

PARA LEER ESTE INFORME
EN ESPAÑOL, VISITE
www.tiny.cc/tlr21sp

a living river

CHARTING SANTA CRUZ RIVER CONDITIONS
DOWNTOWN TUCSON TO MARANA—2021 WATER YEAR

CONNECTING WILDLIFE WITH WATER



Santa Cruz River in Marana





Bobcat (*Lynx rufus*)

THE SANTA CRUZ RIVER CELEBRATE AND PROTECT

Towering cottonwoods, mesquite bosques filled with singing birds, and cool, meandering waters nourishing fish and supplying agricultural canals—this is the scene O’odham would have encountered historically along many sections of the Santa Cruz River. The lush green ribbon is what has allowed their people to call this region home for thousands of years. With many more people now living here, the river has changed, and river flows are not what they once were. Now we are all helping nourish the river and the life it sustains.

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 process wastewater from homes and businesses. This water creates up to two miles of flow in the downtown Heritage Project and over 20 miles of flow from northwest Tucson to Marana, helping sustain cultural and spiritual connections with the river, providing wildlife habitat, and replenishing the aquifer.

Southwestern rivers and their riparian vegetation are rare but used by over 80% of wildlife species. Effluent released since the 1970s has restored native willows and wetland plants that create wildlife habitat. Upgrades to the water reclamation facilities in 2013 resulted in high-quality effluent that now nurtures increasing aquatic diversity, a success that raised community interest and has inspired further work to support the ecosystem. Ongoing efforts include removing non-native salt cedar to mitigate fire risk and maintaining adequate flow in the river for fish. This year we applaud the return of the longfin dace, a native fish not found here for over 100 years! With plans in progress for a ramp that will help wildlife access the river and move between the mountains nearby, the future for more wildlife is looking bright.

NOTABLE ACHIEVEMENTS

-  Longfin dace returns to familiar home
-  Wastewater Reclamation produces sustainable energy
-  Tucson Audubon Society removes 16 acres of salt cedar
-  Volunteers remove 1,828 bags of trash from river
-  Living River of Words program reaches new audiences in Ajo

TRACKING RIVER CONDITIONS

Included here are Santa Cruz River conditions in the flowing reach of the Heritage Project and from northwest Tucson to Marana during the 2021 water year (October 1, 2020 to September 30, 2021). For more information, download a supplementary report from the Sonoran Institute website at www.tiny.cc/tlr21.

Sonoran Institute launched the annual *Living River* reports in 2008 to track river conditions in Santa Cruz County. The effort expanded in partnership with Pima County in 2012 and with the City of Tucson in 2020 to report on conditions in the flowing reaches in Pima County. All *Living River* reports can be found on the Sonoran Institute website: www.sonoraninstitute.org.







LOS MORTEROS

Named for the natural mortars used by ancient inhabitants to grind seeds and plants, Los Morteros Conservation Area is an important cultural park with layers of history. Preserved here are a large Native American village, a major campsite of Spanish explorer Juan Bautista de Anza during his 1775–1776 expedition, and the “Pointer Mountains” Butterfield Stagecoach stop.

