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a living river

SANTA CRUZ RIVER 2023 DOWNTOWN TUCSON TO MARANA

LEARN ABOUT TECHNOLOGY AND TOOLS USED TO CARE FOR THE RIVER



Santa Cruz River in Marana





The Santa Cruz River is a culturally and spiritually important ribbon of nature winding through our urban community, which people continue to care for together.

THE SANTA CRUZ RIVER CELEBRATE AND PROTECT

Rivers support people around the world, but the importance of water is more pronounced in the desert southwest. Our Santa Cruz River is no exception. In Pima County, two reaches of the river that were once fed by groundwater now flow thanks to the release of effluent, or highly treated wastewater, from water reclamation facilities that treat wastewater from homes and businesses. This water creates up to two miles of flow in Tucson's downtown Heritage Project and over 20 miles from northwest Tucson to Marana, nourishing lush vegetation, supporting wildlife habitats, replenishing the aquifer, and enhancing a culturally and spiritually important ribbon of nature winding through our urban community.

Stewardship of this important resource is complex. Some management methods are as basic as picking up trash and pulling out non-native plants by hand. Others are far more complex, such as the technology used to produce the high-quality effluent and the camera surveillance systems that help managers decide when to release it. Even artificial intelligence (AI) is now part of the wastewater reclamation toolkit! Yet, stewardship still comes down to a simple constant—people working together to care for their environment. Please join us in celebrating and protecting the Santa Cruz River.

TRACKING RIVER CONDITIONS



Annual *Living River* reports share conditions along the flowing reaches of the Santa Cruz River. Included here are conditions from downtown Tucson to Marana for the 2022 water year (October 1, 2021, to September 30, 2022). Scan the QR code and learn more in the supplemental report. www.tiny.cc/tlr22

NOTABLE ACHIEVEMENTS



AI technology reduces wastewater treatment costs



Tucson approves the return of ancestral land near the river and A-Mountain to the Tohono O'odham Nation



Endangered wetland plant, Arizona eryngo, planted at Sweetwater Wetlands



"Rapid Recruiter" seed mix developed to restore native vegetation after invasive plant removal



Multiple cleanups remove over 10 tons of trash from the river



U.S. Department of Interior approves management plan for Santa Cruz Valley National Heritage Area

VISIT THE RIVER

The river is a destination for picnics, exploration, wildlife viewing, and more. Many people visit the river by traveling along **The Chuck Huckelberry Loop**—one location near **Speedway Boulevard** saw over **190,000 pedestrians and cyclists in 2022**, with more than **8,000 pedestrians in March alone!** Photographer **Charlie Alolkoy** loves capturing river sunsets like the one here. Share pictures of your river visits (see page 10).

LEGEND



Water reclamation facility (treatment plant)



River reaches with seasonal flows



River tributaries



Northwest Tucson to Marana Reach



Heritage Project Reach

5 Miles

MANAGING FOR DIVERSE NEEDS

Rivers provide many important services for people and wildlife in addition to water. They move nutrients and sediments, recharge aquifers, sustain cooling trees and plants, and connect living organisms across habitats. In a river’s natural state, even flooding provides benefits. As floodwater spills out of a river’s channel and onto its adjacent floodplain, riparian vegetation on the banks and in the floodplain slows flood flows, reduces erosion, filters water as it percolates into the ground, and provides habitat for wildlife. The Santa Cruz River provides these benefits, but like many urban rivers, it has changed with development. Its historically wide floodplain in the Tucson area has shrunk as communities have grown around it, with buildings, parks, and other infrastructure built close to the river

channel. Preserving the river’s important resources while also protecting humans and property requires careful management and stewardship.

Releasing effluent into the river provides habitat and helps replenish the aquifer. These flows are monitored to prevent contact with historic landfills and gravel pits adjacent to the river. Vegetation management is another key stewardship activity. Thick, tall vegetation and accumulated sediment can impede flows and cause floodwaters to spill out of the channel, so trees and excess sediment are occasionally removed to maintain flow capacity. Additional maintenance encourages growth of native plants while removing those that are non-native or invasive.



