

An Assessment of Options for the Future of Brockton's Desalination Facility

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Brockton has periodically faced water shortages due to recurring droughts and increasing water demand (Shallenberger & Cooper, 2013; Vedachalam & Riha, 2012). To alleviate these shortages, in 2002, Brockton signed a 20-year contract with Aquaria, a joint venture between Inima and Bluestone Energy, to build the Taunton River Desalination Facility (TRDF) (Larocque, 2016; Lynch & Mead, 2016). As part of this contract, Brockton pays an annual rate of \$6.5 million and purchases the water at an additional rate of \$1.30/1,000 gallons. Currently, Brockton is Aquaria's only customer and the facility is not being used to its fullest capacity due to the City's limited budget.

Goal

The goal of this project is to develop a variety of options for the City of Brockton to leverage the TRDF that reflect the opinions of the facility's stakeholders. To accomplish this goal, our team completed a series of objectives:

1. Explored the history that led Brockton to site a desalination facility and identify the stakeholders involved in this decision.
2. Examined how the TRDF is currently being used and the attitudes of its stakeholders regarding the facility.
3. Explored the current and long term water demands of Brockton.
4. Identified and compare opportunities for alternative uses for the Taunton River Desalination Facility.



Figure 1: Aerial view of TRDF

Methods

To understand the history of the facility and how it is currently being used, we interviewed staff members from Brockton's Water, Financial, and Public Works departments and the engineer who proposed the original idea for the facility. We also reviewed the following documents to help us understand the history and current use of the TRDF:

- desalination financial model,
- Brockton's annual budget,
- production history of TRDF, and
- plant permits provided by the EPA and DEP

To examine current and projected water demands in Brockton we reviewed reports from Brockton's Water Commission and Metro South Shore Chamber of Commerce (MSSCC). We then interviewed staff members from Brockton's Economic Department, MSSCC and water departments in surrounding municipalities.



Figure 2: Reverse osmosis trains in TRDF

Finally, to develop options for Brockton to leverage the TRDF, we researched uses for desalination in addition to potable water and case studies about desalination for uses besides human consumption. We toured the TRDF to learn about how the facility operates and interviewed staff members from Aquaria. We then came up with three options for Brockton to leverage the TRDF and analyzed them with help of engineers and desalination experts.

Findings & Discussion

Finding #1: Stakeholders believe desalination was the best solution for the City and have a positive attitude about the future of the facility.

Engineers and Brockton officials argue it was the best solution compared to digging new wells or connecting to the MWRA thus “desalination was the way to go.” Current city officials believe desalination has helped the City in emergencies and they like having the facility as a secondary water source.

Finding #2: Residents are unaware of the current use of the TRDF and city officials share little information about the facility to them.

Residents developed a negative attitude towards the TRDF when the plant started operating because they believed the City was misusing their money paying for a facility barely utilized. There is almost no effort to provide information to the residents of Brockton about the TRDF and its current use. There is no evidence that the negative public attitude about the facility has improved.

Finding #3: Since the plant started operating in 2008, Brockton has not used the facility to its fullest potential because the water from TRDF is more expensive than Silver Lake.

Brockton only purchases 5% of their water from TRDF and the remaining 95% from Silver Lake (Creedon, 2017). As seen in the graph to the right, since the plant started operating the volume of water purchased annually has varied over the years due to budget constraints; 2010 was the year were they purchased the most water and 2012 the City did not purchase water at all.

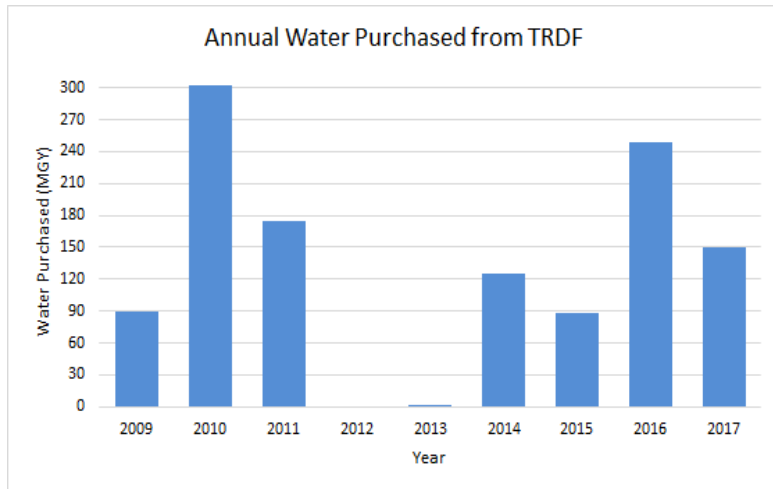


Figure 3: Annual water purchased from TRDF

Finding #4: Due to both legal mandates and environmental precautions, Brockton is required to have a secondary water source.

