

Colorado River Basin

Purpose

The objective of the Colorado River Basin Project (CRB Project) was to build a digital twin to analyze and forecast water quality and flow for multiple users within the watershed. Reports were tailored for the needs of civil society, entrepreneurs, non-governmental organizations (NGOs), and businesses in manufacturing, agriculture and energy to vastly improve their ability to understand water related risks and develop mitigation strategies.



Scope

The CRB is among the world's water stressed regions facing the environmental, economic, and social challenges of increased water scarcity.

The basin includes:

- The cities of Las Vegas, Los Angeles, Phoenix, and Denver
- 7 states (AZ, CA, CO, NV, NM, UT, WY) and 1,396 cities
- 242 larger watersheds (HUC8s) subdivided into 8,219 smaller watersheds (HUC12s). HUC = Hydrologic Unit Code, language used by the US government to identify watersheds.

**True Elements is creating a new era
in water intelligence.**



What's At Stake

Civilization: The CRB supplies more than 1 in 10 Americans with some, if not all, of their water for municipal use, including drinking water.[1] The Basin provides irrigation to more than 5.5 million acres of land and is essential as a physical, economic and cultural resource to at least 22 federally recognized tribes. In addition, dams across the CRB support 4,200 megawatts of electrical generating capacity, providing power to millions of people and some of the U.S.'s largest cities. It has become clear, however, that under current and projected conditions, the Colorado River is no longer able to meet the demands of its many users. Challenges are emerging that will require the acceptance of a new reality among stakeholders in the CRB.

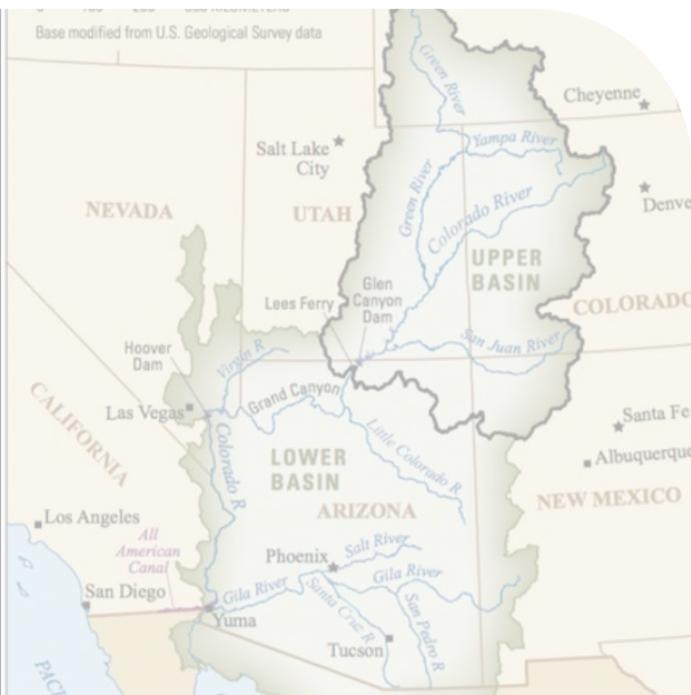
Economy: The economic importance of the CRB cannot be overstated: the Colorado River supports \$1.4 trillion in annual economic activity and 16 million jobs, about 1/12 of the total gross domestic product in the U.S. [2] It's estimated that if 10% of the river's water was unavailable (a decline quite possible under projected climate change scenarios of 10 to 30% flow reductions by 2050) [3], there would be a loss of \$143 billion in economic activity and 1.6 million jobs in just one year.

Environment: This region formed and flourished with the pulse of seasonal floods providing ecosystems with nutrients and nursery habitat. The rush of spring runoff brought new waters to downstream wetlands, and the corrosive power of heavy flows carved out immense landscapes. [4] The terrestrial and aquatic life of the region evolved with a dependency on the Colorado River. With the river's waters now dammed, stored, and allocated for more human demand than supply allows, many species' homes and populations are threatened [5].

Summary of Reports Developed from the CRB Project

True Elements' pioneering approach to data aggregation, normalization, analysis and predictive modeling provided 26 reports divided into **six categories** including:

- **Agriculture**
- **Industry**
- **Storm Water**
- **Wastewater**
- **Water Treatment**
- **Water Quantity**



Agriculture Reports

- **Agriculture Prediction Engine** - based on nutrient runoff from agricultural land, using weather forecast and rain to predict quantities of 9 constituents; Blue Green Algae, Boron, Calcium, Magnesium, Nitrogen, Phosphorous, Potassium, Red Tide, and Sulfur. This is for a specific HUC8 in Maricopa County (Phoenix).
- **Water Statistics and Measures** - visualizes physical data and statistics for various chemical and biological contaminants in lakes, springs, wells, and other sites.
- **Weather History and Future Forecast** - looks at weather measurements of pressure, humidity, dew point, wind, clouds, UV index, visibility, rain, and more.
- **What's in My Surface Water** - combines data from the EPA & USGS including physical, chemical, and biological data measured in water bodies.
- **What's in My Watershed** - provides a view of HUC 12 watershed flows and area descriptions including extensive information about land use and topography.

