Preliminary Overview and User's Guide
SSI Feasibility Guidance Tool

The Subsurface Seawater Intake (SSI) Feasibility Matrix (Matrix) is a decision support process that provides a screening level methodology to assess the potential feasibility of seven different SSIs to provide the desired feedwater to meet the design desalination production capacity at a particular location along the California coastline. "Feasibility" is defined as meeting the feasibility criteria established by the California Coastal Commission (Seawater Desalination and the California Coastal Act, 2004) which is consistent with the CEQA definition of "feasibility". However, while the CEQA definition of considers technical, environmental, economic, and social feasibility, the scope of the Matrix is limited to technical feasibility and additional analysis would have to be conducted to determine feasibility for the remaining three considerations.

The Matrix consists in two steps; evaluation of potential fatal flaws and evaluation of potential challenges. For those SSIs that are not eliminated by a fatal flaw (first step), the Matrix utilizes a scoring system to characterize the technical features and potential environmental impacts of each SSI (second step). The score generated through the matrix can be used to assess potential feasibility of each SSI by ranking the degree of challenges for different SSIs in terms of construction, operation, potential impacts, and risk/uncertainty for project implementation.

The attached flow diagram gives an overview of the feasibility assessment process the Matrix follows.

This document provides a brief overview of the Matrix. A final guidance document will be developed to supplement the Matrix that will fully detail all reasoning and assumptions that went into developing the Matrix, as well as provide guidance on acquiring the necessary information for a given project in order to apply the Matrix. However, for purpose of initial peer review, this document provides a brief overview of the Matrix, including the following elements:

- List of inputs;
- Feasibility Matrix (including Fatal Flaw section and Significant Challenge section);
- Weighting Matrix;
- Levels 2-3 Tests & Analyses; and
- List of Supporting References.

Inputs

Feasibility and degree of challenge for each SSI are based on 25 inputs that characterize the physical characteristics of the proposed site and the required capacity of the proposed plant. If a given desalination project is being considered at multiple locations, a complete set of inputs would be provided for each site. Some of the inputs are the same regardless of which SSI is being considered (e.g. available beach front area), and some of the inputs are unique to each SSI (e.g. land take per unit).

Potential Feasibility

Potential feasibility is based on four criteria, as shown in the Fatal Flaw section of the feasibility matrix. If the proposed project and site characteristics trigger an infeasibility ranking in any of the four general criteria for a given SSI, that SSI is considered infeasible, and no further analysis is required for that SSI. If none of the fatal flaws are triggered for a given SSI, that SSI would be considered potentially feasible and assessment can continue using the significant challenge criteria. It should be noted that although a given SSI may be considered feasible based on a screening assessment using this feasibility matrix, further analysis that is beyond the scope of this feasibility matrix may later determine the SSI to be infeasible.

Challenge Ranking

For SSIs that are determined to be potentially feasible, the degree of challenge that would be associated with their implementation and operation is evaluated in the Significant Challenge section of the feasibility matrix. This section considers challenges associated with five general categories - construction, operation of the intake work, operation of the treatment system, potential environmental impacts, and risk/uncertainty for project implementation. Within each category, a number of criteria are included to address the degree of challenge that might be faced in each category. For each criteria, each SSI is given a score based on the input that ranks the expected degree of challenge.

Not all of the criteria are equally important relative to each other, or relative to the other SSIs. A weighting matrix is provided to account for the relative importance of each of the criteria. The individual scores for each criteria and each SSI are multiplied by their associated weight before being summed for each of the five categories. Because of the different weights for each SSI, and the different number of criteria in each category, the total score possible varies by SSI and challenge category.

Therefore, to facilitate comparison between categories and across SSIs, the scores for each of the five categories are normalized based on the total possible score[1]. The normalized score is multiplied by 5 so the final scores for each category range from 0 to 5 with 5 being most challenging. Each of the potentially feasible technologies would receive a single score (between 0 and 5) for each of the challenge categories, as well as a total overall challenge score (0 to 25), which is a sum of the scores from each of the five categories.

In this way, each of the potentially feasible SSIs can be ranked in terms of degree of challenge to implement for a given project/site.

