Development of Public Communication Toolkit for Desalination Projects

About the WateReuse Research Foundation

The mission of the WateReuse Research Foundation is to conduct and promote applied research on the reclamation, recycling, reuse, and desalination of water. The Foundation's research advances the science of water reuse and supports communities across the United States and abroad in their efforts to create new sources of high quality water for various uses through reclamation, recycling, reuse, and desalination while protecting public health and the environment.

The Foundation sponsors research on all aspects of water reuse, including emerging chemical contaminants, microbiological agents, treatment technologies, reduction of energy requirements, concentrate management and desalination, public perception and acceptance, economics, and marketing. The Foundation's research informs the public of the safety of reclaimed water and provides water professionals with the tools and knowledge to meet their commitment of providing a reliable, safe product for its intended use.

The Foundation's funding partners include the supporters of the California Direct Potable Reuse Initiative, Water Services Association of Australia, Pentair Foundation, and Bureau of Reclamation. Funding is also provided by the Foundation's subscribers, water and wastewater agencies, and other interested organizations.

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Acronyms

AF	acre-foot
AFY	acre-feet per year
BTU	British Thermal Unit
CII	commercial, industrial, institutional
CO_2e	carbon dioxide equivalent
DPR	direct potable reuse
ED	electrodialysis
EDR	electrodialysis reversal
EIS	Environmental Impact Statement
GHG	greenhouse gas
gpd	gallons per day
kW	kilowatt
kWh	kilowatt hour
MED	multiple effect distillation
MF	microfiltration
MGD	million gallons per day
mg/L	milligrams per liter
MSF	multistage flash
MW	megawatt
NF	nanofiltration
NPDES	National Pollutant Discharge Elimination System
OTEC	Ocean Thermal Energy Conversion
ppb	parts per billion
ppm	parts per million
RO	reverse osmosis
SWDA	Safe Water Drinking Act
SWRO	seawater reverse osmosis
TBL	triple bottom line
TDS	total dissolved solids
UF	ultrafiltration
µg/L	micrograms per liter
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VTE	vertical tube evaporator
WTP	willingness to pay
WWTF	wastewater treatment facility

Foreword

The WateReuse Research Foundation, a nonprofit corporation, sponsors research that advances the science of water reclamation, recycling, reuse, and desalination. The Foundation funds projects that meet the water reuse and desalination research needs of water and wastewater agencies and the public. The goal of the Foundation's research is to ensure that water reuse and desalination projects provide sustainable sources of high-quality water, protect public health, and improve the environment.

An Operating Plan guides the Foundation's research program. Under the plan, a research agenda of high-priority topics is maintained. The agenda is developed in cooperation with the water reuse and desalination communities including water professionals, academics, and Foundation subscribers. The Foundation's research focuses on a broad range of water reuse research topics including:

- Defining and addressing emerging contaminants, including chemicals and pathogens
- Determining effective and efficient treatment technologies to create "fit for purpose" water
- Understanding public perceptions and increasing acceptance of water reuse
- Enhancing management practices related to direct and indirect potable reuse
- Managing concentrate and desalination
- Demonstrating the feasibility and safety of direct potable reuse

The Operating Plan outlines the role of the Foundation's Research Advisory Committee (RAC), Project Advisory Committees (PACs), and Foundation staff. The RAC sets priorities, recommends projects for funding, and provides advice and recommendations on the Foundation's research agenda and other related efforts. PACs are convened for each project to provide technical review and oversight. The Foundation's RAC and PACs consist of experts in their fields and provide the Foundation with an independent review, which ensures the credibility of the Foundation's research results. The Foundation's Project Managers facilitate the efforts of the RAC and PACs and provide overall management of projects.

Robust public outreach programs must be utilized to build trust within communities, elicit stakeholder input, and contribute to public understanding and support for projects in order to help water providers bring desalination projects to reality. "Development of Public Communication Toolkit for Desalination Projects" provides a versatile toolkit that water districts and agencies can use as a roadmap to fashion their own public outreach efforts and provides a template to craft outreach materials that address specific conditions they face in their own jurisdictions. The communication toolkit includes a variety of documents and materials that will assist in shaping effective public outreach programs.

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Executive Summary

As many communities consider desalination as a sustainable water source to bolster their water portfolios, they can face significant hurdles when it comes to public acceptance. Any new water project—whether it's a dam, reservoir, or recycled water project—will face questions about the need for and purpose of the project. Desalination is no different. In order to help water providers bring these projects to reality, robust public outreach programs must be used to build trust within communities, elicit stakeholder input, and contribute to public understanding and support for projects.

"Development of Public Communication Toolkit for Desalination Projects" (WRRF-12-02), was developed to provide a versatile toolkit that water districts and agencies can use as a roadmap to fashion their own public outreach efforts with a template to craft outreach materials that address specific conditions they face in their own jurisdictions. The communication toolkit includes a variety of documents and materials that will assist in shaping unique and effective public outreach programs. Materials that are included draw from the experience of water purveyors who have proposed desalination projects in California, Texas, Florida, Australia, and Spain and provide useful real-life experience about what has worked and what hasn't. Both "hands-on" and "virtual" materials are provided. There is a sample fact sheet, FAQs, a how-to guide for creating a backgrounder, and a glossary of terms. A guide to developing a strategic outreach and awareness plan summarizes the necessary steps in creating a successful communication effort. There is a sample video that discusses the key issues facing many desalination projects, such as energy usage, impacts to marine life, and where desalination is being used successfully today.

All of the materials are intended to provide a starting point for creating a public outreach program. A video library and link library were developed to provide a starting point for agency personnel by providing an easy-to-use guide to what others have experienced as their desalination project moved from concept, to design, construction, and operation. The intent was to shorten the learning curve and provide agency personnel the benefit of others' experience as they develop a public outreach plan for their project.

One of the fundamental findings from our one-on-one in-depth interviews with water purveyors who have proposed desalination projects is that every desalination project is unique; there is no cookie-cutter approach to the design and implementation of a project, and neither is there a single, specific approach to developing a communication plan. The water supply situation, political climate, and regulatory environment of each location is unique and requires a carefully tailored approach to communication and public outreach. Another key finding is that communication must be consistent and ongoing throughout a project and it must include all stakeholders. Critics, supporters, elected officials, and members of the public must all be kept informed during all phases of the planning, review, and construction processes. Transparency is a key to all outreach and awareness efforts; transparency builds trust, and that is essential in building support for a desalination project. The Public Communication Toolkit for Desalination provides a useful set of instruments that can help guide projects through the maze of political, regulatory, and public acceptance challenges that often accompany desalination projects**.**

Chapter 1

Development of Public Communication Toolkit for Desalination Projects

1.1 Introduction

As many communities consider desalination as a sustainable water source that can bolster their water portfolios, public and private agencies proposing desalination projects face questions about energy usage, brine disposal, and impacts to marine life. Any new water project—whether it's a dam, reservoir, or recycled water project—can face significant hurdles when it comes to public acceptance. Desalination is no different. In order to help water providers bring these projects to reality, robust public outreach programs must be used to build trust within communities, elicit stakeholder input, and contribute to public understanding and support for projects.

This project, "Development of Public Communication Toolkit for Desalination Projects" (WRRF-12-02), provides a versatile toolkit that water districts and agencies can use as a roadmap to fashion their own public outreach efforts and provides a template to craft outreach materials that address specific conditions they face in their own jurisdictions. Desalination entails complex technical and engineering procedures, and it is important that utilities proposing a desalination project be able to translate the process into clear and plain language that allows stakeholders to understand the process and put it into the context of their own community's water challenges.

The communication toolkit includes a variety of documents and materials that will assist in shaping effective public outreach programs. Materials that are included draw from the experience of water purveyors that have proposed desalination projects in California, Texas, Florida, Australia, and Spain and provide useful real-life experience about what has worked and what hasn't. One-on-one interviews provided insight into their experiences and provided guidance about the kinds of materials and messages that future projects might utilize.

1.2 How to Use the Toolkit

The materials in the Communication Toolkit are both "hands-on" and "virtual." There is a menu of items that includes downloadable materials and a database of resources to assist project supporters in their research into what strategies have proved to be effective. The toolkit can be used in the following ways:

- **Combined Research Executive Summary:** An executive summary of the project research from one-on-one interviews and secondary research provides project proponents with a summary of first-hand experiences and a guide to the literature available on key topics.
- **Strategic Outreach and Awareness Plan:** The Strategic Outreach and Awareness Plan serves as the framework for all the communication efforts that take place in support of a desalination project. The outreach plan will provide an agency considering desalination with a methodical guide to talk with all stakeholders involved in the process—members

of the public, elected officials, environmental groups, and regulators—and provide them with the historical context and information about why the project is being proposed that will allow them to make informed and educated decisions about desalination.

- **A variety of collateral materials**: A collection of sample fact sheets, FAQs, glossary, and other materials that can be used as templates for projects or as planning and development tools for public communication pieces tailored to specific projects.
- **How to Convey Critical Messages for a Desal Project:** This consists of a PowerPoint presentation and an accompanying paper for presentation in a workshop setting at a conference or scheduled meeting. It provides key messages that will contribute to the production of a variety of materials and prepare a desalination project spokesperson with message tracks that can be used in materials, interviews, and presentations. It outlines the important issues that other projects have faced during the planning, permitting, and approval processes for desalination projects and also includes a list of questions that could be asked by the public, with particular emphasis on the most challenging areas of discussion.
- **Link Library to helpful research documents**: This database provides access to a variety of research that has previously been conducted, as well as lists of groups and organizations that have been active in supporting and opposing projects. This library can be useful for an agency considering desalination by shortening the learning curve in developing effective public outreach strategies.
- **Video Library:** A library of videos and useful video footage that can be used by agencies as part of their video production. Short, informational videos have proven effective in raising public awareness of water supply issues and interfacing with new media.

We have endeavored to go beyond the creation of a basic communication toolkit by providing not only guidance for the development of basic building blocks for an effective outreach and awareness effort, but to teach project supporters how to use these tools and provide them with a “virtual” catalogue of resources that can be used by project developers, municipalities, and water agencies. The Public Communication Toolkit for Desalination is intended as a versatile set of proven techniques and strategies that will enrich the public outreach efforts carried out on behalf of desalination projects. It provides a useful set of instruments that can help guide projects through the maze of political, regulatory, and public acceptance challenges that often accompany desalination projects.

Chapter 2

Combined Research Executive Summary

2.1 Executive Summary – Introduction

Our research for development of a Public Communication Toolkit for Desalination Projects included several sources. The primary source was the information gathered during the 12 one-on-one in-depth interviews conducted with project managers, communications staff, and others closely associated with desalination projects in the United States, Australia, and Spain. The information gathered in these interviews clarified and reinforced the key issues that should be considered during the development of a communication plan for desalination projects. It also provided critical first-hand experience and knowledge of successful—and not so successful—communication and public outreach tools.

In addition to the in-depth interviews, we conducted a wide-ranging search for communication tools, videos, and websites that have been used by desalination organizations, public agencies, and others to communicate about their specific projects and the desalination process in general. Also included in this search were reports, white papers, and relevant media reports on various aspects of the desalination process and specific projects. We compiled the findings in two of the appendices found in this report: the Link Library and the Video Library. These libraries provide easy access to a variety of documents, videos, and websites and provide convenient access to sources of information that are available and will shorten the learning curve as agencies enter into the planning process for desalination projects.

2.2 What We Learned from In-Depth Interviews

One of the fundamental findings from our 12 one-on-one in-depth interviews is that every desalination project is unique; there is no cookie-cutter approach to the design and implementation of a project, and neither is there a single, specific approach to developing a communication plan. The water supply situation, political climate, and regulatory environment of each location is unique and requires a carefully tailored approach to communication and public outreach.

The primary objective of the interviews was to gain an understanding of the challenges and successes of communication efforts by those who have been on the front line of desalination projects in their communities. Although the results of the in-depth interviews do not provide a statistical representation of the larger population, they provide a qualitative guide to the relevant issues, attitudes, and experiences of those directly involved in desalination projects. The findings from the interviews are summarized in the following.

2.2.1 Community Support of Desalination

It is not surprising that there is a correlation between the perceived need for an additional water supply and the level of community support for desalination. Regions with a history of water supply shortages, particularly when those shortages have had a direct impact on a community's economy and quality of life, clearly enjoy more support for desalination

projects. Communities that have been "getting by" with their existing supplies and have not been inconvenienced because of shortages, are less inclined to support desalination.

A case in point is Australia, where Western Australia enjoys strong support for desalination because of the long drought in that part of the country. However, in Eastern Australia, there is more negative reaction to desalination where many large and expensive plants are on standby following the end of a drought period.

2.2.2 Project Opposition

One thing that nearly all the projects surveyed had in common was some opposition, and often strong opposition. The primary issues of concern were:

- Environmental impacts of brine discharge/disposal of concentrates
- Energy usage/carbon footprint/cost
- Noise emissions during operations
- Visual impacts/aesthetics
- Impacts on marine life (entrapment, impingement, and entrainment)
- Perception of population growth inducement
- Construction and operational costs
- Construction inconveniences
- Not doing enough to conserve water
- Not exploring other options
- Sustainability (short RO membrane shelf life)

Opposition was expressed in a variety of ways, including highly organized campaigns by established environmental groups (Surfrider, Coastkeeper, Audubon), particularly in California. In some cases, the community protests have resulted in changes to projects, ranging from minor adjustments to the public outreach process to very major concessions and the canceling of projects.

2.3 Communication in Planning Phase

Public outreach efforts varied from project to project, with those in Spain seeming to be less robust than the efforts in the United States and Australia. The most successful tools and activities included:

- Establishing face-to-face contact with community members
- Working closely with community leaders
- Keeping project supporters in the loop, while maintaining communication with the entire community via local media, newsletters, email, and websites.
- Maintaining a customer/contact relationship management (CRM) database
- Responding promptly to issues and problems, with full disclosure
- Establishing close relations with the media
- Involving the business community
- Setting up speakers' bureaus

- Offering tours of plants and education sites
- Providing clear and concise project information (handouts, newsletters, website, etc.)

Respondents said they encountered a number of pitfalls. A lack of messaging continuity and regular communication can deteriorate support. Also, spending too much time on the same audience can result in neglecting to reach out to more broadly based audiences.

2.3.1 Communication in Construction Phase

Methods of communication during desalination plant construction included regular construction-related notifications to affected residents and businesses; updates to elected officials and community leaders; on-site visits for community members or project-related advisory groups; project telephone hotline and website; presentations to neighborhood groups, open houses, and community events; press releases and articles; brochures; and videos. These methods bring people together, keep them informed and allow them to voice their opinions and feel heard. These are all winning strategies.

2.3.2 Ongoing Desalination Project Communication

Respondents with plants that are currently operating were asked about ongoing communication programs. They mentioned periodic newsletters (quarterly, semiannual), websites and email blasts, media releases to mark project milestones and awards, plant tours guided by a marine biologist, water education programs at the plant or nearby university, business and educational institution outreach, presentations to governing boards and community groups, ongoing education about how desalination fits into the overall water supply portfolio, and a visitor/education center.

2.3.3 Most Significant Public Acceptance Challenges

Respondents listed the most significant public acceptance challenges to be communicating the need and purpose of the project, educating the public about their water sources and the true cost of water, cost of desalination, energy demands, marine life impacts, growth inducement perceptions, environmental impacts, project location, and construction impacts.

2.3.4 Regulatory and Political Challenges

Respondents listed numerous agencies that regulate desalination projects, representing local, regional, state, and/or federal government interests. Achieving regulatory approvals from numerous agencies was reported as an onerous and expensive undertaking that can take many years and, in some cases, can be adversarial in nature. Other respondents reported that taking the time to educate and work with regulators and creating political support helped move their projects through various approvals. Many respondents said they had project champions or advocates that were instrumental in gaining support for their projects. One respondent noted that drought and favorable funding conditions played the most significant roles in championing their project.

2.3.5 Greatest Overall Challenges

The greatest overall challenges to educating the public, elected officials, and the media about the benefits of new water sources such as desalination were getting people to understand the drivers for new water supply options and how desalination fits into a community's water supply portfolio. Respondents perceive the public as taking water for granted, as well as

lacking knowledge about the economics and basics of their water systems. This suggests that it is important to provide basic knowledge about water systems and supply before introducing new—and potentially controversial—options into the mix. Other notable challenges mirror the responses to the question of issues of concern among opponents, such as: cost; energy demands; marine life impacts; plant location, and aesthetics.

2.4 Respondent Recommendations

The follow specific recommendations were offered by respondents for utilities, water districts, or advocates seeking support for desalination projects:

1. Talk early and often to the community; address critics, concerns, and fears.
2. Be as transparent as possible (i.e., if possible, allow site visits to the plant). Transparency builds trust.
3. Report any mishaps or hiccups immediately and honestly.
4. Have a team available to the community to directly answer questions.
5. Make yourselves available to attend community functions.
6. Look to other desalination plants around the world as examples of well-functioning plants.
7. Focus on political leaders, people who support them, chambers of commerce, and other community leaders (people who can impact public opinion in a negative or positive way).
8. Explain /illustrate that the cost of desalination can be about the same for other new water supplies (often any new water supply is going to be more expensive than current conventional water supplies). However, desalination, along with a few other new water supplies such as indirect potable reuse, has the advantage of providing significant amounts of water.
9. Regarding greenhouse gas effects—find ways to tap into renewable power portfolios.
10. Identify a champion who can communicate and relate to an audience; have your champion with you the whole time.
11. Gain support from key groups—they will almost do the work for you.
12. Make sure you have the best experts in the subject matter you are dealing with all lined up; know and have your facts straight.
13. Share information with the communication officer at the city where you are; work as closely as you can with them.
14. Communication personnel should work directly for the manager and not be buried in the organization.
15. Put communication and outreach at the top of the list.
16. Consider various formats when planning community meetings. In some cases, a traditional public meeting will be required, but some of those interviewed suggested that more productive dialog could result from an open house, information-station style meeting where participants can talk one-on-one with project team members.

2.5 Secondary Research—Link Library and Video Library

There is a large amount of information available about desalination. A water agency that is considering desalination as a water supply alternative may be hard pressed to know where to start its research. It can be a daunting task to separate useful references and materials from more technical or specific program material. The Link and Video Libraries were developed to provide a starting point for agency personnel by providing an easy-to-use guide to what others have experienced as their desalination project moved from concept to design, construction, and operation. The intent was to shorten the learning curve and provide agency personnel the benefit of others' experience as they develop a public outreach plan for their project.

The Link Library includes an extensive list of websites from a variety of sources, organized by the type of organization. This includes international agencies, desalination industry groups, federal or state government agencies, public agencies or projects, and environmental groups. The library includes a reports section that lists a variety of documents, many of which are helpful in identifying key issues that may be encountered when evaluating desalination.

The library includes materials that have been developed for specific projects, such as fact sheets, brochures, FAQs, and white papers. These provide an example, but not necessarily a template for outreach materials. We know that desalination projects are not a one-size-fits-all proposition. Materials and messages must be tailored for every situation. But the links to these websites, reports, and handouts will provide good examples for the novice who wants to develop materials for his or her agency.

Also listed in the Link Library are relevant published reports, publications, and journals that focus on desalination or water reuse and may include articles about communication programs. One such report is a white paper that describes the public outreach challenges encountered by the desalination project proposed in Santa Cruz, California, that provides a case study in responding to public opposition. A compilation of links to a variety of news stories provides a sampling of the types of issues specific projects, and the industry as a whole, have faced with desalination proposals.

Finally, the Video Library includes samples of the numerous videos that are available on YouTube and other websites. These are included to illustrate how a specific project might be portrayed and how other agencies have used videos to tell their stories by focusing on specific aspects in brief segments. Other projects tell their story in general terms and convey their message about the need for desalination in the broader context of their overall water supply situation.

Chapter 3

Strategic Outreach and Awareness Plan

A Strategic Outreach and Awareness Plan is a key element for any project being undertaken by a public agency, but it is particularly important with a potentially controversial water supply project such as desalination. The Strategic Outreach and Awareness Plan serves as the framework for all the communication efforts that take place in support of a desalination project. The outreach plan will provide all stakeholders involved in the process—members of the public, elected officials, environmental groups, regulators—with the historical context and information about why the project is being proposed that will allow them to make informed and educated decisions about desalination. Step-by-step guidelines for developing a Strategic Outreach and Awareness Plan for a proposed desalination project follow.

3.1 Initial Steps in Developing a Strategic Plan

3.1.1 When to Start the Outreach Plan

The public outreach effort should begin during the earliest phases of a desalination project, even before funding is approved for the project. Public outreach professionals should be involved during the planning, design, and permitting phases of the project, as well as construction. Activities in the early phase consist of meeting with staff and the technical team to initiate background research and begin to develop a Strategic Outreach and Awareness Plan that reflects the issues the specific community may have with regard to this new water supply. Meetings with key stakeholders, such as individuals, organizations, and business leaders, will help in creating a list of key concerns and issues. Public outreach staff and consultants need to be involved in planning meetings and funding discussions, as well as be aware of political strategies and be familiar with every facet of the project. Their understanding of the entire project is critical to accurate and effective communication efforts.

3.1.2 Develop an Outreach Checklist:

- Identify staff or a consultant to manage the Outreach and Awareness Plan.
- Meet with the project team at the outset of project planning. The outreach team needs to be familiar with all aspects of the project throughout the various phases of its development.
- Initial community research—Investigate the agency's history of relations with the community, explore the political landscape and demographics, and identify key opinion makers and community leaders to use in shaping the Outreach and Awareness Plan.

3.2 Development of the Strategic Outreach and Awareness Plan

The Strategic Outreach and Awareness Plan is a "road map" for the strategies, tasks, and tools the agency can use to help the desalination project gain community support and succeed. The plan should include a budget, timeline, and goals, which help track outreach activities as the project proceeds. Once a plan is approved by either management or the

governing body, it should be distributed to the entire project team so they understand how the outreach and awareness plan will work in conjunction with the planning, design, and other work that is going on. Every desalination project is unique and situational—outreach should be tailored to your particular conditions.

3.2.1 Introduction

The introduction of the plan should explain why the Strategic Outreach and Awareness Plan is being developed, why it is important for the success of the desalination project, and how it will facilitate clear and consistent communication to gain support for the project.

3.2.2 Develop a Project Story

Writing the "Project Story" establishes the starting point for developing outreach strategies and materials. It places the project team on the same page and enhances an understanding among the team—and the community—of why the project is being proposed and how we arrived at this point. The Project Story puts the project in a historical context that is easily understood, lays out the review process and the decisions that were made to select desalination as the preferred option. The story clearly states the purpose and need for the project in an objective narrative that will serve as the framework for the entire Strategic Outreach and Awareness Plan. Here are some of the questions the Project Story should answer:

Purpose and Need

- What is the core problem and/or why is there a water shortage?
- What is the purpose and need of the project?
- Can't we just conserve more water?

Alternatives

- What other water supply options or alternatives have been explored and/or should be explored further?
- How were those options analyzed?
- How will desalination solve our water problem?

Project Specific Issues

- Where will the water be used?
- What are the benefits of the project?
- What are the potential impacts of desalination?
- How will the agency resolve the environmental impacts?
- How much will it cost and when will it be complete?
- Where else is desalination being used to solve water scarcity?
- What are the impacts that may relate to growth, the environment, the community's economic vitality?

3.3 Establish Outreach and Awareness Goals

Goals for the Outreach and Awareness plan could include:

- Provide enough information to stakeholders to ensure thorough public involvement in the planning and decision-making process.
- Provide adequate outreach and education to raise awareness about the need for additional local water supplies and foster support for a desalination project.
- Respond to and address questions, including those that may be controversial, from all members of the community.
- Support the agency's effort to design and build the project on time and on budget.

