# a living river

## SANTA CRUZ RIVER 2025 DOWNTOWN TUCSON TO MARANA

# BUILDING RIVER COMMUNITY

**SUPPLEMENTARY REPORT FOR 2013 TO 2024 WATER YEARS**

SONORAN INSTITUTE

PIMA COUNTY

CITY OF TUCSON

TUCSON WATER

# THE SANTA CRUZ RIVER
# A LIVING ECOSYSTEM


Sections of the Santa Cruz River flow all year, providing the principal wetland habitat in the Tucson metro area. River flows in these reaches are sustained by effluent (highly treated wastewater) released from two regional water reclamation facilities. These habitats are managed systems and the distance effluent flows travel is variable, especially in the reach near downtown.

The Tucson area *Living River* reports were developed to annually gauge the health of this valuable ecosystem and track the impacts of our community's investment of over $600 million to upgrade the regional wastewater reclamation facilities in 2013. The series was expanded in 2020 to include data for the Santa Cruz River Heritage Project, where City of Tucson | Tucson Water started releasing effluent or groundwater to the downtown reach in 2019.

This supplementary report provides more detail on recent accomplishments highlighted in the 2025 report and shares data from the 2013–2024 water years. This enables an easy viewing of trends in the water context and diverse indicators of river conditions. All *Living River* reports can be found on the Sonoran Institute website at **www.sonoraninstitute.org**.

*Photos above, left to right, by Wendy.o.logy, Courtney Mack, and Ramón Olivas*

# Assessing Conditions

The *Living River* report evaluates conditions of the Santa Cruz River in the Santa Cruz River Heritage Project reach (later referred to as Heritage Project reach) and from northwest Tucson to Marana using indicators organized into six categories that represent a breadth of biological, chemical, physical, and social properties of the river (see below). The indicators relate to conditions in the river channel and in the riparian areas, the areas next to and affected by the river. This supplementary report expands on information provided in the printed *Living River* report.

The purpose of the *Living River* series is to monitor and report on wetland and riparian conditions at various intervals downstream of the effluent discharge points. As effluent flows downstream, it impacts and is impacted by the natural conditions of soils, vegetation, and the surrounding ecosystem. For the purposes of this study, the river is divided into a 1.4-mile Heritage Project reach and a 23-mile northwest Tucson to Marana reach. The latter is further divided into three sections delineated by their differing hydrology, geology, and adjacent land use: Three Rivers, Cortaro Narrows, and Marana Flats.

Data are collected and summarized by water year (October 1–September 30) and compared to the baseline conditions observed in the 2013 water year.

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|---|---|---|
| **Flow Extent** | Water flowing in and out of the system determines available aquatic habitat. | • Miles of flow in June<br>• Flow at Trico Road and Congress Street |
| **Water Clarity** | Solid particles in the water and on the riverbed can impact habitat and conditions for aquatic life. | • Total suspended solids<br>• Turbidity |
| **Water Quality** | Specific chemical conditions are necessary to sustain the river's animal and plant communities. | • Total dissolved solids<br>• Ammonia<br>• Dissolved oxygen<br>• Biochemical oxygen demand<br>• Metals |
| **Aquatic Wildlife** | Wildlife in the river integrate and reflect conditions of many factors of the surrounding environment. | • Fish<br>• Dragonflies<br>• Turtles |
| **Riparian Vegetation** | Plant communities reflect changes in water quantity and help gauge habitat availability for wildlife. | • Composition and cover in Heritage reach |
| **Social Impacts** | Ecosystem recovery provides outdoor areas for people living or recreating along the river. | • Pedestrian and cyclist use of the Loop<br>• Bird-watching |

# NOTABLE ACHIEVEMENTS

## EXPANSION OF THE CHUCK HUCKELBERRY LOOP RECREATION PATH IN MARANA

The Chuck Huckelberry Loop is a system of paved, shared-use paths and short segments of buffered bike lanes connecting the Cañada del Oro, Rillito, Santa Cruz, and Pantano River Parks with the Julian Wash and Harrison Road Greenway. Over 33 miles of the Loop are located along the Santa Cruz River in Tucson and Marana. The latest expanison of the path connected two existing segments with a new 1.5 mile stretch starting near Avra Valley Road and continuing north towards Marana on the east side of the river. This is an important addition to the Loop in an area were counters indicated that over 11,000 pedestrians and cyclists use the segments in Marana monthly. Learn more about the Chuck Huckelberry Loop.

*Cyclists riding along the Santa Cruz River on a segment of the Loop, ©Bill Hatcher/Sonoran Institute.*

## APPROVAL OF UPDATED FLOODPLAIN MANAGEMENT PLAN FOR PIMA COUNTY

Pima County approved an updated Floodplain Management Plan in 2025 that will result in a series of projects along the river corridor that will increase flood safety. A key objective of this plan is to implement community actions that help reduce flood risks, which in turn will lower insurance premiums within the National Flood Insurance program for Pima County residents who are at risk of economic hardship from flood damage. Beyond flood safety, many of the planned projects will result in numerous benefits for the river and for adjacent communities, including habitat restoration, invasive species management, and improved access to the river for both people and wildlife. One project completed in summer 2025 was the Suzanne Shields Bridge which provides greater access to both sides of the river between Grant and Camino Del Cerro for pedestrians and cyclists using the Chuck Huckelberry Loop. The bridge also serves the important flood control function of providing better maintenance access across the river— an is a location where swiftwater rescues can be performed.

The public is encouraged to join the ongoing stakeholder advisory committee to advise on the action plan implementation. The committee is currently in need of volunteers to fill insurance company and real estate seats, among other community representatives opportunities. Learn more here: Floodplain Management Plan | Pima County, AZ

*Suzanne Shields Bridge (courtesy of Pima County)*

## REMOVAL OF OVER 10 TONS OF TRASH FROM THE RIVER

Clean up events along the Santa Cruz River can help reduce the amount of trash in the river. There were 14 clean up events in 2024 alone, encouraging volunteers to come down to the river and help remove trash from the channel. Overall, 659 bags, each with a 55-gallon capacity, were filled by 794 volunteers. These efforts removed an estimated 10 tons of trash from the Santa Cruz River. Work like this is vital for developing community awareness and stewardship while supporting a healthy river ecosystem—trash is aesthetically unpleasant, but also has impacts on the river and the wildlife that uses it. To complement these efforts, Sonoran Institute is compeleting a trash study to characterize the trash, identify sources, and locate hot spots so that we can develop policies and even engineer devices to capture trash to keep it out of the river all together.

*Clean-up near Grant Road, October 2024, Rebecca Noble/Sonoran Institute*

## RECOGNITION OF TUCSON BY BBC AS ONE OF 25 GLOBAL PLACES TO VISIT

In January 2025, Tucson was listed #7 of twenty-five global places to visit by the BBC. This recognition is based on Tucson as a UNESCO City of Gastronomy, the region's unique multi-national history, the protection of the Sonoran Desert, and the preservation of many historic buildings and landmarks. All of this rich heritage is possible because of the Santa Cruz River.

In a dry land, the river is the secret to survival and the resource around which settlements converge. Concentrations of plant resources and prey along the river corridor attracted early nomadic, hunter-gatherer inhabitants of Arizona. More than 12,000 years later, the river served as a lifeline to Juan Bautista de Anza's contingent of inexperienced travelers in their attempt to discover a land route from Sonora to San Francisco. Stagecoach lines and railroad development also followed river ways and improved access to the Santa Cruz River Valley, driving settlement, increasing ranching and farming enterprises.

Today the river winds through many communties from Mexico to Marana. Though much has changed since people first settled in the region, the river is still a valued resource for recreation, education, and numerous other benefits.

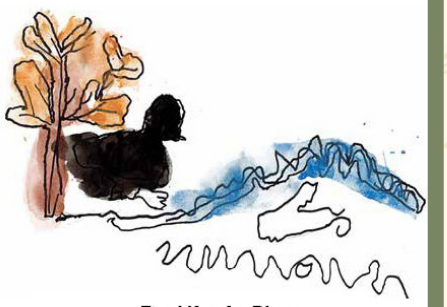
BBC article about Tucson as US's ancient, underrated culinary capital.

*Rainbow over Tucson, ©Bill Hatcher/Sonoran Institute.*

## INCLUSION OF ARIZONA SCHOOL FOR THE DEAF AND BLIND IN TWO PROGRAMS THAT CONNECT STUDENTS TO THE RIVER

The Tucson campus for the Arizona School for the Deaf and Blind (ASDB) sits only a couple hundred feet from the banks of the Santa Cruz River. Despite this, most students had never visited the river before. This changed in 2023, when ASDB teacher Rob Buzzetti participated in the BIORETS Santa Cruz River program at the University of Arizona. Led by Michael Bogan and the BIORETS team, the program provides local teachers and students with support and training to conduct research along the Santa Cruz. In February of 2024, BIORETS hosted Rob and his blind and visually impaired high school students for a field trip to the river at Crossroads at Silverbell Park. Students collected bird and weather data, tested water quality, identified aquatic insects, and touched fish and turtles. Students used a variety of assistive technologies and had an incredible experience learning firsthand about the river. Other teachers followed Rob's lead. In the summer of 2024, Kate Barrett, an ASDB teacher for deaf and hearing-impaired students, also participated in BIORETS. This later inspired a 4-day field research experience for her middle school students focused on turtles in the river.

In fall of 2024, all 6th-12th grade students at ASDB (about 50 total) participated in Pima County's Living River of Words Program, another local program allowing students to learn about water in the desert through science and art. On two field trips, students visited the river, investigated water quality and macroinvertebrates, and worked on nature journaling and art. After working with a local teaching artist in their classrooms, over 40 ASBD students submitted poetry and art pieces inspired by their impressions of the river to the Living River of Words Youth Art and Poetry contest. Multiple ASDB students were recognized as finalists and grand prize winners and their pieces are on display in a traveling exhibit.



**The Life of a River**
Jamal Stell, Grade 11
Arizona School for the Deaf and the Blind • Ms. Buzzetti
Finalist

**In the Wild Desert**
Lily Wilson, Grade 7
Arizona School for the Deaf and the Blind • Ms. BarreV
Finalist

## INITIATION OF REGIONAL COLLABORATION WITH SIGNING OF THE SANTA CRUZ RIVER WILDLIFE PARTNERSHIP

The Santa Cruz River Wildlife Partnership (SCRWP) is a collaborative conservation effort focused on the Santa Cruz River corridor in southern Arizona. Established in 2024 through the U.S. Fish and Wildlife Service's Urban Wildlife Conservation Program, the partnership brings together local governments, nonprofits, and community members to promote habitat restoration, wildlife monitoring, and environmental education in urban and semi-urban areas.

Currently in an exploratory phase, SCRWP is working to determine how best to serve the community and align with existing coalitions and collaboratives. The partnership is further strengthened by Tucson's application to become an Urban Bird Treaty City and ongoing conversations around potential National Wildlife Refuge planning. Together, these efforts reflect a growing regional commitment to inclusive, community-driven conservation that connects people with nature.

*Officials from City of Tucson, U.S. Fish and Wildlife Service, Santa Cruz County, and Pima County at the fall 2024 signing.*

## COMMUNITY SHARES PICTURES FROM THE SANTA CRUZ RIVER

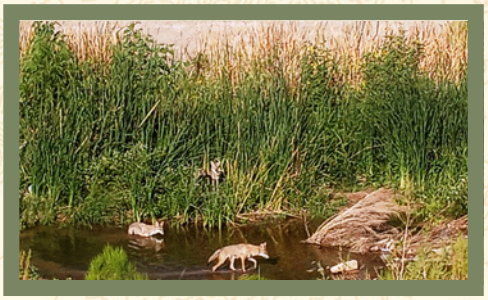
We asked the community to share photos taken from the Santa Cruz River. We received lots of photos of wildlife and even a painting of the river (below), as well as some nice shots of river and adjacent landmarks (page 2).

Send us your photos! Where is your favorite spot? What do you do and see along the river? Send photos by email to **scrphoto@sonoraninstitute.org** Or post your photos on social media with **#scrphoto**.

*Elchanan Heller*

*Peggy Marlatt*

*j.ray.of.light.creations*



*Ramón Olivas*

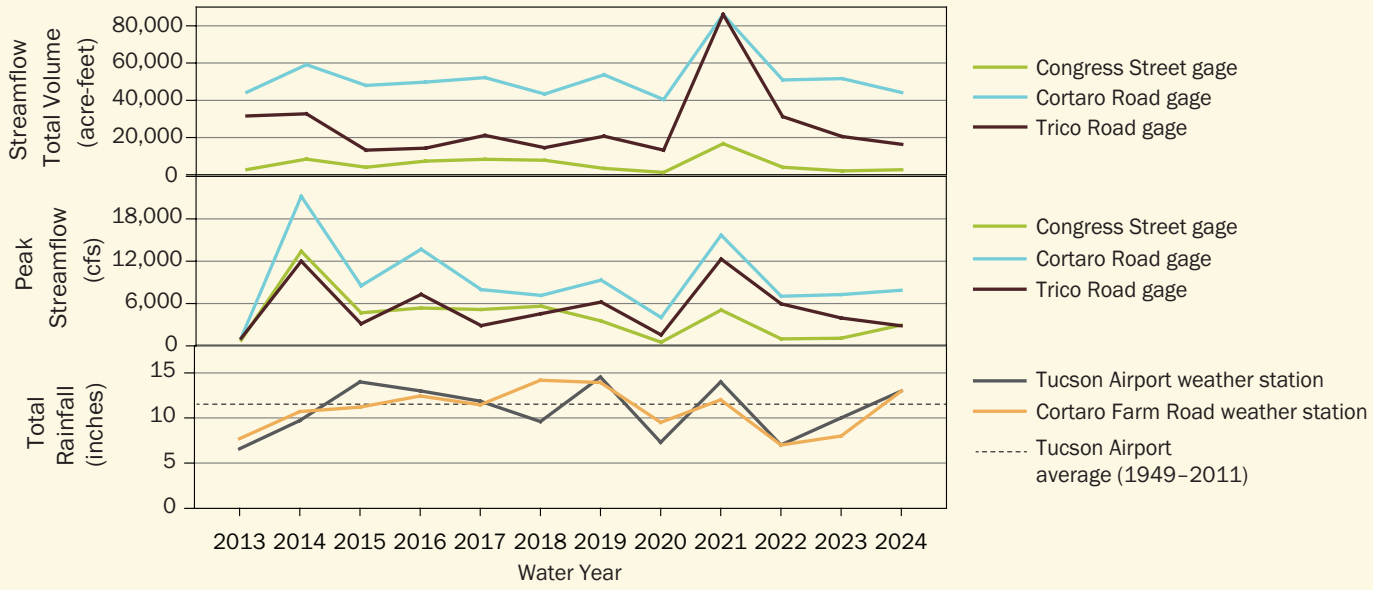
*Catherine Bartlett*

*Elchanan Heller*

# RIVER CONTEXT

## STREAMFLOW AND RAINFALL

Streamflow, or the amount of water flowing in a river, provides an important context for the results of the indicators in this report. The Santa Cruz River is largely dependent on discharges from water reclamation facilities, but during some parts of the year streamflow also includes stormwater. In addition to the amount of rainfall, runoff after storms depends on the amount of impervious surface (i.e., hard surfaces like paved parking lots) in the watershed. The Santa Cruz River watershed includes all of the land where stormwater flows toward the river. Seasonal floods are important for recharging aquifers, dispersing and germinating seeds, moving nutrients and sediment, and clearing natural debris.