Levels 2 and 3

Not all of the inputs may be known at the onset of project evaluation. Where inputs are not known with reasonable certainty, the most favorable conditions are assumed as a default score. Consequently no SSIs are not prematurely designated as infeasible. However, upon completion of this screening level assessment, the user may wish to obtain more accurate data and re-apply the matrix. The Level 2/3 section provides a list of potential tests and analyses that could be performed to obtain more data and improve understanding of site conditions for each of the evaluation criteria. Level 2 tests and analyses can generally be performed for $50,000-$200,000 and within a six month time frame, while level 3 are

[1] As an example, for the Risk/Uncertainty challenge category, there are two criteria, each with a potential score of two. For vertical wells, each of these criteria have a weight of one, meaning that the total possible score for Risk/Uncertainty for Vertical Wells, is four (score of 2 x weight of 1 plus score of 2 x weight of 1 = 4). If the inputs for a given project/site result in a score of 3 for Risk/Uncertainty for Vertical Wells, this would be 75% of the possible points (score of 3 divided by potential score of 4). For this example, after multiplying by five, , the final normalized challenge ranking would be 3.75 (75% of 5).

more in depth analyses that would typically require more time and money. If some SSIs are determined to be infeasible for a particular site based on a screening level application of the feasibility matrix guidance tool, further study and testing can be focused only on the remaining potentially feasible SSIs.

List of References

Bartak, Rico, Thomas Grischek, Kamal Ghodeif, and Chittaranjan Ray, 2012. "Beach sand filtration as pre-treatment for RO desalination," International Journal of Water Sciences, Vol. 1, No. 2, pp. 1-10.

California Coastal Commission (2004). Seawater Desalination and the California Coastal Act (2004) – in particular, Chapter 2.2.1 (on feasibility) and Chapter 5.5.1 (on intakes): http:www.coastal.ca.gov/energy/14a-3-2004-desalination.pdf.

California Department of Health Services, 1997. "Policy Memo 97-005 Policy Guidance for Direct Domestic Use of Extremely Impaired Sources". November 5.

California State Water Resources Control Board, 2008. "Draft Decision in the Matter of Application 31369 (Chino Basin Watermaster)," State Water Resources Control Board Meeting Session, Division of Water Rights, Item 10, September 2.

California State Water Resources Control Board, 2013. "2012 California Ocean Plan: Water Quality Control Plan for Ocean Waters of California," Effective August 19.

Díaz-Caneja, José, and Manuel Farinas, 2004. "Cost Estimation Briefing for Large Seawater Reverse Osmosis Facilities in Spain," In International Conference on Desalination Costing, Middle East Research Center, Lemesos, Cyprus, pp. 6-8.

Farnsworth, Katherine L., Warrick, Johnathan A., 2007. "Sources, Dispersal, and Fate of Fine Sediment Supplied to Coastal California". U.S. Geological Survey Scientific Investigations Report 2007–5254.

Independent Scientific Technical Advisory Panel (ISTAP), 2014. "Final Report: Technical Feasibility of Subsurface Intake Designs for the Proposed Poseidon Water Desalination Facility at Huntington Beach, California," October 9.

Missimer, Thomas M., Noreddine Ghaffour, Abdullah HA Dehwah, Rinaldi Rachman, Robert G. Maliva, and Gary Amy, 2013. "Subsurface intakes for seawater reverse osmosis facilities: Capacity limitation, water quality improvement, and economics." Desalination, Vol. 322, pp. 37-51, August 1.

National Research Council, 2012. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future.

scwd2 Desalination Program, 2011. "scwd2 Seawater Desalination Intake Technical Feasibility Study". Prepared by Kennedy/Jenks Consultants. September.

Water Research Foundation, 2011. "Assessing Seawater Intake Systems for Desalination Plants," Prepared by Carollo Engineers, Collector Wells International, Inc., and Tenera Environmental.

WateReuse Association Desalination Committee, 2011. "Overview of Desalination Plant Intake Alternatives White Paper," June.

Wave Information Studies, 2015. US Army Corps of Engineers . http://wis.usace.army.mil/wis.shtml

West Basin Municipal Water District, 2013. "Ocean Water Desalination Program Master Plan (PMP)". Prepared by Malcolm Pirnie. January.