The Owl Creek Pit Part 1: Relocating Mine Rock from Surface Stockpiles to the Pit to Mitigate Acid Drainage

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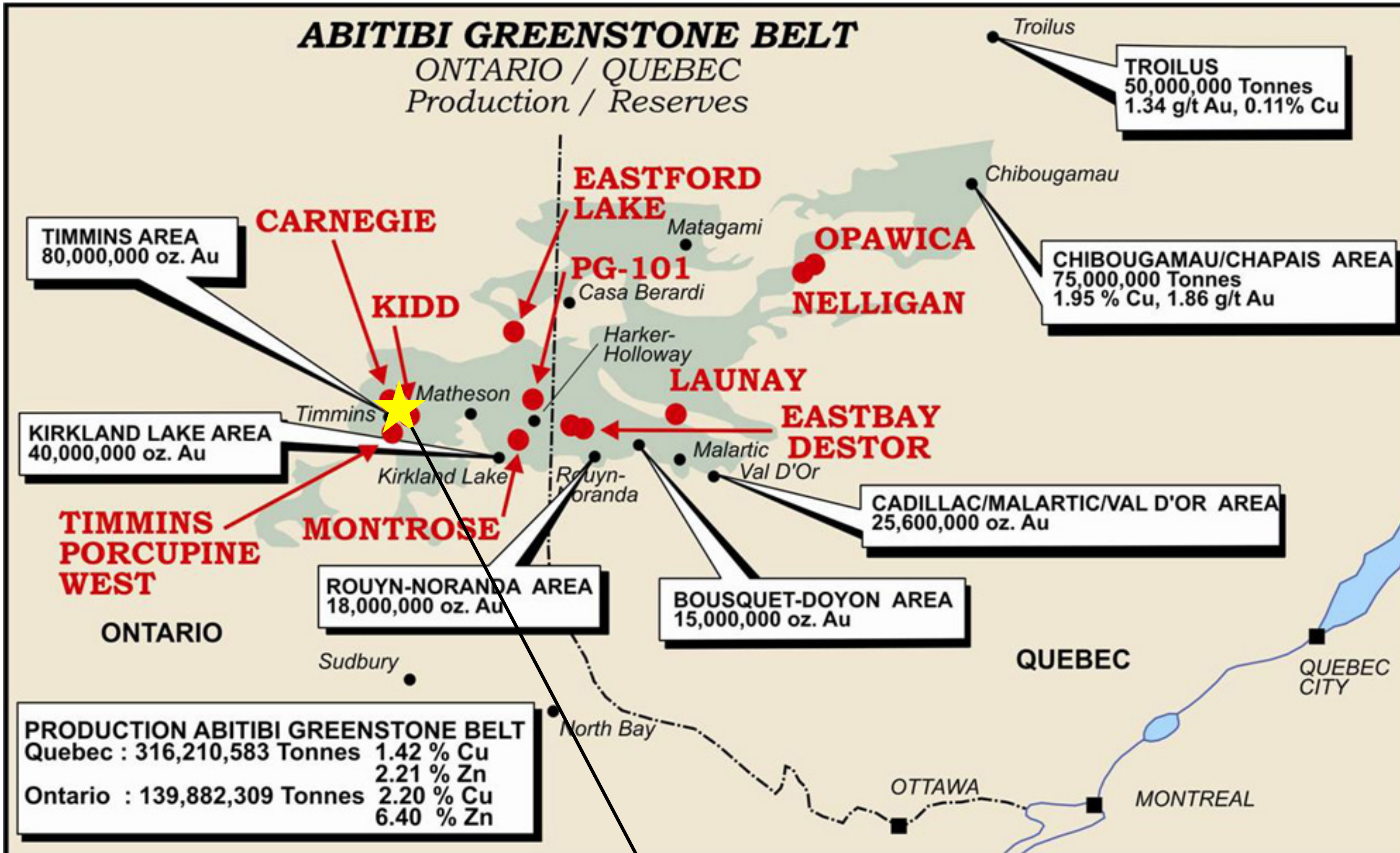