In 1995, MassDEP issued a consent order, mandating Brockton to find a secondary water source due to depletion of Silver Lake. This consent order is still in effect today, and Brockton uses the desalination facility as their secondary water source. From our interview with Brockton Department of Public Works, we learned that Silver Lake is currently overstressed and thus, the DEP will require Brockton to obtain more water from its secondary water source.

Finding #5: The water demand in Brockton is not expected to increase substantially in the upcoming years.

Population projections show Brockton may decrease in population by 2030. The number of large industries has decreased in Brockton, and the City has no plans to attract additional large industries. Their current goal is to support local businesses from within Brockton. Moreover, as explained by an MWRA expert, each year water consumption per capita decreases as water fixtures (i.e showers, toilets, etc.) become more efficient and consume less water. Thus, in the next 10 years the water demand in Brockton is expected to remain constant at 10 MGD.

Based on these findings, our team decided to further explore three options the City has been considering for the future of the desalination plant. The options are to:

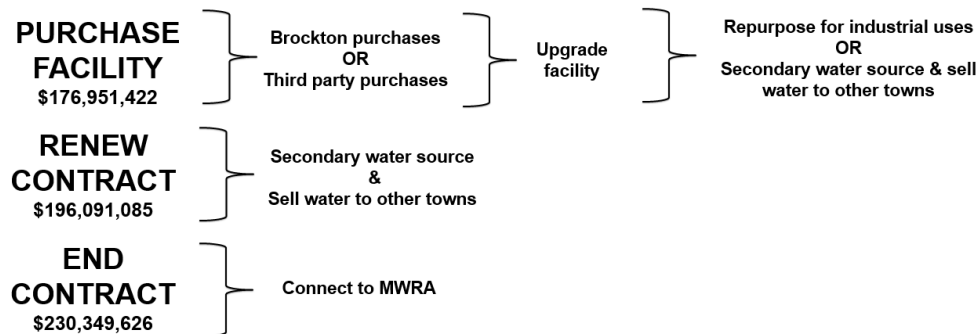


Figure 4: Options and opportunities for TRDF

Option 1 - Purchase TRDF

Brockton has been exploring the option of purchasing the facility, which will then end the contract. As an owner, Brockton could subcontract a third party to operate the facility. Currently, Aquaria’s offer is \$78 million. The City has until January 2018 to make a decision before the bid goes public. If Brockton purchases the facility, we suggest city officials further look into these opportunities:

- **Explore the opportunity of having a third party purchase the facility**
Purchasing the facility represents a large amount of money that Brockton will have to obtain through bonds and debts. To prevent this expenditure, Brockton could explore having a third party purchase the facility. Brockton could then negotiate a contract with this third party to obtain water at an accessible price. By having this third party purchase the TRDF, it would remove the risks of Brockton being directly associated with the facility and reduce City’s expenditures.

- **Upgrade the facility to improve production capacity and reduce operation and maintenance costs**

From our tour to the facility we learned there are opportunities to upgrade the plant to reduce operation and maintenance costs some of the upgrades include:

- Addition of reverse osmosis and ultrafiltration train
- Increase efficiency of reverse osmosis system
- Replace Gunderboom structure
- Addition of solar panels

We also explored the opportunity of expanding the production capacity of the facility up to 7.5 MGD. To do so, some equipment needs to be replaced and added. With help of a desalination expert, expanding the production of the facility will cost around \$73 million.

- ***Continue using the facility as a secondary water source and sell excess water to neighboring municipalities.***

Brockton will remain the largest customer of the TRDF since they are required to have a secondary water source. However, the buyer of the facility could then sell whatever water Brockton does not buy to neighboring communities. From our surveys, we learned commissioners of water departments in municipalities in the area are interested in the long term in connecting to a new water source.

