakage of arsenic contaminated water and solids from chamber 14 at bulkhead 68
 - Avoid further delay in implementation of project



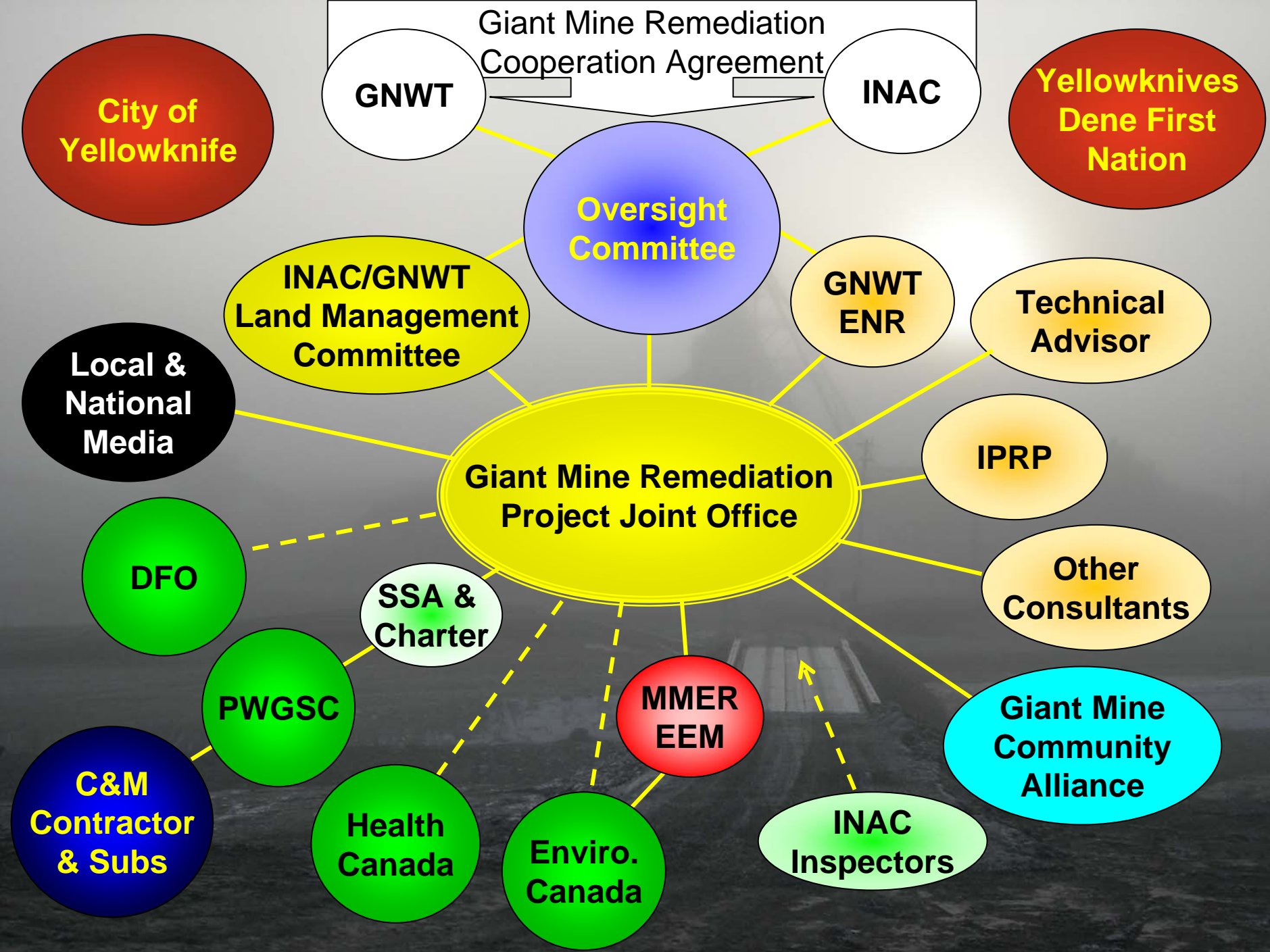
Project Team



Project Team

- Giant Mine Remediation Project Team was formed in 1999
- Team Responsibilities
 - Care and Maintenance of Giant Mine
 - Site Investigations
 - Manage development of arsenic trioxide management alternatives and remediation plan
- Canada and GNWT are co-proponents of Remediation Plan
 - Canada/GNWT Oversight committee provides guidance and advice to Project Team





Clarification of Roles - Responsible Minister

- INAC is Co-proponent of Giant Mine Remediation Project
- Unique position – MVRMA contemplates different roles
 - INAC Minister continues to be the federal Minister responsible for the Mackenzie Valley Resource Management Act (MVRMA)
 - INAC will not be an intervener as is normally the case when industry is the proponent of a development
 - Once the MVEIRB has submitted its EA report, the INAC Minister will take part in the decision making process as a responsible minister along with other responsible ministers (Ministers of DFO, EC and the GNWT Minister of ENR)
 - Type A Water License conditions will be made by the MVLWB and recommended to the Minister



Project Team – Technical Advisor and Consultants

Development of Arsenic Trioxide Management Alternatives and Remediation Plan

- Technical Advisor (since 2000)
 - Provide broad-based, neutral, technical advice on identification of preferred, long-term arsenic trioxide management plan
 - Group of companies chosen through a Canada wide competitive process
 - SRK Consulting Engineers and Scientists
 - Senes Consultants Limited
 - Lakefield Research
 - HG Engineering
- Some other companies have completed specific studies of the site:
 - Golder
 - Jacques Whitford
 - Deton'Cho Environmental Alliance
 - EBA Engineering
 - Dillon Consulting
 - Klohn Crippen
- All information from site studies has been used in the development of the Remediation Plan
- All studies are available in Giant Mine Remediation Project Public Registry

Independent Peer Review Panel

Formed by INAC in 2002 with suggestions from stakeholder communities and interested local public

Nine Recognized Experts

C. O. Brawner

Laurie H. M. Chan

Lawrence J. Connell

Steve Hrudehy

Jean-Marie Konrad

Robert E. Leech

M. A. J. (Fred) Matich

Craig Nowakowski

Kenneth G Raven

Areas of Expertise

Mining

Geotechnical

Mineral processing and environmental engineering

Toxicology

Permafrost and ground freezing

Geochemistry

Risk management and public health

Hydrogeology

Arsenic Trioxide Management Alternatives



Technical Advisor

Arsenic Trioxide Alternatives

- January 2000 – June 2003
 - History of arsenic trioxide production & storage
 - Investigations of dust and storage areas
 - Human Health and Ecological Risk Assessment (HHERA) for current and possible future releases
 - Assessed over 56 methods for managing the dust
 - Initial report with 17 supporting documents (May 2001)
- No walk-away solution
- Not possible to remediate the site to a pre-mining condition
- Requirement to manage existing condition of the site in the best way possible to protect human safety and the environment



