

# Overview of the Manitoba Orphaned & Abandoned Mines Sites Program

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Ernie Armitt, P.Eng. Director  
Doina Priscu, P.Eng. Chief Mining Engineer  
Mines Branch

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# Program & Funding

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- In 1999 – “Strategy Document of Rehabilitation of O/A Mines in Manitoba”
  - Environmental degradation and/or public safety
  - Selection criteria based on risk assessment approach
  - Funding
  - Implementation and recommendations

# Objective of Minesite Rehabilitation

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- (a) Protect public health and safety
  - physical stability;
  - Crown pillars, pit slopes, underground openings, tailing dams, spillways - require stability, cover, fence, berm, etc. to eliminate any hazard to public health and safety.

# Objective of Minesite Rehabilitation

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- (b) Alleviate or eliminate environmental damage
  - chemical stability;
  - surface and ground water must be protected against adverse environmental impacts resulting from mining / processing activities.

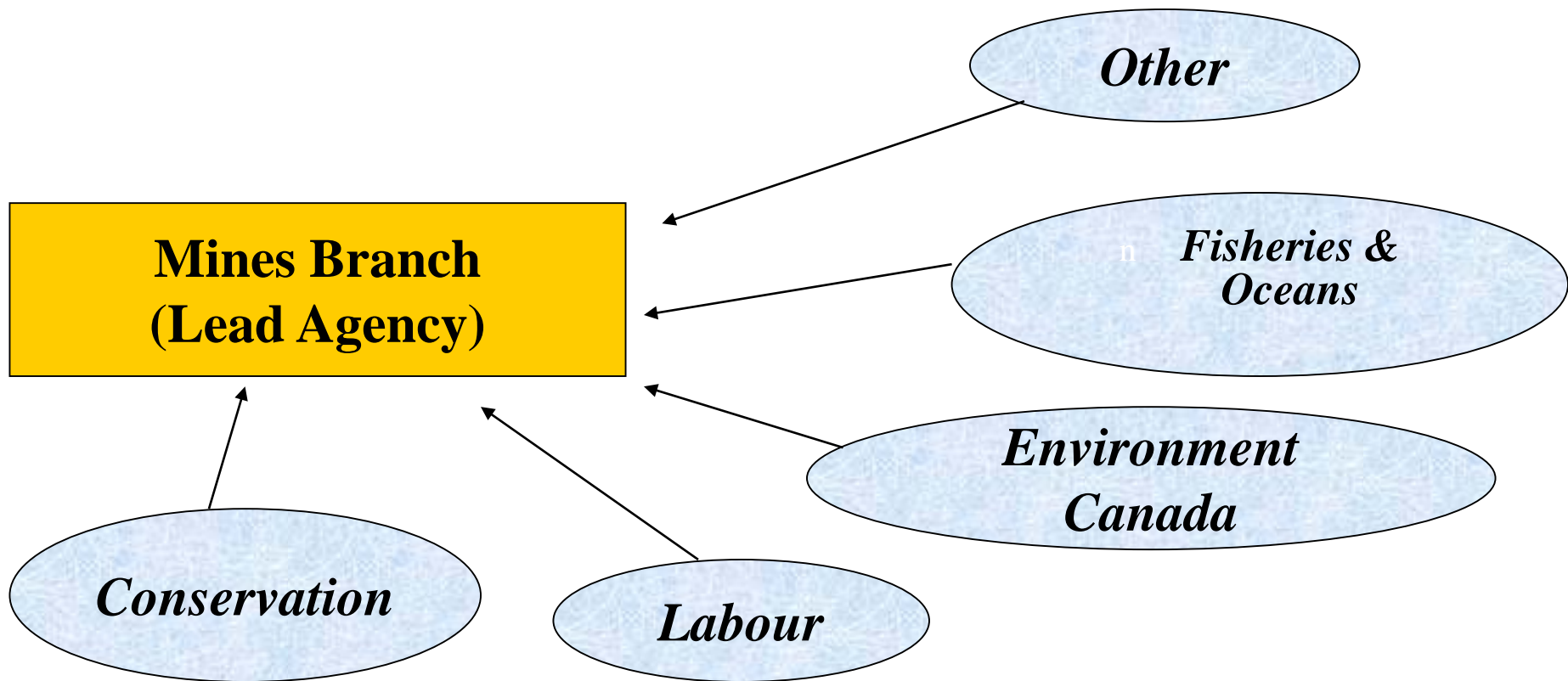
# Objective of Minesite Rehabilitation

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- (c) Allow a productive use of the land similar to its original use or an acceptable alternative.
  - Land use;
  - recreation, farm land, community use, etc.
  
