Controlling Surface Water at One of Canada's Largest Base Metals Operations: From Legacy Challenges to Environmental Award Winner

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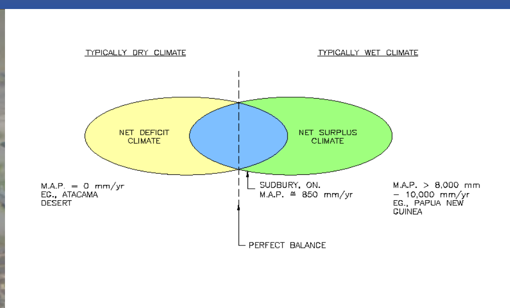
Presentation Overview

- INTRODUCTION
- BACKGROUND / HISTORICAL CONTEXT
- PROBLEM STATEMENT
- CONCEPTUAL OPTIONS REVIEW
- PREFERRED OPTION
- PREFERRED OPTION COMPONENTS
- CLOSING REMARKS / QUESTIONS

INTRODUCTION: Water Management



Background / Historical Context

- 1883: Cu/Ni sulphide ore was discovered in Sudbury Basin
- 1929: INCO was formed by merger with MOND Nickel Co. Ltd.
- 1930: Heap roasting was discontinued
- 1937: A-area was commissioned for tailings disposal
- 1940-1960: CD-, M-, IPS-, Q-, P-areas are commissioned
- 1970: CELA Canadian Environmental Law Association founded
- 1971: Clarabelle Mill was commissioned
- 1972: CCWWTP and NCWWTP are commissioned
- 1977: MMLER Regulation came into force
- 1989: Milling is centralized @ Clarabelle Mill
- 1991: Closure Plans are required under the Mining Act
- 1994: MISA Regulation came into force
- 2002: MMER Regulation came into force

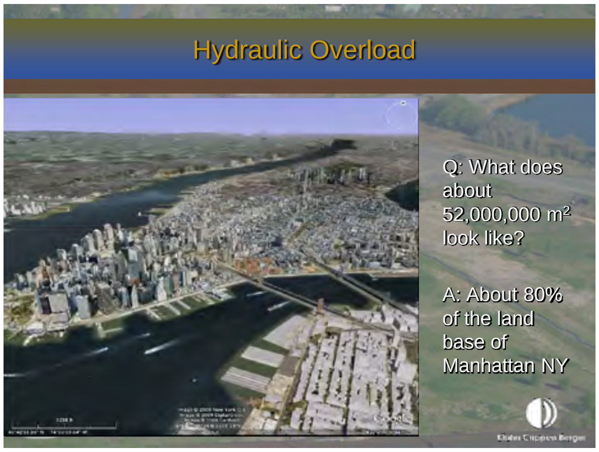
Problem Statement

- 4 MAIN COMPONENTS OF THE PROBLEM
  - Hydraulic overload
  - Dependence on water recycling
  - Plant upset or power supply interruption
  - Legal change, legacy and compatibility with closure

Hydraulic Overload

Vale Canada Limited (Vale) employ "Collect and Treat" strategy for the Sudbury Central Area operations:

- ~ 48 km² drain directly
- ~ 52 km² including pumped inputs


Hydraulic Overload
Q: What does about 52,000,000 m² look like?
A: About 80% of the land base of Manhattan NY
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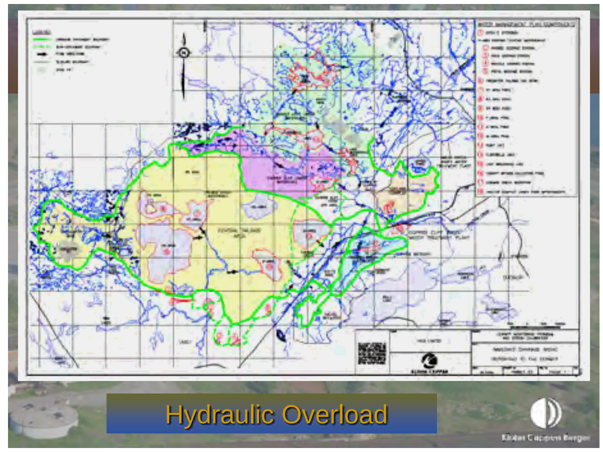
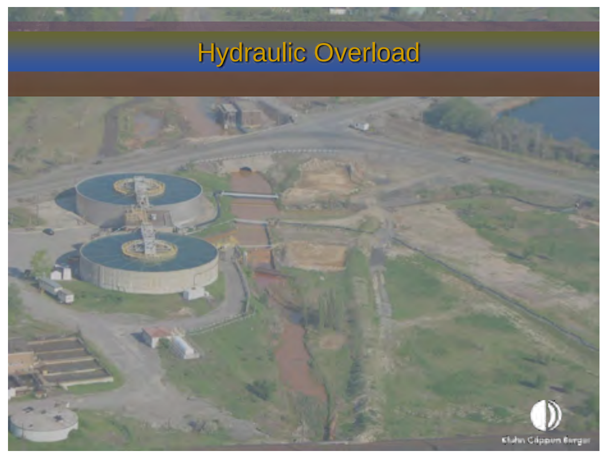
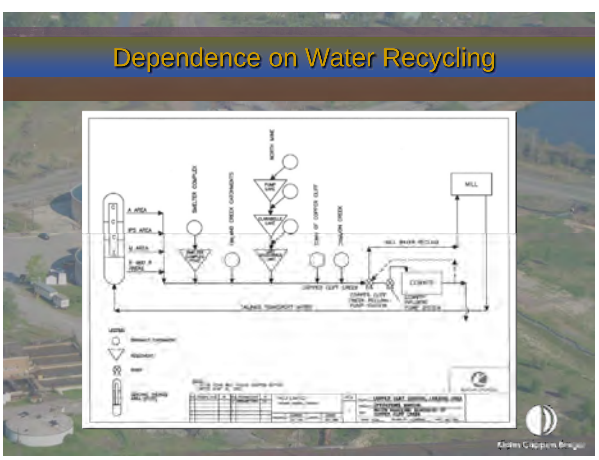