3.4 Identify Challenges and Opportunities

3.4.1 Challenges

Challenges from the public, media, stakeholders, elected officials, or regulators could include any of the following**:**

- Vocal activists opposing the project for a variety of reasons, including growth impacts, impacts to marine life, desal's energy demands and carbon footprint, and safe disposal of brine
- Elected officials, special interest groups, and other community residents who are either uninformed or misinformed opposing the project and damaging the project's reputation
- Cost of the project will raise rates
- Regulatory agencies that are unfamiliar with the technology
- Agency's history of unpopular projects
- Distrust of the agency or the agency's governing body

3.4.2 Opportunities

Opportunities for success can come from**:**

- The prospect of future droughts and water rationing
- Desalination being a drought-proof, local source of water
- The uncertainty of future water supplies due to climate change, environmental regulations, overdrafting of groundwater, saltwater intrusion to drinking water wells, lack of alternative supplies without importation of water from a distance
- The importance of an adequate, local water supply for the local economy
- Other funding sources are available to offset costs
- Pilot project demonstrated efficacy of desalination
- Public surveys show support for desalination

3.5 Develop Key Messages for Outreach

Consistent and effective messages are critical to the success of a public outreach program. These messages should be used in outreach materials, talking points, ads, press releases, presentations, and more. Key messages that have been effective in desalination projects:

- Desalination is a drought-proof, local water supply.
- A desalination project is part of a diverse water supply portfolio.
- Drought, climate change, and increasing environmental regulation will greatly reduce available water.
- Desalination of seawater will reduce the overdraft of local groundwater.
- An adequate local water supply will benefit the local community and economy by providing water for businesses.
- Advances in technology are reducing the potential impacts of desalination, such as more efficient screening to protect marine life and more efficient filtration devices to reduce energy demands and greenhouse gases,
- A new source of water from desalination will reduce the dependence on outside sources such as imported water, which are becoming unreliable.
- Use of desalinated water will improve water independence and self-reliance.
- It is a locally controlled resource.

3.6 Identify Key Stakeholder Groups

Stakeholder groups (individuals, organizations, elected officials, environmental groups) should be identified and strategies developed to make sure each group is contacted and informed about the project. Stakeholder groups can be divided into categories (such as general public, elected officials, businesses, civic groups, environmental organizations, agency employees, and policy makers, potentially affected property owners and businesses) to ensure that a complete list is developed. The main goal of identifying stakeholder groups is to be inclusive and ensure that the concerns of all stakeholders will be addressed.
The following lists examples of general categories and types of groups that might be included in a list of stakeholders for a desalination project.

3.6.1 General Public

Water customers, residents living in the area of a proposed desalination plant, members of homeowners associations, civic groups.

3.6.2 Environmental Groups

Groups such as Surfrider, Save the Bay, the Sierra Club, Food and Water Watch have specific interests in different aspects of proposed desalination projects. For example, opposition from Surfrider may focus on marine impacts, whereas the Sierra Club’s primary concerns might be about energy impacts and growth-related issues.

3.6.3 Elected and Appointed Officials

Members of boards or councils who are considering the project, city managers, department heads, representatives of neighboring jurisdictions, state and federal officials.

3.6.4 Media

Local reporters and editors at newspapers, TV and radio reporters, and web-based news outlets, including bloggers and Twitter feeds.

3.6.5 Internal Staff

Water and Public Works directors and staff, members of the City Manager's or County Administrator's offices, customer service and finance departments. Also, identify workers in the field who have regular contact with the public and educate them about the project.

3.6.6 Business Leaders

Members of local business groups, Chamber of Commerce, building industry association, small business owners, business leaders.

3.6.7 Government Agencies

Include agencies with overlapping jurisdictions and regulatory agencies. For example, if the desal project is proposed by a city, be sure to include surrounding cities and counties in your stakeholder outreach. Also include any state or federal agency responsible for oversight, permitting, and/or funding.

3.6.8 Potentially Affected Property Owners and Businesses that May Be Impacted by Studies and/or Design Plans, Construction, or Placement of Facilities

If there is a property owner's residence or business that is near a proposed facility, such as a pump station, be sure to contact them in advance and make them aware of the proposed plans and how all proposed sites will be evaluated in the review process. Oftentimes there are multiple sites that are being considered or evaluated simultaneously, and it doesn't necessarily mean the property owner will be affected. Explaining the process to them is important.

3.7 Develop Strategies for Stakeholder Groups

It is important to develop strategies to accomplish communication goals and objectives at the beginning of the planning process. The strategies will need to be revised or modified as circumstances change throughout the market assessments, development of materials, environmental review, permitting, approval, construction, and project start-up. These changes will affect the development of informational materials and other outreach tactics. Because the needs and interests of each stakeholder group will vary, it is important that goals and strategies be developed for each individual stakeholder group. Strategies should be updated to reflect progress on the project's planning, design, and construction. Examples of these strategies and tasks follow.

3.7.1 General Public

The level of interest among members of the public can vary greatly and messages should be tailored to address those specific concerns. Specific concerns may include:

- The impact the project may have on water rates
- Location of the proposed desalination plant (and other project components)
- The impact the project may have on neighborhoods during construction
- The impact the project may have on schools, churches, or other public facilities
- Health impacts from desalinated water
- Environmental impacts related to marine life (for intake and brine discharge)
- Energy requirements (and greenhouse gas footprint) of the desalination process

All of these potential issues should be taken into account when strategies are being developed for the general public. It is not uncommon for a small group of neighbors, or even a single individual, to threaten the success of a project because their concerns were not addressed or they perpetrated misinformation that was not corrected or addressed head-on. An individual or small but active group of citizens can create controversy, cause delays, or even stop a project altogether. For instance, the siting options for a desalination plant should be carefully considered when residential areas will be affected.

To prepare for any potential concerns or problems, a list of steps to ensure that the general public's concerns are addressed follows:

1. Do not assume members of the public know anything about their water supply, delivery system, or why a desalination project is needed. The Project Story is fundamental to the public's understanding of why a water problem exists and how it can be solved. The Project Story will provide the context for why the project is needed and the messages it conveys should be consistent throughout the awareness and public outreach effort.
2. Discuss potential problems with staff and consultants, such as rate increases, facilities siting, construction impacts, and health and safety issues.
3. Hold interviews with key community members, or conduct opinion polls to survey community support and opposition. This market research provides baseline information on the knowledge, levels of awareness, and opinions about desalination and the specific project. This information is vital when developing messages and outreach materials.
4. Hold one-on-one meetings with key community leaders and vocal individuals who represent organizations. This helps establish positive relationships, provides information, and is more effective than larger group meetings.
5. Make presentations to community groups about the project. Identify interested groups and associations and request an opportunity to speak.
6. Establish a speakers bureau among agency staff, provide support in terms of conducting speakers training to increase the comfort level and effectiveness of speakers bureau members. Also provide a PowerPoint presentation, message points and other background information for speakers to use.

7. Establish and maintain an email database of any members of the public interested in receiving project updates, important meeting dates, and opportunities for participation in the planning process.
8. Cultivate support among the business community and use their network to disseminate information about the project.
9. Establish a presence at community events, such as fairs and expos. Develop a display booth with handouts and information about the project.
10. Develop an earned media program to raise awareness of the Project Story and the need for desalination. Use press releases to encourage attendance at meetings and events.
11. Consider paid traditional advertising opportunities to expand reach.
12. Create communication materials about the desalination project for distribution by mail, newspaper inserts, and for distribution at public events and meetings.
13. Establish or enhance electronic information resources. This might include developing a project-specific website and using social media platforms such as Twitter, Facebook, YouTube, and more.
14. Develop a Crisis Plan. Have a clear plan for reaching out to the media and the community in the event of an emergency or unexpected event, such as an injury on the job site, or a demonstration by environmental groups or other protesters.

3.7.2 Environmental Groups

Because several of the key challenges with desalination projects involve energy consumption (greenhouse gases), marine impacts, and brine disposal, environmental groups have become a key stakeholder in the political and decision-making process. It is important that representatives of environmental groups be informed about the project during the planning and review processes (including special studies), but it is also important that the project team maintain control of the narrative.

1. The Project Story should emphasize the water reliability benefits of desalination, which may have positive environmental effects on fisheries and groundwater.
2. Communication materials should include the energy efficiency measures and marine life protections that will be included in the project.
3. Emphasize the extent to which conservation has been/will continue to be utilized and other water supply opportunities, such as recycled water, have been explored.

3.7.3 Elected Officials

Elected officials are critical to the success of a desalination project because they control budgets, timelines, environmental reviews, and ultimately the approval of any project. And they can be influenced by public opinion. A desalination project may span the course of several years and election cycles, making it important to keep elected officials updated and informed throughout the process. It is likely that the makeup of a Council or Board will change during the life of a project and newly elected officials should have a good understanding of the issues and the project when they take office. One or two newly elected officials could change the direction of, or even scuttle, a project. Other local, state, and federal officials, including appointed officials and regulators, should also be kept up to date, particularly if they are providing funding.

Strategies for keeping elected officials briefed on a project include:

1. Hold one-on-one meetings with elected officials at the outset of the project to brief them and answer questions.
2. Provide ongoing updates to keep elected officials and their staff informed, receive input, and gain acceptance. In particular, maintain regular communication with the mayor or board chair to encourage continuity in leadership and support as the project progresses, especially prior to key project milestones and decision points.
3. Provide a staff contact name and telephone number or email address so elected officials can refer constituent questions if they desire.
4. Invite elected officials to participate and speak at public events, such as a ground-breaking, pilot plant opening, public tours, or news conferences. This will facilitate buy-in and support.
5. Be prepared to meet with prospective candidates and newly elected board members or council members following elections.
6. Prepare a briefing binder that includes easy to read fact sheets on crucial issues, as well as vetted responses to key concerns their constituents may have.

3.7.4 Media

For better or worse, public opinion and perception is often shaped by the news coverage a desalination project receives. What appears in the press is out of your control. What you can control is how you assist editors and reporters in understanding the technical and environmental issues that are involved in a desalination project. It is important to establish a good relationship with reporters and editors covering your project. That means being open with information, returning their phone calls promptly, and not telling them how you think the story should be written. A well-prepared media kit with clear information that provides context and background on The Project Story, with contact lists and other relevant data, is a valuable tool for a reporter. A few strategies that are effective in working with the media include:

1. Always be available to answer questions about the project and respond by the reporter's deadline.
2. Appoint a spokesperson for the project that will always be available to speak to a reporter (including on nights and weekends), or be able to refer questions to the appropriate person.
3. Help reporters and editors understand the project by providing background information, holding tours (if a pilot project is available), and issuing regular news releases for events or project milestones.
4. Prepare an initial media kit for the project, which includes background information on desalination, the project being proposed, desal technologies, other projects that have been successful, relevant data, and contact information for the agency.
5. Prepare a list of media contacts for desal projects throughout the state who can provide context. Put reporters in contact with numerous sources so they have every opportunity to produce balanced coverage.

6. Politely, but firmly, point out instances when you believe coverage is not objective, or when desal opponents are given a greater opportunity to state their views.
7. Request meetings with television and radio news editors and producers, as well as newspaper editorial boards, to explain the project in detail and answer any questions they may have. Winning the editorial support of your local media outlets can help with public awareness, understanding, and possible support of the project.
8. Reach out to these media contacts prior to key project milestones and decision points so you—not the opponents—are the voice and source of project information.
9. If you are conducting a pilot or demonstration project, plan to invite local media on a tour so they can see operations first hand, better understand the science and technical aspects, and ask questions.

3.7.5 Regulatory Agencies

Desalination projects typically involve a variety of regulating and permitting agencies, including local, state, and federal agencies and overlapping jurisdictions.

1. Meet with each agency that will have a permitting or regulatory role during the project planning process to clarify any issues and establish a rapport with agency staff. Project team representatives should include both technical and outreach representatives.
2. Brief agency staff on a consistent basis, send status updates, and maintain ongoing communications.
3. Reach out to other local government agencies, such as county planning agencies, water boards, wastewater agencies, to garner support. Making sure local agencies are on board will help the project proceed more smoothly.
4. When possible, obtaining letters or resolutions of support for the project can prove highly beneficial.
5. Hold meetings with local, state, and federal elected officials, including members of Congress, who may be helping to obtain funding.

3.7.6 Internal Staff

Internal staff members of an agency, although not necessarily the spokespersons for a desalination project, are nonetheless the face of the project in the public's eyes. Even though not everyone in the agency will be familiar with the details of the project, it is important that they at least understand the basics: Why is the project being proposed? Why is it needed? How will it work? How will it be reviewed? In smaller communities, internal staff members often live and work locally and are asked about the project by friends and neighbors. Workers in the field are often asked about projects, and they too should be familiar enough with it to answer basic questions. A few suggestions for educating internal staff on a desalination project:

1. Conduct a staff workshop to provide information on the project and include handouts. Consider a role-play scenario to practice answering questions from the public.
2. Develop a key facts handout (business-card size) that staff can carry and refer to if needed.
3. Keep staff updated on the project during staff meetings or via email.

4. Consider the various services that will be involved in the desalination project—from water and wastewater plant operators, to meter readers, billing and customer service—and include them in the staff workshops.
5. Brief internal staff prior to key project milestones and decision points so you—and not the project opponents—are the source of project information.

3.7.7 Business Leaders

The support of the business community can be a key component of a successful desalination project. The economic benefits of a reliable, local water supply are often overlooked, or underestimated, during the debate over desalination. Where possible, an economic analysis that quantifies the benefits of a reliable water supply and also the financial impacts of water shortages is a useful tool in helping the business community understand the benefits and social value of a desalination project. One example is a **Triple Bottom Line** (TBL) analysis for a desalination project. This kind of analysis can help members of the community, businesses, and water planners recognize the wide range of social, environmental, and financial benefits and/or tradeoffs (including costs) that desal may provide and how it may affect their service areas. This information can help utilities communicate the range of benefits and/or tradeoffs that may arise from including a desal project as part of their community's water supply portfolio. (An example of a generic TBL for a desal project is included in the Appendix of this report.)

Other strategies for reaching out to business leaders include:

1. Schedule presentations to business groups, such as the Chamber of Commerce, civic groups, and service organizations.
2. Submit news releases to business publications, external organization newsletters, email broadcasts, and more.
3. Provide business leaders with background information about the project so they are prepared to speak to their associates and colleagues.
4. Send regular e-updates to business leaders and other interested parties.

3.8 Creating Communication Awareness Materials

The creation of a suite of communication materials and tools is a key element of a strategic outreach plan. With the advent of social media and the prevalence of the internet, the reach of communication tools extends beyond the traditional printed materials. Printed matter is still important—many stakeholders want to have a takeaway handout that they can refer to later—but it is just one instrument in a larger toolkit. Printed materials, such as fact sheets and brochures, complement face-to-face discussions and presentations. A segment of each stakeholder group can be reached through social media, such as Twitter and Facebook, and these new media should be incorporated into an outreach plan. A well-managed Facebook page can expand the audience a project reaches, demonstrate support and sometimes criticism, and provide a venue for timely updates.

One of the first steps in developing outreach materials is creating a consistent look and feel for all materials, including the project website, handouts, and awareness ads. Some agencies develop a name and logo for their desalination projects, particularly if they are partnering

with other agencies. Figure 3.1 lists of some of the materials and media to consider for creating communication tools and the groups they are designed to reach.

Audience							Outreach Material
General Public	Enviro. Groups	Elected Officials	Media	Regulators	Internal Staff	Business Leaders	
●	●	●	●	●	●	●	"Branding" the project with a name and logo that is simple and will help audiences identify the project.
●	●	●	●	●	●	●	Create a project brochure that tells the "Project Story." This is a primer on the agency's water situation: How we got here, what the problem is, and how we are going to solve it. The story should include a brief history of the reports that have been prepared and alternatives that have been studied that led to the current desalination proposal. It should also place desalination in context both with the other water supply components in the agency's portfolio and its water conservation program.
●	●	●	●		●	●	Email broadcasts—Build a permission-based email broadcast list to send out regular monthly project updates and notices of special events or meetings.
●	●	●	●	●	●	●	Project website—Establish a website dedicated to project information. This includes reports, maps, white papers, relevant documents, news articles, videos, fact sheets, FAQs, and other materials.
●	●	●	●	●	●	●	Frequently Asked Questions—FAQs are a staple of any public outreach toolkit. They provide an easy-to-read guide to desalination that translates technical and complex processes into plain language.
●	●	●	●	●	●	●	Facebook and Twitter—Use social media to broaden your audience. Many agencies use Facebook and Twitter in lieu of traditional sources such as newspapers or radio. Facebook can also be used as an advertising outlet to target very specific audiences by location. Use caution when setting up a Facebook page's interactive features.
●	●		●		●	●	YouTube—Post short videos on the project website, to explain various aspects of the project, water supply, brine disposal, the desalination process, etc.
●	●	●	●	●	●	●	Fact sheets—These are brief (back and front) informational handouts that can give a quick overview of the project or focus on a specific issue, such as energy usage or impacts to marine life.
●	●	●	●		●	●	Newsletters—A project newsletter can be effective in keeping stakeholders up to date on various aspects of the project, such as the environmental review process, status of grant funding, or the results from a pilot plant project.
●	●		●		●	●	Newspaper and magazine awareness ads—These are still the primary source of information for many members of the public and should be part of the overall outreach program.
●	●	●			●	●	Radio and public service announcements—Similar to newspapers and print media, radio can be an effective vehicle for project meeting notices and awareness messages, depending on the reach, market share, and format of the stations.
●	●		●		●	●	Media kit—This is an indispensable item for reaching out to the media and other groups. A media kit will include many of the items previously listed, such as fact sheets, brochures, and newsletters. It could also include news clippings about alternatives evaluated, other desalination projects, and desalination in general.
●	●		●		●	●	Exhibit booth for public events—A portable display booth should include graphics, maps, and illustrations that depict the project and why it is needed. For example, a diagram that illustrates the effects of saltwater intrusion into a groundwater well can help explain why desalination is needed. The exhibits should tell the Project Story visually and quickly. Personnel staffing the booth should be people-friendly and familiar with project issues and community concerns.

Figure 3.1. Materials and media for creating communication tools and the groups they are designed to reach.

3.9 Timeline and Budget

A budget for the outreach effort should include all the costs of developing communication and awareness tools and implementing the plan. Depending on the size of the project and the budget allocated for communication, agencies can establish priorities among the communication tools listed here and place them across a timeline related to other project milestones and key decision points. It is important to keep in mind that the overall cost of a public outreach effort is a fraction of the total project cost, but it is critical to the overall success of the project. Having sufficient communication tools and resources is a key element for a project's success. Outreach efforts should be continual throughout the project phases. There should not be periods of time where no activities are taking place. Projects that have gone dark during election cycles or kept their outreach efforts on hold for other reasons have paid a high price for doing so.

3.10 Summary of Strategies for Success

The following is a list of strategies that have been effective in other outreach campaigns for desalination and water supply projects:

1. Start by developing an Outreach and Awareness Plan that has the support of the project team and agency.
2. Conduct community research. We strongly recommend conducting a survey to shape your communications. A statistically significant telephone survey is a starting point for messaging—it is critical to find out what the community thinks about the project. In addition to phone surveys, in-person iPad surveys, exit surveys, and even focus groups have all contributed and proved useful in planning effective communication programs. In addition, one-on-one interviews can help provide basic information for developing effective outreach messages and tools.
3. Allocate an adequate budget for staff and/or consultants to carry out public notifications, outreach, and awareness efforts throughout all project phases.
4. Develop the agency's Project Story that puts the desalination project in a historical perspective and in context with other water supplies and water conservation, explains what studies have led to the current alternative, and lays out the purpose and need for the project.
5. Reach out early to all the key stakeholder groups and involve them in the initial planning process. Listen and respond to their concerns. Keep them informed throughout project phases and continue to be the voice and informational resource of the project.
6. Keep elected officials in the loop. Maintain close communication with elected officials throughout the life of the project. Elections may likely occur during the project and new officials need to be briefed and kept informed.
7. Seek the support of elected officials. The governing board of any agency controls the budgets, timelines, and approval process. Keeping the mayor or board chair involved every step of the way is essential to a successful project. Elicit the leadership of elected officials in informing the public.
8. Maintain good media relations. Establish a good rapport with editors and reporters. Be open, transparent, and available. Provide all the information they need to cover the desalination story fairly. Meet with local newspapers' editorial boards and other key

media outlets periodically and prior to project milestones and decision points. Include a social media program that provides up-to-date information to the media and all other stakeholders.

9. Communicate with other agencies and jurisdictions. Your project does not exist in a vacuum. Establish communication with outside agencies, neighboring cities, and jurisdictions. Their support is important.
10. Meet with regulators and agencies that will be involved in permitting or regulating the project early and often in the planning process to ensure they understand what is being proposed. This will avoid unexpected hurdles or surprises.

Chapter 4

Informational Materials

4.1 Frequently Asked Questions

What is desalination?

Desalination is the process of removing dissolved salt and other minerals from water. The two most common desalination technologies are membrane-based filtration and thermal. Membrane filtration processes rely on semipermeable membranes to separate salts from water; these can be pressure-driven (reverse osmosis or RO) or driven by an electric field (electrodialysis reversal or EDR). Reverse osmosis is generally the treatment method of choice. Thermal processes involve heating saline water to produce water vapor, which is then condensed and collected as fresh (distilled) water.

Where are most desalination projects located?

Most of the modern interest in desalination is focused on developing cost-effective ways of providing fresh water for human use in regions where the availability of fresh water is, or is becoming, limited. Desalination is used in the Middle East, Australia, Spain, and in the United States in Florida, Texas, and California. There are nearly 16,000 desalination plants operating in 150 countries that produce 17.5 billion gallons of water per day. These plants provide 300 million people with some or all of their daily water needs. Although desalination projects often face some environmental and economic challenges, these challenges can be successfully addressed by carefully selecting the project site, implementing state-of-the-art intakes, properly managing the concentrated salt discharge, and incorporating energy-efficient and environmentally sound equipment and systems.

What is the difference between brackish water and seawater desalination?

The primary difference between brackish water and seawater is how salty the water is, or in technical terms, the amount of total dissolved solids (TDS) they contain. Brackish water refers to water supplies that are more saline than freshwater, but much less salty than seawater. Brackish water may result from mixing of seawater with fresh water, as in estuaries, or it may occur in brackish groundwater basins (aquifers). Brackish water typically contains TDS in concentrations ranging from 1,000 milligrams per liter (mg/L) to 10,000 mg/L. Seawater typically is very salty (TDS around 33,500 to 35,000 mg/L). The desalination treatment process is essentially the same for both brackish water and seawater and uses reverse osmosis. In a reverse-osmosis system, the greater the level of TDS in the water, the higher the pressure needed for the pumps to push the water through the membranes, and consequently, the higher the energy costs.

About Desalination

Desalination Technologies

A desalination process essentially separates saline (salty) water into two parts—one that has a very low concentration of salt (treated water or product water), and the other with a much higher concentration of salt than the original source water, usually referred to as "concentrate."

Thermal and membrane filtration technologies are the two major types of technologies that are used around the world for desalination. Both technologies need energy to operate and produce potable water. Within those two broad types, there are subcategories (processes) using different techniques.

Thermal Technologies

Thermal technologies have rarely been used for brackish water desalination because of the high costs involved. The majority of plants that use thermal methods have been built overseas, primarily in the Middle East where energy resources have been plentiful and inexpensive.

Membrane Technologies

Membrane technologies can be subdivided into two broad categories: Reverse Osmosis (RO) and Electrodialyis/Electrodialysis Reversal (ED/EDR). Reverse Osmosis (RO) was commercialized in the 1970s and currently is the most widely used method for desalination in the United States. The RO process uses pressure as the driving force to push water through a semipermeable membrane (a type of filter) into a product water stream and a concentrated salty water stream. Nanofiltration (NF) is a membrane process that is used primarily for brackish water and removal of hardness ions such as calcium, magnesium, and sulfate. RO processes are used for desalinating both brackish water and seawater.

EDR is an electrical current driven process that was commercially introduced in the 1960s, about 10 years before reverse osmosis (RO). Although EDR was originally conceived as a seawater desalination process, the electrical process works better for lower salinity water. The few EDR units in use are located mostly in Texas and are used in low-salinity applications such as surface water desalination, where brackish surface water is used as the source water.

