

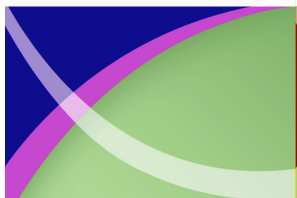


Wetland Enhancement Project at the Terra Mine Site

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Outline

- Background of Silver Bear Mine Site
 - Terra Mine
- Summary of Risk Assessment and Monitoring Findings
- Remediation Decisions for the Wetland
- Way ahead



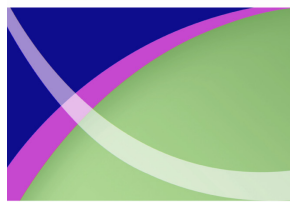
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Silver Bear Location



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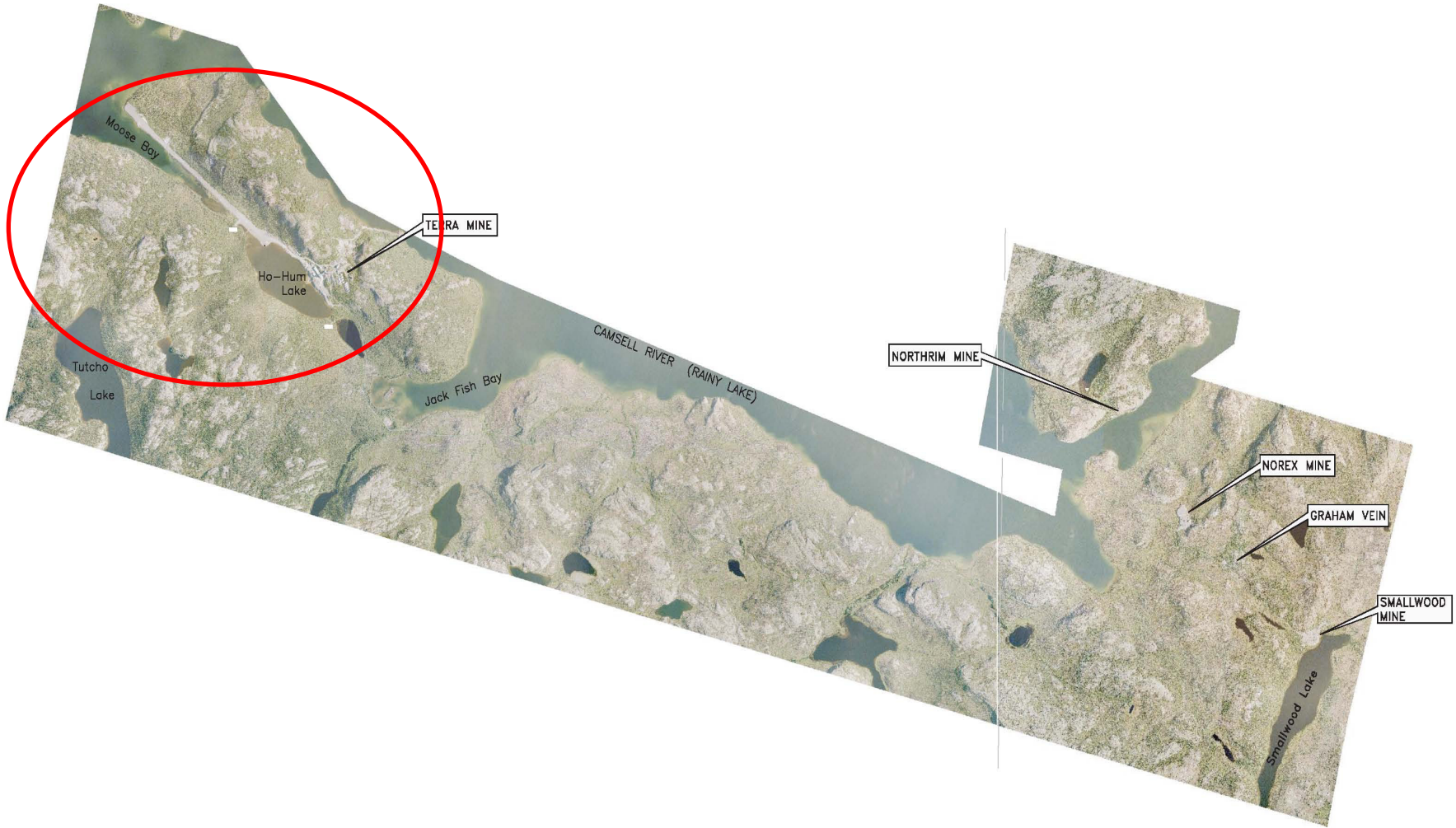