THE LOOP

Wells monitor depth to water table and water quality

Area to pass floods safely

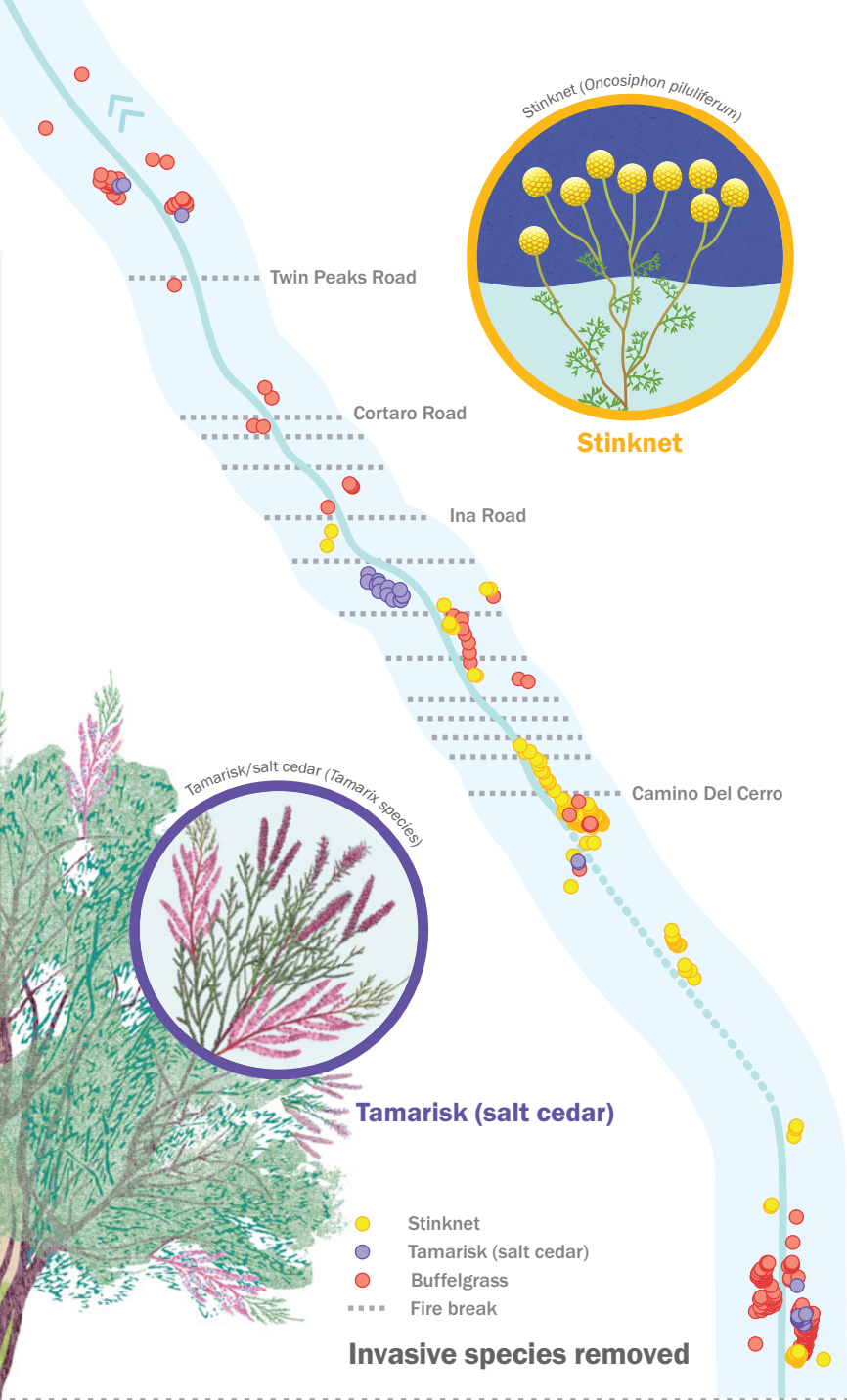
THE LOOP

River flows are managed to prevent contact with gravel pits and historic landfills

Effluent supports aquatic wildlife and riparian vegetation, and sinks into the ground to replenish the aquifer

Water table

Aquifer



Tamarisk (salt cedar)

- Stinknet
- Tamarisk (salt cedar)
- Buffelgrass
- Fire break

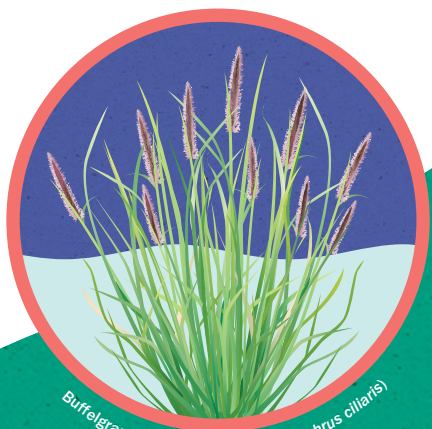
Invasive species removed

PIMA COUNTY COORDINATES WITH PARTNERS TO TARGET INVASIVE PLANTS

Invasive plants are more than just new species introduced to the region; they can dominate the landscape, displace native vegetation, and easily spread wildfires that damage ecosystems and threaten communities. Pima County Regional Flood Control District coordinates with partners to target invasive plants, including buffelgrass, tamarisk trees, and more recently, stinknet, a species that can cause severe allergic reactions in skin and respiratory systems.

