# NATIONAL WATER RESEARCH INSTITUTE

# Draft Final Report

*of the February 26, 2015, Meeting (Meeting #1) of the*

## Independent Advisory Panel

*for*

## West Basin Municipal Water District's Ocean Water Desalination Subsurface Intake Study – Guidance Manual Review

**(Bureau of Reclamation Project No. R14AP00173)**

*Prepared for:*

West Basin Municipal Water District
17140 Avalon Boulevard
Carson, California 90746

*Under Contract to:*

Geosyntec Consultants
3415 S. Sepulveda Blvd, Suite 500
Los Angeles, CA 90034

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*For more information, please contact:*

National Water Research Institute
18700 Ward Street
P.O. Box 8096
Fountain Valley, California 92728-8096 USA
Phone: (714) 378-3278
Fax: (714) 378-3375
www.nwri-usa.org

Jeffrey J. Mosher, Executive Director
Gina Melin Vartanian, Editor

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## ACRONYMS

| | |
|---|---|
| CEQA | California Environmental Quality Act |
| MF | Microfiltration |
| MGD | Million gallons per day |
| NTU | Nephelometric turbidity unit |
| NWRI | National Water Research Institute |
| SDI | Silt density index |
| SSI | Subsurface Seawater Intake |
| TWL | Total water level |
| UF | Ultrafiltration |
| USBR | United States Department of Interior, Bureau of Reclamation |
| WBMWD | West Basin Municipal Water District |

# 1. PURPOSE AND HISTORY OF THE PANEL

In 2015, NWRI formed an Independent Advisory Panel on behalf of the West Basin Municipal Water District (WBMWD) to provide expert peer review of the technical and scientific aspects of a proposed Subsurface Seawater Intake (SSI) Feasibility Guidance Manual, which is being developed by Geosyntec Consultants, under subcontract to WBMWD, with grant funding from the United States Department of Interior, Bureau of Reclamation (USBR) under USBR Project No. R14AP00173. The Guidance Manual is also a part of a larger WBMWD study, the "Ocean Water Desalination Subsurface Intake Study."

The Panel will review the Guidance Manual, which consists of a desktop tool for conducting feasibility analyses of SSIs based on site-specific observations or measurements, available data from public or private sources, or assumptions based on engineering judgment or professional experience.

## 1.1 Project Description

WBMWD has initiated the "Ocean Water Desalination Subsurface Intake Study" to investigate full-scale SSI technologies used to collect seawater through the ocean bottom and coastal aquifer sediments. The purpose of the study, which is under contract to Geosyntec Consultants, is to develop a comprehensive, systematic procedure to evaluate the technical feasibility of SSI technologies at a given project site.

This project will help the industry by providing a subsurface intake guidance manual for ocean-water desalination projects (particularly in California) to follow, as well as aiding regulatory agencies and non-governmental organizations by compiling the body of research on subsurface intakes that could be utilized to evaluate other projects.

The project involves the development of a Guidance Manual that can be used by project proponents when evaluating SSI technologies during the preliminary planning phase of an ocean water desalination plant. Once the Guidance Manual is completed, WBMWD's full-scale ocean water desalination planned facility will be used as a test case for the application of the Guidance Manual.

A "Subsurface Seawater Intake (SSI) Feasibility Matrix" has been prepared as part of the Guidance Manual. The Matrix provides a screening-level methodology to assess the technical feasibility[1] of seven different SSIs to provide feedwater to meet a desired desalination production capacity at a particular location. The seven SSIs include vertical wells, slant wells, horizontal

[1] "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 California Environmental Quality Act (CEQA) definition of "feasibility." However, while the CEQA definition considers technical, environmental, economic, and social feasibility, the scope of the Matrix is limited to technical feasibility. Additional analysis would have to be conducted by project proponents to determine environmental, economic, and social feasibility.

wells, radial collector wells (Ranney wells), beach infiltration galleries, seafloor infiltration galleries, and water tunnels with radial collectors.

The Matrix consists of two steps: the evaluation of potential fatal flaws (step 1) and the evaluation of potential challenges (step 2). If an SSI is not initially eliminated by a fatal flaw (step 1), the Matrix will then use a weighted scoring system to qualify the technical and site assessment features of each SSI (step 2). The score generated through the Matrix would rank the technical feasibility of each SSI by quantifying in terms of construction, operation, potential impacts, and risk/uncertainty for project implementation the degree of challenges of each SSI.

## 1.2 Panel Charge and Members

To review the development of the Guidance Manual, the Panel was charged with the following:

- Validating each of the proposed fatal flaws as they relate to the technical feasibility for each type of SSI.
- The comprehensive list of technical fatal flaws is complete and all assumptions are accurate.
- Proposed fatal flaw thresholds and significant challenge thresholds for each SSI are complete and accurate.
- Scoring for the significant challenges and all assumptions are accurate.
- Weighting allocations for challenges as applied to the scoring of different SSIs are accurate and appropriate.
- Recommended tests and analysis to be performed after use of the Guidance Manual to continue determining the feasibility for SSIs.

To undertake this review, the four-member Panel consists of individuals with expertise in the fields of intake and well design, hydrogeology, coastal processes, evaluation of structures and vessels in the marine and coastal environment, development and implementation of alternate water supply projects (such as seawater desalination) at public agencies, and other areas relevant to the study.

Specifically, Panel members included:

- Chair: Thomas M. Missimer, Ph.D., Florida Gulf Coast University (Fort Myers, FL)
- Claudio Fassardi, CH2M HILL (Long Beach, CA)
- Heidi R. Luckenbach, P.E., City of Santa Cruz Water Department (Santa Cruz, CA)
- Robert G. Maliva, Ph.D, P.G., Schlumberger Water Services (Fort Myers, FL)

Background information about the NWRI Panel process can be found in Appendix A, and brief biographies of the Panel members can be found in Appendix B.

## 2. PANEL MEETING #1

A 1-day meeting of the Panel was held on February 26, 2015, at WBMWD's Edward C. Little Water Recycling Facility in El Segundo, California. This meeting represents the first time the Panel has met to review the framework of the proposed SSI Feasibility Guidance Manual. A portion of this meeting was open to the public for input.

### 2.1 Background Materials

Background materials were provided to the Panel and the public in advance of the meeting. These materials include:

- "Screening Flowchart" – This document was used as a pictorial representation of how to use the Guidance Manual and how computer logic will be set up once the Matrix is finalized.

- "Screening Narrative" – This document provided an explanation of details found in the Matrix.

- "Screening Framework" or the "Subsurface Seawater Intake (SSI) Feasibility Matrix" – This Matrix served as the basis for the Guidance Manual. The details of this Matrix were reviewed, including:

    - Inputs.
    - Fatal Flaws.
    - Criteria for Scoring.
    - Weighted Scoring System.
    - Next Level Testing Recommendations.

