RECLAMATION Managing Water in the West

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The Knowledge Stream
Research Update

Saline Treatment for Salt Marsh Coastal Wetlands

Using wetlands to treat concentrate from desalination processes

Bottom Line

This innovative technique uses a "waste" product that would otherwise discharge to the ocean, while creating a much-needed salt marsh habitat.

Better, Faster, Cheaper

Wetlands decrease the overall concentrate volume through evapotranspiration, reduce the toxicity of the overall discharge, and provide additional marshland habitat for native species.

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Problem

The city of Oxnard, California, has two desalting facilities that treat either brackish ground water or reclaimed water on the coastal plain in Ventura County. All desalination water treatment processes produce a "concentrate" stream—water with a high concentration of the salts left from the desalination process. As desalination becomes ever more crucial for new water supplies, new methods for disposing of this concentrate safely must be found.

Solution

Treatment wetlands could provide an alternative to ocean discharge of the brackish concentrate. This demonstration project uses salt water wetlands to improve the quality of the concentrate waste from the city's desalting plant. These "wetlands in a box" treat the water in stages: bacteria, fungi, algae and other micro-organisms transform certain unwanted elements from the concentrate and then an anaerobic system supports other micro-organisms to reduce selenium and turn other contaminants to nitrogen gas. Finally, the briny concentrate, now with acceptably low nitrate and selenium levels, flows to a pond that wraps around the plant's administrative building to finish the treatment. The pond connects to the city's existing outfall—a pipe that takes treated wastewater from the sewage treatment plant across the street out to the ocean.

To demonstrate the application of engineered treatment wetlands for concentrate reuse, CH2M Hill designed a series of demonstration wetlands to test a sidestream of up to 20,000 gallons per day of concentrate. The projected total dissolved solids (TDS) (>11,000 milligrams per liter [mg/L]) and ammonium (>140 mg/L) are significantly greater in the reclaimed water concentrate than the ground water concentrate (>4 mg/L TDS and <0.1 mg/L ammonium) tested in the initial wetlands pilot study.

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Building saline wetlands at the administrative building in Oxnard, California.
(see next page for the final ponds)

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Key findings from the pilot wetland studies indicated that:

(1) The concentrates and the wetland treatment systems are not objectionable aesthetically (e.g., no odor)

(2) Brackish marsh plant species grow normally in concentrate

(3) Contaminants such as nitrate-nitrogen, selenium, and other metal pollutants are removed passively from the concentrate through natural wetland processes

(4) Acute and chronic toxicity to brackish test organisms are significantly reduced

(5) Concentrate volume is reduced through evapotranspiration

Collectively, these findings support the initial hypothesis that concentrate can be used to help create and restore coastal salt marshes.

Application

Reclamation's Science and Technology Program research project is focused on developing sufficient information to prove the concept and facilitate construction of a full-scale wetland for the facility. A draft monitoring plan has been prepared and baseline plant, soil, and water quality information has been collected to provide adequate data to evaluate the effectiveness of the treatment system on concentrate brine. Results from this study will be applicable to a variety of wetland treatment systems that have the potential to selectively treat concentrate for salt marsh habitat enhancement.

Wetlands pond around the administrative building in Oxnard, California.

Future Plans

This technology will benefit all communities that have or are considering construction of a brine outflow into the ocean. If advanced water treatment concentrate waste flows could be treated in an engineered wetland system, and in turn support the development of a salt marsh, multiple environmental and economic benefits will be achieved. Should this concept function as hypothesized, it will provide an opportunity for water districts in coastal states to avoid building additional ocean outfalls, increase fish and wildlife habitat, and make beneficial use of a traditional "waste" product.

Should the pilot saline wetlands prove successful as treatment wetlands, there is tremendous potential for widespread adoption of this strategy throughout Reclamation's Coastal States. Inland desalination and wastewater purification facilities may also consider using wetland treatment to further remediate concentrate streams and provide additional resources for native environments.

"The Oxnard demonstration wetland is a unique facility for research into wetland treatment processes. Once the initial concept is proven, the demonstration wetland will remain available to support additional research into the future.

Oxnard's saline treatment wetland is a worthwhile concept that could provide a dependable supply of brackish water to support coastal wetland habitats in Ventura County."

Doug McPherson,
Environmental Specialist,
Reclamation

More Information

Oxnard Saline Treatment Wetlands

www.usbr.gov/research/projects/detail.cfm?id=9424

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