

Identification of Municipal Water Sources Contributing to Urban Streamflow in Austin, Texas

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Previous investigations have determined that municipal water can provide a substantial surface water and groundwater recharge source for the Edwards Aquifer in central Texas. Knowledge of how water inputs to urban watersheds change with urbanization is essential for sustainable water resources management. Austin municipal water $^{87}\text{Sr}/^{86}\text{Sr}$ value ranges (0.7086- 0.7094) are distinct from those of naturally occurring phreatic groundwater (0.7078) and stream discharge in many rural watersheds (0.7077- 0.7084). These differences demonstrate the potential for Sr isotopes to serve as a tracer of municipal water inputs to urban streamflow (Christian et al. 2011). While highly urbanized Austin streams have elevated $^{87}\text{Sr}/^{86}\text{Sr}$ values (0.7085- 0.7088) relative to some rural streams, a number of urban streams and springs have $^{87}\text{Sr}/^{86}\text{Sr}$ values higher than those of municipal water. Soil-exchangeable Sr in the region, having $^{87}\text{Sr}/^{86}\text{Sr}$ values that range higher (0.7083- 0.7125) than those of municipal water, is the likely source. Spatial variability in the distribution of high $^{87}\text{Sr}/^{86}\text{Sr}$ soil and temporal variability in soil-exchangeable Sr contributions to groundwater may result in naturally high streamflow $^{87}\text{Sr}/^{86}\text{Sr}$ values, making the identification and quantification of municipal water as a streamflow source unreliable in some instances. Temporal variability in climatic conditions and resulting changes in effective moisture produce distinct natural groundwater $^{87}\text{Sr}/^{86}\text{Sr}$ and trace element ratio (Mg/Ca) variations. We observed these variations in some Austin area streams. Municipal water inputs to urban watersheds peak during the summer (and during drought) when natural recharge inputs (precipitation) are minimal. Thus, proportions of natural vs. municipal water sources in the streamflow of some highly urbanized watersheds vary seasonally. The changing proportions result in distinct $^{87}\text{Sr}/^{86}\text{Sr}$ and Mg/Ca temporal trends, based on the recharge source, and provide a better constraint on groundwater recharge sources than random (discrete) $^{87}\text{Sr}/^{86}\text{Sr}$ values alone.

Christian, L.N., Banner, J.L., Mack, L.E., 2011, Sr isotopes as tracers of anthropogenic influences on stream water in the Austin, Texas, area: *Chemical Geology*, v. 282, p. 84-97.

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