For clarity, the components of this effort are as follows:

- *The "Ocean Water Desalination Subsurface Intake Study."* The Study refers to the entire effort, which includes the development of the SSI Feasibility Guidance Manual Guidance Manual and the beta test of the Guidance Manual.

- *Subsurface Seawater Intake (SSI) Feasibility Guidance Manual or "Guidance Manual."* The Guidance Manual will be the desktop tool for conducting feasibility analyses of SSIs based on site-specific observations or measurements, available data from public or private sources, or assumptions based on engineering judgment or professional experience.

- *"Screening Framework" or the "Subsurface Seawater Intake (SSI) Feasibility Matrix."* The Matrix is a component of the Guidance Manual and provides the screening-level methodology to assess the technical feasibility of seven different SSIs to provide feedwater to meet a desired desalination production capacity at a particular location.

## 2.2 Meeting Agenda

The Panel meeting was divided into two sessions: the first session (from 9:00 am to 12:30 pm) was open to the public, and the second session (from 12:30 pm to 4:00 pm) was a closed working session for Panel members. NWRI staff, WBMWD staff, and Geosyntec project team members collaborated on the development of the two agendas for Panel meeting, which are included in Appendix C.

For the public portion of the meeting, the agenda was based on meeting the following objectives:

- Clarify the Panel's charge and Panel review process.
- Describe the goal and objectives of the Ocean Water Desalination Subsurface Intake Study Guidance Manual.
- Receive public input on this effort and clarify how to provide public comments.

The majority of this session was devoted to presentations made by WBMWD staff members and the Geosyntec project team. Presentations included:

- Introduction to WBMWD's Ocean Water Desalination Program.
- Introduction to the Ocean Water Desalination Subsurface Intake Study.
- Introduction of the SSI Feasibility Matrix.

Time was provided at the meeting for the Panel to ask questions and engage in discussions with WBMWD staff and members of the Geosyntec project team. In addition, time was allotted for members of the public to provide written and oral comments about the Panel process and proposed framework for the SSI Feasibility Guidance Manual.

During the closed portion of the meeting, the Panel discussed specifics of the Matrix with WBMWD staff and members the Geosyntec project team. The Panel then met in a closed (Panel-only) session to prepare a report outline and draft preliminary findings and recommendations on the proposed framework for the SSI Guidance Manual, which are expanded upon in this report.

## 2.3 Meeting Attendees

All Panel members attended this meeting in-person with the exception of Dr. Thomas Missimer, who participated via Skype. Other meeting attendees included NWRI staff, WBMWD staff, Geosyntec project team members, and others. A complete list of Panel meeting attendees is included in Appendix D.

# 3. FINDINGS AND RECOMMENDATIONS

The principal findings and recommendations provided below are focused on the framework for the SSI Feasibility Guidance Manual, particularly the SSI Feasibility Matrix, and are derived from the material presented and discussed during the meeting. The findings and recommendations are organized under the following categories:

- General Comments
- Weighting Scoring System
- List of Inputs
- Level 1 Fatal Flaws
- Level 1 Challenges
- Scoring Matrix
- Levels 2 and 3
- Public Comments

## 3.1 General Comments

These comments pertain to the overall Panel review of the proposed framework for the SSI Feasibility Guidance Manual.

- The Panel recognizes WBMWD and Geosyntec for their effort in preparing for the meeting. The Panel appreciates the level of organization and information provided for the Panel to conducts its review.

- The meeting presentations were informative and helpful in conducting this Panel review (with public input) of the Guidance Manual framework.

- WBMWD needs to be clear as to the purpose and users of the Guidance Manual (as well as be clear in the documentation as they develop this manual).

    - Although the Guidance Manual is geared towards California, will it be general enough to use in other regions?
    - A statement is needed as to how it should be used, who should use it (i.e., the technical backgrounds of users), and what level of effort is required.
    - Be clear that the Guidance Manual framework is a cursory feasibility analysis performed with a desktop tool with limited information. It is a tool to provide guidance as to which options may be most appropriate for a given site. It is not a final determination.
    - Use of the Guidance Manual will standardize SSI evaluations in terms of consistency in SSIs evaluated and the evaluation criteria used.
    - The Guidance Manual is a tool to demonstrate that all SSI technologies have been considered and those eliminated had justification for being eliminated.

- The Panel suggests that including practical issues (e.g., beach stability) in the Guidance Manual is important. In addition, input parameters should be data that could be obtained through a literature and database review and site inspection.

- The intake type is linked to economics (i.e., to the cost of the project and the cost of water to consumers).

    - Describe in the Guidance Manual that proponents should recognize that economic, environmental, social, and regulatory issues should also be factored into the decision-making process, perhaps not at Level 1, but at subsequent levels.

    - Proponents should consider conducting an initial feasibility analysis (i.e., this Guidance Manual) followed by an economic and regulatory and environmental impact analysis to assess the full feasibility of each SSI and whether or not a given option might face insurmountable regulatory challenges.

    - Please refer to the modified flowchart in Appendix E.

- The issue of risk of pursuing SSI options with limited experience is important. There is a need for pilot projects of different SSIs to reduce this risk and increase knowledge and confidence.

- The Panel suggests that the Guidance Manual could be beta tested on one or more existing facilities as a validation of the Guidance Manual. The tool could show that the technology used for an existing facility selected is ranked high, but not necessarily the highest.

- If the Guidance Manual is beta tested with existing facilities, the results could be used to validate the "weightings" addressed in Section 3.2.

- The definition for "feasibility" is derived from the feasibility criteria established by the California Coastal Commission (Seawater Desalination and the California Coastal Act, 2004). Is this definition consistent with the use of the tool for other regions outside of California?

- The Panel has the following recommendations on terminology:

    - The title of the project of the study is mentioned as: "Ocean Water Desalination Subsurface Intake Study Guidance." Consider the title: "Seawater Subsurface Intake (SSI) Feasibility Guidance Manual."

    - WBMWD and the project team need to be consistent in using a consistent phrase such as "subsurface seawater intake" and not other variations.

- The Panel suggests that description "Subsurface Seawater Intake (SSI) Feasibility Matrix" may be a better phrase than "Screening Framework" when describing the Matrix.

## 3.2 Weighting Scoring System

These comments pertain to the weighting scoring system used for the SSI Guidance Manual.

- An explanation is needed of the weights that are included in the final version of the Guidance Manual, including a description of the methodology and justification of the individual weights.

- A weighting based on Southern California or California needs may not be as applicable to users in other regions. If it is to be a more general tool, then the basis for weighting needs to be general (e.g., eliminate California Environmental Quality Act [CEQA] definitions).

- Weights should be fixed by the Guidance Manual and should not allow the user to manipulate the numbers. Validating the weights based on a review of existing facilities would be a benefit if they are fixed. However, there could be an option to override the default weights if the user has more specific information. Users of the Guidance Manual may not understand, agree with, or actually disagree with the weights; therefore, the value of the tool may be diminished. WBMWD should consider this as a potential devaluing of the overall exercise and consider either a robust explanation of weights (as described above), or the ability of the user to change the weights after using the tool with "recommended weighting based on professional experience."