### 2013–2024 STREAMFLOW

Streamflow is measured in cubic feet per second (cfs) and represents the volume of water flowing past a fixed point in one second. Streamflow is measured with gages at Congress Street (Heritage Project) and at Cortaro and Trico Roads (northwest Tucson to Marana reach). The Cortaro Road gage also captures flows from two major tributaries that enter just upstream. Total volume sums all of the water passing a gage, allowing comparisons of streamflow between water years. Peak streamflow is the largest volume of water flowing past a gage, allowing the tracking of flood events.

At Congress Street and Cortaro Road, total streamflow has remained steady over the years. Flows at Trico Road decreased after the facility upgrades were completed in December of 2013, with fewer days when there is flow (see Flow Extent). All gages recorded the highest total flows in 2021 when monsoon rainfall was high. Peak streamflows were highest in 2014, with the exception of Trico Road whose largest peak streamflow is in 2021.

### 2013–2024 RAINFALL

Rainfall totals from the Tucson International Airport (TIA) and near the river at Cortaro Farms Road (CFR) provide an idea of how stormwater may have increased streamflow. The 2024 rainfall measures were a little above the 2013–2024 averages and just above the historical average for total rain at TIA (11 total inches 1949–2011). The CFR site is new since 2012 and has no historical average.

**TIA** annual rainfall averaged 11 inches and peaked at 15 inches in 2019. Total 2024 rainfall was 13 inches.

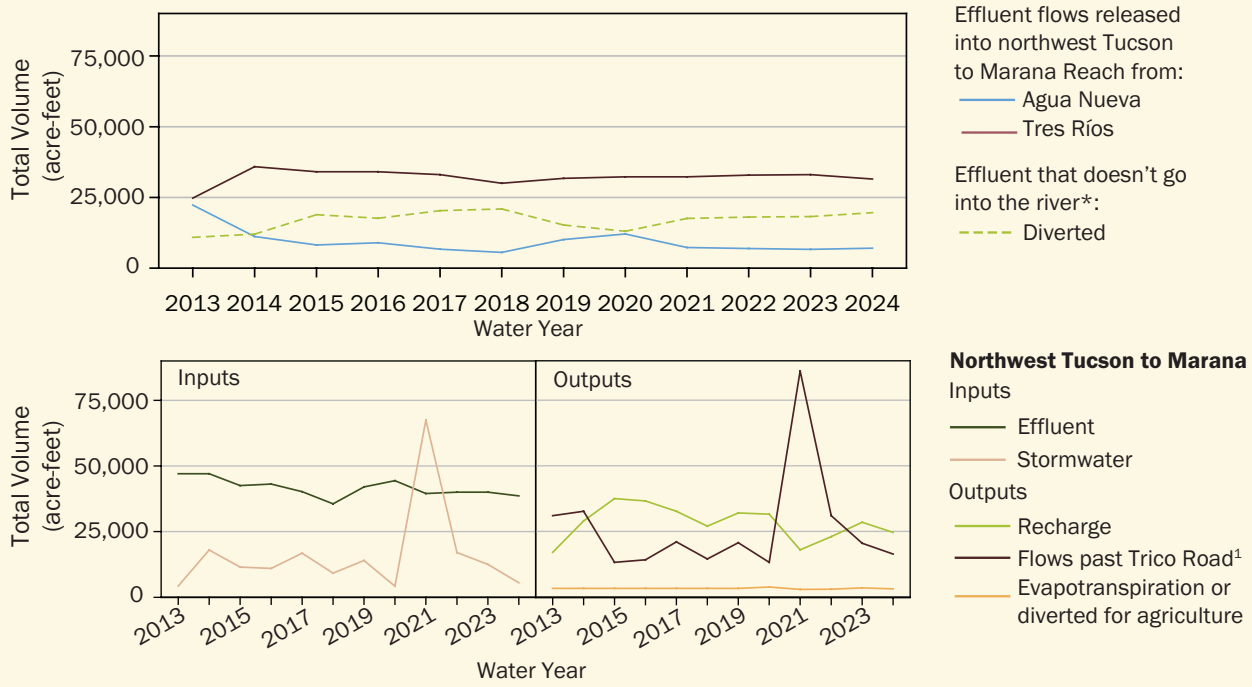
- Winter rains averaged 3 inches (range: 1–6; 2024: 6)
- Monsoon rains averaged 5 inches (range: 2–12; 2024: 5)

**CFR** annual rainfall averaged 11 inches and peaked at 14 inches in 2018 and 2019. Total 2024 rainfall was 13 inches.

- Winter rains averaged 4 inches (range: 1–6; 2024: 6)
- Monsoon rains averaged 6 inches (range: 2–11; 2024: 6)

# WATER BUDGET

A water budget quantifies the water inputs and outputs. Inputs to the Santa Cruz River are effluent and stormwater. Effluent flows come from regional wastewater reclamation facilities, Agua Nueva and Tres Rios. Since 2022, the Tucson Airport Remediation Project contributed additional effluent flows to the river that have influenced conditions in the Heritage Project reach. Outputs include water that does one of the following: flows past the end of the study area (Trico Road for northwest Tucson to Marana reach and Congress Street for the Heritage Project reach), evaporates or is used by riparian vegetation (evapotranspiration), is diverted for off-channel recharge or agricultural use, or percolates through the riverbed to recharge the local aquifer. Volumes are totaled in acre-feet (AF), the number of acres that would be covered with water one foot deep. In the northwest Tucson to Marana reach, there are two managed recharge projects. Recharge is calculated by summing the flow past the Trico Road gage, evapotranspiration, and off-channel diversions, and then subtracting the volume discharged into the river. The difference is the volume recharged. In the Heritage Project reach downtown, Tucson Water calculates recharge similarly by summing the flow past the Congress Street gage and evapotranspiration, and then subtracting this from the total water delivered to the river. For accounting purposes, recharge from stormwater is not quantified. When stormwater is known to be present in the river channel, recharge is assumed to be zero, and managed recharge projects do not receive any credits.




* Includes effluent that is diverted from Agua Nueva either to the reclaimed system for irrigation or to recharge basins located outside the river channel.

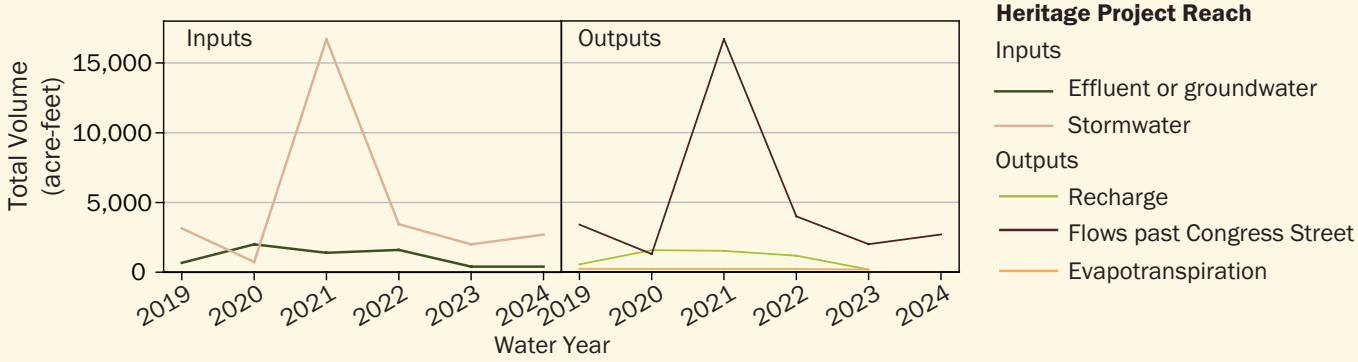
1 Excluding days with stormwater, the volume of effluent flowing past Trico Road is: 2013 = 26,800 AF; 2014 = 13,400 AF; 2015 = 2,100 AF; 2016 = 3,800AF; 2017 = 3,700 AF; 2018 = 6,000 AF; 2019 = 6,000 AF; 2020 = 10,800 AF, 2021 = 16,800 AF, 2022 = 13,200 AF, 2023 = 9,300 AF, 2024 = 12,200 AF

## 2013–2024 NORTHWEST TUCSON TO MARANA REACH

Starting in 2015, total effluent inputs have decreased by an average of 13% compared to the 2013 baseline. Water released from Agua Nueva is more variable than at Tres Ríos and influenced by the demand for reclaimed water and the amount of water diverted into adjacent recharge basins. In addition, the total volume released from Agua Nueva decreased in 2014 when the facility upgrades resulted in some wastewater being redirected to Tres Ríos and released downstream. Reduced effluent flows and variable drying of the river in the reach between the two facilities (see flow extent) increased concerns for the endangered

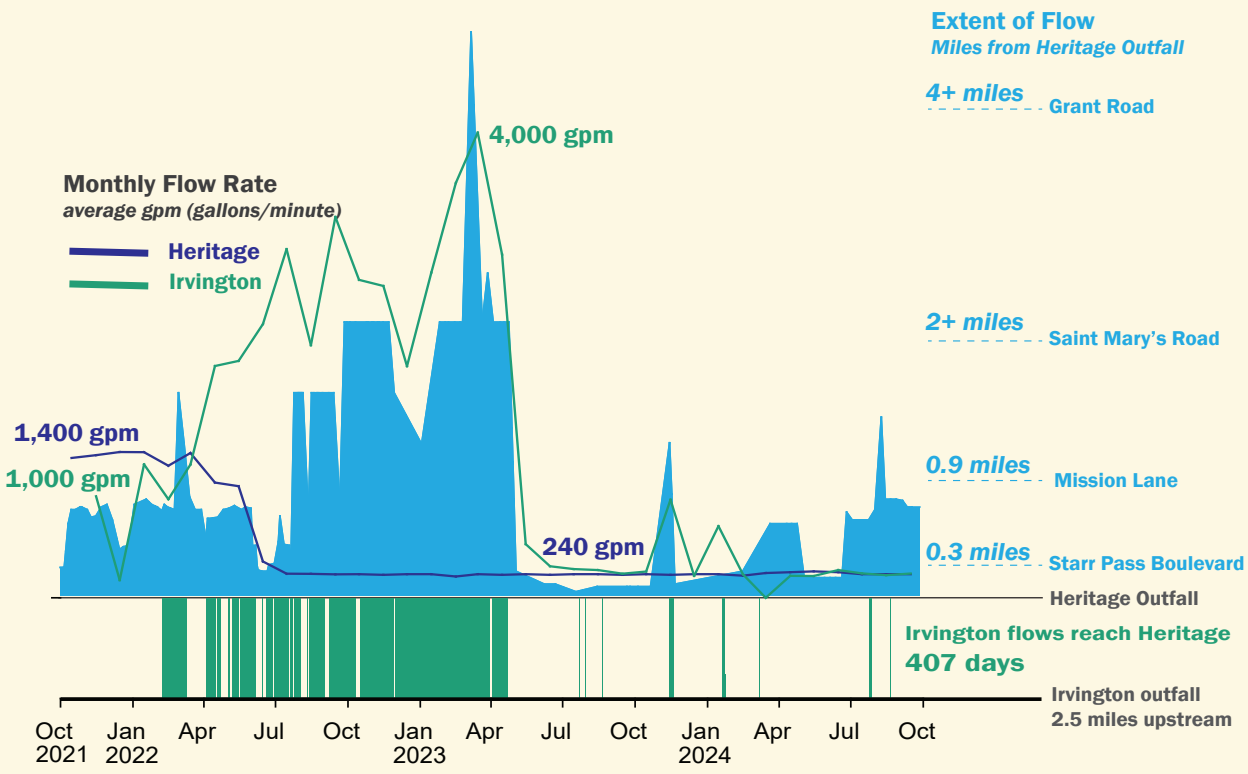
Gila topminnow living in the river. In 2021, officials approved the use of water from the Conservation Effluent Pool to guarantee the release of a weekly average of 5 million gallons a day from Agua Nueva to support the endangered fish.

Stormwater peaked in 2021 with the record monsoon rainfall and contributed to the large amount of water flowing past Trico Road in 2021. Stormwater in the river can reduce recharge as days with stormwater present are not counted in the recharge calculations. In 2021, 32 days (nearly twice the average of 18 days/year) had stormwater and thus didn't contribute to recharge calculations. Overall, increased recharge has reduced the amount of water that flows past Trico Road. However, the amount of recharge has decreased in recent years. In addition to the high number of storm days in 2021, ash flows in 2020 following the Bighorn fire covered the river bed downstream of the Canada del Oro wash and likely reduced recharge. Recharge increased from the low point in 2021, likely due to 2021 monsoon floods scouring the riverbed and removing the ash, thereby promoting infiltration. This increased infiltration can also be seen by the decrease in total volume flowing past Trico Road. When calculating recharge, volumes of water diverted for agriculture or used by wetland vegetation are calculated annually or daily, respectively, and have remained fairly constant.




## 2019–2024 HERITAGE PROJECT REACH

Tucson Water started adding effluent to the Heritage Project reach in June 2019. For most of the year, effluent discharge is the only source of water. This was especially true in 2020 when stormwater flows were minimal. However, stormwater contributed significantly to flows in 2021 with the strong monsoon activity. Starting in 2022, water from the Tucson Airport Remediation Project began influencing conditions (see next page). With the extra water in the river, Tucson Water did not release effluent into the Heritage Project reach in 2023. Instead, the water released from the Heritage outfall was groundwater sourced from a nearby well. This steady water sustained the small wetland habitat near the outfall. For the Heritage Project water budget, the recharge and evapotranspiration reported here are the values officially calculated as part of the managed recharge project. Recharge was zero in 2023 and 2024 because only effluent releases are used in recharge calculations. As such, evapotranspiration is also zero.




## THE IRVINGTON OUTFALL AND TARP

TARP—the Tucson Airport Remediation Project—addresses groundwater contamination stemming from Air Force activity near the Tucson International Airport in the 1950s–1970s. Contaminated groundwater is pumped and treated to remove 1,4-dioxane, trichloroethylene, and PFAS. The treated groundwater is then released to the Santa Cruz River at an outfall near Irvington Road, a little more than 2 miles south and upstream of the Heritage Project reach. Water discharges into the river began in November 2021 and have been a boon to the river and its wildlife. Releases began at an initial average of ~1,000 gallons/minute (gpm) or 400 gpm less than the average release at Heritage outfall, but increased steadily and by September 2022 reached an average high of 4,000 gpm. In April 2023, the TARP system was connected to Tucson's reclaimed water pipelines, meaning that release volumes at the Irvington outfall are now influenced by the demand from reclaimed water customers. For example, at the time of connection, TARP releases were reduced to ~800 gpm, and then further reduced in September to ~250 gpm due to increasing demands for reclaimed water.

