



MEMORANDUM

Date: July 12, 2016

To: The Honorable Chair and Members
Pima County Board of Supervisors

From: C.H. Huckelberry
County Administrator

A handwritten signature in black ink, appearing to read "C.H. Huckelberry", is written over the printed name and title.

Re: **Third Annual *A Living River* Project Report Release –Charting Wetland Conditions of the Lower Santa Cruz River, 2015 Water Year**

Introduction

Data emerging from the Living River Project show that important changes are taking place in the Lower Santa Cruz River. *A Living River, Charting Wetland Conditions of the Lower Santa Cruz River, 2015 Water Year Report* (Attachment 1) documents continued water quality, aquatic life, water clarity, and infiltration improvements during the 2015 water year (October 1, 2014 through September 30, 2015) along the effluent-dependent Santa Cruz River.

The fact sheet, *Your Living River* (Attachment 2) summarizes the overall improvement in the effluent-dependent Santa Cruz since completion of upgrades to Pima County's wastewater treatment facilities in December 2013.

This report is the last of three annual evaluations for which funding has been provided by the US Environmental Protection Agency, the Regional Wastewater Reclamation Department (RWRD), Regional Flood Control District (RFCD), and community individuals.

Findings

Last year's *A Living River 2014 Water Year Report* documented substantial improvements in the wetland health of the effluent-dependent Santa Cruz River because of higher quality water discharged from Agua Nueva and Tres Ríos Wastewater Reclamation facilities. This year's 2015 Water Year Report documents continued improvement in the wetland health as follows:

- Continued improvement in water quality and clarity compared to last year's post-upgrade data.
- Continued improvement for aquatic wildlife, including more dissolved oxygen in the water and reduced ammonia levels.
- Four fish species are now living in the river; three more species than in previous years.

The Honorable Chair and Members, Pima County Board of Supervisors
Re: **Third Annual A Living River Project Report Release –Charting Wetland Conditions of the Lower Santa Cruz River, 2015 Water Year**

July 12, 2016

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- Reports of long-standing odors by users of The Loop have been significantly reduced. RWRD's odor-measuring technology shows little to no odor leaving the facilities' properties under normal operating conditions.
- Increased effluent recharge, with approximately 32,000 acre-feet of effluent infiltrating into the ground, nearly double the volume of the year before the facilities' upgrades (the 2013 Water Year.)
- Decreased flow extent in both the upper and lower effluent dependent reaches of the river.
- One downside impact noted in the report is the loss of some aquatic habitat and riparian tree cover due to a reduction in flow extent.

Public Outreach

The Living River Project continues to bring young people to the river for science-based classroom activities and field trips via Pima County's Environmental Education program. For some students, this was their first opportunity to experience a flowing river. During their visits to the river, students worked with local artists to create poetry or visual arts, i.e., drawing and photography. The 2016 Living River of Words Youth Poetry and Art Contest (Attachment 3) received over 950 submissions from 12 schools, and the entries were inspiring. A short video about the project can be viewed at <https://www.youtube.com/watch?v=R0FxnM0vJ9E>

The Third Annual Living River Celebration and Report Release will be held on July 21, 2016, at 6:00 PM, at the Ellie Towne Flowing Wells Community Center, 1660 West Ruthrauff Road (Attachment 4). The program will include a short presentation about this year's 2015 Water Report results.

CHH/lab

Attachments

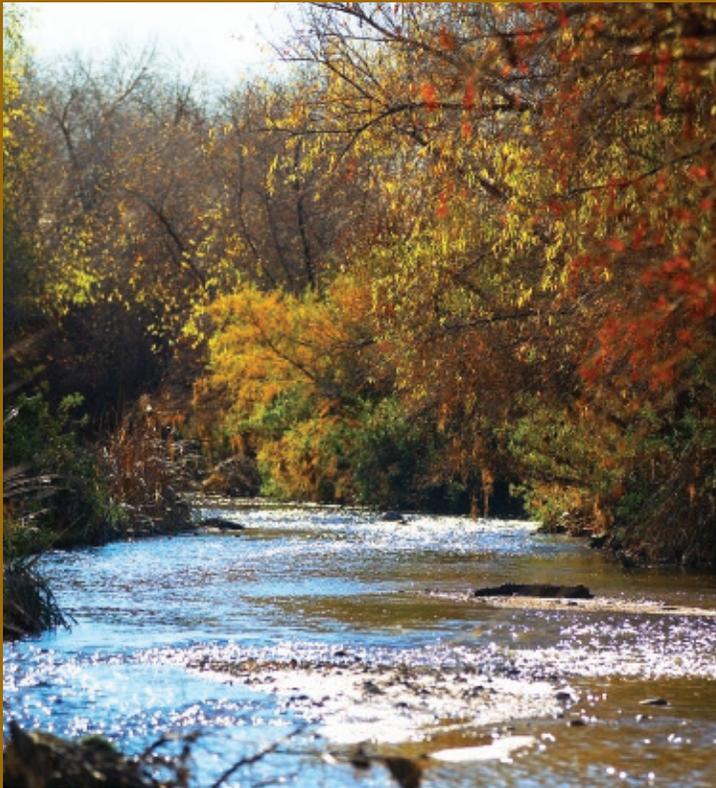
c: John Bernal, Deputy County Administrator for Public Works
Nanette Slusser, Assistant County Administrator for Policy, Public Works
Suzanne Shields, Director, Regional Flood Control District
Linda Mayro, Director, Sustainability and Conservation

