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Working Through the Problems to Realize the Potential of Desalination

Introduction

- It's a pleasure to be with you. At this summit, we will hear about some of the cutting edge work going on in desalination technologies. The theme, From Problem to Opportunity, aptly characterizes desal work—Desalination technologies offer us tremendous potential to provide much needed water supplies.
- This opportunity didn't just appear overnight. I recently saw a quote that sums it up well—Opportunity seems to have an uncanny habit of favoring those who have paid the price of years of preparation.
- The opportunities we have now to push the development of desal technologies are here because of what the prior work has prepared us to do.
- Our water management strategy at the Department of the Interior includes desalination as a potentially important long-term part of ensuring water supplies. This morning, I will speak about the direction we have taken with desal work, some of the significant accomplishments, and the areas we see for further work.

Desalination and Funding

- More than forty years ago, John F. Kennedy made this statement: "If we could ever competitively, at a cheap rate, get fresh water from saltwater ... [it] would be in the long-range interests of humanity [and] could really dwarf any other scientific accomplishments."
- He recognized both the promise of desalination and the crucial pair of challenges we face: the need for effective technology to remove the impurities from water, and the costs of the technologies and the processes.
- Today at Interior, we also recognize the potential benefits of desalination work. It can bring tremendous improvements to people's health and quality of life.

- We talk about “stretching” water supplies through measures such as conservation and water transfers, but what is particularly exciting about desalination is that it may be one of our few opportunities to create **new** water supplies. And this work can benefit both coastal and inland areas.
- While recognizing the potential, we also have to factor in funding constraints, and this is a significant part of the equation.
- There has been long-standing interest in Congress in desalination projects and managing the associated energy costs. In the 109th session, at least 13 separate bills were introduced that concerned various aspects of desalination. That’s a good sign, but we have no guarantee that the interest will enable the large allocation of funds.
- Recognizing the constraint of limited budgets, we needed to assess what we cannot do, and what we **can** do to gain the greatest impact with limited dollars.
- We knew that it would be impossible for the federal government to build and operate treatment plants. But what we determined we could do was to put the money we had toward research that would lead to continued improvements in the technology, reduced costs, and greater accessibility.
- This has been our strategy, and the two bureaus I oversee—the U.S. Geological Survey and the Bureau of Reclamation—have engaged in a great deal of desal research. It has been producing good results. As a way to leverage these research dollars, we have worked in partnership with other federal agencies, with state and local agencies, private entities, and academia.
- It is essential to define the federal role in the development of desal technology and gain the authorities to conduct work and expend funds. Reclamation has commissioned the National Academies of Science to help in defining the federal role in desalination work, and we are expecting the report from NAS this year. Many of our desal authorities came through the Desalination Act of 1996, which expired last year and was not renewed by Congress.
- We aren’t sitting on our hands. Our **vision** is to provide opportunities that can expand water supplies, in a sustainable manner, and relieve stress on Western rural communities, Native Americans, and the Western basins supporting our projects.
- Our **goal** is to advance the state of the art in high risk, applied research and development, and enhance non-Federal partnerships to accelerate the implementation of improved technology, targeted at reducing the cost of treating impaired water.

- Reclamation's *objective* is to focus its investments on R&D and leverage with other Federal and non-Federal R&D interests to facilitate the efficient advancement and deployment of technologies and best practices. A secondary objective is to ensure that knowledge generated from this investment is available to communities looking for solutions.
- We are exploring various authorities for our desal work. One major accomplishment that I'm happy to report is the completion of one of our key legislative priorities: Rural Water Assistance Legislation. I want to commend the Congressional committees, and especially Senators Domenici and Bingaman for their leadership in drafting and shepherding the bill through the Senate, and Congressmen Pombo and Rahall.
- Late last month, President Bush signed the bill into law. A major part of the legislation concerns loans to help communities establish and maintain water supplies. The legislation also gives us the authority for desalination projects, which may be of immense help to some rural communities. In areas where surface or groundwater is not potable—for example, in New Mexico about 75 percent of ground water is too saline for most uses—communities may now be able to desalinate brackish water rather than piping water in—much more efficient and cost-effective. We are now providing Congress with criteria for future projects.

