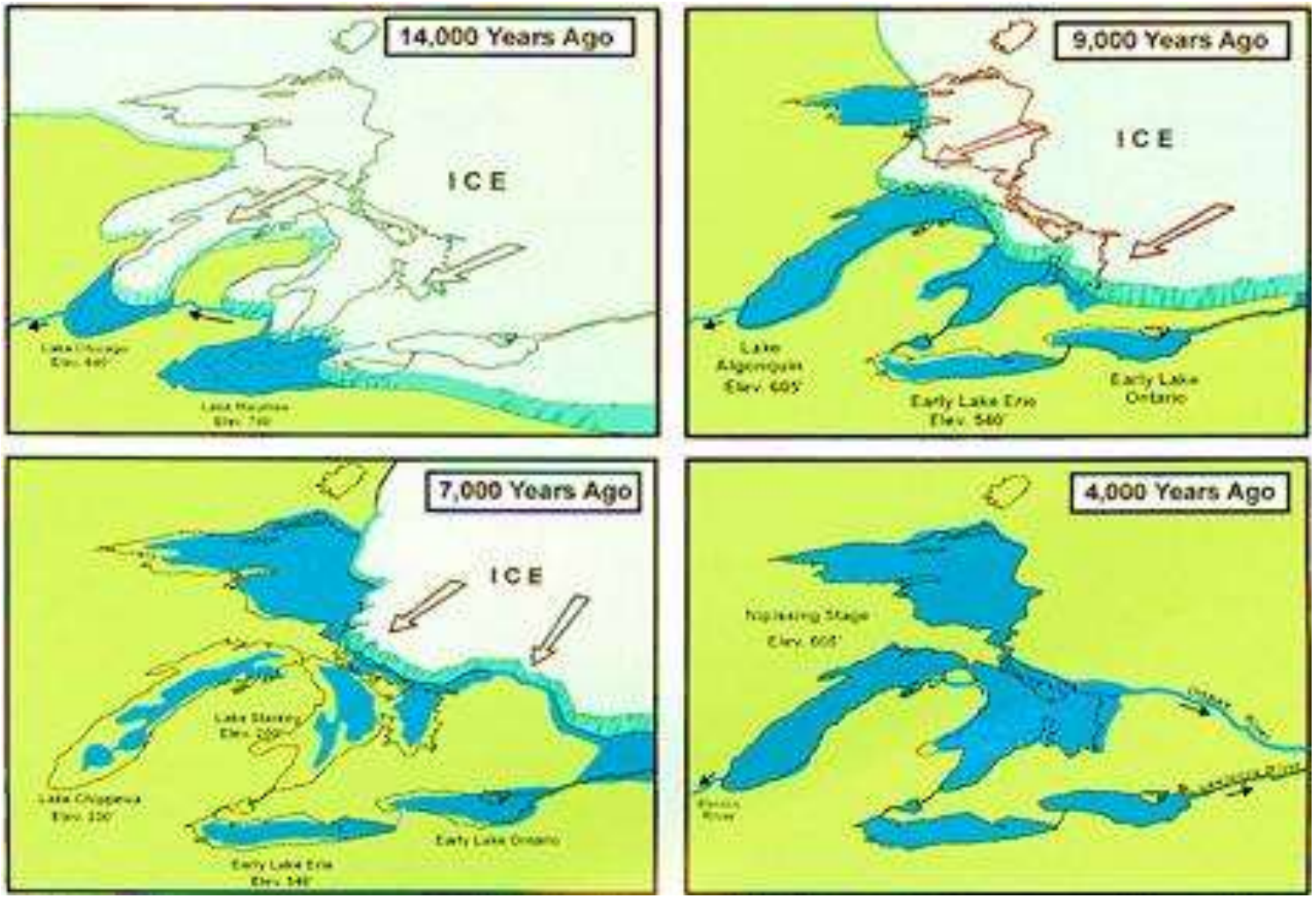
Evolution of a Deep Lake Cooling System

A Brief History…



What? Too far back?

