



# Discovery Mine

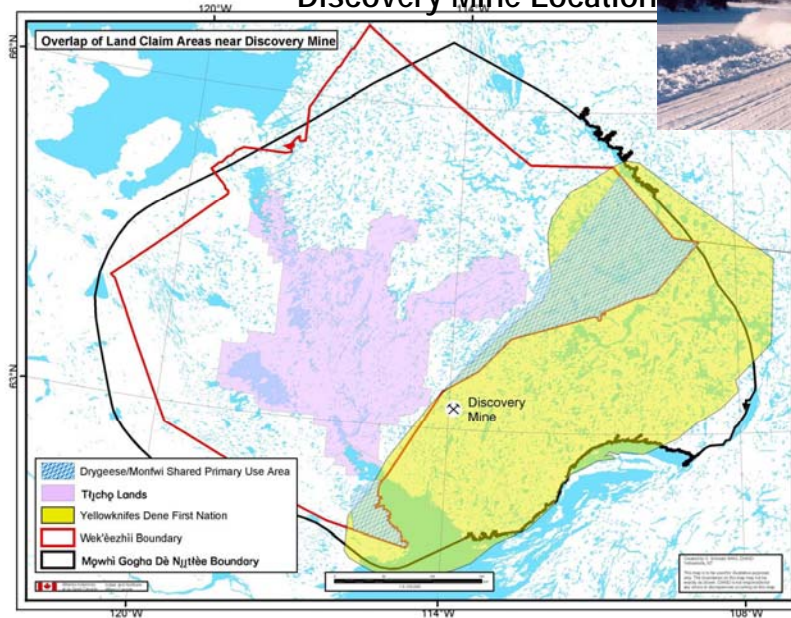
## Remediation Project

### Presentation Outline:

- Brief history and previous work completed
- Summary of the approved Remediation Plan by component and status of progress to date



## Discovery Mine Location





## Discovery Mine History

- Underground gold mining from 1949-1969 by Discovery Mines Ltd.
- Gold was extracted using a mercury amalgamation and cyanidation process
- An on-site mill facility produced approximately 1.1 million tonnes of tailings
- Tailings were deposited on land over a large area and flowed into Giauque Lake
- The town site and mine structures left standing
- Mine openings were temporarily capped



## What was done in the first stage of remediation?

- DIAND completed partial remediation from 1998 to 2000
- Remediation involved:
  - general clean up,
  - off-site disposal of some hazmat
  - capping of the tailings.
- Recently finalized the Remediation Plan for rest of site
- Environmental Monitoring Program



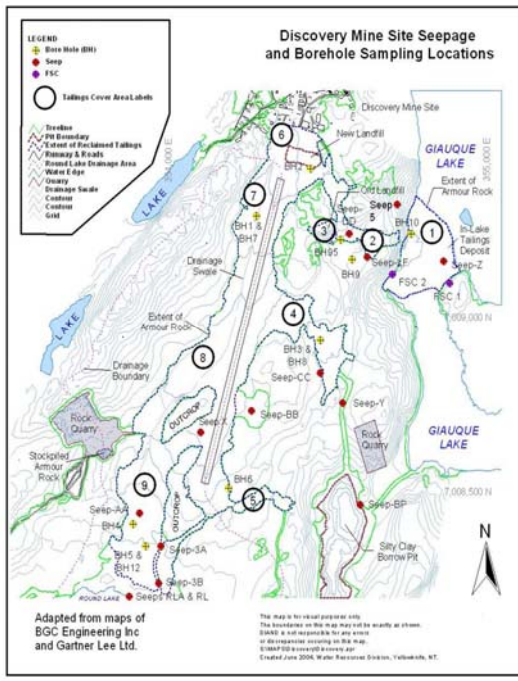


# Tailings Cap



## WQ Monitoring Results

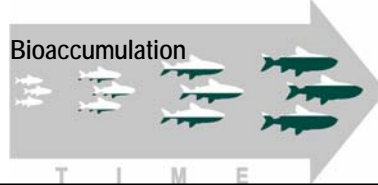
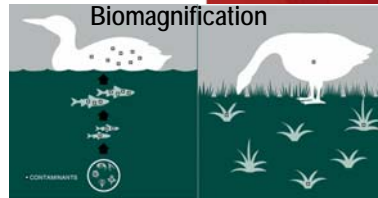
- Tailings cap has:
  - minimized weathering of tailings and
  - limited transportation of contaminants into receiving waters
- Lake water quality has shown general signs of improvement; Hg at or below detection
- Porewater - lower pH and some elevated metals