ATTACHMENT 1

a living river

CHARTING WETLAND CONDITIONS OF THE LOWER SANTA CRUZ RIVER

2015 Water Year



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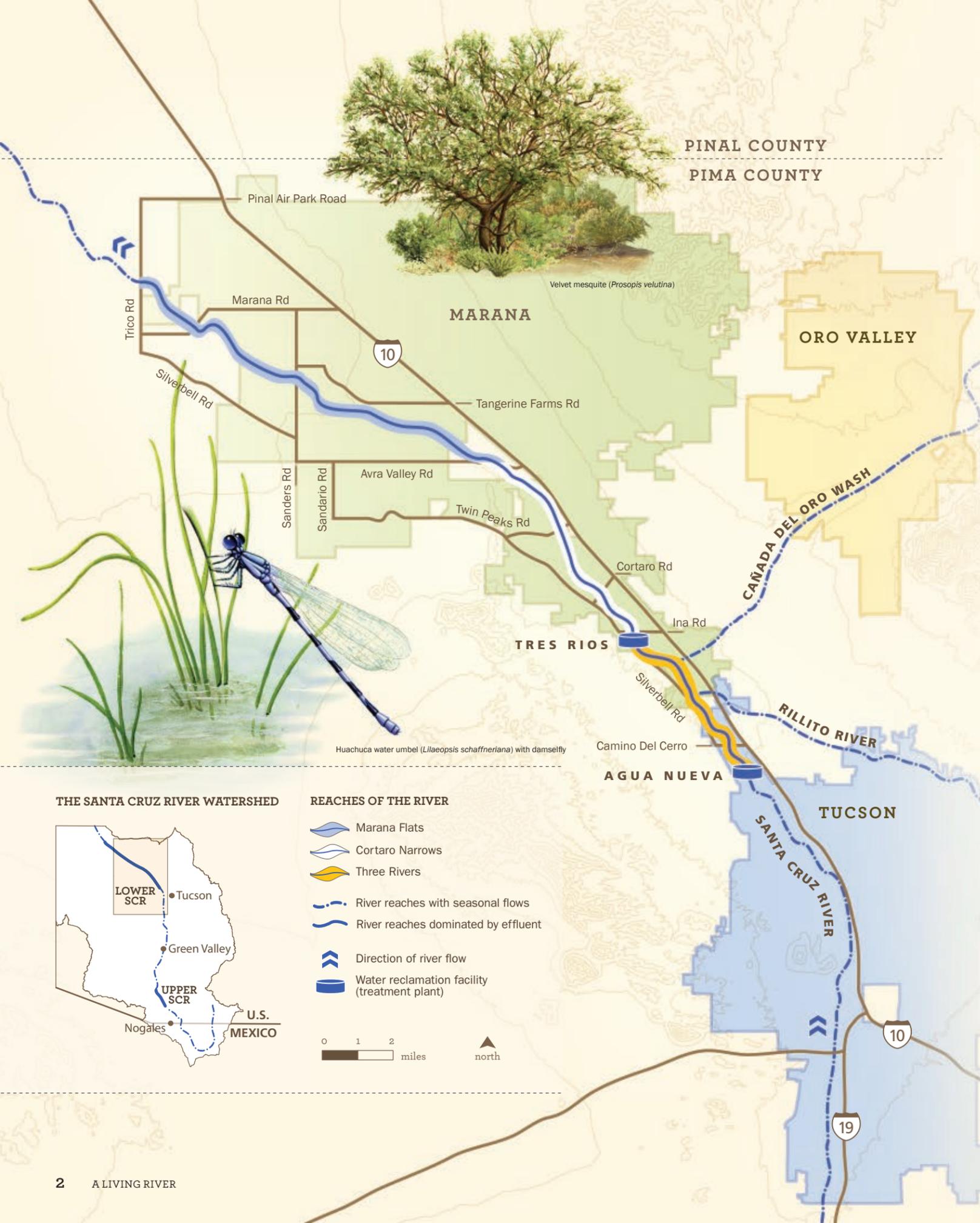
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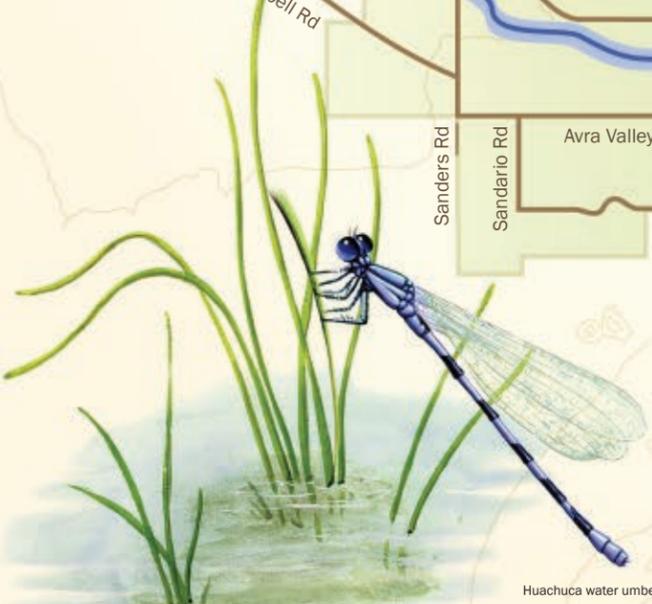
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Velvet mesquite (*Prosopis velutina*)