General Background: Silver Bear Mine Site

- Five sites, explored and developed since the 1930s
 - Terra Mine
 - Northrim Mine
 - Norex Mine
 - Graham Vein
 - Smallwood Mine
- Major activity/operation - 1967 to 1988
 - Predominantly mined for silver
 - Secondary recovery of copper and bismuth
- Various sites had different owners and operators
 - Terra Mines Ltd. went bankrupt and left the site in 1988 without proper site closure
- Tailings were discharge into Ho-Hum (~500,000 t)

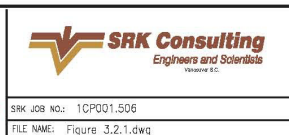


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	 SRK JOB NO.: 1CP001.506 FILE NAME: Figure 3.1.1.dwg	 Indian and Northern Affairs Canada	Silver Bear Mines		
			Project Area Photo		
SILVER BEAR MINES REMEDIAL ACTION PLAN			DATE: Mar. 07	APPROVED: SRS	FIGURE: 3.1.2



Terra Mine		
Aerial Photo		
DATE: Mar. 2007	APPROVED: SRS	FIGURE: 3.2.2



Terra Mine Site





Studies to Date Include:

- Hydrology data: 2002-2008 (INAC)
- Annual water quality data: 2004-2008 (INAC)
- Aquatic studies: 2004 (fish, benthic invertebrates, sediments) (Rescan)
- Physical limnology: 2004 (bathymetry, depth profiles; Rescan)
- Vegetation and wildlife assessment (Rescan, 2004; McDonald 2007)
- Geochemistry studies (Lorax, 2006))
- Human Health and Ecological Risk Assessment (Golder, 2005; SENES 2007)



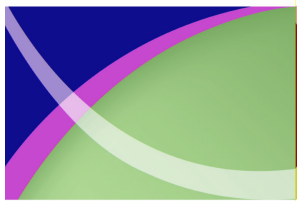
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Summary of Results



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Ho-Hum Water Quality

- Ho-Hum lake water quality is higher in As, Be, Co, Cu, Ni, Pb and Hg compared to many other sites
- As and Cu are the two main elements of concern
 - Arsenic consistently ranges from 52.7 to 83.2 $\mu\text{g/L}$
 - Copper ranges from 4.3 to 8.4 $\mu\text{g/L}$



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Risk Assessment Results – Water Column and Benthos

- Toxicity reference values are exceeded in Ho-Hum Lake for phytoplankton (Cu & As) and zooplankton (Cu)
- As concentrations in Ho-Hum are 5 times that of background Tutcho Lake
- Benthos density and diversity was intermediate to other sites in the Silver Bear area.
- Half of the sensitive groups of invertebrates examined were found in the lake, indicating that the benthic community is moderately impacted.



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Risk Assessment – Results

- Risk to Muskrats from arsenic through the aquatic vegetation pathway
- Potential adverse effects would occur only to individual muskrat and not to the entire population
- No other risks to terrestrial animals, not even to moose in the tailings area were found