- *Note: When developing a closure plan all of the above should be addressed in detail.*

# Functions of Other Regulatory Agencies

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# Funding

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- Environmental Liability Account set up in 2005 to be used for assessment and rehabilitation of OAMS in Manitoba
- Presently at 83M\$ and needs to be adjusted by March 2009
- Target date for rehabilitation of all sites in Manitoba 2012.

# Critical Sites:

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Site	Liability	Status		Consultants
Sherridon (1931-1953)	open glory holes; acid generating tailings	Remediation plan developed	Construction to start summer 2008	Wardrop Gartner Lee
Gods Lake (1935-43)	shafts, mill, buildings, power lines; environmental issue; ground contamination	Power line demolition completed	Site assessment to start in summer 2008	AMEC & To be determined
Baker Patton (1950)	acidic waste rock; acid mine drainage	Completed		Acres



# Critical Sites:

Site	Liability	Status		Consultants
Snow Lake (NorAcme 1949-1958)	arsenopyrite pile (contains \$43 M gold); emergency tailings area; lined leach pad	Preliminary site investigation completed	Detailed site plan and implementation to start summer 2008	Tbd
Lynn Lake (1953-1976)	550 acres of tailings; 25M tonnes  Faley Mine shaft and buildings, settling ponds and discharge monitoring	ETMA - site remediation plan completed 2007  WTMA – to develop site remediation plan	Under implementation	UMA and TetrES  KGS Group

# Critical Sites:

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Site	Liability	Status		Consultants
Mine Sites	149 Sites Safety and environmental liability	Risk assessment completed		AMEC
High priority sites	31 sites identified	11 sites were remediated	11 more sites to start summer 2008	AMEC

# Baker Patton – (before)

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# Baker Patton (after)

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# Baker Patton Summer 2007

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# Condition and Hazard Assessment of Orphaned and Abandoned Mines Sites in Manitoba – 2007

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- Manitoba:
  - Orphan or abandoned
  - Approx. 149 – reverted to the Crown
- Limited number of sites were inspected in the past
- Exact Location ? Size ? Condition?
- What are the issues
- How much \$\$ to fix them? What's the priority?
- Project initiated by the Mines Branch of the Manitoba Science, Technology, Energy and Mines in 2005
- Evaluation and hazard assessment completed by AMEC between May 2005 and February 2007



# Objectives of the Project

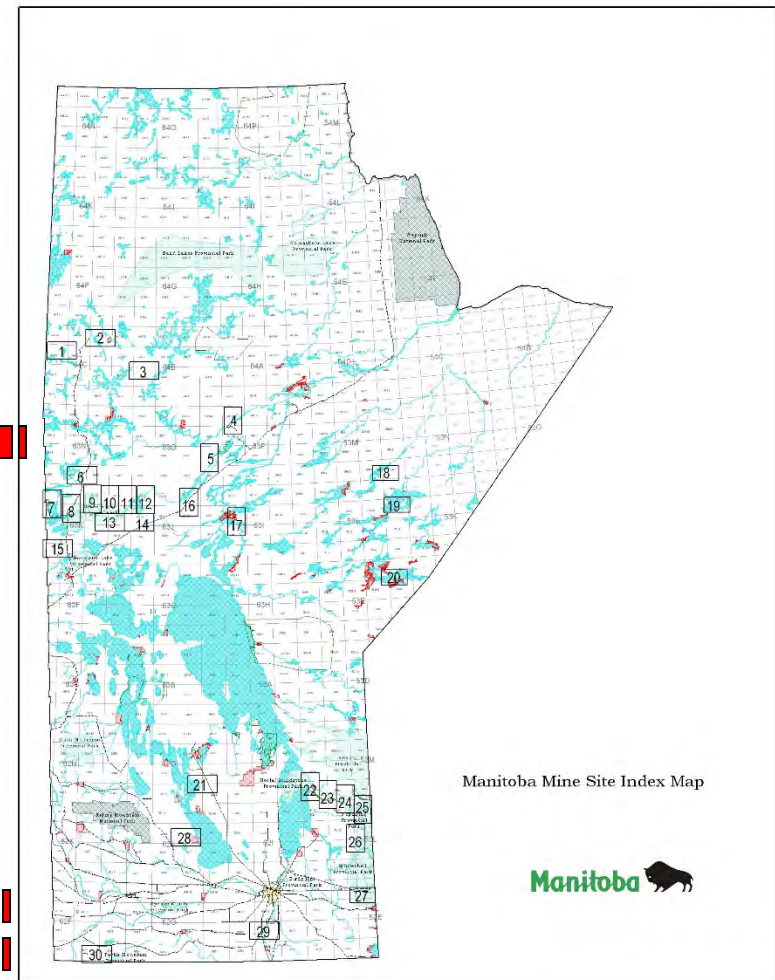
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- ❑ Conduct full inspection of the mine sites
- ❑ Review and asses their condition
- ❑ Evaluate hazards and liabilities – screening level
  - **Public safety**
  - **Environmental impact**
- ❑ Evaluate approximate budget costs for rehabilitation
- ❑ Prepare database of Crown owned inactive mine sites in Manitoba
- ❑ Prioritize rehabilitation work