## Fish

- Last fish study completed 6 years ago – fish consumption advisory
- Fish now exposed to undetectable levels of mercury in water, although still elevated levels in sediment
- Full aquatic assessment planned for next year (fish, sediment, inverts) to determine effectiveness of remediation measures
- Sampling every ~5 years to minimize impacts to fish population



## Second Stage of Remediation Discovery Remediation Team

- Fred LeMouel, (former) NSMA community liaison
- Rachel Crapeau, YKDFN community liaison
- DIAND Contaminants and Remediation Directorate
  - Kate Hearn, Director
  - Scott Mitchell, A/Manager
  - Emma Pike, Project Officer
- Technical experts
  - Jim Cassie/ Geoff Claypool, BGC Engineering Inc.
  - Eric Denholm, Gartner Lee Ltd.
  - Brad Thompson, PWGSC
  - Bob Johnson, Aboriginal Engineering Ltd.



## Approach to Remediation

- Involve affected first nations in making project decisions and determining project direction, rather than consultation after the fact

### Benefits:

- Community issues or concerns are dealt with proactively and incorporated into plans for the site
- Greater understanding of contaminated sites, site issues and remediation



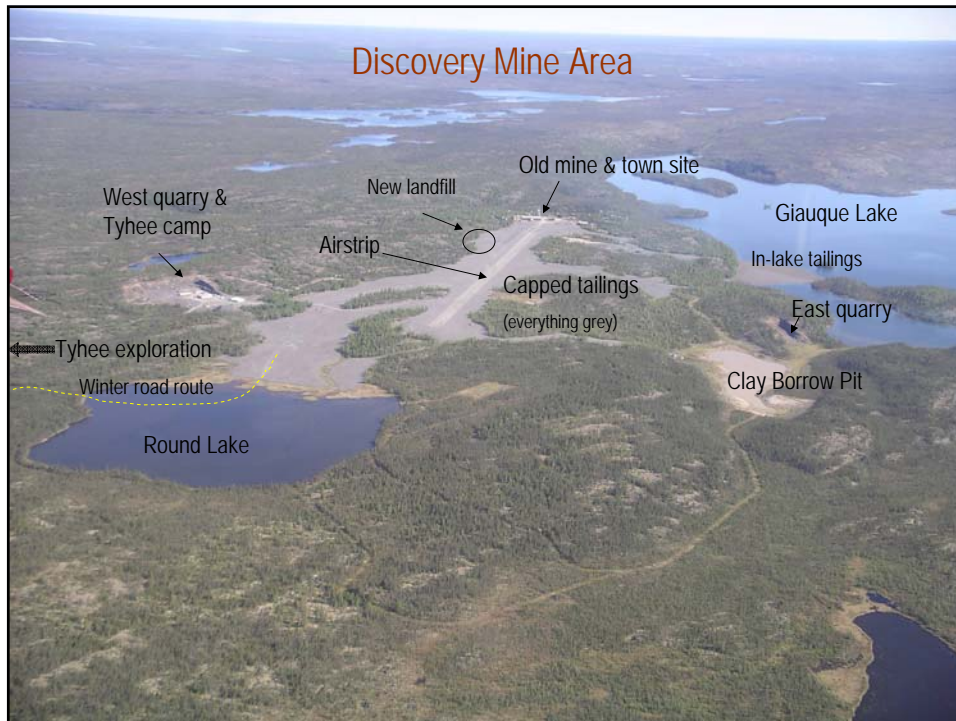
## Evaluation Of Remediation Options

| Requirements  | Environmental & Technical Factors   | First Nations criteria   | Cost  |
|---|---|--|---|
| <ul style="list-style-type: none"> <li>• Legal compliance</li> <li>• Time</li> <li>• Proven technology</li> <li>• Meets minimum objectives</li> </ul> | <ul style="list-style-type: none"> <li>• Meets overall site objectives</li> <li>• Reduce risk to environment</li> <li>• Work can be done safely</li> <li>• Future land use potential</li> <li>• Regulatory approvals</li> <li>• Meet environmental guidelines</li> <li>• Liability reduction at end of project</li> </ul> | <ul style="list-style-type: none"> <li>• Future land use of the area</li> <li>• Walk-away solution</li> <li>• Socio-economic impacts</li> <li>• Training &amp; business opportunities</li> </ul> | <ul style="list-style-type: none"> <li>• Capital cost</li> <li>• Operating cost</li> <li>• Best Available Technology Economically-Achievable</li> <li>• Long-term costs for monitoring and maintenance</li> </ul> |



## Evaluation Process

- Divide mine into various components
- For each component, determine the closure issues, objectives and remediation options
- Rank the options as to how they meet the objectives
  - High - meets objectives
  - Med - partially meets objectives
  - Low - does not meet objectives
- Then rank them overall into:
  - P= preferred
  - A= acceptable
  - NA = not acceptable





## Infrastructure: Quarries

- Preferred option = Reduce rock wall slope angles of the quarries (cut & backfill)

Rationale:

1. Safety – reduces slope angles
2. Matches natural terrain
3. Minimizes environmental impacts
4. Walk-away solution – no maintenance

- East quarry remediation complete
- West quarry currently occupied by Tyhee – scaling planned, remediation by Tyhee



## Example: Comparison of Options for Quarries

| Goals / Options          | Cut and backfill | Rock wall at top | Fence and sign |