Hydraulic Overload
Klohn Crippen Berger


Hydraulic Overload
9 30 '99
Klohn Crippen Berger


Hydraulic Overload
Klohn Crippen Berger


Dependence on Water Recycling
MILL
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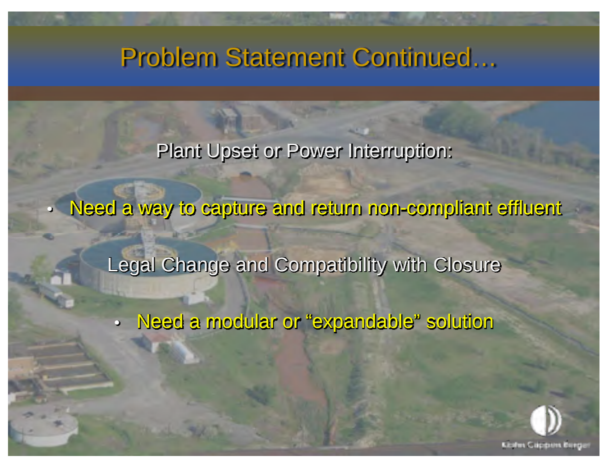
Problem Statement Continued…
Plant Upset or Power Interruption:
Need a way to capture and return non-compliant effluent
Legal Change and Compatibility with Closure
Need a modular or “expandable” solution
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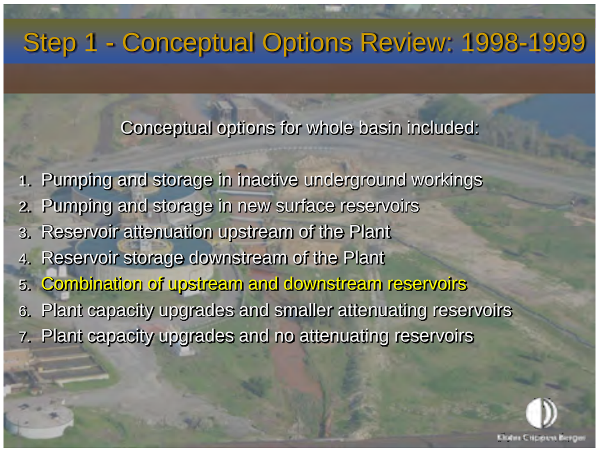
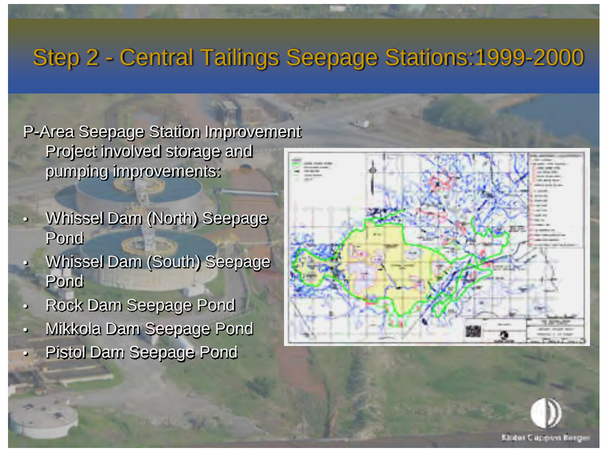
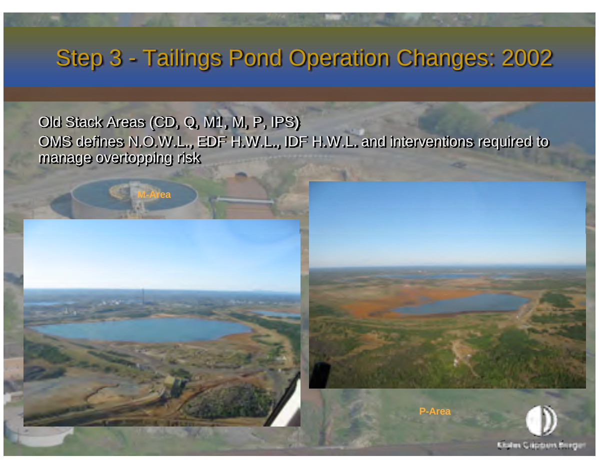
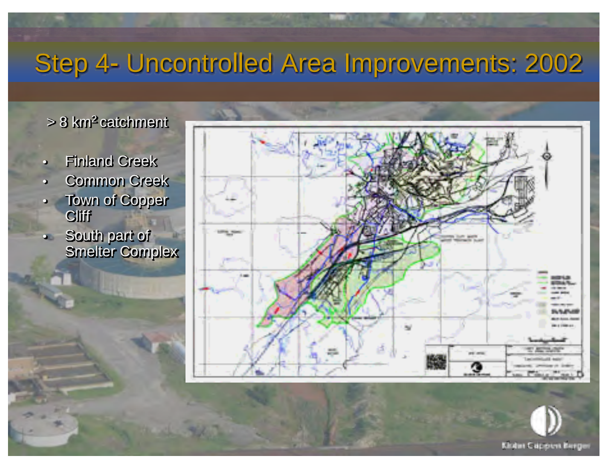

Step 1 - Conceptual Options Review: 1998-1999
Conceptual options for whole basin included:
1. Pumping and storage in inactive underground workings
2. Pumping and storage in new surface reservoirs
3. Reservoir attenuation upstream of the Plant
4. Reservoir storage downstream of the Plant
5. Combination of upstream and downstream reservoirs
6. Plant capacity upgrades and smaller attenuating reservoirs
7. Plant capacity upgrades and no attenuating reservoirs

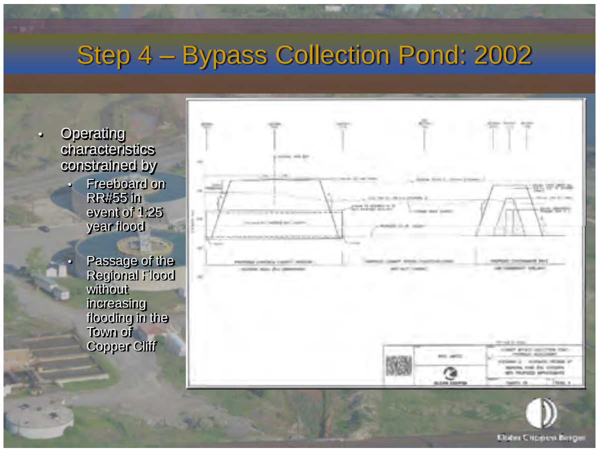

Step 2 - Central Tailings Seepage Stations:1999-2000
P-Area Seepage Station Improvement Project involved storage and pumping improvements:
• Whissel Dam (North) Seepage Pond
• Whissel Dam (South) Seepage Pond
• Rock Dam Seepage Pond
• Mikkola Dam Seepage Pond
• Pistol Dam Seepage Pond