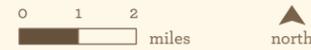
Huachuca water umbrella (*Lilaeopsis schaffneriana*) with damselfly

THE SANTA CRUZ RIVER WATERSHED



REACHES OF THE RIVER

- Marana Flats
- Cortaro Narrows
- Three Rivers
- River reaches with seasonal flows
- River reaches dominated by effluent
- Direction of river flow
- Water reclamation facility (treatment plant)



Willow flycatcher (*Empidonax traillii*)

Learn about the past seven years of *Living River* data for the Upper Santa Cruz River (learn more at www.tiny.cc/uscr7).

2015 NOTABLE FINDINGS

- Water quality and clarity improved
- Several new fish species appeared
- Flow extent shortened with higher infiltration rates
- Wetland plant cover reduced in the river's drying sections
- Very little odor crossed the reclamation facility boundary

THE LOWER SANTA CRUZ RIVER A LIVING ECOSYSTEM

Although the Santa Cruz River has undergone dramatic changes since its waters provided a cool and shady retreat to early inhabitants over 12,000 years ago, the river endures and continues to benefit the wildlife and communities of southern Arizona. The river has never flowed continuously from start to finish, but where and how much it flows has changed. Today, some flowing stretches have gone dry, but others have taken their place. Indeed the Santa Cruz remains a living river.

The Lower Santa Cruz River offers a great example of how this river continues to evolve. Today, thanks to the release of effluent—or highly treated wastewater—into the river, this section flows year-round. The use of effluent is re-creating our flowing-river heritage, supporting rare wildlife habitat, and building a valued community amenity. For decades, much of this stretch of river was hidden from view behind industrial neighborhoods along the freeway. As effluent created a thriving river ecosystem, the community responded by building river parks and The Loop recreational trail to provide easier access to this river bounty.

Effluent in the Lower Santa Cruz River is not new; two wastewater treatment plants, or “water reclamation facilities,” have been operating here since the 1970s. What has changed is the quality of the effluent being released. In its largest

public works project ever, Pima County invested more than \$600 million to upgrade the facilities. Completed in 2013, this project significantly improved the quality of water released into the river, a key ingredient for a healthier river.

To gauge conditions of this valuable ecosystem and track the impacts of our community investment, Pima County and the Sonoran Institute developed a *Living River* series for the Lower Santa Cruz River. Modeled on the Sonoran Institute's *Living River* report for the Upper Santa Cruz River, this report documents annual change along the Lower Santa Cruz River to gain insight into the river's health. Beginning with a baseline in 2013 (prior to reclamation facility upgrades), the *Living River* series is an assessment of the wetland conditions created and affected by the effluent.

This third report examines changes in indicators of river health along a 23-mile stretch of the river during the 2015 water year (October 1, 2014–September 30, 2015). Facility upgrades were completed in December 2013, thus this report captures conditions during the first full water year after project completion.

All *Living River* reports for the Lower Santa Cruz River are available for download at www.sonoraninstitute.org.

WATER SOURCES

In urban areas, water is often pumped or diverted from one location, used by people, treated in a reclamation facility, and released as effluent (highly treated wastewater) in a new location. Most of the water flowing in the Lower Santa Cruz River comes from effluent continuously released by the Agua Nueva Water Reclamation Facility (Agua Nueva) and Tres Rios Water Reclamation Facility (Tres Rios). Effluent is also frequently used in reclaimed water systems that irrigate landscaping.

Additional water in the Lower Santa Cruz River comes from precipitation in the surrounding watershed. When it rains or snows, water that doesn't evaporate, percolate into the soil, or get absorbed by plant roots, becomes stormwater that eventually flows into a wash and down to the river. The Santa Cruz River Watershed includes all of the land whose stormwater flows toward the river. Along with stormwater from Tucson, Marana, Oro Valley, and Green Valley, irrigation runoff from farmland in Marana flows toward the river and provides additional streamflow.

The Ribbon of Green

Sections of the Santa Cruz that are dependent entirely on stormwater tend to have vegetation that is adapted to drier conditions. Add effluent to the river and suddenly we see a vivid ribbon of green snaking its way downstream (notice the green start near the Agua Nueva outfall). This green ribbon includes native

willows and other wetland plants that need more water. Though these ribbons of green represent a small fraction of the landscape in the desert Southwest, they provide vital habitat for wildlife in the region. They also create a vibrant, cooling corridor for people to enjoy as they visit river parks and travel The Loop recreational path.