- ***The buyer could provide water of a particular quality to industries in the area***

From our literature review about alternative uses for desalinated water, our team discovered that some industries that have benefited from using desalination include: electronics, power plants, beverage production, agriculture, and wastewater treatment. Since water is an important driver to site industries, Brockton could develop a plan to attract industries and the TRDF will be the water supply.

Option 2 - Stay in Contract with Aquaria

Brockton has the option of staying in the contract until 2028, renegotiate it, and renew it for 30 more years until 2058. When renewing the contract, Brockton would continue to pay the two rates stated earlier. Brockton will use the TRDF only as a secondary water source, purchasing approximately 2 MGD throughout the next 40 years. This leaves Aquaria in charge of operation and maintenance of the plant and Brockton will be the only customer. If Brockton renews the contract, we suggest city officials further look into the following opportunity:

- ***Continue using the facility as a secondary water source and sell excess water to neighboring municipalities.***

By Brockton using the TRDF as a secondary water they have the opportunity to sell the water to neighboring municipalities. In the current terms of the contract, only Brockton can allow the connection of new municipalities to the TRDF. Thus, it will be Brockton's responsibility to promote the facility in surrounding municipalities to get more customers for the TRDF.

Option 3: End Contract and Connect to MWRA

After the contract with Aquaria ends in 2028, Brockton has the option to end the contract and locate a different secondary water source. Brockton could connect to the Massachusetts Water Resource Authority (MWRA). The closest connection point for Brockton will be at Quincy. Brockton then will be obtaining water from the Quabbin Reservoir. The costs Brockton will assumed for this connection include:

Table 1: MWRA connection estimated costs

| Description | Estimated Cost |
|-------------------------------------|-----------------------------------|
| Entrance Fee | \$4.3 million per million gallons |
| Water Cost | \$3.471 per thousand gallons |
| Construction of Pipeline | \$55 million |
| Permits | \$11 million |
| Additional Treatment to Silver Lake | N/A |

Financial Comparison of the 3 options

In all these scenarios, both the TRDF and MWRA will serve as a secondary water source and Silver Lake will remain the City’s main water source. The City is planning to obtain 2 MGD from any these secondary water sources, in which case from 2018-2058 all options are estimated to be the following:

Option 1: \$176,951,085

Option 2: \$196,091,085

Option 3: \$230,349,626

Over the next 40 years, purchasing the facility could save the City an estimated \$12 million compared to renewing the contract and will save an estimated \$53 million than connecting to the MWRA. The Department of Finance has estimated the costs of obtaining less or more than the 2 MGD this is because in the future the DEP might require Brockton to take even more water from their secondary water source. In this case, for option 1, the savings increase as the water obtained increases and in option 3, expenditures considerably increase as the water obtained increases (Condon, 2017).

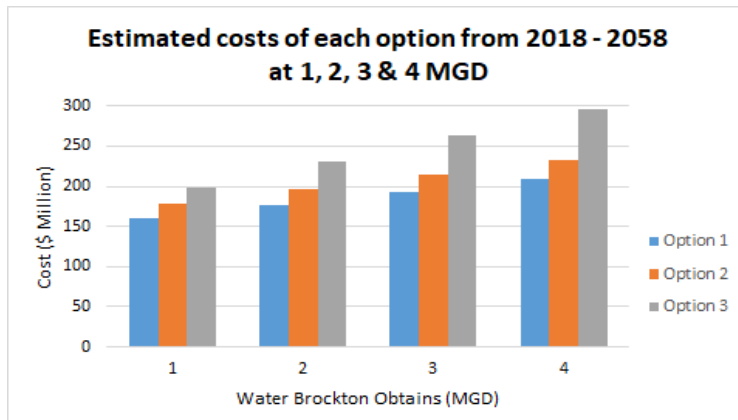


Figure 5: Estimated cost of all options

Project Deliverables

At the end of our project, we delivered the following to NEWIN:

- An in depth literature review of the history of TRDF
- List of individuals contacted during the research projects
- Weekly blog post for NEWIN's web page
- Executive summary of our project

Future Research

After concluding the project, we suggest NEWIN further:

- Investigate available water supplies in the South Shore of Massachusetts
- Investigate opportunities for promoting regional collaboration for water systems in the Metro South Shore
- Help Brockton find potential third parties interested in purchasing the facility
- Assist Brockton with marketing strategies to improve the facility's image
- Guide Brockton in ways to seek public funding to invest in the TRDF
- Explore residents opinion on desalination and the TRDF

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