Step 2 - Seepage Stations Improvements: 1999-2000
Pistol Dam Seepage Station
Rock Dam Seepage Station

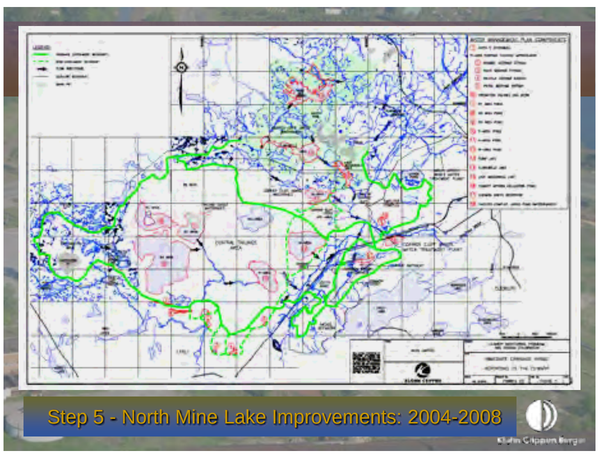

Step 3 - Tailings Pond Operational Changes: 2002
OM&S Manual and Filling Plan allow 27km² to be controlled with minimal capital improvement
Active Areas (R1, R2, R3 and R4)
•Incorporates sufficient freeboard into annual dam raising plans
•Defines operating water levels and levels that trigger water release to manage overtopping risk
R4 Area and No. 3 Seepage Station


Step 3 - Tailings Pond Operation Changes: 2002
Old Stack Areas (CD, Q, M1, M, P, IPS)
OMS defines N.O.W.L., EDF H.W.L., IDF H.W.L. and interventions required to manage overtopping risk
M-Area
P-Area


Step 4- Uncontrolled Area Improvements: 2002
> 8 km² catchment
• Finland Creek
• Common Creek
• Town of Copper Cliff
• South part of Smelter Complex


Step 4 – Bypass Collection Pond: 2002
Operating characteristics constrained by
Freeboard on RR#55 in event of 1:25 year flood
Passage of the Regional Flood without increasing flooding in the Town of Copper Cliff


Step 4- Bypass Collection Pond: 2001-2002
Earth fill dam
Remote controlled pump station
Wave break
Emergency spillway
Fibre optic links
OM&S defines N.O.W.L., EDF H.W.L. IDF H.W.L.


Step 5 - North Mine Lake Improvements: 2004-2008


Step 5 - North Mine Lake Improvements: 2004-2008
Pump Lake, Clarabelle Lake and Lady MacDonald Lake
New dams, remote controlled decants and emergency spillways
Decants are monitored/manipulated at CCWWTP by fibre optic links
OMS defines N.O.W.L., EDF H.W.L., IDF H.W.L. to manage overtopping risk
Pump Lake
Clarabelle Lake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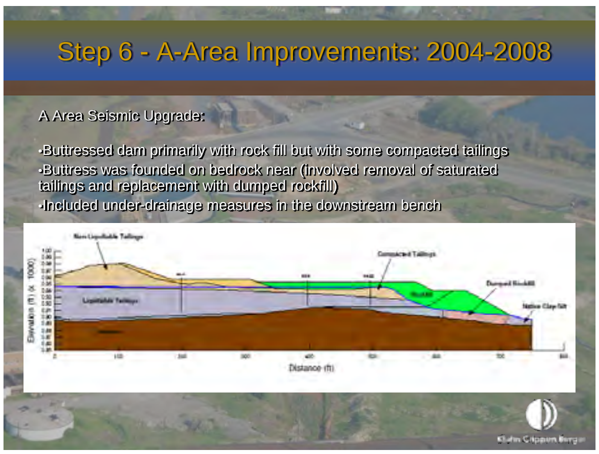
Lady MacDonald Lake


