The Pipe Dream Team

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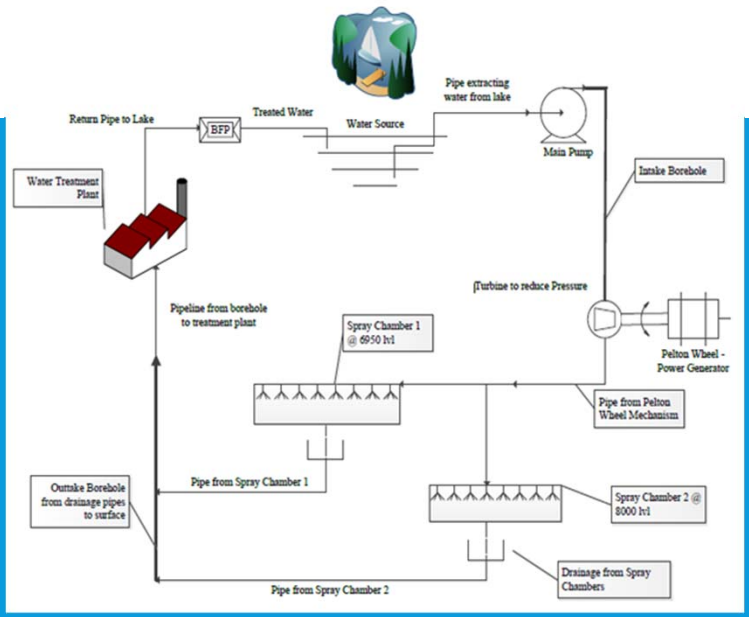
MDEC 2017

OUR SOLUTION!