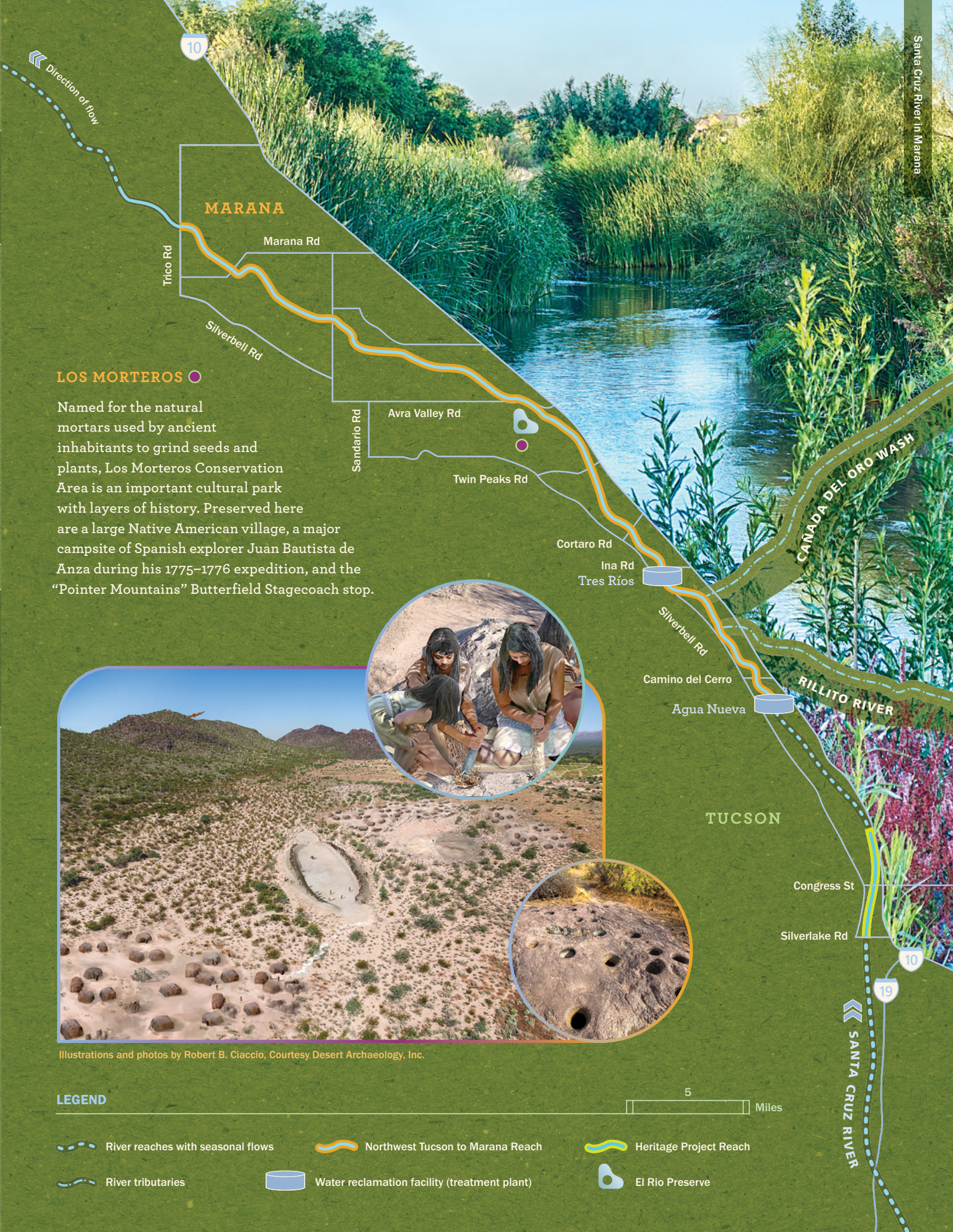


Illustrations and photos by Robert B. Ciaccio, Courtesy Desert Archaeology, Inc.

LEGEND

-  River reaches with seasonal flows
-  Northwest Tucson to Marana Reach
-  Heritage Project Reach
-  River tributaries
-  Water reclamation facility (treatment plant)
-  El Rio Preserve

5 Miles



Santa Cruz River in Marana

MANAGING FOR DIVERSE NEEDS

Rivers provide water for people and wildlife, help to move nutrients and sediments, recharge aquifers, and sustain cooling trees and plants. When flooding, water spills out of the river's channel and onto the 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.