A Brief History…

- Three concrete encased steel pipes extend 3 miles into Lake Ontario, 280 feet below the surface
- 20 years of marine studies and data had determined that water temperatures at that depth and distance from shore were at a constant temperature of 38° F year round
- New Intake Pipes replaced the need for the City to install expensive carbon filters to protect water quality
- New intakes provided security of supply for City water – deeper and N+1 redundancy
- Water is brought to City's Island Filtration plant, processed and sent to John Street Pumping Station

A Brief History…

- DLWC provides chilled water to customers through a heat exchange process that occurs at the JSPS which houses Enwave's heat exchangers and the City's potable water pumping infrastructure
- Enwave's closed loop chilled water system and the City's potable water system interface at this location. Water from the two systems never mixes.
- Heat in the 56° F water returned from Enwave's customers is rejected into the cold 38° F filtered lake water through a heat exchange process that occurs across 36 large heat exchangers
- After heat is rejected, City water continues onto the Toronto users slightly cooler than 56° F while Enwave's closed loop water goes to Enwave's Chilled Water Plant at 38° F

NO SHORTCUTS TO SAFETY

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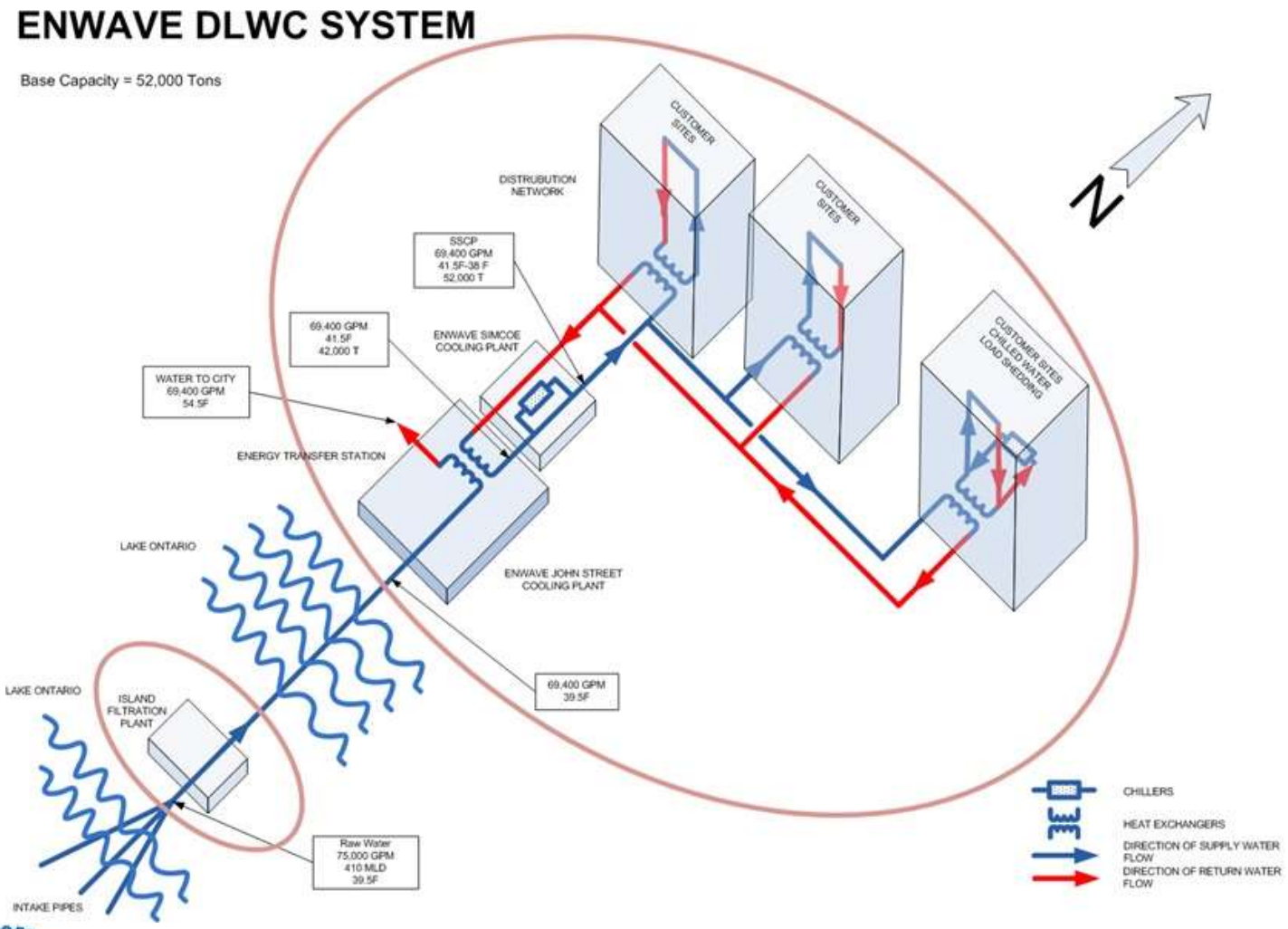
A Brief History…