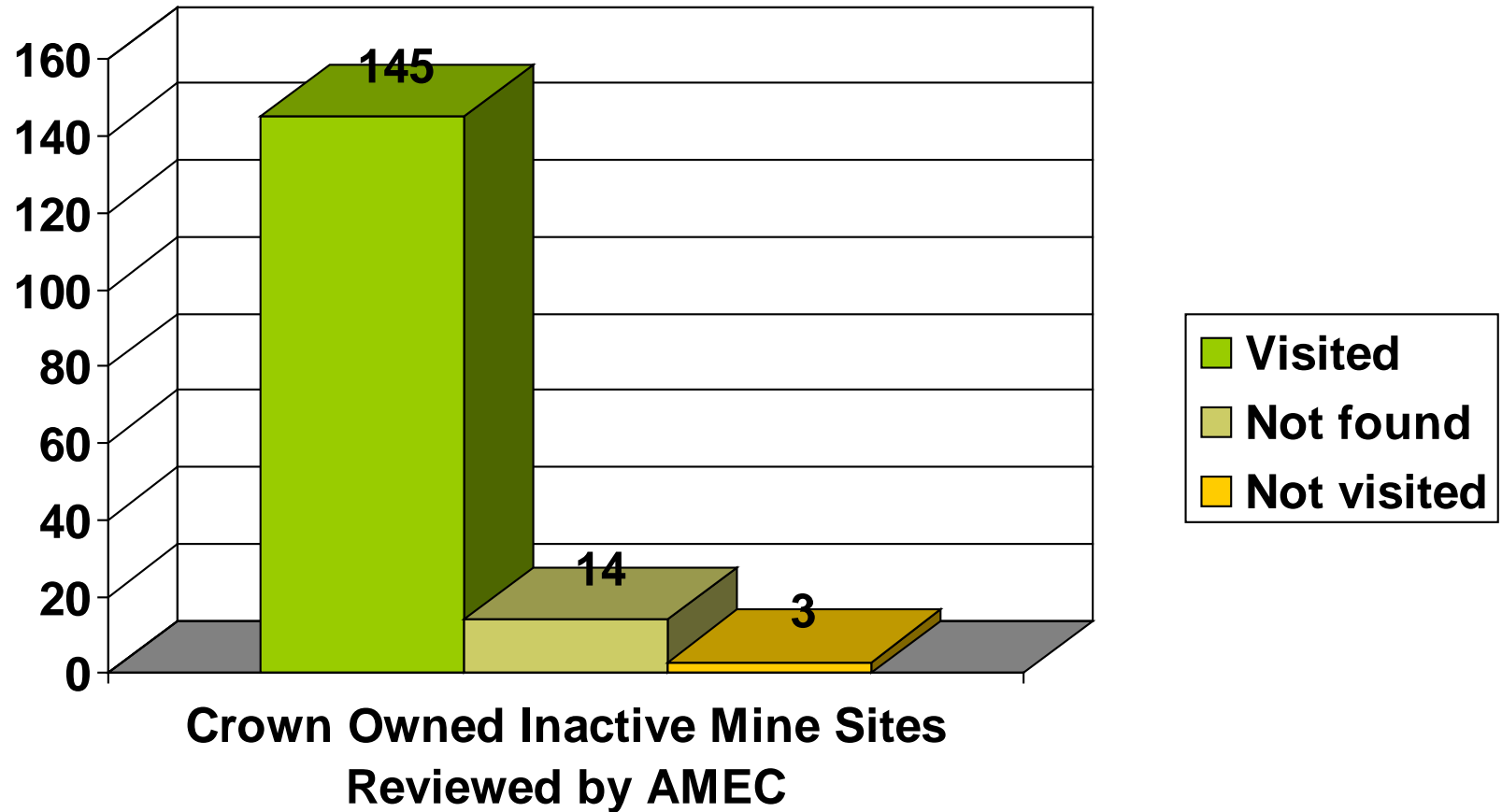
# Index Map and Area / Sheet Descriptions

AREA	Sheet No.	No. of sites
Lynn Lake	2	3
Cold Lake	6	4
Flin Flon	7	3
Cran - Portage	8	6
Elbow Lake	9	6
Snow Lake	11	2
Wekusko Lake	12	12
Hargrave Lake	14	1
Wabowden	16	1
Knee Lake	18	1
Gods Lake	19	3
Island Lake	20	2
Moosehorn	21	1
Manigotagan	22	4
Wanipigow	23	4
Bissett	24	35
Long Lake	25	31
Bernic Lake	26	11
West Hawk Lake	27	17
Goodlands	30	2
TOTAL		149