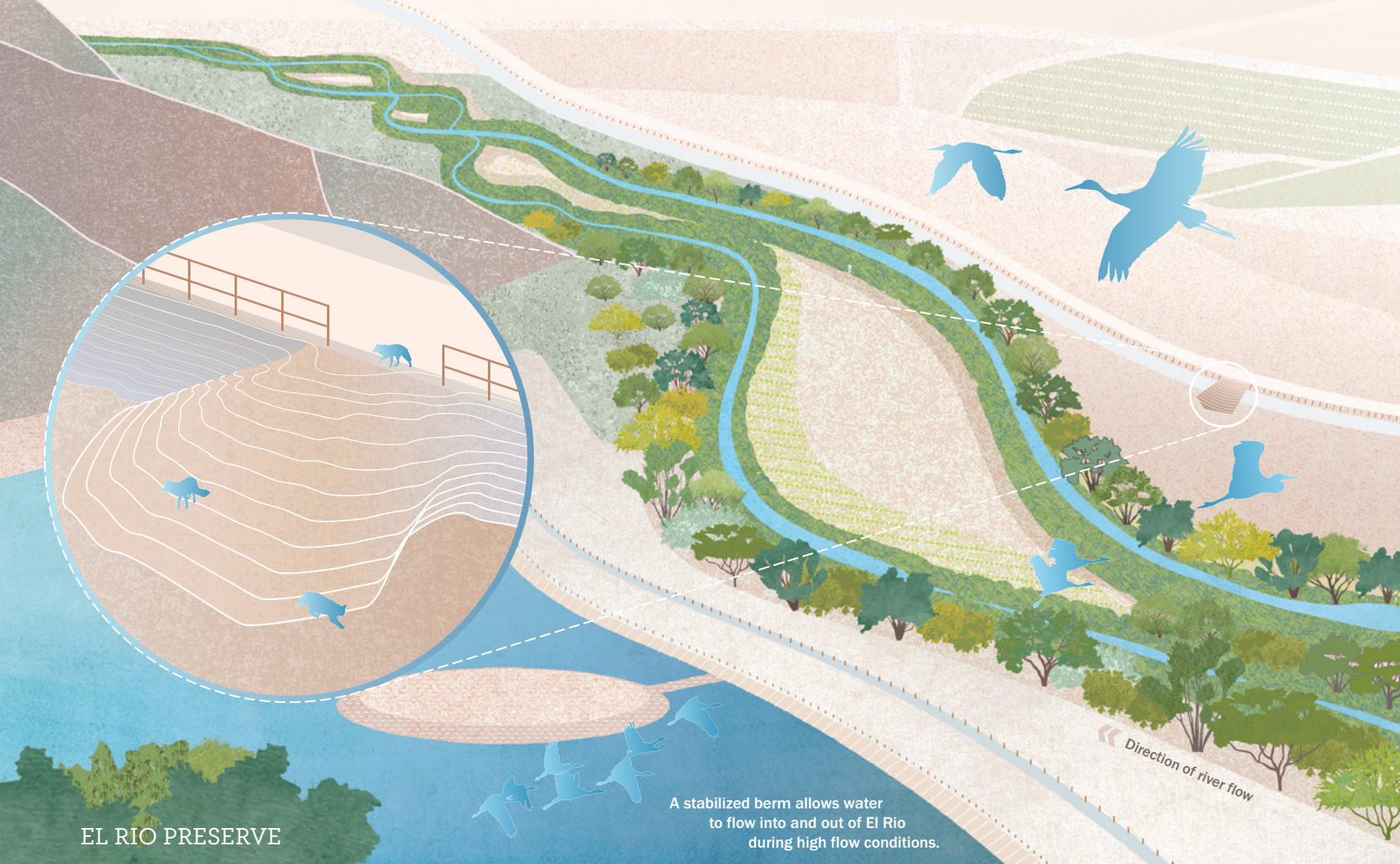
While the river channel serves multiple purposes, a top priority is that it remains capable of safely conveying floodwater through urban areas. Historically, the Santa Cruz River wound through a wide floodplain in the Tucson basin. The growth of our communities has shrunk this floodplain, with buildings, parks, gravel pits, historic landfills, and other infrastructure built close to the river channel. This is especially true of the

Heritage Project, where development has confined the river and floodplain to a narrow corridor near downtown Tucson.

Preventing the flooding of adjacent neighborhoods is critical in the Heritage reach. Thick, tall vegetation and accumulated sediment can impede flows and cause floodwaters to rise out of the channel, so trees and excess sand and dirt are occasionally removed to encourage growth of grasses or small shrubs instead. Farther downstream, and north of the Agua Nueva and Tres Ríos reclamation facilities, the river corridor is

wider. Here, the river has room to meander, and floodwaters can more safely rise, meaning flood flows can easily pass regardless of dense or tall trees.

Stewarding this important resource is complex. The Pima County Regional Flood Control District is implementing a variety of community-supported projects identified in a management plan for the river from Grant Road to the Pinal County line. In the downtown reach, the Flood Control District is working closely with the City of Tucson to manage the Heritage Project.



