Calleguas Creek Watershed Chloride TMDL

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Proposed Chloride TMDL Linking Surface and Groundwater in the Calleguas Creek Watershed

A Total Maximum Daily Load (TMDL) and new water quality objective (WQO) were proposed simultaneously for chloride by the Los Angeles Regional Water Quality Control Board to protect agricultural and groundwater recharge beneficial uses in the Calleguas Creek Watershed, Ventura County, California. If the proposed requirements were implemented, point source dischargers would find it necessary to upgrade to advanced wastewater treatment, such as microfiltration and reverse osmosis.

In order to characterize the chloride balance in the watershed for development of the TMDL, surface and groundwater linkages were modeled. An investigation of the necessary chloride limitations and requirements was conducted for development of a water quality objective to protect the most sensitive agricultural crops in the region.

Carollo conducted an independent scientific assessment of the proposed chloride water quality objective and associated TMDL for reasonableness and economic impacts, including comprehensive surface and groundwater modeling and a chloride mass balance to assure beneficial use attainability.

Background

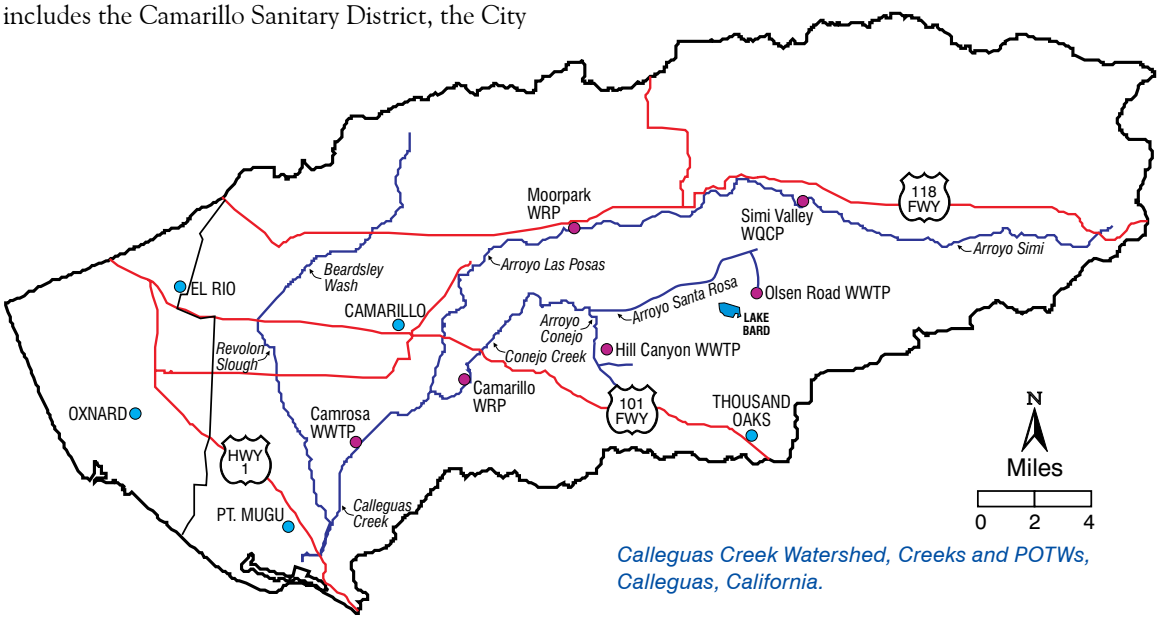
The Calleguas Creek Watershed Joint Powers Association (JPA) represents the five municipal wastewater treatment facilities that own and operate wastewater treatment facilities that discharge to surface waters in the Calleguas Creek Watershed. The JPA includes the Camarillo Sanitary District, the City of Thousand Oaks, Ventura County Waterworks District No.1, City of Simi Valley, and the Camrosa Water District.

The receiving waters are effluent dominated or effluent dependent channels, consisting largely of treated wastewater discharges and irrigation return flow during dry weather periods.

Three factors make this project unique: (1) surface and groundwater analysis are linked as the TMDL is proposed to protect groundwater quality, (2) the impaired beneficial uses driving the TMDL are for the protection of agricultural and groundwater beneficial uses versus public health and/or aquatic life beneficial uses, and (3) the water quality modeling focuses on the "geologic time frame" for the water quality analysis to assess long-term attainability of water quality objectives. Essentially, the scientific challenge is to understand the relationships among: stream water flows and quality, groundwater flows and quality, water quality and crop yields, and chloride concentrations necessary to protect sensitive agricultural crops.

Surface – Groundwater Modeling

There are three considerations to the surface-groundwater modeling. The first is the analysis of the stream flow and chloride concentrations. The second consideration of surface-groundwater modeling is the effect of evapotranspiration from crops on chloride accumulation in the basin. The final



Calleguas Creek Watershed, Creeks and POTWs, Calleguas, California.