- The Panel suggests qualifying the user input by adjusting weights on the basis of the input source. A risk factor would be assigned to the inputs, which in turn would be used to adjust the corresponding weights. For example, if the input is derived from a site-specific measurement or an observation, the input would be considered as high quality, if derived from regional estimates, literature review, and so on. The input would be considered of medium quality, and if the input is based on assumptions, anecdotal evidence, or any unsupported source, then the input would be considered of low quality. Also, uncertainly in the available data contributes to risk/uncertainty.

  The weightings could be adjusted based on the following assessment:

  - High quality input = low risk.
  - Medium quality input = medium risk.
  - Low quality input = high risk.

  The user would need to specify the source of the input, and the tool would perform the background calculation.

It would be useful at the end, when the scores are displayed, to show the level of uncertainty that was factored in the scores of the SSIs. This element could provide guidance into what investigations need to be performed to remove uncertainty.

### 3.3 List of Inputs

These findings and recommendations pertain to the List of Inputs (25 total) provided for the Draft SSI Feasibility Framework.

- Instead of providing a list of parameters, it may be possible to describe these items with a list of questions as questions can provide the context for better understanding the input required and limit misinterpretation. For example:
    - "What is the required capacity of the desalination plant?"
    - "What is the typical significant wave height at the depth of closure?"
    - "What is the top elevation of the beach relative to…?"

- The Panel would like more clarification as to what some of the inputs encompass. For instance, how were the "Number of Units" calculated? Terminology or descriptive details should be provided in the Matrix to assist users when addressing these inputs.

- Regarding "Number of Units":
    - It is recommended that the Number of Units be removed as an input. The Panel feels that the Number of Units should be calculated by the Guidance Manual (based on the input provided) rather than by the user. For example, using the available beach front (user input), the toolbox would calculate the number of conventional vertical wells and production that could be achieved on the basis of an estimate of well productivity (default provided by the toolbox, but adjustable by the user), well spacing (default provided by the toolbox, but adjustable by the user), redundancy (default provided by the toolbox, but adjustable by the user), etc. If the resultant production is less than required to match or exceed the design capacity of the desalination plant, then the technology would be flagged as unfeasible. The toolbox should perform similar calculations and provide guidance for input parameters for all the other SSIs.
    - To evaluate number of units and land take per unit (beach front and area), one would need to know the capacity per each type of unit and land take per unit for each intake option. Using vertical wells as an example, given a required capacity (+/- a safety factor) and well capacity (gallons per minute/well), the number of wells could be calculated and given a well spacing and well pad area, the total land take could be calculated. This information would be needed for each SSI option. There might be a default value and option to enter a site-specific estimated value.

- Guidance for the input on "Land per Unit (Linear Beach Front)" is needed, or this could be calculated (see above bullet).

- For the required input "Significant Wave Height," include additional sub-input like "Wave Period" and "Wave Direction." This information would be used to assess the individual SSIs. However:

    - The initial thought was to input several wave parameters to help assess beach dynamics, but this could be simplified if the user replies to the few questions (see next sub-bullet), which should help in determining the dynamics of the beach.

    - This could be simplified by entering the typical significant wave height and peak wave period at the depth of closure. The depth of closure is the depth beyond which sediment transport or bottom changes are negligible. Because a seabed infiltration gallery or the seaward end of a water tunnel would be constructed in this area, the wave height could make construction a challenge.

- The Panel recommends using turbidity (nephelometric turbidity units [NTU]) rather than silt density index (SDI) as an input.

    - Turbidity will tell you how much silt is in the water and if it will cause plugging of a seabed infiltration system.

    - Use the *Slow Sand Filter Manual* as reference to develop a threshold for turbidity (i.e., 50 NTU is the maximum value available for a slow sand filter).

    - SDI is not a measure of what will cause the fatal flaw because it cannot be related to the operation of the intake, but the surface water reverse osmosis process. As discussed below with reference to Criteria 15, all SSI types are capable of producing low SDI water and there is no one preferred option in this respected. A more important issue is the sensitivity of the intake to turbidity, which would be greatest for gallery type systems.

- The Panel recommends adding the following as inputs (for use with challenges):

    - The beach needs to be characterized; therefore, the Panel suggests questions like:
        - Is the beach artificial?
        - If the beach is artificial, how often is it nourished?
        - What is the beach width at mean higher high water (MHHW)?
        - What is the beach top elevation (relative to some common datum used throughout)?
        - What is the beach slope?
        - What is the depth of closure (depth beyond which there is no significant sediment transport or bottom changes)?

- "Depth to bedrock" (challenge: project proponents will not be drilling into bedrock to put in a structure like a beach gallery).

- "Erosion rate and/or return time for nourishment" (challenge: beach stability is important as it impacts the intake structure most).

  "Erosion rate" (e.g., in feet per year) may be difficult to determine. In any case, using the erosion rate with the beach width an estimate of the "life" of the beach could be computed (e.g., how many years until no beach or nourishment is required).

  This set of questions/answers should allow a determination as to how active or dynamic the beach is and factor that in in the scoring later, without trying to figure this out through wave conditions.

  The "rate of change of beach width over 30 years" should be removed, and replaced by the "erosion rate," which should be determined from measurements or literature. No estimate of "rate of change of beach width over 30 years" can be made from aerial photos alone (i.e., photos may not be available for 30 years, the beach may have been nourished, structures are installed, and the beach width depends on the tide, a photo may be taken at high tide showing a narrow beach and vice versa). While the analysis of photos to determine erosion rates is valid, it requires a level of analysis that is beyond what the typical user of the toolbox could do. Therefore, the Panel suggests the user input estimates made by others and published in the literature or reports by agencies. This refers to Challenge 13 (protection from erosion or scour), too.

- Water levels relative to a common datum (e.g., NAVD88) used throughout should be included. For example:

  - What is the 100-year total water level (TWL)?
  - What is the MHHW?
  - What is the mean lower low water (MLLW)?
  - What is the 100-year TWL by mid-century (to account for the life of the facility [e.g., 30 to 40 years] and sea level rise due to climate change)?

  These water levels should be used to assess the challenge, feasibility, and other aspects of beach-based SSIs. At the same time, the elevation of the land where facilities could be installed should be defined, such as:

  - What is the elevation of the land beyond the beach where components of SSIs could be constructed?

- Requirements for the seven SSI options are needed. That is, the tool can make background calculations based on user inputs and values provided within the tool, like productivity, spacing, required area, and redundancy. Reasonable default values (or a

range of values) are needed to help provide guidance on which well will work and how many wells are needed. There should be an override option in case the user has more specific information available.

### 3.4 Level 1 Fatal Flaws

These findings and recommendations pertain to the Level 1 Fatal Flaws provided as part of the Draft SSI Feasibility Framework.

