EXECUTIVE SUMMARY

INTRODUCTION

This feasibility study assessed the financial viability of constructing a cooling water district (CWD) that utilizes the naturally cold water at depth in Lake Ontario to serve the cooling loads of existing and future businesses that surround the Monroe County Water Authority's (MCWA) Eastside Water Treatment Plant (WTP) located at 593 Basket Road, Webster, NY.

BACKGROUND AND PROJECT DRIVERS

The implementation of a CWD has been considered since the early 1990's and was envisioned to reduce the energy and costs of cooling by using naturally cold water to offset mechanical refrigeration cycles that are more energy intensive. Since the conception of this project two similar projects have been constructed in Toronto, Canada and at Cornell University in Ithaca NY. Both of these projects have realized cost savings and continue to be operated today.

There are several potential benefits of a CWD which include:

- Attracting new businesses
- Job creation
- Retaining existing businesses
- Reduced greenhouse gas emissions
- Reduced strain on the utility infrastructure

CWD OVERVIEW

In order to construct the CWD, a cooling water facility will be built at the MCWA Eastside WTP. The CWD would work in conjunction with the WTP and utilize some of the existing infrastructure which currently supports the WTP. The raw water would be pumped from Lake Ontario through the CWD plant and then proceed to the WTP for processing or returned to Lake Ontario if it is not needed by the WTP. Utilizing the water for both cooling and for processes at the WTP leverages in existing infrastructure and makes the system as cost effective as possible.

The CWD would consist of a closed loop distribution system which would connect the CWD plant to each of the customers. The CWD plant would house the pumps and heat exchangers which will interface the raw water with the closed loop distribution system.

In order to accommodate the full buildout of the CWD, the existing raw water intake will have to be extended at a depth of 250 to 280 feet which will require approximately 15,000 linear feet of additional piping. The distribution system will also have to be constructed which was estimated to be approximately 24,000-feet or 4.5 miles at full system build out. Each customer of the loop will have heat exchanger at their facility which will transfer the heat from the CWD to the customer's distribution facility.

FINANCIAL ASSESSMENT

This study identified potential customers of the CWD and estimated the costs that they bear to operate their cooling systems. The estimate was presented in a unit price of cooling ($/ton-hr) which would later be compared to the price that the CWD would have to charge in order to be financially viable.

The cost of cooling varies by the cooling technology used as well as the utility rates for the type of business. The unit cost was estimated for various types of customers based on how much cooling they produce. The CWD unit price was estimated based on two different parameters. The four cooling water production technologies considered were air-cooled direct expansion (DX) systems, air-cooled chiller systems, small water-cooled chiller systems, and large water-cooled chiller systems. The ownership options considered were a public corporation, a private-public partnership, or a private corporation.

The estimates indicated that the full buildout of the CWD could provide cooling water cheaper than three of the four cooling water technologies considered and only the large water-cooled chiller plants could provide cooling for a lower unit cost. This type of system is common of larger industrial complexes and campuses.

The most attractive operational model was the public corporation due to the tax benefits that were considered along with reduced profitability margins. The table below shows the unit prices for each of the cooling water production technologies that were assessed.

Technology	Cost ($/ton-hr)	Units
Water-cooled Chiller Cooling, Large	$0.077	$/ton-hr
Chilled Water District, CWD	$0.170	$/ton-hr
Water-cooled Chiller Cooling, Small	$0.640	$/ton-hr
Air-cooled Chiller Cooling	$0.836	$/ton-hr
Air-cooled DX Cooling	$0.938	$/ton-hr

ENERGY SAVINGS AND GREENHOUSE GAS SAVINGS

Approximately $1,980,000/year is currently spent on utility costs to produce the 43 million ton-hrs of cooling that are used by the potential customers of the CWD. These utility costs could be reduced to approximately $919,000 if the same amount of cooling water were to be produced by the CWD. The electrical consumption to support these cooling needs were estimated to be reduced from 29 million kWh to 9.6 million kWh or a reduction of approximately 66%.