Technical Advisor

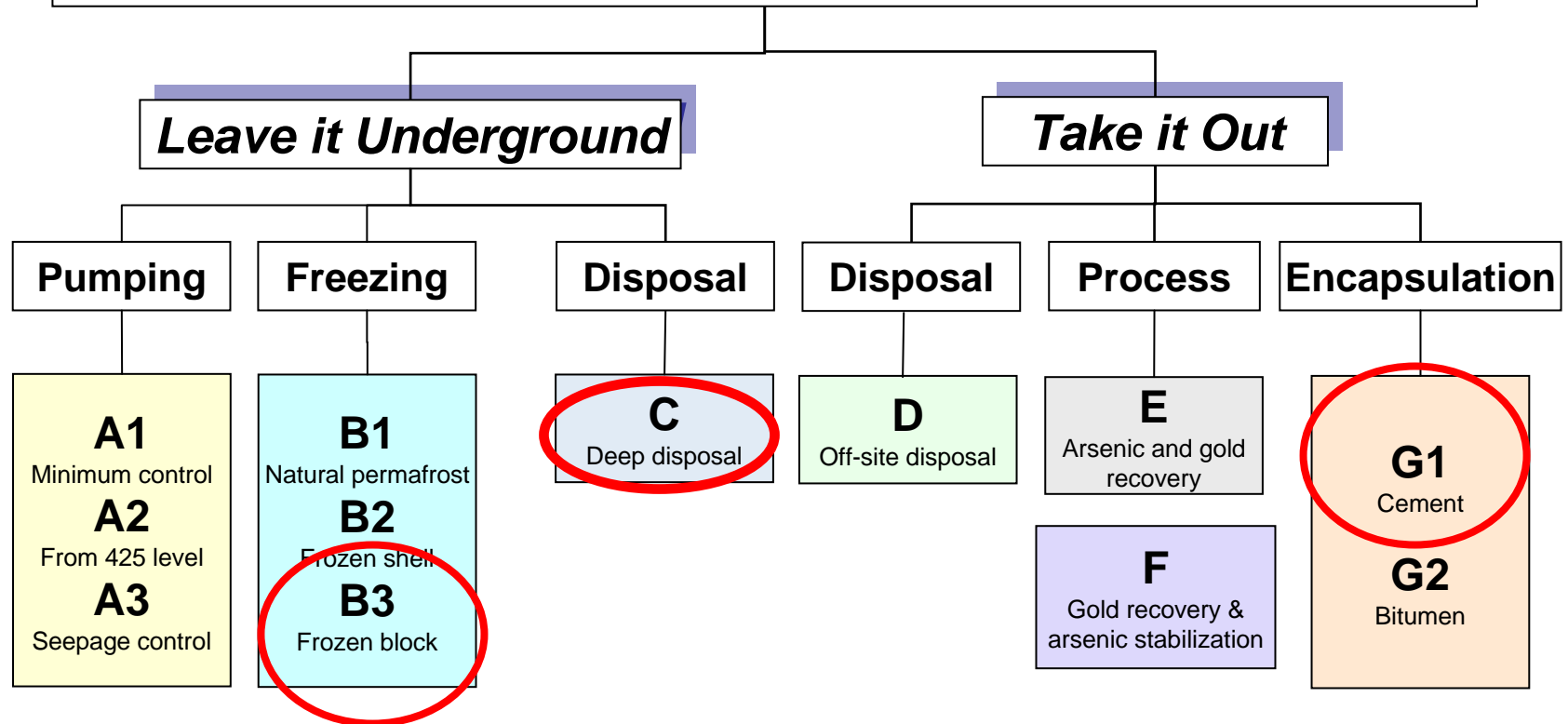
Arsenic Trioxide Alternatives

- Detailed assessment of 12 alternatives
- Comprehensive report with 19 supporting documents (December 2002)
- Independent Peer Review
- Recommended two options for public consideration



Alternatives A through G

Arsenic Trioxide Management Alternatives



Assessments of Risks

Alternative	Probability of Significant Arsenic Release		Worker Health & Safety Risk
	Short Term	Long Term	
A1. Water Treatment with Minimum Control	Low	High	Low
A2. Water Treatment with Drawdown	Low	Moderate	Low
A3. Water Treatment with Seepage Control	Low	Moderate	Low
B2. Frozen Shell	Very Low	Low	Low
B3. Frozen Block	Very Low	Low	Low
C. Deep Disposal	Low	Very Low	Moderate
D. Removal & Surface Disposal	High	Very Low	Moderate
F. Removal, Gold Recovery and Arsenic Stabilization	Moderate	Very Low	Moderate
G1. Removal & Cement Encapsulation	Moderate	Low	Moderate

Developing a Management Alternative for the Arsenic Trioxide Dust

- INAC held over 20 public sessions between January 2003 and another public workshop in May 2003
- At the May 2003 workshop, four Yellowknife MLA's read a statement giving support to "in situ" freeze option
- Many of attendees agreed and indicated that it was time to act
- Some attendees remained unconvinced that "in situ" is preferred option.
- Based on recommendations of Technical Advisor, IPRP and public input, INAC selected the in situ "Frozen Block" as the most appropriate long term management alternative (February 2004)



Giant Mine Remediation Plan



Giant Mine Remediation Plan



Indian and Northern
Affairs Canada



- Requirement to integrate underground and surface aspects of remediation
- Remediation Plan
 - Reviewed by IPRP January 2005
- Cooperation Agreement March 2005
- Complete draft Remediation Plan reviewed by:
 - GNWT
 - Federal Contaminated Sites Action Plan (FCSAP) expert federal departments
 - Health Canada
 - Environment Canada
 - Department of Fisheries and Oceans
- Final review of revised plan by:
 - IPRP – December 2005
 - GNWT March 2006
 - FCSAP expert departments and INAC Regional Directorates – May 2006



Public Engagement

- Details in Supporting Document P1
- Public Workshops to develop, evaluate and select preferred options for long term management of arsenic trioxide
- Focus Groups
- Information Sessions
- Mail out newsletters
- Information brochures
- Site Tours
 - underground and surface
- Giant Mine Community Alliance (9)
 - Regular meetings with project team
 - Open Houses



Site Tours



Impact of the Yellowknife Giant Gold Mine on the Yellowknives Dene

A Traditional Knowledge Report

Prepared by the Yellowknives Dene First Nation
Land and Environment Committee

Prepared for the Department of Indian and Northern Affairs
Giant Mine Remediation Project office
Yellowknife, Northwest Territories
October 13, 2005



Indian and Northern
Affairs Canada



Remediation Plan

- Main Report and 53 Supporting Documents
- Main Report
 - Introduction
 - Site History
 - Current Site Conditions
 - Current Environmental Conditions
 - Remediation Plan
 - Assessment of Post-Remediation Conditions
 - Monitoring
 - Implementation Schedule
 - References



Remediation Plan Supporting Documents submitted as part of Water Licence Application and also to MVEIRB

- A: Environmental Conditions - 11 reports
- B: Geochemical Characterization - 7 reports
- C: Hydrogeology – 6 reports
- D: Arsenic Trioxide Dust Chambers and Stopes – 2 reports
- E: Pit Stability - 2 reports
- F: Historic Foreshore Tailings – 3 reports
- G: Baker Creek – 3 reports
- H: Borrow Sources – 3 reports
- I: Surface Contamination Investigations – 2 reports
- J: Ground Freezing – 1 report
- K: Tailings and Sludge Remediation – 2 reports
- L: Water Treatment – 2 reports
- M: Supporting Calculations of Arsenic Release – 1 report
- N: Risk Assessment, Tier 2 Risk Assessment – 1 report
- P: Communications – 1 report
- Q: Project Implementation – 6 reports

Remediation Plan Elements

1. Underground

- 237,000 tonnes toxic arsenic trioxide dust stored in sealed rock chambers – in situ freezing (Frozen Block)