Desalination Process

Osmosis is a natural phenomenon by which water from a low salt concentration passes into a more concentrated solution through a semipermeable membrane. In an RO process the direction of the water flow, from being more dilute to less dilute, when pressure is applied to the solution with the higher salt concentration solution, the water from the higher salt side will flow in through the semipermeable membrane, leaving the salt behind. An RO desalination plant essentially consists of four major systems (as seen in Figure 4.1):

1. Pretreatment
2. Reverse Osmosis Process
3. Concentrated Salty Water Disposal
4. Stabilization of Desalinated Water

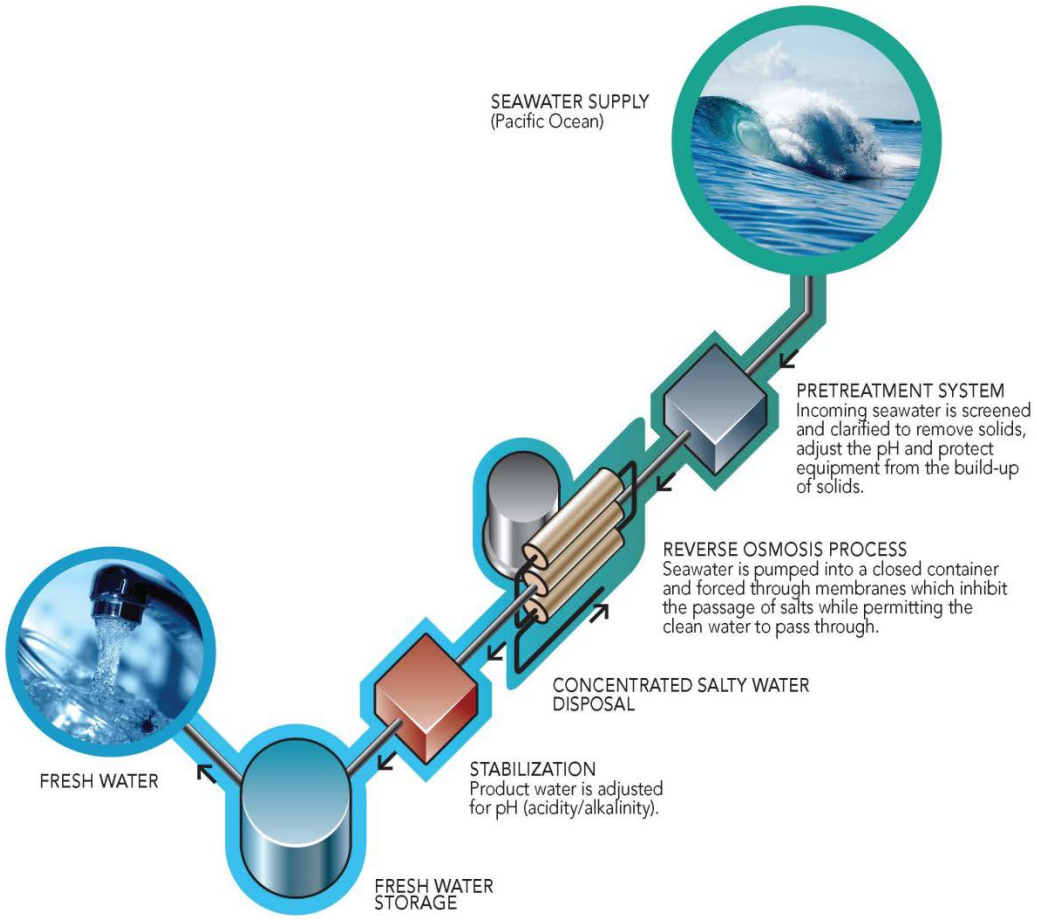


Figure 4.1. Desalination process.
Source: Graphic courtesy of scwd[2]

Is desalination necessary?

An increasing number of communities are facing water supply challenges that are due to increasing demand, drought, and depletion and contamination of groundwater, and dependence on a single source of supply. About 97.2% of the water on earth is saline and can only be used through desalination treatment. Communities with access to saline waters may need to consider desalination as an additional source of water as part of an overall plan to manage their water resources. Desalination can also ensure a diversified water portfolio that includes a local source of water, which is essential to good water-supply planning and self-sustainability.

What are the benefits and challenges of desalination?

The benefits are:

- It provides a needed water supply during droughts
- It provides a reliable, supplemental source of water
- It provides an additional local water source
- It supplements other alternative water resources such as recycled water

The challenges include:

- Ensuring safe disposal of concentrate—the salty water left after the desalination process
- Preventing trapping of marine life in seawater intake pipes (seawater desalination)
- Contributing to greenhouse gas emissions by being an energy intensive process
- Costs of producing water
- Transporting desalted water to the distribution pipelines adds cost

How much ocean water does it take to make potable water?

It typically takes approximately two gallons of ocean water to produce one gallon of potable water using reverse osmosis; this is known as 50% product recovery. Depending on how a desalination facility is operated, the product recovery will normally range from 40 to 70% for ocean and brackish water desalination.

How much salt is in seawater?

This varies slightly with each ocean, but the range is 32,000 mg/L to 45,000 mg/L. For inland seas like the Red Sea, the salinity (salt content) is about 45,000 mg/L. For the contiguous oceans—the Pacific Ocean, the Atlantic Ocean, the Indian Ocean, etc.—the salinity is about 33,500 to 35,000 mg/L (mg/L is a unit of measurement that shows how many milligrams of a certain substance are present in one liter of a liquid or gaseous mixture.)

How is the salt removed from ocean water and what happens to it?

Seawater, after pretreatment to remove solids, is put under very high pressure while flowing through a special type of filter called a semipermeable membrane, as seen in Figure 4.2. The membrane allows water to pass through, but other dissolved contaminants cannot pass through the membrane. The clean water that is pushed through the membrane (called the "permeate") is now salt free and can be used as drinking water, whereas the salt remains on the source water feed side of the membrane. What remains on the other side is actually very concentrated salt water called "brine concentrate."

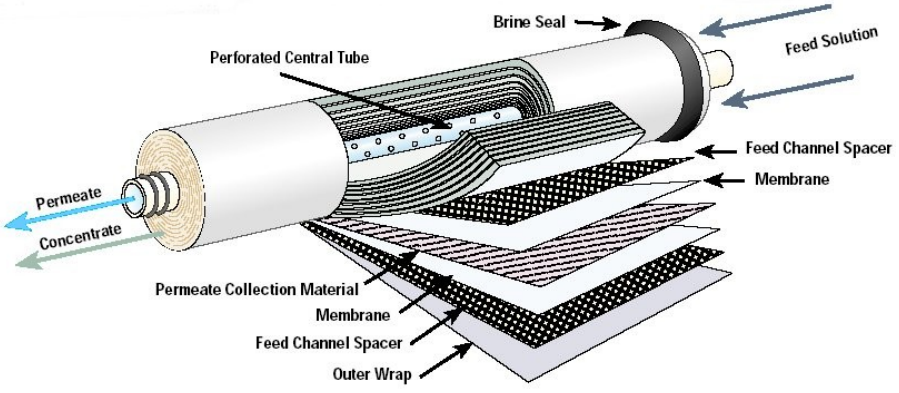


Figure 4.2. Semipermeable membrane.

Brine concentrate produced during the seawater desalination process can sometimes be returned to the ocean in a controlled process (such as diluting with seawater or treated wastewater) to avoid detrimental effects to the environment or marine life. For concentrates produced in inland facilities, a few other options may exist, depending on the local conditions. These include disposal to wastewater treatment plants or co-disposal with power plant cooling water, to surface water bodies, deep or shallow coastal well injection, or to evaporation ponds. Where no other options are feasible, thermal processes can be used to dry the salt for disposal in a landfill.

How much energy is required to desalinate water?

The range of energy required for seawater desalination is 11,000 to 15,000 kilowatt hours (kWh) of energy to produce a million gallons of water (or 3.07 acre-feet). Brackish water requires a range of 1,000 to 8,000 kWh of energy per million gallons. To put that in perspective, the average annual electricity consumption for a residential utility customer in the United States is about 11,280 kWh, an average of 940 kW per month. By comparison, the energy requirements of water imported to Southern California range from 8,000 to 14,000 kWh hours per million gallons.

Is desalination affordable?

Desalination can be an affordable solution in some communities. The affordability of desalination depends on the quality of the source water and a host of other factors. Brackish water desalination costs less than seawater desalination because brackish water generally contains fewer total dissolved salts. Advances in desalination technologies in recent years have reduced costs considerably. Communities must decide on the affordability of desalination projects in the context of local needs. This might include integrating a plan that combines water conservation with traditional and other alternative sources of supply.

What does it cost to produce desalinated drinking water?

The cost to turn ocean water into potable drinking water ranges from $3.8 to $7.7 per thousand gallons ($1,200–$2,500 per acre-foot of water) depending on salt content, necessary pretreatment, finished water quality goals/standards, conveyance, and potential environmental impact mitigation costs. Total production cost to desalinate groundwater ranges from $1.09 to $2.40 per thousand gallons or $357 to $782 per acre-foot, according to a study conducted in Texas in 2012. The cost is also a function of project construction and operating costs.

What types of environmental impacts are examined for a desalination facility?

As with any major construction project, environmental studies are required by regulators for a desalination plant prior to construction. Studies are conducted to identify and investigate potential environmental impacts on aquatic life, soil, air, and water resources and to recommend steps to avoid or reduce these impacts. For seawater desalination, environmental studies look carefully at how marine life is affected during desalination processes. For brackish water desalination, the disposal of brine is the largest potential impact that needs to be evaluated.

Who Is Using Desalination?

Seawater desalination is ideal for arid and coastal regions that need an additional source to augment drinking water supplies. Brackish desalination allows inland communities to take advantage of water sources that are too salty to treat with conventional methods. Seawater desalination allows coastal communities to turn salty water into a potable product. There are

more than 15,000 desalination plants worldwide. Some locations currently using and/or considering desalination technology include:

- Abu Dhabi, United Arab Emirates
- Algeria
- Aruba
- Australia
- Cyprus
- Israel
- Malta
- Saudi Arabia
- Singapore
- Spain
- Trinidad and Tobago
- United Arab Emirates
- United Kingdom
- United States, in states such as Florida, California, and Texas

For information on how other communities are effectively using desalination techniques, visit the websites of the following agencies:

- Carlsbad, CA
- El Paso, TX
- El Segundo, CA
- Melbourne, Australia
- Perth, Australia
- Sydney, Australia
- Tampa Bay, FL

4.2 Glossary

This glossary includes terms and acronyms related to ocean and brackish desalination and is provided as a general reference tool.

Sources:
Blue = WateReuse Association
Black – scwd2 (Santa Cruz project)
Red = EPA

Acre-foot (AF): A unit for measuring the volume of water. One acre-foot equals 325,851 gallons (the volume of water that will cover one acre to a depth of one foot). One million gallons equals 3.07 acre-feet.

Banked water: Water stored in the aquifer that could be extracted at a later time.

Biofouling: The formation of bacterial film (biofilm) on fragile reverse osmosis membrane surfaces.

Brackish water: In general, water having a total dissolved solids concentration ranging from about 1,000 to 10,000 mg/L. Water containing dissolved minerals in amounts that exceed normally acceptable standards for municipal, domestic, and irrigation uses. Considerably less saline than seawater.

Brine/concentrate: Water that contains a high concentration of salt. Brine discharges from desalination plants may include constituents used in pretreatment processes, in addition to the high salt concentration seawater. Also referred to as **concentrated salty water**.

BTU (British Thermal Unit): A standard unit for measuring a quantity of thermal energy, either electricity, natural gas, or any other source of energy. One BTU is the amount of thermal energy required to raise the temperature on one pound of water one degree Fahrenheit at sea level.

Capacity factor: An electric utility's annual capacity factor is defined as the annual kilowatt-hour sales divided by the product of the total hours in a year and the rated capacity of the utility in kilowatts.

Coagulation: A pretreatment process used in some desalination plants. A substance (e.g., ferric chloride) is added to a solution to cause certain elements to thicken into a coherent mass so that they may be removed.

Cogeneration: A power plant that is designed to conserve energy by using “waste heat” from generating electricity for another purpose.

Concentrated salty water. See **Brine**

Desalination: Specific treatment processes, such as reverse osmosis or multistage flash distillation, to demineralize seawater or brackish (saline) waters to purify them for drinking. Also sometimes used in wastewater treatment to remove salts and other pollutants.

Disinfection: Water treatment that destroys potentially harmful bacteria.

Double-pass system: A reverse osmosis (RO) or nanofiltration (NF) system in which treated low-salt water is further processed by a subsequent RO or NF unit.

Deaeration: Removal of oxygen. A pretreatment process in desalination plants to reduce corrosion.

Distillation: A process of desalination where the intake water is heated to produce steam. The steam is then condensed to produce product water with low salt concentration.

Electrodialysis: Most of the impurities in water are present in an ionized (electrically-charged) state. When an electric current is applied, the impurities migrate toward the positive and negative electrodes. The intermediate area becomes depleted of impurities and discharges a purified stream of product water. This technology is used for brackish waters but is not currently available for desalting seawater on a commercial scale.

Entrainment: When intake pipes draw small aquatic organisms into the facility and they are exposed to pressure and high temperatures. Very young organisms, usually at the egg or larvae stage, are most susceptible to death by entrainment.

Environmental Impact Statement (EIS): Detailed analysis of the impacts of a project on all aspects of the natural environment required by the National Environmental Policy Act for federal permitting or use of federal funds.

Feedwater: Water fed to the desalination equipment. This can be source water with or without pretreatment.

Filtration: A process that separates small particles from water by using a porous barrier to trap the particles and allow the water to pass through.

Finished water: Treated drinking water that is considered safe and suitable for delivery to consumers.

Flat sheet membrane: A membrane manufactured in a flat form. Commonly used in spiral-wound membrane elements.

Fouling: The gradual accumulation of contaminants on a membrane surface or within a porous membrane structure that inhibits the passage of water, thus decreasing permeability.

gpd: Gallons per day.

Impingement: The pinning and trapping of fish or other larger organisms against the screens of the intake structures. Young or small fish are most susceptible to being killed by impingement.

Infiltration gallery: A method used for seawater intake. Perforated pipes are arranged in a radial pattern in the sand onshore below the water level. Water from the saturated sand enters the perforated pipes.

Ion exchange: A water treatment process where an electric charge is used to remove charged particles from solution.

Kilowatt (kW): A thousand watts. The watt is a measure of power used by electricity generating plants. One watt is equivalent to 1 Joule/second or 3.4127 BTU/hour.

Megawatt (MW): A million watts.

Membrane: A thin layer of material that acts as a very specific filter that will let water flow through while it catches suspended solids and other substances. Various methods are used to enable substances to penetrate a membrane, such as the application of high pressure, the maintenance of a concentration gradient on both sides of the membrane and the introduction of an electric potential.

MGD: Million gallons per day. This term is used to describe the volumes of water treated and discharged from a treatment plant.

mg/L: Milligrams per liter; a measurement describing the amount of a substance (such as a mineral, chemical or contaminant) in a liter of water. One milligram per liter is equal to one part per million.

Microfiltration (MF): A physical separation process where tiny, hollow straw-like membranes separate particles from water. It is used as a pretreatment for reverse osmosis.

Microlayer: The upper few millimeters of the ocean. Fish eggs are sometimes concentrated in the microlayer.

Multiple Effect Distillation (MED): A form of distillation. Evaporators are in series, and vapor from one effect is used to evaporate water in the next lower pressure effect. This technology is available in several forms, one of the most common of which is the Vertical Tube Evaporator (VTE).

Multistage Flash (MSF): A form of distillation. Intake water is heated then discharged into a chamber maintained slightly below the saturation vapor pressure of the incoming water, so that a fraction of the water content flashes into steam. The steam condenses on the exterior surface of heat transfer tubing and becomes product water. The unflashed brine enters another chamber at a lower pressure, where a portion flashes to steam. Each evaporation and condensation chamber is called a stage.

NPDES: National Pollutant Discharge Elimination System. A federal permit authorized by the Clean Water Act, Title IV, which is required for discharge of pollutants to navigable waters of the United States, which includes any discharge to surface waters—lakes, streams, rivers, bays, the ocean, wetlands, storm sewer, or tributary—to any surface water body**.**

Nanofiltration (NF): A membrane technology that relies on the ability of membranes to discriminate between the physical size of particles or species in a mixture or solution and is primarily used for water pretreatment, treatment, and purification.

Ocean Thermal Energy Conversion (OTEC): A solar, ocean thermal desalination approach where electricity is produced by using the temperature differential between cold, deep waters and warm, shallow surface waters. Water at the ocean surface (at about 70°F) is used to heat liquid ammonia, which vaporizes at this temperature in a vacuum chamber. The ammonia vapor is used to turn a turbine to produce electricity. The vapor is then condensed by using cold water pumped up from the ocean depths (at about 35°F).

Parts Per Billion (ppb): A unit frequently used to measure contamination concentration (parts of contamination per billion parts of water). One thousand parts per billion is equal to one part per million.

Parts Per Million (ppm): A unit used to measure contamination concentration (parts of contamination per million parts of water). One part per million is equal to one milligram per liter. (This term is becoming obsolete as instruments measure smaller particles.)

Potable: Water that does not contain pollution, contamination, objectionable minerals, or infective agents and is considered safe for domestic consumption; drinkable.

Product Water: The desalted water delivered to the water distribution system. Also referred to as **finished water** or **potable water**.

Recycled Water: Treated wastewater used for non-potable uses, such as irrigation.

Reverse Osmosis (RO): A method of removing salts or other impurities from water by forcing water through a semipermeable membrane.

Safe Drinking Water Act (SDWA): Federal legislation passed in 1974 that regulates the treatment of water for human consumption and requires testing for and elimination of contaminants that might be present in the water.

Salinity: Generally, the concentration of mineral salts dissolved in water. Salinity may be measured by weight (total dissolved solids or TDS), electrical conductivity, or osmotic pressure. Where seawater is known to be the major source of salt, salinity is often used to refer to the concentration of chlorides in the water.

Scaling: Salt deposits on the interior surfaces of a desalination plant.

Stage: A set of pressure vessels installed in parallel.

SWRO: Seawater Reverse Osmosis. Used as the abbreviation for seawater using RO.

TDS: Total dissolved solids. A quantitative measure of the residual minerals dissolved in water that remain after evaporation of a solution. Usually expressed in milligrams per liter.

Ultrafiltration (UF): A membrane filtration process that falls between reverse osmosis (RO) and microfiltration (MF) in terms of the size of particles removed.

µg/L (micrograms per liter): Micrograms per liter; a measurement describing the amount of a substance (such as a mineral, chemical or contaminant) in a liter of water. It is expressed in terms of weight per volume. One µg/L is equal to one part per billion.

Vapor Compression Distillation: A form of distillation. A portion of feedwater is evaporated, and the vapor is sent to a compressor. Mechanical or thermal energy is used to compress the vapor, which increases its temperature. The vapor is then condensed to form product water and the released heat is used to evaporate the feedwater.

Demystifying Desalination

A Reliable Water Supply Solution

Desalination is a water supply technology that is practiced throughout the world and continues to be considered a viable option among water supply planners in the United States. According to the International Desalination Association, as of 2011:

- There are nearly 16,000 desalination plants operating in 150 countries.
- They produce 17.5 billion gallons of water per day.
- They provide 300 million people with some or all of their daily water needs.

It is the only climate independent water source available; other alternative water sources, such as water recycling or stormwater harvesting, require water entering from another part of the water cycle to make them feasible.

Desalination Challenges Being Addressed through Advances in Technology

Energy Demands and GHGs
One of the primary challenges to desalination as a viable water supply option is its energy requirements. Although the desalination process does not directly produce greenhouse gases (GHGs), there is a carbon footprint associated with the power that is used/purchased—similar to the way emissions are attributed to electricity used in a home or business.

There are several ways to reduce the greenhouse gas emissions associated with desalination plants, including reducing the total energy requirements of the plant; using renewable energy sources to power the desalination plant; and purchasing carbon offsets.

The energy requirements for desalination have declined substantially over the past 20 years due to technological advances, including the use of energy recovery devices, higher efficiency pumps, and more permeable membranes. Energy recovery devices, which are standard in most desalination plants, recover up to 96 percent of the energy that is contained within the brine concentrate. Another key factor that has contributed to the dramatic decrease of seawater desalination costs (and energy requirements) over the past 10 years is advances in reverse osmosis membrane filtration technology, including greater surface area, enhanced permeability, and denser membrane packing.

Marine Life
Appropriately sited, designed, and operated seawater desalination plant intakes can have minimal environmental impacts on the marine environment and resources. In fact, based on recent studies, impingement and entrainment resulting from well-planned and designed open-ocean intakes would be the equivalent of the daily food intake of one pelican and the loss of the annual bio-productivity of five adult female halibut, respectively.* Ongoing developments in impingement and entrainment reduction technology, combined with the existing wealth of knowledge and experience in this field, both domestically and internationally, pave the way for maintaining sustainable and environmentally safe production of fresh water from the ocean.

Seawater intake screens designed with small openings can draw in water at a low-intake velocity and minimize impacts on marine life.

What Is Desalination?

Desalination is the process of removing dissolved salts and minerals from seawater or brackish water. It is also called desalting or by its shortened name, desal. Desalination produces drinking water and brine concentrate (the water that contains the salts that were removed in the desalination process; in seawater desalination this is sometimes called brine for short).

The two most common desalination technologies are membrane and thermal. Membrane processes rely on permeable membranes to separate salts from water. Membrane processes can be pressure-driven (reverse osmosis or RO) or voltage-driven (electrodialysis). The dominant technology used in desalination today is reverse osmosis, which involves forcing water through semipermeable membranes to remove salts and other impurities. The thermal process involves heating saline water to produce water vapor, which is then condensed and collected as fresh water.

Most of the modern interest in desalination is focused on developing cost-effective ways of providing fresh water for human use in regions where there is a scarcity of fresh water. Although seawater desalination projects often face some environmental and economic challenges, these challenges can be successfully addressed by carefully selecting the project site, implementing state-of-the-art intake and concentrate discharge technologies, and incorporating energy-efficient and environmentally sound equipment and systems.

*Desalination Plant Intakes Impingement and Entrainment Impacts and Solutions, White Paper March 2011; Revised June 2011 www.watereuse.org/sites/default/files/u8/IE_White_Paper.pdf

Desalination in the United States

In the U.S. there are more than 250 municipal desalination plants, including brackish and seawater desalination plants. In some states—such as Texas, Florida, and California—water scarcity has forced many utilities to consider using desalination to supplement their water portfolios.

Texas currently has an estimated total municipal desalination capacity of about 123 million gallons per day (mgd) which includes 73 mgd (about 81,760 acre-feet (AF) per year) of brackish groundwater desalination and 50 mgd (about 56,000 AF per year) of brackish surface water desalination.

Today, Florida has more than 150 desalination facilities, with a combined capacity of more than 515 mgd, which accounts for nearly 25 percent of Florida's total water supply.

While California lags behind Texas and Florida, there are 19 coastal seawater projects in the planning or construction stages, according to a 2013 report by the Pacific Institute. Interest remains high in desalination for the same reasons that it is a water source for millions worldwide. It is a weather-independent water supply in a state that relies heavily on imported water that is reliant on snowfall.

Santa Barbara's Full Story
The City of Santa Barbara and two neighboring water districts built a desalination facility in the late 1980s in response to a severe drought that lasted from 1986 to 1991. The plant was built for $34 million and was in operation for only a short time when voters approved a bond measure to connect with the State Water Project, and the drought ended. Since that time, the city has had sufficient water supplies, and the desalination facility has been in deactivation mode. City officials view the plant as a long-term insurance plan in the event of a severe or extended drought. The plant is capable of producing 3,125 AF of water per year and would cost approximately $20 million to reactivate. Operating costs are estimated to be $1,500 per AF.

The plant remains part of their long-term drought portfolio and is available in the future if needed.