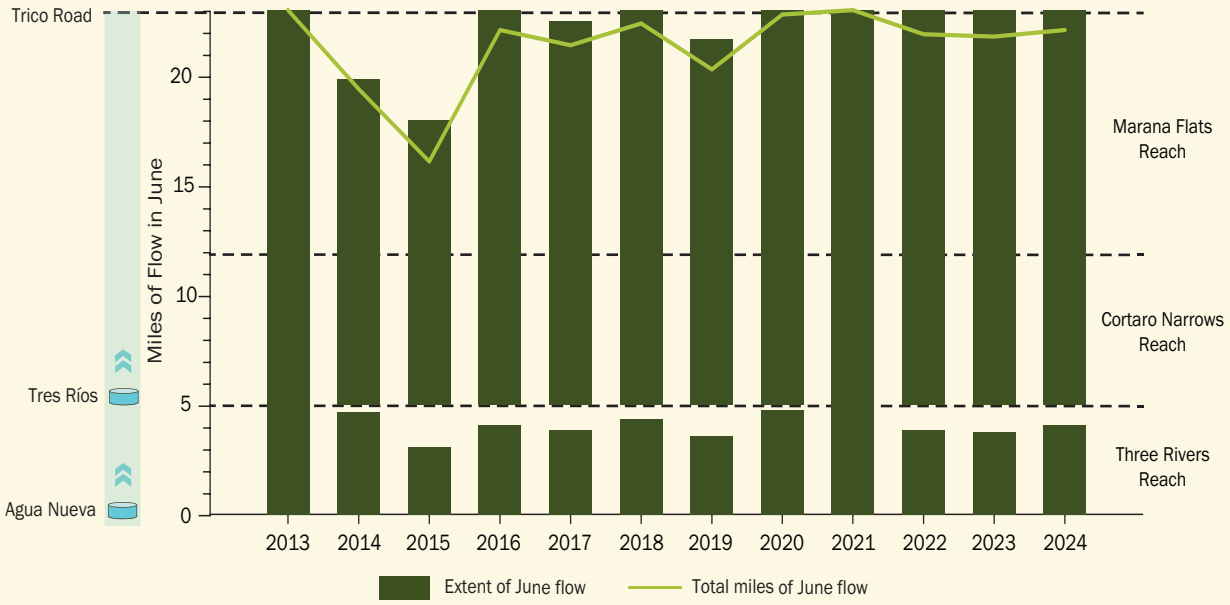
TARP discharges upstream have added more complexity to monitoring within the Heritage Project reach and discharge rates are adjusted for TARP inputs upstream. The additional flow from the Irvington outfall has regularly joined with the Heritage Project reach (407 days since releases began), increasing the flow extent in the Heritage Project reach as far as Grant Road. Groundwater levels in the Heritage Project reach are monitored closely due to the proximity of an historic landfill. In addition to increased flow extent, more water resulted in more recharge and flows from Heritage outfall were reduced. However, a steady discharge from the Heritage outfall was maintained to support a vital wetland near the outfall that is a refugia for endangered Gila topminnow, Sonora mud turtles, and other wildlife. Overtime, if TARP releases remain less than 800 gpm, there is likely to be little to no surface water connection between these two outfalls.

# INDICATORS

## FLOW EXTENT: Miles of flow in June

Measuring flow extent, or the distance the river is flowing, is a quick visual way to track changes in water inputs and outputs, while providing a rough measure of the quantity of aquatic habitat available. For example, longer flow extent may indicate high inputs and availability of habitat for aquatic life. Shorter flow extent may indicate reduced inputs or greater infiltration of water into the aquifer, which could decrease aquatic habitat.

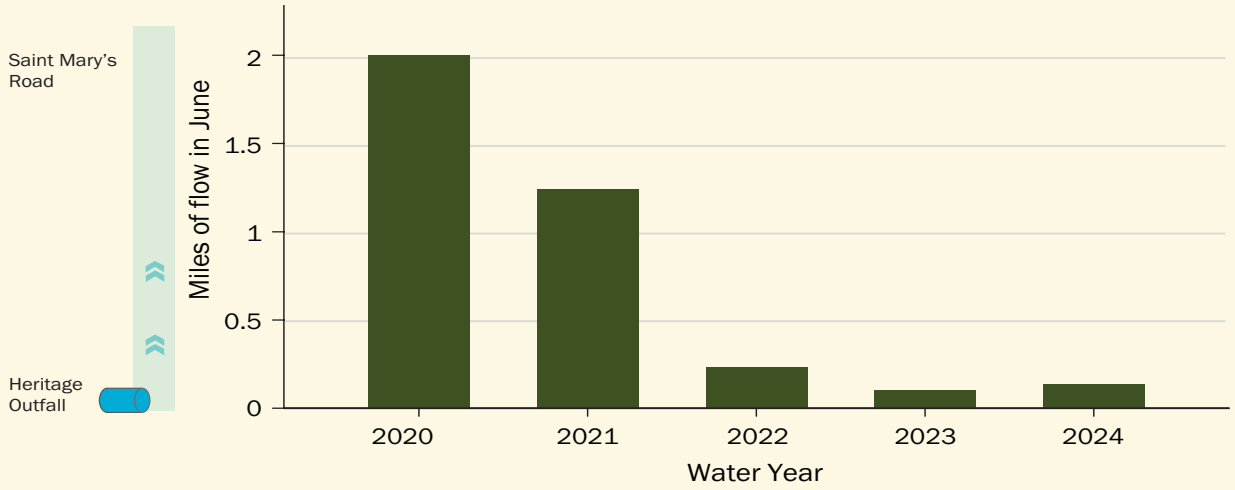
Measuring the **miles of flow in June** from the outfalls to the end of each stretch of river prior to the monsoon season determines the minimum extent of flow in each reach during the driest time of year. This is typically measured on one morning in mid-June.




### 2013–2024 NORTHWEST TUCSON TO MARANA REACH RESULTS

Flow extent decreased and was more variable after the December 2013 upgrades. In June 2013, the river flowed uninterrupted to the end of the 23-mile study area and continued another 5 miles further into Pinal County. Uninterrupted river flow occurred again in June 2021, with the river reaching past the 23-mile study area. In other years, dry river stretches of varying lengths have formed between Agua Nueva and Tres Ríos reclamation facilities, and upstream of Trico Road.

Many factors influence flow extent. In the northwest reach, discharges of cleaner water beginning in 2013 were strongly correlated with reduced flow extent. We also know that recharge increases after large floods scour the riverbed. The longest dry stretch in the Three Rivers reach was in 2015. This follows the largest flood recorded during this study (see Streamflow), one that peaked in 2014 at 21,200 cfs near the Tres Ríos facility, which is over twice the average flood peak during this study. Timing of floods may also play a role. Conditions that impact the factors influencing flow extent vary by reach, a helpful detail to keep in mind when comparing these reaches.



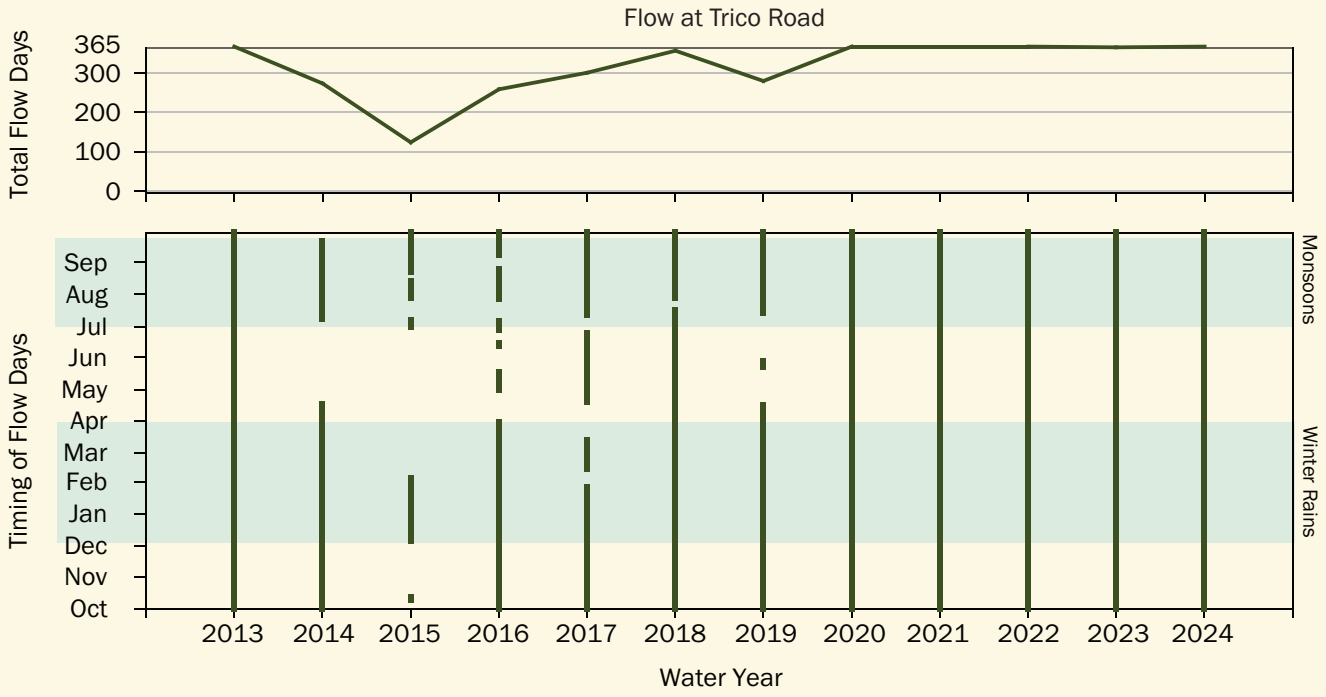

## 2019–2024 HERITAGE PROJECT REACH RESULTS

In June 2024, the river flowed approximately 0.14 miles from the Heritage Project outfall. This is a small increase from the shortest extent seen in 2023. There are many reasons flow extent varies, as has been discussed in the water context section. Inputs in this highly managed reach are closely monitored and adjusted. The rate of recharge also plays a role. The significant monsoon activity of 2021 scoured the riverbed. This increased the river's recharge capability and reduced the flow extent in the months following the monsoon floods.

## FLOW EXTENT: Flow at Trico Road and Congress Street

Tracking the streamflow at the furthest downstream point of each reach estimates daily changes in maximum flow extent. This is done by tracking **flow at Trico Road and Congress Street** and counting the "flow days," or number of days with streamflow at the downstream end of the study area—Trico Road for the northwest Tucson to Marana reach and Congress Street for the Heritage Project reach.

The Heritage Project is still new, and flows are highly variable and dependent on the volume of water released. A stream gage managed by U.S. Geological Survey has been recording streamflow at Congress Street from long before the Heritage Project started in 2019, allowing us to monitor "flow days" at Congress Street since 2013 when this study began.



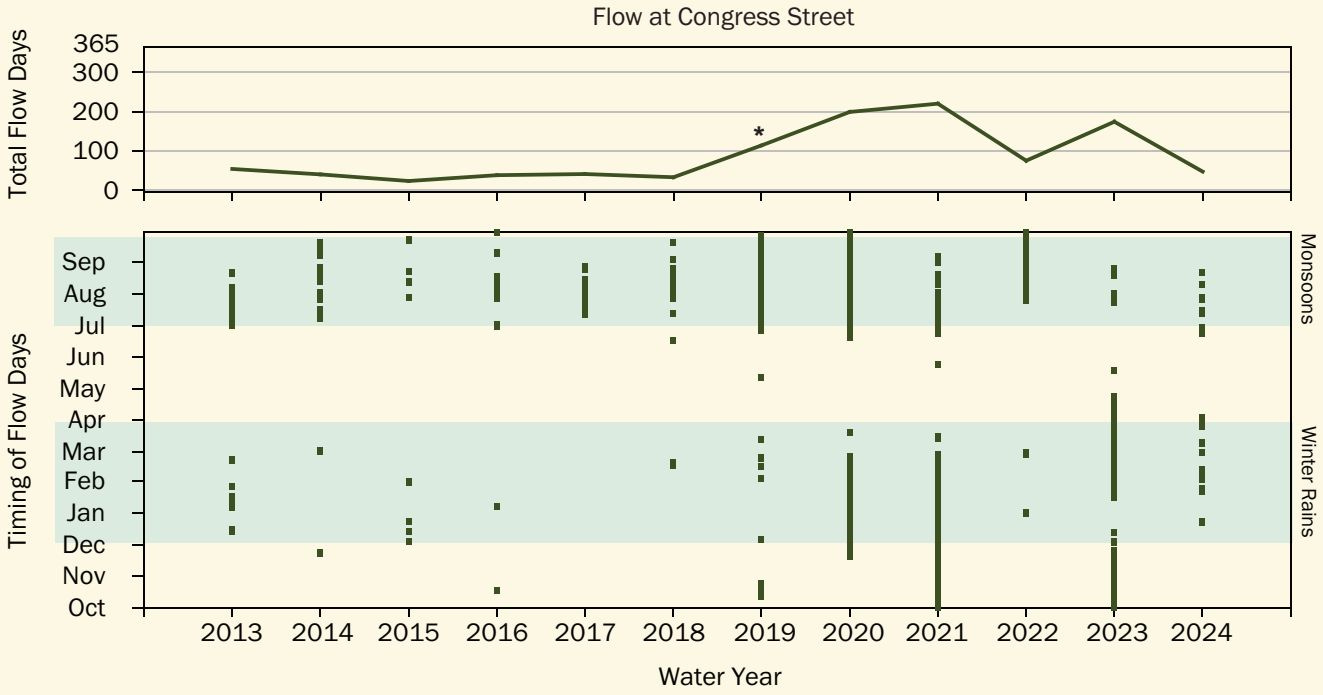

### 2013–2024 NORTHWEST TUCSON TO MARANA REACH RESULTS

In 2024, 365 flow days were recorded at Trico Road. The daily flow at Trico Road was more variable immediately following the treatment upgrades in 2013. Between 2014 and 2019, there were fewer days of flow during the dry hot summer months. The lowest number of flow days occurred in 2015 and 2016 and has been increasing since. In addition to increased recharge and human management of river flow, natural flooding has likely influenced conditions at Trico Road.

In September 2014, floodwaters moved the location of the low-flow channel and breached a berm along the El Rio Preserve, a former borrow pit near the start of Marana Flats. This allowed water to flow into the pit and form the wetlands at El Rio Preserve. In addition, the 2014 peak flood was the largest since the 2013 upgrade and may have further increased the infiltration rate. This combined with diversion of flow into the wetlands may have decreased the number of flow days recorded

in 2015. Floods also bring nutrients and sediments. Ash flows from the Catalina Mountains following the 2020 Bighorn Fire covered parts of the riverbed and likely decreased infiltration, thus allowing the river to flow farther.