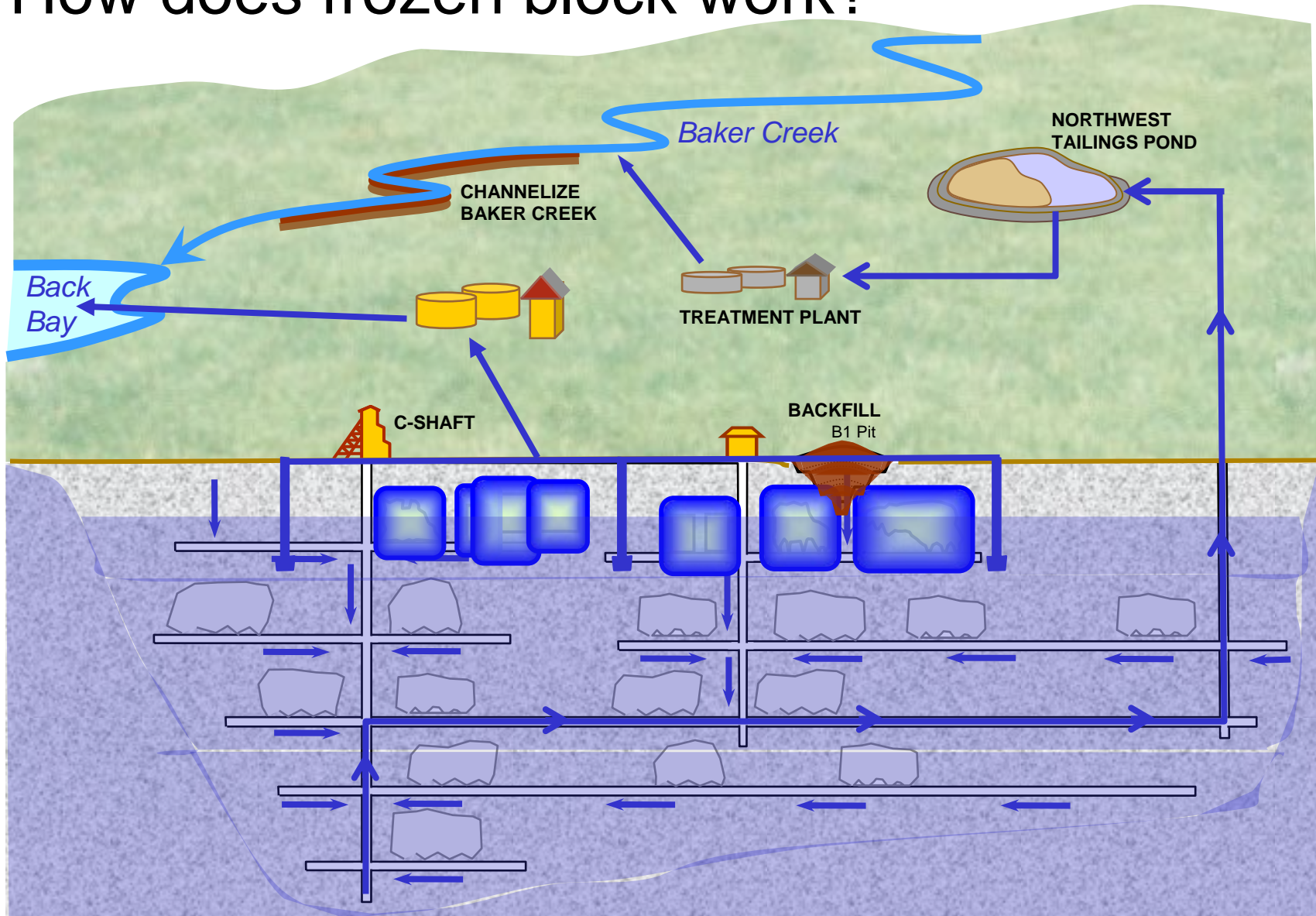
2. Surface

- Pits and Underground mine openings
- Tailings impoundments, sludge pond
- Contaminated surficial materials (arsenic and hydrocarbon)
- Contamination in Baker Creek and realignment
- Decaying mine infrastructure and buildings including those with severe arsenic contamination, asbestos insulation
- Construct new Water Treatment Plant

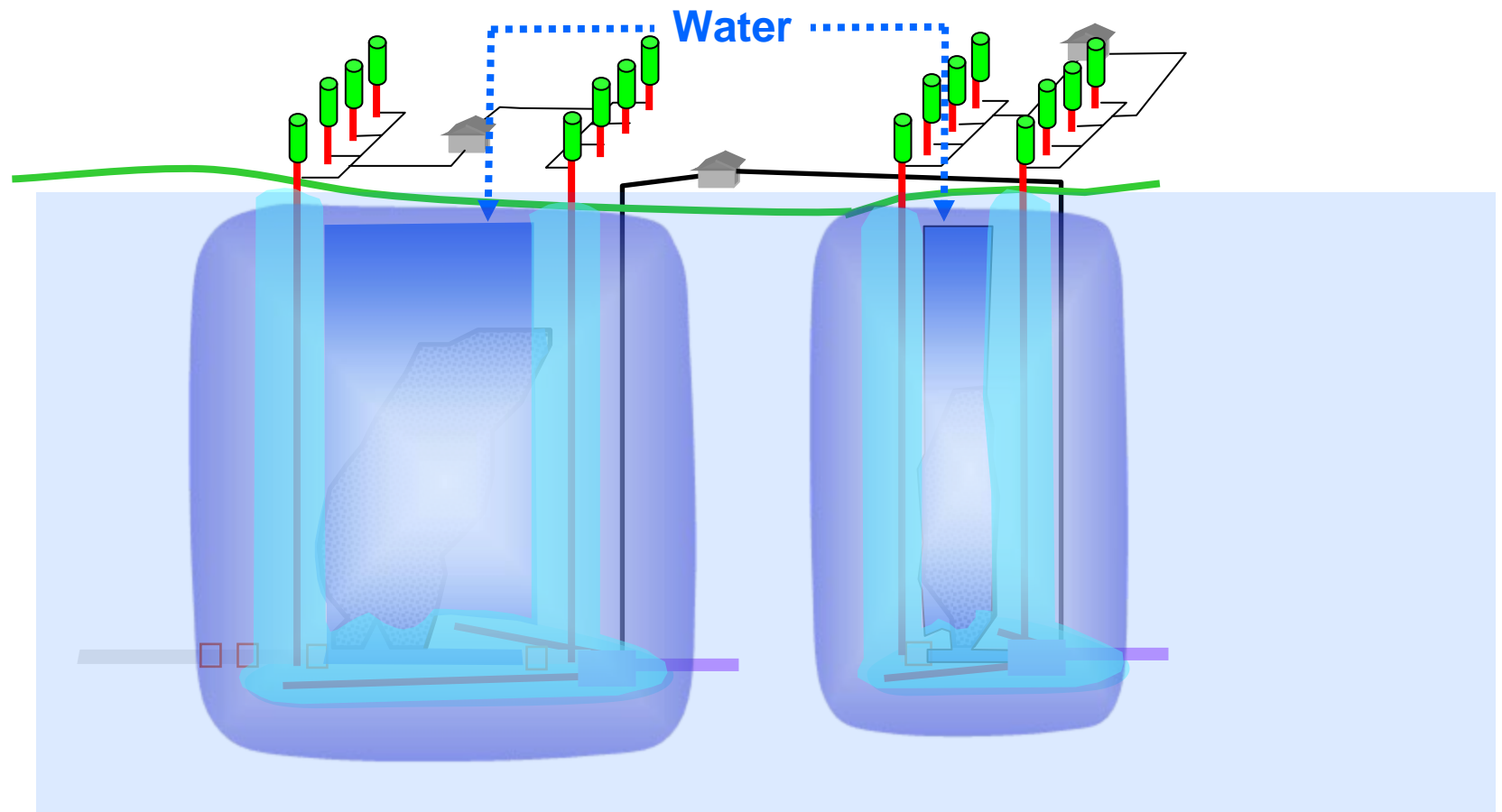
3. Monitoring and Long Term Water Treatment