Owl Creek

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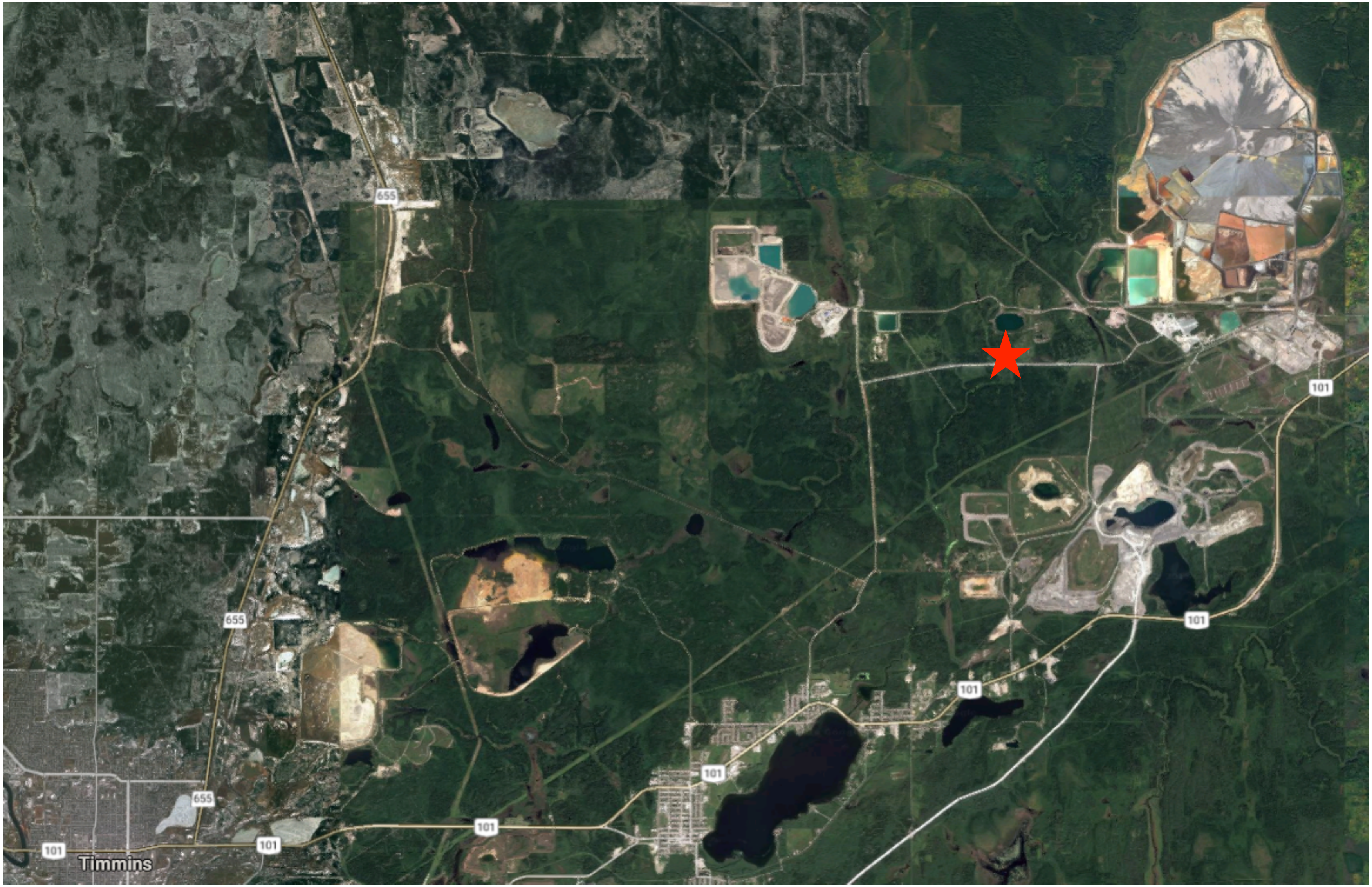
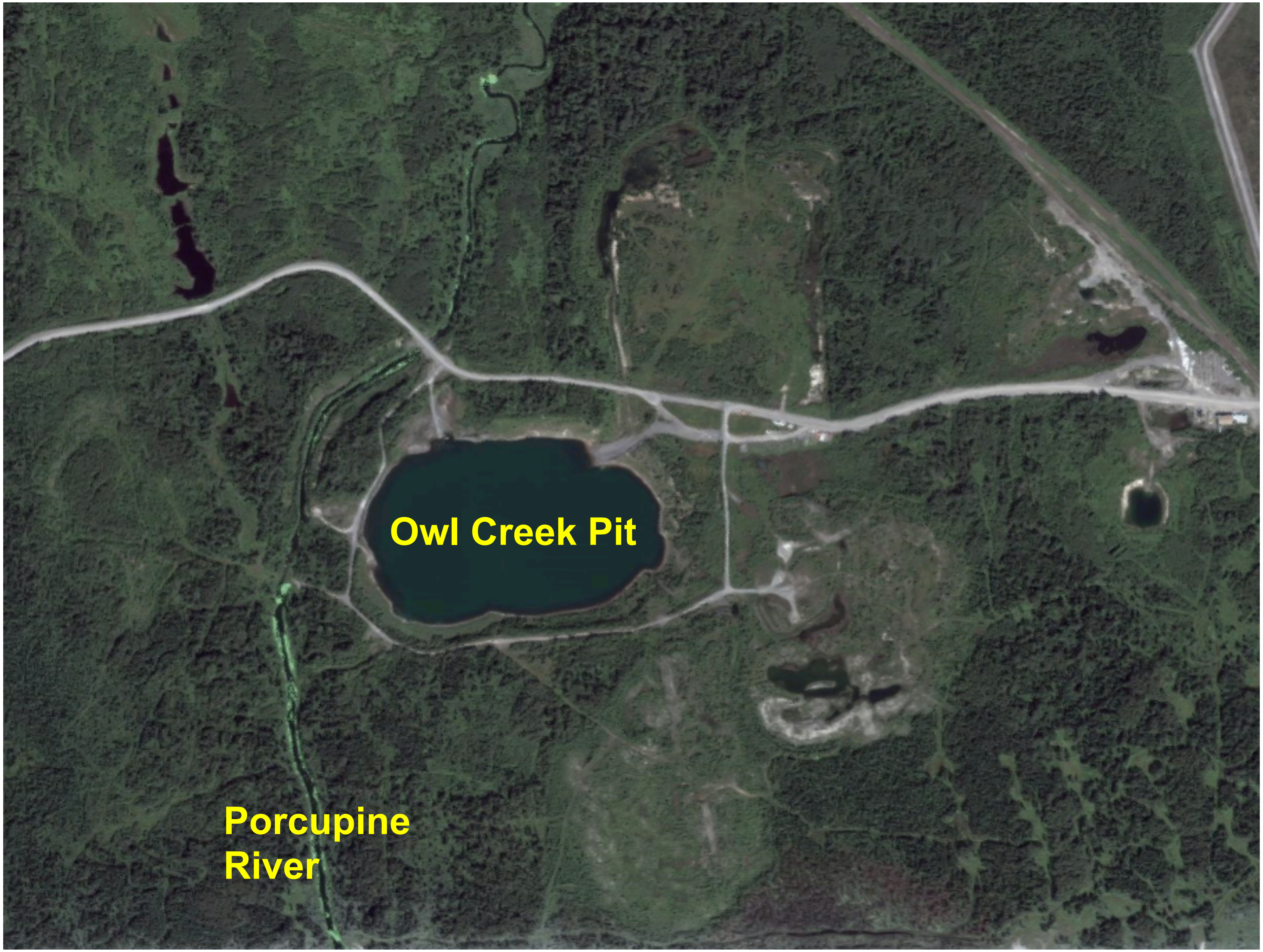