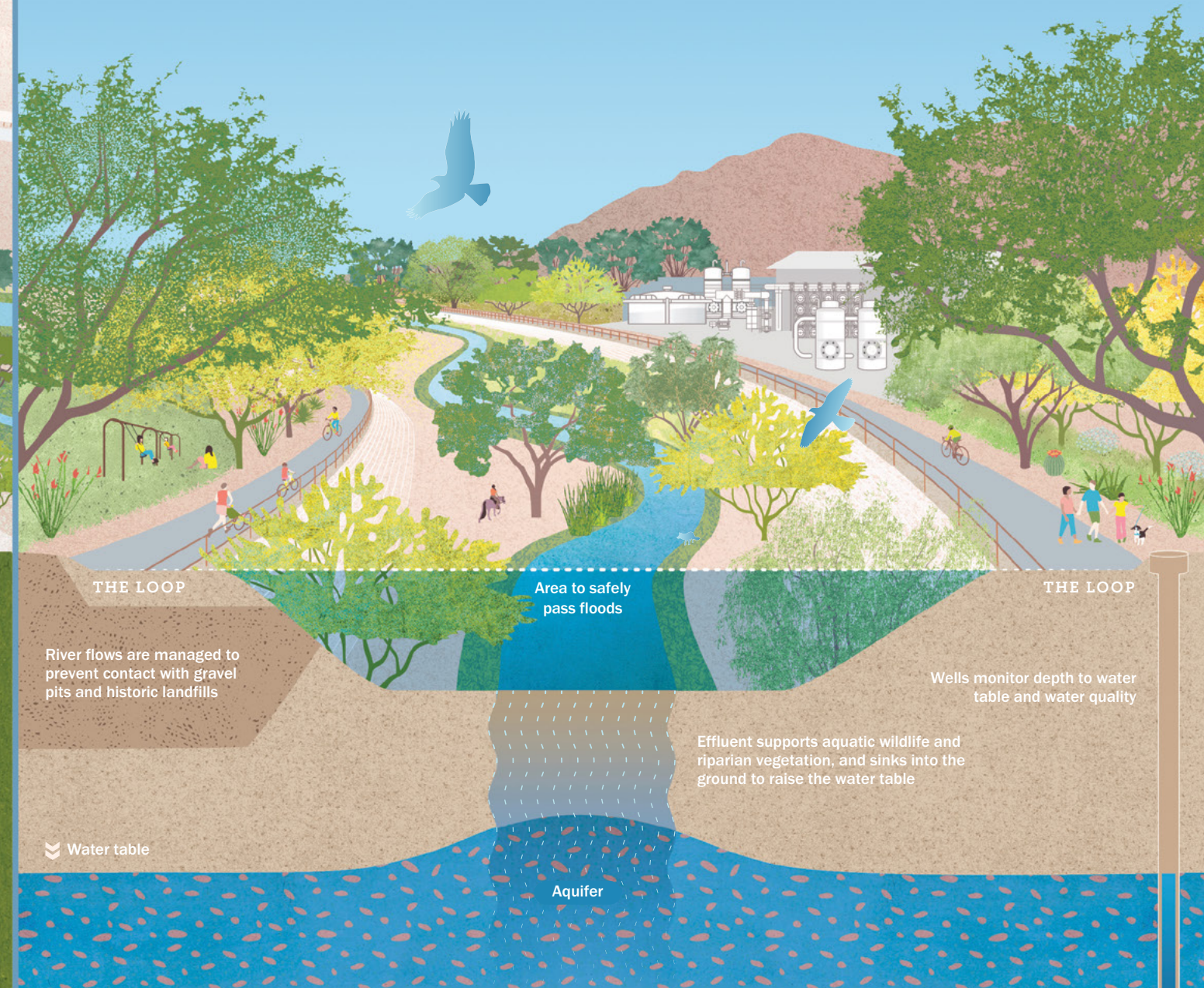
EL RIO PRESERVE

Increased Wildlife Connectivity and Floodplain Function
Bobcats, coyotes, javelinas, and other wildlife travel in the Santa Cruz River corridor to reach the adjacent desert and Tucson Mountains. Their travel down steep banks will soon be easier when the Flood Control District builds a wildlife ramp near the El Rio Preserve, a project in the Santa Cruz River Management Plan. The ramp will enhance a corridor where wildlife can use an abandoned underpass to cross Interstate 10 and will better connect the mountains and desert east of the highway to the river and the Tucson Mountains.