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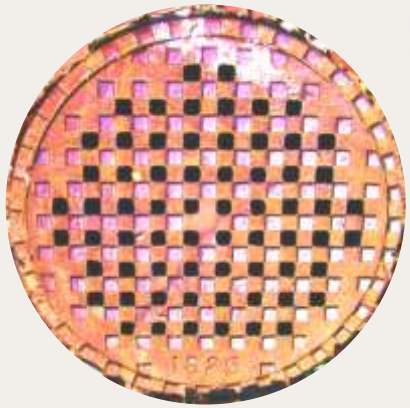
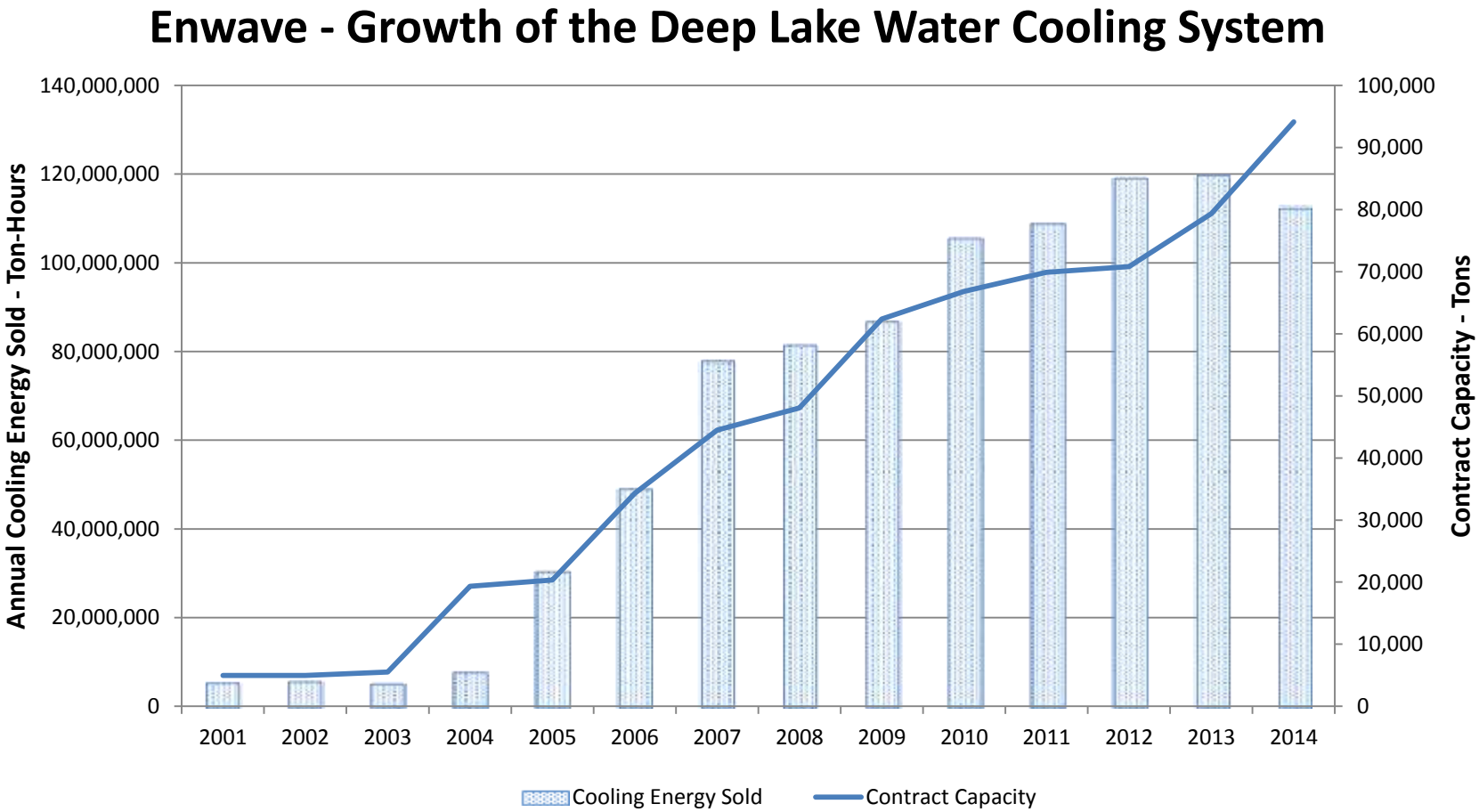
A Brief History…