Brackish Water Desal in Texas
There are currently 46 municipal brackish water desalination facilities in Texas, with a total design capacity of 123 mgd. The majority of the facilities use brackish groundwater as a raw water source and all but two of the plants use reverse osmosis technology, according to the Texas Water Development Board. In addition to municipal desalination, industrial desalination capacity in the state is 60 to 100 mgd, mainly in the power and semiconductor industries. The average cost to produce an acre-foot of desalinated water from brackish groundwater ranges from $357 to $782.

The state is also exploring seawater desalination as a water supply option as part of its Seawater Desalination Initiative, established in 2002. Two pilot plants in the Brownsville region were constructed, and voters in the Laguna Madre Water District approved a bond proposition to build a 1 mgd seawater desalination plant. Construction of the plant is envisioned for a future date.

Reverse osmosis, which forces water through semipermeable membranes to remove salt, is the dominant technology used today in desalination.

Largest Desal Plant in the U.S.
The largest desalination plant in the U.S. is in Tampa Bay. The Tampa Bay Seawater Desalination facility is a drought-proof, alternative water supply that provides up to 25 mgd of drinking water to the region, up to 10 percent of the region's needs. As of 2012, South Florida has 33 brackish and two seawater desalination plants operating with an additional seven brackish water plants under construction. These desalination plants have the capacity to produce 245 mgd of potable water.

For information on how other communities are using desalination techniques effectively, please visit the links below:

Carlsbad, CA: carlsbaddesal.com • **Australia:** desalination.edu.au

El Paso, TX: epwu.org/water/desal_info.html

Tampa Bay, FL: tampabaywater.org/tampa-bay-seawater-desalination-plant.aspx

El Segundo, CA: westbasin.org/water-reliability-2020/ocean-water-desalination/west-basins-approach

www.watereuse.org/foundation
WateReuse Research Foundation
1199 North Fairfax Street, Suite 410
Alexandria, VA 22314
Phone: (703) 548-0880
Fax: (703) 548-5085

Rev. Summer 2014

Date

YOUR Desalination Project Name

How To Develop a Desalination Fact Sheet

Instructions: The reason you are creating this background fact sheet is your community has a water problem. This is where you describe that problem as it exists today and what you are doing to solve it. With water supply problems, there is no need to overstate the situation—it is probably serious enough and does not need to be exaggerated. Describe the problem and follow that with a description of how the proposed desalination project will solve the water problem. Use this space for a brief description.

This is Why We Need Desalination

Clearly describe your water problem and why the project is needed. An introduction might read as follows: *Our community faces the prospect of long-term water shortages due to lack of rainfall, overdrafted groundwater basin, the likelihood of decreasing amounts of imported water, or all of these. Water planners and elected officials have explored a variety of solutions to our long-term water problem. Studies have been conducted to evaluate various alternative water sources, including additional water conservation, additional surface water storage, aquifer storage and recovery, and expanding our recycled water program. After years of study, our water agency leaders have concluded that seawater desalination is the preferred alternative to provide an adequate water supply for our community's future.*

The desalination project proposed by our water agency will meet our community's water demands, even during times of drought. By desalinating nearby seawater, we will have a drought-proof source of water that will allow us to protect our groundwater basin and prevent overdraft and saltwater intrusion.

Why Desalination is Best Option

Introduce the desal project as the preferred solution that was chosen.

Once the groundwork has been laid as to the purpose and need for the desalination project, the next step is to lay out the reasons that desalination is the preferred option to solve the community's water problem. The questions that should be answered include: How much water is needed? What other options were studied before you chose desal? What are the pros and cons of the other options? When was the last time there were water restrictions? When was the last drought? What decision-making process was followed? Was the decision based on cost? Who was involved in making this decision? Why didn't I hear about it?

Your Community's Water Story

The Water Agency or City Council didn't decide overnight to propose a desalination project. In all likelihood it took years (if not decades) to reach the decision. There is a lot more to the Project Story than the last study or decision point. This story should provide a historical context for how the decision to pursue a desalination project was reached. It should include a brief history of the reports that were prepared and alternatives that were studied, and the public meetings that led to the current proposal. It should explain the community's water supply system. Where does your water come from? How is it stored? How much water do you use on a per capita basis? What type of water conservation programs are in place or planned for the future?

It is important to explain the constraints on your water supply, such as historic rainfall levels, the occurrence of droughts, overdrafted groundwater basins, decreasing availability of imported water, and limits on water diversions from streams to protect endangered species.

The Project Story provides the background information for stakeholders to understand the water system, the changing water supply outlook, and the purpose and need for the project. It forms the basis for the outreach and awareness efforts that will support the success of your desalination project.

Use photos here that illustrate your community's water problem and the potential solutions.

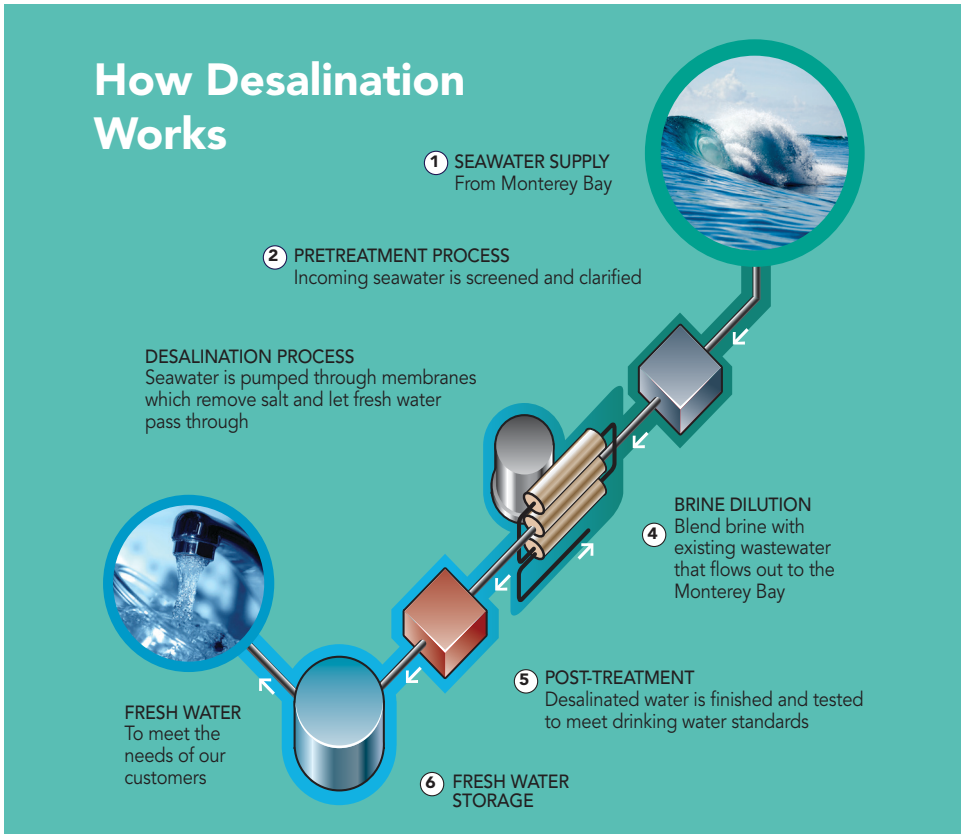
The Proposed Project and Benefits

Describe the project in objective and factual terms—what it is, where it will be located, how much water it will produce, and what is the estimated cost. In general terms, describe how the plant will work. Where will the source water come from? Where will the finished water be stored? How will it be distributed? Outline the benefits of the project, including providing a drought-proof local source of water, protection of the groundwater basin from overdraft and seawater intrusion, or other relevant points.

Because the energy requirements of desalination are a key concern for environmental groups, include the energy saving features that will be included, such as energy recovery devices or renewable energy sources that may be considered. Helpful data can be found in a study that compares the energy requirements for desalinated water to other typical domestic energy uses, such as heating and cooling requirements for a typical household, refrigeration, or the energy requirements of a local hospital. Another factor to consider is the cost of energy to import water versus the cost to produce a local supply. Some communities place an emphasis on avoiding importing water.

What is desalination?

Because many stakeholders may be unfamiliar with how desalination works, it is useful to provide a primer on desalination technology. In the simplest terms, describe the process by which seawater or brackish water is treated, what happens to the brine, and where the drinking water is stored. Develop a diagram of the process so that your readers can more clearly understand it. An example of a diagram developed for the scwd2 project has been provided here.



How will potential impacts of the project be analyzed?

Provide clear and concise information about the environmental review process for the desalination project. Let stakeholders know when they will be able to provide input on the project, who will respond to their comments, and how the decision-making process will work. It can be helpful to provide a graphic of the timeline, with important dates for public hearings and key decision points for elected officials. Emphasize that the review process is inclusive and transparent and that all input is welcome and will be taken into consideration during the decision-making process. Identify dates when members of the public can provide input if these are known.

Checklist of other ideas that have proved useful in other projects:

- A graphic timeline for the environmental review process
- Cost comparisons of desalination versus increasing imported water supplies
- Handout or graphic that compares the energy requirements for desalinated water with other daily activities. For example, see www.scwd2desal.org/documents/Fact_Sheets/EnergyHandout_FinalLo2.pdf

How To Get More Information

Contact name, phone number, email address

How to sign up for email notices

YOUR LOGO HERE

website

En Español

Chapter 5

Importance of Communicating About a Desalination Project

5.1 Why Communicate About Desalination?

Public understanding and support are critical to the success of desalination projects. Delivering the right messages—at the right time, in the right context, and to the right audiences—are keys to the successful implementation of a public communication plan for a desalination project. Developing and delivering these critical messages are at the heart of a strategic outreach and awareness plan.

5.2 The Challenges of Desalination

As many communities consider desalination as a sustainable water source that can bolster their water portfolios, agencies proposing desalination projects must answer questions about energy usage, brine concentrate disposal, and the impacts to marine life. Any new water project—whether a dam, reservoir, or recycled water project—can face significant hurdles when it comes to public acceptance. Desalination is no different and has its own unique set of challenges. In order to help water providers bring these projects to fruition, robust public outreach programs must be implemented to build trust within communities, elicit stakeholder input, and contribute to public understanding and support.

5.3 Developing Effective Messages is Crucial

The development and delivery of effective and clear messages is the foundation of a successful strategic outreach and awareness plan. One of the fundamental findings in our research was that the communication and outreach efforts must be tailored to specific projects. There is no "cookie-cutter" approach to the design and implementation of a desalination project; neither is there a single approach to developing a communication plan. Each community or region's water supply situation, political climate, and regulatory environment are unique to their location and require a carefully tailored approach to outreach and awareness efforts.

For example, there is a correlation between the perceived need for an additional water supply and the level of community support for desalination. Regions with a history of water supply shortages, in particular when those shortages have had a direct impact on the quality of life and economy of the community, clearly enjoy more support for desalination projects. Not surprisingly, those communities that have been getting by with existing supplies and have not been inconvenienced by shortages, are less inclined to support desalination. Messages that place a proposed desalination project in the larger context of the community's long-term water supply needs are effective in generating community support.

5.4 Strategic Outreach and Awareness Plan

A strategic outreach and awareness plan should serve as the framework for all the communication efforts that take place in support of a desalination project. The outreach plan

will provide all stakeholders involved in the process—members of the public, elected officials, environmental groups, regulators—with the historical context and information about why the project is being proposed. Understanding the purpose or need for the project will allow stakeholders to make informed and educated decisions about desalination. The backbone of the outreach and awareness plan is message development and delivery. Simply having all the information available if someone wants to see it is not enough. Desalination involves a number of technical and complex processes that must be presented in formats and language that stakeholders can understand. And the outreach plan outlines all the ways that agencies will share information with members of the community about the desalination project.

Developing a strategic outreach and awareness plan and key messages involves these initial steps:

1. Identify your communication goal and objectives
2. Conduct community research such as one-on-one interviews, telephone surveys, and focus groups to identify community interests and concerns and who the supporters and opponents are
3. Develop your key messages, as well as the strategies and outreach activities or tactics that help you accomplish your communication goals and objectives

5.5 Telling Your Project Story

Telling the project water story is the foundation for development of key messages. Creating an understanding of the history of the region's water supply, past projects, studies, and current planning will raise public awareness of the need for desalination and contribute to community support. The project story puts the project in a historical perspective that is easily understood and lays out the review process and decisions that were made to select desalination as the preferred option. These are some of the questions the project water story should answer:

What are the purpose and needs for the project?

- What is the core problem and why is there a water shortage?
- Can't we just conserve more water?

What are the alternatives?

- What other water supply options or alternatives have been explored and/or should be explored further?
- How were those options analyzed?
- How will desalination solve our water problem?

Are there project specific issues?

- Where will the water be used?
- What will happen if we *don't* do the project?
- What are the benefits of the project?
- What are the potential impacts of desalination?
- How much will it cost and when will it be complete?
- Where else is desalination being used to solve water scarcity?

- What are the impacts that may relate to growth, the environment, the community's economic vitality?

5.6 Developing Key Messages for Outreach

The development and delivery of consistent and effective messages are critical to the success of a public outreach program. The information gathered from interviews and surveys should be used in conjunction with the project story to develop the key messages. These messages should be used in outreach materials, talking points, ads, press releases, presentations, and more. The following are some key messages that have been effective in desalination projects:

1. Desalination is a drought-proof, local water supply.
2. Desalination is one of a number of water supply sources and strategies comprising a community's water portfolio.
3. Drought, climate change, and increasing environmental regulation can greatly reduce available water.
4. Desalinating seawater can reduce the overdraft of local groundwater.
5. An adequate local water supply will benefit the local community and economy by providing water for businesses.
6. Advances in technology are reducing the potential impacts of desalination. These include more efficient screening to protect marine life and more efficient filtration devices to reduce energy demands and greenhouse gases.
7. A new source of water from desalination will reduce the dependence on outside sources such as imported water, which can be unreliable.
8. Improves water independence and self-reliance.
9. Desalinated water is a locally controlled resource.
10. Development of any new water supply can be expensive, but only desal provides a significant amount of water supply.

5.7 Delivering the Messages

After the key messages have been developed, it is important to identify the challenges and opportunities for delivery of the messages. Being prepared to deliver the messages in a variety of formats and circumstances will allow the messages to be heard by as many stakeholders as possible.

Challenges from the public, media, stakeholders, elected officials, or regulators could include any of the following:

1. Vocal activists opposing the project for a variety of reasons, including population growth impacts, effects on marine life, desal's energy demands and carbon footprint, and safe disposal of brine concentrate.
2. Elected officials, special interest groups, and other community residents who are either uninformed or misinformed, oppose the project, and intentionally damage the project's reputation.

3. Concern that the cost of the project will raise rates.
4. Regulatory agencies unfamiliar with the technology.
5. Agency's history of unpopular projects.
6. Distrust of the agency or the agency's governing body.

Opportunities for acceptance can come from:

1. Desalination is a drought-proof, local source of water.
2. The uncertainty of future water supplies due to climate change, environmental regulations, overdrafting of groundwater, saltwater intrusion to drinking water wells, lack of alternative supplies without importation of water from a distance.
3. The importance of an adequate, local water supply for the local economy and quality of life.
4. Other funding sources available to offset costs.
5. Pilot projects that demonstrate efficacy of desalination.
6. Public surveys showing support for desalination.

5.8 Identify Key Stakeholder Groups

Stakeholder groups should be identified and strategies developed to make sure each group is contacted and informed about the project. Stakeholder groups can be divided into categories (such as general public, elected officials, businesses, civic groups, environmental organizations, agency employees, policy makers, and potentially affected property owners and businesses) to ensure that a complete list is developed. The main goal of identifying stakeholder groups is to be inclusive and ensure that the concerns of all stakeholders will be addressed. Their concerns should be taken into account as messages and delivery methods are developed. Examples of general categories, and types of groups, that might be included in a list of stakeholders for a desalination project:

1. General public – Water customers, residents living in the area of a proposed desalination plant, members of homeowners associations, civic groups.
2. Environmental groups – Groups such as Surfrider, Save the Bay, the Sierra Club, Food and Water Watch have specific interests in different aspects of proposed desalination projects. For example, opposition from Surfrider may focus on the impacts on marine life, whereas the Sierra Club's primary concerns might be about energy impacts and growth-related issues. They will often have local affiliate groups. Environmental groups will want to ensure conservation measures are being maximized.
3. Elected and appointed officials – Members of boards or councils who are considering the project, city managers, department heads, representatives of neighboring jurisdictions, state and federal officials.
4. Media – Local reporters and editors at newspapers, TV and radio reporters, and web-based news outlets including bloggers and Twitter feeds.
5. Internal staff – Water and Public Works directors and staff, members of the City Manager's or County Administrator's offices, customer service, and finance departments.

Also, identify workers in the field who have regular contact with the public and educate them about the project.

6. Business leaders – Members of local business groups, Chamber of Commerce, building industry association, small business owners, and business leaders will have an interest in water reliability, job creation, and the economic benefits of an adequate water supply.
7. Government agencies – Include agencies with overlapping jurisdictions and regulatory agencies. For example, if the desal project is proposed by a city, be sure to include surrounding cities and counties in your stakeholder outreach. Also include any state or federal agency responsible for oversight, permitting, and/or funding.

5.9 Develop Strategies for Stakeholder Groups

It is important to develop strategies to accomplish communication goals and objectives at the beginning of the planning process. The strategies will need to be revised or modified as circumstances change throughout the market assessments, development of messages and materials, environmental review, permitting, approval, construction, and project start-up. These changes will affect the development of informational materials and other outreach tactics. Because the needs and interests of each stakeholder group will vary, it is important that goals and strategies be developed for each individual stakeholder group. Strategies and key messages should be updated to reflect progress on the project's planning, design, and construction. Examples of these strategies and tasks include:

1. Start communicating to stakeholders during the planning phase.
2. Continuity is a key—maintain communication even during lulls or quiet periods.
3. Maintain communication during the construction phase.
4. Communication should be ongoing in all formats—newsletters, websites, emails, etc.
5. Establish a good relationship with the media. Be accessible, open and honest.
6. Provide reporters and editors with background, context, and objective sources.
7. Be direct in addressing the issues raised by project opponents.
8. Maintain close contact with elected officials throughout the life of the project.
9. Always be available to respond to media inquiries and requests.
10. Prepare a crisis plan in the event of emergencies or unexpected events.
11. Meet with regulators regularly and keep them informed and up-to-date on the project.
12. Keep agency staff informed and in the loop—they are often who the public sees or talks to first.
13. Schedule meetings and presentations with community and special interest groups, such as civic organizations, business, environmental, and agricultural groups.

5.10 Questions the Public and Other Stakeholders Will Probably Ask

There are many questions that will be asked by stakeholders during the planning, review, and construction of a desalination project. Being prepared for the most challenging questions

ensures that you appear informed, prepared, and that the process is transparent. Questions may include:

1. Why can't we just conserve more water?
2. Have you installed low-flow fixtures in every home or business?
3. Have you explored all other supply options or alternatives?
4. How were those options analyzed?
5. How will desalination solve our water problem?
6. Doesn't desalination use a lot of energy?
7. Why would you consider an energy-intensive technology given what we know about climate change and greenhouse gases?
8. How are you addressing the environmental impacts of the project?
9. How will you dispose safely of the brine concentrate?
10. How will you protect the marine life that could be harmed?
11. How much will it cost and when will it be complete?
12. How will it be financed? What is the total cost?
13. Where else is desalination being used to successfully solve water scarcity?
14. Won't this contribute to growth?
15. How will this affect my water bill?
16. Why are you building it in my neighborhood?

5.11 Delivering the Message

The creation of a suite of communication materials and message delivery tools is a key element of a strategic outreach plan. With the advent of social media and the prevalence of the internet, the reach of communication tools extends beyond the traditional printed materials. Printed matter is still important—many stakeholders want to have a takeaway handout that they can refer to later—but that is just one instrument in a larger toolkit. Printed materials, such as fact sheets and brochures, complement face-to-face discussions and presentations. A segment of each stakeholder group can be reached through social media, such as Twitter and Facebook, and these new media should be incorporated into an outreach plan. A well-managed Facebook page can expand the audience a project reaches, demonstrate support and sometimes criticism, and provide a venue for timely updates. A dynamic and user-friendly website is an indispensable element of any outreach program.

One of the first steps in developing outreach materials is creating a consistent look and feel for all materials, including the project website, handouts, and awareness ads. Some agencies develop a name and logo for their desalination projects, particularly if they are partnering with other agencies. Figure 3.1 lists some of the materials and media to consider for creating communication tools and the groups they are designed to reach (see page 20).

5.12 Most Significant Challenges

Among the most significant public acceptance challenges desal projects have faced were communicating the purpose and need for the project, educating the public about their water sources and the true cost of water, cost of desalination, energy demands, impacts on marine life, growth inducement perceptions, environmental impacts, project location, and construction impacts.

The most significant regulatory and political challenges include the number of regulating agencies and the time-consuming and sometimes onerous regulatory process. Some of those surveyed had adversarial relationships with regulatory agencies, whereas others reported success in educating regulators about their project. Some reported it was helpful to create public and political support to help move projects through approval processes.

The greatest overall challenge to educating the public, elected officials, and the media about using desalination as a new water source was getting people to understand the drivers for new water supplies and how desalination fits into a community's water supply portfolio. There is a perception that the public takes water for granted and lacks basic knowledge about their water systems, which suggests that it is important to include basic knowledge of water systems and supply as part of the message delivery program.

5.13 Summary of Strategies for Success

Here is a list of strategies that have been effective in other outreach campaigns for desalination and water supply projects:

1. Start by developing an outreach and awareness plan that has the support of the project team and agency.
2. Conduct community research—We strongly recommend conducting a survey to shape your communications. A telephone survey that is demographically reflective of your community is a starting point for messaging—it is critical to find out what the community thinks about the project. In addition to telephone surveys, in-person iPad surveys, exit surveys, and even focus groups have all contributed and proved useful in planning effective communication programs. In addition, one-on-one interviews can help provide basic information for developing effective outreach messages and tools.
3. Allocate an adequate budget for staff and/or consultants to carry out public notifications, outreach, and awareness efforts throughout all project phases.
4. Develop the agency's Project Story that puts the desalination project in a historical perspective and in context with other water supplies and water conservation, explains what studies have led to the current alternative, and lays out the purpose and need for the project.
5. Reach out early to all the key stakeholder groups and involve them in the initial planning process. Listen and respond to their concerns. Keep them informed throughout project phases and continue to be the voice and informational resource of the project.
6. Talk early and often to the community. Address critics' concerns and fears.
7. Regarding potential greenhouse gas effects, consider finding ways to access renewable power portfolios.

8. Keep elected officials in the loop—maintain close communication with elected officials throughout the life of the project. Elections are likely to occur before the project is operational and new officials need to be briefed and kept informed.
9. Be as transparent as possible (if possible, hold site visits to the plant). Transparency builds trust.
10. Report any mishaps. Develop a crisis plan for any incidents or emergencies.
11. Seek the support of elected officials. The governing board of any agency controls the budgets, timelines, and approval process. Keeping the mayor or board chair involved every step of the way is essential to a successful project. Elicit the leadership of elected officials in informing the public.
12. Maintain good media relations. Establish a good rapport with editors and reporters. Be open, transparent, and available. Provide all the information they need to cover the desalination story fairly. Meet with local newspapers' editorial boards and other key media outlets periodically and prior to project milestones and decision points. Include a social media program that provides up-to-date information to the media and all other stakeholders.
13. Have a team available to the community to directly answer questions.
14. Be available to attend community functions.
15. Communicate with other agencies and jurisdictions. Your project does not exist in a vacuum. Establish communication with outside agencies, neighboring cities, and jurisdictions. Their understanding and support is important.
16. Meet early and often in the planning process with regulators and agencies that will be involved in permitting or regulating the project to ensure they understand what is being proposed. This will avoid unexpected hurdles or surprises.
17. Focus on political leaders, people who support them, chambers of commerce, and other community leaders (people who can affect public opinion in a negative or positive way).
18. Identify a champion who can communicate and relate to an audience; have your champion with you the whole time.
19. Gain support from key groups—they will almost do the work for you.
20. Make sure you have the best experts in the subject matter you are dealing with all lined up; know and have your facts straight.
21. Learn from others that have been successful in your region or around the world.