|--------------------------|------------------|------------------|----------------|
| Safety – prevent falling | High             | Med              | Low            |
| Match local terrain      | High             | Low              | Low            |
| Minimize env. impacts    | MedHigh          | Med              | Med            |
| Walk- away               | High             | Med              | Low            |
| A / P / NA               | P                | NA               | NA             |





## Airstrip

- Preferred option = Maintain then remove from use Sept 1/ 2005; use surface material in landfill construction

### Rationale:

1. Safety – will not be maintained
2. Protects existing tailings cover from degradation
3. Airstrip surface material will be used as aggregate source
4. Walk-away solution

- Note: Expecting airstrip proposal from Tyhee.



## Roads

- Preferred option = maintain then restore drainage, scarify & let revegetate naturally

### Rationale:

1. Restores natural drainage and prevents erosion
2. Restores natural vegetation over time
3. Walk-away solution – no maintenance

Agreed with Tyhee not to scarify road to dock







## Dock

- Preferred option = Remove existing cribbed dock and install floating dock

Rationale:

1. Increases safety
2. Restores fish habitat (DFO)
3. Minimizes maintenance

Recently completed.



## Powerline

– Bluefish to Discovery ~65km; hundreds of poles

Preferred option = Cut down all poles except those with nests and remove wire for potential salvage

Rationale:

1. Eliminates hazards to people and wildlife (hung wire, fallen or burnt poles).
2. Complies with regulations and best practices for bird nests (~ 25 nests)
3. Takes advantage of any salvage/recycle opportunities.
4. Walk-away solution – no maintenance.





## Clay Borrow Pit - Review

- Fall 2001 - Borrow pit filled with water and began to overflow to Giauque Lake
- Water contains suspended clay due to permafrost degradation, slumping, erosion etc of pit walls
- 2002/03/04 – treat & pump Pit water
- large catchment area (34.8 ha)
- 2003 & 2004 revegetation and stabilization



## Clay Borrow Pit & Water

Preferred option=

- Promote revegetation
- Implement small-scale local mitigation measures for permafrost degradation.
- Continue water treatment to prevent release to Giauque Lake ( 2-3 years), then allow to overflow

Rationale:

1. Prevents high-sediment water from discharging to lakes (complies with regulations, licence)
2. Recreates usable habitat for wildlife
3. Doesn't disturb new areas
4. Adaptable solution, as conditions may change
5. Walk-away solution – no maintenance





Separation dykes & erosion control measures  
(March 2005)



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## Tailings: Existing Tailings Cover

Preferred option=

- Some maintenance – settlements & drainage.
- Remediate areas with concentrated tailings boils.
- Remove select deep root vegetation on cover.
- Develop design for access over cover for short-term remediation efforts.
- Restrict access/use of other access over cover - not designed for repeated use by heavy equipment.