Owl Creek Mine – Location



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Owl Creek Minesite

History

- Timmins Area: 250 Mt mined to produce 60 M oz of gold prior to 1980, mainly underground mining
- Prior to Owl Creek, Acid Rock Drainage (ARD) from waste rock had typically not been a significant issue for Timmins area gold mines
- Mining at Owl Creek began in 1981 (Kidd Creek Mines Ltd.) and closed in 1990 (Falconbridge Gold Ltd.)
- 1.7 Mt ore, 5 Mt waste rock and 3 Mt overburden removed from Owl Creek open pit
- Ore processed at Kidd, Bell Creek and McIntyre

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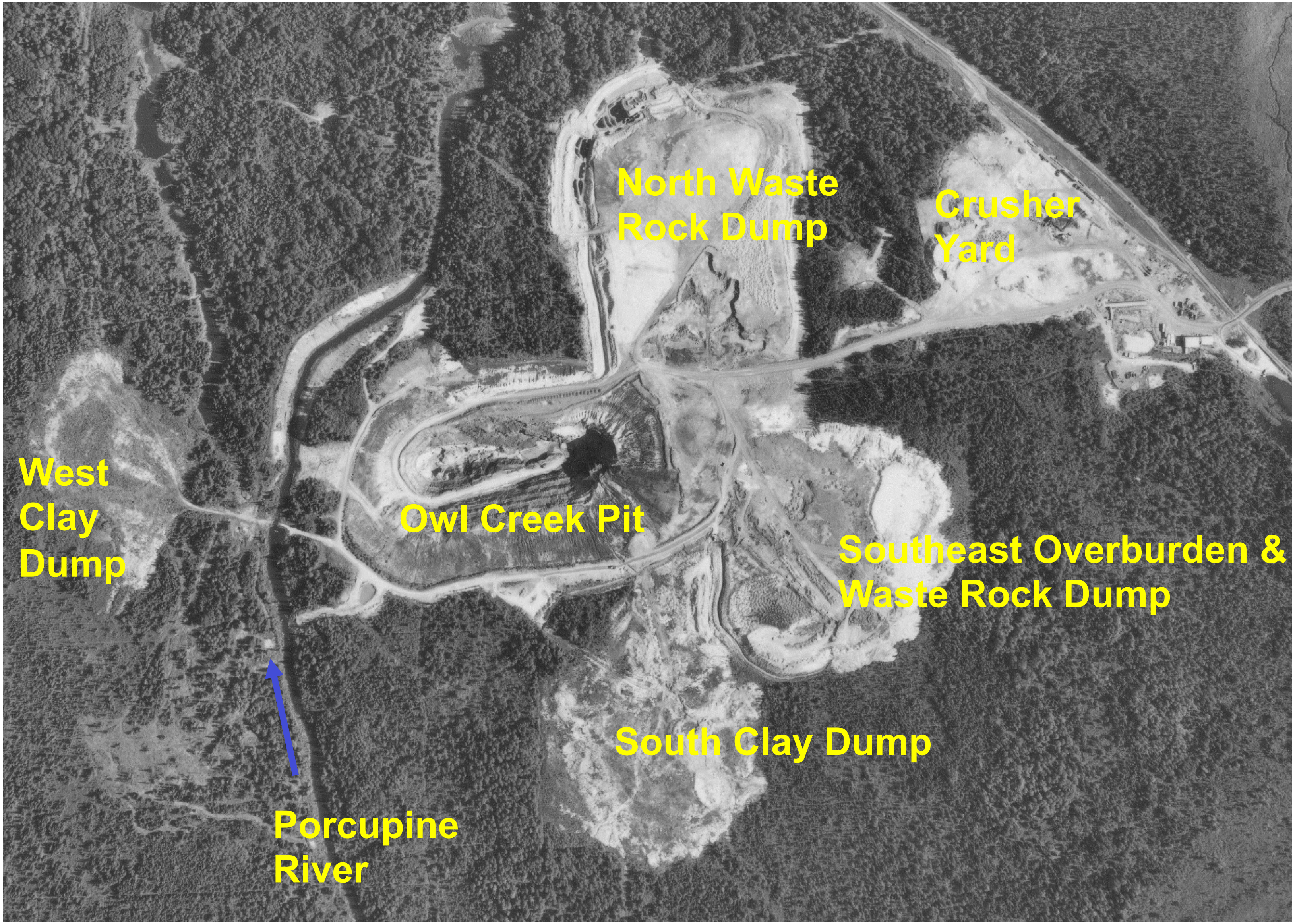