Appendix

A.1 Link Library

As water supplies become scarcer in certain areas of the world, the search for new water supplies may include desalination of brackish water or ocean water. The personnel assigned to develop a communication program for a water agency considering desalination as their water supply for the future may be hard pressed to know just where to begin. A Google search for "desalination" yields numerous references, and it can be a daunting task to separate helpful references from more technical articles or specific program material. This Link Library (Table A.1) was developed to bridge that gap and provide a starting point for communication professionals who need background information or want to understand what others have experienced as their desalination project moves from concept, to design, construction, and operation. The library is not definitive—it does not include every article, video, fact sheet, or report on desalination. But it does include a broad sampling and provides a starting point for those who want to broach the subject of desalination in their communities.

The document title, author, publication date (if available), and the agency or source for each document are included. Also included is an online link to access most of the documents in the library. If they are no longer available online, the available format is noted and the document may be requested from the agency that published it.

Here is what you will find in this document:

- Websites: A variety of websites have been included to provide background information and show the types of information that can be included for a project website. Also included are some websites that have technical information, including information about specific desalination processes, and one that purports to debunk myths of desalination. The websites are further sorted into groupings as follows:
  (a) International (coded as yellow)
  (b) Desal Industry Group (coded as green)
  (c) Government Sites (coded as orange)
  (d) Public agencies or projects (coded as blue)
  (e) Environmental Groups (coded as red)
- Reports (coded as aqua): There are a variety of documents included in this category. Most identify issues that may be raised by proponents and opponents of desalination and can help prepare agency staff for issues they may encounter when examining whether desalination is the right water source for their community. The reports include documents prepared by state agencies, environmental groups, water agencies, and more.
- Handouts (coded as purple): This category includes materials developed for specific projects such as fact sheets, brochures, FAQs, white papers, and more. It is easy to see that informational materials must be developed to address each very specific situation—one size does not fit all. But the Link Library includes a sampling of informational materials that will help guide the novice who wants to develop materials to describe what his or her agency will do with desalination.

- Publications and Journal Articles (coded as grey): Journals focusing on desalination or water reuse and desalination are listed here. These may include informative articles about communication programs. There is also a technical paper about public outreach challenges encountered by the desalination project proposed for Santa Cruz, California.
- News stories (coded as blue): Desalination projects have received positive and negative media coverage. Agencies considering desalination projects should be aware that they could experience and need to respond to a wide variety of news articles. The articles chosen for inclusion in the library are representative of media coverage and can be instructive as to the scope of reporting the communication professional can anticipate.

A.2 Video Library

Similar to the link library for print documents, the video library (Table A.2) includes a sampling of the thousands of videos that are available on YouTube and in other areas. The videos in the library are included to illustrate how a specific project might be portrayed, as well as to provide a general background on desalination or one aspect of the desalination process.

They are sorted as follows:

- International (coded as yellow)
- Florida (coded as green)
- Texas (coded as blue)
- California (coded as gold)

Table A.1 Link Library

Category	Title	Author	Date	Source	Link
INTERNATIONAL WEBSITES & PROJECTS					
Website	Adelaide Desalination Plant	Government of South Australia	N/A	Government of South Australia	http://www.sawater.com.au/sawater/whatsnew/majorprojects/adp.htm
Website	Australian Water Association	Australian Water Association	N/A	Australian Water Association	https://www.awa.asn.au/
Website	Caribbean Desalination Association	Caribbean Desalination Association	N/A	Caribbean Desalination Association	http://www.caribda.com/
Website	Desalination	Water Corporation Australia	N/A	Water Corporation Australia	http://www.watercorporation.com.au/water-supply-and-services/solutions-to-perths-water-supply/desalination
Website	Desalination Facts	Australian Water Association	N/A	Australian Water Association	http://www.awa.asn.au/DesalinationFacts.aspx
Website	European Desalination Society	European Desalination Society	N/A	European Desalination Society	http://www.edsoc.com/
Website	Gold Coast Desalination Plant	Halcrow	N/A	Halcrow	http://www.halcrow.com/Our-projects/Project-details/Desalination-plant-Australia/
Website	International Desalination Association	International Desalination Association	N/A	International Desalination Association	http://www.idadesal.org/
Website	International Water Association	International Water Association	N/A	International Water Association	http://www.iwahq.org/1nb/home.html
Website	Israel Desalination Society	Israel Desalination Society	N/A	Israel Desalination Society	http://www.ildesal.org.il/
Website	Middle East Desalination Research Center	Middle East Desalination Research Center	N/A	Middle East Desalination Research Center	http://www.medrc.org/
Website	National Centre of Excellence in Desalination (Australia)	National Centre of Excellence in Desalination (Australia)	N/A	National Centre of Excellence in Desalination (Australia)	http://desalination.edu.au/
Website	Nuclear Desalination	World Nuclear Association	9/1/13	World Nuclear Association	http://world-nuclear.org/info/Non-Power-Nuclear-Applications/Industry/Nuclear-Desalination/#.UlW3NhBnEl5
Website	The Victorian Desalination Plant	State Government of Victoria	2/13/13	State Government of Victoria	http://www.water.vic.gov.au/initiatives/desalination

Category	Title	Author	Date	Source	Link
DESALINATION INDUSTRY GROUP WEBSITES					
Website	A Thirsty Planet	A Thirsty Planet	N/A	A Thirsty Planet	http://www.athirstyplanet.com/
Website	CalDesal	CalDesal	N/A	CalDesal	http://www.caldesal.org/
Website	Desalination and Water Purification	Sandia National Laboratories	N/A	Sandia National Laboratories	http://www.sandia.gov/water/desal/
Website	National Water Research Institute	National Water Research Institute	N/A	National Water Research Institute	http://www.nwri-usa.org/
Website	Southeast Desalting Association	Southeast Desalting Association	N/A	Southeast Desalting Association	http://www.southeastdesalting.com/
Website	Texas Desalination Association	Texas Desalination Association	N/A	Texas Desalination Association	http://texasdesal.org/index.php
Website	Water Research Foundation	Water Research Foundation	N/A	Water Research Foundation	http://www.waterrf.org
Website	WateReuse Association	WateReuse Association	N/A	WateReuse Association	http://www.watereuse.org/

Category	Title	Author	Date	Source	Link
GOVERNMENT WEBSITES & PROJECTS					
Website	Brackish Groundwater National Desalination Research Facility	U.S. Department of Interior, Bureau of Reclamation	N/A	U.S. Department of Interior, Bureau of Reclamation	http://www.usbr.gov/pmts/water/research/tularosa.html
Website	Center for Inland Desalination Systems	University of Texas El Paso	N/A	University of Texas El Paso	http://research.utep.edu/Default.aspx?alias=research.utep.edu/cids
Website	Desalination Facilities and Brine Disposal	State Water Resources Control Board	N/A	State Water Resources Control Board	http://www.waterboards.ca.gov/water_issues/programs/ocean/desalination/
Website	North Cameron Regional Water Supply Corporation: Brackish Groundwater Desalination Guidance Manual	Texas Water Development Board	6/29/05	Texas Water Development Board	http://www.twdb.state.tx.us/innovativewater/desal/projects/northcameron/
Website	Saline water: Desalination	U.S. Geological Survey (USGS)	8/19/13	USGS	http://ga.water.usgs.gov/edu/drinkseawater.html
Website	Sand City Desalination Project	California Division of Ratepayer Activists	N/A	California Division of Ratepayer Activists	http://www.dra.ca.gov/hpage.aspx?pageid=1069
Website	U.S. Bureau of Reclamation/Desalination	U.S. Bureau of Reclamation/Desalination	N/A	U.S. Bureau of Reclamation/Desalination	http://www.usbr.gov/pmts/water/desalination/
Website	UTEP Center for Inland Desalination Systems	University of Texas El Paso	N/A	University of Texas El Paso	http://research.utep.edu/Default.aspx?alias=research.utep.edu/cids

Category	Title	Author	Date	Source	Link
PUBLIC AGENCY WEBSITES & PROJECTS					
Website	Bay Area Regional Desalination Project	Bay Area Regional Desalination Project	N/A	Bay Area Regional Desalination Project	http://www.regionaldesal.com/
Website	Bay Area Regional Desalination Project	East Bay Municipal Utility District	N/A	East Bay Municipal Utility District	http://www.ebmud.com/our-water/water-supply/long-term-planning/desalination-regional-pilot-project
Website	Brackish Groundwater Desalination	San Antonio Water System	N/A	San Antonio Water System	http://www.saws.org/Your_Water/WaterResources/projects/desal.cfm
Website	Brownsville Large-Scale Seawater Desalination Pilot Plant Study	Texas Water Development Board	N/A	Texas Water Development Board	http://www.twdb.state.tx.us/innovativewater/desal/projects/brownsville/index.asp
Website	City of Santa Cruz and Soquel Creek Water District Regional Seawater Desalination Project (scwd2)	scwd2	N/A	scwd2	http://www.scwd2desal.org/Page-Project-phases_EIR_Project_Desc.php
Website	DeepWater Desal	DeepWater Desal	N/A	DeepWater Desal	http://deepwaterdesal.com/
Website	Desalination	City of Santa Barbara	N/A	City of Santa Barbara	http://www.santabarbaraca.gov/gov/depts/pw/resources/system/sources/desalination.asp
Website	Desalination	South Florida Water Management District	N/A	South Florida Water Management District	http://www.sfwmd.gov/portal/page/portal/xweb%20-%20release%203%20water%20supply/desalination
Website	Desalination	Southern Nevada Water Authority	N/A	Southern Nevada Water Authority	http://www.snwa.com/ws/future_desalination.html
Website	Desalination Plant	El Paso Water Utilities	N/A	El Paso Water Utilities	http://www.epwu.org/water/desal_info.html
Website	Ocean Water Desalination	Municipal Water District of Orange County	N/A	Municipal Water District of Orange County	http://www.mwdoc.com/pages.php?id_pge=68
Website	Ocean Water Desalination	West Basin Municipal Water District	N/A	West Basin Municipal Water District	http://www.westbasin.org/water-reliability-2020/ocean-water-desalination/overview
Website	Ocean Water Desalination: West Basin's Approach	West Basin Municipal Water District	N/A	West Basin Municipal Water District	http://www.westbasin.org/water-reliability-2020/ocean-water-desalination/west-basins-approach
Website	Sand City Coastal Desalination Facility (CA)	Sand City	N/A	Water Build Design Council	http://www.waterdesignbuild.com/water-design-build-projects/sandy-city-coastal-desalination-facility-ca/
Website	Sand City Coastal Desalination Plant, United States of America	Water-Technology	N/A	Water-Technology	http://www.water-technology.net/projects/sand-city-plant/

Category	Title	Author	Date	Source	Link
PUBLIC AGENCY WEBSITES & PROJECTS					
Website	Seawater Desalination	Long Beach Water Department	N/A	Long Beach Water Department	http://lbwater.org/long-beach-seawater-desalination
Website	Seawater Desalination: Huntington Beach Facility	Huntington Beach Seawater Desalination	N/A	Huntington Beach Seawater Desalination	http://hbfreshwater.com/
Website	South Orange Coastal Ocean Desalination Project	South Coast Water District	N/A	South Coast Water District	http://www.scwd.org/services/potable/oceandesal.asp
Website	Tampa Bay Seawater Desalination Plant	Tampa Bay Water	N/A	Tampa Bay Water	http://www.tampabaywater.org/tampa-bay-seawater-desalination-plant.aspx
Website	The Carlsbad Desalination Project	City of Carlsbad	N/A	City of Carlsbad	http://carlsbaddesal.com/

Category	Title	Author	Date	Source	Link
ENVIRONMENTAL GROUP WEBSITES					
Website	San Francisco Baykeeper	San Francisco Baykeeper	N/A	San Francisco Baykeeper	http://baykeeper.org/
Website	Cambria Desalination Project	Desal Response Group	N/A	Desal Response Group	http://www.desalresponsegroup.org/desal_norcal/cambria.html
Website	Debunking the Myth of Desalination	California Coastkeeper Alliance	N/A	California Coastkeeper Alliance	http://www.cacoastkeeper.org/programs/healthy-marine-habitats/desalination
Website	Desal in CA	Desal Response Group	N/A	Desal Response Group	http://desalresponsegroup.org/desalfacts.html
Website	Food and Water Watch	Food and Water Watch	N/A	Food and Water Watch	http://www.foodandwaterwatch.org/water/desalination/
Website	Pacific Institute	Pacific Institute	N/A	Pacific Institute	http://www.pacinst.org/
Website	Santa Cruz Desal Alternatives	Desal Alternatives	N/A	Desal Alternatives	http://desalalternatives.org/
Website	Santa Cruz Desalination Campaign	Surfrider	N/A	Surfrider	http://www.surfrider.org/campaigns/entry/santa-cruz-desalination
Website	Sierra Club	Sierra Club	N/A	Sierra Club	http://sierraclub.org/
Website	Texas Sierra Club	Texas Sierra Club	N/A	Texas Sierra Club	http://texas.sierraclub.org/

Category	Title	Author	Date	Source	Link
REPORTS					
Report	California Desalination Planning Handbook	California Department of Water Resources	N/A	California Department of Water Resources	http://www.water.ca.gov/desalination/pud_pdf/Desal_Handbook.pdf
Report	Cost of Brackish Groundwater Desalination in Texas	Texas Water Development Board	7/4/05	Texas Water Development Board	http://www.twdb.state.tx.us/innovativewater/desal/doc/Cost_of_Desalination_in_Texas_rev.pdf
Report	Desalination Guidelines Development for Drinking Water: Background	Joseph A. Cotruvo	8/1/04	World Health Organization	http://www.who.int/water_sanitation_health/dwq/nutdesalination.pdf
Report	Desalination, With a Grain of Salt	Heather Cooley Peter H. Gleick Gary Wolff	6/1/06	Pacific Institute	http://www.pacinst.org/publication/desalination-with-a-grain-of-salt-a-california-perspective-2/
Report	Desalination: A National Perspective	Committee on Advancing Desalination Technology Water Science and Technology Board, Division on Earth and Life Studies, National Research Council of the National Academies	6/30/05	National Academies Press	http://www.nap.edu/openbook.php?record_id=12184&page=R1
Report	Desalination: Is It Worth Its Salt?	Lone Star Chapter of the Sierra Club	12/1/08	Sierra Club	http://www.texas.sierraclub.org/press/Desalination.pdf
Report	Guidelines for Desalination Projects Scope	Sierra Club	4/1/07	Sierra Club	http://www.sierraclub.org/policy/conservation/desalination-guidelines.pdf
Report	Key Issues for Desalination in California: Cost and Financing	Heather Cooley Newsha Ajami	11/1/12	Pacific Institute	http://www.pacinst.org/publication/costs-and-financing-of-seawater-desalination-in-california/
Report	Key Issues for Seawater Desalination in California: Energy and Greenhouse Gas Emissions	Heather Cooley Matthew Heberger	5/1/13	Pacific Institute	http://www.pacinst.org/reports/desalination_2013/energy/
Report	Key Issues in Seawater Desalination in California: Proposed Seawater Desalination Facilities	Heather Cooley Kristina Donnelly	7/1/12	Pacific Institute	http://www.pacinst.org/publication/key-issues-in-seawater-desalination-proposed-facilities/
Report	Public Opinion Survey	Gene Bregman & Associates	12/21/10	Gene Bregman & Associates Bill Kocher, Water Director, Santa Cruz Water Department	http://www.scwd2desal.org/documents/Reports/SoquelCreekWD2010Memo.pdf

Category	Title	Author	Date	Source	Link
REPORTS					
Report	Public Perception of Desalinated Versus Recycled Water in Australia	Sara Dolnicar, A.I. Schafer	6/28/05	University of Wollongong, University of Edinburgh	http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1145&context=commpapers
Report	Summary Report: Introduction to Desalination Technologies in Australia	Australian Agriculture, Fisheries & Forestry - Australia	12/20/12	Australian Government, Department of Environment	http://www.environment.gov.au/water/publications/urban/pubs/desalination-summary.pdf
Report	Assessing Seawater Intake Systems for Desalination Plants	Erin Mackey, Nicki Pozos, Wendie James, Tom Seacord, Henry Hunt, David Mayer	1/1/11	Water Research Foundation	http://www.waterrf.org/Pages/Projects.aspx?PID=4080
Report	Guidelines for Implementing Seawater and Brackish Water Desalination Facilities	Robert Raucher, Janet Clements, Pei Xu, Jeff Oxenford, John Ruetten, Zororai Choto, Robert Reiss	1/1/10	Water Research Foundation	http://www.waterrf.org/Pages/Projects.aspx?PID=4078

Category	Title	Author	Date	Source	Link
HANDOUTS					
Handout	Adelaide Desalination Plant at a Glance	Government of South Australia	N/A	Government of South Australia	http://www.sawater.com.au/NR/rdonlyres/50026806-5623-4AAB-93A5-6C85F780546E/0/ADPFactsheet_AtaGlance.pdf
Handout	Committed to Providing Reliable Water Through Ocean-Water Desalination	West Basin Municipal Water District	N/A	West Basin Municipal Water District	http://www.westbasin.org/files/pdf/ocean-desal-fact-sheet-final-summer-2010.pdf
Handout	Desalination in Australia	National Centre of Excellence in Desalination	N/A	National Centre of Excellence in Desalination	http://desalination.edu.au/2012/10/desalination-in-australia-fact-sheet/#.UknGUT9nEl4
Handout	Desalination of Ground Water: Earth Science Perspectives	William M. Alley	10/1/03	USGS	http://pubs.usgs.gov/fs/fs075-03/
Handout	Desalination: Environmental Management	Government of South Australia	N/A	Government of South Australia	http://www.sawater.com.au/NR/rdonlyres/FC01714C-AD40-4D89-ABA9-1A348FC67C74/0/ADPFactsheet_EnvironmentalManagement.pdf

Category	Title	Author	Date	Source	Link
HANDOUTS					
Handout	Desalination: From Ocean to Tap	Government of South Australia	N/A	Government of South Australia	http://www.sawater.com.au/NR/rdonlyres/A00F0A00-7DE4-4B04-B86E-DE8691D361EC/0/ADPFactsheet_FromOceantoTap.pdf
Handout	Desalination: Marine Monitoring	Government of South Australia	N/A	Government of South Australia	http://www.sawater.com.au/NR/rdonlyres/7689F5CE-F540-4209-BACE-2766ACAEEECB/0/ADPFactsheet_MarineMonitoring.pdf
Handout	Desalination: Operating the Adelaide Desalination Plant	Government of South Australia	N/A	Government of South Australia	http://www.sawater.com.au/NR/rdonlyres/D05260C7-8177-4EDF-970E-A678A10C2797/0/ADPFactSheet_OperatingThePlant.pdf
Handout	Desalination: Preparing for Drinking	Government of South Australia	N/A	Government of South Australia	http://www.sawater.com.au/NR/rdonlyres/FE37B83F-DEBB-4427-96E5-83555D4AA367/0/ADPFactsheet_PreparingWaterForDrinking.pdf
Handout	Desalination: What It Is and How Does It Work	Government of South Australia	N/A	Government of South Australia	http://www.sawater.com.au/NR/rdonlyres/7A1D5AC6-BAC8-4A42-AFC1-530FCF372535/0/ADPFactsheet_HowdoesitWork.pdf
Handout	National Centre of Excellence in Desalination Fact Sheet	National Centre of Excellence in Desalination	N/A	National Centre of Excellence in Desalination	http://desalination.edu.au/2012/10/nceda-fact-shee/#.UknG1D9nEl4
Handout	Pilot Test Fact Sheet	Bay Area Regional Desalination Project	6/1/09	Bay Area Regional Desalination Project	http://www.regionaldesal.com/downloads/BARDP%20Pilot%20Test%20Fact%20Sheet_June2009.pdf
Handout	Preliminary Design and Environmental Study Fact Sheet	Bay Area Regional Desalination Project	1/1/10	Bay Area Regional Desalination Project	http://www.regionaldesal.com/downloads/012710RDPFactSheet-WRDA.pdf
Handout	Rockingham Desalination Research Facility Fact Sheet	National Centre of Excellence in Desalination	N/A	National Centre of Excellence in Desalination	http://desalination.edu.au/2012/10/rockingham-desalination-research-facility-fact-sheet/#.UknGsz9nEl4
Handout	Seawater Desalination in California: Key Desalination Facts	California Coastal Commission	N/A	California Coastal Commission	http://regionaldesal.com/downloads/california_coastal_commission.pdf
Handout	Tampa Bay Seawater Desalination Project Fact Sheet	Tampa Bay Water	7/2/05	Tampa Bay Water	http://www.tampabaywater.org/Portals/0/desal-fact-sheet.pdf
Handout	The Facts on the Proposed Hudson River Desalination Plant	Riverkeeper	N/A	Riverkeeper	http://www.riverkeeper.org/wp-content/uploads/2012/02/Desalfactsheet-FINAL.pdf
Handout	White Papers & Handouts	City of Santa Cruz & Soquel Creek Water District	12/1/10	City of Santa Cruz & Soquel Creek Water District	http://www.scwd2desal.org/Page-Documents_FactSheets.php

Category	Title	Author	Date	Source	Link
PUBLICATIONS and JOURNALS					
Publications & Journals	Desalination	Various	N/A	The International Journal on the Science and Technology of Desalting and Water Purification	http://www.journals.elsevier.com/desalination/
Publications & Journals	Desalination & Water Reuse	Desalination & Water Reuse	N/A	Desalination & Water Reuse	http://www.desalination.biz/
Publications & Journals	Desalination and Water Reuse	Various	11/1/09	International Desalination Association Journal, AWWA	http://mydigimag.rrd.com/publication/?i=25998
Publications & Journals	Desalination Engineering: Planning & Design	Nikolay Voutchkov	N/A	Water Environment Federation	https://www.e-wef.org/Default.aspx?TabId=192&ProductId=19504263
Publications & Journals	Public Outreach for Desal - Facing the Challenges	Barry Dugan Mark Millan Melanie Mow Schumacher	3/18/13	Data Instincts Soquel Creek Water District	http://www.watereuse.org/sites/default/files/u3/Mark%20Milland%20and%20Melanie%20Mow%20Schumacher.pdf
Publications & Journals	World Water: Water Reuse & Desalination Magazine	Water Environment Federation	N/A	Water Environment Federation	http://www.wef.org/waterreusemagazine/

Category	Title	Author	Date	Source	Link
NEWS ARTICLES					
News Article	Amid Drought, Water Desalination Gets Attractive	Juan Carlos Llorca	1/5/12	Bloomberg Businessweek	http://www.businessweek.com/ap/financialnews/D9S2SKUO0.htm
News Article	Arid Australia Sips Seawater, but at a Cost	Norimitsu Onishi	7/10/10	New York Times	http://www.nytimes.com/2010/07/11/world/asia/11water.html
News Article	Baykeeper Questions the Bay Area Regional Desalination Project	Ian Wren	6/15/11	Baykeeper	http://baykeeper.org/blog/baykeeper-questions-bay-area-regional-desalination-project
News Article	For Santa Cruz, Desalination Could Be Part of the Answer to Global Warming	Brent Haddad	12/8/12	Santa Cruz Sentinel	http://www.santacruzsentinel.com/opinion/ci_22154340/brent-haddad-santa-cruz-desalination-could-be-part

