Final Report

Title

Economic analysis of proposed seawater desalination facility in Brownsville, Texas

Project Number

(2009TX323B)

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Abstract

A seawater desalination project is being actively pursued by the Brownsville Public Utilities Board, municipal power and water supplier to the City of Brownsville located in the Texas Lower Rio Grande Valley. Seawater desalination provides a means to expand and diversify the region's water supply offering protection against water delivery shortfalls and periodic droughts. This research will compile economic and financial cost data from desalination facilities similar to the facility being proposed for Brownsville (to be located on the Port of Brownsville). The analysis will compare the projected costs of water production via desalination at the Port of Brownsville with the costs of alternative potable water supplies, including conventional surface water treatment, brackish groundwater desalination, and seawater desalination at other locations, controlling for water quality, energy costs, time value of money, etc. Cost analysis will use DESAL ECONOMICS©, a cost model developed by Texas A&M AgriLife Research and AgriLife Extension Service economists, along with cost models used in the industry, e.g., Reverse Osmosis Desalination Cost Model (RODCM) published by Water Resource Associates, and WTCost© II published by I. Moch and Associates.

Problem and Research Objectives

Water scarcity has been an issue for community managers in the arid parts of the world for many years. As population levels increase across the globe, even areas that are traditionally thought of as non-arid or semi-arid must be prepared to engage the reality of increasing levels of water scarcity. Competition among a diverse set of ever-growing consumers motivates interest in both non-traditional water supply projects and non-traditional water demand management strategies. This research addresses the several inter-related issues by looking at one such non-traditional water supply project for a semi-arid region which consistently ranks high among the fastest-growing parts of the country. For many years, the Rio Grande Valley of south Texas has relied heavily, essentially primarily, on river diversions from the Rio Grande and conventional surface water treatment technologies to provide its population with potable water supplies. In recent years, the water suppliers of the Valley have expanded their water supply portfolio to include brackish groundwater desalination. This research investigates another potential technology to harness an as yet untapped potential source of freshwater for the region. Municipal-scale, seawater desalination is a novel technology for the Valley, and for that matter, much of the US. Two municipal-scale seawater desalination facilities currently in operation in the US include one located in Tampa Bay, Florida and another in North Dighton, Massachusetts. The objective of this research is to estimate life-cycle facility segment and component costs for a hypothetical seawater desalination facility that would be located in the Valley, with the costs grounded in the real world experiences of engineers and water managers who have already undertaken projects which employ the technology of seawater desalination, such as those facilities in Florida and Massachusetts.

Materials/Methodology

The approach taken is essentially that of a two-stage case study, with the first stage encompassing a study of existing seawater desalination facilities to acquire *in situ* life-cycle facility segment and component costs. In the second stage, segments and components which would be appropriate for a hypothetical facility in the Valley are identified, and results from the first stage are modified to approximate the most likely costs for a Valley facility.

Principal Findings

Of the two seawater desalination facilities mentioned above located in the US, neither, without substantial and possibly disencumbering modifications, would provide an accurate approximation for costs for a facility in the Rio Grande Valley of Texas. Each facility has different upsides and downsides relative to providing accurate cost information towards the hypothetical Valley facility; a discussion of these pros and cons follows.

In terms of output capacity, the Tampa Bay facility more closely matches the size of the fully built-out facility described in the Final Pilot Study Report (NRS Consulting Engineers, 2008), which is 25 million gallons per day. However, the Tampa Bay facility has recently undergone rehabilitation following undesirable production results during the early years of its operations. Additionally, the Tampa Bay facility was constructed adjoining a power generation facility, to take advantage of the power facility's cooling water infrastructure; doing so provided for more readily accessible and less expensive source water than if the desalination facility had to independently construct and operate its own raw water intake extraction and concentrate discharge outfall systems. Such an independent construction and operation is a likely outcome for a facility in the Valley; therefore, the complications during the startup phases and the absence of an independent intake and outfall system made the Tampa Bay facility seem less desirable as a model for the first stage of this project.

Initially, the facility in Massachusetts seemed more promising since that facility did construct an independent intake and outfall system. Also, the facility has a current operating capacity of 4 million gallons per day which, while smaller than the full build-out recommendation from the Brownsville pilot study, was considered near enough to the range of the initial build-out capacity from the pilot study recommendation, i.e., 2.5 million gallons per day. Additionally, the Massachusetts facility was known to employ a membrane pretreatment system, which is similar, though not identical, to the membrane pretreatment system recommended from the Brownsville pilot study. The downsides of the Massachusetts facility were discovered to be the source of raw water is not very similar to that which is expected to be found in the Valley. In addition to the likely differences due to seasonal differences from Massachusetts and south Texas, the facility is located not on the ocean but rather on a tidal river. The facility managers, wisely, take advantage of the river's tidal influences and extract raw water when the salinity is at a minimum, because treating the less saline water requires less energy. This characteristic of facility operations results in much lower treatment costs than would be experienced if the facility treated undiluted seawater, as will likely be the case for the Valley facility.

Significance

This project took an important step towards identifying a reasonable first-stage case study project to use to evaluate likely life-cycle segment and component costs for a seawater desalination facility located in the Texas Lower Rio Grande Valley. Although neither facility in the U.S. seems ideal for the first stage of this project, during the site visit and subsequent follow up consultation with the engineers and managers, who built the Massachusetts facility, a third prospective facility was introduced to the authors. A 20 million gallon per day facility, located in Baja California, Mexico, equipped with an independent intake and outfall system, may be the ideal first-stage case study project that will ultimately provide the information necessary to construct an acceptable estimate of the costs for a seawater desalination facility in south Texas.

References Cited (if needed)

NRS Consulting Engineers. "Final Pilot Study Report: Texas Seawater Desalination Project." *Brownsville Seawater Desalination Pilot Project.* October 2008.