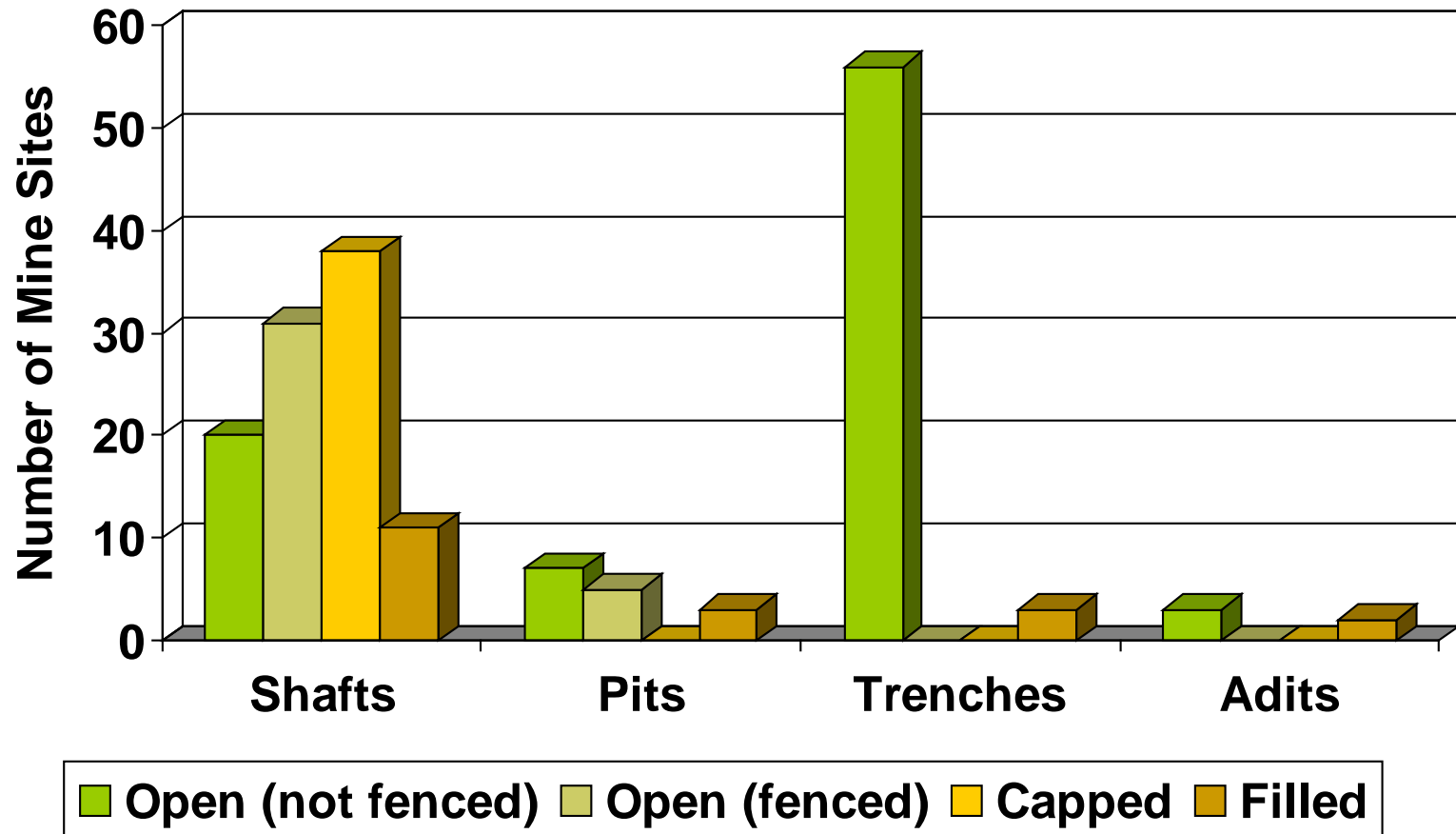
# Project Findings



# Project Findings (cont'd)

## Mine site openings (stats)

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# Project Findings (cont'd)

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- ❑ Inactive crown owned mine sites in Manitoba can be characterized as having an Moderate Hazard level (overall)
- ❑ Highest rating (Weighted Hazard Index) was **65.25** points out of a maximum **100**.
- ❑ A total of 31 sites (24%) received a High Hazard rating
- ❑ A total of 51 sites (39%) received a Moderate Hazard rating
- ❑ A total of 49 (37%) sites received a Low Hazard rating
- ❑ Public safety is confirmed as being current top priority
- ❑ In the future, as rehabilitation works are advanced and public safety hazards are considerably reduced, the balance of priorities would naturally shift towards minimizing environmental hazards.