Since 2017, flow at Trico Road has increased and in 2020 the number of flow days was 365 (year round) for the first time since 2013. During this same time, the average volume of effluent and stormwater flowing in the river decreased (average total water in the river in 2017–2022 was just under 5,000 acre-feet less than the average total in 2014–2016). More flow at Trico Road even with less water in the river may suggest the rate of recharge is stabilizing or even decreasing.




*Santa Cruz River Heritage Project flows began June 24, 2019

## 2019–2024 HERITAGE PROJECT REACH RESULTS

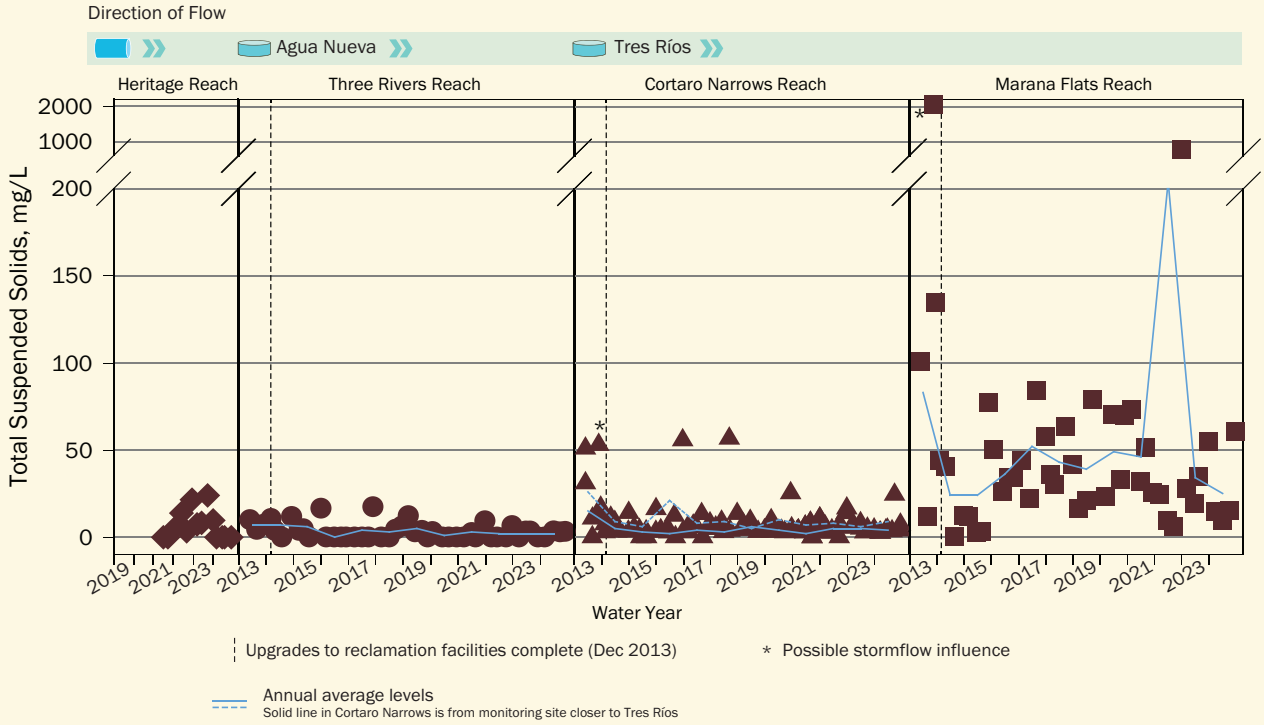
The number of days with flow at Congress Street has significantly increased since the Santa Cruz River Heritage Project began. Prior to this, flows consisted only of stormwater. The drop in flow days in 2022 was likely influenced by the increased rate of recharge following the 2021 monsoon season that had many scouring floods. But flow days increased again in 2023, even with reduced water being released into this reach. This is likely due to the additional water coming from the Tucson Airport Remediation Project (see Irvington Outfall and TARP in the Water Context section). With water from TARP decreasing, flow days dropped in 2024, though are still higher than before the project began.

# WATER CLARITY: Total Suspended Solids

Rivers naturally move sediments, wildfire ash, and other small particles of algae or detritus downstream. High concentrations of materials in the water can create "dust storm" conditions and can impact conditions for aquatic life.

**Total suspended solids** is an estimate of the number of particles in the water, or the intensity of the "dust storm."

Levels of total suspended solids naturally increase during flooding conditions with extra stormwater. The Arizona Department of Environmental Quality (ADEQ) does not have a standard for total suspended solids. The concentration of total suspended solids in each reach from the 2013 water year serves as a baseline.




## 2013–2024 RESULTS

Total suspended solids (TSS) were measured a total of 199 times during normal flow conditions. Levels of TSS are lowest and least variable in the Heritage and Three Rivers reaches. Cortaro Narrows had decreased levels of TSS since 2013, with only occasional high levels observed. Marana Flats had the most variable levels of TSS. From 2014–2015, TSS briefly decreased in Marana Flats after the upgrades were complete. After 2015, TSS levels in Marana Flats increased though remained lower than levels recorded before the upgrade. Levels appear to be dropping since 2022 except for a late 2022 water sample that recorded the highest recent level of TSS for unknown reasons (there was no stormwater influence).

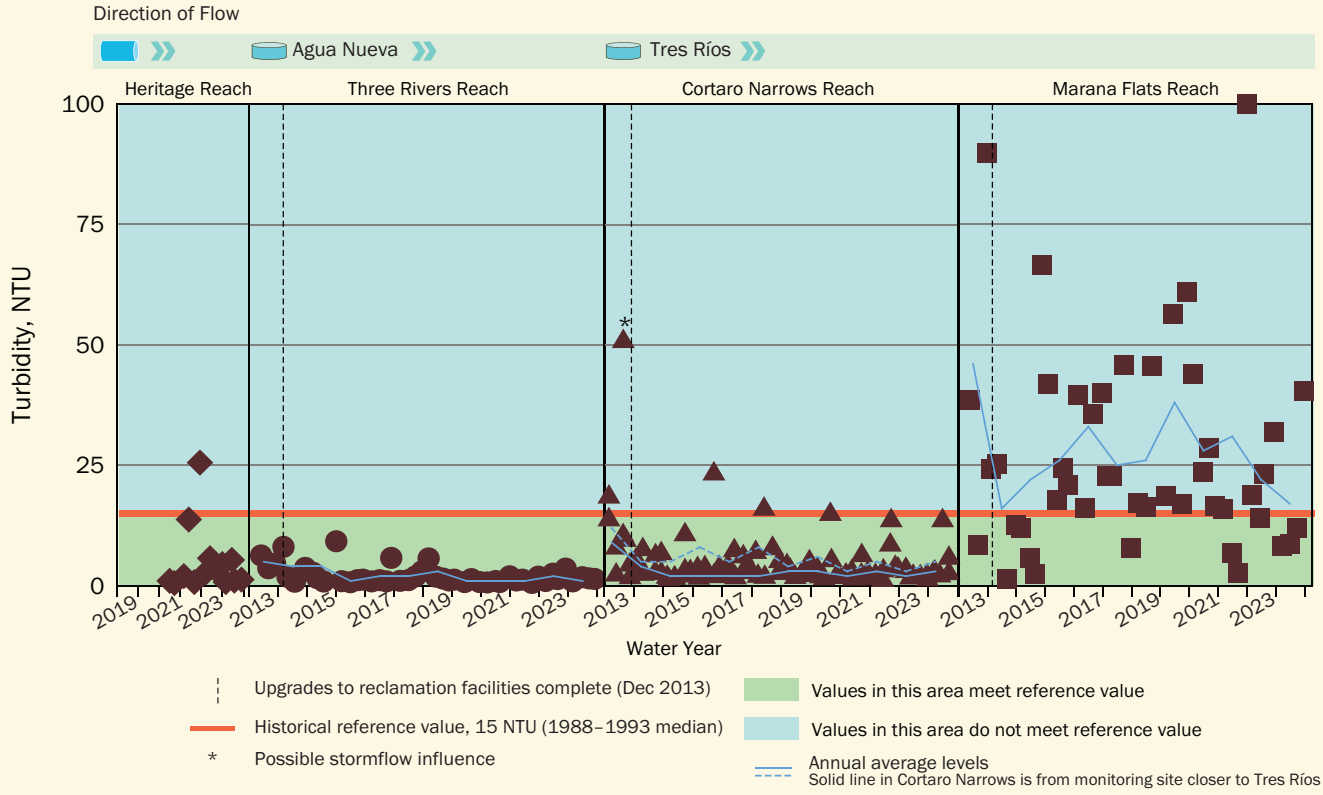
To understand how TSS levels may change with addition of stormwater, samples of stormwater were collected upstream of Agua Nueva. Four samples collected (one each year during the summer monsoon for 2013–2016) had TSS concentrations ranging from 1,050 to 46,300 mg/L and were higher than levels on normal flow conditions. Higher levels of sediment in stormwater is expected because of sediment transport by the stormwater flows.

Measures of TSS in the Heritage Reach began in the 2021 water year and have remained low.

# WATER CLARITY: Turbidity

Under chronically high "dust storm" conditions when there are high concentrations of suspended sediments in the water, sunlight doesn't travel as deep into the water. Aquatic plants may not receive enough sunlight to photosynthesize and aquatic predators may not be able to see well enough to capture prey.

**Turbidity** measures water clarity, or how far you can see through the water column and is reported in Nephelometric Turbidity Units (NTU). High NTU indicates the water is cloudy and hard to see through. The 1988–1993 median level of turbidity in the Cortaro Narrows reach was 15 NTU. ADEQ does not have a standard for turbidity, so this assessment uses 15 NTU as a historical reference value. This is slightly higher than a typical value of 10 NTU for a river with normal base flow and no stormwater influence.



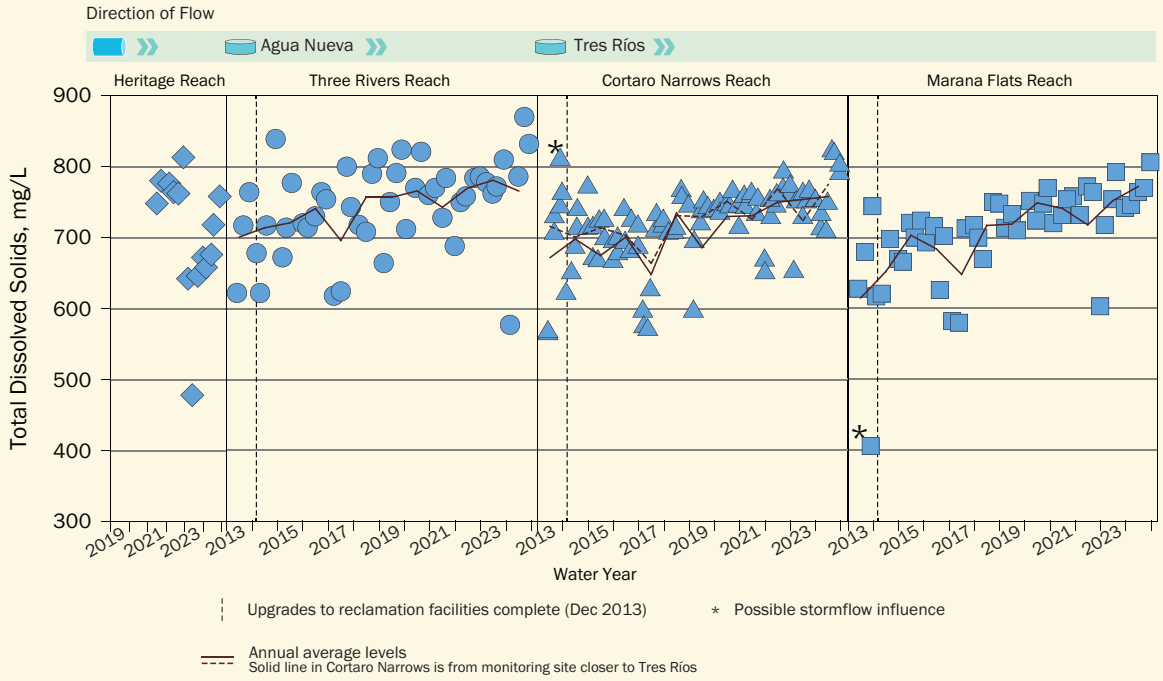

## 2013–2024 RESULTS

Turbidity was measured throughout the year at several locations for a total of 199 times. Overall, the reference value was met 161 times (81%). Average turbidity within Three Rivers and Cortaro Narrows has decreased since the 2013 upgrades were complete; both have averages below 10 NTU. Although average turbidity decreased in Marana Flats following the upgrades, values have been higher and most variable in this reach since 2016, with the highest reading in 2022.

Measures of turbidity in the Heritage Reach began in the 2021 water year and were far below the two reference values. In 2022 a high value caused an increase in the average of this measure to 11 NTU, higher than it was before but still below the 15 NTU historical reference value used for the river.

# WATER QUALITY: Total Dissolved Solids

Many of the dissolved solids are essential nutrients for plants and animals, but when too abundant they can produce unhealthy conditions for aquatic life and riparian vegetation. Thus, measuring **total dissolved solids** (TDS) is commonly used to monitor salts in the water. TDS in the effluent has been rising since the 1990s with increased use of Colorado River water in the Tucson area. The Colorado River has greater TDS, mostly in form of dissolved salts, than the local groundwater. Because there is no standard for TDS (often standards are for individual elements that contribute to TDS), the results from the 2013 water year will serve as a baseline. Freshwater generally has TDS <1,000 mg/L and stormwater generally has low levels of TDS.