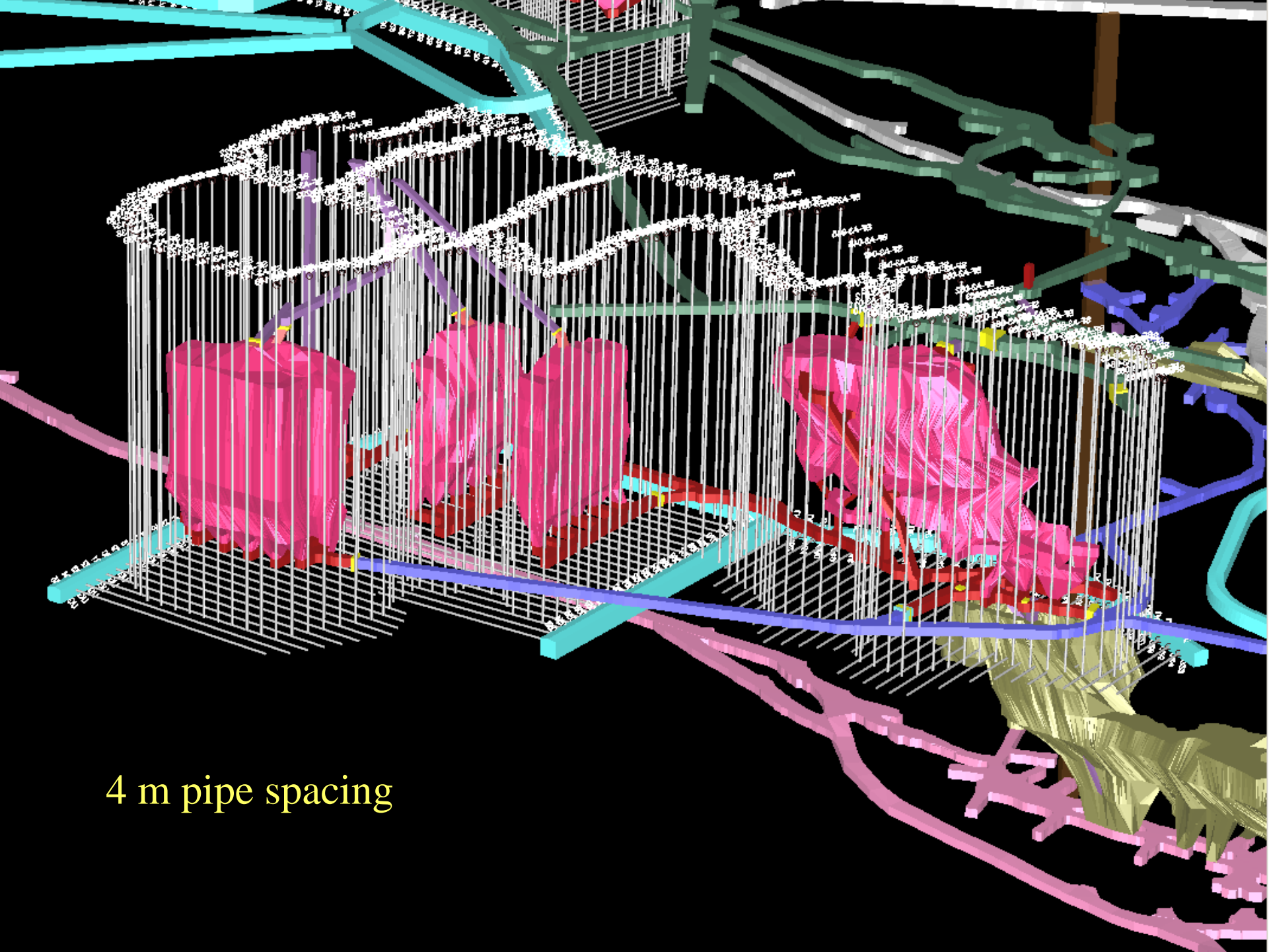
Remediation Plan Underground

How does frozen block work?



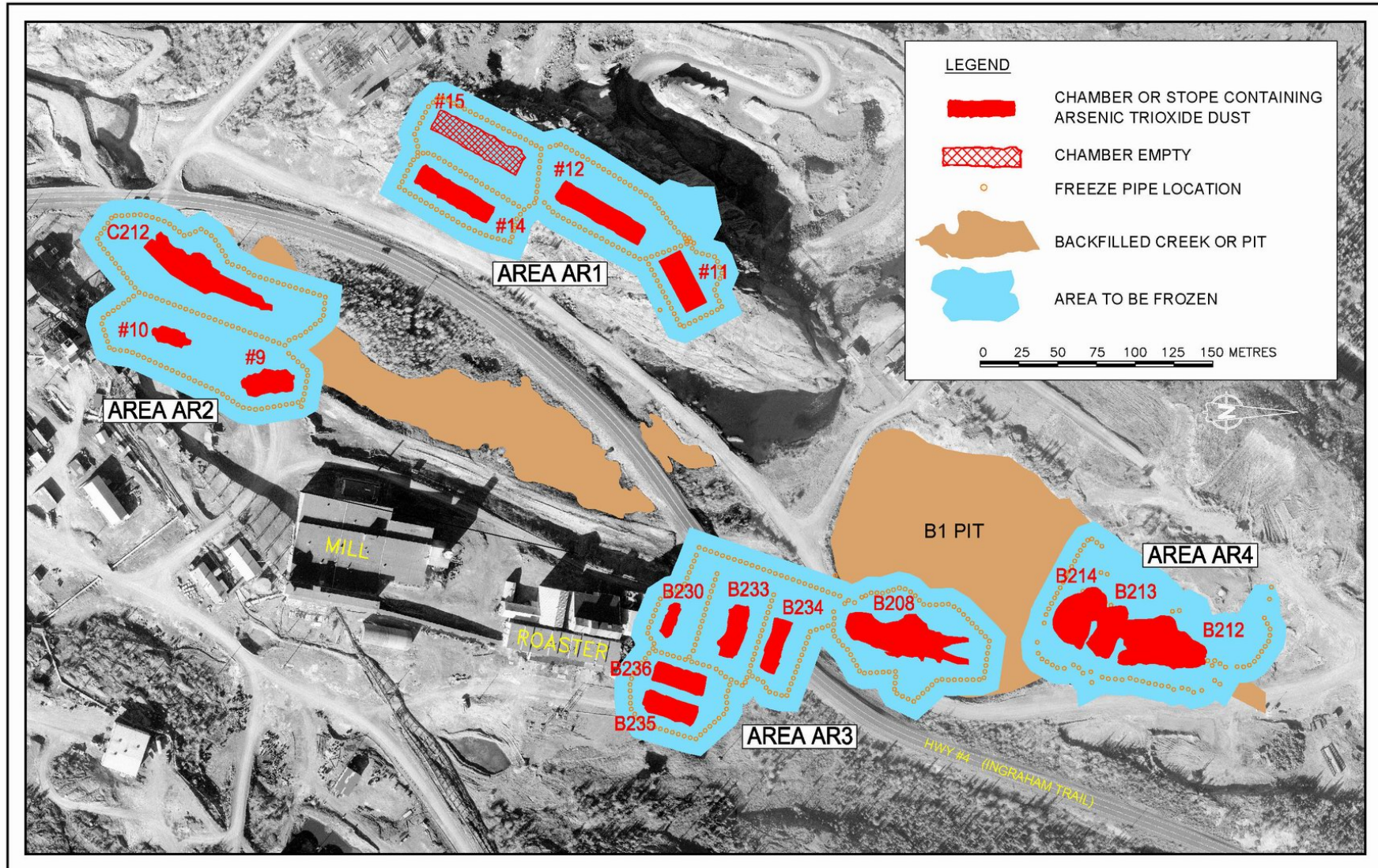
Freezing and Water Management Sequence





4 m pipe spacing

Four Separate Arsenic Trioxide Storage Areas to be Frozen



Thermal modeling of freezing and thawing

- Modeling of freezing and thawing takes into account climate change and models incorporate the warming predictions of the Intergovernmental Panel on Climate Change
- Here are a few examples of the modeling:

<C:\Documents and Settings\mitchellb\Desktop\freeze simulations\tAR3Ts2QbArSatLongPipeYr00to05by001.avi>

<C:\Documents and Settings\mitchellb\Desktop\freeze simulations\tAR3Ts2QbArSatYr05to25THERMOSYPHON.avi>