# High Hazard Rated Sites in MB Selected for Rehabilitation in 2007 – 2008 AMEC

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- **A total of 10 sites – rated as High Hazard - were selected for rehabilitation**
  - **Grand Central Shaft - Wanipigow Mining Area**
  - **Emperor Shaft, Packsack Mine Shaft, Albany Shaft, Poundmaker Shaft and Vanson Shaft - Bissett Mining Area**
  - **Dumbarton Shaft – Bernic Lake Mining Area**
  - **Thompson Shaft, Waverley Shaft, and Unidentified Adit - West Hawk Lake Mining Area**
- **Some examples / site photos to follow**



# Emperor Shaft (Bissett Mining Area)

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# Packsack Mine Shaft (Bissett Mining Area)

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# Grand Central Shaft (Wanipigow Mining Area)

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# 2007 – 2008 Priority Sites

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- Sealing of shafts, adits and vent raises - #1 priority
- Demolition work
- Clean-up of the sites (debris, etc).
- Revegetation





# Rehabilitation of Mine Features and Openings

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- ❑ Novel approach in sealing openings
- ❑ Very attractive for remote areas
- ❑ Use of Equipment-less Foam Sealant, a polyurethane foam
- ❑ Used and proven in the US for the last 15 years (NV, AK, AZ, MO)
- ❑ One test site completed in Saskatchewan
- ❑ Small size applications completed in the past in ON, AB & BC
- ❑ Manitoba – First large scale application in Canada in a mining environment



# Pros and Cons of Using EFS Product

## □ Advantages:

- Equipment-less
- Attractive for remote sites
- Provides good positive seal
- Inert material
- Light weight
- Resistant to ARD and chemicals
- Can be stored in sub-zero temperatures

## □ Disadvantages

- Flammable (needs fire retardants on exposed surface)
- Mix not to be poured in sub-zero temperatures



# Progress to date

- ❑ All 10 sites were completed and rehabilitated within original budget
- ❑ Schedule was met (January 1<sup>st</sup> to May 31<sup>st</sup>)
- ❑ Used of winter conditions to access sites was critical for remote areas
- ❑ Use of EFS proved to be a success
- ❑ Intensive laboratory testing undertaken in AMEC's Hamilton office on the foam sealant. Both ASTM and customized testing completed to confirm material characteristics and properties.
- ❑ Laboratory test report to be available in August 2008 – compares lab to field pours of the foam.





# Selected photos from sites 2007 – 2008 Mine Site Rehabilitation Program

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# Selected photos from sites 2007 – 2008 Mine Site Rehabilitation Program

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# 2008 – 2009 Mine Site Rehabilitation Project in Manitoba

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- **Four sites to be rehabilitated**
  - Flin Flon (1)
  - Bernic Lake (1)
  - Long Lake (2)



# 2008 – 2009 Mine Site Rehabilitation Project in Manitoba

- **Seven mine sites to prepare rehabilitation plans**
  - Wekusko Lake (1)
  - Cranberry Portage (2)
  - Long Lake (2)
  - Bernic Lake (1)
  - Island Lake (1)
- **Work to include site investigations and laboratory testing, risk assessment, preparation of remedial alternatives, and budget cost estimates.**
- **Project to be completed by April 2009**





# Environmental Assessment & Remediation of the East Tailings Management Area Lynn Lake, Manitoba



# ETMA History

- Mining/milling from 1953 to 1976 with tailings piped to ETMA
  - ~20 M tonnes of tailings over 250 ha



**Since Operations ended.....**

- **Numerous studies (incl. Health Risk Assessment & studies of tailings & river)**
- **Groundwater, surface water, vegetation, aquatic health, & ecological risk assessments & monitoring by TetrES**
- **Dyke-stability & safety monitoring & required maintenance by UMA | AECOM**
- **Conceptual designs for engineering options by UMA | AECOM**
- **Ongoing site-management activities by TetrES & UMA | AECOM**



Town

Cutoff Pond

**ETMA**

cyclone  
area (coarse)

Dyke 2

slimes area (fine)