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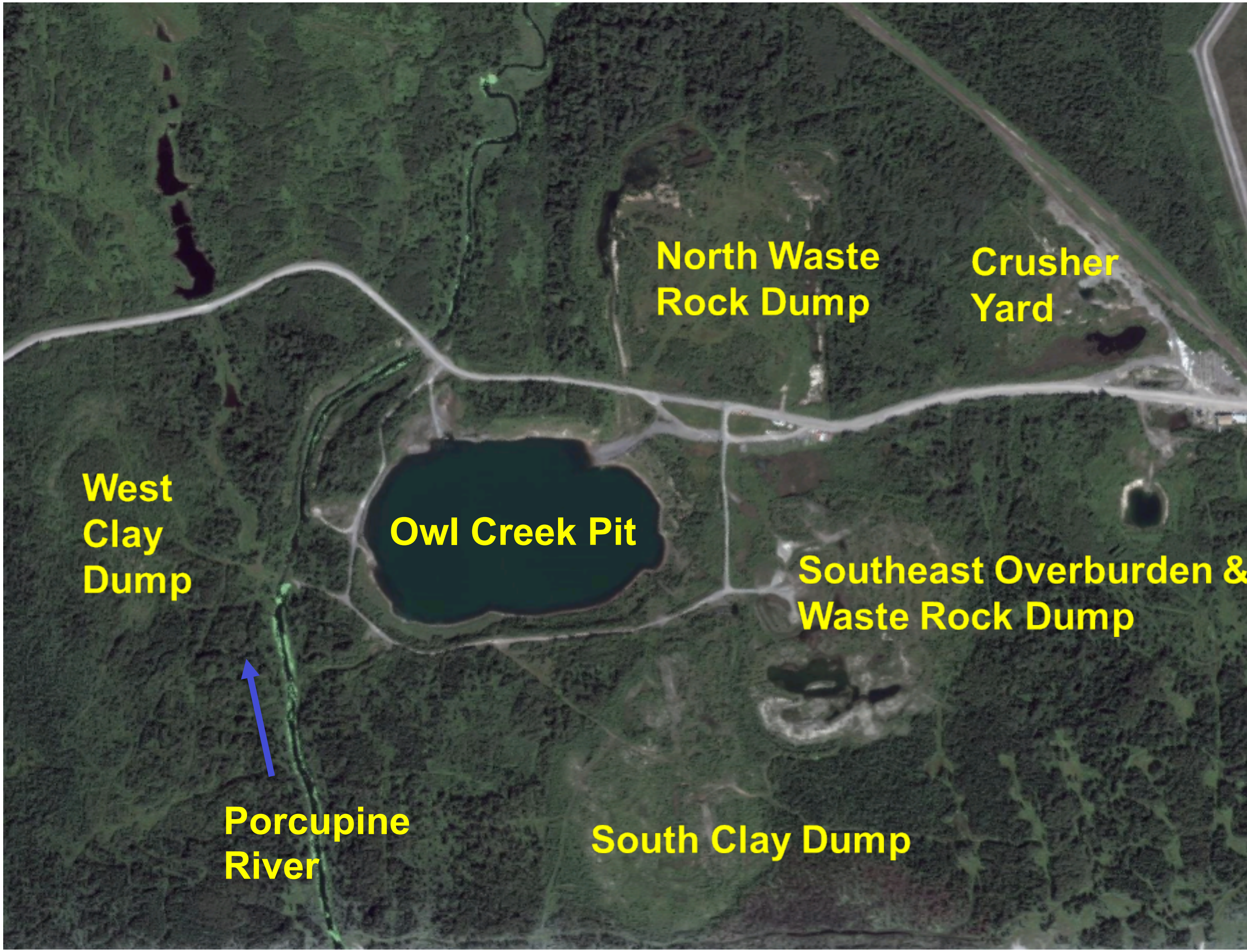
Owl Creek Minesite in 1991



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Owl Creek Minesite – Present Conditions

Owl Creek Pit – Local Geology

- Stratigraphy – moderate to steep dip to north
- Massive to pillowed basalts
- Metasediments (greywacke and argillite) some graphitic argillite with pyrite
- Ore within east/west deformation zone
- Graphitic schistose contacts on both sides of main ore zone, 10-35 m wide on south, 0.5 m on north
- Waste rock; carbonate, sericite, sulfide (1-10% pyrite) alteration.
- Ore: free gold and gold in pyrite associated with quartz veins, carbonate, graphite, and disseminated sulphides (pyrite, marcasite, pyrrhotite, arsenopyrite, chalcopyrite)

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Breaking News

AT FALCONBRIDGE

Investigation is continuing into discharge

TIMMINS DAILY PRESS
June 14, 1990

By SCOTT A. PATTISON
Daily Press Staff Writer

TIMMINS — Charges may be laid against Falconbridge Gold Corporation following an acidic discharge into the Porcupine River.

Meanwhile, officials are monitoring the discharge, trying to assess the effects. Local Ministry of Environment (MOE) officials say extensive environmental damage may have been done to a section of the river.

Officials estimate the acidic effluent discharge — discovered by a fluke June 8 — had been leaking into the Porcupine River for at least two weeks from the Owl Creek waste rock dump on the north end of the company's property.

Daily Press, Wednesday, June 27, 1990, Timmins—3

Local

Barry Ellsworth, editor, 268-5050

Acidic runoff stopped

TIMMINS (Daily Press Staff) — The stubborn runoff of weak acid from a waste rock storage site at the Owl Creek gold mine has been contained.

Peter Blakey, Timmins-area manager for Falconbridge Gold, owner of the now-closed mine, says the acid leak was fully contained as of June 14, but it was June 21 before the leaking acid was stopped from draining in to the nearby Porcupine River.

Blakey said a permanent lime station has been erected on the site in Hoyle Township, behind the huge Kidd Creek metallurgical site. Lime will now be used on an on-going basis to neutralize any further potential runoff.

"The lime station is in place, the perimeter road has been cut through the trees and a dyke is also in place," he said. "We don't expect the dyke to overflow until July 8."

By that time, said Blakey, any dangerous solids in the run-off from the waste rock pile will have settled. Only clean water will run over the lip of the dyke.

"The water flowing into the Porcupine River will be fully treated," he said. "Everything is now under control."

Blakey said the run-off from the waste rock pile, which was left over from the days when Owl Creek was an operating gold m... contained small amou... sulphuric acid.

The acid had a ... added. Blakey ...

acidic run-off appeared to be unique to Owl Creek. He said he knew of no other gold mine in Canada where water seeping through a waste rock pile dissolved sulphides that were present, thus creating the weak sulphuric acid.