Rationale:

1. Minimizes impact to receiving environment
2. Minimizes impact to tailings cover and therefore costly repairs in the future
3. Prevents wind-blown tailings
4. Minimizes infiltration through cover

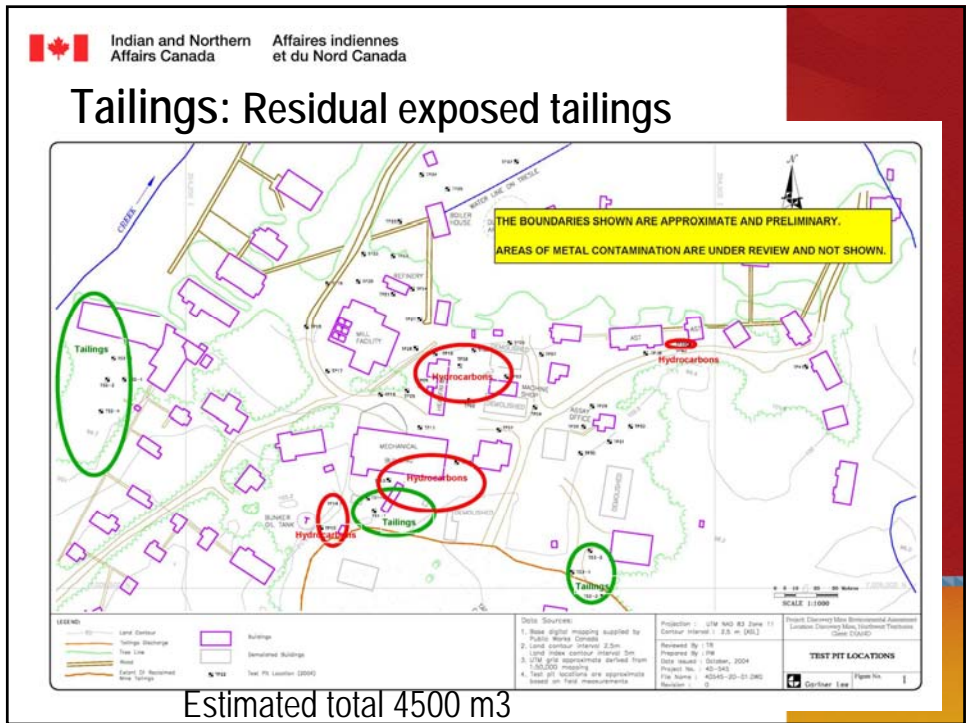
Note: Overall good performance, objectives are being met





### Tailings Cap 'Patches'

- Had to shut down operations due to softness of cap materials – very sensitive
- Can create impacts even with best intentions





# Residual Exposed Tailings

Preferred option:

- Excavate residual exposed tailings to landfill
- Use some tails as initial bedding for landfill cover.

Rationale:

1. Safety - prevents exposure and minimizes risk of contamination
2. Minimizes environmental impacts (erosion, wind-blown tailings, wildlife attractant etc.)
3. Minimizes footprint of tailings

Excavation in progress.



