*Presentation by*
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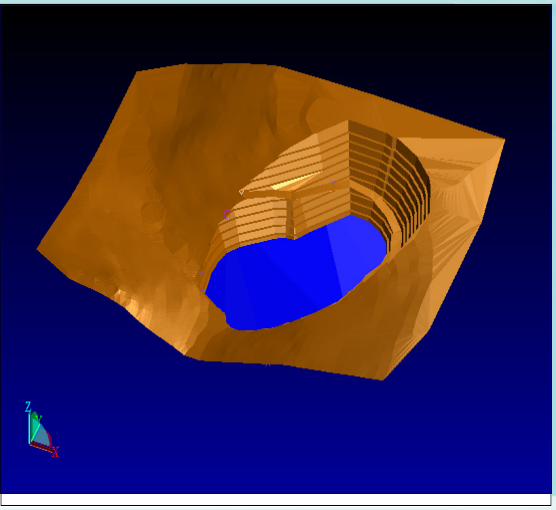


# A MEND Case Study Update

# The Owl Creek Open Pit Waste Rock Backfill Project

13th Annual BC MEND Workshop
Simon Fraser University Harbour Centre
Nov 29 & 30, 2006

# Agenda

- The key objectives of in-pit disposal.
- MEND Report 2.36.1.
- In-pit project planning considerations.
- Revisit the Owl Creek open pit case study.

# Key In-Pit Disposal Objectives

- Permanently inhibit / prevent ARD.
- Create stable physical and geochemical conditions.
- Passive closure.

► *Using a planned mine waste management strategy*◄

# MEND Report 2.36.1*

- It started with an international search for information and led to case studies:
- 2 on proposed in-pit projects.
- 7 on completed in-pit projects.
- 3 others with relevant information.

*MEND Contractor: SENES 1995.

# MEND 2.36.1 concluded, in part, that

- Open pit mines that have ceased production are increasingly being considered for the permanent and environmentally acceptable disposal of mine waste rock and tailings that are, or have the demonstrated potential to become, sources of acidic drainage;
- Not all pits are suitable for in-pit disposal; and
- Additional information is needed to improve / confirm our understanding.

# MEND 2.36.1 - In-pit disposal concepts

| Concept | Technique | Main control feature |
|---|---|---|
| 1 | Underwater disposal | Water layer |
| 2 | Elevated water table | Moisture saturation |
| 3 | Perched water table | Moisture saturation |
| 4 | Dry disposal | Conventional dry cover |

# In-Pit Planning considerations

| Area | Information<br>Examples |
|---|---|
| Waste characterization | ⇒ Geology and mineralogy<br>⇒ Geochemistry<br>⇒ ARD / ML potential<br>⇒ Leachable mass, leachate quality…<br>⇒ Grain size<br>⇒ Permeability – hydraulic transport…<br>⇒ Waste consolidation |
| Pit characterization | ⇒ Mining related constraints<br>⇒ Pit wall geology & mineralization<br>⇒ Hydrogeology & hydrology |
| Legal & other requirements | ⇒ As relevant |
| Environmental | ⇒ Site-specific requirements<br>⇒ Assess other options |
| Mine Planning | ⇒ Costs, scheduling, closure plan |

# Owl Creek Open Pit Case Study

Background:

- This open pit gold mine closed in 1989.
- 7.8 Mt of waste rock were placed in dumps.
- There were resources below the pit when it closed.

**In 1990, run-off from the Owl Creek Pit's North Dump was found to be acidic.**


*The onset of ARD could have looked something like this...*

# Response and assessments

- Short term ARD collection and treatment.
- Waste characterization and hydrology.
- Five options were identified.
- Preferred option selected & implemented.

# Reactive Waste Inventory

| Dump | Waste Quantity | Estimated Acidity | Potential Sludge Volume | Estimated Time to Deplete Sulphides |
|---|---|---|---|---|
| North Dump | 1,500,000 t | 50,000 t | 1,800,000 $m^3$ | 75% in 20 yrs |
| Graphitic Argillite | 35,000 t | 4,640 t | 200,000 $m^3$ | 100 years |
| Rock/overburden /clay dumps | 1,720,000 t | 105,000 t | 4,000,000 $m^3$ | 100 years |
| Total | 3,255,000 t | - | 6,000,000 $m^3$ | - |