- ✓Feasible
- ✓Safe
- ✓No Pollution

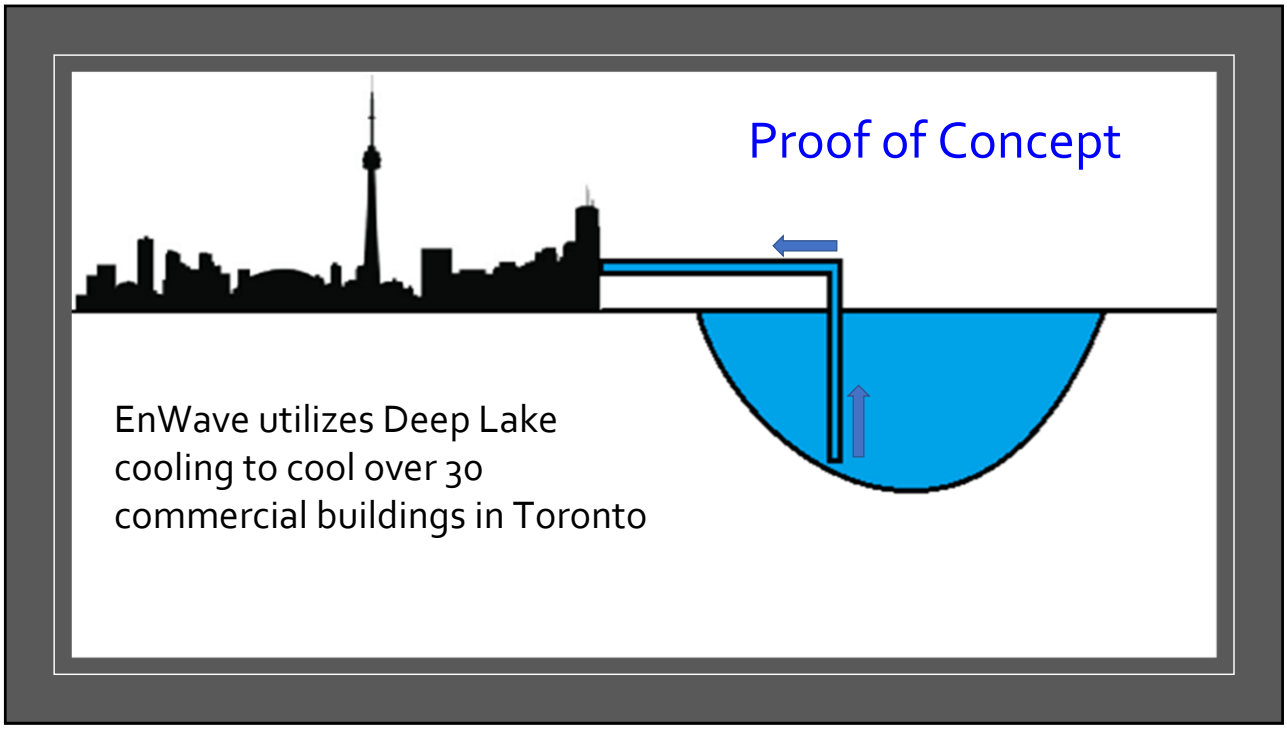


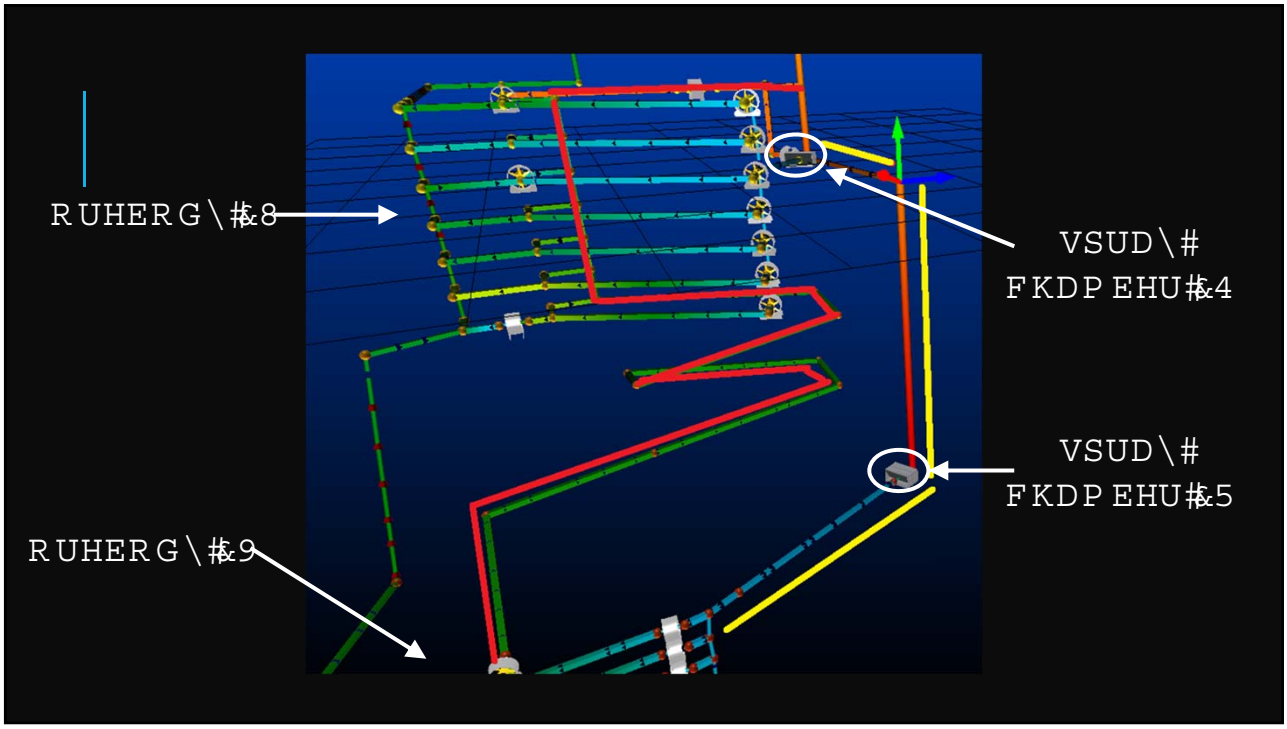
Benefits of Deep Lake Cooling

- An alternative to conventional vapor-compression refrigeration system
- Deep lake is utilized as a natural heatsink
- Spray chambers serves dual function of cooling and cleaning mine air
- Cool lakes water as a means of providing coolth in mine
- Removes need for water tower underground (more air for workings)
- Infrastructure decisions reduce vehicle requirements (winze vs ramp)

Assumptions

- Ambient lake temperature 5 degrees C
- Lake temperatures remain constant over time
- Return water does not cause detrimental environmental impact
- Less than 1% of lake water used and recirculated annually
- Water temperature increases by 5 degrees C during transport
- Returning water via a perforated pipe will distribute the water back in the lake and not cause local hotspot upon return.