"It was completely ... as far as we were ..." said. "But ..."

TIMMINS DAILY PRESS
JUNE 13, 1990

AT KIDD CREEK

Crew cleaning up spill

By SCOTT A. PATTISON
Daily Press Staff Writer

TIMMINS — A discharge of chemicals Wednesday from Kidd Creek Mines into the Porcupine River has government and mine officials scrambling to clean up the mess.

Kidd Creek environmental analysts and Falconbridge officials (Kidd's parent company) have dumped 3,000 gallons of lime solution to neutralize a low-level acidic effluent spill on the north side of the Owl Creek waste rock dump site.

As of late Tuesday afternoon, officials from the ministries of natural resources and environment were on the scene.

The discharge has found its way 500 metres through the woods and into the Porcupine River — but there has been no significant environmental damage because of the discharge.

In its wake, the discharge has left a 30-metre by three-metre stretch of dead bush and small trees. Falconbridge mine manager Peter Blakey says the site should be cleaned up within a week — and he added only a few trees, not even enough to cover half a housing lot, were killed.

"As of today, no more liquid will get down to the Porcupine River without being treated," said Blakey. "It will take us around one week to get the impoundment area and overflow working properly. Right now there is between 20-25 litres of effluent per minute being discharged."

An unidentified Ministry of Natural Resources pilot spotted a large red substance floating in the Porcupine River (by the railway bridge) and notified the Ministry of Environment, which subsequently notified Kidd Creek and then Blakey.

From there, the site was isolated and a road constructed through the waste rock dump to the North edge where the discharge is occurring.

"Initially we checked the pump pit discharge where water flows into the river but found no problem," said Blakey. "Then we came down our rail line around 3/4 of a kilometre and found the area. It's been discharging for around five or six weeks but we haven't noticed it because nobody ever comes back here."

The discharge also went unnoticed by the company's one testing station downstream on the Porcupine River because it became quite diluted before reaching it.

The discharged acidic water contains a 2.5 PH level which Blakey says is the same as that of a lemon. The water also contains 140 parts per million of zinc and 7,000 parts per million of iron. Blakey says the lime should bring the PH level back to an acceptable reading of 6.5 to 7.

"My feeling is the pyrite (fool's gold) in this rock has become oxidized which in turn gives an acidic reaction," said Blakey. "We're bringing in a backhoe to build up a five-foot wall to try and trap as much of the liquid down there to enable the lime to neutralize it properly."

Falconbridge and government environmental officials have since checked all waste rock dump sites on the property by ground and air to ensure there are no other discharges.

The environmental mishap occurred amid successful re-vegetation projects.

Scott A. Pattison

FALCONBRIDGE GOLD Corporation Mine Manager Peter Blakey points to an effluent discharge recently found on the company's property. Company officials have since dumped 3,000 gallons of lime on the acidic water to neutralize it. Cleanup efforts are currently ongoing.

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First Signs of Trouble

- June 1990 – ten years after mining started
- Ministry of Natural Resources (MNR) pilot observed a "reddish-brown colour" in a 2 km reach of the Porcupine River
- Drainage with pH = 2.3 and 7 g/L Iron traced back to the North waste rock stockpile
- Flow from waste rock ~ 8 L/s into Porcupine River with flow of ~ 130 L/s

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Water Quality (mg/L except pH)

Constituent	Flow from North Waste Rock	Upstream in Porcupine River	Provincial Water Quality Objectives
pH	2.3	7.5	6.5 – 8.5
Aluminum	1,400	0.09	NA
Copper	69	0.007	0.005
Iron	7,000	0.26	0.3
Lead	6	<0.001	0.005
Nickel	48	0.01	0.025
Zinc	100	0.006	0.03

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Immediate Actions

- Constructed cutoff berms
- Constructed impoundment at North Dump
- Piping to pump acidic water to the Kidd Creek tailings management area for treatment
- Local application of lime on stockpiles
- Initiated surface and groundwater monitoring
- Hired consultants to investigate cause

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The Investigation (SENES 1990)

- Field program
- Waste rock samples from:
  - Surface (14)
  - Drill Cuttings (12)
- Rock Analyses: Acid Base Accounting, Metals, Mineralogy
- Water Analyses: general chemistry and metals

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Reactive Argillite / Leachate Impoundment

Golder Associates, 1991

Golder Associates, 1991

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Spreading Lime on the stockpiles as an Interim Measure

