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San Juan Basin Authority
Groundwater and Desalination Optimization Program
Foundational Actions Fund Final Report

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

MUNICIPAL WATER DISTRICT OF ORANGE COUNTY

SAN JUAN BASIN AUTHORITY

March 2016

1. EXECUTIVE SUMMARY

San Juan Basin Authority (SJBA) has been actively pursuing development and expansion of groundwater production facilities, while ensuring preservation and sustainability of the local water resources. Current water demands of the SJBA member agencies is approximately 86,400 acre-feet per year (afy) for a total service area population of about 406,200. This demand is satisfied through imported potable water sources (69,600 afy) augmented by local groundwater production (5,268 AFY), and local recycled water (14,000 afy) supplies. Demand within the basin is expected to increase to about 106,400 afy by 2035 due to population growth.

The San Juan Basin Groundwater Facilities Management Plan (SJBGFMP) recognized that in-stream recharge along both San Juan Creek and Arroyo Trabuco Creek is the only viable large-scale recharge method for the San Juan Basin due to the lack of suitable off-stream sites for stormwater storage and recharge, and the inability of the basin to accept large amounts of recharge at a specific site. The San Juan Basin watershed has an alluvial stream morphology that extends offshore and currently the aquifer has storage capacity that is underutilized. Without adaptive management and expanded recharge of the watershed there is limited opportunity for production of potable water. Basin enhancement concepts include:

- increasing groundwater recharge utilizing stormwater capture
- introduction of recycled water for groundwater recharge
- dry-weather discharge of recycled water to creeks
- application of alternative groundwater production techniques
- protecting against seawater intrusion

In 2013 the SJBA, in conjunction with the Municipal Water District of Orange County, submitted a proposal to the Metropolitan Water District of Southern California for a Foundational Actions Fund (FAF) Grant to evaluate the feasibility of implementing alternative six of the SJBGFMP. The objective of the FAF grant program study was to analyze options for sustainable, long-term use of an impaired watershed that is typical to Southern California.

Six conceptual strategies were developed in the initial FAF analyses for further refinement and cost evaluation. Each conceptual strategy contained some or all of the following program elements:

- seawater extraction barrier
- enhanced stormwater recharge
- recycled water recharge
- in-lieu recharge through the offset of private well pumping with direct recycled water deliveries to the pumpers.

The conceptual strategies were grouped into two categories as they relate to the recharge elements of the Program:

- surface water recharge (SWR) and
- injection (INJ).

Surface water recharge involves recharge with rubber dams and/or incidental recycled water recharge. Injection involves construction of injection wells in strategic locations to inject recycled water into the basin and subsequently recover it downstream without allowing rising groundwater to occur.

Rubber dams would create a series of ponds in the stream channel making the channel flow "bank to bank" thereby maximizing the wetted area and recharge to capture storm water runoff before it reaches the ocean. During wet periods, the rubber dams would remain inflated as long as the flow in the channel results in a stage less than one-foot greater than the rubber dam crest. When this stage limit is exceeded, the rubber dam would deflate restoring the full flood capacity of the channel. The rubber dam would re-inflate as soon as the flow in the channel is reduced. Thus, after a storm has passed, water will be stored behind the rubber dam for subsequent recharge.

With the potential to utilize the existing Upper Oso Reservoir and the SMWD's planned Trampas Reservoir, there is potential to utilize recycled water for a future groundwater recharge program that is not being used by the agencies' non-potable recycled (NPR) systems. However, both NPR and indirect-potable reuse (IPR) systems require seasonal storage, so a regional assessment of the total available wastewater and recycled water was completed to understand what is truly allocated for NPR vs. what may be available for a future IPR program.

Based on the projected recycled water demands an average of 1,185 af of recycled water is needed to be stored during off-peak seasons to meet the estimated peak season demands. With all the wastewater treatment plants contributing, a projected average of 11,114 af of recycled water could be available for seasonal storage reservoirs. After subtracting the projected seasonal storage needs of the NPR demands, the net result is a projected average of 9,929 af of recycled water. It is anticipated that, during dry seasons, recycled water would be introduced upstream of the rubber dams to promote infiltration/percolation for groundwater recharge.