In 2022, the Flood Control District inspected 12,452 acres for buffelgrass and other non-natives and chemically or mechanically treated 638 acres, including over 900 spots along the Santa Cruz River. Tucson Audubon Society removed 27 acres of tamarisk (salt cedar), treated 50 acres of invasive grasses, and created 13 firebreaks—strips of open spaces that help prevent the spread of wildfires. Pima County will re-treat the 27 acres of tamarisk to prevent re-growth of these trees.

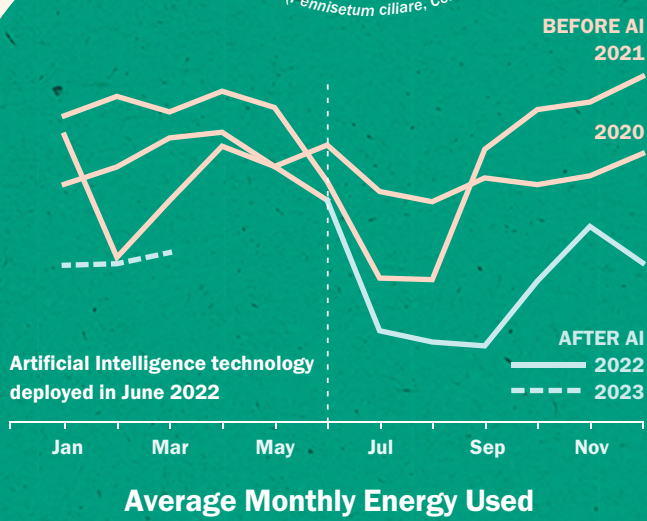
Buffelgrass



Buffelgrass (Pennisetum ciliare, Cenchrus ciliaris)

ARTIFICIAL INTELLIGENCE TECHNOLOGY SAVES ENERGY IN WASTEWATER TREATMENT

In June 2022, Pima County Regional Wastewater Reclamation Department deployed AI technology to increase efficiency and reduce energy usage in the wastewater treatment process. Starting with a module that focused on power consumption at the Agua Nueva Reclamation Facility, the AI technology immediately resulted in an energy savings of 20% (an estimated annual \$300,000 savings) while maintaining the high quality of effluent being released into the river. While energy usage varies, savings trends continued into 2023, adding to previous sustainability achievements like the Tres Ríos Renewable Gas Facility, operated since 2021.



HERITAGE PROJECT REACH

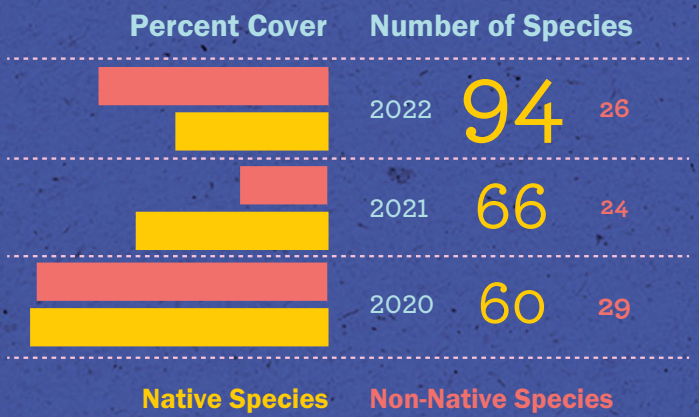
Beginning north of Silverlake Road, this reach flowed year-round until 1914 and was home to several species of native fishes, lowland leopard frogs, and other aquatic species. Groundwater pumping caused water levels to decline, and the reach has typically been dry since the 1940s. Flows returned in June 2019, when Tucson Water launched the Santa Cruz River Heritage Project. The project uses the reclaimed water system to transport effluent from the Agua Nueva facility

STABLE HIGH-QUALITY WATER

Water treatment technologies continue to provide high-quality water to the river. Scores for water quality monitored near Starr Pass indicate fish and aquatic life have the conditions they need to thrive. Conditions even improved, with dissolved oxygen increasing slightly to an average of 7 mg/L, up from 6 mg/L in 2021.

VEGETATION DIVERSITY AND COVER INCREASING

Vegetation surveys following the summer monsoon recorded more than double the amount of non-native plant cover compared to 2021, though still less than 2020 levels. This suggests the lower monsoon intensity in 2022 and less scouring of the river channel allowed plants to recover from record rainfall in 2021. Though native cover declined slightly, overall diversity and number of native plant species are increasing, and native plants continue to represent the majority of species identified.



and release up to 3,150 acre-feet annually into the river downtown. Though developed primarily to store water in the aquifer for future use, the Heritage Project is also creating riparian habitat, supporting community cultural connections, providing educational opportunities, and improving the quality of life in downtown neighborhoods. Some of the water in this reach comes from the Conservation Effluent Pool reserved for environmental restoration efforts.