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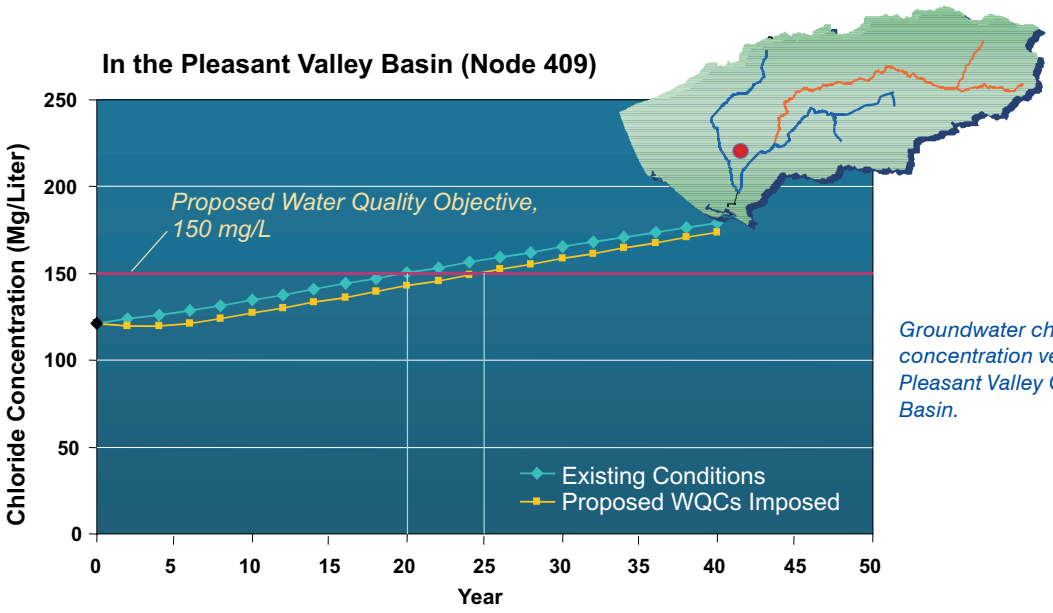


Groundwater chloride concentration versus time in Pleasant Valley Groundwater Basin.

consideration is the assumptions used as inputs into the model to determine characteristics of the basin under each condition.

Prior to significant urbanization and development, groundwater inflows were in equilibrium with groundwater outflows. With recent groundwater pumping for agriculture, groundwater levels have decreased, consequently decreasing the outflows from the basins. The simulations were run to determine the distribution of chlorides over a 40-year period into the future.

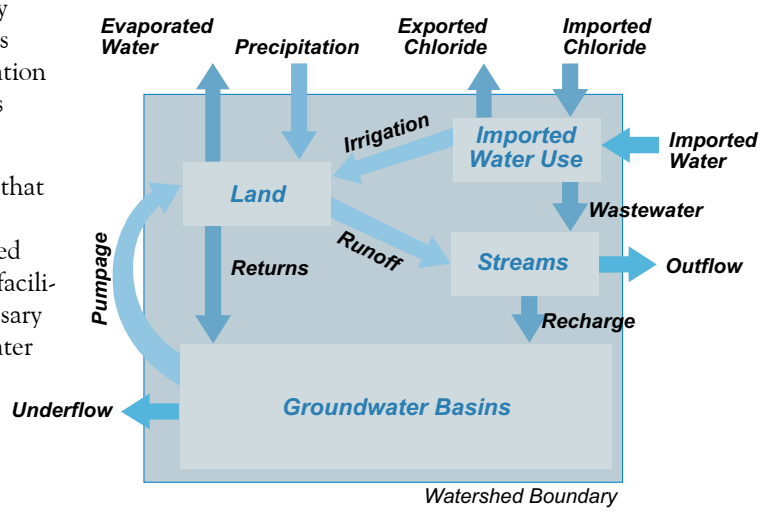
The model results revealed a trend of increasing chloride concentrations in groundwater occurring with and without wastewater treatment plant compliance of the proposed water quality objective and TMDL. Irrigation practices and groundwater pumping used for irrigation causes increased chloride concentrations through various mechanisms.

Findings from the evaluation concluded that changes in streamflow quality, including proposed changes resulting from advanced treatment for the wastewater treatment facilities, would have minimal effect on necessary chloride concentrations in the groundwater basins. Groundwater chloride concentrations would continue to increase. In fact, if the treatment facilities were to remove their discharge from the receiving waters, groundwater chloride concentrations would continue to increase at the same or even greater rate.

Treatment and Costs

Carollo conducted a cost analysis evaluating the impacts to the Agencies and their ratepayers due to adoption of the proposals. The proposed treatment scheme for compliance with the proposed objectives involves adding advanced treatment to the POTWs current processes. Reverse osmosis (RO) is the most effective and efficient method to remove chlorides from a water stream. Microfiltration (MF) units would be required for pretreatment to the RO units.

The brine from the RO units will require either land disposal or infrastructure for an ocean discharge.



Surface and groundwater components of the Conceptual Chloride Flux Model.