# Mine Openings

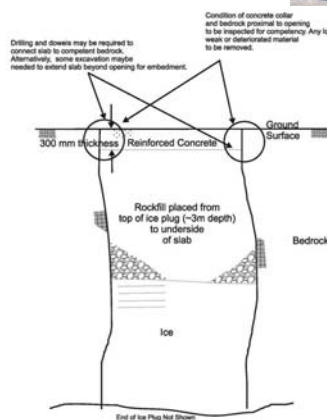
Preferred option=

- Expose Openings for Inspection.
- Fence & sign for short term mitigation.
- Install permanent seals

Rationale:

1. Minimizes health and safety risk to people and wildlife
2. A long-term solution
3. Minimizes monitoring and maintenance
4. Meets territorial legislation

Currently being inspected for final design



Notes:  
 1. Conceptual design only and not for construction  
 2. Configuration shown for mine shaft geometry



# Underground Mine – Water

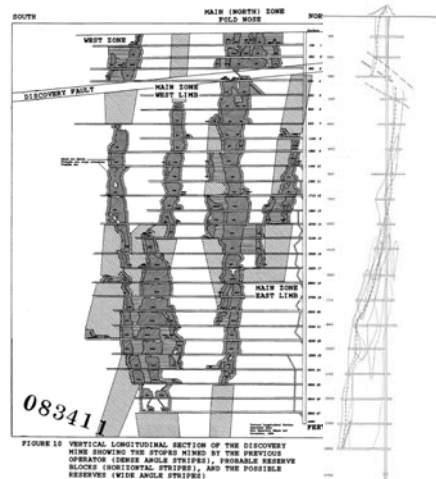
Preferred option:

- Expose openings and conduct a minewater assessment if accessible
- Develop a seepage monitoring and contingency program if required.

Rationale:

1. Further information still required
2. Water level in mine above that of Giauque Lake, suggesting retention
3. Ensures risks are managed and monitored

Currently no water accessible



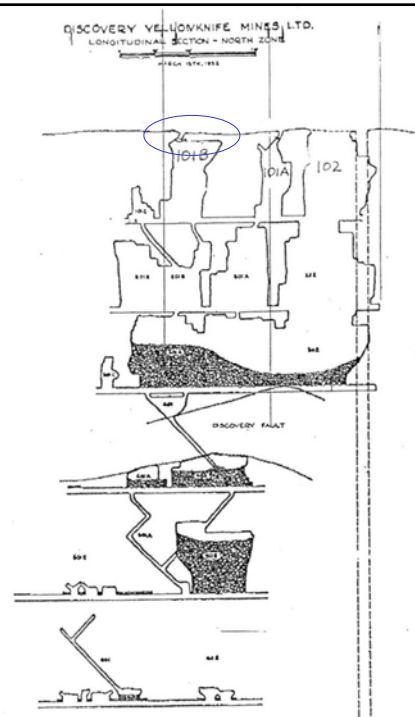
# Crown Pillars

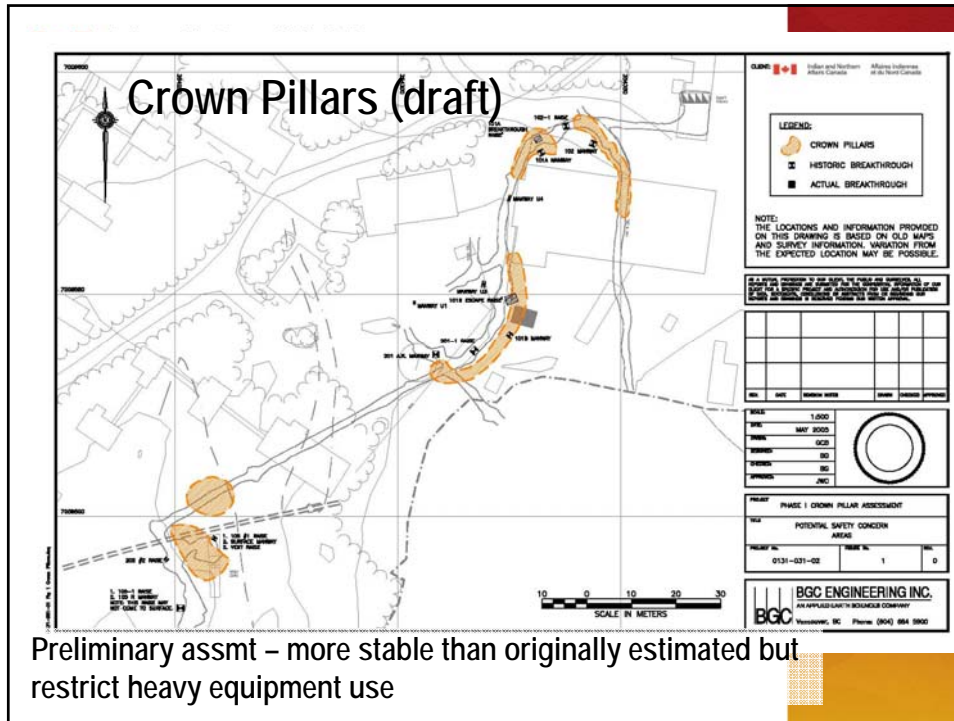
Preferred option:

- Mark crown pillars.
- Conduct settlement/subsidence risk assessment.
- Develop a subsidence monitoring and contingency program.

Rationale:

1. Need more information to determine risks
2. Lead to safer site – identify areas of potential concern





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## Buildings & Equipment

Preferred option:

- Collect and Bag Asbestos.
- Remove PCB-containing light ballasts and mercury thermometers from Buildings.
- Tear down all buildings.
- Reduce concrete foundations, remove contaminated concrete and recontour.
- Set aside heritage artifacts for transport to Yellowknife

Rationale:

1. Eliminates safety hazard
2. Reduces risk from contaminated materials
3. Meets heritage objectives
4. Walk-away solution – no maintenance

Most buildings: burned or demolished

Mine Heritage Society site visit



## Hazardous Waste

Preferred option:

- Collect liquid hydrocarbons from tanks and equipment – either burn on-site or ship offsite
- Collect and transport all other regulated materials, including PCBs and mercury, off-site
- Dispose of bagged asbestos and lead-based paint, still incorporated onto building materials, in the landfill

Rationale:

1. Eliminates safety hazard to people and wildlife
2. Minimizes further impact to the environment
3. Logistically achievable
4. Minimizes long-term maintenance/monitoring

95% hazmat collection is complete



## Non-hazardous Waste

Preferred option:

- Burn clean wood products where appropriate to reduce landfill volume.
- Dispose of inert solid waste in the landfill

Rationale:

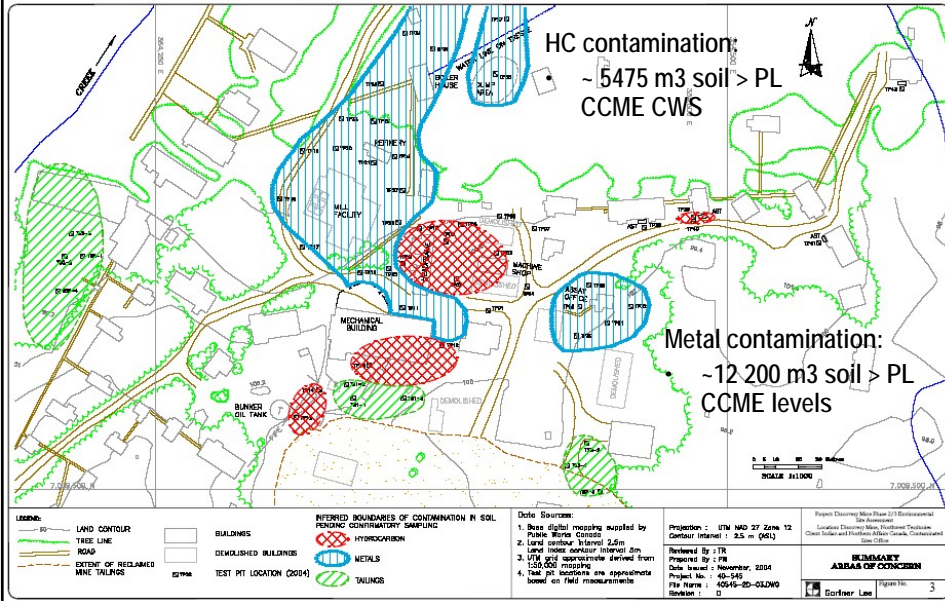
1. Increase safety of people and wildlife
2. Minimizes further impact to the environment and is aesthetically pleasing
3. Logistically achievable and cost-effective







# Contaminated Soil - ESA Results



## Contaminated Soil

Preferred option:

- Excavate metal- and HC-contaminated soil to the landfill.