Sweetwater Wetlands

A portion of effluent from Agua Nueva is reused to create the Sweetwater Wetlands and supply adjacent recharge ponds where the treated water percolates down through soil and replenishes the local aquifer. This water is then pumped and distributed by the reclaimed water system for reuse at golf courses, parks, and other large turf-irrigation areas. In addition to these human benefits, the wetlands are a water-rich environment providing urban wildlife habitat for many native species.

ASSESSING CONDITIONS

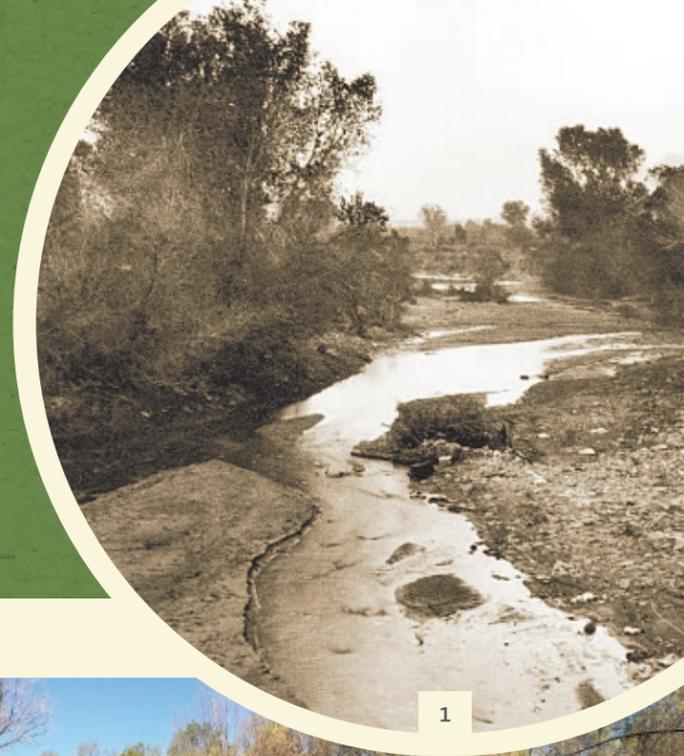
The *Living River* report evaluates conditions of the Lower Santa Cruz River using indicators (see table below) organized into six categories that represent a breadth of biological, chemical, physical, and social properties of the river. The indicators relate to conditions in the river channel and in

riparian areas, the areas next to and affected by the river. Other characteristics monitored informally and discussed throughout the report include birds, amphibians, reptiles, and recreation.

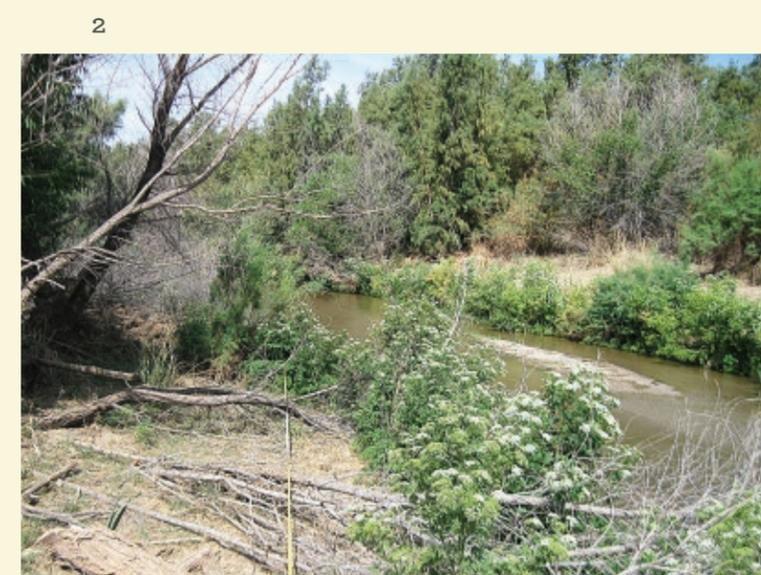
The purpose of the *Living River* series is to monitor and report on wetland and riparian conditions at various intervals downstream of the effluent discharge points. As effluent flows downstream, it impacts and is impacted by the natural conditions of soils, vegetation, and the surrounding ecosystem. For the purposes of this study, the 23-mile stretch of river is

divided into three sections, or reaches: Three Rivers, Cortaro Narrows, and Marana Flats. Reaches were delineated by their differing hydrology, geology, and adjacent land use.

The following pages compare the data collected in the 2015 water year (October 1, 2014–September 30, 2015) to the baseline conditions observed in the 2013 water year. To review data and additional charts from the 2013, 2014, and 2015 water years, please download a supplementary report from the Sonoran Institute website that is available at www.tiny.cc/lr15.