El Rio Preserve is now a wetland, birding hotspot, and community destination after a 2014 flood breached the berm separating the Santa Cruz from a former gravel pit. The Town of Marana stewards this important riparian area, maintaining water for over 200 bird species and other wildlife. In 2021, the Flood Control District constructed a stable connection between El Rio and the active river channel that enhances and widens the natural floodplain function of the river corridor during high flow conditions.

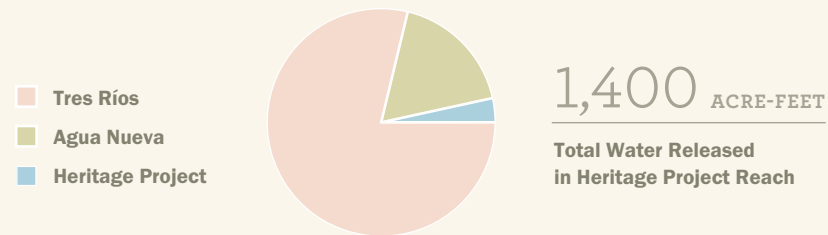
Turning Wastewater into Sustainable Energy

In October 2021, the Pima County Regional Wastewater Reclamation Department opened the Tres Ríos Renewable Natural Gas (RNG) Facility to purify methane, a clean-burning byproduct of the reclamation process, and sell it to Southwest Gas. Fulfilling a sustainability goal of the department and county, this first direct connection to a public gas provider in Arizona not only provides a sustainable alternative to fossil fuel natural gas but also generates revenue and renewable energy credits.



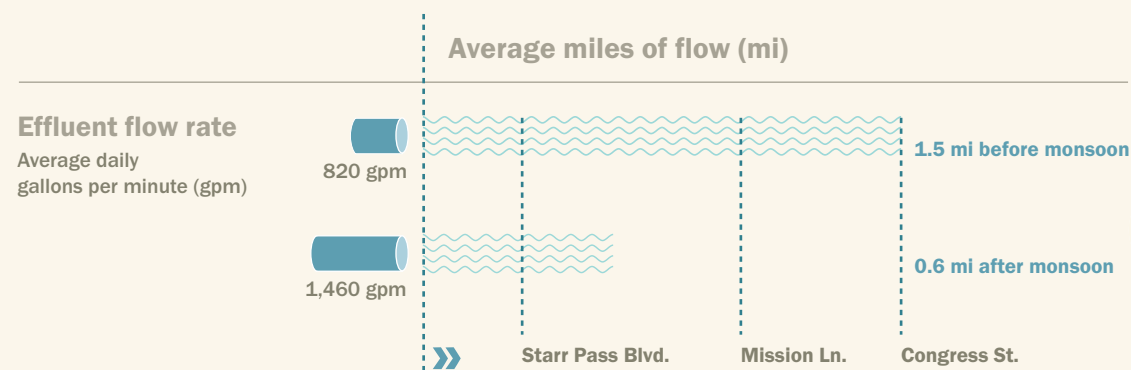
HERITAGE PROJECT REACH

Beginning north of Silverlake Road, this reach historically flowed year-round until 1914 and was home to several species of native fishes, 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. Using the reclaimed water system, the project transports effluent from the Agua Nueva facility and releases up to 3,150 acre-feet annually into the river downtown. Though developed primarily to recharge water in the aquifer to store 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.



MONSOON FLOODING DECREASES FLOW EXTENT

Summer 2021 demonstrated the impact and importance of monsoon floods to desert rivers. The record 12 inches of rain in Tucson doubled the 6-inch summer average since 2013. Heavy stormflow scoured vegetation from the riverbed, allowing more water to sink into the ground and raise the water table. This groundwater infiltration caused the river's average surface flow distance to decrease to 0.6 miles after the monsoon, despite a 78% increase in effluent released. Even with frequent floods, the wetland or "preservation area" where plants and wildlife flourish at the Heritage outfall (situated slightly above the channel) was rarely inundated. Protected in this small refuge, Gila topminnow and many other species were able to more quickly colonize other, washed-out areas after the floods.



