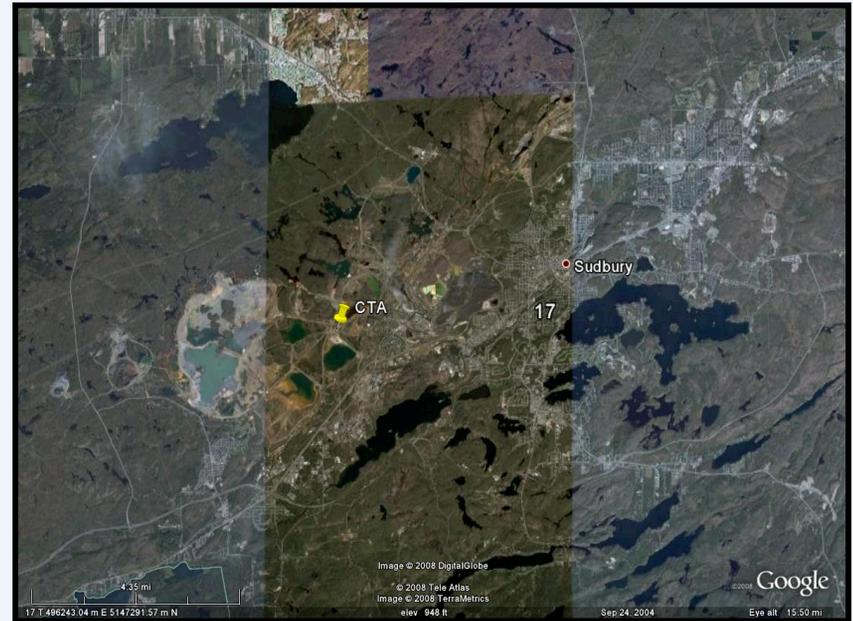
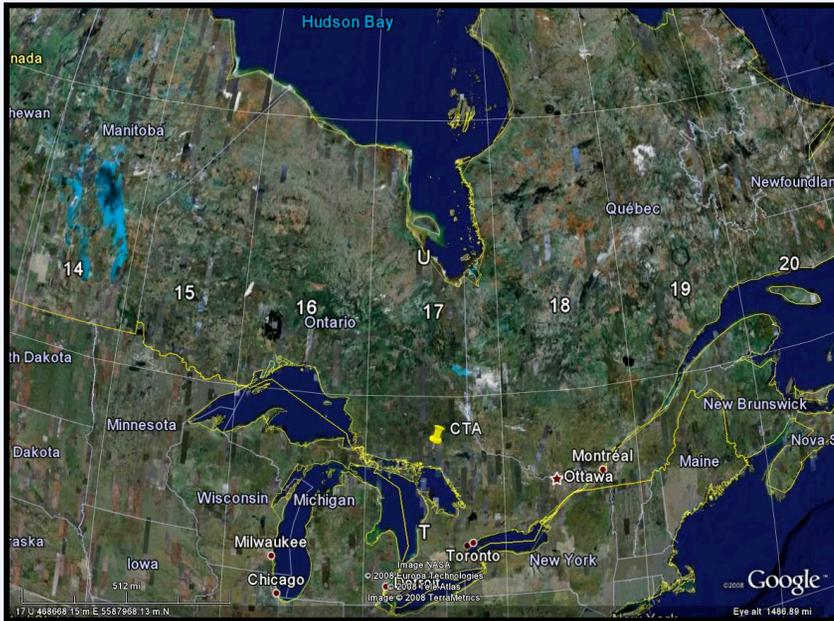


# Copper Cliff Central Tailings Area (CTA) General Overview and Management Systems



# General Site Conditions



- The CTA covers approximately 35 km<sup>2</sup> and is situated between the communities of Copper Cliff and Lively, approximately 7 km's apart and adjacent a major traffic route.
- The site began receiving tailings in 1937 and has evolved into a complex system of active and former tailings disposal cells, watershed systems and treatment plants.
- The CTA comprises several discrete tailings disposal areas or “cells” of various sizes, which are referred to as the A, CD, M, Inactive Pyrrhotite Storage (IPS), Q, P, and R Areas. Only the R Area is active while the remaining areas, ~50% of CTA, are inactive and reclaimed.
- Given the quantities of impounded tailings and process water and the CTA's urban setting, the tailings containment structures are managed as high consequence dams.