Golder Associates, 1991

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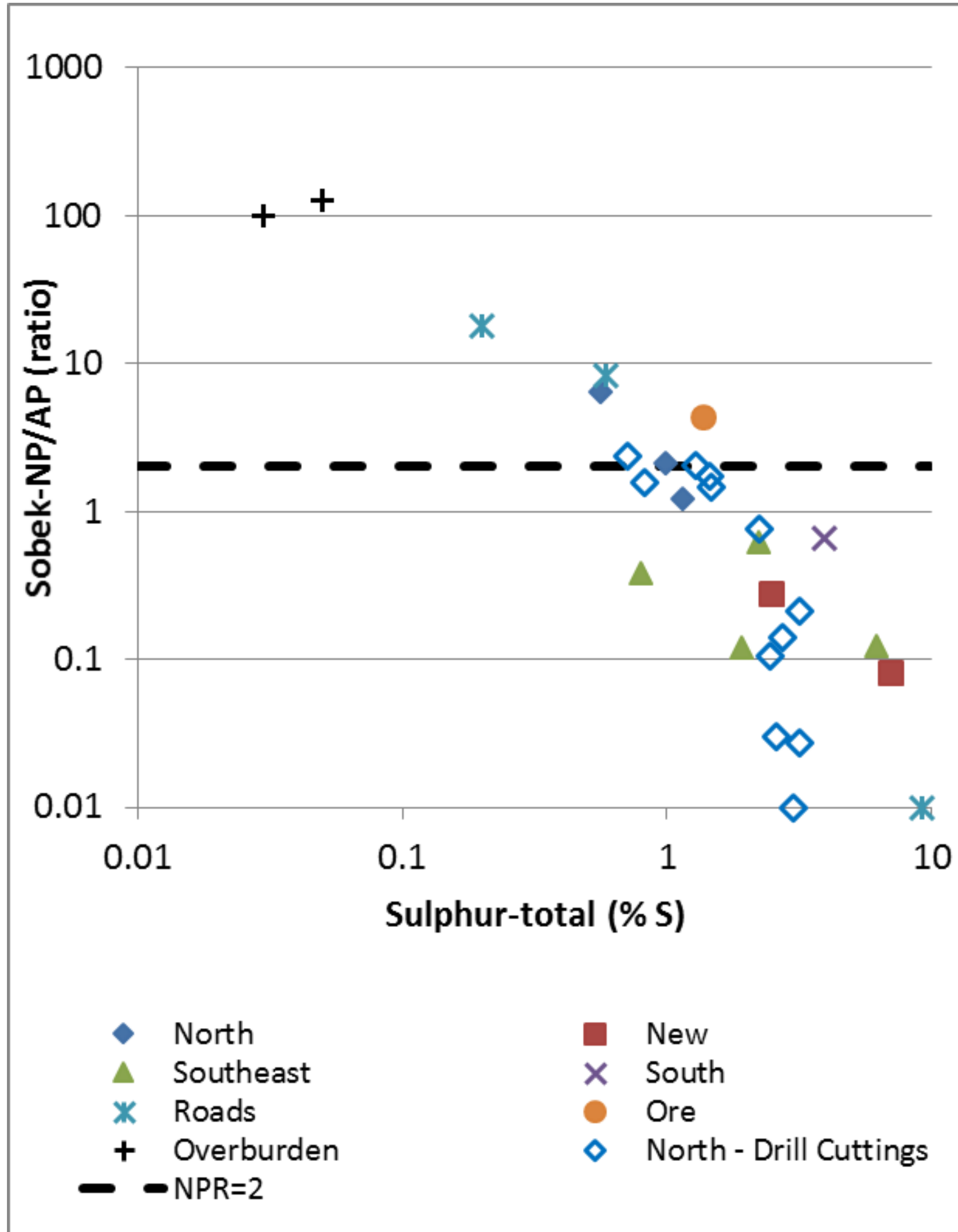
Waste Rock Characteristics

Original Data from SENES (1990)



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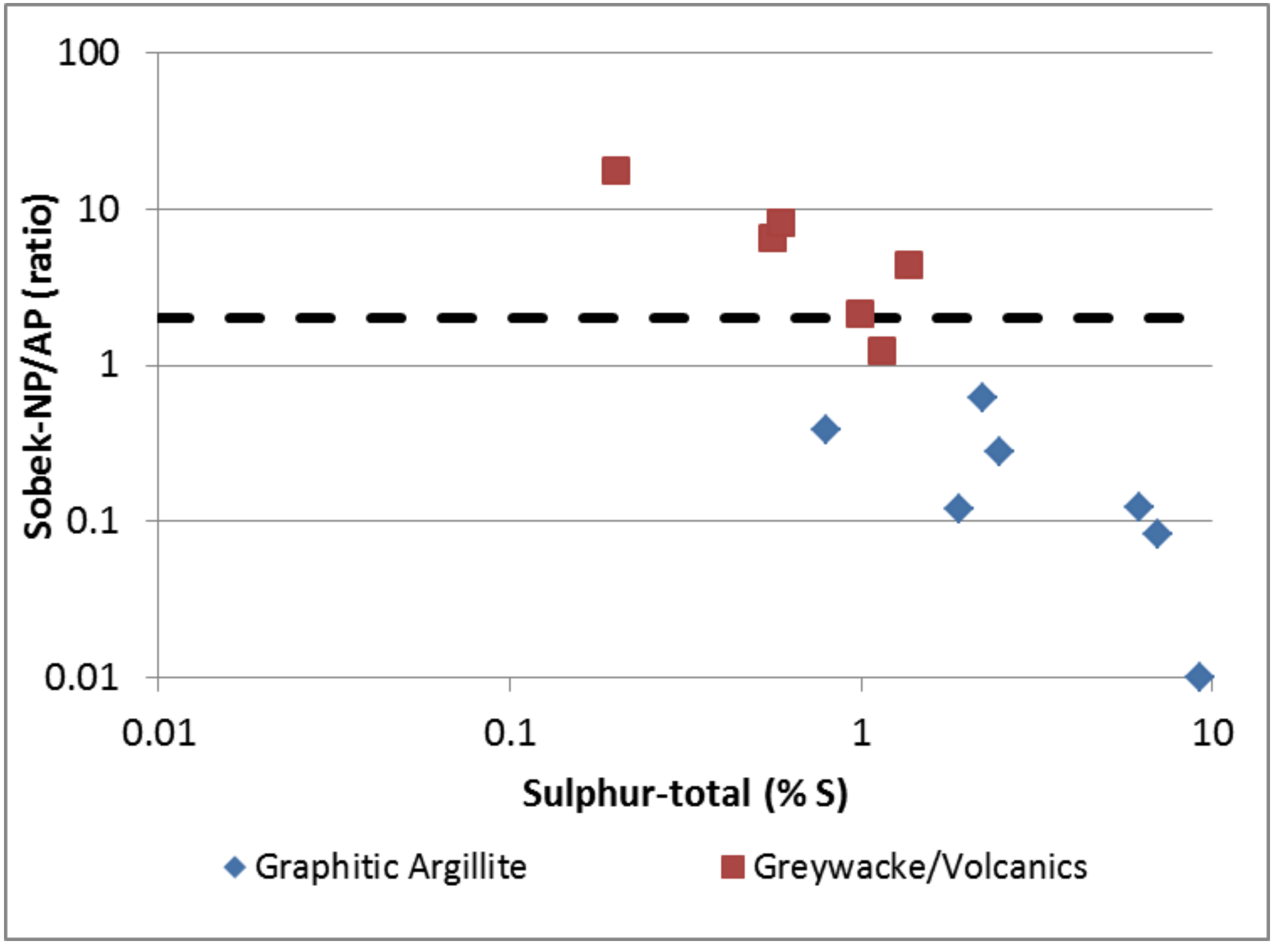
Argillite (PAG) and Other (non-PAG) Rock Types