Dyke 3

Pond 1-3

overflow

Lynn  
River

Dyke 4

Pond 3-4

Pond 4-5

Dyke 5

surface-  
discharge  
points

**Looking SW**

# Major Issues

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## Dyke Stability & Safety

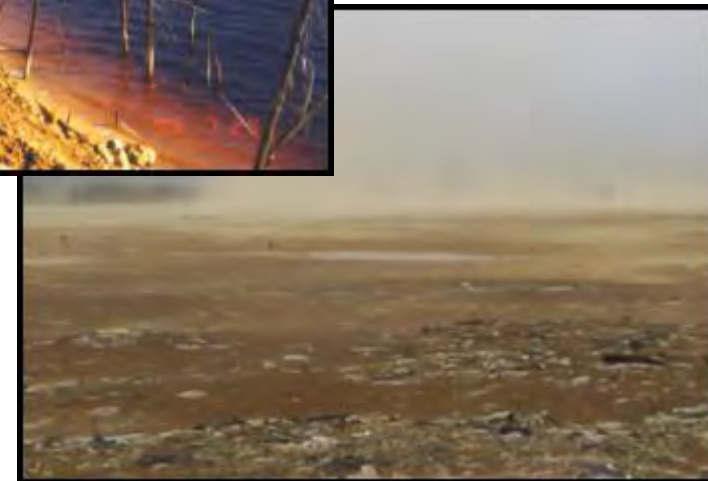


## Acid-Mine Drainage

- ❑ Surface-water runoff
- ❑ Groundwater contamination



## Tailings Dusts



# Site-Management Plan

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- In 2006, an agreement was signed by Province of Manitoba & Viridian to develop & implement a Site-Management Plan
- Plan Objectives are to:
  - Mitigate environmental impacts of ETMA on Lynn River
  - Address community concerns related to dust entrainment
- Initial Plan will evolve as data accumulate & knowledge grows
  - Plan involves pilot testing of some components to determine whether effectiveness sufficient to be included in evolving Plan



