

## **Pollution Dynamics in the Tijuana River During Continuous Multi-year Contaminated River Flow**

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The continual discharge of tens of millions of gallons per day of wastewater, sewage, and chemical pollution from Tijuana, Mexico to the Tijuana River Estuary (TJRE) in San Diego, CA, USA has resulted as a consequence of rapid population growth and inadequate wastewater infrastructure. Such conditions pose health threats to the adjacent community of Imperial Beach, have impacted the TJRE ecosystem, and have forced beach closures due to microbial pollution.

Monitoring of water quality in the TJRE has been ongoing since 2021 with ground-based and satellite remote sensing, in-situ submersible sensors, and ground-truthing via temporal and spatial sampling and chemical and microbiological analyses.

Sensor platforms equipped with Manta sondes that measure CDOM, Tryptophan, chlorophyll, depth, pH and other water quality characteristics provided real-time water quality data that revealed hypoxic conditions at our estuary study site during and immediately after low tides.

Wastewater addition experiments have been conducted with untreated influent wastewater from the International Boundary Water Commission Treatment Plant with clean seawater and freshwater. Such experiments were used to determine which surrogate parameters are most strongly correlated with percent wastewater. From there, end-member mixing analyses were performed to calculate percent wastewater for different sampling dates.

Loading calculations were determined using average daily discharge data from the TJR at the border along with concentration data from over 14 sampling events at multiple sites throughout the estuary.

These calculations of percent wastewater and contaminant loadings were then compared to local, state, and national water quality regulations and objectives to contextualize the severity of the pollution crisis. These analyses of bacteria concentrations and other pollutants within San Diego and Tijuana's shared river basin are integral to alerting surrounding communities to exposure risks, to treating or removing the pollutant sources, and to facilitating transboundary cooperation.