152

bird species



46

dragonfly species



6

native frog species

1

non-native frog species



2

native fish species

1

non-native fish species



16

aquatic invertebrate species



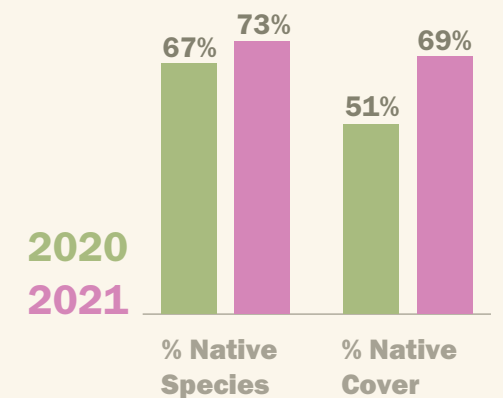
HIGH-QUALITY WATER SUPPORTS DIVERSE WILDLIFE

When water started flowing through this reach, wildlife quickly appeared. Birdwatchers counted 152 species of birds in 2021, and researchers from the University of Arizona have documented 46 dragonfly species. Since 2021, the Wastewater Reclamation Department has monitored water quality in the river near Starr Pass. Results show high-quality water, rich in dissolved oxygen while low in ammonia and heavy metals, is allowing aquatic wildlife to thrive. A survey in spring 2021 found 16 species of aquatic invertebrates, comparable to the average 14 species found at four sites in the Northwest Tucson to Marana reach.

The flowing reach is again home to two native fish species once common in this stretch before it dried: the Gila topminnow, released in October 2020, and the longfin dace, released in March 2022. Due to illegal introduction, non-native Western mosquitofish are also present. They were spotted in an isolated pool just days before topminnow were released, but efforts to eliminate them were unsuccessful. To give native species a fighting chance, newly installed signage reminds people not to release pets, plants, or wildlife into the river.

NATIVE VEGETATION INCREASED

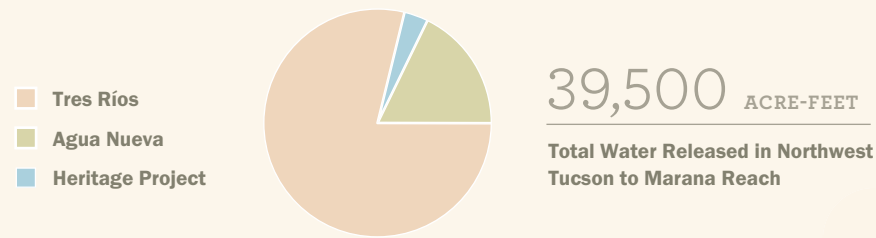
Despite the vegetation-scouring monsoon floods, native plant cover and diversity increased in 2021. Post-monsoon surveys recorded more native plant cover and a higher percentage of native species than in 2020. Annually, seeds from native plant species are obtained through a local nursery and broadcast in the Heritage Project to facilitate riparian restoration and promote re-establishment of native vegetation. Further monitoring will determine if native vegetation continues to increase and dominate over non-native species.



Review more information in the supplementary report at www.tiny.cc/tlr21

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. Starting in the 1970s, Pima County's two largest water reclamation facilities have released effluent into the river year-round, as much as 47,000 acre-feet since 2013, 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 diversity.



LONGFIN DACE REINTRODUCED TO THE RIVER

Historically, the Santa Cruz River supported at least six native fish species, and all had disappeared in the Tucson reach until the endangered Gila topminnow reappeared in 2017. Now, a second native fish has returned. In March 2022, hundreds of longfin dace (*Agosia chrysogaster*) were released. Rarely longer than 2.5 inches, this native minnow is not threatened or endangered but is a key part of the food web and has thrived upstream in the river near Nogales. Though longfin dace may have found their way to this reach on their own, sometimes even resilient species need some help.



246
bird species



50
dragonfly species



2
native frog species

1
non-native frog species



2
native fish species

3-5
non-native fish species



14
aquatic invertebrate species average

EXTENT OF RIVER FLOWS INCREASES

After the 2013 upgrade to the water reclamation facilities, water in the river stopped flowing daily past Trico Road, the end of the 23-mile study area. After dropping to as few as 121 days of flow at Trico Road in 2015, flow days have increased even though total water released from Tres Ríos has remained steady. Many factors impact flow extent, and explaining such variability is difficult. Floods scour riverbeds, allowing water to infiltrate and replenish aquifers, shortening the length of surface flows. But floods also move nutrients and sediments onto the riverbed. Ash flows from the Bighorn fire in 2020 covered parts of the riverbed downstream of the Cañada del Oro Wash confluence, reducing infiltration and allowing the river to flow farther.