- There is a large variety of coastal features to consider for Fatal Flaw #1 (land type makes construction of SSI infeasible). For example: Beach, Estuary, Bay, Wetland, Cliff, Bluff, Inlet, Lagoon, Reef, Flood Plain, Dune, Spit, etc. These could combine to define a specific coast type that may or may not be suitable for a particular SSI. For example, a beach could be in a bay and thought to be protected, but if the bay is like Santa Monica Bay, the location on the bay would be important in determining if the SSI would be exposed to large waves. A beach could be backed by a cliff or bluff, or be on a spit, and the beach may be fronted by a reef. All these scenarios would need to be defined if a flaw to a particular SSI is to be determined.

- The Panel feels that reference to CEQA in Fatal Flaw #4 is too California-specific and may be speculative at this stage of the review. The Panel recommends that WBMWD use a more general description (such as "state environmental review" or "regulatory review"). CEQA could then be referenced as an example. In addition, regulatory approval varies by intake type. A type-by-type evaluation of intakes will be needed based on state requirements.

- The Panel recommends including a fatal flaw that relates to sea level and/or elevation of the land. This effort may include defining what land elevation is not acceptable and where. Also, factor in flooding events and sea level rise, such as the 100-year flood and SLR due to climate change by mid-century or hurricane surge analysis for parts of the United States.

- Regarding Fatal Flaw #2 (insufficient beach front available to construct SSI): How is this computed and who computes it? Background calculations per user input and toolbox defaults could be used to compute this to determine if this is a fatal flaw or not.

- Similar for Fatal Flaw #3 (insufficient land available to construct SSI) and the proposed Fatal Flaw related to water level. If the top elevation of the beach is below the 100-year TWL, then beach-based SSIs like vertical well beach structures may not be a good idea.

### 3.5 Level 1 Challenges

These findings and recommendations pertain to the Level 1 Significant Challenges identified as part of the Draft SSI Feasibility Framework. They encompass construction, operation (intake and treatment), potential environmental impacts, and risk (uncertainty) challenges.

- Challenge #5 (limited area for drilling equipment). This challenge only deals with the staging area for drilling, but what about other staging areas for other land use considerations? A beach gallery will take up more space than a well. An offshore gallery may require the construction of a trestle that could impact the beach for months or years.

- Challenge #8 (wave limit for construction). Use two options instead of three. The two options include: less than 3 feet (zero points, feasible) and greater than 3 feet (2 points, unfeasible, too expensive, significant construction downtime). For Beach Infiltration Gallery, note that waves break as a function of depth with a ratio of height at breaking = 0.78 x depth, so the depth at the seaward end of the beach infiltration gallery will control the wave height at that location. Furthermore, a cofferdam may be built to protect/isolate the construction area from the waves (in which case waves would not be relevant).

- Challenge #9 (depth to seabed). The Panel recommends adding the phrase "at planned construction site." Note that greater than 35 feet is not feasible; the Matrix cites 50 feet for slant wells.

- The Panel noticed an inconsistency in the scoring with Challenge #10 (land type). For example, for radial collectors, a rocky coastline is considered a fatal flaw, while it is rated a (1) in Challenge 10. Cliffs are also listed as (2) and a fatal flaw.

- Challenge #12 (protection against sea level rise). Specify 30 years from what date (likely from the initiation of construction, which could reach to 40 years or greater from the time of project initiation). The SLR projection should account for the planning/design period, the construction period, and the lifetime of the facility. Refer to SLR projections by the National Research Council for California, Oregon, and Washington.

- Challenge #13 (protection from erosion or scour). Looking at historical aerial photos is reasonable, but it is also important to consider beach nourishment. Maybe this challenge should be redesigned to consider whether it is a stable or unstable beach. An important criteria would be if the beach needs nourishment (if it does, it is an eroding beach and would score a 2). Conversely, if the beach is receiving too much nourishment, the site will end up stranded. Also, see the discussion in Section 3.3 (List of Inputs) on "Erosion rate and/or return time for nourishment."

- Challenge #14 (clogging). This challenge is unlikely to be useful for screening due to a lack of information. Because more information is needed, it might be moved to Level 2. Alternatively, this challenge could be called "geochemical stability," with SSI rates based on the likelihood of mixing of waters with different chemistries (particularly redox conditions). Gallery types systems would rank (0), whereas vertical wells would receive a (2) and perhaps other types a (1).

- Challenge #15 (fouling). Replace this challenge with source water turbidity sensitivity. As previously noted, all SSI types can potentially provide very low SDI water. Thresholds will be needed for seabed and beach infiltration galleries.

- Challenge #16 (poor feedwater requiring additional permits). How will this challenge be practically applied in the absence of test well data? The SSIs would not differ from one another based on these criteria, and data will be hard to obtain. Can this be removed from the Guidance Manual, or does it belong in Level 2?

- Challenges #17-20. Why are these environmental challenges being considered when the guidance is focused on technical feasibility and not environmental feasibility? Also, these types of inputs need to be "well-type specific" and not generic inputs. However, it was noted that these only flag negative conditions (only scores of 2) and might still be worth considering in the Guidance Manual. In addition, remove references to CEQA.

- Challenge #20 (contaminant plumes). Horizontal wells under the seabed will not be affected by landward contamination. It should be "not applicable."

- Challenges #21 and #22. It was pointed out that precedents as far as capacity and units may not be of great value as SSIs tend to have a modular design and are readily scalable. As a hypothetical example, the largest beach gallery capacity to date is, say, 5 million gallons per day (MGD), which is not really a negative when considering a 10-MGD system, as there is no reason why the former could not have been made larger. Perhaps a more useful criterion is the number of (successful) operational systems with a capacity of 1 or 5 MGD or greater.

- In either the Risk section or Operations section, WBMWD should add challenge criteria "Maintainability." The input would be system-type specific, focusing on whether the user can readily and cost-effectively maintain these systems.

- Add "Practical Ability to Pilot Test" as a challenge in the Risk Section to consider economics. For example, it is relatively inexpensive to pilot test a vertical well (Score = 0), versus an off-shore gallery, water tunnel, or radial collector system (Score = 2), which can be impractical (i.e., too expensive) to pilot test. Other SSI types would be intermediate.

### 3.6 Scoring Matrix

These findings and recommendations pertain to the tables provided in "Scoring Matrix," which covered "SSI Significant Challenge Raw Score Calculation Matrix" and "Summary of Max Scores for Each SSI."

- The Panel would like to note that higher scores, traditionally, represent the better option. Perhaps WBMWD should consider reversing the scoring system so that zero is "highly challenging" and 2 is "not challenging/slightly challenging."

- A single weight should be provided for each Challenge in the Scoring Matrix. Currently, weights are listed for each SSI. That is, Challenge "Area available for drilling" should be

weighted "1" for each SSI. This change would simplify the table/spreadsheet. After the "Challenge" column, add another column on "weight" and then include scores.