# Waste Rock Disposal Options

**(As Identified in 1991)**

| Waste Rock Management Option | Total Cost (NPV 4%, 1991$) |
|---|---|
| In-Situ Flooding | $10 000 000 |
| Relocate the Rock to a Tailings Area | $9 000 000 |
| Cover with a Composite Dry Cover | $7 600 000 |
| ARD Collect and Treat | $7 400 000 |
| Place Rock in the Owl Creek Pit | $6 200 000 |

# The Preferred Option:

1. Temporarily collect and treat drainage from dumps.
2. Relocate the reactive waste rock to the Owl Creek Pit.
3. Add crushed limestone to 1.5 m lifts in the pit at a rate of 9 kg limestone:1 t waste rock – equivalent to twice the theoretical requirement.
4. Assess water balance and the time (within 1-2 years) to flood pit.
5. Monitoring the pit lake. Use lime to the treat the pit lake if required.

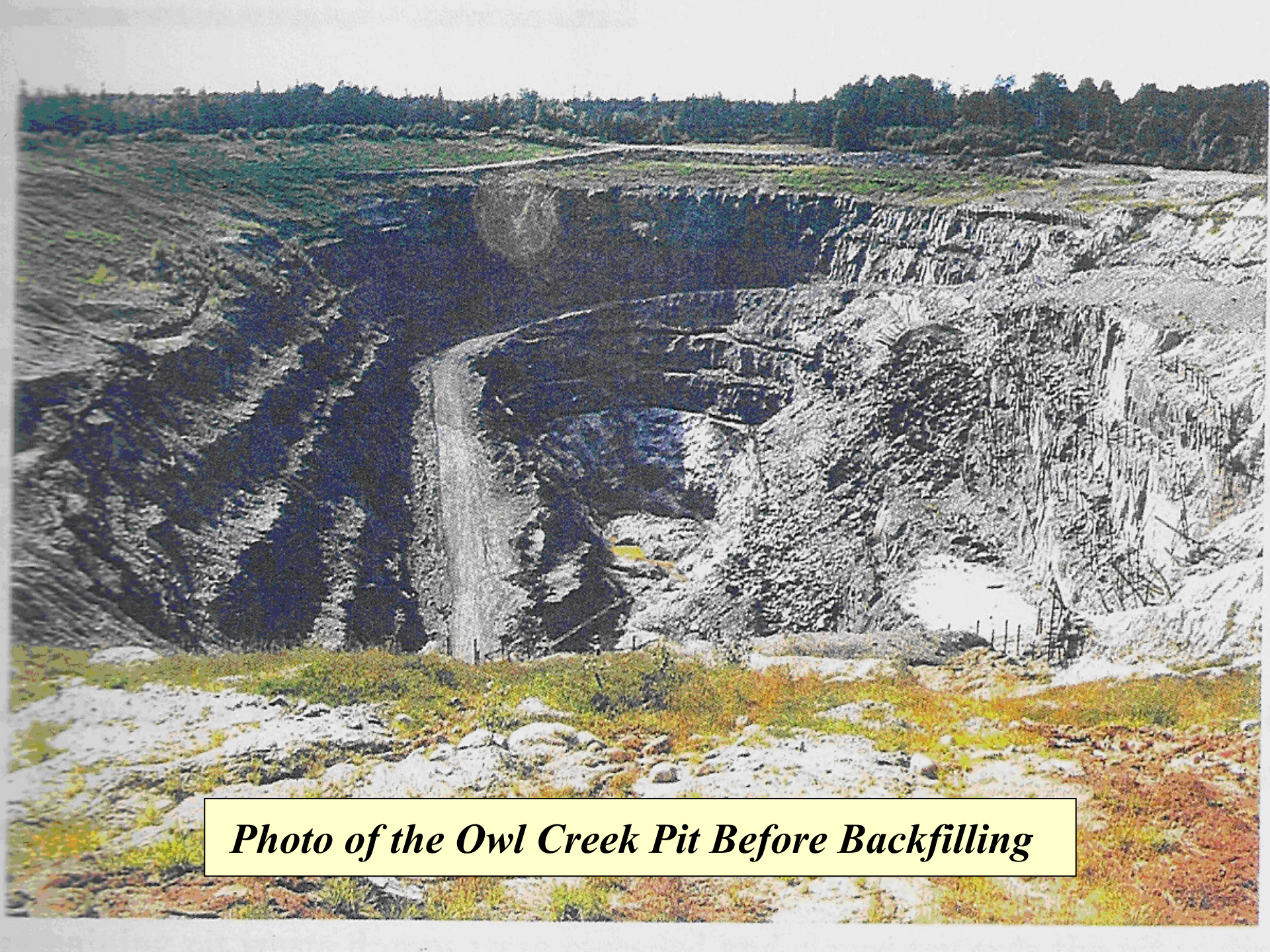
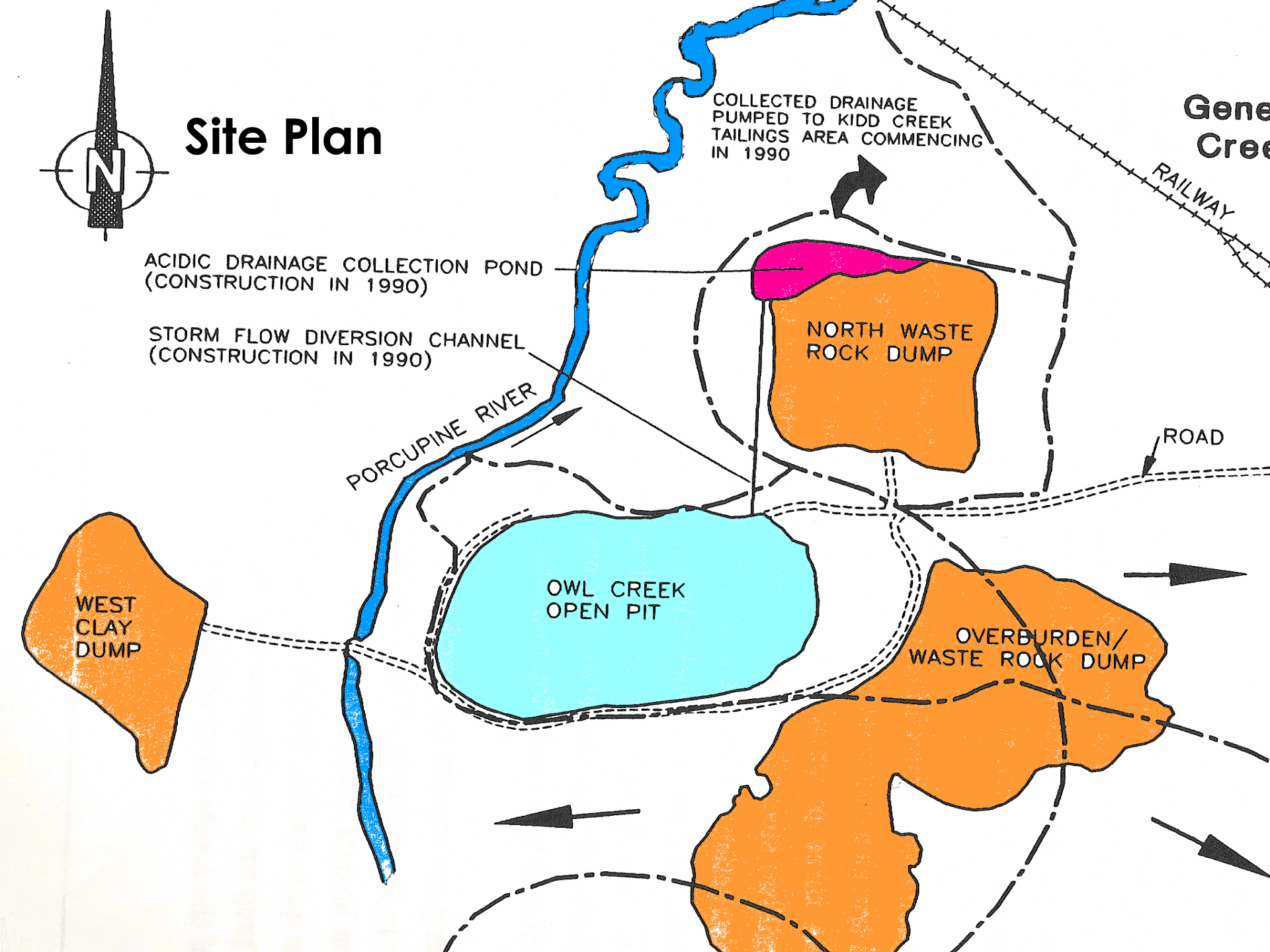


