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# Intensive groundwater use and management drive trends in inorganic constituents in California groundwater

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Extensive replumbing of hydrologic systems in California has resulted in long-term changes in geogenic constituents in groundwater resources. The U.S. Geological Survey Groundwater Ambient Monitoring and Assessment program examined trends in several constituents measured in groundwater resources used for public drinking supply in California during 2000-2020. Significant trends were identified for total dissolved solids (23% of tested area), uranium (22%), fluoride (12%), and arsenic (14%). Changes in groundwater chemistry and flow dynamics due to anthropogenic processes such as managed aquifer recharge can drive changes in mobility of geogenic constituents to aquifers. Source water for recharge includes local and imported surface water, run-off, and treated wastewater. Differences in source-water chemistry and the shift to recharge in former discharge areas can affect recharge dynamics and ultimately water quality. Sampling and trend analysis methods established by the U.S. Geological Survey allow for examination of the processes by which engineered recharge can alter groundwater quality at regional scales. Fluoride concentrations are changing in 20% of public-supply resources in the state of California, with decreasing trends more common in wells. Increasing and decreasing fluoride trends can be attributed to variations in recharge source water across different regions of California. At a more local scale, managed aquifer recharge, and irrigation using imported Colorado River water in the Coachella Valley increased concentrations of total dissolved solids in the groundwater resources over the last 50 years. Managed aquifer recharge is important for sustainable water management in water scarce regions, and understanding the dynamics of water-quality changes at the basin and regional scales will inform development of managed recharge systems that preserve water quality in groundwater resources of California.