Over 14 kilometers of chilled water piping run beneath the streets of Toronto...

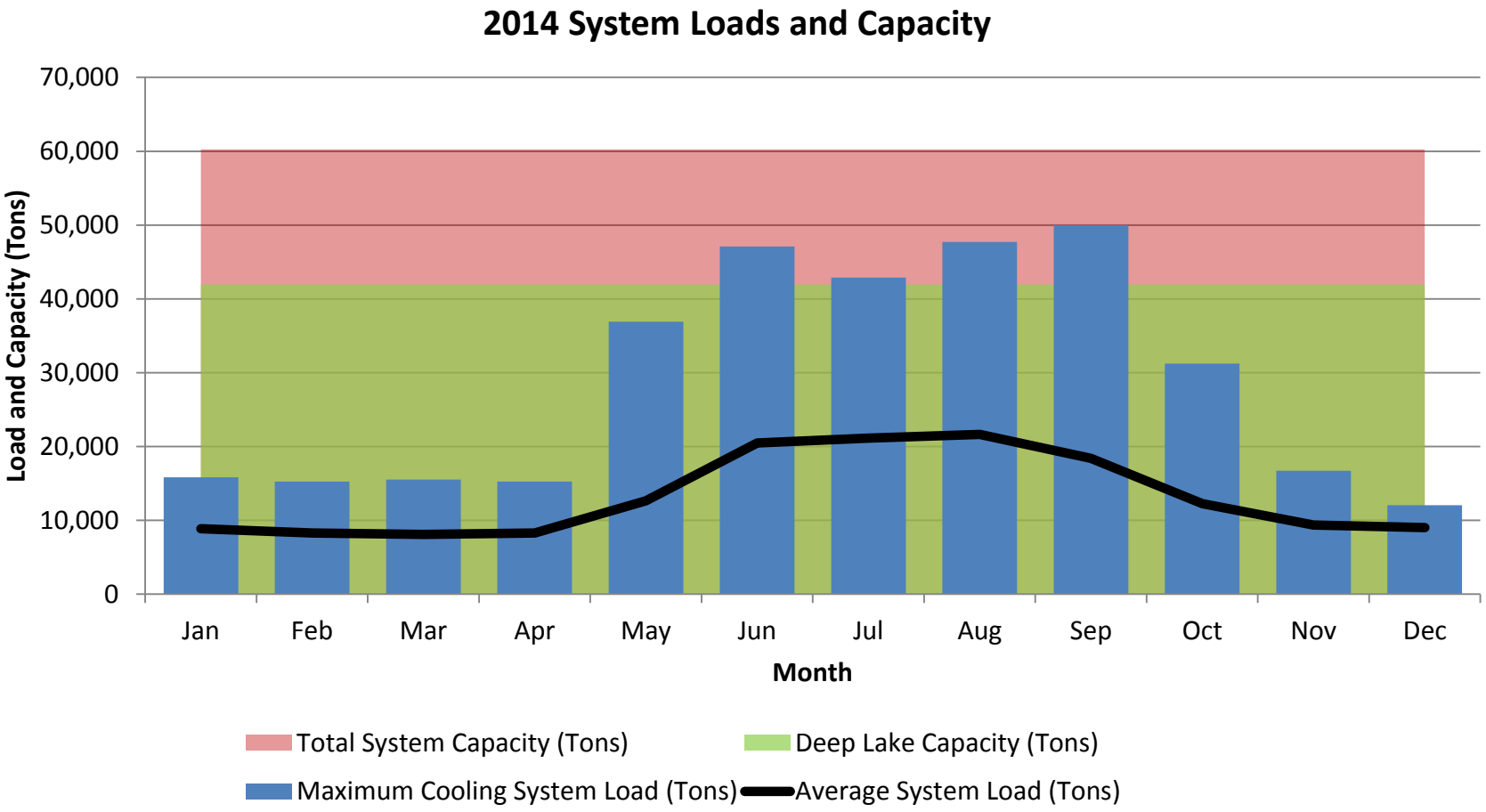


...and 6 MILLION litres of water being circulated

A Brief History...



Selling Capacity vs Cooling Energy



How Can We Continue to Grow?

Any suggestions……PLEASE!!!

Avenues to Growth

- Interruptible Cooling Customers
- Additional Mechanical Cooling Capacity/Plants
- Chilled Water Trading