SOME SPECIES OBSERVED IN 2022

ENDANGERED
GILA TOPMINNOW

CHECKERED
GARTERSNAKE

AMERICAN
BULLFROG
(non-native)

47
DRAGONFLY
SPECIES

122
BIRD
SPECIES



Green heron (Butorides virescent)

MANAGEMENT MODULATES HERITAGE REACH FLOWS AS SECOND OUTFALL ADDS WATER TO RIVER

In November 2021, the Tucson Airport Remediation Project began releasing clean, treated groundwater into the river near Irvington Road, south and upstream of the Heritage Reach outfall. Initially, the average flow rate was nearly 1,000 gallons/minute (lower than the average 1,400 gallons/minute released at Heritage) but steadily increased and reached a high of 4,000 gallons/minute. This water flow regularly traveled as far as the Heritage Reach and increased the extent of flow in that reach from an average 0.5 mile before February 2022 to over 2 miles at times.

Tucson Water carefully monitors flow rates and groundwater levels in the Heritage Reach to maximize the amount of water that can recharge the aquifer. With additional water from upstream, releases at Heritage were decreased, reaching a steady 240 gallons/minute to maintain a vital wetland habitat area for endangered Gila topminnow and other aquatic wildlife near the outfall.

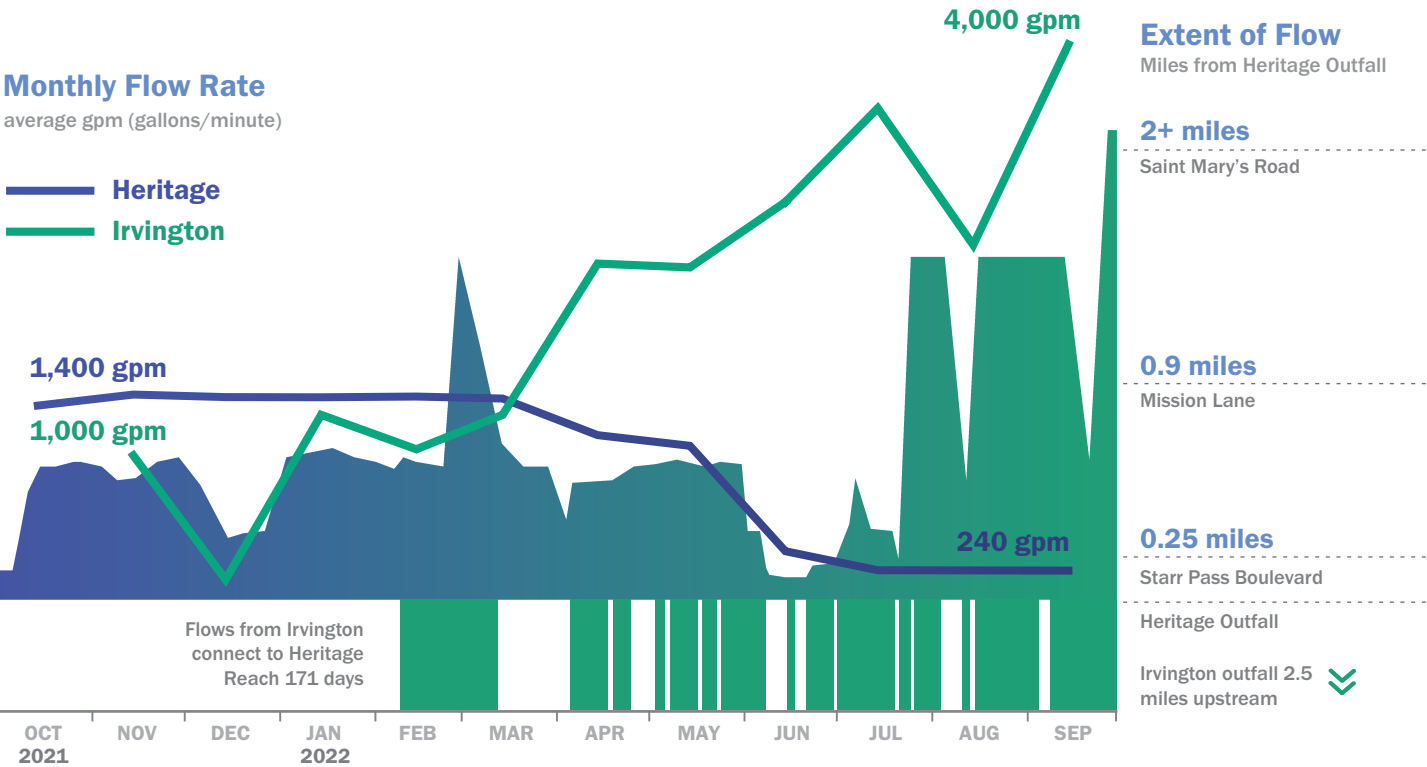


American bullfrog (Lithobates catesbeianus)

Monthly Flow Rate

average gpm (gallons/minute)

Heritage
Irvington



CAMERA SURVEILLANCE TECHNOLOGY MONITORS REAL-TIME FLOW CONNECTION

Water released into the river near Irvington Road traveled all the way to the Heritage Reach outflow for the first time on February 10, 2022. Between then and September 30, 2022, the flows have connected 171 days, or 73% of the time. A live video feed from a new camera installed near the Silverlake outfall allows Tucson Water staff to easily monitor conditions in real time.