<C:\Documents and Settings\mitchellb\Desktop\freeze simulations\Ar3B230ArSatRockCalibThawNt2Yr15to65by001.avi>



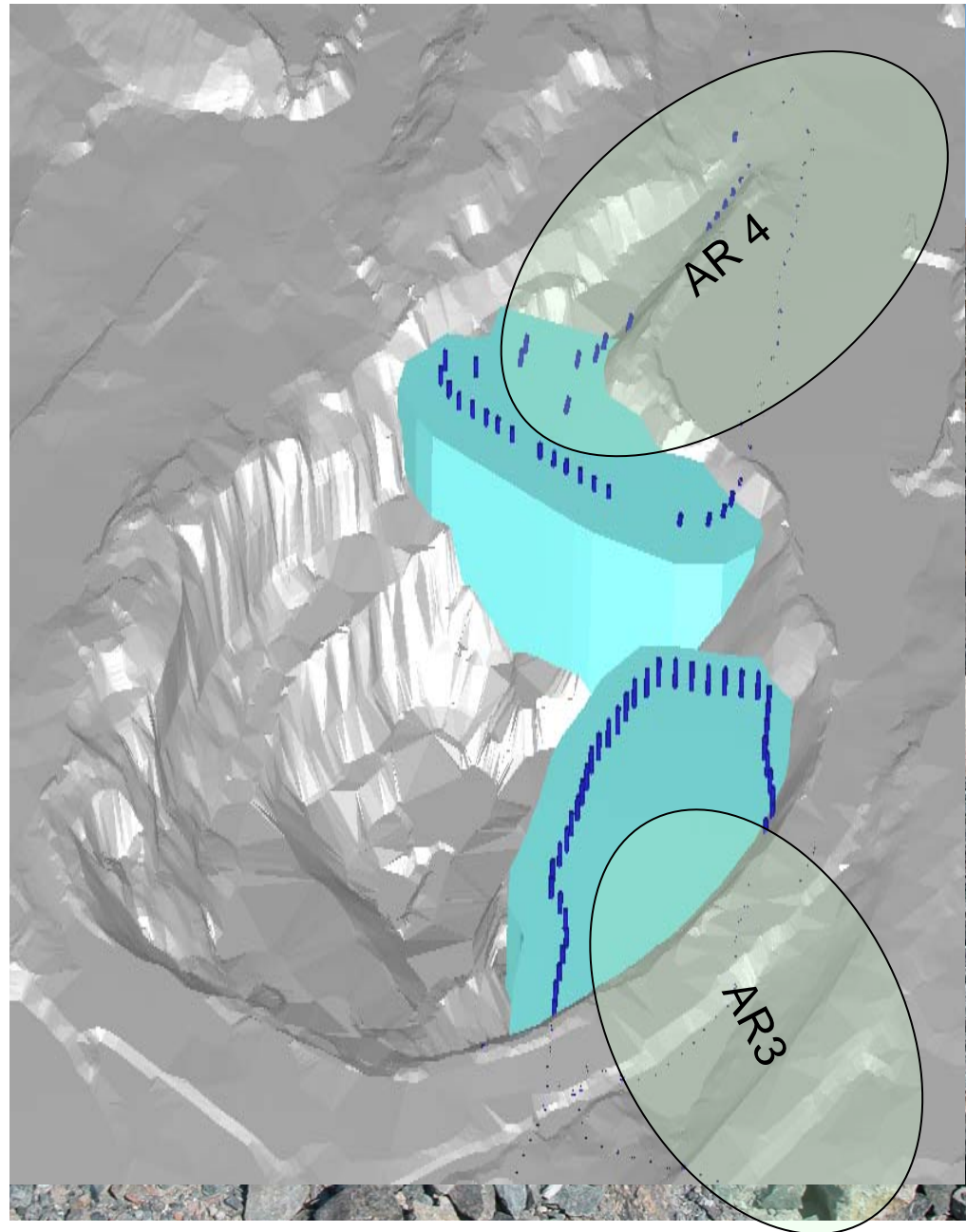


Giant Mine Remediation Plan - Surface
2002 Air Photograph



B1 Pit

- Requires backfill to construct drill platform for freezing AR3 & AR4 areas
- Platform - 60,000 m³ of contaminated surficial material, >340 mg/kg As to be frozen
- 330,000 m³ of fill needed to fill pit
- 270,000 m³ will consist of waste rock, quarry rock or clean demolition debris



Pits A-1, A-2 and C-1

- All three pits will remain open – bermed/fenced
- No source of fill material on the site without quarrying and causing added impacts



Tailings Containment Areas 95 hectares



NW Pond

North Pond

Central Pond

South Pond

Tailings Cover Design – 2 Layer

Bottom layer of broken rock has 4 functions:

1. Physical Barrier to prevent contact with the tailings by humans or animals
2. Prevents erosion (ATV's, Dirt Bikes)
3. Prevent upward wicking of arsenic salts through to cover
4. Helps prevent roots from penetrating tailings

Upper layer of locally available silt and silty clay will:

1. Act as clean surface to shed runoff
2. Allow vegetation to establish
3. Reduce water infiltration
4. Allow for future recreational and/or traditional use
5. Eliminate airborne tailings fines on windy days

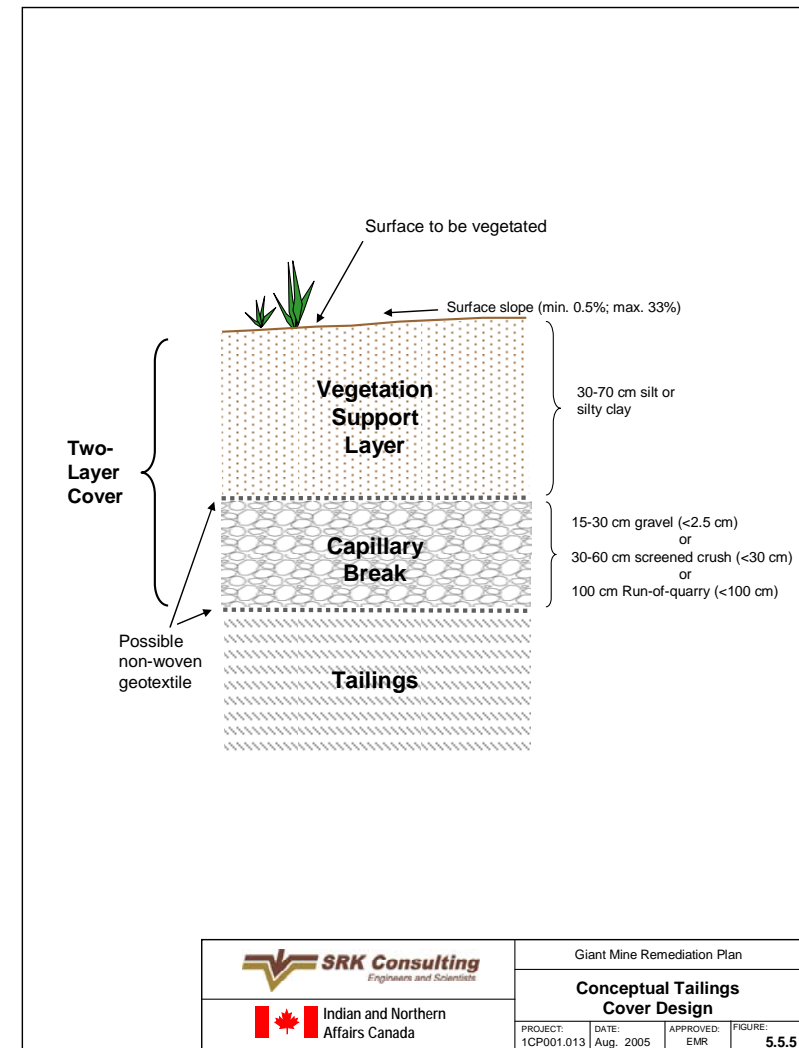


Fig 5.5.5_5.5.6-Conceptual Tailings Cover Design.ppt

Note:

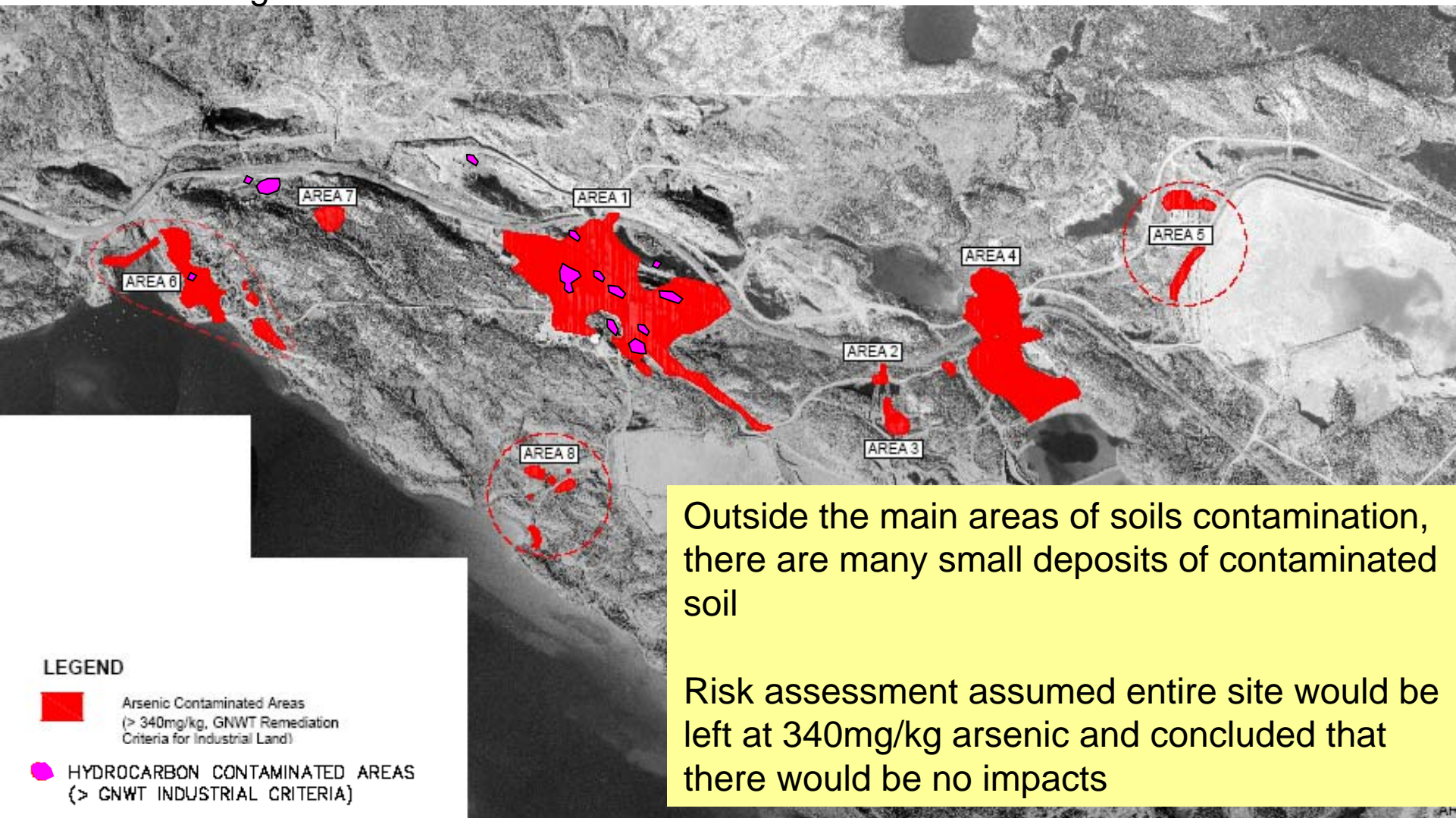
Minimizing infiltration is NOT a primary objective, but the two layer design will reduce infiltration

Contaminated Surface Materials

Site will be remediated to GNWT industrial standard - 340 mg/kg

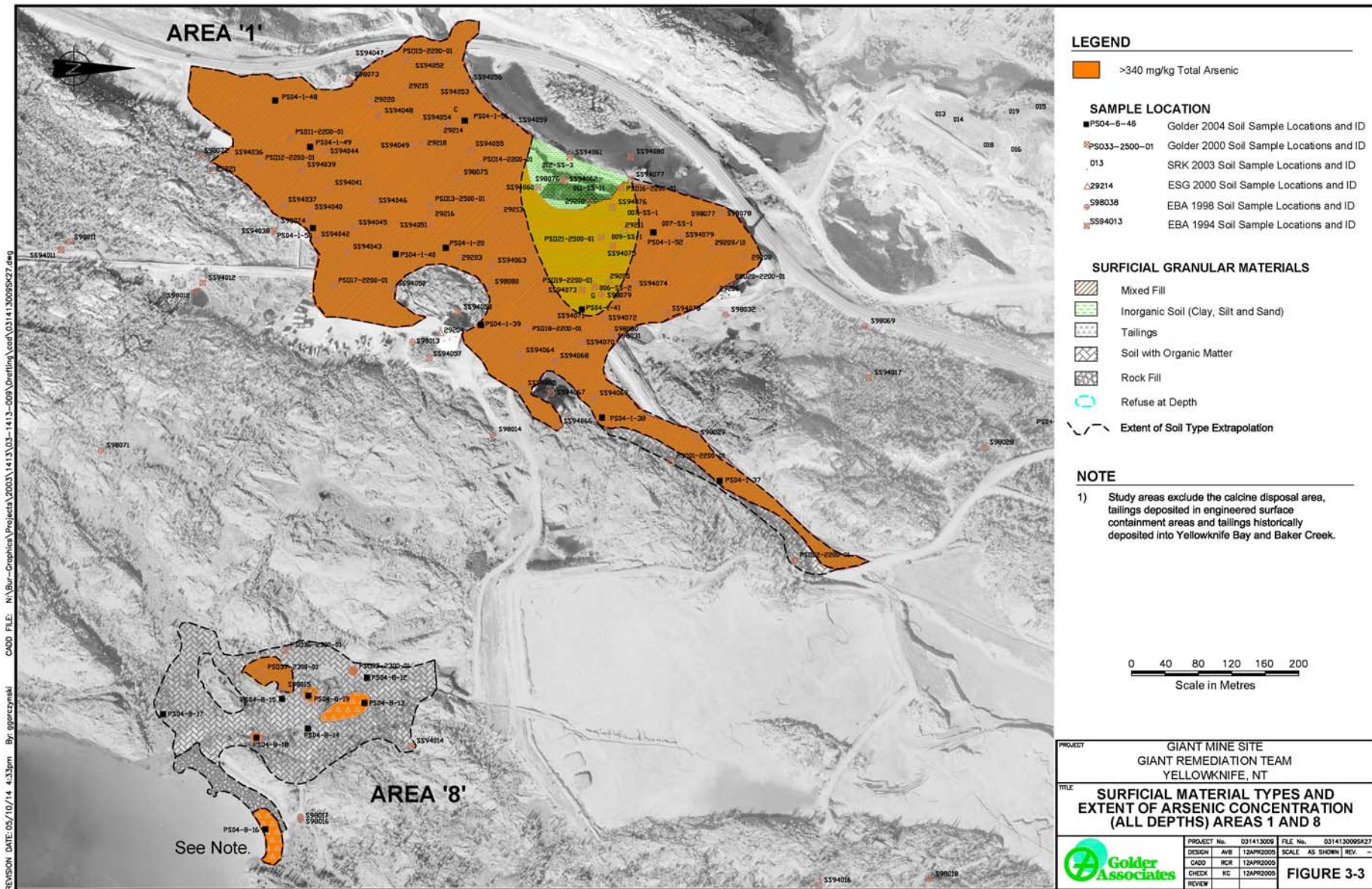
Adopted industrial criterion to flag most contaminated areas