- Raw Water Storage and Bypass
- Lower Chilled Water Supply Temperature
- New intakes and DLWC Plant

Avenues to Growth

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Interruptible Cooling Customers

NOT what we meant by interruptible…

Interruptible Cooling Customers

Pros	Cons

Avenues to Growth

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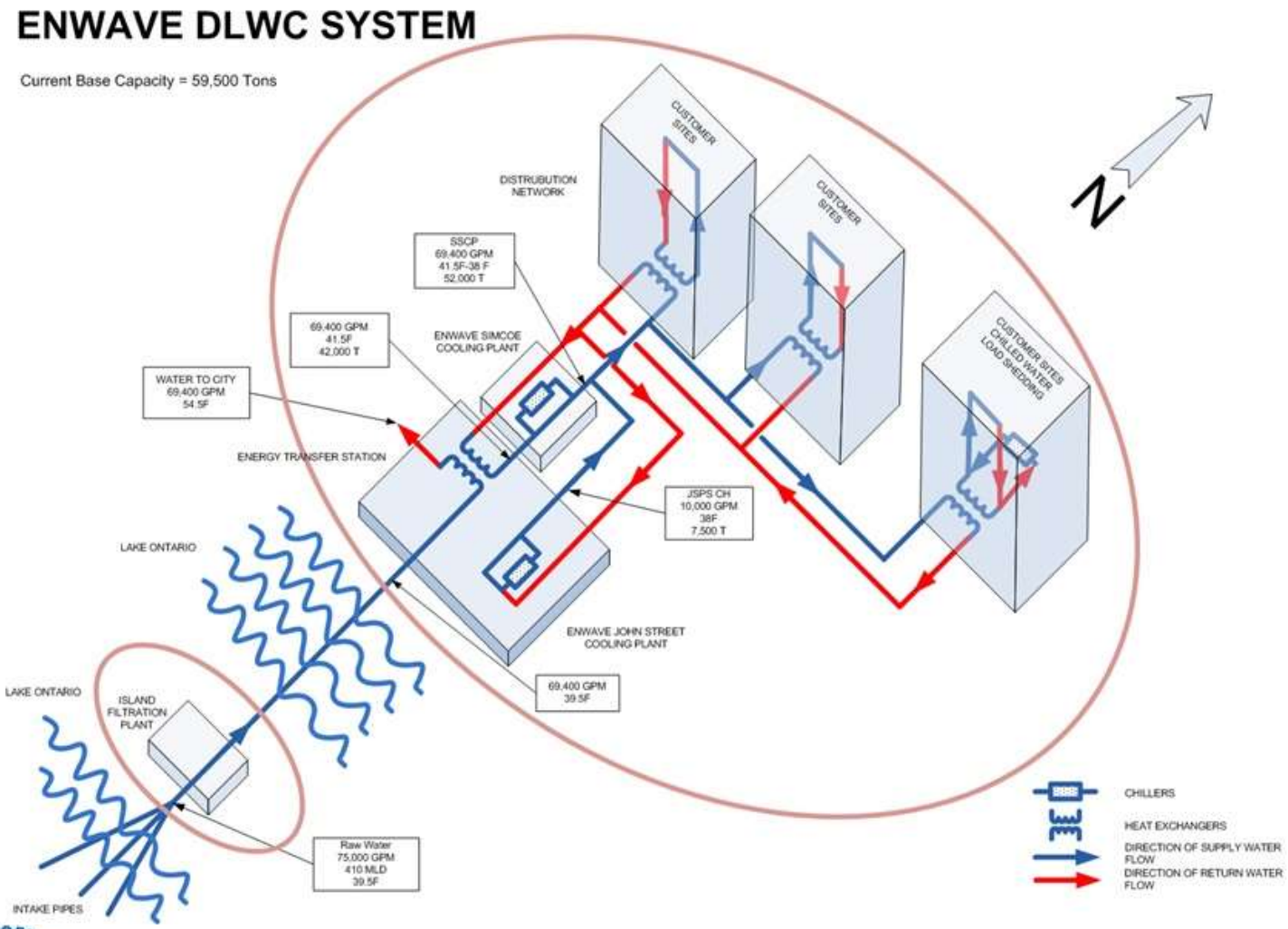
Additional Mechanical Cooling Plants