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**Ho-Hum
Lake**

T-9

T-6

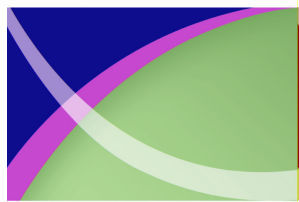
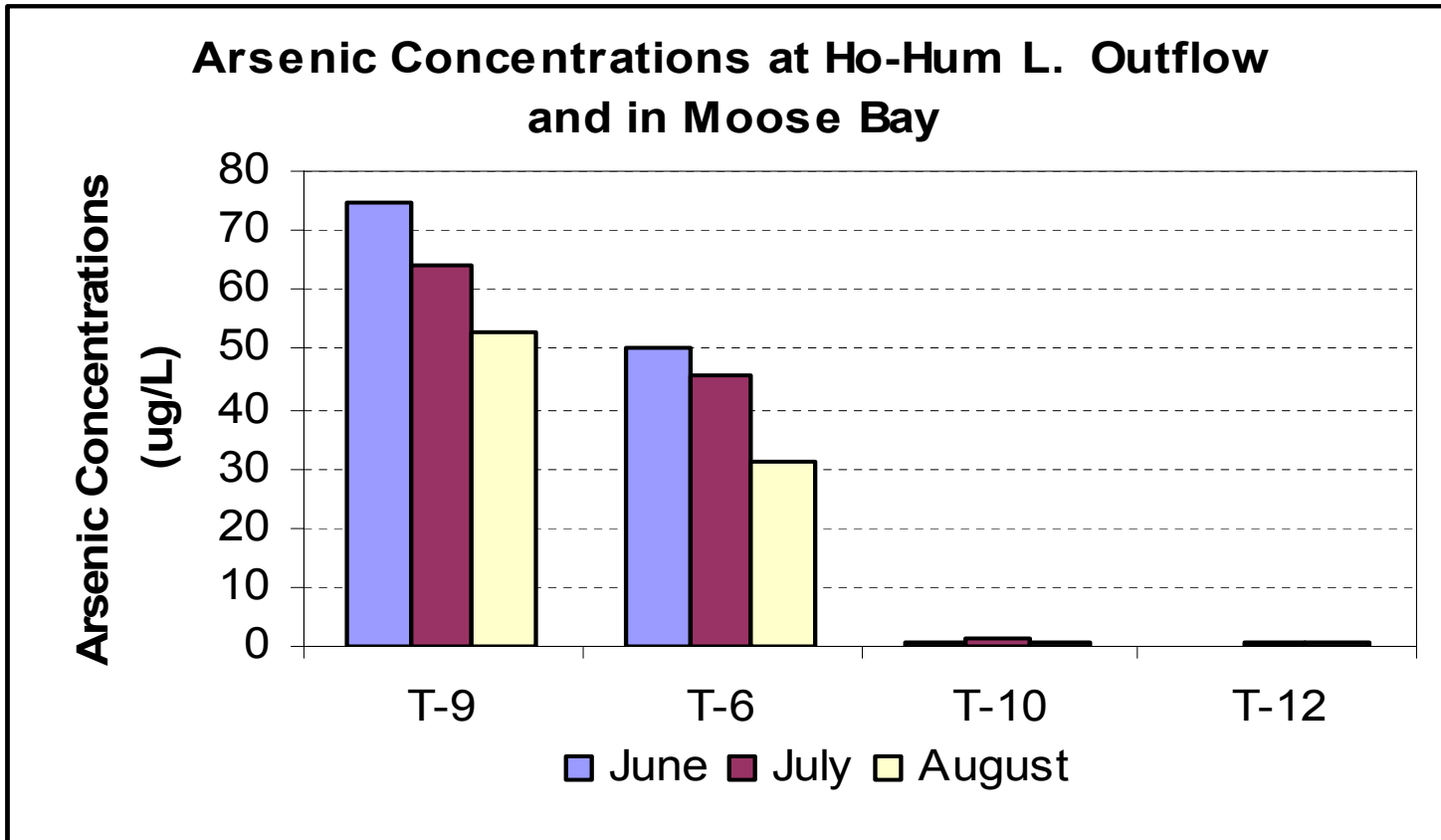
T-10