- Is the "Summary of Max Scores for Each SSI" showing the weighted scores? It needs to be clear.

- Thresholds can be dealt with qualitatively. However, there is a need to include an interpretation of the normalized score.

- In the flow chart, the purple box with "Refine Site Characteristics" should automatically move to "Apply Feasibility Matrix Challenges." See the modified flow chart in Appendix E for the Panel's edits.

### 3.7 Level 2 and 3 Matrix

These findings and recommendations pertain to the tables provided under "Level 2 and 3 Analyses," which covered fatal flaws and challenges.

- If a SSI has a fatal flaw, then it would logically no longer be considered. Hence, there is no need for additional Level 2 and 3 testing.

- The Panel notes that the Guidance focuses only on technical feasibility. Before the Level 2 and 3 analyses, the Guidance Manual should point users towards evaluating for environmental and economic challenges to assess whether the options should be further considered. It is strongly suggested that it be recommended that an initial economic and regulatory analysis be performed before proceeding to field testing (i.e., if it is clear that an option would be too expensive or could never be permitted, than it makes no sense to do any testing).

- The Panel would like a better description of the value added by Level 2 and 3.

- The Panel recommends separating the Level 2 and Level 3 information into different tables in the Matrix, including separating them in the flow chart (see Appendix E). Once they are separated, be more specific and individualize the information provided.

- Level 3 would include constructing and operating a pilot test well as a challenge.

### 3.8 Public Comments

The following comments were provided by members of the public who attended the Panel meeting. The Panel has addressed each comment below.

- Warren Teitz of Metropolitan Water District of Southern California congratulated WBMWD for taking a leadership role in developing a new water supply for the State of California. WBMWD took a leadership role with recycling, and now they are doing so

with desalination. The work that this Panel is doing is very important and will help agencies in California wrestle with the issue of subsurface intakes.

*Panel Response: Noted.*

- Dana Murray of Heal The Bay works with marine and coastal environmental issues in California. She provided the following questions for consideration:

    - Will this guidance be undertaken for open ocean intakes as well? Can you integrate open ocean intakes into the SSI Guidance Manual effort to determine the best options for different sites?
    - How will you allow for adjustments when looking at the challenges? What feedback and/or input will you consider?
    - Will you look at the impact on coastal and marine spatial planning in California?
    - Who will undertake quality assurance/quality control to verify the accuracy of inputs?

  *Panel Response: These questions should be addressed by WBMWD as they are not a part of the Panel review of the proposed framework of the SSI Guidance Manual.*

- Richard Bell of the Municipal Water District of Orange County (MWDOC) thanked WBMWD for the leadership and great work they have been doing for years. This is a neat process and great tool. He noted that MWDOC constructed a slant well several years ago, and wanted to ask if mitigation or design protective measures were considered as part of the SSI Guidance Manual. For example, putting in a well head on a beach may involve dealing with liquefaction, so protective measures may be needed against earthquakes. Another issue that can come up long after a project is built is the listing of endangered species in your site area. He asked how we can work with Fish and Game to mitigate these issues. He also noted issues pertaining to the draw of water and water rights, and cautioned to not just look at required capacity but rather what the resource can produce.

  *Panel Response: Mr. Bell is encouraged to submit written comments with additional detail.*

- Jeff Barry of GSI Water Solutions has been involved in large projects like this, including evaluating feasibility. He suggested that WBMWD consider creating "off ramps" for people going through the feasibility process (that is, places to go where you can identify fatal flaws early). He suggested setting up the process in tiers, which can help users eliminate options earlier in the process.

  *Panel Response: Noted.*

- John Loveland of Poseidon congratulated WBMWD for undertaking this process. He noted that Poseidon has been engaged in a similar collaborative process with the California Coastal Commission and has vetted most of the issues spoken about today.

They have worked on their own process for 18 months and have published a feasibility study. He also noted that members of the Panel and technical project team have been drawn from Poseidon's own expert panel. Keep this transparent, he stated, because WBMWD may receive a lot of questions on their process, as Poseidon did. In response, Jeff Mosher of NWRI acknowledged that Poseidon's effort had a specific project site, but that WBMWD's effort is more of a general project to develop a screening tool that has wide use throughout the United States. Mosher also acknowledged that some of the same experts were drawn from Poseidon's project and are using their knowledge to inform WBMWD's project.

*Panel Response: Noted.*

- Tom Seacord of Carollo Engineers noted that the State Water Resources Control Board is finalizing amendments to the California Ocean Plan. He wondered if the manual would be flexible enough to insert future inputs based on new information from the State Board's amendment plan. Diane Gatza of WBMWD responded that they are following the State Board process closely and if new criteria come out before the Guidance Manual is finalized, then it can be included in this effort. Seacord then asked if there is a way to include additional inputs or fatal flaws once the Guidance Manual is finalized. Gatza replied that it is a great comment that requires further consideration.

  *Panel Response: Noted.*

- Tom Luster of the California Coastal Commission submitted the following comments:

  Thank you for the opportunity to comment on the draft documents you provided earlier this week. You received comments earlier today from myself, Poseidon, and Concur, Inc. regarding our concerns about how your Panel process may affect our separate Independent Science and Technical Advisory Panel process for the Poseidon Huntington Beach proposal. I'm providing just a few brief initial comments below on the substance of the draft documents, based on my preliminary review, but would appreciate the opportunity to provide more detailed review and comments later.

  Overall, the proposed tools don't appear to recognize or incorporate the main regulatory reasons for finding suitable designs and locations for subsurface intakes (i.e., both the State Water Code and the Coastal Act require that entrainment be minimized to the extent feasible). In fact, the tools overall emphasize the difficulties, rather than the need for, and benefits of, subsurface intakes. We recommend the tools identify these regulatory requirements and that the tools emphasize the importance of identifying site characteristics best suited for subsurface sites rather than focus solely on the challenges.

  Even with that change, however, the tools will likely have limited usefulness in regulatory review. While some of the proposed components may provide a useful framework for evaluating sites and designs (e.g., the "Required Inputs"), the proposed tools overall do not adequately recognize the site-specific nature of the regulatory review required for desalination facilities and their intakes. The proposed "Fatal Flaws,"

"Challenge Ranking," "Scoring Ranking," and other screening criteria are overall not consistent with regulatory review and, in some cases, are arbitrary or incorrect (see examples below).

***Re: "Required Capacity"*** – The Screening Flowchart uses the phrase "required capacity" and includes it with the "fatal flaw" criteria. We recommend the phrase be changed to "proposed capacity" and that "proposed capacity" be recognized as a contributing factor to project design and regulatory review, but not as a component of "fatal flaw" criteria. We also recommend the tools recognize that a project's "proposed capacity" may be a result of site-specific conditions rather than something used to "screen out" a particular site.