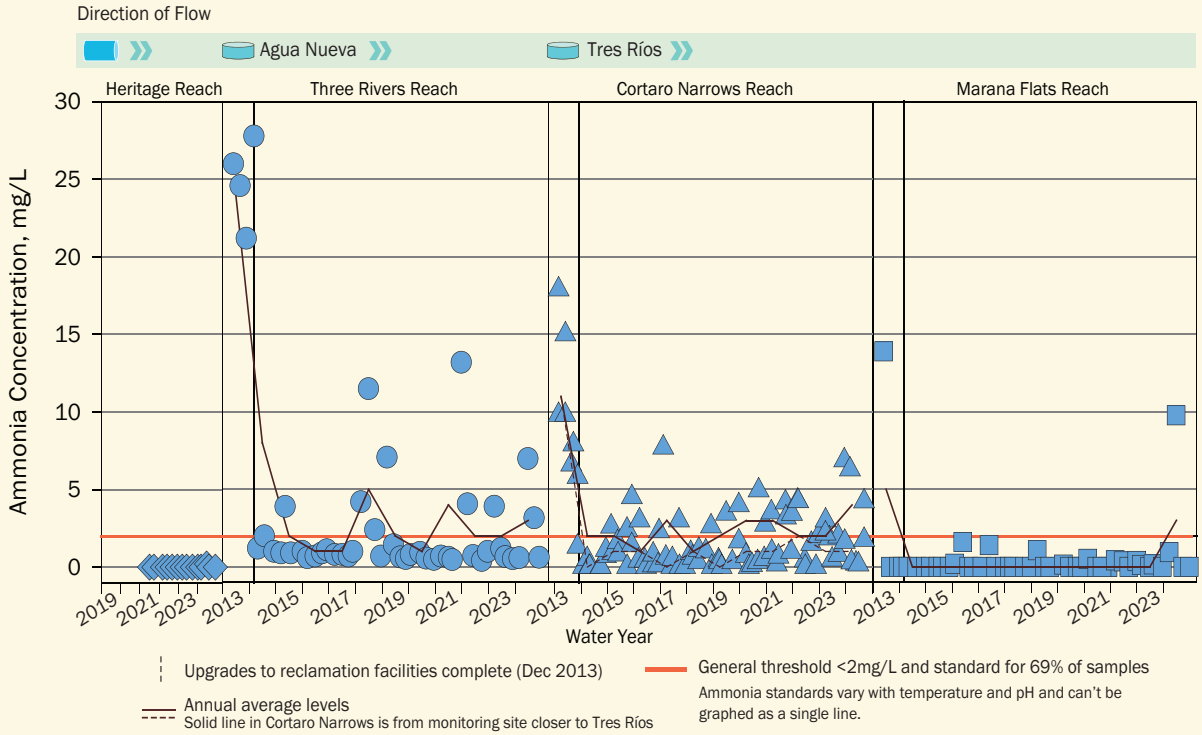

## 2013–2024 RESULTS

Total dissolved solids (TDS) were measured 198 times. Overall, levels of TDS were similar in all three reaches downstream of Agua Nueva. Average levels appear to be increasing in all reaches and decreasing with distance from the treatment plant. The reason for this trend is unknown. The lowest measure of TDS was in Marana Flats. This sample was collected on a day where there was possible stormwater influence—the addition of water with lower TDS levels may have diluted the levels in this reach of the Santa Cruz River. Samples of stormwater are collected upstream of Agua Nueva when possible. Four samples collected (one each year during the summer monsoon in 2013–2016) averaged 280 mg/L.

Measures of TDS in the Heritage Reach began in the 2021 water year and are comparable to levels in the other reaches.

# WATER QUALITY: Ammonia

Nitrogen is an essential nutrient for plant and animal life, but too much can contribute to nutrient pollution. Nutrient pollution, such as high levels of nitrogen and phosphorus, enters the river from air pollution, fertilizer, surface runoff, and the release of effluent. While elevated nutrient levels can benefit riparian plants, they can also lead to poor water quality conditions for aquatic wildlife. **Ammonia** ($NH_3$) is one form of nitrogen that is toxic to fish and amphibians. Even at low concentrations, ammonia can reduce hatching success for fish and amphibian eggs, among other impacts. The ADEQ standard for ammonia varies with pH (level of acidity) and temperature. As pH and temperature increase, the toxicity of ammonia increases; thus, the acceptable level of ammonia decreases with high pH and temperature. A general threshold often used is <2 mg/L to avoid toxic conditions.




## 2013–2024 RESULTS

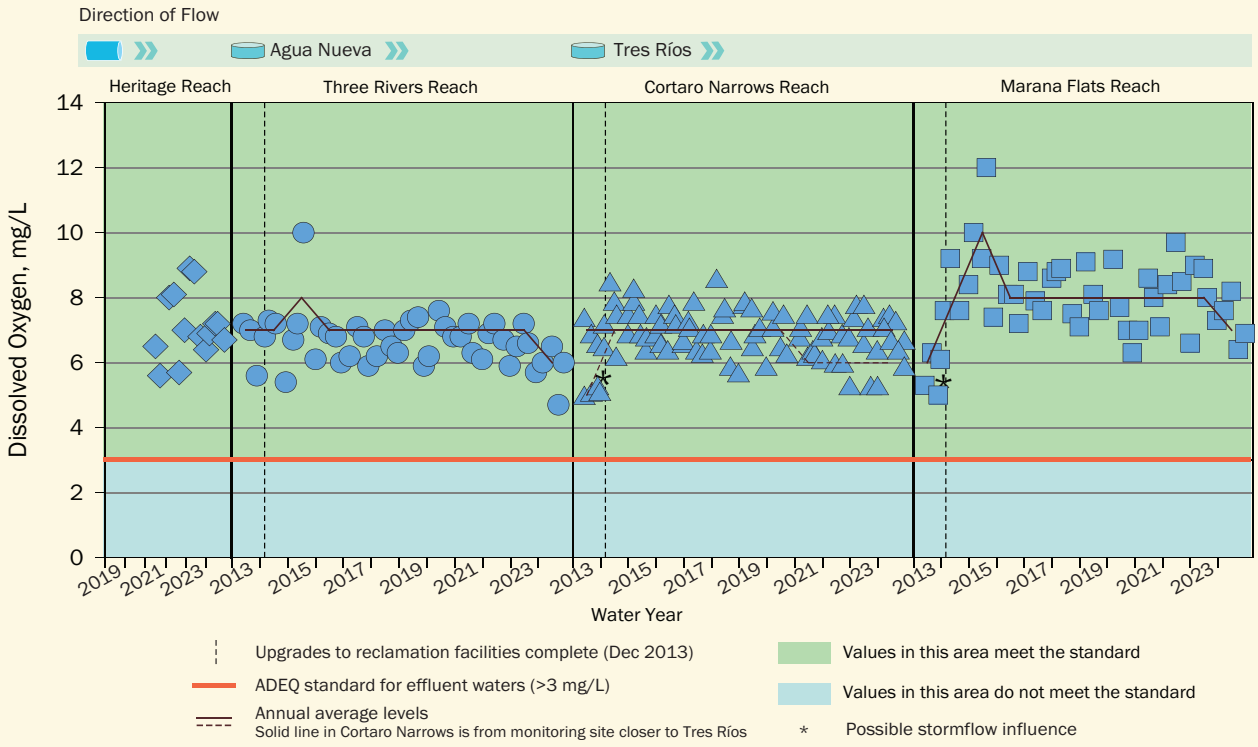
Ammonia was measured 197 times along the river and met the standard 143 times (73%). The standard varies with pH and temperature but was <2 mg/L for 66% of the samples. Levels of ammonia have dropped significantly after the upgrade was complete in 2013. Levels of ammonia also decreased with distance from the reclamation facilities, as it converts into other forms of nitrogen while moving downstream. Measured at four locations (two locations in Cortaro Narrows reach), average ammonia concentrations declined from a toxic 13 mg/L in 2013 to 1 mg/L in 2014–2024. In 2024, average levels increased slightly at 3 of the four monitoring locations and a single sample in Marana Flats was highest seen since the upgrade. Reasons for any increases in ammonia are unknown.

Occasional elevated levels of ammonia are observed near the Agua Nueva and Tres Ríos Water Reclamation Facilities. Removing ammonia is a complex process. The facilities use a five-stage process that features alternating oxygenated and oxygen-free zones. To prevent any occasional spikes in ammonia, Pima County regularly optimizes processes to better maintain the delicate balance of oxygen needed for maximum ammonia removal.

Measures of ammonia in the Heritage Project Reach began in the 2021 water year. Ammonia has not been detected.

# WATER QUALITY: Dissolved Oxygen

Fish and other aquatic animals need **dissolved oxygen** to survive. Rivers absorb oxygen from the atmosphere, and aquatic plants and algae produce oxygen during photosynthesis. Natural causes of variability in dissolved oxygen levels include nutrient levels, shading, water temperature, decay of organic materials, and time of day. ADEQ sets the minimum standard for dissolved oxygen in streams dominated by effluent at 3 milligrams per liter (mg/L) during the day (3 hrs after sunrise to sunset).



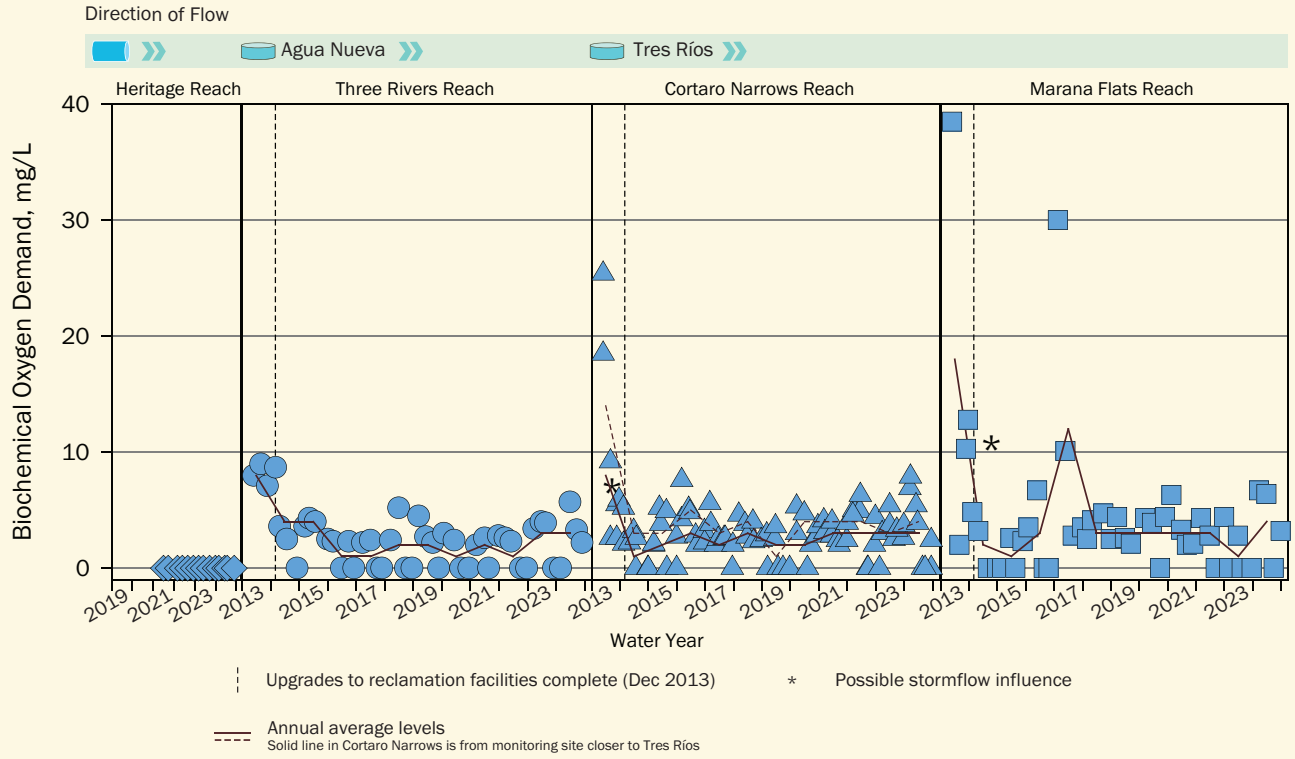

## 2013–2024 RESULTS

Dissolved oxygen was measured 197 times along the river. All of the samples met the standard for dissolved oxygen (100%). In 2024, average levels declined slightly in Three Rivers and Marana Flats. Overall, levels of dissolved oxygen stayed fairly constant in Three Rivers and Cortaro Narrows. However, starting in 2014 Marana Flats saw an increase in dissolved oxygen. The reason for the increase only in this reach is unknown.

Measures of dissolved oxygen in the Heritage Reach began in the 2021 water year and have continually met the standard.

# WATER QUALITY: Biochemical Oxygen Demand

**Biochemical oxygen demand** (BOD) is an estimate of how much dissolved oxygen is being used. Microorganisms in the river consume dissolved oxygen as they break down organic materials such as leaves and woody debris, dead plants and animals, and animal wastes. If there are a lot of organic materials in the water, these microorganisms become so numerous that they consume much of the dissolved oxygen and deprive other aquatic animals of the oxygen they need to survive. Though there are standards for BOD in the wastewater reclamation process, which are met in the released effluent, there is no standard for BOD in rivers. The 11 mg/L average from the river during the 2013 water year serves as a baseline value to track changes.




## 2013–2024 RESULTS

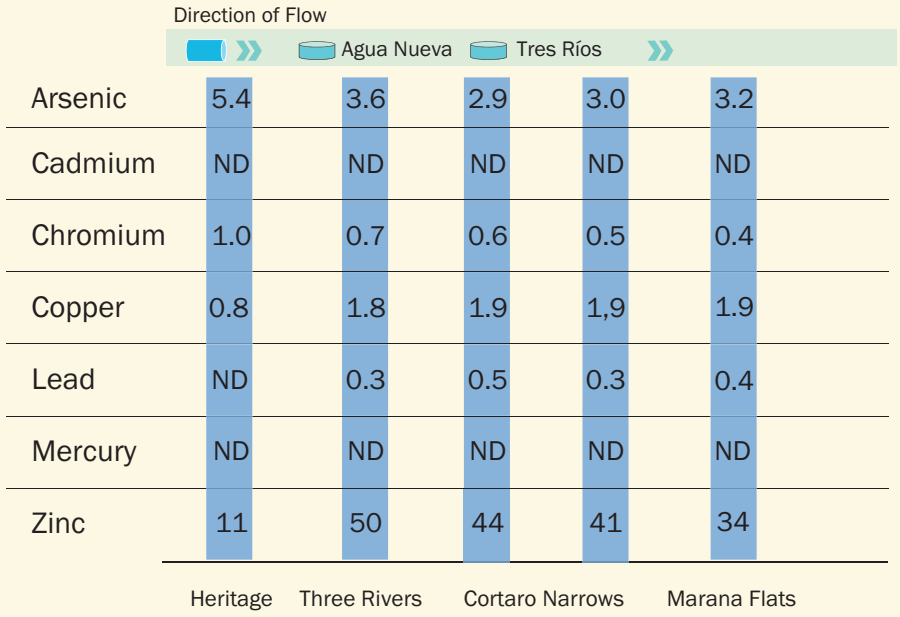
Biochemical oxygen demand was measured 199 times along the river. BOD has decreased since the upgrades to the reclamation facilities were completed. The high levels observed in Cortaro Narrows are absent after the 2013 water year. This pattern is generally the same in Marana Flats except that, for reasons unknown, measures of BOD in the first half of 2017 were similar to the high levels observed during the 2013 baseline.

Measures of BOD in the Heritage Reach began in the 2021 water year and have resulted in non-detections.

# WATER QUALITY: Metals

**Metals** in high concentrations endanger wildlife in aquatic ecosystems by lowering reproductive success, interfering with growth and development, and, in extreme cases, causing death. Most metals build up in aquatic food chains and may pose long-term threats to all organisms in the aquatic environment. Rivers are exposed to pollutant metals through numerous sources, including mine drainage, roadways, and by the release of metals naturally occurring in near-surface rocks and sediments. ADEQ has set standards for the protection of aquatic wildlife. Results for the following metals are compared to their appropriate standard: arsenic, cadmium, chromium, copper, lead, mercury, and zinc.