LEARN MORE
www.tiny.cc/tlr22



NORTHWEST TUCSON TO MARANA REACH

Beginning near El Camino Del Cerro, this reach historically had only seasonal flows but is now Pima County’s longest continually flowing section. Since the 1970s, Pima County’s water reclamation facilities have released effluent into the river here year-round, creating a ribbon of green vegetation. Upgrades to the treatment process in 2013 mean that higher-quality water supports a thriving and more diverse

aquatic community, including native and non-native fish species. The Flood Control District has identified 20 projects to further improve this stretch of the river, such as creating a more winding flow path to encourage wildlife and plant diversity. Some of the water in this reach comes from the Conservation Effluent Pool reserved for environmental restoration efforts.

SOME SPECIES OBSERVED IN 2022

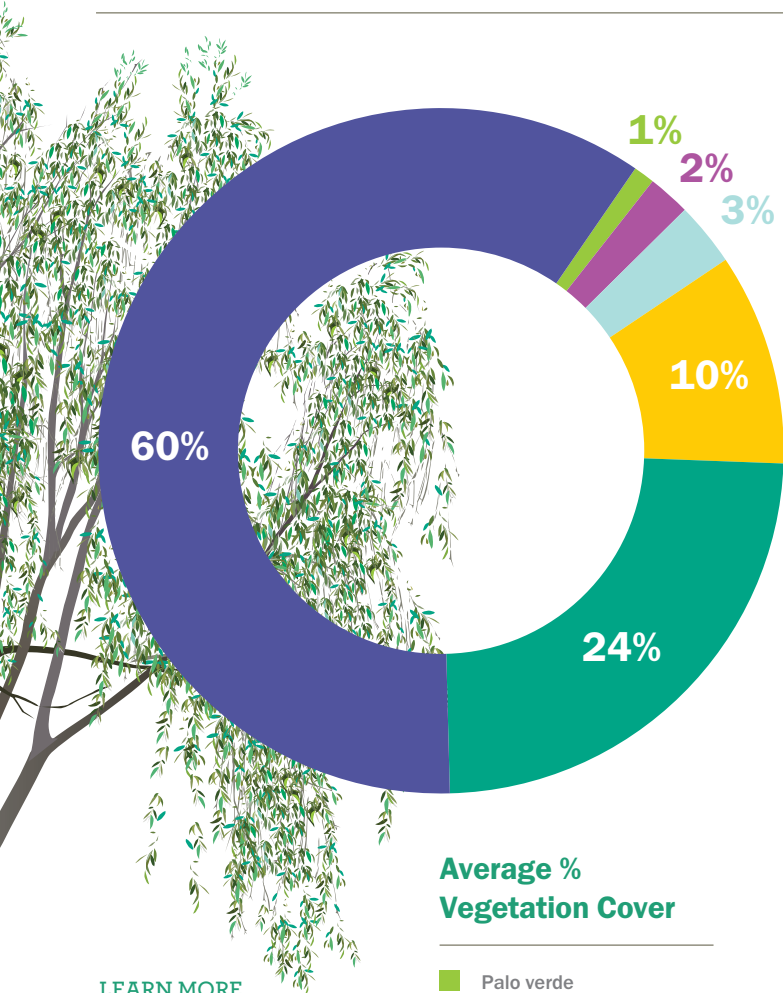
SONORA
MUD TURTLE

AMERICAN
BULLFROG
(non-native)

ENDANGERED
GILA TOPMINNOW

237
BIRD
SPECIES

50
DRAGONFLY
SPECIES



Average %
Vegetation Cover

- Palo verde
- Goodding’s willow
- Tamarisk (salt cedar)
- Large woody
- Small woody/herbaceous
- Bare ground

LEARN MORE
www.tiny.cc/tlr22



REMOTE SENSING TECHNOLOGY HELPS MONITOR VEGETATION ALONG THE RIVER

Pima County uses remote sensing technology, such as images taken from airplanes and drones, to monitor and map river vegetation cover. New data collected in 2021 and 2022 found that, on average, 40% of the river corridor had vegetation cover between the Agua Nueva outfall and Avra Valley Road. Remote sensing can only identify the species of large vegetation, like trees, and invasive tamarisk (salt cedar) were the most common. Ground surveys are best for monitoring the presence of smaller invasive plants like buffelgrass and stinknet.

