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Salinity

Background

Salinity is defined as the saltiness or the salt content of a body of water. There are four levels of salinity, ranging from fresh water, which has less than 0.5 parts per thousand (ppt) of dissolved salts, to brine, which has more than 50 ppt of dissolved salts. Brackish water has between 0.5 and 35 ppt and saline, or sea water, has 35-50 ppt. Salt or salinity is typically used interchangeably with total dissolved solids (TDS) or electrical conductivity (EC).

Salinity in soil and water is caused by nature and through human activity.   Mineral weathering, dust and precipitation all deposit salts into the soil and groundwater. In dry regions salts may accumulate, leading to naturally saline soils. In addition, human practices can increase the salinity of soils through waste and the addition of salts in irrigation water. Salinity caused by irrigation water is greatly increased by poor drainage and use of saline water for irrigating agricultural crops.

Regional Salinity

The causes of salinity in California vary by geographic region. The problem of salinity in California's Central Valley affects much of the state and is of increasing concern. As surface and groundwater supplies become scarcer, and as wastewater streams become more concentrated, salinity impairments are occurring with greater frequency and magnitude. Agricultural activities and imported water greatly contribute to the salt load. Conjunctive use projects are also affected because water applied to the ground will dissolve and mobilize additional salts as it moves through soils and is stored in aquifers. Pumped groundwater in the Central Valley is often of poorer quality than surface water supplies, thus pumped groundwater, when used as an irrigation or municipal supply, can contribute significant additional salt loads to surface water.

In the Sacramento-San Joaquin Delta, salinity is primarily caused by wastewater and agricultural activities. For example, the cities of Manteca and Tracy and the Mountain House Community Services District discharge wastewater into south Delta waterways and food processors operate several unlined wastewater ponds, significantly contributing to the salt levels in the rivers. Drainage and tail water pumping is also a problem along the South Old River and the San Joaquin River. Agricultural drainage in the South Delta is particularly saline due to heavy mineralized resident soils originating from eroded Diablo Range marine sedimentary rock.

Seawater intrusion is of major concern in the coastal aquifers of California. Saltwater intrusion is a process that occurs in virtually all coastal aquifers, where they are in hydraulic continuity with seawater. It consists in salt water (from the sea) flowing inland in freshwater

aquifers. This behavior is caused by the fact that sea water has a higher density (which is because it carries more solutes) than freshwater. This higher density has the effect that the pressure beneath a column of saltwater is larger than that beneath a column of the same height of freshwater. If these columns were connected at the bottom, then the pressure difference would trigger a flow from the saltwater column to the freshwater column. Seawater intrusion has been noted in Monterey, Santa Cruz, and Ventura counties, and in lands surrounding the San Francisco Bay (DWR, 2006), dating back to the 1930s. Seawater intrusion is also a problem in the coastal areas of Los Angeles and Orange Counties.

In the Chino Basin, agriculture (mostly dairies) is the principal source of salinity. The Chino Basin contains the highest concentration of dairies found anywhere in the world. The large animal populations generate considerable volumes of liquid and solid waste, which contain significant amounts of salt. The resulting poor quality, salt-laden groundwater in the Basin makes its way into the Santa Ana River and thus negatively impacts that surface water body as well.

And in Southern California, the Colorado River has proven to be a main source of salinity in the region. The Colorado River and its tributaries provide municipal and industrial water for more than 23 million people in the seven Basin States and irrigation water to nearly 4 million acres of land served by the Colorado. The threat of salinity is a major concern in both the United States and the Republic of Mexico. Salinity affects agricultural, municipal, and industrial users. High salinity levels make it difficult to grow winter vegetables and popular fruits. Salt in water systems plugs and destroys municipal and household pipes and fixtures. Studies show that salinity damages in the United States' portion of the Colorado River Basin range between $500 million and $750 million per year and could exceed $1.5 billion per year if future increases are not controlled.