First priority is to remove highly contaminated soils and place as fill in B-1 Pit for freezing

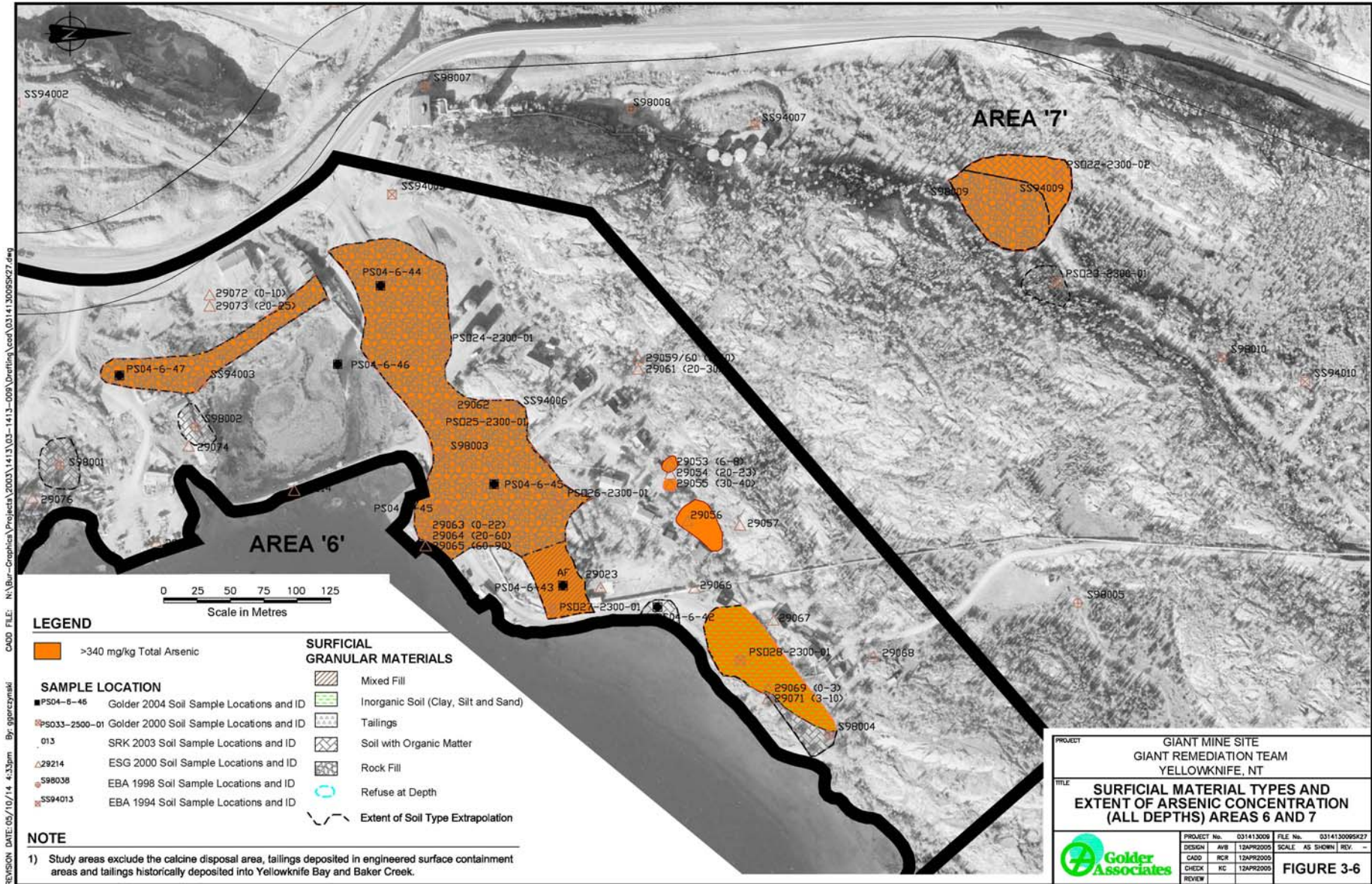


Main area of surface contamination – around roaster

Contaminated soils in mill area will be removed



Distribution of contaminated surface material in Town Site



- All existing infrastructure with no future use will be demolished



Minewater Management

- Minewater is expected to require treatment for an extended period of time after remediation measures have been implemented
- Current water treatment system
 - Issues with age of plant and seasonal treatment
 - One bank of reactor tanks has been decommissioned because of leakage



Remediation Plan - Site Water Management





- Construct a new Best Available Technology (BAT) water treatment plant
- Plant will be located near the C-Shaft
- Change operating procedure from a seasonal discharge to a year round discharge
- Design includes holding pond and monitoring
- Change discharge point from Baker Creek to Yellowknife Bay
- All surface runoff from the tailings pond will be directed to the underground until it has reached acceptable quality for direct discharge to environment



Site – Post Remediation



LEGEND

-  FENCE
-  ROCK BERM
-  MAJOR SPILLWAY
-  FREEZE PIPE COLLARS

0 80 160 240 320 400 metres

 SRK Consulting <i>Engineers and Scientists</i>	Giant Mine Remediation Plan			
	Post Remediation Site Conditions			
	Indian and Northern Affairs Canada			
PROJECT NO. 1C001.013	DATE Jan. 2006	APPROVED MDR	FIGURE 6.1.1	

SRK CONSULTING

Assessment of Post-Remediation Conditions - Human Health and Ecological Risks (HHERA Tier 2)

- Arsenic releases from the project area to the environment will be reduced significantly
- The Remediation Plan will prevent release of many thousands of kilograms of arsenic per year



Data used in HHERA Assessment



Indian and Northern
Affairs Canada



- # of Surface Water Data Samples
 - Baker Creek - 57
 - Back Bay – 49
 - Yellowknife Bay – 69
- # of Sediment Quality Data Samples
 - Baker Creek - 47
 - Back Bay – 85
 - Yellowknife Bay – 108
- # of Aquatic vegetation Data Samples
 - Baker Creek - 14
 - Yellowknife Bay – 4
 - Regionally – 41
- Fish Data
 - Lake white fish - 186 muscle, 206 Liver, 165 kidney
 - Northern Pike – 83 Muscle, 85 liver
 - Benthic Invertebrate – 11 samples + EEM
- Terrestrial Environment Soils
 - Data collected at different locations at the mine site and in the Yellowknife Area from 1987-2003 9 studies – 600 samples
- Terrestrial Environment Vegetation
 - Yellowknife Area -Garden Vegetable, moss lichen and mushroom - 74 samples
 - Berries - 17 samples for Yellowknife, mine site and Dettah
 - Medicinal Plants/Labrador tea - 38 samples from mine site and Dettah



Assessment of Post-Remediation Conditions – HHERA conclusions

- People living in the region are unlikely to be at risk of adverse effects from arsenic exposure
- Arsenic intakes are generally within the range of other Canadians. Estimated cancer risks arising from Giant Mine arsenic are well below the risks associated with other causes of cancer
- To be cautious, there may need to be restrictions on the use of Baker Creek



Ecological Risk Assessment of Post-Remediation Conditions

- Aquatic plants and fish in Back Bay and Yellowknife Bay will not be at risk
- Due to existing sediment contamination and upstream sources, Baker Creek may take a long time to recover
- Mink and muskrat in Baker Creek could be at risk but field studies show healthy populations