Moose Bay

T-12



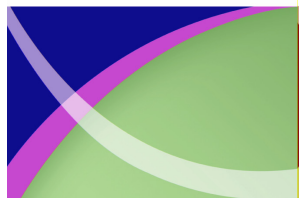
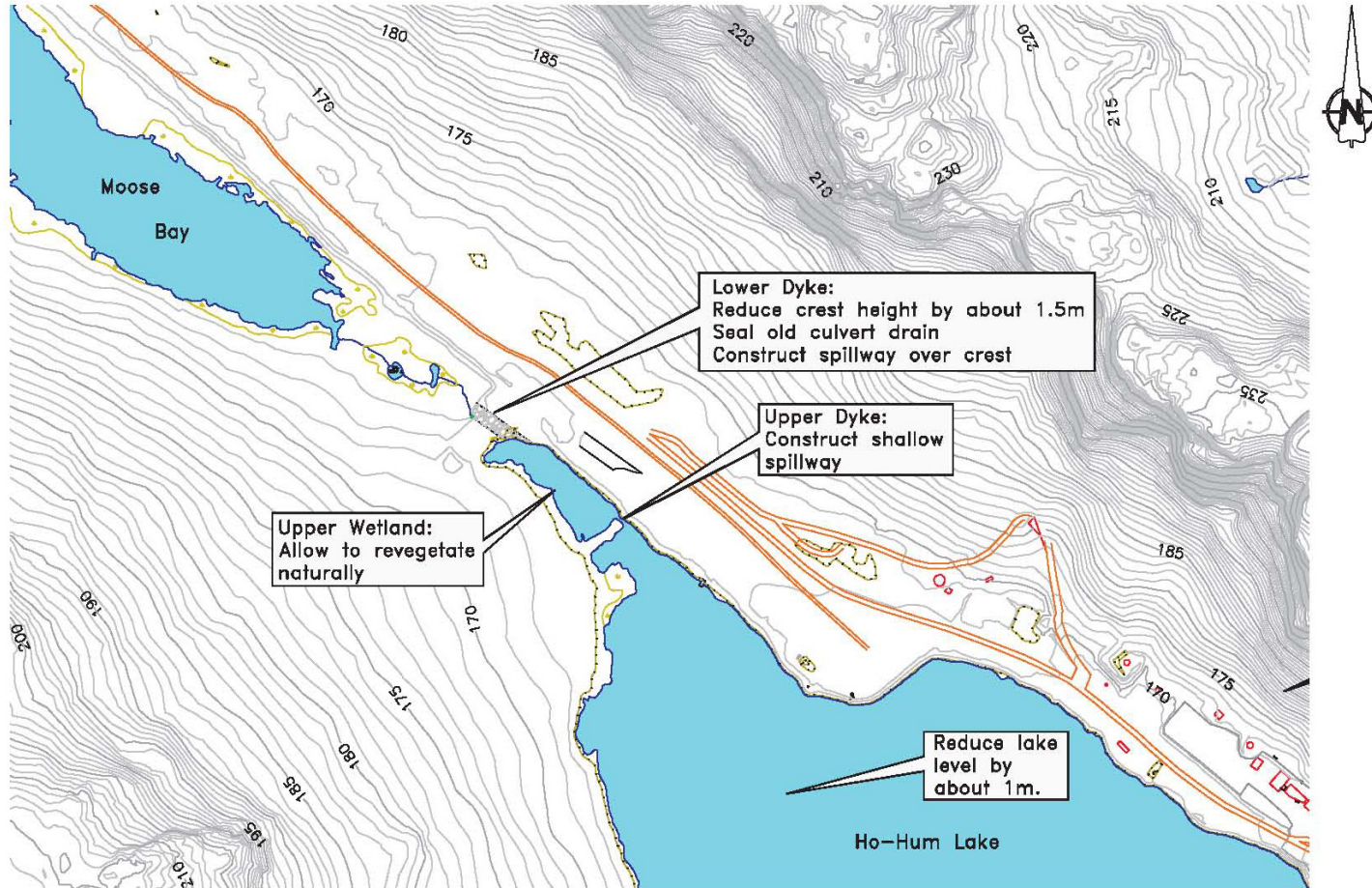
Ho-Hum Lake discharge Water Quality





Remediation Plan

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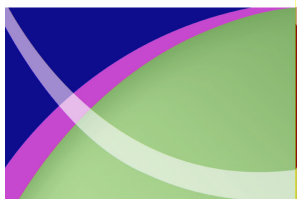