Desal Research Strategies and Programs

- The Interior Department has engaged in desal research with two main aims: to improve technology, and to reduce costs. We have made great strides in creating more effective and efficient ways to remove impurities, dispose of brine, and reduce energy costs.
- In 2006, Reclamation funded the completion of 10 research reports produced in collaboration with a number of universities and private entities. Some of the most significant findings concerned the effectiveness of membrane filtration, methods to reduce costs, and processes to improve water yields.
- We have a major research development facility currently in operation—the Water Quality Improvement Center in Yuma, Arizona—and construction on the National Research Center for Groundwater Desalination in Alamogordo, New Mexico, usually referred to as Tularosa, will have construction completed in late March.
- You will hear a detailed presentation on the Tularosa Research facility from Reclamation's Mike Gabaldon later in the program. Our aim is for this Center to be a leading place to do collaborative research and development. The Center's

research will focus on brackish groundwater desalination, concentrate management, small-scale systems for rural and remote applications, and the integration of renewable energy into desalination processes.

- We are working to clarify the transition from construction to operations in light of the expiration of the Desalination Act. We had enough funds to complete construction, but have to clarify how to handle operations. The federal government is currently operating under a Continuing Resolution, so our funding authorities come under last year's budget.
- A number of important developments have come out of the work at the Water Quality Improvement Center. One major area has been improvements in membranes. The Center has done work in developing a chlorine-resistant membrane, which performs better, lasts longer, and works cheaper. They have also developed a mega-membrane, which takes less space for greater yield of desalinated water. This is an especially promising development for treatment plants in municipal areas, where space confinement is an issue.
- They have also been developing research in forward osmosis, which requires no energy inputs.
- At the Center, Reclamation is working closely with the Metropolitan Water District of Southern California to study large-scale desalination equipment and operations at high recovery.
- We have a number of ongoing salinity programs. On the Colorado River, for instance, salinity is a major issue, and USGS and Reclamation work together in reducing the river's natural salinity. Nearly 9 million tons of salt passes from the Upper Basin to the Lower Basin each year. Reclamation's Kib Jacobson, who speaks later on the program, tells me that's enough salt to fill a train ... 1,100 miles long.
- Resulting damages in the United States are estimated to be over \$300 million per year.
- The Colorado River Basin Salinity Control Program partners with the Basin states and Interior's Bureau of Land Management to reduce the river's salinity load. Salinity control measures now prevent about one million tons of salt from entering the river, and Reclamation's control measures are responsible for close to 60 percent of that reduction. By the year 2020, the program aims to prevent 1.8 million tons of salt from entering the river.
- The program is also working with developments in disposal processes—disposal is done through below-surface injection of brine.
- Reclamation is studying alternative ways to replace or recover the high-salinity irrigation return flows that are being bypassed around the Colorado River, in

compliance with salinity requirements under the Treaty with Mexico, and discharged to the Ciénega de Santa Clara in Mexico. This study is designed to reduce or eliminate the use of system storage from the Colorado River to make up for the bypass flow.