***Re: Preliminary Overview and User's Guide: SSI Feasibility Guidance Manual*** – As noted above, several of the proposed criteria are not consistent with those used in regulatory review. For example, this document's "Potential Feasibility" section describes four criteria that would be used to "trigger an infeasibility ranking." However, at least one of the "fatal flaws" (i.e., CEQA approvability) is incorrect or misstated, as a preliminary screening tool cannot be used to determine whether a subsurface intake can be "approved" or not through CEQA. Other components of the proposed "fatal flaws" are incorrect or appear arbitrary (e.g., >80 percent of beachfront, presence of cliffs, etc.). These types of characteristics are evaluated on a site-by-site basis and the screening tool errs in automatically rejecting certain designs or sites without considering the detailed location-specific information needed to evaluate various sites and designs.

In closing, and as noted above, I would appreciate the opportunity to provide a more detailed review and additional comments later in your process.

*Panel Response: The Panel agrees that qualifying the use of the tool when it is used by a project proponent in their planning process would be a benefit for users and those reviewing the results. A significant amount of work will be put into completing Level 1 of the tool to understand the location and production capability of each SSI. As a result, it would be beneficial for the results to be useful for regulatory agencies. However, the tool results should be considered in the context that the tool is an initial screening/guidance tool. One suggestion is that project proponents should review the Level 1 results with regulatory agencies to get comments prior to eliminating any SSIs from considerations and before embarking on to Level 2.*

*The Panel recognizes the benefits of SSIs and it is assumed that a tool user would also understand the benefits. As a result, the tool would not need to highlight these benefits versus a conventional open ocean intake.*

*Some of these concerns can be addressed in the description/narrative for the tool.*

*The Panel agrees that the use of CEQA be removed from the Matrix as described in the Panel's responses. In addition, the Panel made specific comments on components of the*

*Matrix, including "Fatal Flaws," "Challenge Ranking," and "Scoring Ranking," so that the tool reflects current experience and can provide reasonable results.*

- Mark Williams, Ph.D., P.E., of GEOSCIENCE Support Services, Inc., submitted the following comments:

  FATAL FLAWS:

  1. The inputs and fatal flaws are too simplistic and cannot be generally applied to all SSI and all sites. For example, to reject a site because it lies on a cliff is not sufficient as the site may be engineered to be acceptable (e.g., Marina Coast). Many of the proposed fatal flaw determinations listed cannot be practically evaluated to any reliable extent at this early stage and may be more appropriately evaluated during later (Level 2 or 3) evaluations.

  *Panel Response*: *The tool is intended as an initial screening tool. In addition, the site-specific nature of each alternative would need to be reflected in the use of the tool. As such, the Panel agrees that potential engineering solutions to allow for specific SSIs to be viable should be a part of the process. In addition, if the tool is made too complex by covering many details it could become problematic to implement.*

  2. There is no theoretical upper limit of the yield and sustainability of slant wells or some of the other SSI types used as a source of feed water supply to ocean desalination plants. Research and field testing over the past 9 years suggest that slant wells extracting water from subsea alluvial aquifers can provide a high yielding and long-lasting sustainable water supply when designed, constructed, and maintained properly. Furthermore, the total yield is a function of scale, and the reliability is guaranteed by the ocean source.

  *Panel Response*: *WBMWD and the Project Team should consider this comment.*

  SIGNIFICANT CHALLENGES: CONSTRUCTION

  1. Many of the Significant Challenges for Construction are not relevant at all or are not relevant at this preliminary screening stage. For example, in Monterey and Dana Point projects, drilling footprints were all well under 10,000 square feet with staging nearby the site. Access and construction were all challenging, but certainly did not prevent successful construction of the two projects. This will be the case, to some extent, for most coastal sites.

  *Panel Response: The tool is intended to evaluate the feasibly of SSI options for the proposed full-scale project.*

  2. It does not make sense to have such general statements in this section. It appears that the authors have selected a handful of topics and tried to apply to all SSI types and all site conditions. Potential subsurface intakes are quite site-specific and subject to a number of factors. These projects usually have high visibility with a good deal of public attention.

As such, siting considerations need to consider a number of factors other than just feed water production and proximity to the desalination plant. For example, along the coast of California, these factors include the normal permitting land acquisition and access factors, but are also dependent upon a number of environmental and operational factors, which if not complied with, could prohibit the project altogether. For example, many of these projects are tied to a maximum percentage of feed water derived from inland water supplies, which if not met, may require expensive mitigation or provision of supplemental supplies, all of which add to the cost of supplied desalination product water.

*Panel Response*: *WBMWD and the Project Team should consider this comment.*

3. Ranney-type collector wells have lateral lengths typically limited to approximately 46 meters or less. They also may draw a high percentage of recharge from inland supplies and require construction of a large diameter caisson, which is visually offensive in a beach environment. Horizontal directionally drilled wells could potentially be used for subsurface supply; however, the main disadvantage is the inability to place an engineered artificial filter pack around the well screen, which may result in clogging and limited well production in fine-grained alluvial formations.

*Panel Response: WBMWD and the Project Team should consider this comment.*

SIGNIFICANT CHALLENGES: OPERATIONAL

1. You cannot just select a range of aquifer parameters as a criteria for discrediting a subsurface intake. Groundwater modeling of site-specific areas and for site-specific feedwater supplies needs to be part of the selection. To say that the transmissivity has to be a certain value is pointless unless you consider other factors, specifically benthic zone leakance values.

*Panel Response*: *WBMWD and the Project Team should consider this comment.*

2. To maintain feed water production, planned rehabilitation should be performed with all subsurface intake types based on efficiency and yield decline. All wells (vertical and angled) need redevelopment from time to time to maintain performance. This periodic redevelopment typically consists of mechanical and/or chemical redevelopment using the same “tried and true” methods developed in the water well industry for vertical wells over the past 70 years. As access to the wellhead area is required, provision must be made during siting to minimize disturbance during routine maintenance.

*Panel Response: WBMWD and the Project Team should consider this comment.*

3. As a general rule, with all wells, when well efficiencies decline to 50 percent of the maximum value (at the design production rate), it is a good idea to take the well out of service and perform a video inspection and rehabilitation plan. Based on limited data from the Dana Point Test Slant Well, it is expected that in wells properly designed,

developed, and consisting of corrosion resistant steels, the frequency between well rehabilitation would be on the order of 3 to 5 years. However, depending on other constituents in the groundwater (e.g., iron and manganese), rehabilitation frequency may vary.

*Panel Response*: *WBMWD and the Project Team should consider this comment.*

## APPENDIX A: PANEL BACKGROUND

### About NWRI

For over 20 years, NWRI – a science-based 501c3 nonprofit located in Fountain Valley, California – has sponsored projects and programs to improve water quality, protect public health and the environment, and create safe, new sources of water. NWRI specializes in working with researchers across the country, such as laboratories at universities and water agencies, and are guided by a Research Advisory Board (representing national expertise in water, wastewater, and water reuse) and a six-member Board of Directors (representing water and wastewater agencies in Southern California).