Proof of Concept
EnWave utilizes Deep Lake cooling to cool over 30 commercial buildings in Toronto


RUHERG\#&8
VSUD\#
FKDP EHU#&4
VSUD\#
FKDP EHU#&5
RUHERG\#&9

Spray Chamber

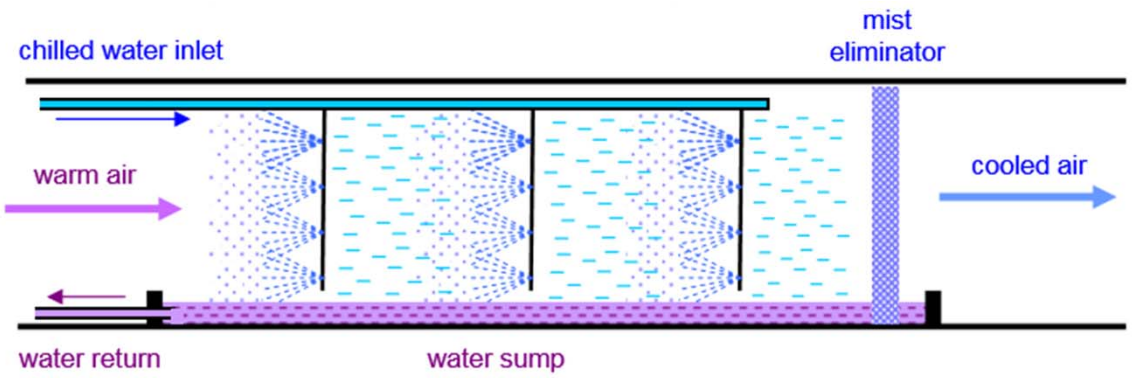
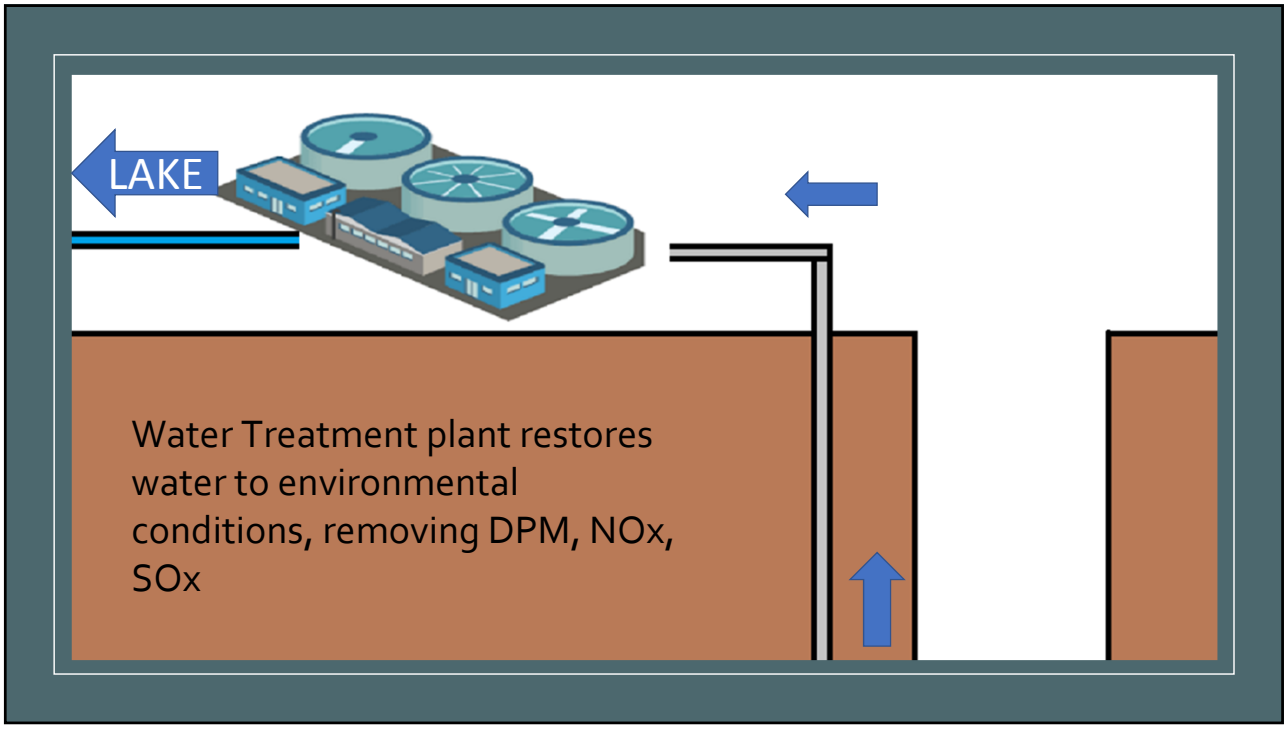
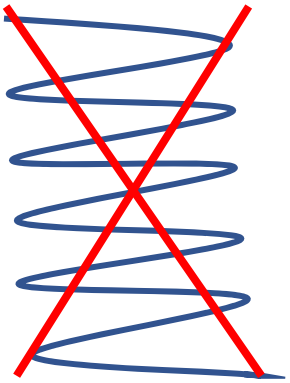