We’re not quite back to that….yet

Additional Mechanical Cooling Plants



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Additional Mechanical Cooling Plants

Pros	Cons
Lower capital cost per unit of capacity compared to available DLWC options for expansion	Higher variable operating costs
Cooling capacity can be brought to market relatively quickly and can better match the customer growth profile	Fixed costs and resources for operation and maintenance.
	These assets have a shorter useful life, replacement cost in 15 to 25 years

Avenues to Growth

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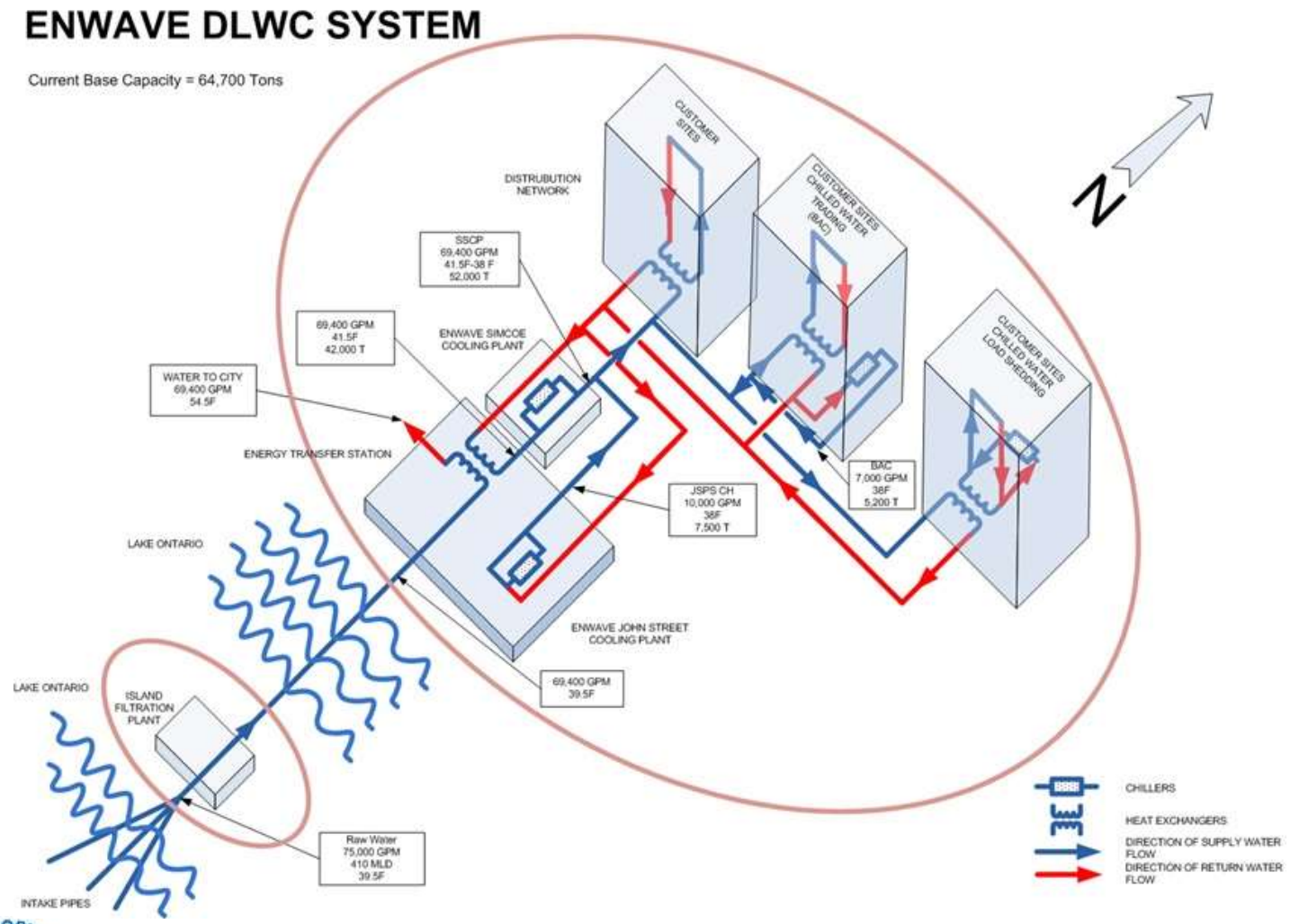
Chilled Water Trading

And not a ton-hour to be found….

Additional Mechanical Cooling Plants



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Chilled Water Trading

Pros	Cons
Minimal capital outlay • Depreciated value of chiller assets • Customer connection	Most expensive form of cooling to operate, both utilities & maintenance
Addresses market penetration for clients with existing chiller assets.	Complications associated with dispatch and coordination with customer sites
	Complicated customer agreement • Utilities • Maintenance