CATEGORY	PURPOSE	INDICATORS
FLOW EXTENT	Water flowing in and out of the system determines available aquatic habitat.	<ul style="list-style-type: none"> Miles of flow in each reach Number of “dry days” at Trico Road
WATER CLARITY	Solid particles in the water and on the riverbed can impact habitat and conditions for aquatic life.	<ul style="list-style-type: none"> Total suspended solids Turbidity Percent fines on riverbed
WATER QUALITY	Specific chemical conditions are necessary to sustain the river’s animal and plant communities.	<ul style="list-style-type: none"> Total dissolved solids Ammonia Dissolved oxygen Biochemical oxygen demand Metals
AQUATIC WILDLIFE	Wildlife in the river integrate and reflect conditions of many factors of the surrounding environment.	<ul style="list-style-type: none"> Fish Aquatic invertebrates
RIPARIAN VEGETATION	Plant communities reflect changes in water quantity and quality.	<ul style="list-style-type: none"> Wetland indicator status Nitrogen affinity score Riparian tree cover
SOCIAL IMPACTS	Aesthetic factors directly impact people living or recreating along the river.	<ul style="list-style-type: none"> Odor at reclamation facilities



1. Where the river flows start and stop has varied through time. Long before releases of effluent created the Lower Santa Cruz, the river flowed in a narrow channel right through downtown Tucson as seen here at the Congress Street Bridge in 1907.

2. Before the facility upgrades, the river was flowing to the end of the study area as seen here near Trico Marana Road, May 2013.

3. At the downstream end of the study area, increasingly dry conditions from reductions in flow extent caused a decline in riparian tree cover as seen near Trico Marana Road, June 2015.

4. Water is critical for many insects because life starts in the river with a larval stage before they live outside of the water as adults like this adult damselfly.

STREAMFLOW, RAINFALL, AND WATER BUDGET

The amount of water flowing in the river provides an important context for the indicator results. Rainfall influences the amount of stormwater contributing to streamflow and flooding. Floods can scour the riverbed, recharge aquifers, disperse seeds, induce seed germination, and clear natural debris.

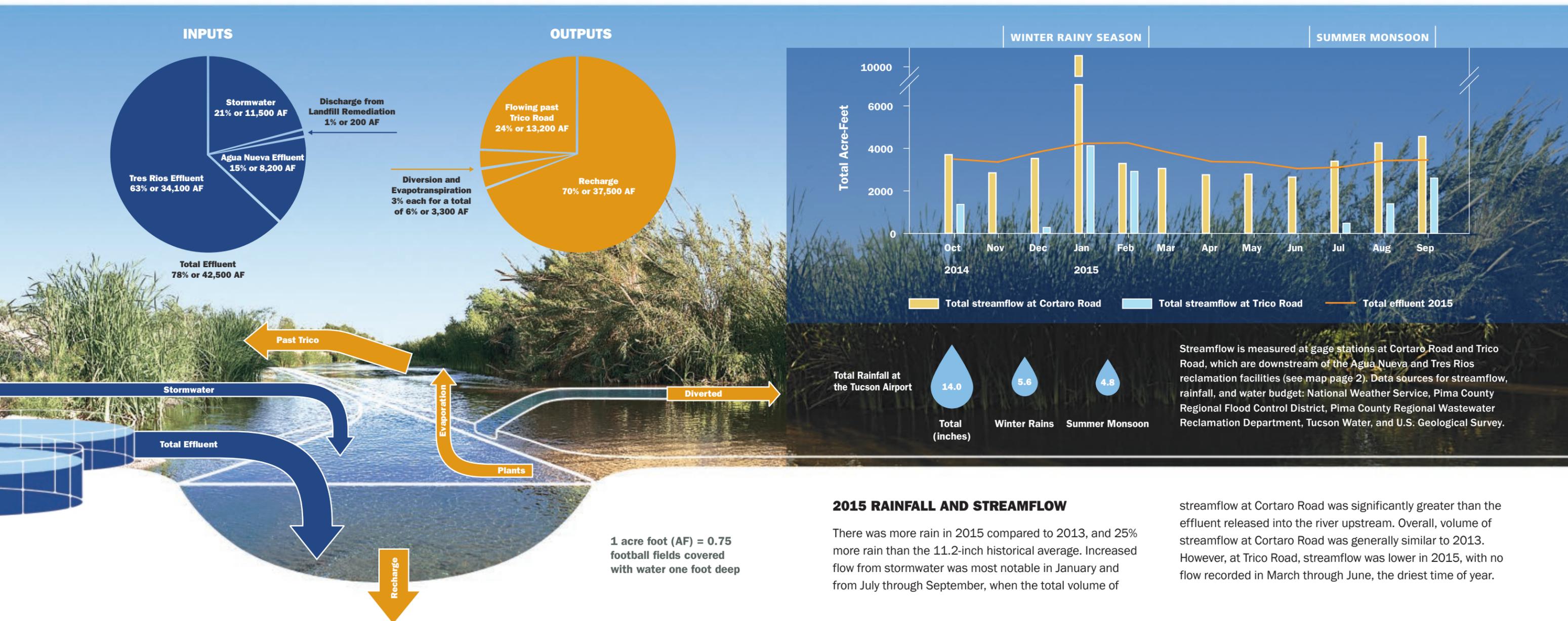
A water budget for the Lower Santa Cruz River estimates the water inputs and outputs. Inputs are effluent and stormwater (2015 also included a small input from the remediation of a landfill along the river). Outputs describe where the water went