Average values for dissolved metals tested throughout the year
*concentrations in micrograms/liter (µg/L), also known as parts per billion (ppb)*




| | Average Standard<br>*standards for wildlife vary with water hardness* |
|---|---|
| Arsenic | 150 µg/L* |
| Cadmium | 3.8 µg/L |
| Chromium | 11 µg/L* |
| Copper | 19 µg/L |
| Lead | 7 µg/L |
| Mercury | 0.01 µg/L* |
| Zinc | 252 µg/L |

*set value, not an average

ND = Not Detected

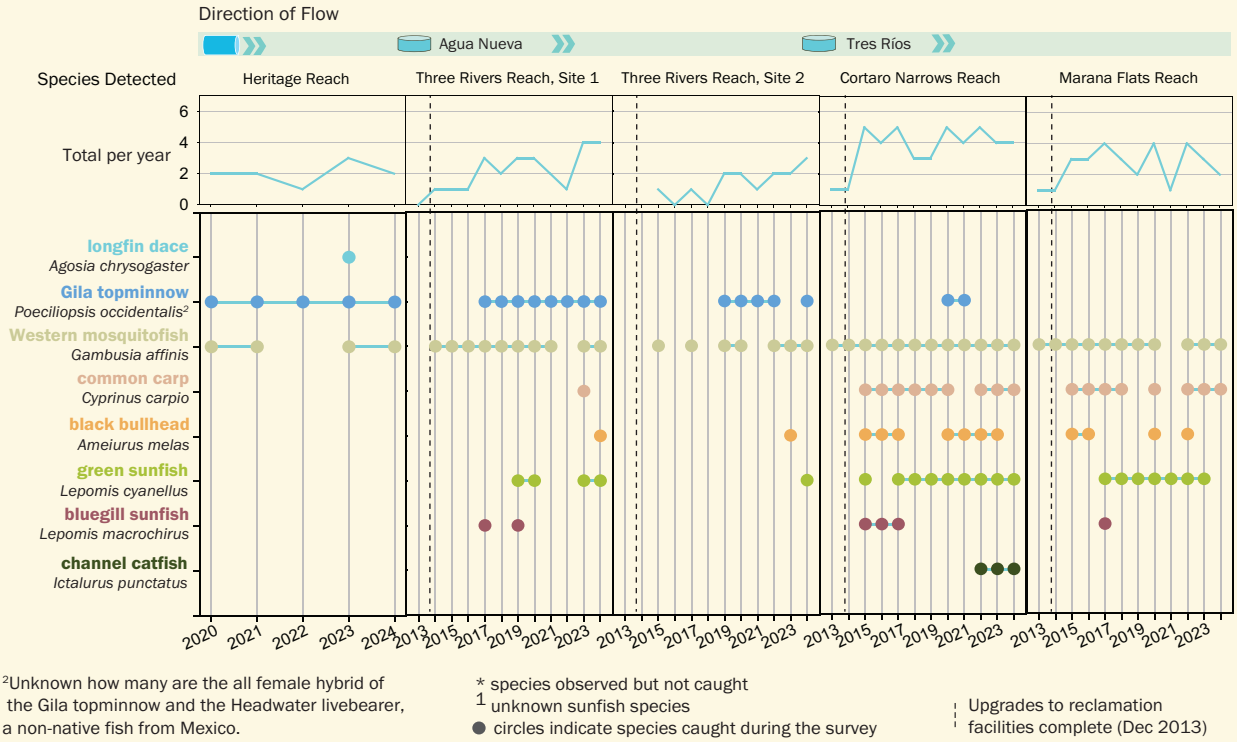
## 2013–2024 RESULTS

All samples tested at four sites over the years have met the appropriate standard for the following dissolved metals: arsenic, cadmium, chromium, copper, lead, mercury, and zinc. The samples taken within Marana Flats were from three different sites and averaged here. The sample location had to be moved twice due to reduced flow extent and inconsistent flows following increased infiltration rates, though has been at the same location since 2014.

Measures of dissolved metals in the Heritage Reach began in the 2021 water year. Levels have met all standards and remained comparable to levels in the other reaches.

# AQUATIC WILDLIFE: Fish

**Fish** can serve as effective indicators of river health because they live for several years and vary in their tolerance to pollution. Historically, the greater Santa Cruz River supported several native fish species: Gila topminnow, Gila chub, desert sucker, Sonora sucker, longfin dace, and a pupfish species that went extinct when the river ceased to flow year-round. There is no standard for abundance or diversity of fish. The results from the 2013 water year will serve as a baseline for measuring change in subsequent years.




²Unknown how many are the all female hybrid of the Gila topminnow and the Headwater livebearer, a non-native fish from Mexico.

* species observed but not caught
1 unknown sunfish species
● circles indicate species caught during the survey

Upgrades to reclamation facilities complete (Dec 2013)

## 2013–2024 RESULTS

Fish surveys were conducted annually in the fall at four locations with two sites located in the Three Rivers Reach. Surveys aim to detect all fish species present at a location, but do not try to assess population numbers. Improvements in water quality have allowed fish to thrive. Overall, the number of fish species observed increased from one to eight. All are non-native, except for the endangered Gila topminnow and longfin dace. Recording the most species, the Cortaro Narrows reach may provide the most diverse habitat for fish. Flows in the Three Rivers reach are often very shallow and may favor smaller fish like the Western mosquitofish and Gila topminnow, although occasional larger fish like sunfish, carp, and black bullhead have been seen. Though Gila topminnow continue to be found in the Three Rivers reach, the catch-per-unit effort (a measure of how easy it is to find a species) has been lower in the last two years. Another challenge is the uncertainty regarding the number of topminnow that are the all female hybrid with the closely related species from Mexico. An analysis of this kind would require examination of genetics or teeth (see next page for more information about this hybrid.).

Fish surveys in the Heritage Project Reach began in fall 2021. Arizona Game and Fish Department introduced Gila topminnow in October 2020, with individuals collected from the Tubac reach in Santa Cruz County. Since 2023, this site has had the highest catch-per-unit effort of Gila topminnow. Though the number of all female hybrids present remains unknown.

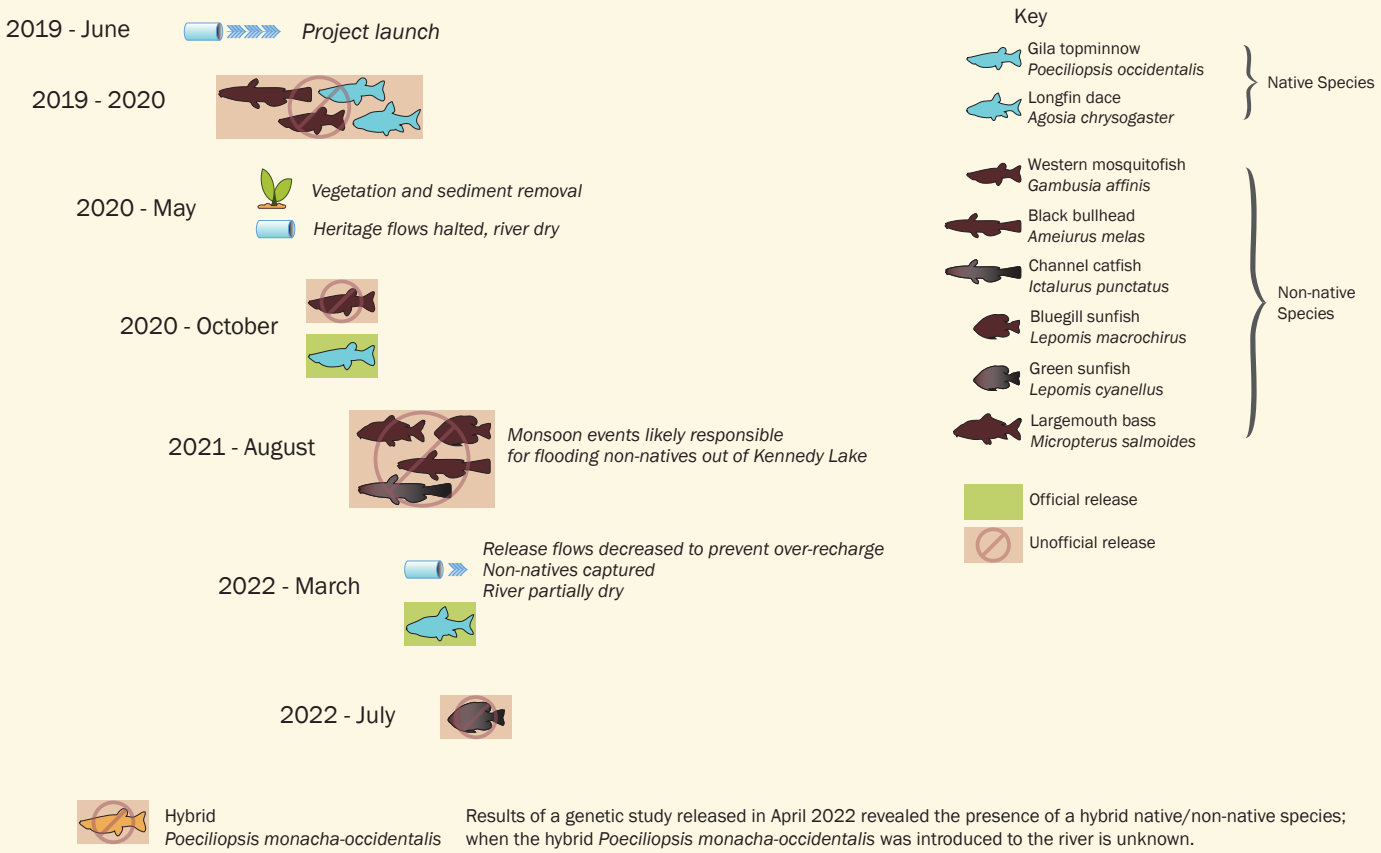
Native longfin dace (*Agosia chrysogaster*) used to be found in Tucson area and were released into the Heritage Project and Three Rivers reaches in 2022. In 2023, a single dace was found in the Heritage Project and have otherwise not been detected.

Introductions like that of the Gila topminnow in 2020 to the Heritage Project reach reflect the success of conservation work on the Santa Cruz River. However, the unplanned release or translocation of any wildlife or plant can negatively impact efforts to re-establish native species and manage the river ecosystem—any such actions are illegal and subject to heavy fines.

Illegal introductions have been observed in the Heritage Project reach from the beginning of the project. After its launch in 2019 multiple species were discovered in pools that subsequently dried, resulting in the death of those populations. Similar fates were met by fish released just before Pima County conducted a sediment removal project. Sometimes weather events can cause flooding that flushes non-native species into the river from nearby sources such as Kennedy Lake, which is stocked with sport species for recreational fishing. Often these introductions are suspected to have been the result of illegal human action. Western mosquitofish that were discovered in the Heritage Project reach in 2020, just prior to the planned release of Gila topminnow, are now an established non-native species that poses an ongoing threat to the native's success, and in July 2022, green sunfish were discovered near the outfall of the Heritage Project without any prior flooding.

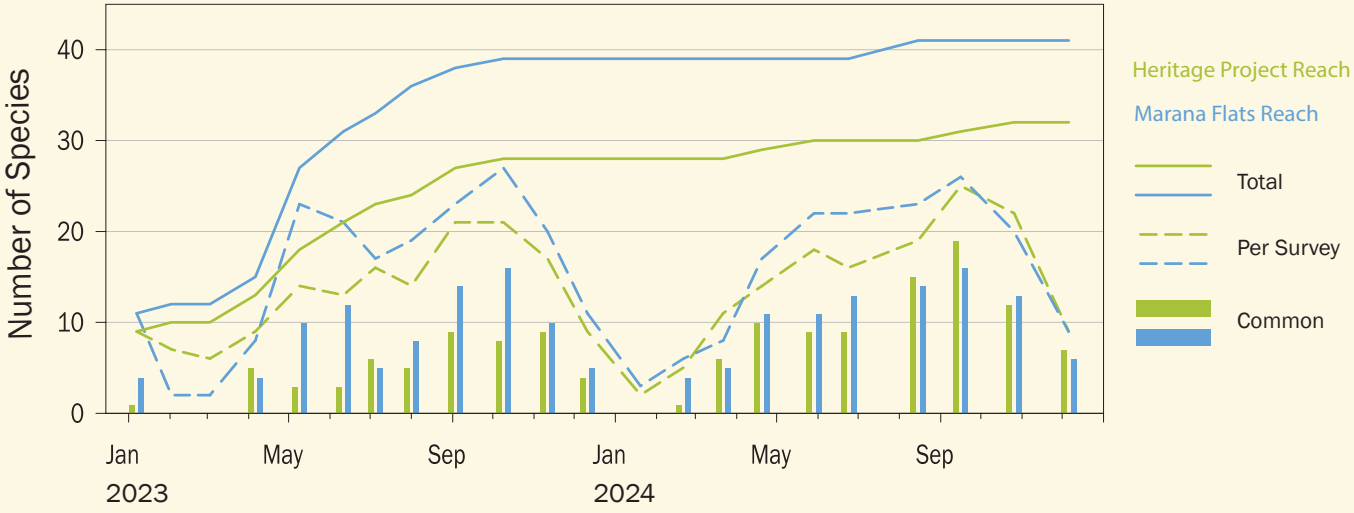
Researchers from the U.S. Fish and Wildlife Service have also identified the presence of *Poeciliopsis monacha-occidentalis*, a hybrid species of the endangered Gila topminnow (*Poeciliopsis occidentalis*) and the Mexico native headwater livebearer (*Poeciliopsis monacha*). This hybrid exploits Gila topminnow for reproduction, discarding the male genome and producing offspring that are clones of the hybrid females. The presence of this hybrid has been confirmed in both the Heritage and Northwest Tucson to Marana reaches, further complicating monitoring efforts. Western mosquitofish and Gila topminnow are difficult to tell apart and must be identified by trained experts, but the hybrid species can only be distinguished from Gila topminnow in the lab by looking at teeth under a microscope or with genetic analysis.

Timeline of Heritage Reach Introductions



# AQUATIC WILDLIFE: Dragonflies

**Dragonflies** are excellent indicators of river health. Their presence reflects water quality because larval stages of dragonflies live in the river for months until they emerge as adults. They are also important for the ecosystem by serving as both prey and predator through all stages of their life. Changes in dragonfly diversty and abundance can signal environmental stress, pollution, or climate change. University of Arizona conducts monthly surveys of adult dragonflies within the Heritage Project and northwest Tucson to Marana reaches of the river. In addition to documenting the species found during a survey, abundance is evaluated to help identify the common species.