Step 5 - North Mine Lake Improvements: 2004-2008
Lady MacDonald Dam
·Was originally a fresh water supply dam for Copper Cliff in the early 1900's
·Was rehabilitated and raised in the 1960's to improve control of mine water inputs and discharge to the CCWWTP
Lady MacDonald Dam

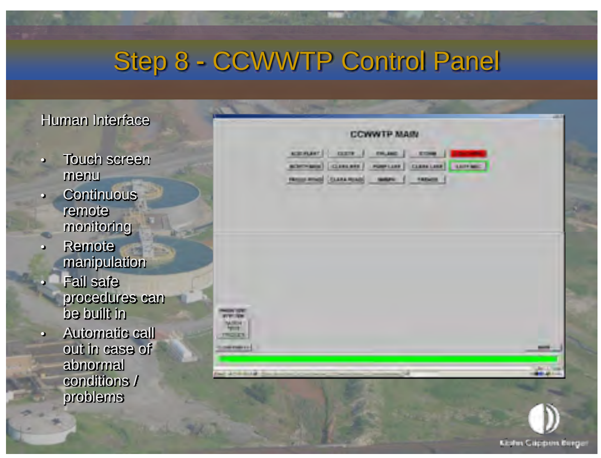

Step 6 - A-Area Improvements: 2004-2008
Old Stack – A Area Improvement
Seismic Improvement – 40 m high urban tailings dam

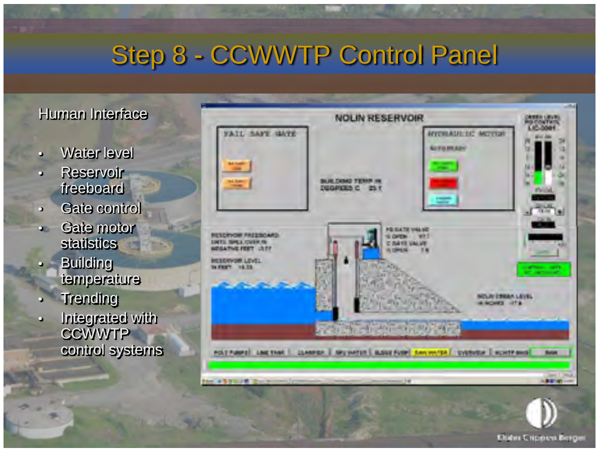

Step 6 - A-Area Improvements: 2004-2008
Old Stack – A Area Dam - Background
•Originally built in the 1930s as a pipeline support embankment
•Subsequently used for tailings storage in the 1937-1958
•About 40 years later, the need to store water and increased seismic criteria in Ontario led to a Stability & Emergency Spillway Improvement Project

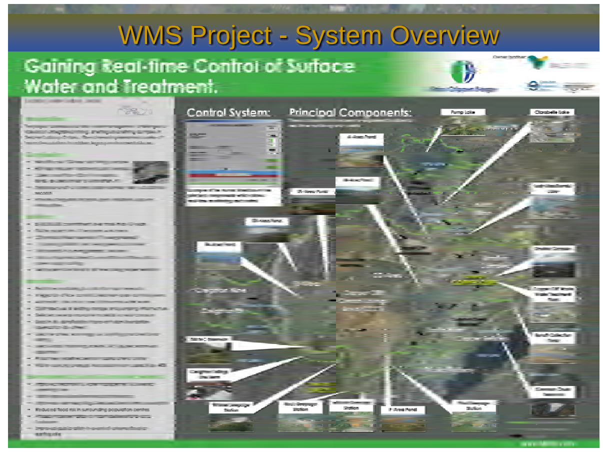

Step 6 - A-Area Improvements: 2004-2008
A Area Seismic Upgrade:
•Buttressed dam primarily with rock fill but with some compacted tailings
•Buttress was founded on bedrock near (involved removal of saturated tailings and replacement with dumped rockfill)
•Included under-drainage measures in the downstream bench
Distance (ft)