Note: 5 stations placed at specific sites (large inland rivers and coastal rivers) offer 8 measured constituents: Dissolved Organic Carbon (DOC), Dissolved Ammonia as N (NH₃), Dissolved Nitrate plus Nitrite (NO₂3), Dissolved Orthophosphate as P (OP), Dissolved Silica as SiO₂ (SI), Suspended Sediment (SSC), Total Nitrogen as N (TN), and Total Phosphorous as P (TP).

Industry Reports

- **Industry TrueQI Scores** - looks at the 369 HUC12s that have industries in Manufacturing, Food & Beverage, Mining, or Technology, and generates an index based on the toxic weighted pounds equivalent of discharges for which each facility has permits.
- **Risk Screening** - looks at multiple areas of the CRB at once. It explores data on releases of toxic substances from industrial facilities and assigns TrueQI scores based on the amount of toxic chemicals released, and factors such as the chemical's fate, transport, relative toxicity, and potential human exposure.
- **What Industrial Facilities Are in My Watershed?** - shows major and minor permit holders for all HUCs within the CRB.

Storm Water Reports

- **True QI Forecast** - forecasts the number/amount of 72 contaminants present in any rainfall event in a target area. This is for a specific HUC8 (Grand Junction, CO).
- **Storm Water True QI Scores** - generates daily predictions for each HUC12 within the Grand Junction HUC8, on what will be in the water after a storm event or weather impulse.
- **National Storm Water Quality Database** - offers a view of attributes of pH, hardness, alkalinity, temperature, total dissolved solids, conductivity, chloride, total suspended solids, and turbidity.

- 1.(Drought in the Colorado River Basin n.d.)
- 2.(Economic Importance of the Colorado River 2019)
- 3.(Colorado River 2017)
- 4.(Environment and Ecology of the Colorado River Basin 2012)
- 5.(Building a New Future for the Colorado River 2016)



Wastewater Reports

- **True QI Score** - generates an index for the 225 HUC12's that have wastewater treatment plants, based on the toxic weighted pounds equivalent of discharges for which each facility has permits.
- **Wastewater MGD and Pounds by HUC12** - views wastewater treatment plants by their capacity to filter water (Million Gallons per Day) or by their discharge released in pounds. A comparative risk screening tool.
- **Toxic Release Inventory** - views toxic chemical releases and pollution prevention activities reported by industrial and federal facilities. Can be filtered by chemical, industry and year of interest.
- **Discharge Monitoring Report** - shows facilities tagged as major (and selected minor) permittees under the National Pollutant Discharge Elimination System (NPDES) program, and links to Pollutant loading reports. The report gives present-day and historical statistics for top facility discharges, filtered by HUC.
- **Facility Registry Service/System** - in support of the EPA's mission of protecting human health and the environment, views data about facilities, sites, or places of environmental interest that are subject to regulation. It links to the EPA's detailed facility report and can be filtered by Significant Industry Code (SIC).

Water Quantity Reports

- **Groundwater Levels and Site Locations** - views historic and present-day aquifer data showing groundwater levels and statistics measured above sea level and below land surface to show trends across all HUCs. Users can view a range of historical data using our historic date range slicer.
- **Surface Water Flow Rate** - views historic and present-day water flows and stage levels in the streams, canals, and lakes from various data sensors measuring velocity of water flow and water stage for all HUCs.
 - Daily Lake Mead Levels
 - US weekly Drought Monitoring (data layer)
 - Domestic Well Location by population served heat map (data layer)
 - Principal Aquifer Map (data layer)

Water Treatment Reports

- **Drinking Water True QI Score** - generates a zip code based index from public water system's Consumer Confidence Reports. We use 88 Primary and 15 Secondary drinking standards, and rank by health effects associated to each constituent. Scores are currently available for all cities serving a population of 75k or greater.
- **Permit Discharge Report** - shows what is being discharged into the water, with permit compliance status (active, terminated, violations, etc) and descriptions for all HUCs.
- **What's in My Drinking Water** - monitors the occurrence of unregulated contaminants (UCMR- Chemical, and Microbial) at a facility and source level, for all systems serving greater than 10,000 people. The Safe Drinking Water Act requires that EPA monitor for no more than 30 unregulated contaminants every five years.
- **An experimental 3D view of Drinking Water True QI Scores** - a river runner approach to walk through all the scores generated for Drinking Water.

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