STABLE HIGH-QUALITY WATER IN THE RIVER

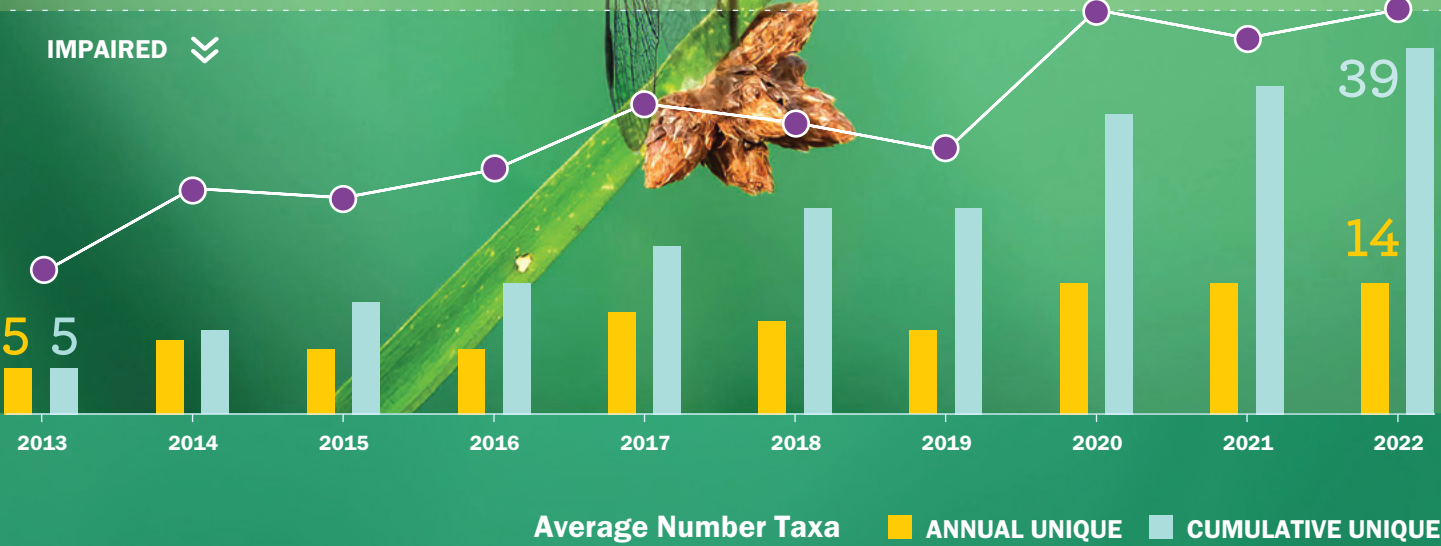
Regional Wastewater Reclamation Department staff work hard to maintain the high quality of water released into the river, while also monitoring water quality at four river sites. The river continues to score high for dissolved oxygen and low for turbidity—favorable conditions for aquatic life. Ammonia is regularly below the levels that are toxic to fish. In 2022, average ammonia levels immediately downstream of the reclamation facilities were lower than the previous year, likely reflecting new treatment technology completed in 2021 that further removes ammonia.

Arizona Index of Biological Integrity

HEALTHY ⬆

UNCERTAIN

IMPAIRED ⬇



AQUATIC INVERTEBRATE DIVERSITY IMPROVED

Ten years of annual samples at four sites along the river demonstrate that the diversity of aquatic invertebrates has increased. The average annual number of unique taxa has nearly tripled from 5 to 14. Although the number of taxa observed each year seems to be stabilizing, the cumulative number of unique taxa continues to rise, suggesting diversity continues to improve. Increasing diversity may explain the

rising average scores for the Arizona Index of Biological Integrity, a reference standard that combines several measures of diversity into one score. Though developed for Arizona’s warm water rivers, not those with effluent, rising index scores suggest that the river may be reaching a healthy diversity of aquatic invertebrates.

SURVEYS FIND NEW NON-NATIVE FISH SPECIES

Fish surveys are conducted along four sites of the river every November. The 2022 survey showed mixed results. Channel catfish were found near Cortaro Road, bringing the total of non-native fish species found in the river up to 6. Native longfin dace released earlier in the year were not found during the survey, but endangered native Gila topminnow are still present and thriving. Survey results suggest the topminnow may be doing better than the similar looking but non-native Western mosquitofish.