Original Data from SENES (1990)

Conclusions of the Investigation

- Three main waste rock types, with pyrite & carbonate alteration:

- Metavolcanics and Greywacke
  - typically less than 1% S & classified as non-PAG

- Graphitic Argillite (schist)
  - typically 1 to 10% S and classified as PAG

- Only 10% of waste rock was Argillite but it was mixed with non-PAG rock and overburden

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Material Inventories (tonnes)

Location	Varved Clay and Till	Greywacke and Volcanic Rock	Graphitic Argillite	Totals
North	150,000	1,500,000	300,000	1,950,000
South-East	1,000,000	1,500,000	200,000	2,700,000
South	1,050,000	10,000	5,000	1,065,000
West	850,000	0	0	850,000
NEW (test)	0	0	25,000	25,000
Roads	0	1,055,000	7,000	1,062,000
River Channel	0	170,000	0	170,000
Total	3,050,000	4,235,000	537,000	7,822,000

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Data from Blakey (1993)

Additional Conclusions

- North and New stockpiles highly acid generating
- Southeast stockpile has substantial volume of PAG material with less acid leachate observed
- South pile has small volume of PAG – mostly clay
- West clay pile – no waste rock – from channel excavation

Potential Water Treatment Requirements

Location	Estimated Lime Requirement (tonnes CaO/year)
North Dump	1,875
Other Locations including Southeast Overburden & Waste Rock, South Clay Dump	975
Total	2,850

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Adapted from SENES (1990) and Golder (1991)

Options Assessed

Option	Description	Estimated Cost ($ 1991)
0	Continued Collection and Neutralization of Water	$7.4M
1	Encapsulation and Flooding in Place	$9.6M
2	Relocation to Kidd Tailings Basin	$9.2M
3	Relocation to Open Pit	$6.2M
4	Encapsulate with Geomembrane	$7.6M

Adapted from Golder Associates (1991)

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Selected Option – Relocate to Pit

- Relocated 3.26 M tonnes to pit in 1991-1992
- Placed as 1.5 m thick layers of rock and overburden
- Crushed Limestone added at a rate of 5.5 kg/t-rock for a total of 15,400 tonnes, spread between layers of waste rock
- Pit allowed to flood naturally with some pumping of water from Porcupine River
- Water level rose above backfilled rock in Spring 1993
- Overburden side slopes around pit were graded for stability

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Owl Creek Pit prior to backfilling and flooding

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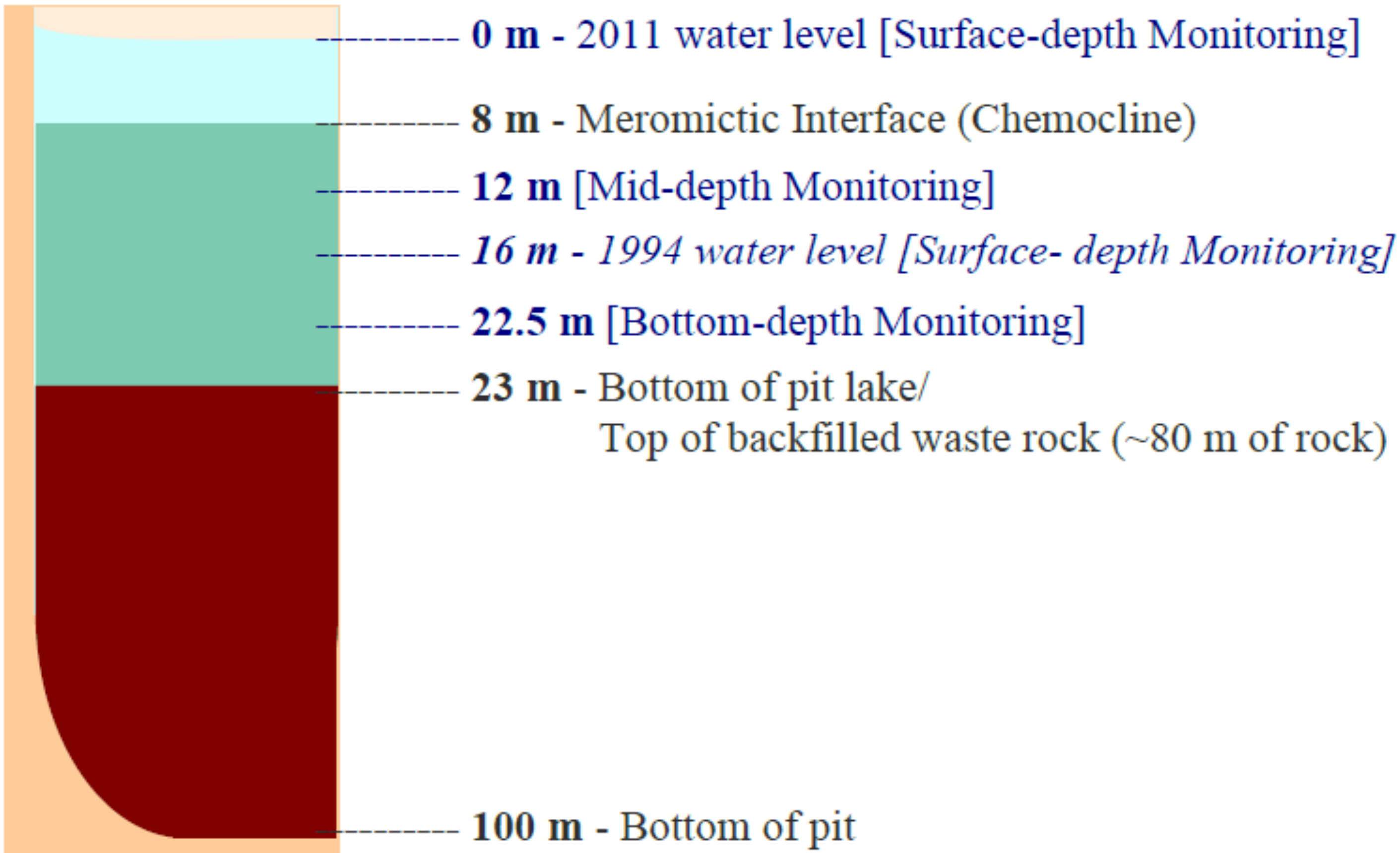
Schematic Cross-section: Flooded Owl Creek Pit