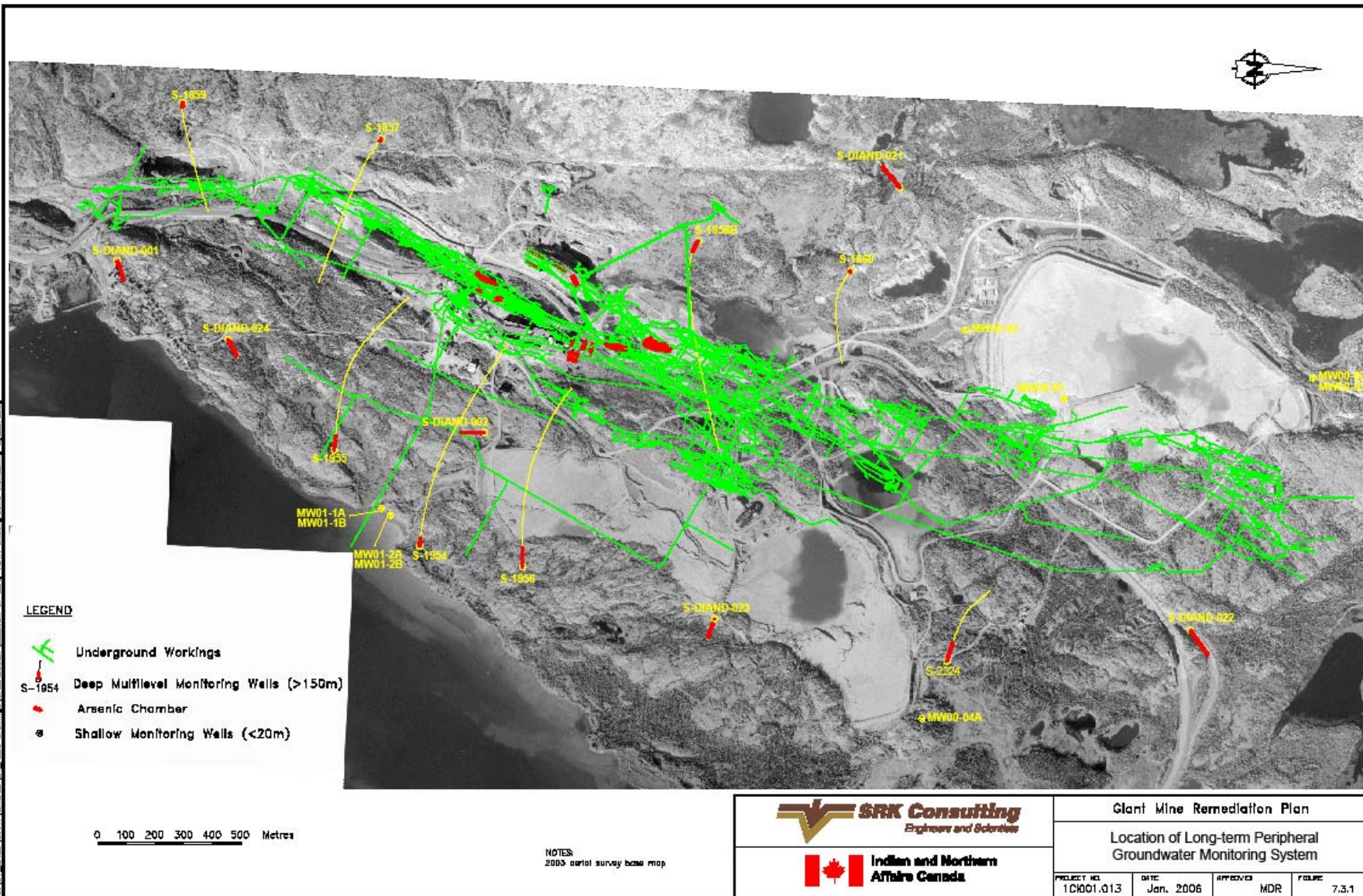


Monitoring to verify project results

- Surface Water monitoring – Surveillance Network Program
- Treated Water monitoring
- Minewater monitoring
- Groundwater monitoring
- Air monitoring
- Environmental Effects Monitoring under Metal Mining Effluent Regulations
- Frozen ground monitoring
- Inspections and maintenance
- Need final engineering design before final monitoring details can be developed



Groundwater Monitoring



C:\G1_SITES\GANTY\Shared\01_Aerial\Drawings\Groundwater\Location of Long Term Underground Monitoring System.dwg

Monitoring and Independent Audit Evaluation

- Monitoring requirement is normally specified in regulatory licensing process
- Various Additional Audit Options:
 - Status of Environment Reports (Uranium Industry example)
 - Independent monitoring audits every 5 years of project and enforcement/regulatory agencies (Alaska example)
 - Independent Environmental Monitoring Agency (NWT Example)



Scoping Recommendations



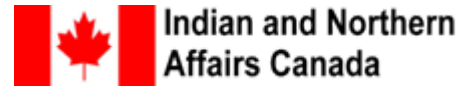
Scope of the Development

- The scope of the development should be the Remediation Plan as proposed and submitted as part of the Water Licence application
- The interim necessary activities and freeze optimization should be excluded from this assessment.
- The road realignment, beyond that which is discussed in the Remediation Plan, should be excluded from this assessment



Scope of Development

Highway Realignment



- Drawing from the MVEIRB guidelines, the GNWT-DOT highway realignment proposal should be excluded for the following reasons:
 - **Independence:** The Remediation Plan does not depend on a road development that goes beyond what has been proposed. The Remediation Plan only depends on the minor realignment noted in the plan.
 - **Linkage:** The highway realignment corridors currently proposed by GNWT-DOT are significantly different than the minor realignment required for the Remediation Plan. The DOT proposal is also designed to address other highway issues not related to the remediation. As such, the decision to undertake the remediation does not make the GNWT-DOT's version of the road realignment inevitable.
 - **Proximity:** INAC will not be the developer or a co-proponent for a road relocation that extends beyond what has been proposed in the Remediation Plan. The GNWT will be the developer in such case.
- Were the GNWT-DOT to proceed with such a separate development, in terms of cumulative impacts, it may be reasonable to consider such a development in combination with this proposed development.

Scope of Assessment

Nature of Development

- The distinct and unique nature of the proposed development and the state of the site, being an abandoned mine site, should be taken into account when determining the scope of the assessment
 - Not typical “for profit” development that generates wealth – taxpayer pays cost of remediation
 - Site environment is already heavily impacted
 - Short term impacts from remediation activities will be mitigated
 - Long term impacts of remediation will be positive and result in significant improvement to existing state of the site and the receiving environment
- The scope of the development should inform the scope of the assessment
- Given existing state of decay of the mine infrastructure including arsenic chamber bulkheads and the effluent treatment plant, it is important that the project proceed on a timely basis to protect human safety and the environment



Scope of Assessment

Impact determination

- The proponents' view is that the impacts at issue for a significance determination under s.128 are those which derive from the proposed development being the remediation not those impacts which derive from the history and state of the site itself.
- However, the proponents recognize that in order to conduct an assessment of the Remediation Plan, the history and current environmental state of the site may be relevant insofar as such information informs the significance determination above



Scope of Assessment

Cumulative Impacts

- Given the unique nature of the proposed development the cumulative impact assessment is also unique - Supporting Document Q5 Assessment of Cumulative impacts indicates:
 - No potential cumulative effects are expected to extend beyond the implementation phase of the remediation
 - No significant cumulative effects are anticipated for the physical works and activities associated with the proposed development
- The Proponents recommend that the relevant cumulative impacts determination should focus on whether it is likely that the remediation activities may worsen or compound the impacts of the abandoned site



Conclusion

- After eight years of extensive detailed study and consultation, INAC and GNWT believe that the proposed Remediation Plan will:
 - Protect human health
 - Improve the environment
 - Ultimately meet the approval of local stakeholders