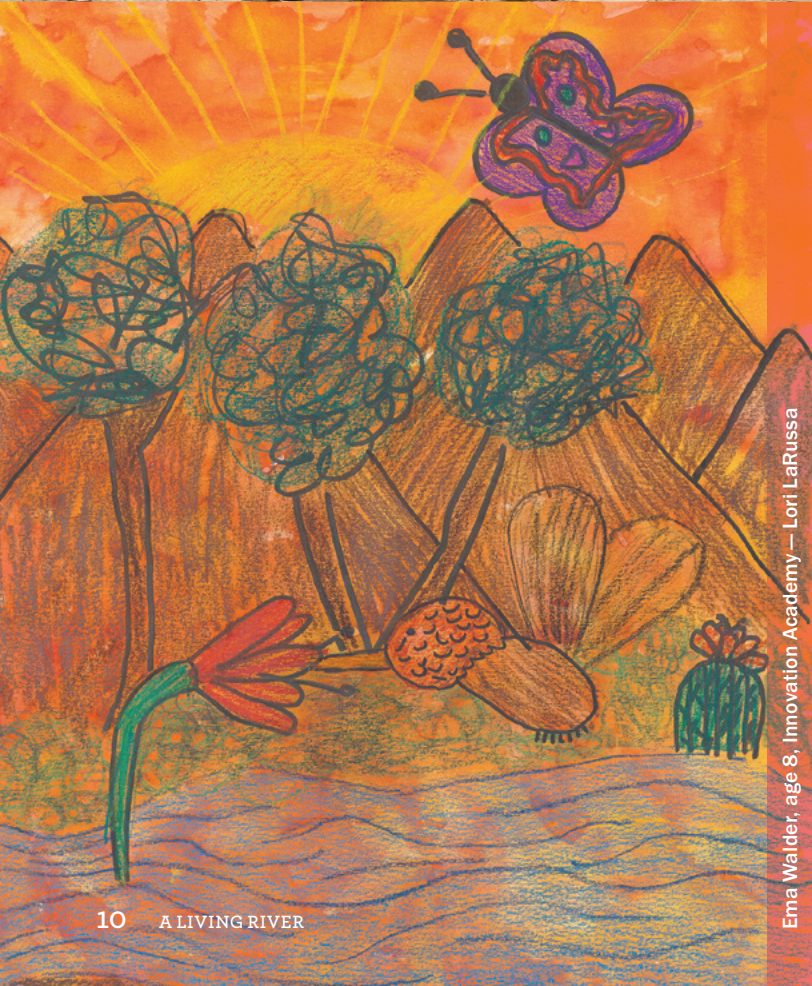


IT'S YOUR RIVER. GET INVOLVED!

JOIN THE #NOTINMYRIVER CAMPAIGN Sonoran Institute is identifying the composition, potential sources, and major accumulation spots of trash in the river to help Pima County engineer solutions in the future. In the meantime, the #NotInMyRiver campaign encourages volunteer cleanup efforts to build community stewardship of the river. In 2022, volunteers pulled more than 10 tons of trash out of the Santa Cruz during multiple events hosted by Pima County. Thank you to the 685 volunteers who spent over 2,200 hours helping clean the river! Interested in Tucson-area cleanups? Contact AdoptaSite@tucsoncleanandbeautiful.org

HELP STEWARD THE LOOP Did you know that you can help take care of the Loop? The Chuck Huckelberry Loop follows 23 miles of the Santa Cruz River and is a fun and easy way to explore art, history, and nature along the river corridor. Now you can share feedback regarding trash, debris on the path, invasive species, and more. To help Pima County see what needs maintenance, visit Pima County's online Contact The Loop form at www.tiny.cc/contactpc

SEND US YOUR SANTA CRUZ RIVER PICTURES Where is your favorite spot? What wildlife do you love seeing? What do you do along the river? We want to feature your photos in upcoming *Living River* reports to showcase what you love about the Santa Cruz River. Submit a photo and get a chance to win a Sonoran Institute gift bag. Send photos to scrphoto@sonoraninstitute.org. Or post your photos on social media, tagging Sonoran Institute.



VISIT THE RIVER The river is a popular recreation area, but did you know it is also a place to see public art? Near the base of A-Mountain, you can view "Tumamoc and the River of Life," installed in 1993. Or the next time you drive over the Sunset Road bridge, check out "A Desert Bloom," the beautiful metal art installed along the bridge in 2017. You can find more public art along the river in Pima County's The Loop Art Map at www.tiny.cc/artmap

CREATE ART ABOUT THE RIVER Kids can enter the Living River of Words Youth Poetry and Art contest. This Pima County program helps young people learn about water in the desert through science and art. View some of the 2023 finalists in this report. Learn more at: www.pima.gov/RiverofWords



Blue dasher (*Pachydiplax longipennis*)



Barn owl (*Tyto alba*)

Owlet
The little owlet
Holed in a saguaro
Peering at me
With his curious eyes

Clyde Moore, age 13
Satori School—Tina Love

GET INVOLVED WITH SONORAN INSTITUTE Follow us on social media and join our mailing list. Learn about Santa Cruz River events and get updates on all Sonoran Institute programs. Sign up at: www.tiny.cc/scrnews

IMAGE CREDITS

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Mom and it's Baby by Erin James, age 11, Wakefield Middle School — Rachel Carpenter



Red eared slider (*Trachemys scripta elegans*)

ACKNOWLEDGEMENTS

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SONORAN INSTITUTE, a non-profit organization, is working to make the Santa Cruz River a living, flowing river and the foundation of community health and prosperity from Mexico to Marana. Since 1990, the Sonoran Institute's mission has been to connect people and communities with the natural resources that nourish and sustain them.