and includes water that either flows past Trico Road (see map on page 2), evaporates or is used by wetland vegetation (a process called evapotranspiration), is diverted for agricultural use, or sinks into the riverbed to recharge the local aquifer. Input and output volumes are totaled in acre-feet (AF). An acre-foot is the amount of water needed to cover an acre with water one foot deep. Learn more about streamflow, rainfall, and the water budget, and view data from 2013–2015 at www.tiny.cc/lr15.

2015 WATER BUDGET

Total inputs of water to the Lower Santa Cruz were 5% higher than the 2013 baseline. This increase is due to greater stormwater flows, which contributed 21% of the inputs in 2015 compared to only 8% in 2013. Effluent was still the primary source of water, with a total of 42,500 AF released into the river. This represented a 10% reduction from the 47,000 AF released in 2013, largely because more effluent was diverted to supply nearby basins with water to recharge local aquifers.

The largest output in 2015 shifted from flow passing Trico Road to recharge. The 13,200 AF flowing past Trico Road in 2015 was considerably lower than the 31,000 AF in 2013. This is likely from increased rates of infiltration resulting in part from improved water quality and scouring floods in September 2014 and January 2015 which reduced the “clogging layer” in the riverbed (see page 14). The fact that 2015 had the highest calculation of recharge in the river in the past three years, with 20,500 AF more recharge in 2015 than in 2013, demonstrates this increased infiltration.



SUMMARY OF 2015 CONDITIONS

This report compares indicators in the 2015 water year to 2013 baseline conditions. Data from 2014 can be found online in the supplementary report at www.tiny.cc/lr15.

As anticipated, water quality improved following the completion of the upgrades to the reclamation facilities. All water quality measures were better or similar to the 2013 baseline. Most notably, ammonia levels were significantly

reduced, improving conditions for fish and aquatic life. Although surveys found no native fish, four fish species were now present in the river. Furthermore, reductions in ammonia likely allowed fish to expand upstream to Three Rivers, where fish were absent in 2013.

Reduced nutrient levels may have diminished the “clogging” layer in the riverbed, which increased infiltration and percolation of river water through the sediment in the riverbed. This effect likely contributed to the drying of sections of Three Rivers and Marana Flats. Although shorter flow extent suggests decreased availability of habitat for aquatic wildlife, increased infiltration of water recharges local aquifers.

Sediment and other particles carried in the water decreased, resulting in clear river water on normal non-flooding days. The percentage of the fine materials covering the riverbed

was reduced compared to the 2013 baseline. Fine materials can smother habitat and suppress life on the riverbed if too abundant. Therefore, in addition to improved water quality, the decrease in fine materials may have contributed to improvements in the aquatic invertebrate community.

While pollution-tolerant invertebrates are still the most common, community diversity improved and the abundance of species sensitive to pollution increased. However, the invertebrate community still reflects impaired river conditions compared to warm-water streams in Arizona that are not dominated by effluent. More time may be needed for the invertebrate community to attain the diversity and abundance found in other streams.

Release of effluent supports wetland species and mature trees that are abundant downstream of the reclamation facilities.

However, in river sections that are drying, there may be a shift from wetland plants to more upland plants. In 2015 there was a decrease in native willow trees, a species with shallow roots that is sensitive to changes in soil moisture.

As discussed in the 2013 baseline report, both the extent and intensity of odor emanating from the reclamation facilities has diminished significantly with the upgrade process. An extensive system monitors odor at the facility and along the fence line. Levels of hydrogen sulfide, the cause of the “rotten egg” odor, were far below the levels required by facility permits. Furthermore, anecdotal observations from people recreating in the area indicate that odors are either gone or hardly noticeable compared to past conditions.

CATEGORY	2013 CONDITIONS	2015 CONDITIONS
FLOW EXTENT	Water was always flowing through all three reaches.	Flow extent decreased in both Three Rivers and Marana Flats (p. 12).
WATER CLARITY	High amount of particles in the water column during normal, non-flooding conditions. Materials in the water increased as the river flowed downstream.	Water clarity improved with reduced particles in the water column during normal, non-flooding conditions (p. 13).
WATER QUALITY	High levels of ammonia posed a health risk to aquatic life. Other measures met standards or provided a baseline for comparison in future assessments.	All water quality measures improved or remained similar to 2013. Most important were significant reductions in ammonia, improving conditions for aquatic wildlife (pp. 14–15).
AQUATIC WILDLIFE	No fish in Three Rivers, but Western Mosquitofish present in Cortaro Narrows and Marana Flats. Aquatic invertebrate communities in all three reaches suggest the river is impaired or under environmental stress.	Four fish species found and at least one fish species observed in all reaches. Aquatic invertebrate communities showed some signs of improvement (pp. 16–17).
RIPARIAN VEGETATION	Wetland and nitrogen-tolerant plants increased immediately downstream of the reclamation facilities. With the exception of Marana Flats, riparian trees generally declined as the river flowed downstream.	Effluent supports wetland and nitrogen-tolerant plants as well as mature trees downstream of the reclamation facilities. Decrease in willows suggests shift to upland plants in drying areas of Three Rivers and Marana Flats (p. 18).
SOCIAL IMPACTS	New odor data unavailable at press; past efforts to reduce odor impact have resulted in significant reductions in odor levels.	Odor levels far below levels required by facility permits, and anecdotal observations of odor as hardly noticeable near the facility boundaries (p. 20).