Current State regulations for injection and for some surface recharge applications of recycled water require Full Advanced Treatment (FAT). There are a few options for achieving FAT, but the most typical process include micro-filtration and reserve osmosis (MF-RO) followed by advanced oxidations processes (AOP), which achieve the requisite chemical contaminant removal. For the facilities included in this planning project, a combination of ultraviolet (UV) light with a strong oxidant such as hydrogen peroxide (UV-AOP) has been considered for advanced treating water prior to recharge of groundwater basins.

A recovery wellfield and new Groundwater Recovery Facility (GWRF) are required to pump and treat the recharged recycled water. Advanced treatment (reverse osmosis and advanced oxidation process typically) improvements are also required under current state regulations to create a higher-quality recycled water for injection into the basin would be required for this strategy. Both the J.B. Latham Plant and the Chiquita Water Reclamation Facility (WRF) have enough flow capacity and space to allow for such improvements. For the purposes of this study, the J.B. Latham Plant is the preferred site for advanced treatment improvements over the other alternatives due to its available supply source, proximity to the injection well field, available space onsite for additional facilities, and the availability of supply in the near future. Future studies should look at more detailed designs and costs for the three options to determine the most cost-effective solution should one of the Injection Strategic Concept be implemented.

Program alternatives included a seawater extraction barrier to ensure that seawater would not intrude into San Juan Basin due to upstream groundwater pumping and to produce a new source of water. The SJBGFMP suggested that the extraction barrier pumping would range between 3,000 to 6,000 afy. Modeling work conducted for this project confirmed the hydrologic feasibility of the creation of a robust 3,000 afy extraction barrier would prohibit seawater intrusion along the coastal extent of San Juan Creek. For all Program alternatives the seawater barrier draws about 2,100 afy from the ocean, about 700 afy from groundwater originating upstream, and the remaining 200 afy from vertical recharge that occurs between the coast and the SCWD wells.

The average project yield for the baseline alternative was determined to be about 7,200 afy. The average project yields for the Program alternatives ranged from 11,200 afy to 15,000 afy with a net increase over the baseline alternative of 4,000 afy to 7,000 afy.

Key findings from the San Juan Basin Desalination and Optimization Program that can be applied in other impaired costal groundwater aquifers include:

Seawater Extraction Barrier

An extraction barrier is a feasible method of protecting inland groundwater from seawater intrusion and develops a new, reliable water supply. Considerations for developing an extraction barrier include:

- Monitoring and modeling will be required to appropriately size the extraction well barrier to ensure the effectiveness of the barrier.

- The extraction barrier wells will likely reduce the pumping capacity at existing inland production wells that are close to the coast. This lost capacity should be accounted for in estimating the project yield.
- The extraction barrier can capture recharge that is not captured by inland production wells.
- An extraction barrier project is expensive, but costs can be reduced by seeking Regional support. Decreasing imported water demand in one service area benefits all local water agencies and this is valuable from a reliability standpoint.

Recycled Water Recharge via Injection in an Impaired Basin

- Injection in a small, narrow aquifer is not recommended. There is little getaway capacity for the injection water and numerous relief wells are needed to prevent rising groundwater downstream of injection sites.
- Based on current State of California Division of Drinking Water (DDW) regulations, injection of recycled water requires advanced treatment and is cost prohibitive for an impaired basin.

Recycled Water Recharge via Surface Water Recharge in an Impaired Basin

- Surface water recharge strategies are optimal because they also have the benefit of increasing storm water capture for recharge.
- Live stream recharge of stormwater or recycled water also has the multiple benefits of supporting riparian habitat and elimination of non-native vegetation as well as providing food sources, breeding grounds, and a wintering ground for migratory birds.
- Monitoring and modeling will be required to optimize the location of recharge to minimize RWC and URT.
- Recharge operations will needs to be adaptive: in wet years recharge will be less and in dry years recharge can increase.
- Facilities should be sized for the dry years, where the maximum amount of recharge can occur.
- Constructing Seasonal storage for recycled water will increase the amount of water available for recharge – both seasonally and in variable climates.
- Projects and facilities should be phased to incrementally increase recharge over time.

Adaptive Production Management

- Groundwater pumping needs to be adaptive to match the basin recharge (with or without enhanced recharge).

- If seawater barriers are cost prohibitive, groundwater pumping can be adapted from year to year in order to minimize groundwater outflow to the ocean and protect against seawater intrusion.
- Monitoring and modeling will be required to develop and adaptive production management plan.