Black-tailed jackrabbit (*Lepus californicus*)



Coyote (*Canis latrans*)



Couch's spadefoot (*Scaphiopus couchii*)



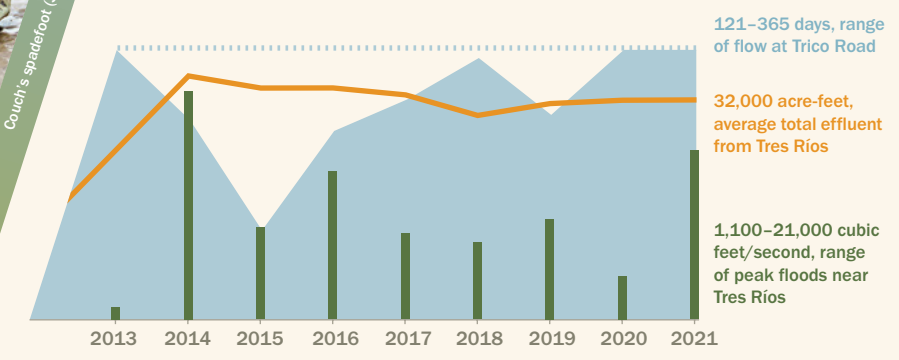
Sonoran Desert tortoise (*Gopherus morafkai*)



Mexican amberwing (*Parthenis intensa*)



Greater roadrunner (*Geococcyx californianus*)



STABLE HIGH-QUALITY WATER IN THE RIVER

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. Heavy metals including arsenic, lead, and cadmium are low or undetected, and ammonia is regularly below the levels that are toxic to fish.

Review more information in the supplementary report at www.tiny.cc/tlr21

The “Bobcats in Tucson” study has found bobcats using the Santa Cruz River corridor.



Bobcat (*Lynx rufus*)

IT'S YOUR RIVER GET INVOLVED!

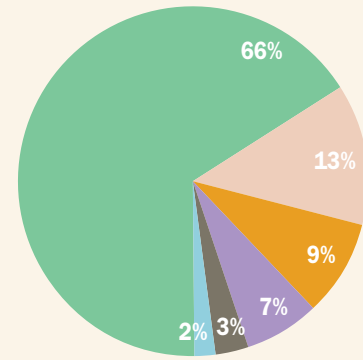
HELP PICK-UP TRASH Clean-up efforts are helping visitors to appreciate the river's beauty, without the trash. Since 2020, 1,498 volunteers have filled 1,828 large 55-gallon bags of trash! Sonoran Institute is learning that most river trash is lightweight food packaging like wrappers, bottles, and cups, which can come from anywhere. All city washes ultimately flow into the river, so you can help by picking up trash near your home. Document your efforts on social media, add #NotInMyRiver, and help spread the word. Interested in Tucson area clean-ups? Contact AdoptaSite@tucsoncleanandbeautiful.org

VISIT THE RIVER Travel along the Chuck Huckelberry Loop and discover the river and nearby parks. In 2021, a stretch of the trail along the river near St. Mary's Road saw over 57,000 pedestrians and nearly 133,000 cyclists. No wonder The Loop was awarded USA Today's Best Recreational Trail, two years in a row! While you're there, check out the diverse wildlife, dragonflies, and birds. During 2021, over 2,000 people participated in the eBird citizen-science program, documenting 251 different species (www.ebird.org).

JOIN A PROGRAM! Pima County Natural Resources, Parks and Recreation's Environmental Education team offers a variety of public programming and community science initiatives, like *Signs of the Season* native plant monitoring along the newly established Phenology Walk. Learn more at www.tiny.cc/nrpre.

MAKE CULTURAL CONNECTIONS Discover Tucson Basin's extensive agricultural history at Mission Garden. Located on the site of an ancestral village, the garden honors over 4,000 years of cultivation and the oldest irrigation canals in the United States. This is a sacred place for the Tohono O'odham who farm today in the San Xavier District and whose Sobaipuri O'odham ancestors farmed along the Santa Cruz for thousands of years.