Category	Title	Author	Date	Source	Link
NEWS ARTICLES					
News Article	Californians Need Water, But Desalination Projects Are Bogged Down	Tiffany Hsu	12/4/10	Los Angeles Times	http://articles.latimes.com/2010/dec/04/business/la-fi-desalination-20101204
News Article	Callegeri: Texas Needs Seawater Desalination	State Rep. Bill Callegeri	4/28/12	Amarillo Globe News	http://amarillo.com/opinion/opinion-columnist/guest-columnist/2012-04-28/texas-needs-seawater-desalination
News Article	Cambria Desalination Plan Dealt a Blow	Kathe Tanner	12/15/11	San Luis Obispo Tribune	http://www.sanluisobispo.com/2011/12/15/1873380/cambria-desalination-plan-dealt.html
News Article	Cambria Desalination Study Fails Consistency Test	D&WR	1/1/12	D&WR	http://www.desalination.biz/news/news_story.asp?id=6275&title=Cambria+desalination+study+fails+consistency+test
News Article	Camp Pendleton Desal Project to Be Added to Clean Water Act Master Plan Portfolio	Joe Naiman	2/7/13	Fallbrook/Bonsall Village News	http://www.thevillagenews.com/story/69249/
News Article	Camp Pendleton Tapped for Possible Desal Plant	Rob Davis	5/25/09	Voice of San Diego	http://www.voiceofsandiego.org/environment/article_96e7c69e-a626-5f77-9b4f-e76131ec23fa.html
News Article	Carlsbad Desalination Plant Creates Jobs, May Lead to Water Bill Increase for San Diegans	Natasha Zouves	1/30/13	10 News San Diego	http://www.10news.com/home/homepage-showcase/desalination-plant-creates-jobs-raises-water-bill-for-san-diegans
News Article	Coastal California City Turns to Desalination to Quench Its Thirst	Larry Greenemeier	4/7/10	Scientific American	http://www.scientificamerican.com/article.cfm?id=california-desalination-reverse-osmosis&page=2
News Article	Customer Costs Still Uncertain for New Water Supply	Deborah Sullivan Brennan	11/17/12	UT San Diego	http://www.utsandiego.com/news/2012/nov/17/customer-costs-for-new-water-supply-still/
News Article	Desal Plant Decision Looms for Region	Mike Lee	8/9/12	UT San Diego	http://www.utsandiego.com/news/2012/aug/09/desal-plant-decision-looms-region/
News Article	Desalination—Pros and Cons of a Typically Thorny Issue	Mark Anslow	6/1/08	The Ecologist	http://www.theecologist.org/News/news_analysis/269784/desalination_pros_and_cons_of_a_typically_thorny_issue.html
News Article	Desalination a Big Part of Texas' Water Future	Jeannie Kever	11/14/11	Houston Chronicle	http://www.chron.com/news/houston-texas/article/Desalination-a-big-part-of-Texas-water-future-2269050.php

Category	Title	Author	Date	Source	Link
News Article	Desalination and You	Mikaela Todd	9/18/12	Santa Cruz Good Times Weekly	http://www.gtweekly.com/index.php/santa-cruz-news/santa-cruz-environmental-news/4175-desalination-and-you.html
News Article	Desalination Gets a Serious Look	Phoebe Sweet	3/21/08	Las Vegas Sun	http://www.lasvegassun.com/news/2008/mar/21/desalination-gets-serious-look/
News Article	Desalination Group to Host Town Hall	Annie Burris	9/25/07	O.C. Register	http://www.ocregister.com/articles/desalination-127658-residents-beach.html
News Article	Desalination No Panacea for Calif. Water Woes	Alicia Chang and Jason Dearen	9/22/12	Associated Press	http://news.yahoo.com/desalination-no-panacea-calif-water-woes-174531736.html
News Article	Desalination Officials Hear Concerns of Residents	Kimberly White	12/9/11	Santa Cruz Sentinel	http://www.santacruzsentinel.com/ci_19503282
News Article	Desalination Plant an Asset for El Paso's Future	David Burge	1/7/10	El Paso Times	http://www.elpasotimes.com/ci_14137533
News Article	Desalination Plant Helps Save a California Coastal Community	Jaymi Heimbuch	N/A	TLC	http://tlc.howstuffworks.com/family/desalination-plant-helps-save-a-california-coastal-community.htm
News Article	Desalination Plant Tour: Officials Praise El Paso on Water Conservation	Cindy Ramirez	1/5/12	El Paso Times	http://www.elpasotimes.com/news/ci_19676813
News Article	Desalination Task Force Reviews $2 Million in Spending for Coming Year; Critics Take Issue with iPad Interview	J. M. Brown	3/21/12	Santa Cruz Sentinel	http://www.santacruzsentinel.com/ci_20225939/desalination-task-force-reviews-2-million-spending-coming
News Article	Desalination: A Process of Eliminating Alternatives	J. M. Brown	9/29/12	Santa Cruz Sentinel	http://www.santacruzsentinel.com/desal/ci_21659662/desalination-process-eliminating-alternatives
News Article	Desalination: An Ocean of Problems	Food and Water Watch	2/3/09	Food and Water Watch	http://www.foodandwaterwatch.org/reports/desalination-an-ocean-of-problems/
News Article	Desalination: Let the Buyer Beware	Peter H. Gleick	N/A	Huffington Post	http://www.huffingtonpost.com/peter-h-gleick/desalination-let-the-buye_b_2199814.html
News Article	Dirty, Pricey, and Obsolete: Why Desalination Is Not Worth Its Salt	Adam Scow	1/2/13	Truth Out	http://truth-out.org/opinion/item/13657-dirty-pricey-and-obsolete-why-desalination-is-not-worth-its-salt
News Article	Drought Prompts Australia to Turn to Desalination Despite Cost	Murray Griffin	4/6/13	Bloomberg Businessweek	http://www.bloomberg.com/news/2013-03-06/drought-prompts-australia-to-turn-to-desalination-despite-cost.html

Category	Title	Author	Date	Source	Link
News Article	Dueling Ballot Measures Over Marin Desalination	Kelly Zito	7/28/10	San Francisco Chronicle	http://www.sfgate.com/science/article/Dueling-ballot-measures-over-Marin-desalination-3179771.php
News Article	El Paso's 15-year Wait for Desalination Plant Is Over	Associated Press	8/9/07	Houston Chronicle	http://www.chron.com/news/houston-texas/article/El-Paso-s-15-year-wait-for-desalination-plant-is-1794691.php
News Article	Largest U.S. Desalination Plant on San Diego's Drawing Board	Environment News Service	5/15/09	Environment News Service	http://www.ens-newswire.com/ens/may2009/2009-05-15-093.html
News Article	Fresh-Squeezed Water: Desalination Debate Raises Financial, Environmental and Philosophical Concerns	J. M. Brown	9/27/12	Santa Cruz Sentinel	http://www.santacruzsentinel.com/desal/ci_21646511/fresh-squeezed-water-desalination-debate-raises-financial-environmental?source=rss
News Article	Growth of People, Fish Big Factors: Habitat Protection, Planning for Population Increase Color Desalination Debate	J. M. Brown	9/27/12	Santa Cruz Sentinel	http://www.santacruzsentinel.com/desal/ci_21646779/growth-people-fish-big-factors-habitat-protection-planning
News Article	H.B. Desalination Debate Heats Up Again, This Time Over Costs	Jaimee Lynn Fletcher	11/29/12	O.C. Register	http://www.ocregister.com/articles/water-379116-project-cost.html
News Article	How Desalination Works: Siting of Plant, Intake Critical to Permitting	J. M. Brown	9/8/12	Scwd[2]	http://www.scwd2desal.org/In_the_News_09-28-12.php
News Article	How desalination works: Siting of plant, intake critical to permitting	J. M. Brown	9/28/12	Santa Cruz Sentinel	http://www.santacruzsentinel.com/desal/ci_21655154/how-desalination-works-siting-plant-intake-critical-permitting
News Article	In Cambria, a Cautionary Tale on Debating Desalination	J. M. Brown	9/29/12	Santa Cruz Sentinel	http://www.santacruzsentinel.com/desal/ci_21659652/cambria-cautionary-tale-debating-desalination

Category	Title	Author	Date	Source	Link
News Article	Is Desalination Damned in Cambria?	Colin Rigley	1/27/10	New Times	http://www.newtimesslo.com/news/3928/is-desalination-damned-in-cambria/
News Article	Israel Launches Cyprus Desalination Plant	CBN News	8/8/13	CBN News	http://www.cbn.com/cbnnews/insideisrael/2013/August/Israel-Launches-Cyprus-Desalination-Plant/
News Article	Judge Affirms Decision Striking Down Marin Desalination Plan	Mark Prado	8/16/11	Marin Independent Journal	http://www.marinij.com/marinnews/ci_18693466
News Article	Judge Rejects Arguments Against Desalination Plant	Michael Burge	4/9/09	UT San Diego	http://www.utsandiego.com/news/2009/apr/09/bn09desal1932/
News Article	Letters to the Editor on Desalination, Trash, Nightlife	Eileen Murphy	6/12/07	O.C. Register	http://www.ocregister.com/articles/water-127560-city-beach.html
News Article	Local Water District Outlines Potential Deal for H.B. Desalination Facility	Gabriel Cortes	2/1/13	OC Metro	http://www.ocmetro.com/t-MWDOC-outlines-proposal-for-Huntington-Beach-desalination-plant-02-01-2013.aspx
News Article	Lt. Governor: Huntington Desalination Plant Would Kill Fish	Jaimee Lynn Fletcher	8/31/09	O.C. Register	http://www.ocregister.com/news/water-129232-poseidon-garamendi.html
News Article	Marin County Desalination Plant Plan Suffers Setback	ABC 7 San Francisco	8/16/11	ABC 7 San Francisco	http://abclocal.go.com/kgo/story?section=news/local/north_bay&id=8310464
News Article	Marin Desalination Plans Can Move Forward	John Upton	11/3/10	The Bay Citizen	https://www.baycitizen.org/news/water/marin-desalination-plans-can-move/
News Article	Marin Desalination Plant Debate Gets Heated	KTVU	N/A	KTVU	http://www.ktvu.com/news/news/marin-desalination-plant-debate-gets-heated/nK38J/
News Article	Marin Desalination Plant Unnecessary Finds: Food & Water Watch Report	Kate Fried Adam Scow	6/4/09	Food & Water Watch	http://www.foodandwaterwatch.org/pressreleases/marin-desalination-plant-unnecessary-finds-%E2%80%A8-food-water-watch-report-%E2%80%A8/
News Article	Marin Desalination Plant Would Cost $115 Million; Board Invites Comment	Mark Prado	11/5/07	Marin Independent Journal	http://www.marinij.com/marin/ci_7381128
News Article	Marin Voters to Decide on Desalination Plant	Bay City News Service	10/19/10	The Bay Citizen	https://www.baycitizen.org/news/elections-2010/marin-voters-decide-desalination-plant/
News Article	Marin Water Board OKs Desalination Plant	Kelly Zito	8/20/09	San Francisco Chronicle	http://www.sfgate.com/news/article/Marin-water-board-OKs-desalination-plant-3221257.php
News Article	Mayor Wants to Have Say on Poseidon	Anthony Clark Carpio	5/6/13	Huntington Beach Independent	http://articles.hbindependent.com/2013-05-06/news/tn-hbi-0509-boardman-letter-20130506_1_water-quality-boardman-city-council-agenda

Category	Title	Author	Date	Source	Link
News Article	New Proposed Desalination Plan Could Save Customers Over $100 Million	Chloe Beardsley	1/22/13	KION 46 / FOX 35	http://www.kionrightnow.com/story/20653447/new-proposed-desalinastion-plan-could-save-customers-over-100-million
News Article	New Report on Desalination Looks at Financial Risks, Costs	Pamela Martineau	11/27/12	ACWA	http://www.acwa.com/news/desalination/new-report-desalination-looks-financial-risks-costs
News Article	New Water Desalination Technology Shows Promise	Deanna Conners	N/A	EarthSky	http://earthsky.org/human-world/new-water-desalination-technology-shows-promise
News Article	On Our Radar: A Desalination Giant	NY Times	N/A	NY Times	http://green.blogs.nytimes.com/2012/09/28/on-our-radar-a-desalination-giant/
News Article	Opponents and Supporters Debate Desalination Plan	Brad Kava	11/2/11	Santa Cruz Patch	http://santacruz.patch.com/groups/politics-and-elections/p/city-council-hears-first-formal-study-of-desalination-plan
News Article	Opponents Sue to Stop Marin Desalination Plant	Ventura County Star	9/22/09	Ventura County Star	http://www.vcstar.com/news/2009/sep/22/opponents-sue-to-stop-marin-desalination-plant/
News Article	Opposition to Santa Cruz Desalination Plant Lobbies for Signatures	Shanna McCord	4/7/12	San Jose Mercury News	http://www.mercurynews.com/breaking-news/ci_20348890/opposition-santa-cruz-desalination-plant-lobbies-signatures
News Article	Proponents, opponents Debate Merits of Desalination Plant	Kimberly White	4/15/11	Santa Cruz Sentinel	http://www.santacruzsentinel.com/ci_17852776
News Article	Proposed Water Plant Raises Growth Issues in Marin County	Susan Sward	10/22/09	New York Times	http://www.nytimes.com/2009/10/23/science/earth/23sfdesal.html?pagewanted=all&_r=0
News Article	Renewable Energy Technologies Make Desalination More Sustainable	Antonio Pasolini	2/5/13	Just Means	http://www.justmeans.com/Renewable-Energy-Technologies-Make-Desalination-More-Sustainable/57739.html
News Article	Report: Future of California Desalination Plants In Doubt	Red Orbit	9/23/12	Red Orbit	http://www.redorbit.com/news/science/1112699177/desalination-california-092312/
News Article	Right to Vote on Desal in Santa Cruz Sails Through	J.M. Brown	11/7/12	San Jose Mercury News	http://www.mercurynews.com/breaking-news/ci_21944198/right-vote-desal-measure-leading
News Article	Rising Water Use is Challenge: Expert Says El Paso Poised To Manage Growing Needs	Chris Roberts	9/24/12	El Paso Times	http://www.elpasotimes.com/news/ci_21615332/rising-water-use-is-challenge-expert-says-el-paso-poised-manage-growing-needs

Category	Title	Author	Date	Source	Link
News Article	San Juan Pulls Out of Desalination Project	Frank Shyong	3/21/12	Orange County Register	http://www.ocregister.com/articles/city-345609-san-water.html
News Article	Sand City Desal Plant Will Allow Cal Am to Slow Carmel River Pumping	Dennis Taylor	5/21/10	The Herald	http://www.montereyherald.com/ci_15132859
News Article	Sand City's Groundbreaking Desal Plant Gets National Attention	Kera Abraham	4/9/10	Monterey County Weekly	http://www.montereycountyweekly.com/news/local_news/article_5b67c367-c167-5eff-845f-b76046a42f8c.html
News Article	Santa Cruz City Council Members Raise Flags Over Desal Spending	J. M. Brown	1/22/13	Santa Cruz Sentinel	http://www.santacruzsentinel.com/localnews/ci_22429333/santa-cruz-councilmembers-raise-flags-over-desal-spending
News Article	Saudi Arabia and Desalination	Erika Lee	12/23/10	Harvard International Review	http://hir.harvard.edu/pressing-change/saudi-arabia-and-desalination-0
News Article	Saudi Arabia: The Desalination Nation	Abeed Al-Suhaimy	7/2/13	Asharq Al-Awsat	http://www.aawsat.net/2013/07/article55308131
News Article	Seawater Desalination Plant Might Be Just a Drop in the Bucket	Bettina Boxall	2/17/13	Los Angeles Times	http://articles.latimes.com/2013/feb/17/local/la-me-carlsbad-desalination-20130218
News Article	Singapore's Second Desalination Facility Set to Open with Combined Power Plant	Tom Freyberg	9/11/13	Water World Magazine	http://www.waterworld.com/articles/2013/09/singapore-s-second-desalination-facility-set-to-open-with-combined-power-plant.html
News Article	Solar-Powered Desalination Brings Relief to Parched Farms	John Roach	N/A	NBC	http://www.nbcnews.com/technology/futureoftech/solar-powered-desalination-brings-relief-parched-farms-947344
News Article	Southeast HB Residents Raise Objections to Desalination Plant	Annie Burris	3/2/07	O.C. Register	http://www.ocregister.com/articles/desalination-127462-plant-meeting.html
News Article	Support for Desalination May Be Evaporating	Kathe Tanner	3/11/12	San Luis Obispo Tribune	http://www.sanluisobispo.com/2012/03/11/1985485/support-for-desalination-may-be.html
News Article	Texas Agencies Test Desalination Waters	Louise Poirier	7/25/12	Engineering News Record	http://texas.construction.com/texas_construction_news/2012/0725-Texas-Agencies-Test-Desalination-Waters.asp

Category	Title	Author	Date	Source	Link
News Article	Texas' Water Woes Spark Interest in Desalination	Kate Galbraith	6/10/12	The Texas Tribune	http://www.texastribune.org/2012/06/10/texas-water-woes-spark-interest-desalination/
News Article	U.S. Desalination Industry Grows Since 2000; Seen as Essential to Meeting Supply Needs	Rachel Leven	8/21/13	Bloomberg Businessweek	http://www.bna.com/us-desalination-industry-n17179876105/
News Article	United Water New York's Proposed Desalination Plant	Riverkeeper	N/A	Riverkeeper	http://www.riverkeeper.org/campaigns/river-ecology/waterfront-development-review/united-water-desal/
News Article	Water Authority Approves Desal Plant Planning Agreement with Marine Corps	San Diego County Water Authority	4/22/10	San Diego County Water Authority	http://www.sdcwa.org/water-authority-approves-desal-plant-planning-agreement-marine-corps-%E2%80%A8
News Article	Water from the Sea: The Risks and Rewards of Israel's Huge Bet On Desalination	Meredith Mandell	7/14/12	International Business Times	http://www.ibtimes.com/water-sea-risks-and-rewards-israels-huge-bet-desalination-723429\
News Article	Water Supply: Desalination Plant is Model	El Paso Times Editorial Board	3/19/12	El Paso Times	http://www.elpasotimes.com/opinion/ci_20202495/water-supply
News Article	Water Surplus in Israel? With Desalination, Once Unthinkable is Possible	Ben Sales	5/28/13	Jewish Telegraphic Agency	http://www.jta.org/2013/05/28/news-opinion/israel-middle-east/water-surplus-in-israel-with-desalination-once-unthinkable-is-possible
News Article	Where They Stand: Decision Makers Weigh in on Desalination	J. M. Brown	9/29/12	Santa Cruz Sentinel	http://www.santacruzsentinel.com/santacruz/ci_21659030/where-they-stand-decision-makers-weigh-desalination
News Article	Why Building the Carlsbad Desalination Plant is a Good Thing for San Diego	Doug Porter	12/5/12	O.B. Rag	http://obrag.org/?p=68714
News Article	Why Desalination Doesn't Work (Yet)	Michael Schirber	6/25/07	Live Science	http://www.livescience.com/4510-desalination-work.html
News Article	Why Huntington Beach's Desalination Plant Has So Many Fans	Molly Peterson	10/10/12	89.3 KPCC	http://www.scpr.org/blogs/environment/2012/10/10/10405/why-huntington-beachs-desalination-plant-has-so-ma/
News Article	Yes to Desalination	Joseph Perkins	9/8/12	Cal Watchdog	http://calwatchdog.com/2012/09/28/yes-to-desalination/

Table A.2 Video Library

Category	Title	Author	Date	Link
Video	From Salt Water to Drinking Water	ATETV	1/13/10	http://www.youtube.com/watch?v=LdxoS80xsSo
Video	Water from Water Desalination	CarlsbadDesal	1/2/13	http://www.youtube.com/watch?v=-wuJRWi3LnA
Video	How Desalination Works	DVSMarketing	4/12/13	http://www.youtube.com/watch?v=_H8EDLFNDtI
Video	Desalination Plant: Water from Water	El Paso Water Utilites	10/7/11	http://www.youtube.com/watch?v=JRPSv5OS8k0
Video	El Paso's Desalination Plant: More than Machinery	El Paso Water Utilites	6/20/12	http://www.youtube.com/watch?v=WwebB1UWLTY
Video	Desalination Myths and Misconceptions	National Centre of Excellence in Desalination Australia	6/6/11	http://www.youtube.com/watch?v=hJbqafB4POA
Video	National Centre of Excellence in Desalination Australia	National Centre of Excellence in Desalination Australia	N/A	http://www.youtube.com/user/NCEDAustralia
Video	Desalination Plant in Limassol Cyprus	NirosoftWater	8/5/12	http://www.youtube.com/watch?v=0nT1jeIJgYA
Video	Seawater Desalination—Menachem Elimelech	NWRIwater	12/12/12	http://www.youtube.com/watch?v=x1cnigMxWKo
Video	Planet 100: Water Desalination Explained	PlanetGreenTV	7/30/10	http://www.youtube.com/watch?v=gA_XVxhBmTQ
Video	Building Seawater Desalination	San Diego County Water Authority	5/20/13	http://www.youtube.com/watch?v=bjhRhT4flWU
Video	Water—Desalination	scthegreen08	4/3/08	http://www.youtube.com/watch?v=Y7w58dGm3lQ
Video	scwd2 Desalination—Intake Approach	scwd2Videos	2/14/13	http://www.youtube.com/watch?v=bSEmJZmJRMU
Video	scwd2 Desalination: Brine	scwd2Videos	2/14/13	http://www.youtube.com/watch?v=OAX-TlqPS9s
Video	"Drinking from the Sea", Explore How and Why Sea Water is Desalinated	SUEZenvironnement	11/27/12	http://www.youtube.com/watch?v=x1cnigMxWKo
Video	Under the Surface of Perth Seawater Desalination Plant	Watercorpwa	12/9/11	http://www.youtube.com/watch?v=qAcxK5mYtSc
Video	Desalination in Western Australia	Watercorpwa	12/15/11	http://www.youtube.com/watch?v=bggjUPSsq80
Video	Implementing Desalination Facilities: Experiences from Inland to the Coast	WaterResearchFoundtn	12/3/10	http://www.youtube.com/watch?v=Qizodjha0AA
Video	Implementing Coastal and Inland Desalination Facilities and Assessing Seawater Intake Systems	WaterResearchFoundtn	2/7/12	http://www.youtube.com/watch?v=1CauJw5NB9A
Video	West Basin Desalination Demonstration Wedge Wire Screen	West Basin	2/15/13	http://www.youtube.com/watch?v=GE-iF0vLdxc
Video	West Basin Ocean Water Desalination Research	West Basin	2/15/13	http://www.youtube.com/watch?v=5MnGk-5ft9I
Video	Carlsbad Desalination Plant Construction Aerial View	City of Carlsbad	12/31/13	https://www.youtube.com/watch?v=x5jJzFekimU

A.3 Desalination Project Communication Exploration Topline Report—June 2013

This report presents topline insights and learning from a total of 12 one-on-one in-depth interviews that were conducted with desalination project general managers, communication staff, or others closely associated with projects in the United States, Western Australia, and Spain. A more detailed respondent description follows. The interviews were conducted via telephone or, in some instances, the questionnaire was sent to respondents who then completed it in writing. The interviews took place between March and June 2013.

The primary objective of this research effort was to gain an understanding of the communication challenges and successes from those who have been on the front lines of desalination projects in their communities. The discussion guide is found in the Appendix beginning on page 76.

The findings from these interviews will be combined with learning from secondary research to assist the Katz & Associates and Data Instincts team in developing the Desalination Communication Toolkit in association with WateReuse Research Foundation report WRRF-12-02.

Specifically, the questions were designed to explore the following:

1. What are the most significant public acceptance challenges as more communities consider new water sources, such as desalination?
2. What specific communication strategies were successful; not successful?
3. What regulatory and political challenges make public acceptance more difficult to achieve?
4. What are some of the greatest challenges in educating the public, elected officials, and the media about the benefits of new water sources, such as desalination?
5. What specific recommendations can be made to utilities, districts, or advocates seeking support for desalination projects?

Methodology

In-depth interviews are a qualitative research method best suited for uncovering the range of views, beliefs, attitudes, opinions, and experiences that may exist in a certain population. During the in-depth interview process, an experienced interviewer uses a discussion guide to conduct a structured conversation with participants.

Like other qualitative methods, in-depth interviews allow for detailed exploration of topics, but do not provide data that is statistically representative of a larger population. Instead, the information obtained is descriptive and should be considered as representing a range of opinions that may exist among various segments. It should also be noted that opinions may not necessarily be factually accurate.