Figure taken from Subsurface Ventilation and Enviromental Engineering



Infrastructure Decisions

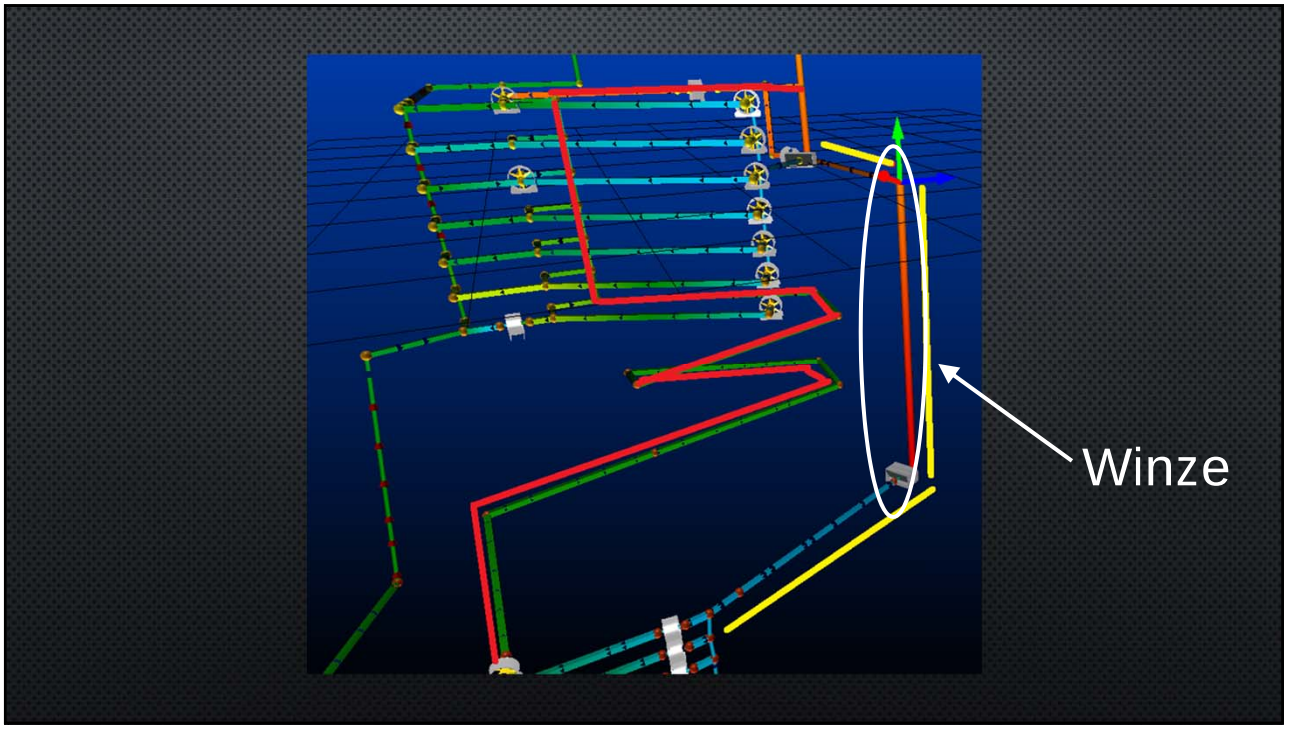
Ramp



VS.

Winze

Requires Less Vehicles for materials handling



Natural Resources Canada, 2015
http://www.nrcan.gc.ca/mining-materials/publications/aboriginal/bulletin/8818

"At Musselwhite, the company is investing approximately $90 million to develop an underground winze…"
-E&MJ News

CanStockPhoto, 2017
http://www.canstockphoto.com/dump-truck-6464123.html

= 500,000 CFM!

Infrastructure Decisions

Replacing Refrigeration Plants

- Reduce Energy requirements compared with Refrigeration Plant.
- Air servicing Underground Water Cooling Tower now available for workings

SUSTAINABILITY

- Less than 1% of total lake water supply annually
- Water returns to lake in original condition
- Carbon emissions reduced with less truck utilization
- Efficient direct heat exchange provides cooling and cleaning of air
- Scalable solution - add more spray chambers, pump more water

Other Options Considered

1. Adding a series of pelton wheels or turbines on the downcast water line

Would offset energy requirements for pumping water to surface. A series would be required due to the enormous head

1. Close loop of lake water on surface cooling a refrigerant (likely a brine solution) which would circulate in a closed loop underground cooling the air via indirect heat exchange.

Would remove need for water treatment before returning lake water, however it would not reduce DPM, NOx, SOx in mine air.

QUESTIONS