- Reclamation is planning some time in the next few months to run the Yuma Desalting Plant for a 90-day demonstration period, at one-tenth capacity. This will provide us data on the potential costs of operating the plant at different capacities, and help us determine whether the design deficiencies revealed during the 1992-93 test have been resolved. In addition, the University of Arizona will monitor water quality in the Cienega during the test run to help assess potential environmental impacts of operating the plant.
- Because of anticipated high operation and maintenance costs and potential impacts to the Ciénega, we are studying other bypass flow replacement or recovery options as well
- The U.S. Geological Survey is engaged in research on groundwater to increase our understanding of chemical composition, effects of extracting saline from water, and effective disposal of waste.
- USGS has recently been involved in two major desal studies—one at Cape May, New Jersey and one in San Diego.
- Saltwater contamination has forced the closure of water-supply wells for the City of Cape May and caused concerns about the future sustainability of ground water. Long-term monitoring and a numerical ground-water model of the aquifer system helped engineers combine desalination of brackish ground water at some wells with reduced pumping of fresh ground water at other wells to stabilize the saltwater front.
- In San Diego, the Sweetwater Authority has been desalinating ground water since 1999. They are looking at increasing their capacity, but need to assess the potential for seawater intrusion caused by any increased pumping. USGS studies are underway to characterize the aquifer and its flow system.
- The Sweetwater Authority is looking for a low-energy desal process, capable of handling brine as an input source with the option for zero-discharge to the Sweetwater River. A solar distillation loop is potentially capable of meeting these objectives, and Interior was awarded a general patent for the 'Solar Distillation Loop' in 2006.
- USGS research has also developed a novel approach to desalination using a low-energy process that takes advantage of below-surface heat to accelerate solar

distillation of saline water. The first proof-of-concept study was in Palo Alto, California in 2005. During 2007, USGS in cooperation with the Sweetwater Authority plans a second proof-of-concept field test at the Chula Vista desalination plant south of San Diego.

Some Ongoing Partnership Efforts

- Reclamation is engaged in a number of partnership efforts in California. Twelve cooperative agreements in California are currently in place using nearly \$2 million—more than one-third of Reclamation’s research funding. Five of the projects are carrying out research and seven of the projects are in the final report phase.
- One of the more interesting reports under review is the first phase of the Dana Point Project. Seawater intake design for desalination plants was identified as a major issue by the California Desalination Taskforce. Reclamation has been partnering with the Municipal Water District of Orange County to study the feasibility of using slant wells to extract seawater for a potential future desalination facility near Dana Point.
- A cooperative agreement with the district was awarded in September 2004 for the first phase of the demonstration and Reclamation has provided \$360,000 for this work.
- The first phase of the testing is complete and slant wells appear to provide a more environmentally friendly alternative to co-location of desalination plants with power plants and power plant intakes.
- Reclamation has been partnering with the City of Long Beach since 2002 on a feasibility study to demonstrate the effectiveness of a new ocean desalination methodology developed by the City. The primary work being performed is the construction and operation of a pilot plant to test the new method alongside conventional reverse osmosis membranes to determine potential energy savings. The City of Los Angeles is also a partner in this effort.
- Reclamation has been providing technical advice during the design and construction of the facility, which is complete except for a few minor items. The testing phase is scheduled to begin soon, with Reclamation providing technical oversight. Reclamation has provided 50 percent of the funds for the pilot plant to date, totaling about \$3.8 million.

Conclusion

- The desalination picture isn’t crystal-clear, but our work is moving ahead as effectively as we can move it, and we are optimistic about the future.

- Research has helped improve processes and reduce costs. Figures vary, but within the past twenty years or so costs of desalination have decreased by half, even more. Research investment has resulted in improvements in membranes, making them less expensive and more effective and improvements in brine disposal, a critical consideration especially here in California.
- We have a solid foundation of research, and we're interested now in pushing forward to the next generation of technologies, to advance the state of the art through collaboration with industry, academia, and water supply agencies. Interesting work in areas such as forward osmosis may help us integrate desalination work as an increasingly important method of meeting water needs. We are looking for the research to make these technologies even better, even more affordable and more accessible.
- We look forward to continued work in research and development with our stakeholders. We need to work in partnership, throughout the desal community, to see how we can progress with our existing resources—and we can progress if we work smart.
- I know that these next two days will go a long way toward helping us to work smart and to bring together those on the ground who will continue to improve the technology, reduce costs, and make the potential of desalination an accessible reality for people.

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