Anonymity

Interview participants were told that the list of projects would be included in this report; however, their responses, including quotations, would be incorporated anonymously. Participants were promised anonymity to encourage candid feedback. This report uses the

pronoun “he” in all cases, whether referring to a male or female respondent, to preserve anonymity.

Report Format

This report summarizes responses from interview participants, as seen in Table A.3. Occasionally a response will be in quotes to indicate a specific comment, although the interviews were not recorded and remarks are not verbatim. These remarks are included to give the reader a flavor for the language interview participants used when discussing the issues.

Table A.3. Summary Report

Respondent Descriptions	Active Plant	Length	Current Production	Notes
California				
West Basin Municipal Water District	Demonstration	2 years		Had a 7-year pilot; currently doing environmental impact statement (EIS) for 20–50 million gallons per day (MGD) plant
San Diego Water Authority (Camp Pendleton feasibility study)	No			Feasibility study for 50–150 MGD plant
Carlsbad Project, Poseidon Resources	No			13 years in development; currently in construction phase
Huntington Beach, Poseidon Resources	No			Proposed in late 90s; currently waiting for final permit from Coastal Commission (applied for it in 2006)
City of Santa Cruz Water Department	No; operated pilot plant 2008–2009			15 years in the planning; draft EIS May 2013; citizens will vote on proposed plant in 2014
Marin Municipal Water District	No; pilot plant several years ago			Awaiting appeal on CEQA lawsuit; need voter approval to spend money constructing plant
Other USA				
Texas Water Development Board	Yes			45 brackish groundwater desalination plants in operation in Texas; four seawater desalination plants are in the planning phase in Texas
El Paso Water Utilities	Yes	7 years	9 MGD	The plant is rated at 27.5 MGD and operates continuously year-round in response to demands that are due to weather conditions
Tampa Bay Water	Yes		20 MGD	Capacity is 25MGD; will run in spring but maybe not at all during summer rainy season
Other Countries				
Water Corporation of Western Australia	Yes	7 years/2 years	45 BLY** 100 BLY	Three desalination plants (two are in same location); power offset by wind and solar farms
Acuamed, Spain	Yes	See notes	663,900 m^3/day***	12 plants; 5 in operation; 7 in construction to begin operations 2013/2014; by end of 2013 capacity will be 893,000 m^3/day; by end of 2015 will be 1.1 million m^3/day
ATLL Water Agency, Barcelona, Spain	Yes	4 years	4.7 MGD	Has average capacity of 47 MGD but is operating at minimum capacity because of combination of favorable wet weather and economic austerity measures

Notes:
*Million gallons per day (MGD)
**Billion liters per year (BLY)
***Cubic meters per day (m^3/day)

Core Highlights

Community Support of Desalination

Many respondents report that their communities are supportive of desalination as part of their water supply portfolios, with some Southern California communities citing polls that indicate support from 60% to 80% of the population. Other communities have experienced mixed results, such as support early on, followed by some disintegration as the project gained momentum, more accurate cost/environmental information became available, and detractors became organized and active.

Not surprisingly, there seems to be a direct correlation between perceived need and the level of community support. Areas with a history of water supply woes (such as Florida, Texas, Southern California, Western Australia, and parts of Spain), particularly when such woes have had a direct and dramatic impact on the general community, clearly enjoy more support for desalination projects. Communities that have been "getting by" with their current supply options and have had no, or relatively minor, inconveniences because of shortages, are far less inclined to embrace desalination.

Case in point, in the Barcelona Metropolitan Area (BMA) in Catalonia/Spain, water supply issues abound. Still, desalination has been a subject of controversy since 2007; but plans for and construction of the Water Desalination Plant of El Prat de Llobregat made great gains in community and political support during a particularly severe drought in 2008–2009. However, as drought conditions subsided and the economy plummeted, so went support for the plant, which, to keep costs down, now operates at only 10% of capacity, primarily to keep it properly maintained for when it is needed.

Likewise, in Western Australia there is strong support for desalination because that part of the country is receiving noticeably less rain than in past years and decades. By contrast, in Eastern Australia there is more negativity toward desalination, and many large and expensive plants are on standby during a time that the area is getting a lot of rain.

Project Opposition

Nearly all desalination projects in this survey experienced some opposition with the primary issues of concern being:

1. Environmental impacts of brine discharge/disposal of concentrates
2. Energy usage/carbon footprint/cost
3. Noise emissions during operations
4. Visual impacts/aesthetics
5. Impacts on marine life (entrapment, impingement, and entrainment)
6. Perception of population growth inducement
7. Construction and operational costs
8. Construction inconveniences
9. Not doing enough to conserve water
10. Not exploring other options
11. Sustainability (short RO membrane shelf life)

Concerns and opposition were/are being expressed in a variety of ways—direct contact with desalination plant team/water purveyors, engagement of politicians and local leaders, public comment opportunities, full-on social and traditional media campaigns. The latter tactics are typically the work of highly organized environmental groups (such as Surfrider, Coastkeeper, and Audubon), which seem to be more active in California communities than elsewhere in the USA or Western Australia and Spain.

For some communities, little has changed between the planning phase and the design, implementation, or construction and operation of their plant(s) based on the opposition. Other communities, particularly those with stiff opposition, have made adjustments that range from minor changes to their public outreach processes to very major concessions, including undertaking costly studies and/or changes in design in an effort to resolve specific issues.

Being very proactive and transparent, having detailed and accurate information on hand early in the project planning phase, and working openly and closely with local leadership, regional water quality boards, or other appropriate agencies are all deemed as successful approaches for mitigating vocal opposition and keeping projects on track.

Communication in Planning Phase

Based on the interviews, Spain appears to have implemented a very limited public outreach process. Their communication efforts during project planning seems to be primarily aimed at local authorities, although they do publish information in the official government newspaper and must respond to community members who pose written inquiries. They also keep an up-to-date project website for all who are interested.

In Western Australia, public outreach efforts during project planning seem to more closely match those in the United States, particularly those reported by respondents representing California projects. Those efforts include:

1. Tours of pilot, demonstration or permanent desalination facilities
2. Face-to-face or one-on-one meetings
3. Commitments register to allow the community to hold project team accountable (Australia)
4. Bringing community leaders up to speed early in process
5. Community meetings, neighborhood events
6. Presence at community functions (fairs, festivals, etc.)
7. Speakers bureaus
8. Establishing technical working groups
9. Robust corporate donations to local non-profits (for corporate-run projects)
10. Project websites
11. Handouts, brochures, fact sheets, newsletters
12. Email updates/newsletters
13. Newspaper advertising

"Customers value accurate, clear, and understandable information regarding what is being proposed. We complicate this and make it look like we are hiding something. In Texas we are blessed with a wide diversity of water supplies, so desalination is new to most of our communities. Local leaders and community residents are not acquainted with the technology, so there is a lot of education needed."

When asked which communication efforts worked particularly well during the project planning phase, the following emerged:

1. Direct face-to-face contact with community members; neighborhood meetings, workshops, etc.
2. Working closely with community leaders
3. Maintaining continuity of project personnel throughout the process; establishing the face of the project
4. Establishing a Community Reference Group and Commitments Register (Australia)
5. Keeping project supporters in the loop while maintaining ongoing communication for the general community via local media, project newsletters, email updates, website
6. Maintaining customer/contact relationship management (CRM) database
7. Responding to issues and problems in a timely manner and with full disclosure
8. Establishing close relationships with the media
9. Direct involvement with the local business community; becoming members of business and community groups; sitting on boards
10. Speaking engagements; speakers bureaus
11. Plant tours and education centers (tour plant site, other similar plants, video tours)
12. Having clear, concise and transparent project information on hand (handouts, backgrounders, newsletters, web, etc.)
13. Specific educational exhibits or tools:
    a. Pull-out salinity meters at the treatment plant that allow tour participants to check salinity before and after treatment
    b. Videos of processes

"We had a fish kill and managed that especially well: We immediately told everyone what happened and how we were fixing it. We called the media immediately and also sent a special email from our general manager to interested parties and groups we had worked with."

"The continuity of the same project personnel as the face of the project also allowed trust to be built with the community."

"A good idea is to build, inside the plant, a special [education center]…for scholars and local organizations. We have a lot of visits of locals to the plant where they can see photographs and videos of what is going on when the plant is working. We use also this installation to show these materials to people from other communities that are going to have a desalination plant in the future."

"Working with community leaders, especially those that are active and engaged. They helped get other groups engaged too. All of the cities in our service area except one support the project and all Chambers of Commerce in the area are on record supporting it."

"The establishment of a well-functioning Community Reference Group (CRG) and Commitments Register was pivotal in turning community perception."

"It is very unorthodox; however, throughout the environmental approvals phase we encouraged and assisted the community to have valuable input into the process. This demonstrated to the community that we were very keen to hear their concerns and address them where possible and also assisted in lowering the number of unwarranted objections during the process."

"We made a video of the wedgewire screen we propose to use (we used the Santa Cruz video that shows fish swimming close to the screen are not being pulled toward the screen) and our own video of Santa Monica Bay with happy fish swimming around the screens. Power plants thought the screens would clog, but the metal used repels fish (it is a copper/nickel alloy)."

Concerning communication efforts that did not work so well during the planning phase, some respondents noted that a lack of messaging continuity and regular communication cost them at times. By not keeping lines of communication open and active, the level of support can deteriorate. Others lamented spending too much time on the same audience, thus neglecting to reach out to broader based audiences. One respondent felt that paid advertising in community newspapers was unproductive.

"We should have reached out more to the broader community—we spent lots of time reaching out to the same people. Plus, this is a very complicated topic, and we should have provided more understandable information early on."

"One area of improvement is ensuring regularity of outreach. You can't take for granted a group that supported you at one time will be with you years later. We started this in 1998."

Communication in Construction Phase

Communication methods used during desalination plant construction phase, include:

1. Regular construction-related notifications to affected residents and businesses
2. Regular updates to city council, chambers of commerce, and other community leaders
3. Onsite visits for community members and project-related community groups or advisory committees
4. Project telephone hotline and website
5. Face-to-face opportunities, such as presentations to HOAs, clubs, neighborhood meetings, open houses, door-to-door walks, community BBQ
6. Press releases/articles
7. Brochures
8. Video

When asked what worked (or is working) well, the sentiment was that bringing people closer to the project, keeping them in the loop, providing community members opportunities to voice their opinions and feel they are being heard, are winning strategies.

"Allowing the CRG (a community advisory committee) to visit the site and monitor firsthand the construction impacts and our adherence to the Commitments Register."

"Making people feel that their opinions are considered while making as minimal changes to the project as possible."

As to what did not work well during the construction phase, only two respondents offered their thoughts:

"The monthly newsletters were useful during the planning and design phase, however, as the project moved into construction and the impacts were specific to the local community, the CRG advised that the community were not responding as well to the newsletter as they were to the column in their local monthly newsletter."

"Changing too many things (plant location, pipeline alignment, etc.) in order to gain public acceptance."

Ongoing Desalination Project Communication

Respondents representing plants that are currently operating were asked about their ongoing communication program. Here are the tools and techniques they mentioned:

1. Quarterly to semi-annual newsletters
2. Website and e-mail blasts
3. Media releases to mark project milestones, awards, recognition, achievements
4. Plant tours guided by a marine biologist
5. Water education programs at the plant or nearby university
6. Business and educational institution outreach
7. Presentations to governing boards and community groups
8. Ongoing desalination education including how desalination fits into the overall water supply portfolio
9. Visitor/Education center

Tours and various educational activities are widely viewed as among the most successful ongoing communication efforts.

"Tours: People are very impressed with the sophistication and knowledge of the part this plant plays in the area's water supply. Attendees are from Rotary Clubs and other civic organizations, engineering groups, university classes, etc. We don't advertise tours, they are free, and there is a form on the website to sign up for a tour. Civic organizations either just take the tour or ask for TBW to speak about the plant."

"Tech H2O [visitor/education center]— especially for the long term. We have seminars, receptions, meetings, etc. there and it is open to the public. This is really a long-term educational resource (kids are ratepayers of the future)." (Tech H2O is at the El Paso Water Utilities Desalination Facility)

On the negative side, some respondents noted that their facilities are not roomy enough to accommodate larger groups that often request tours. And some educational exhibits were not as successful as was hoped.

Most Significant Public Acceptance Challenges

When asked what respondents believe will be the most significant public acceptance challenge as more communities consider new water sources like desalination, here is what they said:

1. Communicating the need and purpose of the project—educating the community about their water sources, the true costs of their water (in terms of economic, social, and environmental), and why new sources are needed
2. Cost (construction and operating)
3. Energy usage (cost, carbon footprint)
4. Marine life impacts
5. Population growth inducement perceptions
6. Environmental impacts
7. Project location
8. Construction inconveniences

"If customers aren't familiar with where their water comes from, how it is managed and used, etc., they will not understand why rates increase. This is why communication is so important. We need to make sure our customers are as informed as possible. We need to reach the 'right people' —community leaders and the business community— because they belong to civic organizations and sit on boards and can share knowledge with others they come into contact with and support efforts of the utility. One of the biggest successes we had was getting the support of community leaders and those with vested interests from a business perspective."

"In my view, the cost of energy and associated environmental impacts of generating energy, are key. From what I have seen, the other technical issues are all things that can be solved by good engineers and resource people. I also believe that the public will have to be convinced that desalination is preferable to alternatives, both in terms of cost and in terms of environmental impacts. The public will have to believe that the water purveyor has done everything it can to promote water conservation."

Regulatory and Political Challenges

Respondents were asked if they experienced any regulatory and/or political challenges that made public acceptance of desalination more difficult to achieve. Based on these interviews, most projects seem to be subject to regulations from multiple agencies representing local, regional, state, and/or federal government interests.

A number of respondents indicated that achieving regulatory approvals from multiple agencies is an onerous and expensive undertaking that can take many years and, in some cases, can be adversarial in nature, which garners negative publicity and fuels project opponents. However, a few reported that they very intentionally devoted a great deal of time to educating and working with various regulatory agencies and/or creating strong political support on a local or regional level, which helped in moving their projects through various approvals.

A little over half of the respondents said they had one (or more) project champion(s) or advocate(s) that were helpful in gaining support for the project. These champions included university professors/educators, respected scientists, regional water quality board members, water district board members, marine industry professionals, mayors and city council members, state and federal elected representatives, a power company, and a U.S. Army general. One respondent noted that drought and favorable funding conditions played the most significant roles in "championing" their project; likewise, a reversal of both of those conditions has dampened project support.

> *"Professor Jorg Imberger, Director, Centre for Water Research of the University of Western Australia played a vital role during the Environmental Approvals phase. He visited the community and spoke to them about the potential impact of the brine discharge and alleviated many concerns. He openly encouraged the community to direct any concerns to the Water Corporation project team and not take them to the media."*

> *"Mayor Lewis—he was the mayor of the host city and also the Water Authority Chair so he understood water. Ted Owen at the Chamber of Commerce in Carlsbad—he organized the supporters group and their meetings were held at the Chamber as it was regarded as a neutral location."*

> *"The 'champions' for the project implementation were the favorable funding conditions and the strong promotional efforts by public water authorities and local water companies, in a context of a severe drought and historical water deficits in the BMA. The actual 'champion' of the subsequent dismissal of the desalination project has been the severe economic and financial austerity measures that have been applied, and will have to be applied for some years, to bring estate and regional government budget deficits within the allowed limits. The very favorable hydrologic conditions have fortunately helped in alleviating the seasonal water deficits experienced by the BMA."*

Greatest Overall Challenges

Respondents were asked what they believe are the greatest challenges in educating the public, elected officials, and the media about the benefits of new water sources such as desalination. Many respondents said that it is challenging to get people to understand the drivers for new supply options and how desalination fits into the community's overall water supply portfolio. There is a sense that the general public takes water for granted and lacks knowledge about the economics and basic workings of their water systems. These respondents seem to suggest that it is important to ground the public in the fundamentals of water supply before introducing new, expensive, and potentially controversial alternatives into the mix.

Another noted the challenge is the complexity of the subject of water, in general, and desalination specifically. In the words of one respondent, *"Long-term water supply planning*

is inherently complex, because it always involves trade-offs and future projections with many variables baked into the analysis."

A respondent from Spain pointed out that, with austerity measures in place and water currently not in short supply, many desalination plants are operating at minimum capacity, which causes the population to question the role desalination plays in their water supply.

Other challenges of note closely mirror the responses to an earlier question regarding issues of concern among opposition factions:

- Cost
- Energy usage (in terms of cost and environmental impacts)
- Marine life impacts
- Plant location and aesthetics

"Meeting the information needs of the recipient of the educational outreach effort; ensuring that the language is appropriate and that the message is complete but simple; providing accurate information about costs, concentrate disposal/management options."

"Understanding tradeoffs of alternative supplies: overuse of groundwater will result in no water and the cost of desalination is a challenge, but the tradeoff is how desalination fits into the overall supply mix and how water is used during dry times."

"One of the most needed pieces of information is a sound analysis of the actual economic and environmental implication of water desalination, over a long-term period, as compared to other management strategies. Tracking the technical and management contribution of the numerous desalination plants built in Spain over the last decade in solving the water scarcity management issues should become a fundamental contribution to the future of desalination in many other regions of the world, unless they are willing to repeat similar errors and suffer comparable economic and financial austerity measures."

Respondent Recommendations

When asked what specific recommendations they would offer utilities, water districts, or advocates seeking support for desalination projects, here is what emerged:

1. Talk early and often to the community; address critics, concerns, and fears.
2. Be as transparent as possible (e.g., if possible, allow site visits to the plant). Transparency builds trust.
3. Report any mishaps or hiccups immediately and honestly.
4. Have a team available to the community to directly answer questions.
5. Be available to attend community functions.
6. Look to other desalination plants around the world as examples of well-functioning plants.
7. Focus on political leaders, people who support them, chambers of commerce, and other community leaders (people who can impact public opinion in a negative or positive way).

8. Explain/illustrate that cost is about the same for all new water supplies, but, compared to other water supply options, this is one of the few sources where you can get a significant amount of water.
9. Regarding the greenhouse gas effects, find ways to tap into renewable power portfolios.
10. Identify a champion who can communicate and relate to an audience; have your champion with you the whole time.
11. Gain support from key groups—they will almost do the work for you.
12. Make sure you have the best experts in the subject matter you are dealing with all lined up; know and have your facts straight.
13. Share information with the communication officer at the city where you are—work as closely as you can with them.
14. Communication personnel should work directly for the manager and not be buried in the organization.
15. Put communication and outreach at the top of the list.
16. Consider various meeting formats when planning community meetings. In some cases, a traditional public meeting will be required, but some of those interviewed suggested that more productive dialog could result from an open house, information-station style meeting where participants can talk one-on-one with project team members.

    "Over the years, we have had strong scientists backing and doing work for us. Include strong environmental scientists and those that have a reputation with permitting agencies and are experienced in working with permitting agencies."

    "Many utility leaders are active in their community but are not aware of what is happening in their own state or across the country. They don't need to reinvent the wheel. They can mimic best practices in other areas. Webinars have helped, but we need to do more of this."

    "Developers of projects need to have a very clear case of why desalination is being pursued. It has to make sense to the public and to the community leaders."

    "Meet early and often with regulatory agencies. Build up credibility with respect to commitment to conservation, and make clear that desalination is being considered only because conservation alone is not enough. Prepare for a long slog."

    "Devote as much effort as they can to 'revisit' and critically assess the role and capacity that different water resources management strategies do have in solving water scarcity and seasonal water shortages. That assessment should be based on current and meaningful projects, covering seawater desalination and water reuse."

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DISCUSSION GUIDE

Desalination: Communication with the Public

Name:_____

Interviewer:_____

Organization:_____

Date:_____

1. Please tell me a little about your desalination plant. Is it currently operating? How much water is produced each day?

2. Was/is your community (or members of the public) supportive of desalination? How was this support manifested?

3. Were there opponents of your project? If so, what were their key issues of concern (please name the top three issues) and how were those concerns expressed? Did anything change between the planning phase and design/implementation/construction/operation of the plant based on this opposition?

4. What types of community outreach and communication with the public did you do during the planning phase?
   What did you do that you felt was successful or worked well?
   What did you do that was not successful?

5. What types of community outreach and communication did you do during the construction phase?
   What worked particularly well?
   What didn't work so well?

6. Now that the plant is operating, what types of communication activities do you engage in?
   What have been the most successful communication strategies you implemented?
   Are there any that were less successful?

7. Moving forward, what do you see as the most significant public acceptance challenge as more communities consider new water sources like desalination?

8. Have you experienced any regulatory challenges and political challenges that make public acceptance of desalination more difficult to achieve and what were they? Did anyone emerge as a champion or key advocate for the project? Who was this champion, what was his or her position in the community, and was this helpful in terms of gaining project support?

9. What do you think are some of the greatest challenges to educating the public, elected officials, and media about the benefits of new water sources such as desalination?

10. What specific recommendations would you offer utilities, water districts, or advocates seeking support for desalination projects?

A.4 Special Analysis: Conveying the Triple Bottom Line Benefits of a Desalination Project

Provided by Robert S. Raucher, PhD., Stratus Consulting

This supplemental analysis describes the types of valuable benefits that potentially would be described in a Triple Bottom Line (TBL) analysis for a generic desalination (desal) project. The intent of this exercise is to help utilities and water planners recognize the wide range of social, environmental, and financial benefits (and costs) that desal can provide their service areas. This information is intended to help utilities better communicate the range (and potential size) of benefits that may arise from including a desal project as part of their community's water supply portfolio.

More specifically, this analysis provides practical insights into what types of benefits are associated with desal and how large those benefits have been for some communities. This information is based on practical case studies that have been developed by the research team for the WateReuse Research Foundation (the Foundation), individual utilities, and other entities. This work also draws on "An Economic Framework for Evaluating the Benefits and Costs of Water Reuse," a report developed for the Foundation (Raucher et al., 2006; WateReuse Foundation report no. WRF-03-006-02), and extends the concepts developed in that document to desal.

As part of this effort, we provide a "checklist" and associated guidance intended to help utilities identify and articulate the benefits of having desal as part of their community's water supply portfolio. These benefits include having a locally controlled and climate-independent source of supply, which can greatly increase the reliability of the local supply portfolio to avoid water shortages. We also offer examples of TBL assessments for specific projects that demonstrate the types and potential values for the important potential benefits of desal, and describe how the TBL analyses can be used as an effective part of the communication process. We also help frame the discussion of what the impacts would be to the community if desal is *not* implemented (e.g., defining the "baseline" against which desal needs to be compared). The key baseline impacts might include more frequent and severe water shortages, and/or greater reliance on imported water that may be subject to periodic supply disruptions and considerable price escalations.

What is a Triple Bottom Line Approach?

The TBL approach is a form of comprehensive benefit–cost analysis that is intended to reflect all the impacts—both positive and negative—associated with a project or program. As implied by the name, the impacts are organized and portrayed according to three bottom lines:

- **Financial:** typically reflecting the cash flow implications for a utility, such as revenues gained and expenditures or other costs incurred. This is similar to a traditional accounting style bottom line, as might be reported in a utility's fiscal annual report.
- **Social**: reflecting impacts on the broader community, such as public health and welfare, water system reliability, contributions to employment or other community values, affordability, and so forth.

- **Environmental**: reflecting impacts to watersheds and other ecosystems (including freshwater and marine fisheries), carbon footprints, and other consequences for natural systems.

The TBL concept emerged from the sustainability field, as a suggested approach for corporations and other entities to expand how they conduct their annual reporting (e.g., Elkington, 1998). In lieu of reporting a single financially oriented, accounting-based bottom line in an annual report, the suggestion was made to have businesses and public sector entities report annually on how their activities also affected social and environmental matters. Water utilities in Australia and other parts of the Commonwealth now provide such annual, enterprise-level TBL reporting on a routine basis (although much of the reporting is highly qualitative rather than quantitative).