Further Studies – 2009

- Research: Understanding As sequestration in natural wetland impacted by mine waste – H. Jamieson (Queen's University)
- Wetland enhancement – identification of key plant species



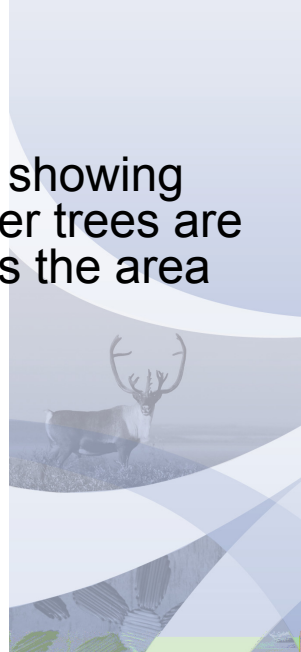
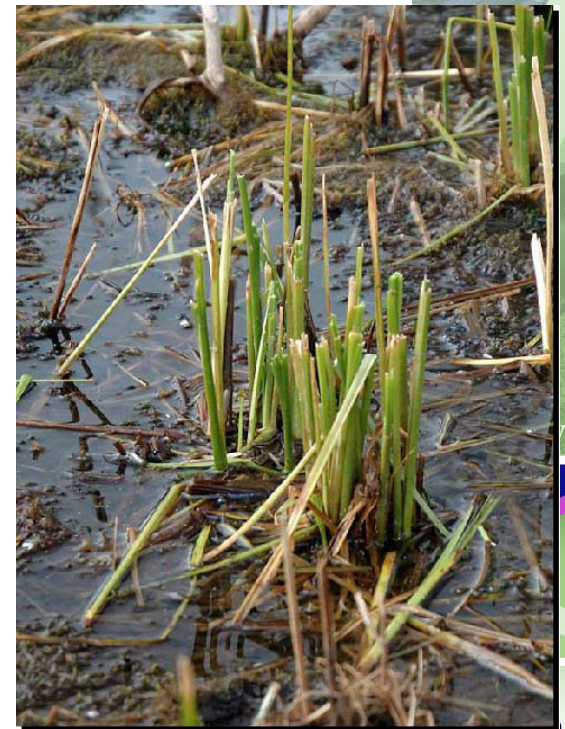
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Outflow of Ho Hum Lake showing browsed *Carex*. The larger trees are willows that were killed as the area was flooded.

Close-up of a *Carex* plant showing loss of the top of the plant, probably due to browsing by moose.



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Macrophyte mat situated along
Ho Hum Lake shoreline

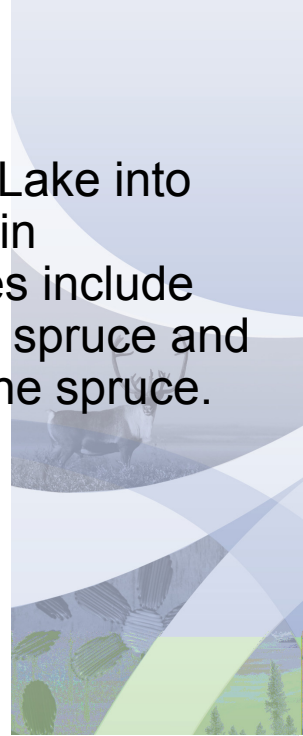


Willows along shoreline of the
wetland, leading into spruce on
drier upland area. Several
submerged macrophytes were
present in the flooded area.





At the outflow from Ho Hum Lake into Moose Bay. Moose Bay in background. Plant species include *Carex*, willow, *Equisitum*, spruce and Labrador tea at base of the spruce.



Edge of wetland as it enters Moose Bay (to left).
Vegetation includes *Carex*, *Equisitum*, and willow.





Further Studies – 2009

- Establishment of threshold limit for As in water
- Establishing baseline (biota: fish, benthics; sediments, soil, vegetation)



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Next Steps

- Assess what is happening through the wetland and if the wetland is contributing to sequestering arsenic
- Construct the upper wetland and spillway
- Monitoring during remediation and afterwards to determine performance



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Questions?



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