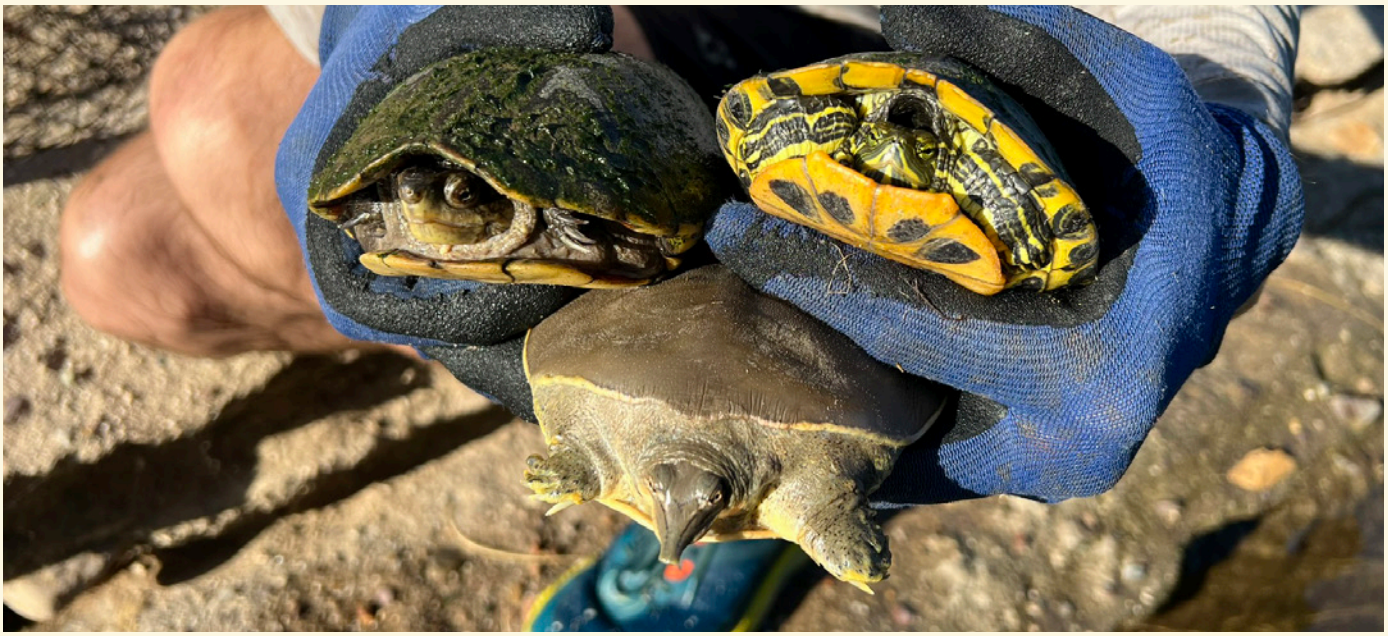



## 2023–2024 RESULTS

Dragonfly diversity is variable by season and has been increasing steadily. Diversity is highest in the Marana Flats reach, however, with just a little bit of water, the Heritage Project reach is providing habitat for a high diversity of species too. Dragonfly numbers naturally decrease during the cold winter months. Following the cold seasons, dragonfly diversity increases more quickly in the Marana Flats reach. In 2023, the number of dragonfly species that were common was higher in Marana Flats. Though, in 2024, the number of commonly found species was similar in both reaches, and occaisionaly higher in the Heritage Project reach. Overall higher diversity in Marana Flats may reflect the greater habitat available given the greater amount of water and vegetation. But the increasing water and vegetation cover (see page28&29) in the Heritage Project reach may help explain the increase in number of common species.

# AQUATIC WILDLIFE: Turtles

**Turtles** are long-lived and sensitive inhabitants of ponds and rivers around the globe. In the Santa Cruz River, the Sonoran mud turtle (*Kinosternon sonoriense*) was the only native turtle in the river historically. However, at least three other non-native turtles have been introduced to the river in recent decades. Recent surveys by researchers from the University of Arizona have demonstrated that Sonoran mud turtles still persist in the Santa Cruz River, but in low numbers likely due to the high abundance of non-native species. Current turtle conservation efforts in Tucson are focused on translocating Sonoran mud turtles to parts of the river where fewer non-native species are present, specifically the City of Tucson | Tucson Water's Santa Cruz River Heritage Project downtown.

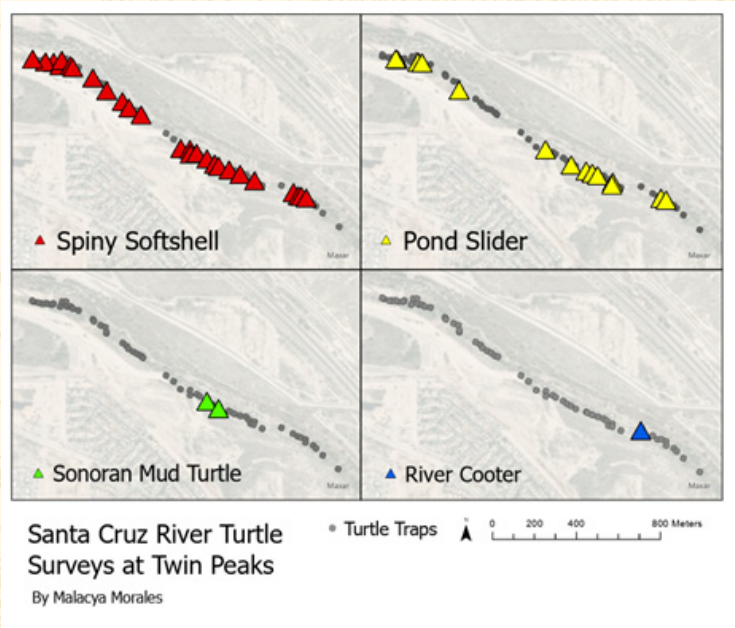


The three most common turtle species encountered in the Santa Cruz River: the Sonoran mud turtle (*Kinosternon sonoriense,* upper left), the pond slider (*Trachemys scripta*, upper right), and the spiny softshell (*Apalone spinifera*, lower center)

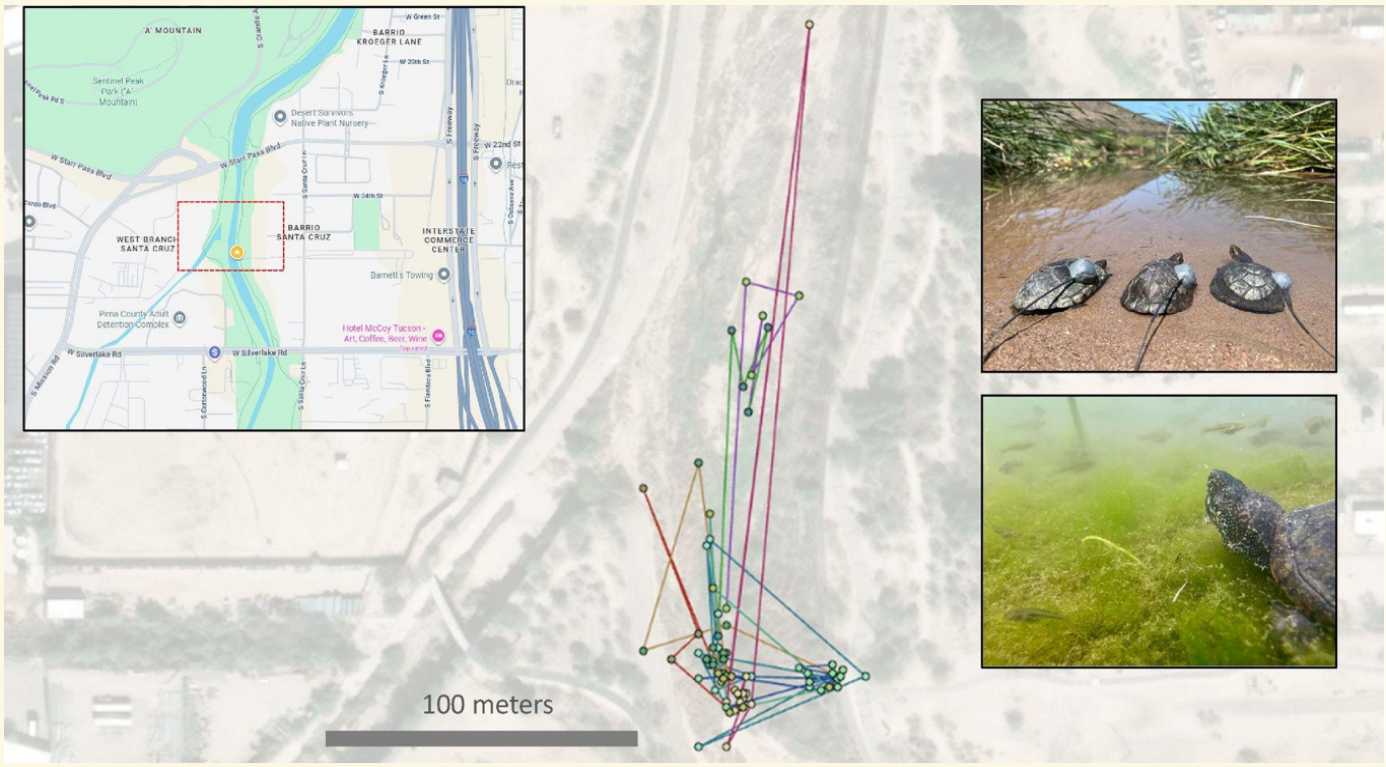
## 2023-2025 RESULTS

As part of an ongoing collaboration between Pima County Regional Flood Control District and Professor Michael Bogan and his students at the University of Arizona, turtle salvage efforts are conducted each fall along the river near Twin Peaks Road, which is in the Cortaro Narrows reach of the river. In this location, the Flood Control District is realigning the channel to improve flood protection infrastructure. Prior to channel work and flow diversions, Professor Bogan and his students exhaustively trapped for turtles over a several week period each year. All native Sonoran mud turtles encountered were then translocated several miles upstream to the Heritage Project reach. In October 2024, two Sonoran mud turtles were salvaged and translocated to the Heritage Project reach, and a total of eight Sonoran mud turtles have been brought there in the past two years. Radio transmitters affixed to turtles allowed the researchers to use radio telemetry to track each individual turtle after translocation, to ensure that each turtle survived the move and thrived in their new habitat. This conservation collaboration between the university, the county, and the city, with permitting and logistical support from the Arizona Game and Fish Department, will continue in the fall of 2025 near Twin Peaks Road.

*Images, maps, and content related to turtles provided by Michael T. Bogan, University of Arizona*



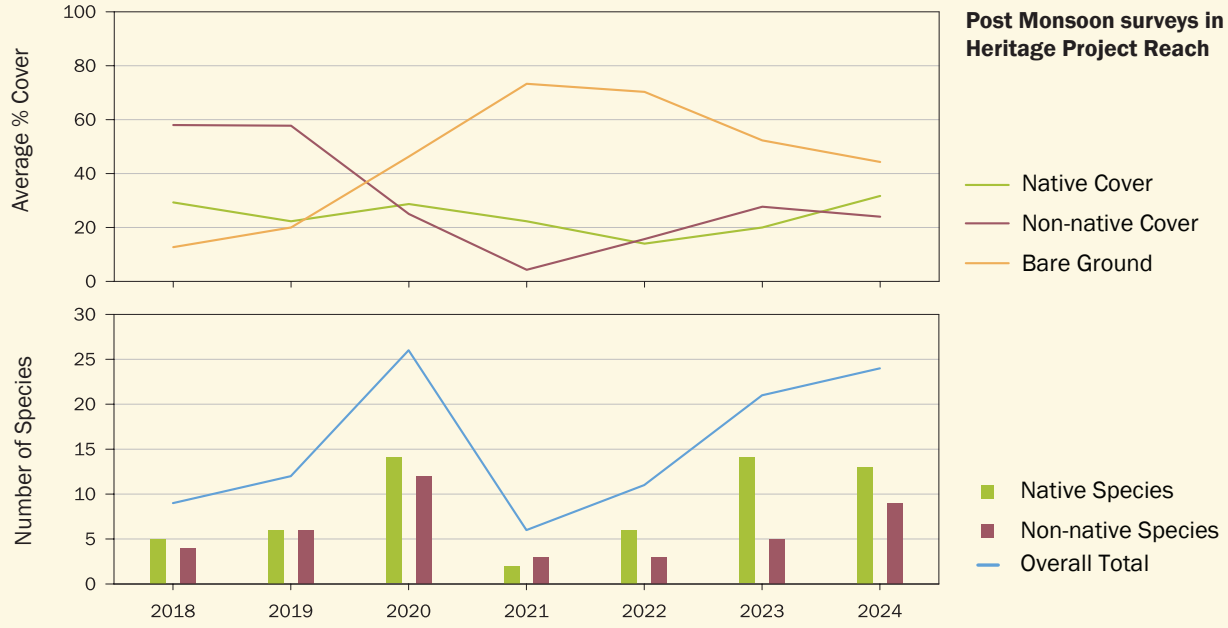

**Above left:** Map highlighting all the turtle trapping done in Fall 2024 (Sept & Oct) and where native and non-native turtles were found across all 60 trapping locations. Non-native turtles were far more abundant than native turtles; only two Sonoran Mud Turtles were found. **Above right:** Searching for translocated Sonoran mud turtles using a radio antenna receiver that 'listens' for the signal from the transmitter affixed to each turtle's shell.




Map of all the known locations of translocated Sonoran mud turtles in the Heritage Project reach of the Santa Cruz River from fall 2023 to spring 2025. Each point is a location of an individual turtle on an individual date, with different colored lines connecting observations of each of the eight individual turtles that have been translocated to date.

# RIPARIAN VEGETATION: Composition and Cover in Heritage Reach

Riparian vegetation benefits flood management, groundwater recharge, wildlife habitat, and more. The Santa Cruz River Heritage Project was primarily developed for aquifer recharge but also supports riparian and wetland plants.
City of Tucson | Tucson Water aims to develop this vegetation by increasing the native shrubs, grass, and other cover, while eliminating trees that increase flood risk in the narrow corridor. Harris Environmental Group (HEG) surveys vegetation **composition and cover in Heritage reach** each year after the summer monsoon season. Surveys began in 2018 and seeding in 2019, prior to a sediment removal project conducted by Pima County Regional Flood Control District in 2020 to improve conveyance of floods through downtown. Surveys after the monsoon aim to identify monsoon influence on vegetation and monitor species planted or seeded. In 2024, HEG conducted a mature tree survey to tag and identify trees in the area. This will help establish a baseline that will help measure future change in tree cover and also allow targeted removal of non-native trees that will help manage the reach for flood saftey through this narrow reach.