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Lessons Learned

- Don’t rely on entirely on historical precedent
  - testing required

- ARD can still occur even if only small volumes of Potentially Acid Generating (PAG) material are mixed with non-PAG rock

- Best to segregate potentially problematic materials

- Management of PAG waste rock in a flooded open pit is an extremely effective remedial option

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The Outcome

- Implemented closure plan very effective!
- Stay tuned for Part 2

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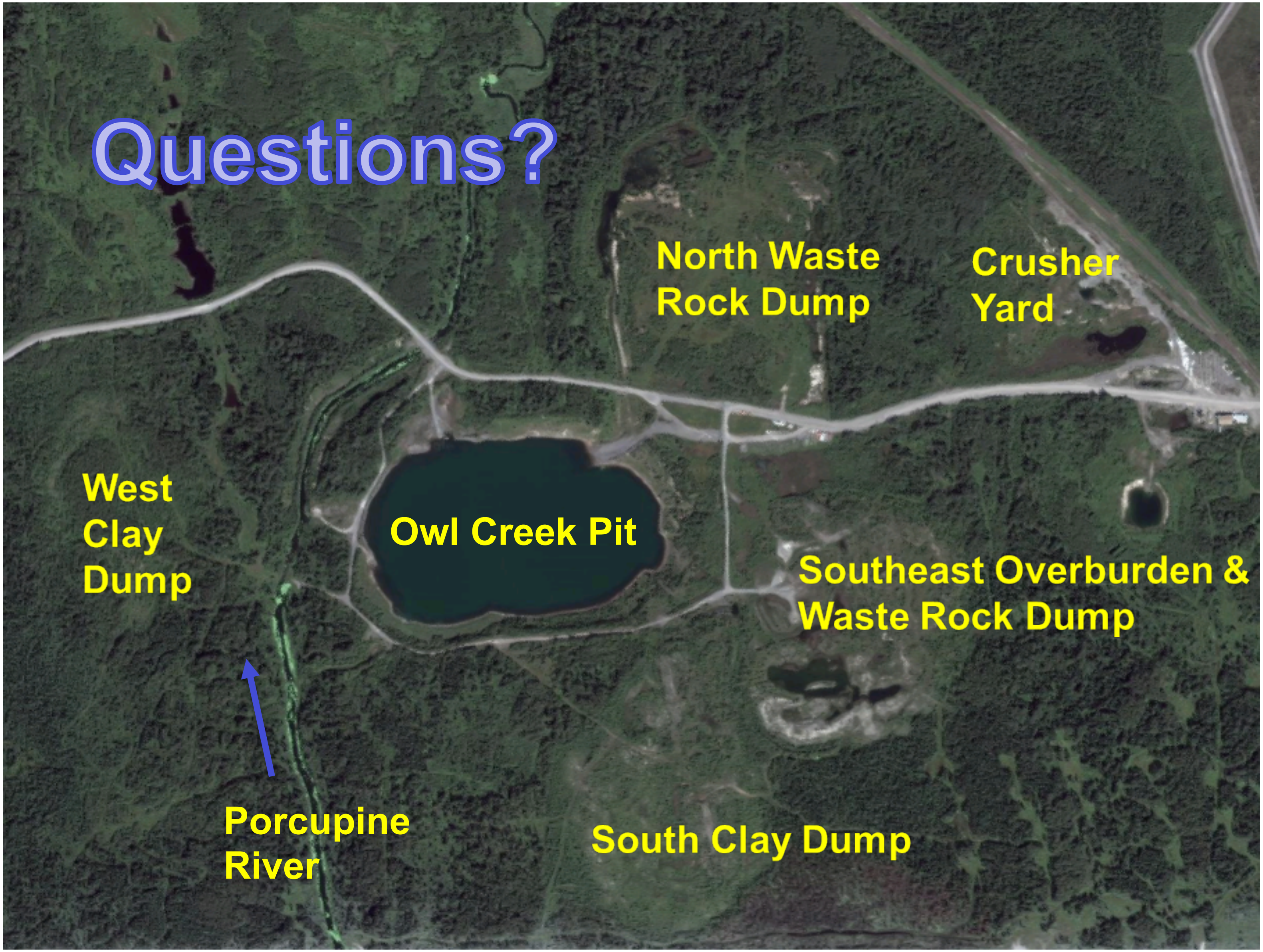

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