The greenhouse gas (GHG) savings for the system are proportional to the energy used in the CWD. It was estimated that approximately 9,700,000 lbs of CO_2 per year could be saved through the implementation of this project. The table below summarizes these values.

	Cooling Water Demand (ton-hr/yr)	Energy Consumption (kWh/yr)	Utility Cost ($/yr)	GHG (lbs of CO_2/yr)
Current Distributed Generation	43,131,323	29,203,520	$1,986,162	14,541,017
Future CWD	43,131,323	9,670,910	$919,611	4,815,339
Savings Estimate	-	**19,532,610**	**1,066,551**	**9,725,677**

FEASABILITY STUDY FINDINGS

The CWD is far more efficient than mechanical refrigeration cycles and this is shown through the energy savings shown above. The capital cost for the project was estimated between $80 and $100 million which was anticipated to be financed through a capital loan for the project. This study estimated the debt service payment as part of the operational costs for the CWD. For the public corporation business model, the annual operational cost was estimated to be $7.3 million with the debt service payment comprising of $5.8 million. This is approximately 80% of the total cost of ownership which leads to a unit price above that of what a large water-cooled chiller plant can produce cooling water for.

The CWD would have to significantly reduce its up front debt spending to be competitive with existing large chilled water users such as Xerox. Xerox represents 97%[1] of the cooling water needs for the potential existing customers and for this reason the CWD would not be viable without altering the debt service payment. Options to reduce the debt payment would be to decrease the capital cost to the greatest extend possible, obtain grant funding or seed money, extend the duration of the payment term, and/or utilize lower interest rate options (such as municipal bonds). Increasing sales could also improve the financial competitiveness; however, this would have to be accomplished by having customers with larger and consistent year round cooling.

The "break point analysis" and sensitivity analysis sections of this study assess the financial impact of the CWD by varying various parameters. If the CWD were to reduce the capital cost of the project by approximately $74 million (while all other parameters remain constant) the CWD would be competitive with existing large industrial cooling water system.

ADDITIONAL CONSIDERATIONS

This feasibility study considered one possible approach to assessing the viability of the CWD. Alternate approaches that could be assessed include:

Reduced Capital Cost System that Leverages Polishing Chillers

This option would be similar to the Toronto, Canada system which is sourced with water at Lake Ontario that is taken at a shallower depth. The shallower depth would reduce the capital cost of the project, but decrease the temperature certainty of the raw water. Polishing chillers would be purchased to reduce the intake temperature when required. This would be a slightly more energy intensive process, but the reduced capital cost could offset some of the in operational costs associated with the debt payment.

Right Size the CWD to an Ideal Client

This feasibility study compared the CWD to existing customers which already have invested in their own infrastructure to meet their cooling loads. In order for the CWD to be attractive, it would have to provide cooling water at a lower unit cost than the client is able to produce utilizing their own infrastructure.

If the CWD were tailored to an ideal client, then the system and the client could be designed to meet the needs of the other. An ideal client for the CWD would be one that has a large, continuous cooling load year round that would match the infrastructure capacity of the CWD. The client would also be located at one site to reduce the capital cost of the distribution system. Clients that require large cooling loads are unique process industries or businesses that have large data centers.

CONCLUSIONS

The energy savings and GHG savings associated with this project identify that the technology is viable and the CWD is more energy efficient that traditional cooling water systems. The high capital cost possess risk to the financial viability of the CWD, but with a combination of alternate variables the project could become viable.

The CWD as proposed by this feasibility study was not cost competitive with Xerox who represented 97% of the cooling water needs. If Xerox were not included in the CWD then the cooling demand would not be enough to warrant the extension of the deep water intake. Additional assessments should be completed to assess the viability of reducing the capital cost and leveraging polishing chillers or right sizing the CWD to an ideal client.

[1] Xerox represents a demand of approximately 10,410 tons out of a system total of 13,265 tons which is 78% of the system demand. Xerox is anticipated to consume approximately 41.6 million ton-hrs our of a system total of 43.1 million ton-hrs which is 97% of the total system consumption.