Over 100 dragonfly species, including this Flame skimmer, thrive in Arizona’s warm climate.



Common carp (*Cyprinus carpio*)



Black bullhead (*Ameiurus melas*)



Green sunfish (*Lepomis cyanellus*)



The fall 2015 fish survey found three additional non-native fish in the river.

INDICATOR RESULTS

FLOW EXTENT

Measuring flow extent, or the distance the river has visible water flowing, provides a general measure of changes to the river's water budget and the length of available aquatic habitat. Full flow extent suggests high availability of habitat for aquatic life or low infiltration of water into the riverbed. Decreased flow extent could result from low water input or high infiltration of water into the riverbed.

2015 RESULTS: Flowing stretch of river is shorter

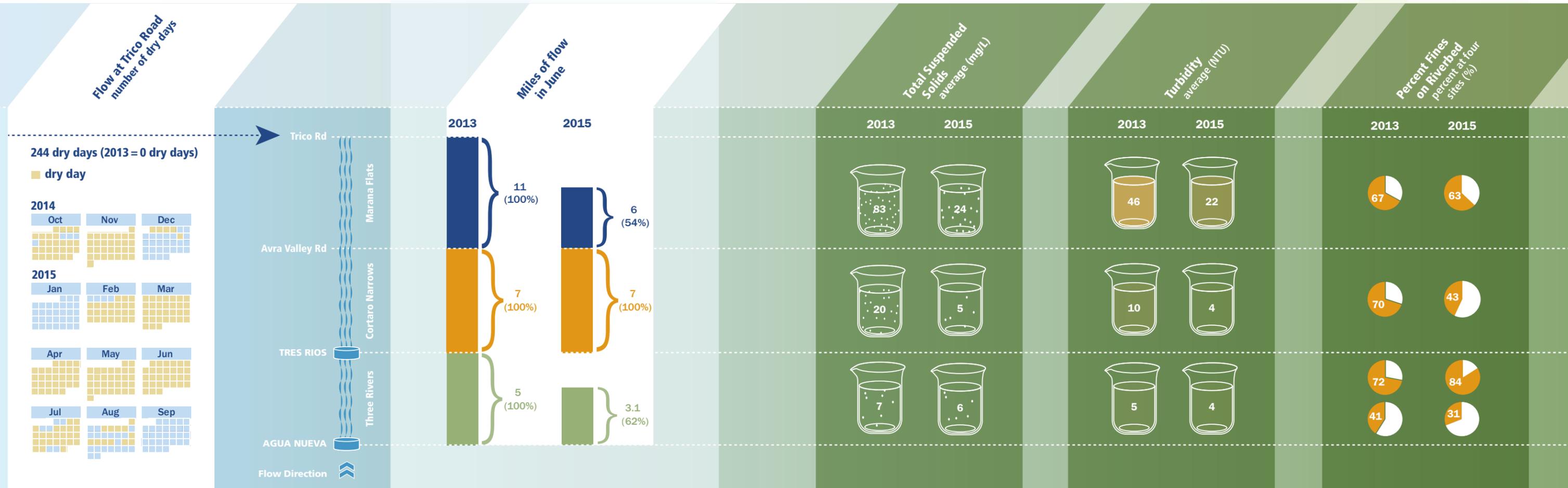
Flow extent decreased considerably in 2015. When measured as miles of flow in June, prior to the start of the monsoons, only Cortaro Narrows maintained flow through the entire reach. When looking at daily flow at Trico Road, the end of the study area, there were 244 days when the river was dry and did not flow. In 2013 the river flowed every day past Trico Road. Overall, decreased flow extent is likely due to increased infiltration (see water budget page 8). Reductions in effluent released from Agua Nueva also contributed to changes observed in the Three Rivers reach. Some wastewater was redirected to Tres Rios and thus released further downstream, and more effluent was used to supply recharge basins near Agua Nueva. Learn more about changes in flow extent and view data from 2013–2015 at www.tiny.cc/lr15.

2015 RESULTS: Water clarity improved

Water clarity was measured throughout the year at several locations when the river was not flooding (murky conditions are normal during storm flows). Suspended solids in the water declined in 2015. Turbidity evaluates the ease of seeing through the water, with high scores representing cloudier water. Average turbidity was lower in 2015, indicating improved water clarity. The percent fines that settle out of the water onto the riverbed was reduced at two sites in the spring of 2015, suggesting improved conditions for aquatic life on the riverbed. Similar, or increased, levels of fine materials are found in areas experiencing reduced flows. Slow flows allow particles to easily settle onto the riverbed. Learn more about changes in water clarity and view data from 2013–2015 at www.tiny.cc/lr15.