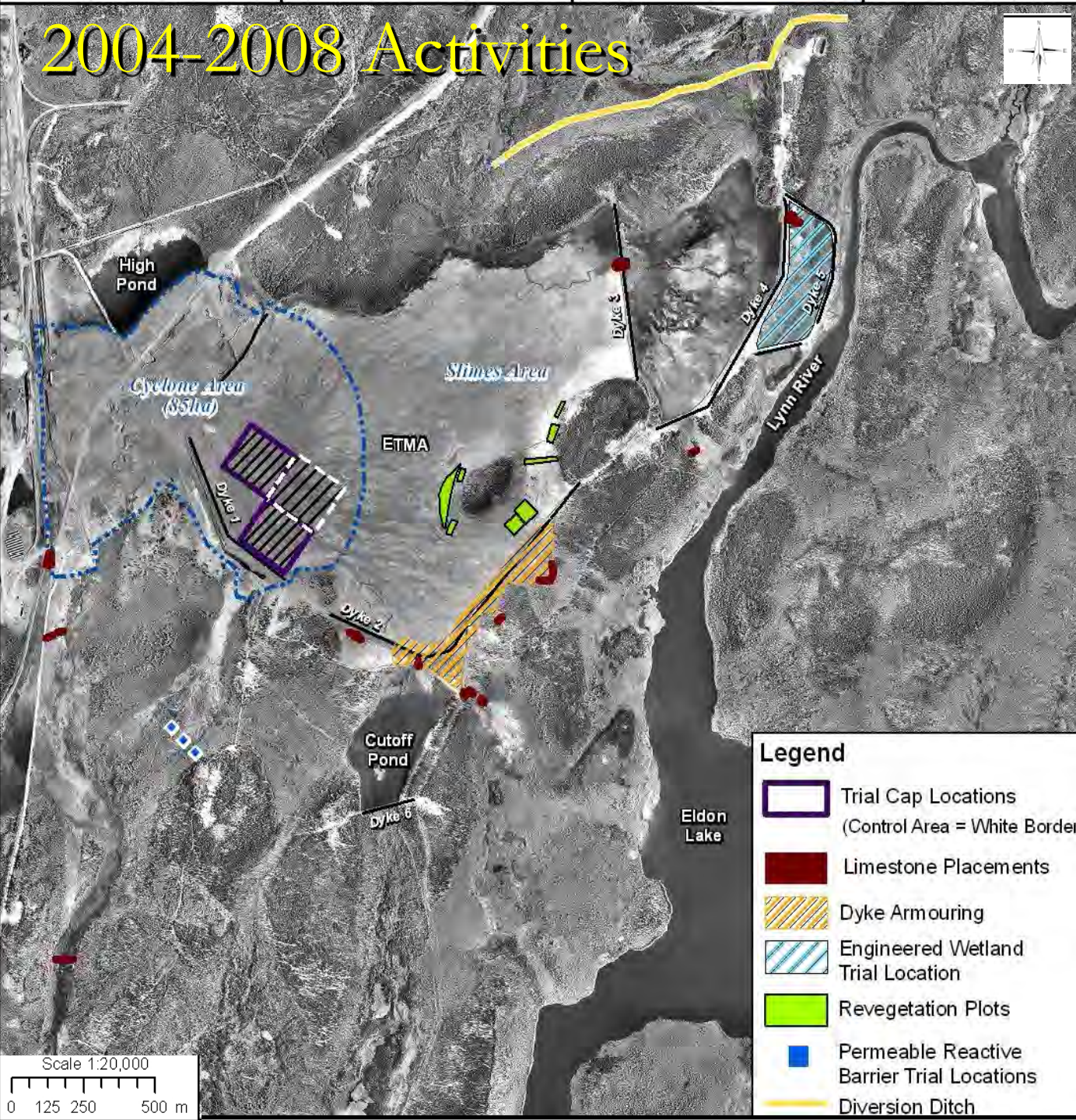
# Site Management

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- Immediate need to manage surface-water runoff metal loadings along pathways to river
- Immediate need to mitigate wind erosion & reduce dust entrainment
- Immediate need to test feasibility of some selected management options before committing to conceptual design(s)
  - e.g., Permeable Reactive Barrier, Upstream/Headwater Diversion, Cap/Cover, Engineered Wetlands...
- Other elements of Long-Term Plan address groundwater-plume migration & other challenges



# 2004-2008 Activities



**Diversion Ditch**



**Limestone Placement**



**Permeable Reactive Barrier**



**Cap Construction**



**Wetland Enhancement**



# WEST TAILINGS MANAGEMENT AREA

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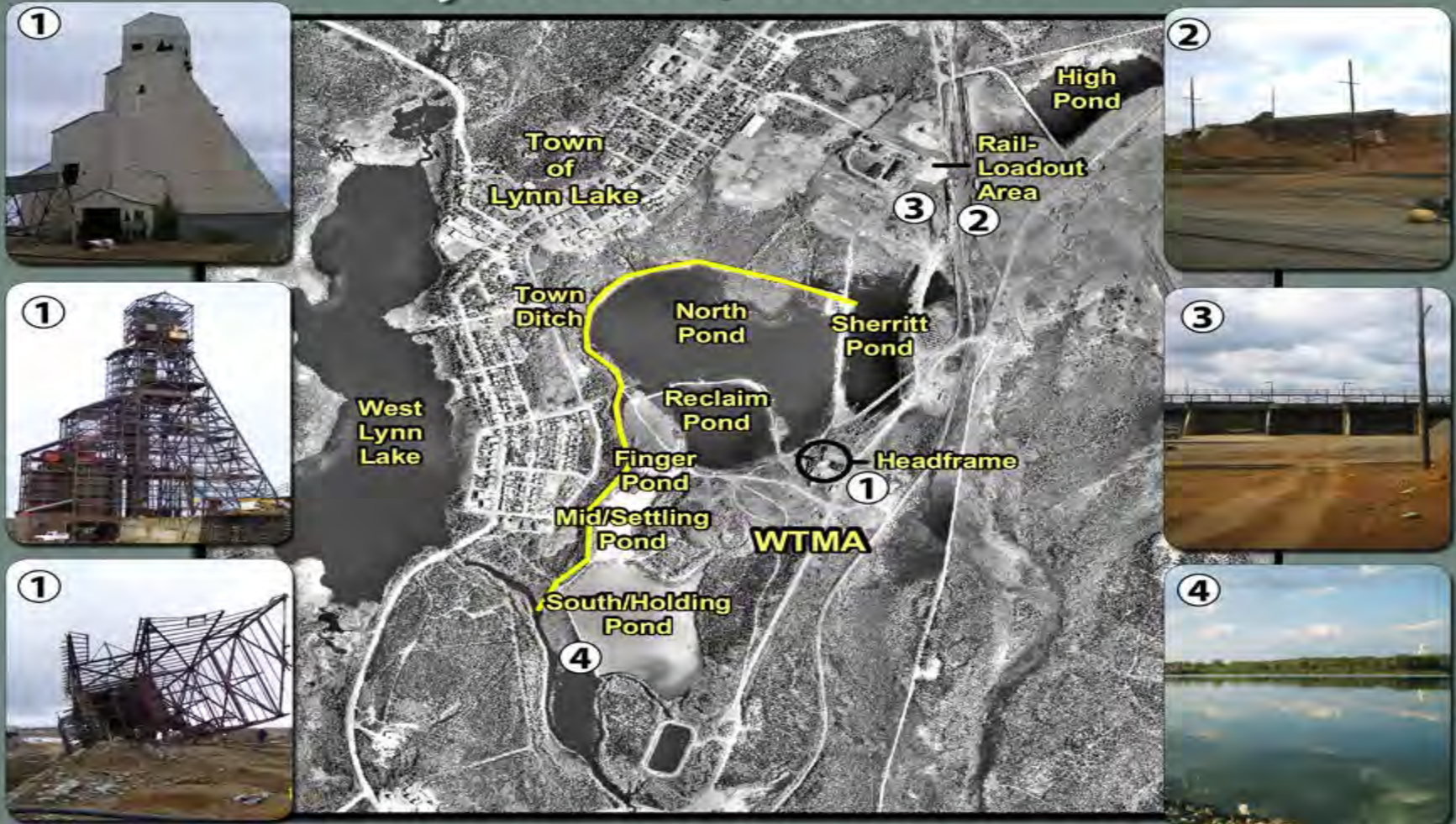
## (WTMA)