## CTA Aerial Views



Active R Area



Inactive Areas (l to r: P, CD, M)

# CTA – Storage & Plan View



Tailings Area & Operating Period	Current Storage (M tons)	Future Storage (M tons)
A (1936-58) (2035-47)	16	163
CD (1940-50)	38	0
M (1945-79)	115	0
IPS (1957-70)	3	0
Q (1960-74)	53	0
P (1960-89)	118	0
R (1985-2035)	204	222
<b>Total</b>	<b>547</b>	<b>385</b>



•At the current life of mine plan, 932 M tons of tailings will be contained within the CTA

# Tailings Filling Plan for Active R Area



- The CTA filling plan is updated at 2 or 3 year intervals or when significant change(s) are proposed to the tailings deposition strategy (i.e. development of long pyrrhotite beaches or winter beach deposition). Filling plan updates are undertaken by an external consulting engineering group.
- The filling plan updates typically include:
  - Target or predicted tailings dam crest, beach, and bathymetric topography based on production inputs and measured deposition characteristics
  - Predicted topography in 1 year time steps for the first 5 years followed by 5 to 10 year time steps to verify long term deposition is consistent with Certificate of Approval and Closure documents
  - Water management plan, namely target pond levels and dam crest elevations to optimize deposition while maintaining necessary freeboard for regulatory floods and dam safety requirements
- Updates also include a capital construction milestone schedule to assist long and short term capital planning.

# Tailings Filling Plan for Active R Area (cont.) - General Filling Strategy



- Vale Inco's Clarabelle Mill circuit produces two tailings streams, rock and pyrrhotite tailings. The pyrrhotite tailings have higher sulfur content (18 - 20%) than rock tailings (1.5% - 2%) and have a finer gradation.
- The pyrrhotite tailings are highly reactive with respect to acid rock drainage and metal leaching (ARD/ML). This combined with their fine gradation renders the material unacceptable for upstream perimeter dam construction.
- Consequently, to reduce long term ARD/ML liabilities, the filling strategy relies on rock tailings to construct sufficiently high perimeter containment dams that allow enough freeboard to submerge the centrally deposited pyrrhotite tailings.