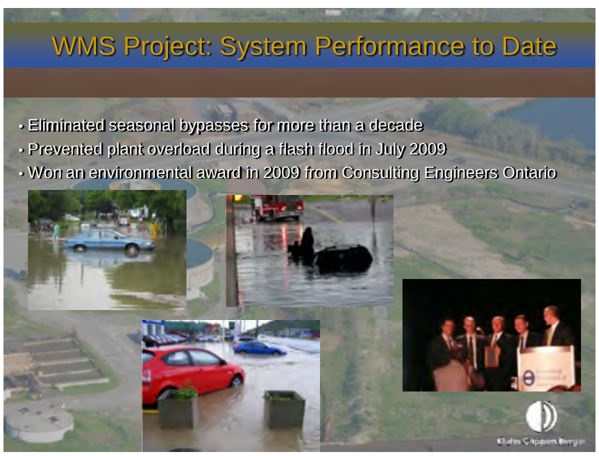

Step 6 - A-Area Improvements: 2004-2008
A Area Improvement
Seismic upgrade
EDF storage
New low flow decant
Fibre optic links
New emergency spillway
Tunnel widening to safely pass a PMF
Stilling basin improvement

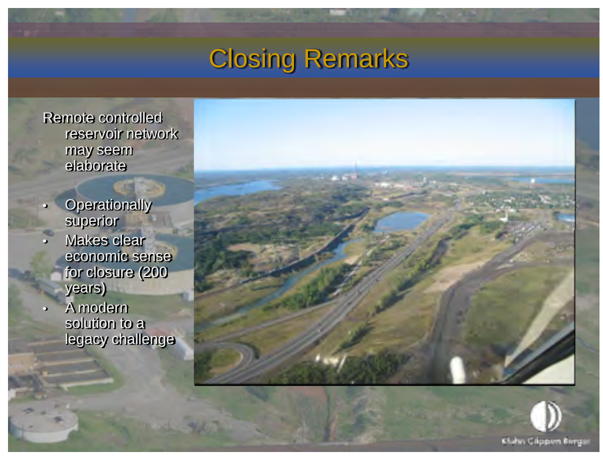

Step 7 - Common Creek Improvements: 2006-2007
• Sheet pile cut-off to prevent rail line subsidence
• Remote controlled decant
• Emergency spillway
• Fibre optic links
• OM&S defines N.O.W.L., EDF H.W.L., IDF H.W.L.

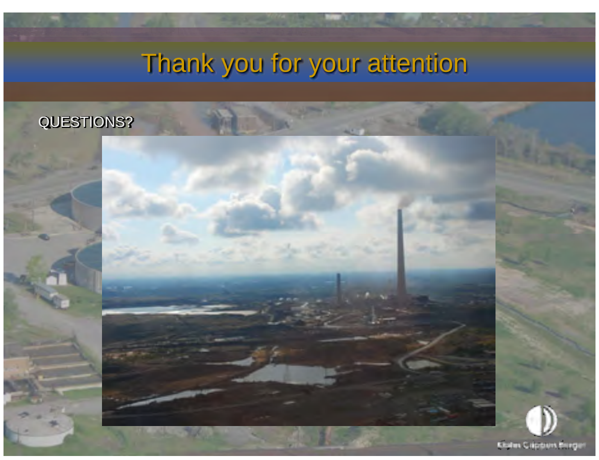

Step 8 - CCWWTP Control Panel
Human Interface
• Touch screen menu
• Continuous remote monitoring
• Remote manipulation
• Fail safe procedures can be built in
• Automatic call out in case of abnormal conditions / problems
CCWWTP MAIN


Step 8 - CCWWTP Control Panel
Human Interface
Water level
Reservoir freeboard
Gate control
Gate motor statistics
Building temperature
Trending
Integrated with CCWWTP control systems
NOLIN RESERVOIR
FAIL SAFE GATE
HYDRAULIC MOTOR


WMS Project - System Overview
Gaining Real-time Control of Surface Water and Treatment.
Control System:
Principal Components:


WMS Project: System Performance to Date
Eliminated seasonal bypasses for more than a decade
Prevented plant overload during a flash flood in July 2009
Won an environmental award in 2009 from Consulting Engineers Ontario


Closing Remarks
Remote controlled reservoir network may seem elaborate
Operationally superior
Makes clear economic sense for closure (200 years)
A modern solution to a legacy challenge


Thank you for your attention
QUESTIONS?