### LYNN LAKE, MANITOBA

#### **Three Areas:**

- ❑ Mill Site
- ❑ Ruttan Loadout
- ❑ Tailings Ponds

# West Tailings Management Area (WTMA), Lynn Lake, Manitoba



Agreement signed by  
Central Sun Mining Inc &  
Mines Branch May 2008

Mill and loadout area  
remediation underway

Site Management  
Plan to be developed



# Mill Site and Ruttan Loadout

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## Problems

- Unconfined Deposits of Tailings and Waste Rock
- Ruttan Loadout also contains base metal concentrate
- Tailings and Waste Rock are Acid-Generating

## Approach

- Contract with KGS Group of Winnipeg in 2006
- Phase III Environmental Site Assessment (ESA)
- Remedial Action Plan (RAP)

# Environmental Site Assessment

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## Phase III ESA

- ❑ Delineate Extent of Tailings, Waste Rock and Concentrate
- ❑ Determine Concentrations of Metals and Compare to CCME Guidelines
- ❑ Determine Acid-Generation Potential of Different Materials
- ❑ Determine Quantities of Materials Requiring Remediation

## Remedial Action Plan

- ❑ Examine Remedial Alternatives
- ❑ Recommend the Preferred Alternative and Prepare Cost Estimates for Implementation



# Results of Phase III ESA

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- ❑ Total of 30 Samples of Tailings and Concentrate
- ❑ Primary Contaminants were Chromium, Copper, Nickel and Zinc
- ❑ Tailings and Concentrate Generally High Acid-Generation Potential
- ❑ Waste Rock Generally Low Acid-Generation Potential
- ❑ Tailings and Concentrate Volume Estimated as Approximately 100,000 cubic metres
- ❑ Waste Rock Volume Estimated as Approximately 200,000 cubic metres



# Remedial Action Plan

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- ❑ Consolidate Tailings, Waste and Concentrate into One Large Waste Pile
- ❑ Place Demolition Debris from Loadout Structure into the Pile
- ❑ Cover Waste Pile with Geomembrane to Reduce Leachate Volume
- ❑ Cap Waste Pile with Sand and Organic Soil, and Revegetate
- ❑ Divert Surface Water from Waste Pile
- ❑ Collect and Treat any Leachate Produced from the Waste Pile



# Remediation Plan

# Implementation

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- ❑ Contract with KGS Group to Implement the RAP in 2008
- ❑ Demolition of Ruttan Loadout and Mill Site Buildings in 2008
- ❑ Construction of Waste Pile, Cap and Surface Water Diversion in 2009
- ❑ Monitoring until Summer 2011



# Tailings Ponds

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- ❑ Management of Tailings Ponds was the Responsibility of Private Companies
- ❑ Province of Manitoba Assumed Responsibility in Spring of 2008
- ❑ Continue to Operate Water Treatment System
- ❑ Examine Methods to Improve Efficiency of Existing Treatment System
- ❑ Develop Conceptual Design for Permanent Treatment System

# Sherridon Mine Rehabilitation - Wardrop

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- ❑ The tailings will be relocated and neutralized and then flooded.
- ❑ This is a multi phase and multi year project to be completed by 2011.
- ❑ First phase involves design of the dams for raising the water level of North Camp Lake.
- ❑ Second phase is the construction of the dams and relocation of the tailings. Construction of the South Camp Lake dam starts in 2008.
- ❑ Once the tailings are relocated the water level in Camp Lake will be raised to flood the tailings.









# Moving Forward in 2008-2009

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- ❑ Sherridon Mine rehabilitation plan to be implemented
- ❑ Lynn Lake ETMA and WTMA site remediation plans to be implemented
- ❑ Snow Lake remediation plan and implementation will be starting in 2008
- ❑ El Mine (Lynn Lake) site investigation and closure plan development and implementation will be starting in 2008
- ❑ Rehabilitation of another 11 High hazards sites will be implemented
- ❑ God's Lake site investigation and demolition will commence

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- Thank you for your attention!
  - Questions?