# CTA Management Systems



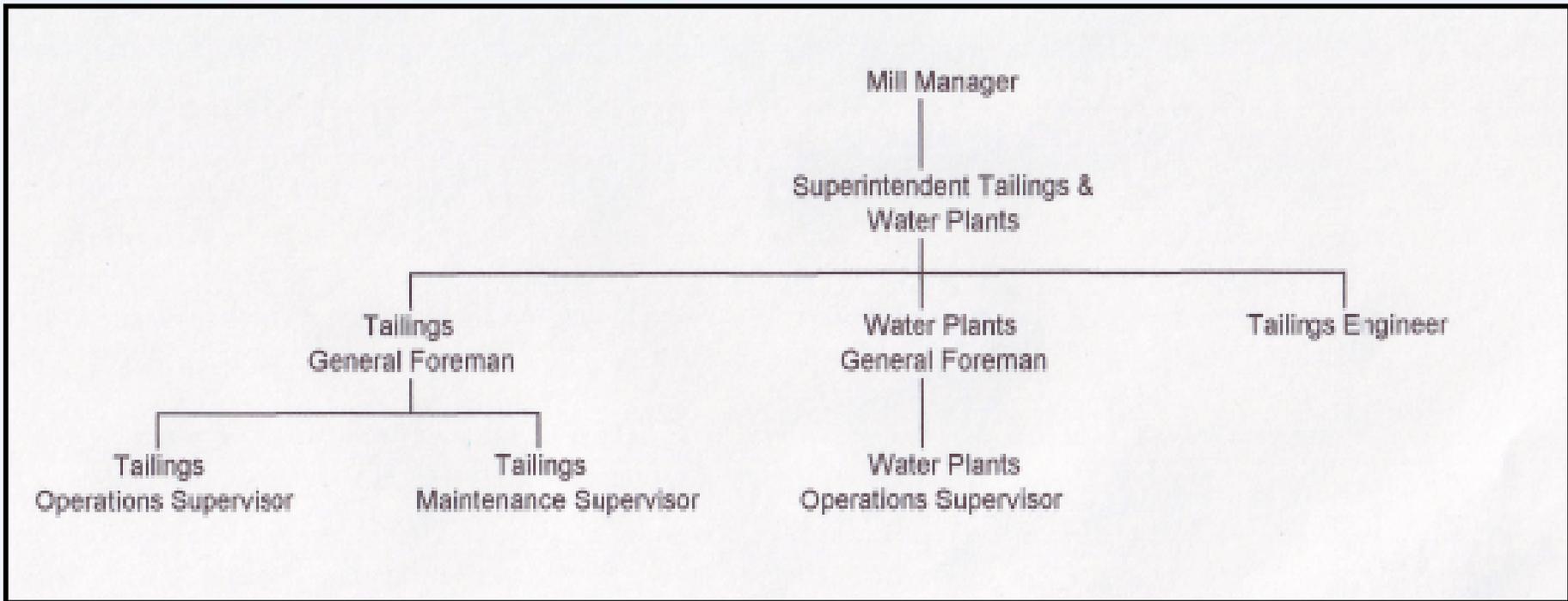
- Capital Expenditure Planning
  - Based on requirements identified from filling plan and other engineering studies
- Environmental Controls
  - Dam Safety Inspections
  - Surface Water Management
  - Seepage Control
- Tailings Filling Plan for Active R Area
  - Short term 5 year and long term 5 to 25 year planning
  - Operations Maintenance and Surveillance (OMS) Manual for ongoing construction, inspection and maintenance activities
  - Dust Control

# CTA Management Systems (cont.)



- Geotechnical Review Board
  - Provides technical commentary and review to Vale Inco management regarding significant issues identified with CTA
- Active Participation with Industry Wide Associations involved with Tailings Management
  - Canadian Dam Association (CDA)
  - Mining Association of Canada (MAC)
- Stakeholder Involvement
  - Community Liaison Committees
  - Regular Vale Inco Management tours
  - Regular visits from regulatory bodies such as MOE

# Tailings Management Organization Structure



- Given the size of process water ponds impounded within the CTA and that the CTA comprises approximately half the serviced watershed reporting to the CCWWTP, water management and treatment are integral to the operation of the facility.

- Given the duration the CTA has been in operation and the evolution of geotechnical engineering and other industry operation guidelines, a strategy is in place to upgrade the facility.
- The strategy is based on various levels of engineering assessment. Examples include:
  - Filling Plan Development Requirements (Guindon and R1-CD Dams).
  - Earthquake Hazard Analysis resulted in increased design seismic loading (All perimeter structures).
  - Hydrology studies identified the need for upgrades to water management capabilities (A, P and M Area).
  - CTA closure strategy revisions resulted in pumping system upgrades to deposit pyrrhotite tailings in central R Area locations.
- Short and long term capital plans are jointly developed by the Superintendent, Tailings Engineer and Capital Projects Engineer.

- **Dam Safety**

- Formal annual inspections undertaken by independent geotechnical engineering consultant.
- Tailings Engineer is responsible for informal quarterly inspections and instrumentation monitoring.
- Pond levels are managed in accordance with a formal Operations, Maintenance and Surveillance manual which was prepared under several industry guidelines, such as ODSG, CDA, and MAC.
- During the course of their typical work, tailings system operators, mechanics and patrol personnel are also tasked with reporting unusual field conditions to the Tailings Engineer.
- Patrol Personnel trained in visual geotechnical observations and are on duty 24/7/365.

