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Name of Presenter
EVS Environment Consultants

SNAP LAKE WATER QUALITY

SOURCES, EFFECTS AND IMPACTS

BASELINE DATA

DeBeers

- Baseline data (water and sediment quality, biota) considered sufficient to support the EA

Major Concerns:

- Current baseline insufficient to characterize temporal and spatial variability (water, biota – e.g., zooplankton)

Implications:

- Current baseline insufficient for assessing effects during and post-development (need to be able to detect an effect if one exists)

METALS

DeBeers

- Metals will not adversely affect aquatic organisms

Major Concerns:

- Many metals effects concentrations lower than predicted based on Canadian Council of Ministers of the Environment (CCME) calculation procedures
- Concentrations of some metals in Snap Lake could exceed toxicity thresholds for sensitive species (e.g., zooplankton)

Implications:

- Adverse effects (mortality, impairment) could occur to sensitive species

[All values in micro-g/L and apply at a water hardness of 180 mg/L CaCO₃]

Metal	DeBeers HC ₅ Concentration	CCME Chronic Threshold
Copper	7.9	1.5
Cadmium	0.36	0.039
Chromium (III)	46.8	32
Chromium (VI)	2.1	<2.5

TDS (TOTAL DISSOLVED SOLIDS)

DeBeers:

- TDS will increase from 15 mg/L to a maximum average of 330 mg/L for the whole lake and up to 444 mg/L for 1% of lake
- Ca (major TDS ion) will increase from 1.34 mg/L to a range of 88 to 133 mg/L
- Cl (major TDS ion) will increase from <0.2 mg/L to a range of 137 to 177 mg/L
- Cl more toxic in combination with Ca

[Concentrations likely to be 2-3x higher]

	De Beers Values	2X	3X	Lowest Toxicity Thresholds
TDS	330-444	660-888	990-1332	500 Alaska (Red Dog)
Ca	88-133	176-266	264-399	116 for Daphnia
Cl	137-177	274-354	411-531	372 US EPA

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TDS (continued)

Major Concerns:

- DeBeers maximum projections close to effects levels
- If DeBeers are wrong and concentrations are higher, as indicated, adverse effects will occur
- Potential major effects to the whole of Snap Lake will probably include:
 - loss of species
 - changes in food chains
 - energetic effects (e.g., reductions in growth and reproduction) to remaining species

PHOSPHORUS (P) AND DISSOLVED OXYGEN (DO)

DeBeers:

- Bioavailable P will not significantly affect this oligo-mesotrophic lake
- No significant eutrophication, but *algal concentrations could increase up to 40%*
- Reduced DO concentrations occur naturally in some parts of the lake; avoidance and adaptation have occurred

PHOSPHORUS (P) AND DISSOLVED OXYGEN (DO) (continued)

DeBeers (continued):

- Winter DO reductions (1 to 2.2 mg/L) may be low enough to limit habitat in <10% of lake with associated decreased species richness of benthic invertebrates
- Additional nutrient modeling suggests changes in primary productivity could be greater than predicted in EA (more than 2x baseline conditions if dissolved P is bioavailable)

PHOSPHORUS (P) AND DISSOLVED OXYGEN (DO) (continued)

Major Concerns:

- Increased eutrophication beyond that predicted by the EA, with associated species changes
- The <10% of the lake affected by low DO in winter may well be significant

Implications:

- Greater DO depressions than predicted
- Associated greater loss of habitat and species changes (magnitude and areal extent)
- *Changes will occur in the aquatic community structure of Snap Lake*

AQUATIC COMMUNITY CHANGES

DeBeers:

- Functional redundancy exists
- No energetic or other costs from species loss

Major Concerns:

- Simpler food chains exist in North; less functional redundancy
- "Energetic bottlenecks" possible (e.g., yellow perch in Ontario lakes stunted due to need to eat smaller prey resulting in more energy expenditure - related to metals pollution in these lakes)

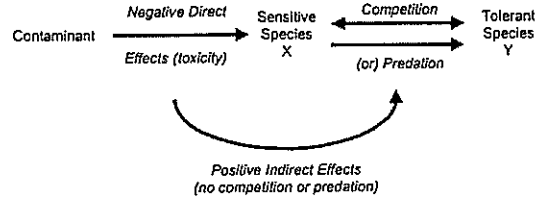
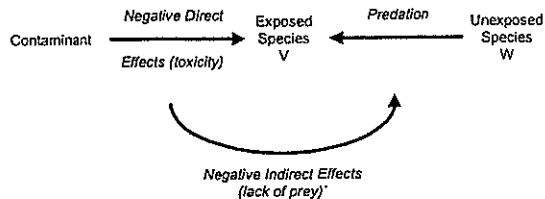
TYPES OF AQUATIC COMMUNITY CHANGES

Effects on organisms, populations and communities:

- *Direct toxicity* (death and/or impairment)
- *Toxicity affecting food* (death and/or impairment)
- *Toxicity affecting interactions among species* (impairment)

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INTERACTIVE EFFECTS OF CONTAMINANTS

DeBeers:

- Not addressed

Major Concerns:

- Exposure to multiple stressors: increased TDS, increased productivity, decreased DO, increased metals in Snap Lake

Implications:

- Greater than predicted effects on aquatic organisms over a longer period of time

INTERACTIVE EFFECTS OF CONTAMINANTS (continued)

Implications (continued):

- Potential major effects to the whole of Snap Lake will probably include:
 - loss of species
 - changes in food chains
 - energetic effects (e.g., reductions in growth, reproduction) to remaining species

SCOPE OF EFFECTS ON SNAP LAKE

DeBeers:

- Major effects limited to <1% of Snap Lake
- Subtle effects could occur on a lake-wide basis

Major Concerns:

- Likely substantially increased stresses compared to EA predictions

SCOPE OF EFFECTS ON SNAP LAKE (continued)

Implications:

- Substantial adverse effects to the whole lake for an extended period of time (decades beyond mine closure)
- Biota not totally eliminated from the lake
- Effects likely reversible, but almost certainly not to the same community as exists currently