KEEP IT NATIVE Please do not release pets or move wildlife anywhere. State law prohibits the release of animals and many plants to prevent unnecessary conflict, or even death, for native species. The latest evidence of an introduction to the Santa Cruz is a new fish species normally found only in Mexico. Researchers from the U.S. Fish and Wildlife Service identified the presence of *Poeciliopsis monacha-occidentalis*, a hybrid of the endangered Gila topminnow (*Poeciliopsis occidentalis*) and the Mexico native Headwater livebearer (*Poeciliopsis monacha*). The hybrid exploits Gila topminnow males—the male genome is discarded, and offspring are clones of hybrid females. This species may interfere with the successful return of the Gila topminnow to the river, illustrating the danger of moving, releasing, or introducing wildlife.



WHAT KIND OF TRASH?

- Food Packaging
- Toys/Recreational
- Large Heavy
- Personal Care/Medical
- Clothing
- Paper



Makayla Collins, age 15, Tucson High Magnet School — Marea Jenness



Flowi Monarch by Isela Coleman, age 16, Tucson High Magnet School — Marea Jenness

ADDITIONAL RESOURCES

- 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 2022 finalists in this report. www.pima.gov/RiverofWords
- Follow the Pima County Regional Flood Control District's progress on the management plan for the Santa Cruz River. www.pima.gov/SantaCruzRiverPlan
- Request a free water audit from Tucson Water to learn how you can best conserve water at your home. www.tucsonaz.gov/water/request-audit
- Get Involved with Sonoran Institute! Follow us on social media and join our mailing list. Learn about Santa Cruz River events like Dragonfly Day and get occasional updates about all Sonoran Institute programs. Sign up at: www.tiny.cc/scrnews

ACKNOWLEDGEMENTS

Sonoran Institute, Pima County, and Tucson Water developed and prepared this report with funding from the Pima County Regional Wastewater Reclamation Department, Pima County Regional Flood Control District, Tucson Water, and community stakeholders. We thank all who contribute to the data collection 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.

IMAGE CREDITS

Cover photos: Santa Cruz River, and Greater roadrunner by Charlie Alolkoy: www.alolkoyphotography.com **2:** Bobcat by Florence McGinn **3:** Santa Cruz River by Charlie Alolkoy **4–5:** Illustrations by Terry Moody **6:** Flooding along the Santa Cruz by Pima County Communications Office **7:** Great egret, Javelina, and Zebra-tailed lizard by Charlie Alolkoy; Roseate skimmer dragonfly, and Couch's spadefoot toad by Michael T. Bogan; Bobcat courtesy of JumpStory **8:** Santa Cruz River underwater ©Bill Hatcher/Sonoran Institute, 2022; Longfin dace by Pima County Communications Office **9:** Greater roadrunner by Mick Thompson, courtesy of Tucson Audubon Society; Coyote, and Black-tailed jackrabbit by Charlie Alolkoy; Sonoran Desert tortoise courtesy of JumpStory; Mexican amberwing dragonfly, and Red-spotted toad by Michael T. Bogan; Bobcat by Jerry Webster



SONORAN
INSTITUTE

100 N. Stone Ave., Suite 1001
Tucson, Arizona 85701

NON PROFIT
U.S. Postage
PAID
Permit #1454
Tucson, AZ 85701

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

PROTECT CLEAN WATER: PICK UP YOUR PET WASTE!

Bacteria, viruses, and parasites can pollute the river when pet waste is carried off in stormwater. Pick it up!

WHAT DO YOU WANT TO KNOW?

Share your river interests and questions! www.tiny.cc/tellus



Sunny and Stormy by Grant Peterson, age 8, Coyote Trail Elementary School — Katie Johnson

PIMA COUNTY

Pima County Regional Flood Control District
Pima County Regional Wastewater
Reclamation Department
Pima County Office of Sustainability
and Conservation
Pima County Natural Resources, Parks
and Recreation

PIMA COUNTY ADMINISTRATOR

Jan Leshner

PIMA COUNTY BOARD OF SUPERVISORS

Rex Scott, District 1
Dr. Matt Heinz, District 2
Sharon Bronson, Chair, District 3
Steve Christy, District 4
Adelita Grijalva, Vice-chair, District 5

www.pima.gov

CITY OF TUCSON

Tucson Water
www.tucsonaz.gov/water

CITY OF TUCSON MAYOR AND COUNCIL

Regina Romero, Mayor
Lane Santa Cruz, Vice Mayor, Ward 1
Paul Cunningham, Ward 2
Kevin Dahl, Ward 3
Nikki Lee, Ward 4
Richard Fimbres, Ward 5
Steve Kozachik, Ward 6

CITY MANAGER

Michael Ortega