- **Surface Water Management**

- Surface runoff leaving the CTA reports to the Copper Cliff Waste Water Treatment Plant (CCWWTP). Plant capacity is 200,000 m<sup>3</sup>/day.
- The CCWWTP services a watershed approximately 50 km<sup>2</sup>, and Vale Inco are nearing the completion of a number of watershed and reservoir system upgrades to support a store and release strategy in managing peak runoff events. The hydraulic reservoir control structures are monitored and controlled remotely.
- The water management plan for the CTA requires freeboard maintenance sufficient to store a 1:100 yr spring flood while still allowing for safe passage of the 1:1000yr flood. Pre-feasibility engineering was recently initiated to design a spillway capable of safely passing the Probable Maximum Precipitation (PMP).

- **Seepage Control**

- The physical stability of the active R Area containment structures requires the outer dam shell to remain in a “drained state”, consequently the R Area perimeter dams were designed with an under drainage system that allows controlled seepage from the downstream toe. Seepage either reports to or is generally directed by gravity to satellite downstream collection facilities for return pumping to the tailings pond. There are 3 seepage stations to service 6.5 km’s of dam.
- The old stack perimeter containment dams were not constructed with under drainage, however seepage is of significant quality and quantity to require collection and pump back from several locations. There are 4 seepage stations to service 3.7 km’s of perimeter dam.

- **Dust Control**

- Two principal drivers of the CTA filling plan are focused on minimizing the risk of dusting events.
  - Beach width is minimized (to the extent possible without compromising physical stability or required freeboard) in order to maximize the extent of water cover.
  - Seasonal deposition strategies. During late winter/early spring snow cover on the tailings beach is typically minimal and the tailings surface has “freeze dried” Consequently, deposition in areas proximate adjacent communities occurs when dust suppression crews are readily available to follow tailings deposition and dam raising activities.
- From early spring to late fall, dust suppression crews are coordinated to closely track deposition and dam raising work. Dust suppression measures include high pressure tacifier application from aircraft and truck mounted hydro-seeders and straw spreading/crimping over trafficable portions of the beach.

- Board members are recognized in the geotechnical engineering aspects of tailings management.
- Board meets annually over 3 to 4 days and includes ground and aerial reconnaissance. External consulting engineers in addition to Vale Inco engineers present status updates of relevant projects for commentary and feedback from the board. The board presents their findings to Vale Inco stakeholders during a wrap up meeting.
- The board will also meet as required to review/comment on significant projects or technical issues.
- Vale Inco will be adding an internal GRB member to provide operator perspective and continuity of past experience. There is consideration towards to including experts in geochemistry and/or hydrotechnical engineering. Other technical expertise is retained on a project by project basis as required (i.e. paste or thickened tailings).

## Active Participation with Industry Wide Associations concerned with Tailings Management



- Vale Inco CTA staff actively participate in various industry wide associations and forums relating to dam safety, tailings management and other mining/environmental issues. These primarily include CDA, MAC, MEND and ICARD.
- Vale Inco recently presented (September 2008) papers on two major CTA containment structures at the CDA conference in Winnipeg.
- Vale Inco is an active member of the MAC working group that prepared the guideline document entitled “Developing an Operation, Maintenance and Surveillance Manual for Tailing and Water Management Facilities”. Other MAC documents Vale Inco have contributed to include:
  - A Guide to the Management of tailings Facilities
  - External Verification of the Towards Sustainable Mining Program

- A number of stakeholders are apprised of Vale Inco's management activities of the CTA. Some of these include:
  - Copper Cliff Liaison Committee, a working group comprising Vale Inco staff from various operational departments and several Copper Cliff residents. The group meets bi-monthly to review tailings issues among an number of environmental issue.
  - Senior Vale Inco Management tour the CTA by ground and helicopter. The Superintendent and Tailings Engineer typically tour the CTA together once per month.
  - Ontario Ministry of Environment officer's typically tour the CTA once per quarter accompanied by Tailings and Environmental Management

Thank-you!

Questions?