Salinity Management

There are many brackish water desalination plants operating in California. An example of such a project is the Chino Basin Desalting Program, which includes the Chino I Desalter that removes approximately 10,000 tons of salts annually and produces 8 million gallons of fresh water per day (mgd). The Chino I Desalter uses reverse osmosis to produce its freshwater supply and the concentrated brine travels to the ocean through the Santa Ana Regional Interceptor (SARI). This project was developed by Santa Ana Watershed Protection Authority in cooperation with a large number of Southern California agencies. Plans are in the works to expand the desalter's capacity and to build another facility. Many of the participating agencies are part of the Southern California Salinity Coalition, formed in 2002 to provide a means of coordinating the efforts of stakeholders to address the critical need to remove salt from water supplies and preserve water resources in that region.

The Zone 7 Water Agency operates the Mocho Groundwater Demineralization Plant, which uses wells and reverse osmosis treatment facilities to draw water with high total dissolved solids from unused shallow aquifers to reduce net salt loading in its main groundwater basin. De-mineralized water is used for potable municipal and industrial use. Zone 7 is part of the Northern California Salinity Coalition, formed in 2003 to address salinity issues in the region. By forming this Coalition, the agencies committed to working together to define priorities and

action plans, identify funding opportunities, and establish a framework for regional cooperation in addressing desalination and salinity issues.

The Central Valley Regional Water Quality Control Board and State Water Board have initiated a comprehensive effort to address salinity problems in California's Central Valley and adopt long-term solutions that will lead to enhanced water quality and economic sustainability. Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) is an effort to develop and implement a comprehensive salinity management program. The goal of CV-SALTS is to maintain a healthy environment and a good quality of life for all Californians by protecting the state's groundwater and surface water resources.

The United States Bureau of Reclamation is working with the U.S. Department of Agriculture and the Bureau of Land Management in the Colorado River Basin Salinity Control Program to build many salinity control projects on the Colorado River. The program's overall goal is to cost-effectively reduce the amount of salinity in the river water.

There are also several seawater intrusion barriers developed throughout the coastal plains of California that are designed to prevent saltwater from entering into groundwater aquifers. For example, several intrusion barrier systems have been developed in the West Coast Basin, Dominguez Gap, Alamitos Gap and Talbert Gap in Los Angeles and Orange counties. In addition, Alameda County Water District's (ACWD) management activities address saltwater intrusion caused by past overdrafting of the Newark Aquifer and deeper aquifers. ACWD has reversed the overdrafting by constructing artificial recharge facilities and augmenting natural Alameda Creek base flow with imported water for groundwater recharge. ACWD operates several extraction wells to remove high salinity groundwater from the Newark Aquifer and deeper aquifers within the Niles Cone (Aquifer Reclamation Program or ARP).

Current Regulatory Status

A secondary Maximum Contaminant Level (MCL) has been set for electrical conductivity to protect drinking water supplies and industrial users often have to treat water supplies to protect processes that are sensitive to total salinity and/or individual ions.

In addition, both the United States Environmental Protection Agency and the State Water Board have approval authority over water quality standards, basin plans and various other water quality programs including Total Maximum Daily Loads (TMDLs) developed for salt in the San Joaquin River and other waters listed on the 303(d) list of impaired waters.

The State Water Board also has authority over water quality and water rights in the Delta. The State Water Board has set salinity standards for the San Joaquin River near Vernalis and other locations in the South Delta. Decision 1641, issued in March 2000, conditioned the permits under which the United States Bureau of Reclamation delivers water to the Tulare Lake and San Joaquin River Basin to require that the United States Bureau of Reclamation meet the 1995 Bay-Delta salinity objectives at Vernalis. Decision 1641 also directed the Central Valley Regional Board to develop and adopt salinity objectives and a program of implementation for the main stem of the San Joaquin River upstream of Vernalis.

ACWA's Position

ACWA recognizes the significant salinity challenges faced by water districts in the Central Valley and throughout the state. ACWA is taking an active role in the CV-SALTS program and other collaborative efforts to address increasing salinity in the water supply.

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