Sonoran Institute



@sonoraninst

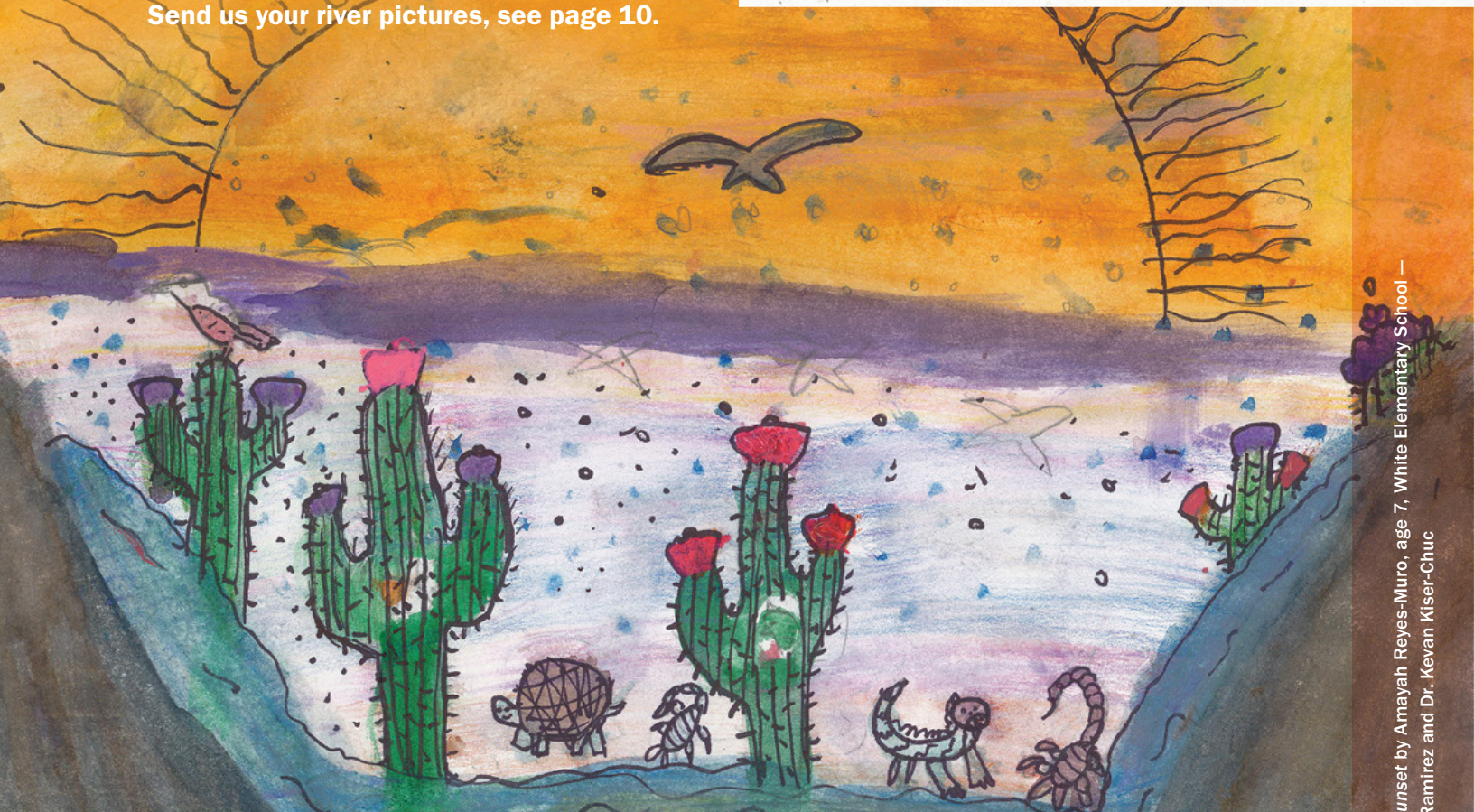


SonoranInstitute



ENTER TO WIN A SONORAN INSTITUTE GIFT BAG!

Send us your river pictures, see page 10.



Desert Sunset by Amayah Reyes-Muro, age 7, White Elementary School —
Jessica Ramirez and Dr. Kevan Kiser-Chuc

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Pima County Regional Wastewater
Reclamation Department
Pima County Office of Sustainability
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