Rationale:

- Safety of people and wildlife
- Cleanup method is practical and logistically achievable
- Minimizes further disturbance - if this soil was not used in the landfill, clean fill would be required





# Landfill



Preferred option:

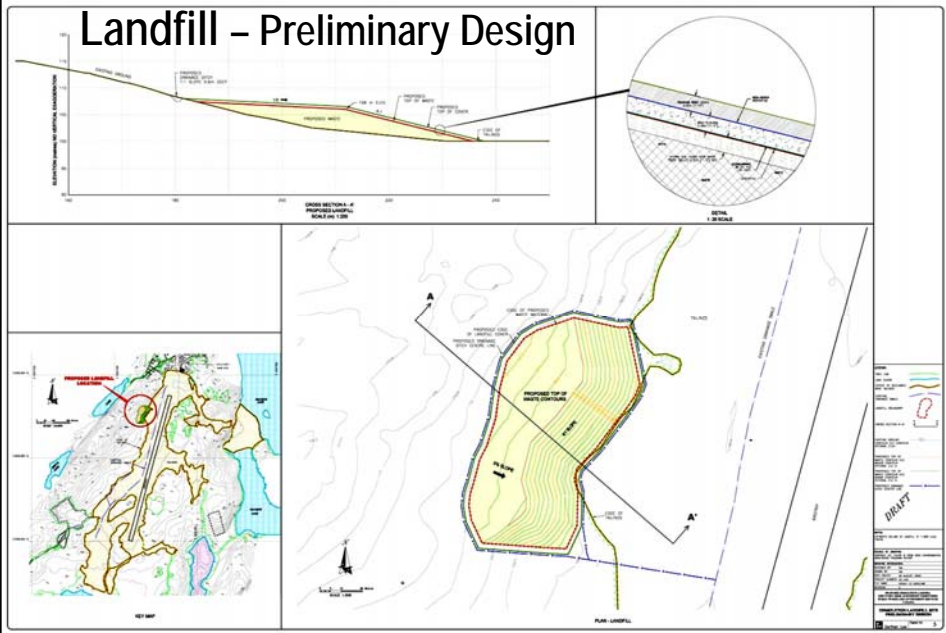
Place all waste identified (excluding specific hazmat) into the proposed landfill. Close landfill with the proposed impermeable cover.

Rationale:

1. Reduces risk from contaminated materials
2. Uses contaminated soil instead of clean fill and therefore minimizes new environmental disturbance
3. Landfill location minimizes footprint and ensures drainage to Round Lake
4. Cover system prevents infiltration of precipitation into the landfill



## Landfill - Preliminary Design





## Remediation Schedule



- Phase 1 (complete):
  - mobilize to site March 2005
  - Quarry & crush necessary aggregate for work on site during winter road (cover materials for landfill, airstrip, mine seals etc.)
- Phase 2 (currently ongoing):
  - Complete remediation work May-Sept 2005
- Phase 3:
  - Demobilize from site March 2006
  - Remediate powerline


Monitor the site as appropriate in the long-term


### Overall, we plan to:

-return the site to a safe condition so that people and wildlife can make use of the area

-meet the needs and concerns of INAC, its First Nation partners and all Northerners.

(consultations with First Nations, internal DIAND, EC, DFO, RWED, MVLWB, WCB, heritage organizations, third party interests)


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**YELLOWKNIFE GOLD PROJECT**  
Discovery Mine Property, Northwest Territories, Canada  
View to the Northwest

**INAC Area of Interest**

INAC is currently applying for a federal reserve for the area highlighted.


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## Winter Road

- Wildlife issues
- H&S issues
  - width of truck
  - blind corners