***Photo of the Owl Creek Pit Before Backfilling***

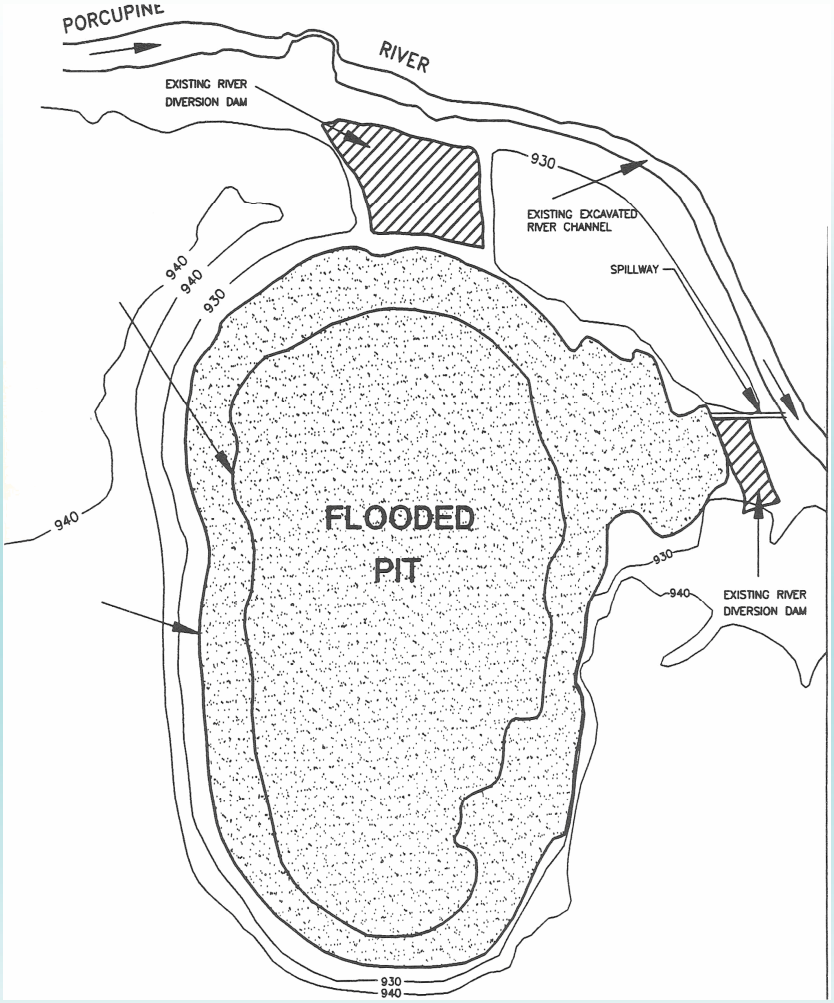

N
Site Plan
COLLECTED DRAINAGE PUMPED TO KIDD CREEK TAILINGS AREA COMMENCING IN 1990
Gene
Cree
RAILWAY
ACIDIC DRAINAGE COLLECTION POND (CONSTRUCTION IN 1990)
STORM FLOW DIVERSION CHANNEL (CONSTRUCTION IN 1990)
NORTH WASTE ROCK DUMP
PORCUPINE RIVER
ROAD
WEST CLAY DUMP
OWL CREEK OPEN PIT
OVERBURDEN/ WASTE ROCK DUMP

# Environmental Aspect Assessment

| Item | Potential Impacts | Controls |
|---|---|---|
| Acid rock drainage | **ARD/ML Impacts** | Relocation & Flooding. |
| Protect Surface water | | Waste characterization.<br>Temporary ARD treatment.<br>In-pit disposal.<br>Monitoring program.<br>Contingency plan (lime). |
| Protect Groundwater | | Provide a suitable stable environment for the wastes over the long term. |

# Project Completion

- Project took 21 months (Dec 1991 to Aug 1992).
- 3,600,000 t of waste were relocated to pit.
- Minus 95 mm crushed limestone was added to 1.5 m lifts.
- The pit was allowed to flood and submerge the waste.



## Status as Reported in 1995:

- Pit water was continuing to improve.
- Success was attributed in part to prompt submergence of the waste; the neutralization of the pore water; and the site conditions.

## Current Status

- The Owl Creek Pit lake water quality remained acceptable. The pit lake has been converted to a settling pond.


Thank You