Avenues to Growth

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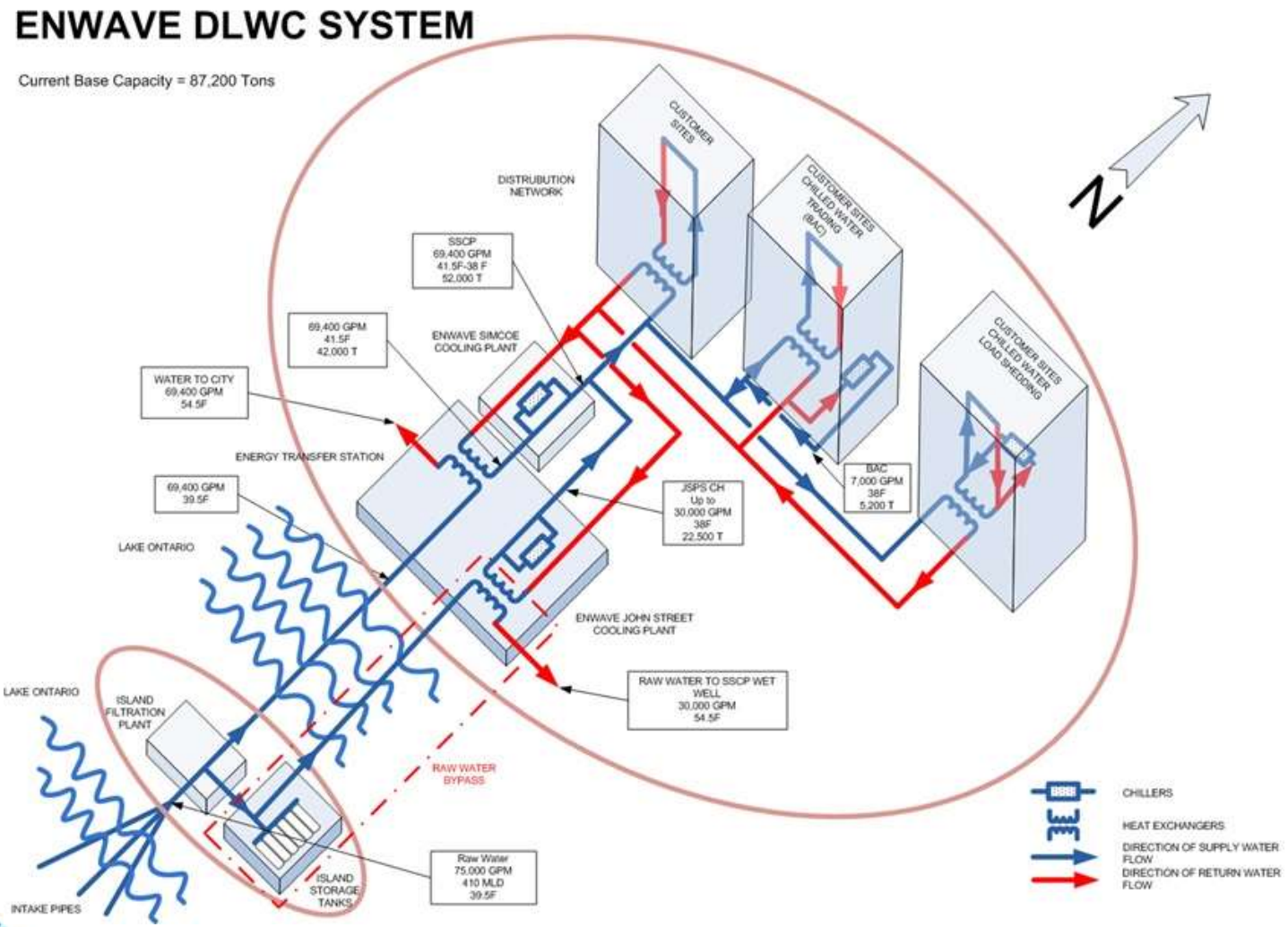
Raw Water Storage and Bypass

Well….that certainly won’t do

Raw Water Storage and Bypass



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Raw Water Storage and Bypass

Pros	Cons
Maximizes use of available infrastructure	High capital requirements per unit of cooling capacity
Increases availability of renewable resource	Large step block (20,000 tons) of cooling added, not aligned with customer growth.
Lowest cost of cooling supply • Utility • Maintenance	

Avenues to Growth

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Lower Chilled Water Supply Temperature

The colder the water the better!

Lower Chilled Water Supply Temperature

Pros	Cons
Creates opportunity to increase return temp, this means more DLWC capacity	Adjustment of customers' chilled water return temperature setpoint
Alleviates flow capacity restrictions at far end of distribution system	Uncertainty regarding risks associated increasing return temperature setpoint
Low capital costs per unit of additional capacity achieved	Increased parasitic load from distribution system
Highly efficient incremental cooling because of additional DLWC energy	

Avenues to Growth

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New Intakes and DLWC Plant

R.C. Harris Filtration Plant

New Intakes and DLWC Plant

New Intakes and DLWC Plant

Pros	Cons
Substantial growth opportunity, expand Enwave's footprint within Toronto	High level of capital requirement per unit capacity.
Low operating and maintenance cost of cooling supply	Limited ability to interconnect/support existing DLWC distribution system.
Opportunity to learn from lessons from the first DLWC project	Delay between building capacity and customer sales
	Challenges associated with servicing new areas of Downtown Toronto

Questions?

(or we can head out right out for Break?)

Thank you!