Through NWRI's research program, NWRI supports multi-disciplinary research projects with partners and collaborators that pertain to treatment and monitoring, water quality assessment, knowledge management, and exploratory research. Altogether, NWRI's research program has produced over 300 publications and conference presentations.

NWRI also promotes better science and technology through extensive outreach and educational activities, which includes facilitating workshops and conferences and publishing White Papers, guidance manuals, and other informational material.

More information on NWRI can be found online at www.nwri-usa.org.

### About NWRI Panels

NWRI also specializes in facilitating Independent Advisory Panels on behalf of water and wastewater utilities, as well as local, county, and state government agencies, to provide credible, objective review of scientific studies and projects in the water industry. NWRI Panels consist of academics, industry professionals, government representatives, and independent consultants who are experts in their fields.

The NWRI Panel process provides numerous benefits, including:

- Third-party review and evaluation.
- Scientific and technical advice by leading experts.
- Assistance with challenging scientific questions and regulatory requirements.
- Validation of proposed project objectives.
- Increased credibility with stakeholders and the public.
- Support of sound public-policy decisions.

NWRI has extensive experience in developing, coordinating, facilitating, and managing expert Panels. Efforts include:

- Selecting individuals with the appropriate expertise, background, credibility, and level of commitment to serve as Panel members.

- Facilitating hands-on Panel meetings held at the project's site or location.
- Providing written report(s) prepared by the Panel that focus on findings and recommendations of various technical, scientific, and public health aspects of the project or study.

Over the past 5 years, NWRI has coordinated the efforts of over 20 Panels for water and wastewater utilities, city and state agencies, and consulting firms. Many of these Panels have dealt with projects or policies involving groundwater replenishment and potable (indirect and direct) reuse. Specifically, these Panels have provided peer review of a wide range of scientific and technical areas related water quality and monitoring, constituents of emerging concern, treatment technologies and operations, public health, hydrogeology, water reuse criteria and regulatory requirements, and outreach, among others.

Examples of recent NWRI Panels include:

- **Development of Water Recycling Criteria for Indirect Potable Reuse through Surface Water Augmentation and the Feasibility of Developing Criteria for Direct Potable Reuse** for the State Water Resources control Board Division of Drinking Water (CA)
- **Evaluating Water Quality Testing at the Silicon Valley Advanced Water Purification Center for Future Potable Reuse Applications** for the Santa Clara Valley Water District (CA)
- **Developing Proposed Direct Potable Reuse Operational Procedures and Guidelines for New Mexico** for the New Mexico Environment Department (NM)
- **Monterey Peninsula Groundwater Replenishment Project** for the Monterey Regional Water Pollution Control Agency (CA)
- **Groundwater Recharge Scientific Study** for the LOTT Clean Water Alliance (WA)
- **Groundwater Replenishment System Program Review** for the Orange County Water District (CA)
- **Examining the Criteria for Direct Potable Reuse** for Trussell Technologies (CA) and WateReuse Research Foundation (VA)
- **Evaluating Potable Reuse** for the Santa Clara Valley Water District (CA)
- **Indirect Potable Reuse/Reservoir Augmentation Project Review** for the City of San Diego (CA)
- **BDOC as a Surrogate for Organics Removal in Groundwater Recharge** for the California Department of Public Health (CA)
- **Recycled Water Master Plan** for Tucson Water (AZ)
- **Groundwater Replenishment Project Review** for the Los Angeles Department of Water and Power (CA)

More information about the NWRI Independent Advisory Panel Program can be found on the NWRI website at http://nwri-usa.org/Panels.htm.

## APPENDIX B: PANEL BIOGRAPHIES

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**PANEL CHAIR: Thomas Missimer, Ph.D., P.G.**
*President, Missimer Hydrological Services, Inc., and*
*Visiting Professor, Florida Gulf Coast University (Fort Myers, FL)*

Thomas Missimer has 40 years of experience in the field of hydrogeology and is a recognized expert in artificial recharge and aquifer storage and recovery. He has managed more than 250 technical projects and is the author of eight books, 80 peer-reviewed articles, and 300 technical consulting reports. He currently serves as Executive Editor of *Groundwater*, a technical journal for groundwater hydrogeologists. Missimer co-founded the consulting firm Missimer & Associates, Inc., and helped grow the company's revenues to exceed $25 million per year. Before that, he was Vice President and national practice leader in artificial recharge/aquifer storage and recovery technology for CDM Missimer. He currently holds a courtesy faculty appointment at Florida Gulf Coast University. Missimer's education includes degrees in Geology from Franklin and Marshall College (BA), Florida State University (MS), and University of Miami (PhD). He is a registered Professional Geologist in the states of Florida, Georgia, and Virginia, and holds certifications from the American Institute of Professional Geologists and the National Groundwater Association.

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**Claudio Fassardi**
*Senior Principal Engineer*
*CH2M HILL (Long Beach, CA)*

Claudio Fassardi has nearly 30 years of experience in the management and execution of coastal engineering projects. He specializes in planning, field work, analysis and design to support the development of waterfront facilities, analysis of coastal processes, and climate change impact assessment and adaptation. Additionally, Fassardi has expertise in analyzing and developing solutions to natural and anthropogenic impacts to the coastal environment. As the coastal engineering lead, Fassardi was part of a multidisciplinary team that performed a site characterization and feasibility assessment for the planned West Basin Municipal Water District (WBMWD) Desalination Plant in Santa Monica Bay. Fassardi was responsible for evaluating marine conditions and site characterization, and he assisted with evaluating existing intake/discharge infrastructure, reviewing the existing intake and discharge technologies, and selecting the preferred alternatives. He managed a multidisciplinary team of geotechnical and civil engineers, assisted in the development of the intake and discharge conceptual designs, and performed preliminary analysis of brine dispersion.

**Heidi Luckenbach, P.E.**
*Deputy Director/Engineering Manager*
*City of Santa Cruz Water Department*

Heidi Luckenbach is a civil engineer with more than 20 years of experience in water supply planning, drinking water treatment, and distribution. She has worked for the City of Santa Cruz Water Department for 17 years. As Deputy Director, she is responsible for managing engineering services for maintenance, operation, and improvement of the water utility, including long-range water supply planning. Luckenbach previously served as Desalination Program Coordinator for seven years, during which she developed and implemented the work plan for the ***scwd$^2$ Regional Seawater Desalination Project***. Program elements included a seawater desalination pilot study, evaluation of intake alternatives, analysis of brine dilution, comparison of water supply alternatives, and engagement with regulatory agencies. The 2.5-million gallon per day supplemental water supply would serve several communities in North Santa Cruz County. Luckenbach received her BS in Civil Engineering from California State University, Northridge, and an MS in Environmental Engineering from University of California, Los Angeles. She is a Registered Civil Engineer in California, serves as Vice Chair of the Desalination Committee for the California Nevada Section of American Water Works Association (AWWA), and was recently a board member for the American Membrane Technology Association (AMTA).