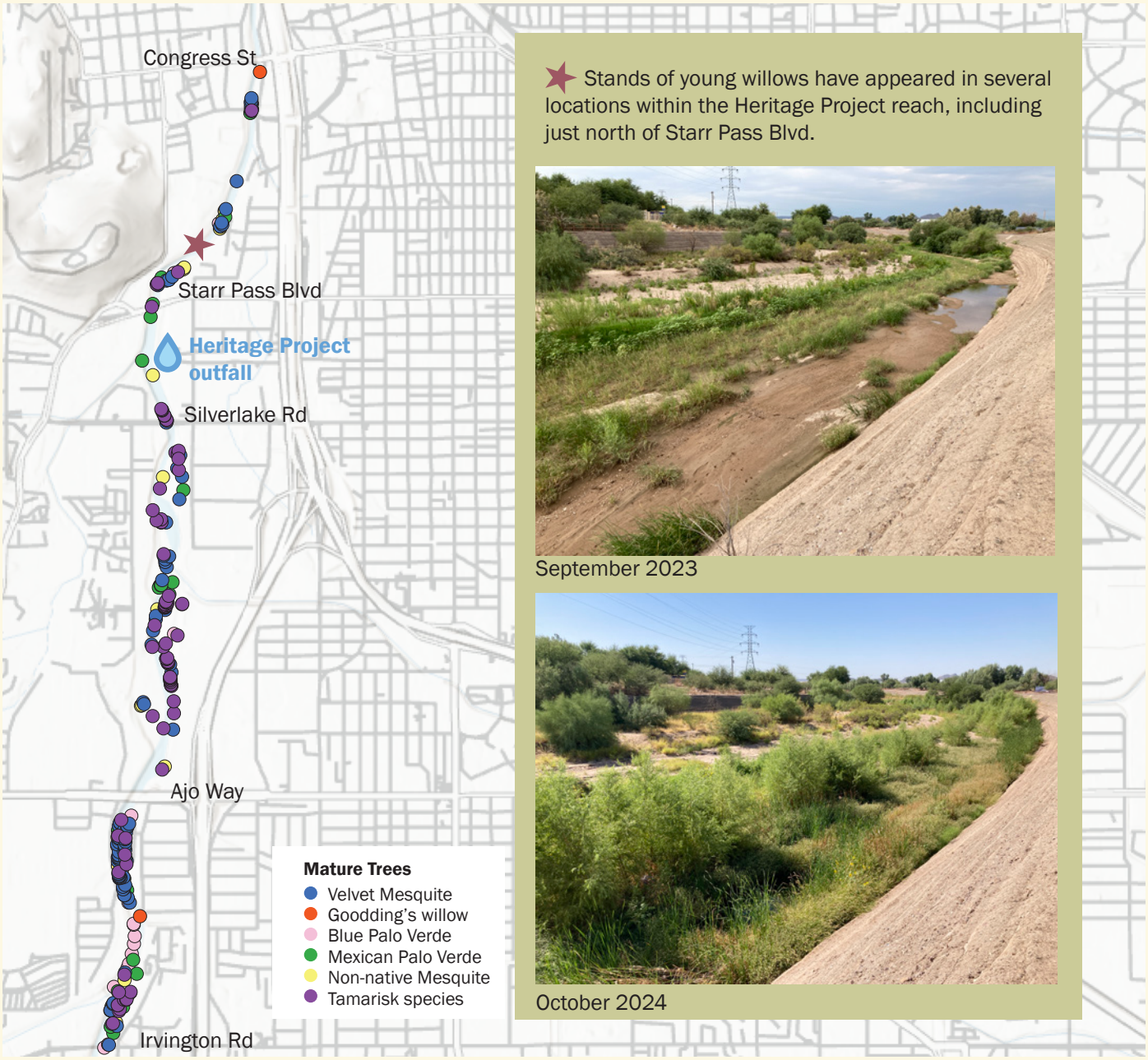



## 2018–2024 RESULTS

Vegetation composition and cover has been variable in the Heritage Project Reach. Vegetation was monitored at 6 locations between the Heritage Project outfall and Verdugo Park located about 0.6 miles downstream. Prior to the the start of the project in 2019, the average percent cover was dominated by non-native species and there were few species detected. The sediment removal project in 2020 significantly influenced vegetation cover by reducing non-native cover and increasing the amount of bare ground. Since 2022, the amount of bareground has been decreasing and overall number of species detected during post-monsoon surveys has be increasing with the reestablishment of vegetation. Species diversity has generally increased and likely refelcts the additional water now available in the reach. Both the sediment removal project in 2020 and strong monsoon flooding in 2021 reduced species diversity observed in 2021.

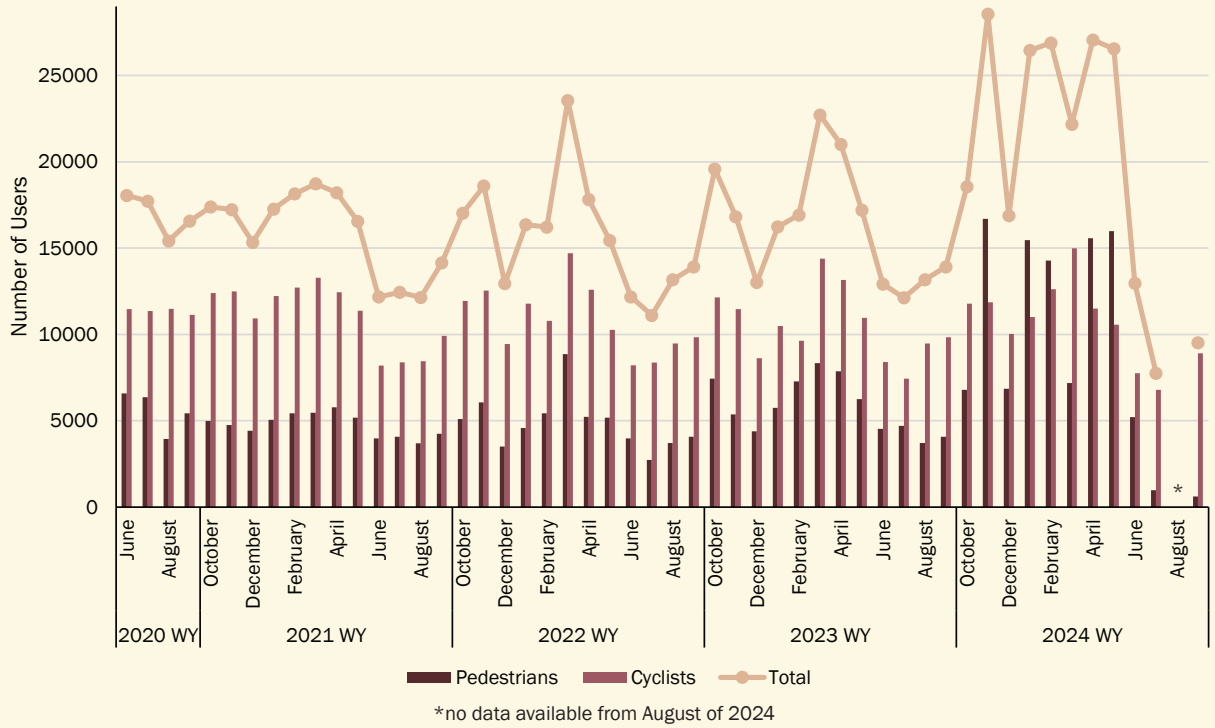
Surveys documented the appearance of Goodding's willow, a native riparian tree species, starting in 2022. Starting in 2024 there were noticeable stands of young willows and one area had a significant jump in willow cover from 0% in 2023 to 26% in 2024 (see photos below).

In 2024, the mature trees were mapped and tagged along the river from Irvington to Congress. This is the area where there are releases of remediated water from the Tucson Airport Remediation Project (close to Irvington) or groundwater and effluent as part of the Santa Cruz River Heritage Project (between Silverlake Road and Starr Pass Boulevard) provide additional flows of water in the river. In total, 272 trees were tagged of which 43% were native species (velvet mesquite, Goodding's willow, and blue palo verde) and 57% were non-native species (tamarisk species, non-native mesquite, and mexican palo verde). Velvet mesquite and two kinds of tamarisk species were the most commonly tagged trees.



## SOCIAL IMPACTS: Pedestrian and Cyclist Use of The Loop

The Santa Cruz River is not just for wildlife. The Chuck Huckelberry Loop trail and numerous parks along the river corridor provide popular destinations for people to enjoy the river as well. **Pedestrian and cyclist use of the Loop** trail is one way to monitor recreational use along the river. The Loop has more than 136 miles of paths extending throughout the greater Tucson area and in January 2018 the "loop" feature was completed by connecting the Rillito and Pantano River Parks. Users in the Santa Cruz River Park can now connect with the Rillito and Pantano Parks, Harrison Greenway, and Julian Wash on a 53.9-mile circuit. Over the past two years, Pima County has installed counters to monitor activity along the multi-use path, with one counter along the river between the flowing reaches. These counters differentiate between cyclists and pedestrians, allowing trends of use to be studied.



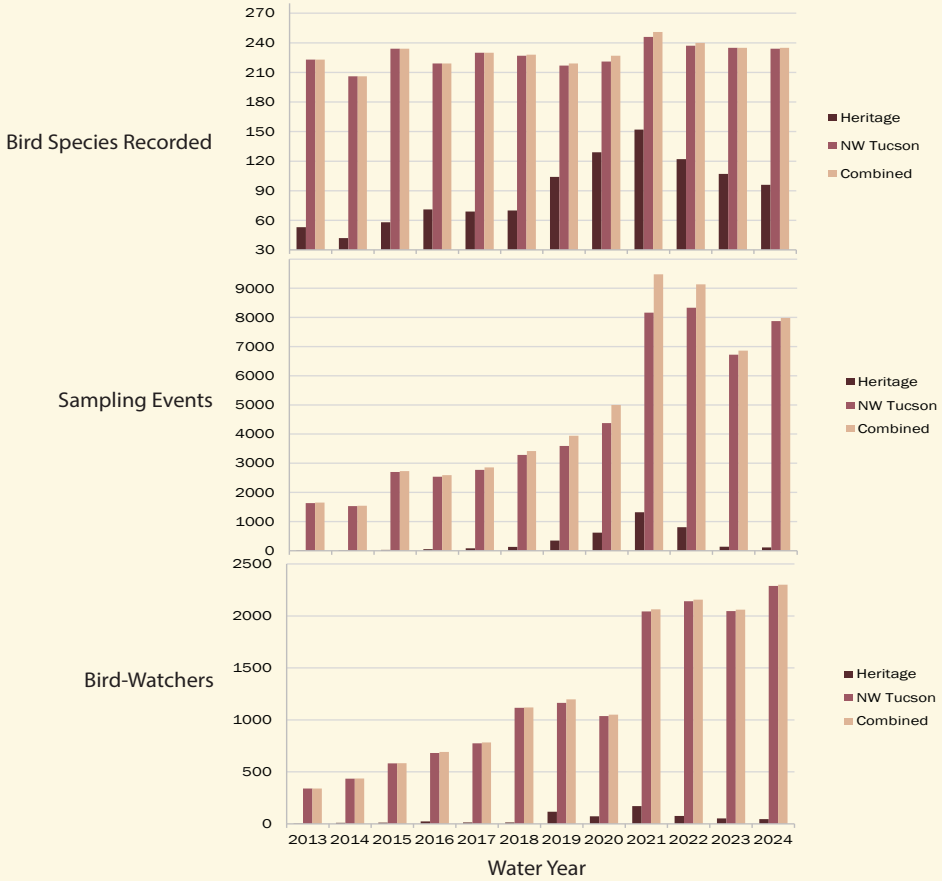

*no data available from August of 2024

## 2020–2024 RESULTS

In the Santa Cruz River Park, from Speedway to Saint Mary's Road, counter data shows a steady use year-round. Seasonal variation is expected, with the lowest numbers generally occurring in the heat of the summer. In 2024, there was an increase in use of this stretch of the Loop. On average there are nearly 17,000 total Loop users that were counted on this stretch of the path every month (10,800 cyclists and 6,000 pedestrians). Counters don't identify unique individuals. If we assume everyone is doing an "out and back" and thus counted twice, we have an average of 280+ people per day traveling along the river in this location. This is a conservative estimate since many cyclists are doing large distances and loops that don't pass by the same location twice.

# SOCIAL IMPACTS: Bird-watching

The flowing water and rich riparian vegetation of the Santa Cruz River support a diverse array of bird and wildlife species. **Bird-watching** is thus an easy way to understand the importance of wildlife viewing as a type of recreational use of the river and adjacent parks. We can also track the number of different bird species seen along the river. A citizen-science bird-watching program run by Cornell Lab of Ornithology, eBird (**www.ebird.org**), offers interested passersby an opportunity to take part in data collection by recording bird species they see along the river, thus providing river managers with an ongoing source of information. For this analysis, we include only observations collected during traveling or stationary counts of species making use of the river corridor and adjacent parks. Birds simply flying over, and those that are exotic or domestic, are excluded to focus on the effectiveness of the area as wildlife habitat.




## 2020–2024 RESULTS

Observed diversity was highest in 2021, which is also the peak year for total number of sampling events in both reaches. Diversity is highest and fairly stable in the northwest Tucson to Marana. However, the Heritage reach has high diversity considering that it is a small reach (~3.4 miles) compared to 23 miles along the northwest Tucson to Marana reach that also includes habitat options such as Sweetwater Wetlands and El Rio Preserve. The majority of bird-watchers recording observations are in the Northwest Tucson to Marana reach. Efforts like this demonstrate the potential of citizen-science efforts, and the latent willingness of communities to be involved in our natural areas.

## ACKNOWLEDGEMENTS

Sonoran Institute, Pima County, and City of Tucson | Tucson Water prepared this report with generous funding from Pima County Regional Wastewater Reclamation Department, Pima County Regional Flood Control District, City of Tucson | Tucson Water , and community stakeholders. We thank all who contribute to the data collection, photography, and conservation efforts along the river. We especially thank the University of Arizona and Michael T. Bogan for his expertise, public education, and diverse research efforts along the Santa Cruz River.

We are grateful for the expert guidance from our Living River Technical Committee, and for the support of our project partners, including Arizona Department of Environmental Quality, Arizona State University, Tucson Audubon Society, University of Arizona, and the U.S. Geological Survey.

In 2012, the Sonoran Institute convened a Living River Technical Committee of ecology, hydrology, and wildlife experts to bring the best available science to bear on the development of the *Living River* health assessments. The Technical Committee provided guidance by selecting and aggregating indicators of river health, identifying reference values or standards for evaluating and tracking changes in river conditions, and reviewing the development of this report. The information presented in this report grew out of discussions involving these experts and represents the product of a collective effort; it does not reflect the opinions or viewpoints of any individual member of the technical team. The viewpoints and opinions expressed in the discussions of the group and captured in this report also do not reflect the opinions or viewpoints of the agencies, institutions, or organizations with whom the technical team members and external reviewers are associated or employed. Any errors or omissions contained herein are solely those of the Sonoran Institute.

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**Cover photo**: Teachers along the Santa Cruz River in Marana by **Michael T. Bogan**

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**SONORAN INSTITUTE** has worked since our founding in 1990 to realize our vision that the Santa Cruz River, from Mexico to Marana, is a living, flowing river and the foundation of community health and prosperity. The Sonoran Institute's mission is to connect people and communities with the natural resources that nourish and sustain them.

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Take this short survey

tiny.cc/tlr25surv

Where do you access the river and what makes it a good location?

*Untitled* by Jayla Bacasegua, Grade 5, Grijalva Elementary • Ms. Quintero