The application of the TBL concept can be greatly expanded beyond annual enterprise-level reporting, and the TBL approach now is often applied at a project or programmatic level as a form of business case evaluation. Over the past several years, we have been applying the TBL framework as a way of organizing and communicating quantitative benefit–cost analyses for specific utility projects or programs (as illustrated in the following). In quantitative TBL assessments, we aim to identify and describe and then quantify and monetize (to the extent credible and feasible) all the important consequences of a potential project (and its alternatives). We then structure the resulting outcomes in a simple graphic or table, accounting for all three bottom lines. Several examples of practical application to desal projects in the community water supply sector are provided later in this analysis.

What are some of the Factors Typically Relevant for a Desal-Oriented TBL Analysis?

As implied by its name, a TBL approach uses an organization construct in which all the identified benefits and costs (advantages and disadvantages) of a project or activity are placed within one of three bottom lines. For a typical public water supply utility, a desal project TBL may have the following key components under each respective bottom line:

- ***Financial***, which in the case of application to a desal facility, would typically reflect the cash flows associated with the costs incurred by the utility (and hence its customers) for providing desal water (e.g., the present value of the lifecycle costs—including initial capital outlays and annual operating expenses—over a relevant planning horizon).

  A very important (and potentially overlooked) aspect of the financial analysis is that it must be *comparative*; that is, the analysis should reveal the cost of desal *compared to* the cost of obtaining the same volume of water from alternative available supply options (e.g., importing more water from a distant source, or the effective cost of conserving the relevant quantity of water). Although desal is considered relatively expensive compared to many source waters used in the past (e.g., locally available fresh surface water or groundwater), most locations exploring desal have fully tapped the available low-cost water and all future options will be relatively expensive. In this typical forward-looking context, desal may turn out to be a relatively low-cost future supply alternative.

  In one example described elsewhere in this paper, the El Paso Water Utilities (EPWU)—and thus their customers—are estimated to save nearly $1 billion (in present value terms, over a 50-year planning horizon) because the use of brackish groundwater desal

postpones the need to invest a larger sum of money to pipe and pump water imported from a neighboring groundwater basin.

- ***Social*** impacts for the community (and others beyond the service area), which in the case of desal would typically entail the value of having a more reliable (climate-independent) and locally controlled water supply option. The water supply reliability value refers to the value provided to utility customers—residential, commercial, industrial, and institutional—of reducing the frequency and/or severity of drought-related water curtailments (use restrictions) that impose losses to homeowners and other community members and effected businesses.

  Other social outcomes of relevance may include changes in public health risk (e.g., because of changes in energy demands and the associated changes in power sector emissions of air pollutants) when deploying desal in comparison to using an alternative viable source. Additional discussion of the possible benefits relevant to the social bottom line is provided elsewhere in this analysis.

- ***Environmental*** impacts, which in the case of desal facilities could include changes in the carbon footprint associated with net changes in energy use, possible impacts on fisheries and aquatic ecosystems, brine discharge impacts, and so forth.

  As with the financial and social bottom lines, it is critical to recognize that all impacts need to be assessed on a *comparative* basis wherein the impacts of desal are net of impacts from the most viable alternative water supply option. Thus, a coastal desal facility might have some unmitigated adverse impacts on marine fisheries because of intake impingement and entrainment (I&E). However, if the alternative water supply option is to draw more water from a flow-limited coastal stream, then this alternative may also be associated with adverse impacts on salmon and/or other fish species of concern. Thus, the TBL analysis should reflect the difference between these options.

Establishing Appropriate Comparisons

Water resource planning inevitably involves a comparison of various possible future courses of action, such as whether to expand the community's water supply portfolio. Thus, the analysis needs to consider and compare the relevant options, which may include tapping into a new surface or groundwater source, adding or increasing the level of water reuse, examining desalination, increasing water efficiency programs, expanding reservoir storage capacity, or any of the other plausible alternatives.

Such planning also entails asking and answering questions about (1) why any action may be warranted (as contrasted to a status quo, do nothing baseline), (2) determining what option will best serve the community, (3) when action should be initiated, and (4) how to best implement a selected option. As such, water resources planning and the associated TBL assessment entail an evaluation of the various alternatives that are feasible for a utility and informing deliberations and decisions about which option may be considered the "best" choice.

As noted earlier, the TBL evaluation needs to be comparative, meaning that the approach must explore the differences between the most relevant options under consideration. For example, if the alternative to a desal project is to obtain the additional water yields from

another supply source (e.g., securing more imported water), then the analysis must reflect the difference in costs or benefits between those alternatives.

In some instances, a relevant alternative to desal may be to not add any new water sources to the local water supply portfolio. In such cases, one is comparing desal (and the associated increase in available water) to an alternative where there is less water available to the community (e.g., more emphasis on conservation and periodic water use restrictions of varying severity). Thus, the "without desal" comparison might typically imply a relatively higher risk of periodic water shortages and associated water use restrictions. In such instances, the comparison is focused on the additional value (benefit) of having a more reliable supply (fewer and/or less severe curtailments) versus the added financial cost and other aspects of adding desal.

Regardless of what the alternative option(s) are to desal, one of the analytic and communication challenges will be to have customers and other stakeholders recognize that there is a need to *compare* desal to an alternative. Therefore, if the community does not opt for a desal option, then the analysis needs to portray how the community will have an alternative situation of either less available water (i.e., potential shortfalls) or have the costs and benefits of tapping supplemental water from some other source. This issue is also known as defining the appropriate baseline for the analysis, and is described further in the following.

Defining the Relevant "Baseline"

The prior discussion about the comparative nature of TBL can also be framed as "defining the relevant baseline." The "baseline" is the *future* state of the world if desal is not selected. For example, if the local choice is desal or no additional water, then the baseline is what happens in the future of there is no additional water added to the supply portfolio.

Discussions with stakeholders about the baseline can be very challenging and time-consuming. This is because many participants may be thinking of desal in isolation and not grasping that there are also alternative states of the future world to be weighed if the "without desal" alternative is considered.

Another reason the baseline discussion can be challenging is that it needs to reflect the *future* state of the community absent desal. The future without desal is not likely to be the same as the world today absent desal. In the future, community water demands may well be higher than in the past and present (e.g., because of population and economic growth, and/or because of increased needs associated with a warmer climate).

Another way to describe the baseline is to define the outcomes associated with the "no action" status quo (i.e., what would happen "without" the option(s) being considered). This base case may entail doing nothing different (i.e., not pursuing a different water supply project), or undertaking already planned actions. The baseline is the mark against which changes resulting from the water alternative(s) are measured. It is important to define the scale and timing of the impacts of the baseline, articulate what problems the proposed project (or range of project alternatives) is intended to resolve, be explicit about assumptions, and engage stakeholders about their perspectives of what happens under a no-action, status quo baseline.

Basic Objectives and Guiding Principles for Using a TBL Analysis

It is always good practice to make a sound and effective business case—or value proposition—when a utility is seeking support for a large capital outlay or other investment, such as is involved in developing a desal project or other water resources planning activities. Utility managers, governing boards, and economic regulators (such as Public Service Commissions) are keenly interested in moderating future rate increases on water utility customers, especially in difficult economic times. They need to be well convinced that the problem to be addressed is real, that there are high costs or other serious consequences if the utility fails to act, and that the proposed investment (i.e., desal or some other selected alternative) is a wise choice that will leave the community better off than if no action were taken (and also better off than if an alternative potential solution were selected).

Utility customers and local stakeholder organizations may also be skeptical of the need for desal or any other large-scale water resource investment their utility is considering. Concerns may reflect a broader array of issues than just the cost and the ultimate impact on rates. There may be strongly held opinions about the environmental or social consequences of a proposed utility project. For example, utilities often face opposition to efforts to invest in desal, water reuse, reservoir expansion, or other such options to increase local water supply reliability for the community as it grows and as its current water sources become fully tapped. Such public concerns extend beyond the overall fiscal costs and often include potential impacts on local ecosystems, community identity, affordability, energy demands, carbon footprints, and so forth.

Ultimately, utility professionals need to be able to convince themselves, their managers and boards, their customers, and other stakeholders that they are proposing a wise course of action. They need to effectively communicate that even if a proposed action entails a costly investment, the community will be better off for having taken that action.

There are some principles that should guide a utility's efforts in conducting a sound analysis of alternatives. Key guiding principles in conducting the analyses are the following: objectivity, transparency, and replicability. These are widely recognized elements of good practice. It also is important to be as comprehensive as possible (i.e., avoiding the omission of important benefits or costs), avoiding double counting, discounting to present value, and the need to include qualitative as well as quantitative and monetized outcomes. Additional discussion and guidance is provided in WateReuse Foundation report no. WRF-03-006-02 (Raucher et al., 2006;) and other reputable guidance materials.

Checklist of the Potential TBL Benefits and Costs

There is a wide array of benefits that may apply to each of the bottom lines in a TBL assessment. The objective of this section is to help utility planners and public outreach professionals identify and describe the various types of value added effects that a desal project might offer a community. This section provides an overview of the types of benefits that might be applicable to a desal project, organized by bottom line. However, there are several important caveats to keep in mind:

- First, not all of the benefits described here may be applicable to all locations and all desal projects; some careful assessment is required so as not to overstate or misrepresent the potential values and account for site-specific considerations.

- Second, the types and levels of benefits are *relative*, meaning that they depend considerably on the baseline to which the desal option is being compared (i.e., the status quo no-action scenario, ambitious conservation, or some alternative source of additional water supply).
- Third, there may be some additional costs or other negative effects associated with desal, and these should be properly acknowledged and included in the assessment and any related communication, in order to convey objectivity.

Financial Values

Cost Savings. As noted previously, a key consideration for a desal project is that it may save the community a great deal of expense compared to the other feasible options for securing additional water for the region's portfolio. This may be counterintuitive for many stakeholders, as desal is widely recognized as being a fairly expensive water supply option. However, *compared to the cost of alternative viable options for acquiring more water in the future, desal can be quite a bargain*. This has been shown to be a significant benefit in several applications where the alternative entailed importing water as the alternative to desal for meeting future water needs (case studies are described in the next section).

Cost Stability. Depending on the alternative supply source being compared to desal, the desal option may provide less cost volatility and greater price certainty. This is especially true for many water importation options, where the pricing and cost of acquiring and delivering the water can be highly unpredictable (e.g., the price escalation observed over the past decade for Tier 2 water secured through the Metropolitan Water District of Southern California, or water acquired on the spot market in dry years). On the other hand, the cost of delivering desal water can also be uncertain, especially if permit conditions are not yet well established (e.g., for a seawater intake system that mitigates potential impingement and entrainment (I&E) impacts on fisheries). Energy cost volatility, and/or potential issues with membrane performance and maintenance/replacement schedules can also lead to unplanned impacts on desal costs. Ultimately, it is important to provide a balanced assessment and retain credibility.

Social Values

Supply Reliability. There is considerable value to a community in having a water supply that provides a reliable yield over most years. This is largely reflected in the willingness to pay (WTP) by local residents and businesses to avoid periodic water shortages and the adverse impacts that may accompany them.

- For ***residential customers***, this typically includes the WTP to avoid restrictions on lawn and garden watering and other outdoor uses (and associated loss of green lawns, gardens, turf sports fields, public parks and picnic areas, and other community green spaces). This residential WTP for supply reliability reflects the desire to avoid household-related costs (e.g., to replace a drought-killed shrub or tree, or revive or replace a stressed or dead lawn), and the desire to avoid the loss of green space amenities and aesthetics and outdoor recreational opportunities because of restrictions on outdoor (and/or indoor) water use.

A recent Foundation study reveals a significant per household WTP for avoiding periodic water shortages and related water use curtailments (Raucher et al., 2013 WateReuse

Foundation report no. WRF-08-09). The statistically significant estimated WTP is approximately $20 to $35 per household per year (depending on the five communities surveyed), for each future year over the next 20 years for which a "level 2" curtailment is avoided (where a level 2 curtailment typically involves very limited ability to irrigate outdoor areas, wash cars, and so forth; Raucher et al., 2013. Thus, if a desal project is anticipated to reduce the number of future years with severe shortage-related water use restrictions by 4 years over the next 20, then this added reliability is likely to be valued at between $80 and $140 per household per year (4 x $20 = $80; and 4 x $35 = $140).

For local business and institutional entities—commercial, industrial, and institutional (CII) customers of the water utility—and for the regional economy as a whole, the value of water supply reliability translates into the economic viability (e.g., employment, output, revenues, costs, profits, tax receipts) of local private enterprises and water-reliant public and quasi-public sector entities. Key examples of the entities suffering potential direct economic impacts because of a lack of water supply reliability include:

- Manufacturers that rely on local water to produce their products
- Schools and medical facilities that rely on water to provide their essential services
- Hospitality-oriented businesses such as hotels and restaurants that need water to cater to tourists, who may be drawn to the region by local water-supported amenities
- Nursery and landscape businesses that rely on water to maintain and grow their stock and rely on the ability of residential and commercial customers to maintain lawns and other green spaces
- Municipal entities that rely on water revenues or business-generated tax receipts

All of these types of CII entities, and others, feel the pinch when water is scarce and water deliveries and uses are restricted.

The direct economic impacts then get "multiplied" as they create indirect and induced impacts on other regional business sectors, the local workforce, and the regional economy as a whole. Thus, a lack of water supply reliability can have a significant cumulative adverse economic impact on CII entities and the community at large. To the degree to which desal can support a more reliable supply (e.g., because it has a climate-insensitive yield compared to other alternatives), then there will be reliability benefits for a desal option. See the Foundation-sponsored report no. WRF-09-05 by Raucher et al. (forthcoming in 2014) for additional detail.

Public Health Risks. There may be public health impacts associated with a decision to use desal or some other alternative. These potential health risks are often associated with energy use and related emissions of air pollutants linked to the relevant mode of power generation. Although desal is considered to be energy intensive, if the alternative supply option is imported water, then there may be an appreciable net reduction in energy requirements with desal. The reduced energy use, where applicable, translates into the following:

- Cost savings from using less energy (which would be reflected in the financial bottom line)
- Fewer emissions of greenhouse gases (GHGs, or carbon footprint, which would typically be reflected in the environmental bottom line)

- Reduced emissions of other air pollutants (such as sulfur oxides and nitrous oxides, SOx and NOx, respectively) and the associated reductions in risks to public health.

Case study illustrations in the following provide examples of the approach and potential magnitude of these benefits (e.g., see Raucher and Raucher, 2011). Of course, in situations where desal creates a net increase in energy use and related emissions, relative to the most relevant water supply alternatives, then these changes in public health risks become costs rather than benefits, and should be reflected appropriately as such.

Another pathway to potential public health risks pertains to the finished water quality itself. A desal facility will produce highly purified water because it will rely on advanced membrane technologies, and then often be blended with other local supplies. Whether or not desal will provide higher quality, healthier tap water depends on the alternative option(s) and other local factors.

Environmental Values

Desal projects can have positive and negative environmental consequences, compared to alternatives. These will be project-specific, but may include the following categories:

Carbon Footprint. As noted earlier, desal projects can have less (or greater) energy-related GHG emissions than the alternatives to which they are being compared. These carbon emissions can be estimated as metric tons of CO_{2e} per year, via various methods (e.g., USEPA and USDOE web-available tools) that reflect the local relevant energy source (e.g., grid-produced electricity at region-specific power plants).

Fishery Impacts. Desal facilities can have positive and negative effects on fisheries, depending on the source water and intake methods, mitigation actions taken, and also depending on the supply alternative to which it is being compared. Coastal desal intakes may have I&E impacts on local marine fisheries, although this greatly depends on the location, the intake design (e.g., open water versus subsurface), operational characteristics (e.g., volume and velocity of the intake), and whether habitat restoration or other mitigation-related offsets are applied. Brackish groundwater desal will not have any impacts on fisheries.

The alternative to desal may have fishery impacts as well. For example, where the alternative supply is a stream that supports salmon or other special status or recreationally valued fish species, then new or expanded freshwater extractions could have a considerable adverse effect on the resident fisheries. These need to be weighed against any impacts on fisheries that may arise through desal.

Residuals Management Impacts. Desal processes generate brine concentrates that need to be properly managed. This can add environmental costs, but again this depends on the volume generated, method of concentrate management, and the receiving environment. The net impacts also depend on what residuals are generated by the alternative(s) to desal that is (are) under consideration.

Case Study Illustrations of Desal Project TBL Assessments

Quantitative TBL assessments have been used to demonstrate the high net value for utilities and the communities they serve that have included desalination in their water supply

portfolios. In these instances, the investments in desal (and also in water reuse) were known to be quite expensive when contrasted to the cost of the utilities' historical water supply options (such as pumping and treating local groundwater). However, in each community, local groundwater basins were overextracted and subject to significant quality degradation. In order to sustain local groundwater quality and long-term extraction, alternative water supply sources were required to meet the communities' current and anticipated future demands.

Figure A.1 shows the results of a quantitative TBL we conducted for the El Paso Water Utilities (EPWU) in the southwestern region of Texas (Raucher and Raucher, 2011). EPWU's investments (past and planned) in desalting brackish groundwater and reuse appear, on the surface, to be very expensive in terms of the cost per acre-foot of water derived, when compared to their historical costs from local groundwater pumping. However, because of pumping limitations that were imposed to ensure sustainable aquifer yields and to avoid degradation of groundwater quality, no additional fresh groundwater extractions are feasible to meet all existing demands or anticipated larger demands through 2060. Additional water supplies must rely on desal and reuse, or on long distance importation of groundwater that the utility holds rights to, but which is located many miles away.

Over the 50-year water supply planning period, the TBL study revealed savings of nearly $1 billion (in present value terms) that are due to the existing and planned use of desal and reuse, as contrasted to the other alternative of water importation. Social and environmental benefits also were derived for the desal and reuse programs, as contrasted to the next viable alternative of accelerated water imports, because of reduced energy use and associated reductions in carbon emissions and other air pollutants associated with adverse risks to human health.

Another case study, with similar results, examines the TBL benefits and costs of desal at the Inland Empire Utilities Agency (IEUA) in the Chino Basin, east of Los Angeles in Southern California. The IEUA results are summarized in Figure A.2. A more expansive explanation of methods and findings can be found in the Water Research Foundation report no. 4078 (Raucher et al, 2010).

How TBL Can Help in Communication Efforts

The TBL approach has been demonstrated to be a highly effective way to include stakeholders in an active dialogue. By explicitly recognizing at the outset that the approach is intended to capture the broad array of impacts—including social and environmental issues—stakeholders are often more open to participating in the process. Stakeholders are able to recognize at the outset that the issues of priority to them will have a place in the analysis and related deliberations.

Further, the TBL approach reinforces the need to examine desal in a comparative framework, relative to other alternatives. This helps recast the debate into a more constructive problem identification and problem solving mode of defining the core issue of concern (i.e., defining the "no-action" baseline). It also casts desal into a relative evaluation framework, comparing the range of possible solution alternatives (e.g., water shortages, additional conservation, additional imports), and combinations of options, rather than isolating an option and examining only its impacts in isolation.

Stakeholders also can be engaged through the process of comparing options and identifying and characterizing adverse impacts. This inclusive process can be highly effective for helping stakeholders feel that their primary issues of concern are being taken into consideration.

Conclusions

Quantitative TBL can be a highly effective approach for understanding the overall merits and importance of the many high-cost water sector investments needed by water utilities in the 21st century, including desal projects in many communities. The TBL-based approach to stakeholder engagement and project evaluation has proven to be effective across a wide array of applications—water, stormwater, wastewater, and biosolids management. A soundly developed quantitative TBL can help engage stakeholders, evaluate alternatives, and ultimately can help make a solid business case for worthwhile capital projects such as a desal facility (as seen in Figures A.1 and A.2).

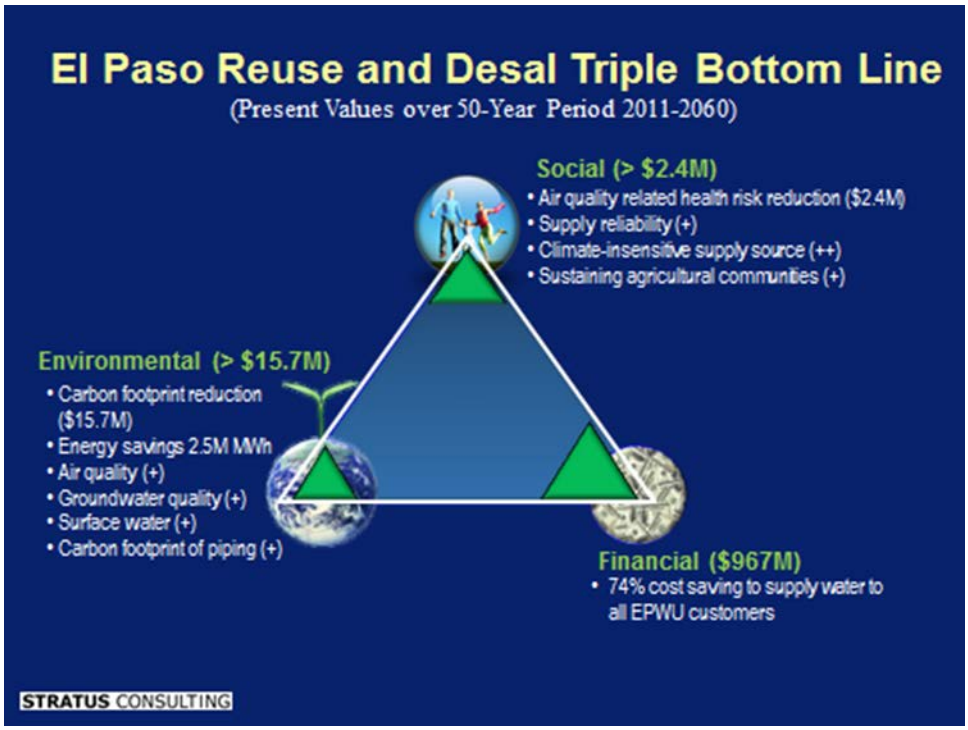

Figure A.1. TBL results for including water reuse and brackish groundwater desal in the water supply portfolio for El Paso Water Utilities, compared to the next best alternative of groundwater importation.

Note: Present values over a 50-year planning horizon**.**

Figure A.2. TBL results for including desal in the water supply portfolio for Inland Empire Utilities Agency and Chino Basin, compared to the next best alternative portfolio of increased reliance on importation of Bay-Delta waters.

Note: Present values over a 30-year planning horizon.

References

Elkington, J. *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*. New Society Publishers: Gabriola Island, BC, Canada, 1998.

Raucher, R.; Darr, K.; Henderson, J.; Linsky, R.; Rice, J.; Bahman,S.; Wagner, C. *An Economic Framework for Evaluating the Benefits and Costs of Water Reuse*. Final Project Report and User Guidance. Report No.WRF-03-006-02. WateReuse Research Foundation: Alexandria, VA, 2006.

Raucher, R.; Clements, J.; Xu, P.; Oxenford, J.; Ruetten, J.; Choto, Z.; Reiss, R. *Implementation Guidelines for Seawater and Brackish Water Desalination*; Report No. 4078; Water Research Foundation and Arsenic Water Technology Partnership: Denver, CO, 2010.

Raucher, K.; Raucher, R. *The Triple Bottom Line Impacts of Water Reuse and Desalination for the El Paso Water Utilities*. Report prepared for El Paso Water Utilities. Stratus Consulting: Boulder, CO, 2011.

Raucher, R.; Clements, J.; Donovan, C.; Chapman, D.; Bishop, R.; Horsch, E.; Johns, G.; Hanemann, M. *The Value of Water Supply Reliability in the Residential Sector;* Report No. WRF-08-09. WateReuse Research Foundation: Alexandria, VA, 2013.

Raucher, R. Using a Quantitative Triple Bottom Line Approach to Make a Strong Business Case. *Water Online, The Magazine* (Clean Water Edition), Spring 2013 www.wateronline.com

Raucher, R., Clements, J.; Henderson, J.; Kiefer, J.; Dziegielewski, B. *The Value of Water Supply Reliability in the CII Sector.* Report No. WRF-09-05. WateReuse Research Foundation: Alexandria, VA, in press.