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**Robert Maliva, Ph.D., P.G.**
*Principal Hydrogeologist*
*Schlumberger Water Services (Fort Myers, FL)*

Robert Maliva has more than 24 years of international research and consulting experience in groundwater resources management, subsurface geology, and fluid flow investigations. Prior to joining Schlumberger Water Services, Maliva was a Principal and Senior Hydrogeologist at CDM, and he held research positions at Harvard University, University of Cambridge, and University of Miami. He specializes in the development of alternative water supplies for municipal and industrial clients and has varied expertise in hydrogeology, including: design and permitting of injection wells; aquifer storage and recovery; managed aquifer recharge systems; stratigraphy and sedimentology; and aqueous geochemical modeling. Maliva has authored or co-authored more than 70 peer-reviewed journal articles and book chapters, and he is the senior author on two books on water management. His education includes degrees in Geology from The State University of New York at Binghamton (BS), Indiana University at Bloomington (MS), and Harvard University (Ph.D.). He is a registered Professional Geologist in the states of Florida and Texas.

**APPENDIX C: MEETING #1 AGENDAS**

# NATIONAL WATER RESEARCH INSTITUTE

## Independent Advisory Panel:

## West Basin Municipal Water District's Ocean Water Desalination Subsurface Intake Study – Guidance Manual Review

**(Bureau of Reclamation Project No. R14AP00173)**

## PUBLIC MEETING – Final Agenda

**Thursday, February 26, 2015**

**Location**
Edward C. Little Water Recycling Facility
1935 S. Hughes Way
El Segundo, CA
(310) 414-0183

**Contacts:**
**Jeff Mosher (Cell)**
714-705-3722
**Brandi Caskey (NWRI Office)**
(714) 378-3278

**Meeting Objectives:**

- Clarify the Panel's charge and Panel review process.
- Describe the goal and objectives of the Ocean Water Desalination Subsurface Intake Study Guidance Manual.
- Receive public input on this effort and clarify how to provide public comments.

**Thursday, February 26, 2015**

| | | |
|---|---|---|
| 9:00 am | Agenda Item #1: Welcome and Introductions<br>• Introductions<br>• Review Agenda<br>• Provide Panel Framework<br>o Charge and Review Process | Jeff Mosher, NWRI<br>Thomas Missimer, Panel Chair |
| 9:30 am | Agenda Item #2: Welcome by West Basin's General Manager | Rich Nagel, West Basin |
| 9:45 am | Agenda Item #3: Introduction to West Basin's Desalination Program | Shivaji Deshmukh and Diane Gatza, West Basin |
| 10:15 am | Agenda Item #4: Introduction to Subsurface Intake Study | Diane Gatza, West Basin |

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|---|---|---|
| 10:30 am | Agenda Item #5: Introduction of the Feasibility Matrix | Gordon Thrupp, Geosyntec Consultants |
| 11:00 am | Agenda Item #6 Public Comment Period | Facilitated by Jeff Mosher, NWRI |
| 12:00 pm | Agenda Item #7: Panel Comment Period | Facilitated by Jeff Mosher, NWRI |
| 12:15 pm | Agenda Item #8: Closing Remarks<br>• How to Provide Comments<br>• Next Steps in Panel Review Process | Jeff Mosher, NWRI |
| 12:30 pm | **ADJOURN** | |
| 12:30 pm – 1:30 pm | Guided Tour of Edward C. Little Water Recycling Facility | Open to Interested Parties |
| 12:30 pm – 4:00 pm | Panel Deliberations | Panel Members |

# NATIONAL WATER RESEARCH INSTITUTE

## Independent Advisory Panel:

## West Basin Municipal Water District's Ocean Water Desalination Subsurface Intake Study – Guidance Manual Review

**(Bureau of Reclamation Project No. R14AP00173)**

## PANEL MEETING #1 – Final Agenda

**Thursday, February 26, 2015**

| **Location** | **Contacts:** |
|---|---|
| Edward C. Little Water Recycling Facility | **Jeff Mosher (Cell)** |
| 1935 S. Hughes Way | 714-705-3722 |
| El Segundo, CA | **Brandi Caskey (NWRI Office)** |
| (310) 414-0183 | (714) 378-3278 |

**Meeting Objectives:**

- Provide finding and recommendations on efforts to-date to develop the Ocean Water Desalination Subsurface Intake Study Guidance Manual.
- Provide recommendations on future work and activities.

**Thursday, February 26, 2015**

| | | |
|---|---|---|
| 12:30 pm | **WORKING LUNCH** | Panel Members, West Basin, Geosyntec, and Regulators |
| 1:30 pm | CLOSED SESSION:<br>• Panel Discussion<br>• Develop Framework for Panel Report<br>• Assignments | Panel |
| 2:30 pm | **BREAK** | |
| 2:45 pm | Continue with Closed Session | Panel |
| 4:00 pm | **ADJOURN** | |

## APPENDIX D: MEETING #1 ATTENDEES

**Panel Members:**

- Chair: Thomas M. Missimer, Ph.D., Florida Gulf Coast University (Fort Myers, FL) (on Skype)
- Claudio Fassardi, CH2M HILL (Long Beach, CA)
- Heidi R. Luckenbach, P.E., City of Santa Cruz Water Department (Santa Cruz, CA)
- Robert G. Maliva, Ph.D, P.G., Schlumberger Water Services (Fort Myers, FL)

**National Water Research Institute:**

- Jeff Mosher, Executive Director
- Gina Vartanian, Communications Manager

**West Basin Municipal Water District:**

- Shivaji Deshmukh, Assistant General Manager
- Diane Gatza
- Richard Nagel, General Manager
- Oliver Perez, Information Technology Officer
- Justin Pickard
- Ron Wildermuth, Communications Manager

**Geosyntec Consultants:**

- Rebecca Batchelder
- Julie Chamber
- Mark Hanna
- Gordon Thrupp, Ph.D., P.G., CH.G.

**Others:**

- Jeff Barry, GSI Water Solutions
- Richard Bell, Municipal Water District of Orange County
- Bryan Bundy, Calleguas Municipal Water District
- Jeremy Crutchfield, San Diego County Water Authority
- Gerry Filteau, SPI Engineering
- Kris Helm, KH Consulting
- John Loveland, Poseidon
- Doug McPherson, United States Bureau of Reclamation
- Dana Murray, Heal the Bay
- Tom Seacord, P.E., Carollo Engineers
- Frances Spivy-Weber, California State Water Resources Control Board
- Linda Sumansky, P.E., City of Santa Barbara
- Warren Teitz, Metropolitan Water District of Southern California
- Kevin Thomas, RBF Consulting and Michael Baker International
- Mark Williams, GEOSCIENCE

## APPENDIX E: MODIFIED FLOW CHART