WATER CLARITY

Rivers naturally move sediments and other particles downstream. As these materials are swept away, others are conveyed from upstream, bringing an influx of nutrients, organic matter, and sediments to the river ecosystem. Measuring the concentration of the materials in the water provides an estimate of the suspended particles or “cloudy” conditions in the water. Murky water and the associated fine materials that settle on the riverbed can harm aquatic life and degrade river aesthetics.



Data source: Pima County Regional Flood Control District and U.S. Geological Survey

Data source: Pima County Regional Wastewater Reclamation Department, Harris Environmental Group, Inc.

Aquatic ecosystems, such as streams, depend on particular water-quality conditions (chemical, physical, and biological properties) to sustain plant and animal communities. There are many typical measures that help track changes in water quality in the river, including the amounts of total dissolved solids, ammonia, dissolved oxygen, biochemical oxygen demand, and metals.

Nitrogen and other nutrients enter the river from air pollution, fertilizer, surface runoff, and release of effluent. While elevated nutrient levels can benefit growth of riparian plants, they can also lead to poor conditions for aquatic wildlife. High nutrient levels can also encourage an overabundance of organisms that live in the spaces between the sand and gravel in the streambed. These organisms can explode in number and are one of the factors that create a “clogging layer” that reduces the ability of water to soak into the riverbed and recharge local aquifers.



Desert Sucker
(*Catostomus clarki*)



Sonora Sucker
(*Catostomus insignis*)



Gila Topminnow
(*Poeciliopsis occidentalis*)



Longfin Dace
(*Agosia chrysogaster*)



Gila Chub
(*Gila intermedia*)



Sonora mud turtle (Kinosternon sonoriense)

Amphibians, Reptiles, and Fish

Riparian areas are critical habitat for numerous amphibian, reptile, and fish species. The effluent stretch of the Lower Santa Cruz River provides some of the only flowing water habitat for these species in the Tucson area. Historically, the Santa Cruz River was home to a community of amphibians and reptiles commonly found along rivers and desert washes in southeastern Arizona. Though no formal surveys were conducted, Sonora mud turtles have been observed in the river. American bullfrogs and spiny softshell turtles are two non-native species that are present and breeding in the river.

The Santa Cruz River historically supported several native fish species in the Tucson area. These species included 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. Several groups survey fish annually. See results on page 16.

2015 RESULTS: Improved water quality with reduced nitrogen and more oxygen

Measures of water quality were taken at several locations throughout the year. The upgraded wastewater treatment process improved the water quality in the river. Ammonia (NH₃) is one form of nitrogen that can be toxic to fish and is more common in rivers dominated by effluent. Average concentrations of ammonia significantly declined in 2015. Lower concentrations of ammonia and other nutrients are likely a major factor in reducing the clogging layer in the riverbed. Reduced clogging has, in turn, resulted in increased recharge (page 8) and reduced flow extent (page 12).

Fish and other aquatic animals need dissolved oxygen to survive. Levels of dissolved oxygen remained high enough for fish and were notably higher in Marana Flats as compared to 2013. Biochemical oxygen demand estimates the amount of dissolved oxygen used to break down organic matter. If organics are abundant,

microorganisms breaking them down use up oxygen in the water and leave little for other aquatic life. Compared to 2013, biochemical oxygen demand declined along the river, suggesting lower organic pollutant levels.

Other measures of water quality remain similar to the 2013 baseline. Measuring total dissolved solids is a common way to test for salts in the water. Total dissolved solids have been higher with the community's rising use of water from the Colorado River. However, the range of observed values did not change much compared to 2013. Metals in high concentrations can endanger wildlife in aquatic ecosystems. As in 2013, all the samples tested for arsenic, cadmium, chromium, copper, lead, mercury, selenium, and zinc were low enough to protect conditions for aquatic wildlife in the river.

Learn more about changes in water quality and view data from 2013-2015 at www.tiny.cc/Ir15.

AQUATIC WILDLIFE

Water is essential for aquatic wildlife to survive in our arid landscape. With naturally occurring waters becoming increasingly rare throughout the Southwest, release of effluent into the Lower Santa Cruz River provides critical habitat for aquatic wildlife in the Tucson region. Furthermore, wildlife can be good indicators of river health because they integrate and reflect conditions of multiple factors in the surrounding environment, including water quality and availability of habitat.



Aquatic Invertebrates

Dragonflies (adult pictured here) start life in the water and, like mayflies, are sensitive to pollution. Though surveys found only a few, dragonfly larvae in the river provide further evidence of improved water quality.

Birds

The Lower Santa Cruz River is an excellent destination for birdwatching. Between 2013 and 2015, 787 volunteers collected over 80,000 bird observations along the river as part of a citizen-science program managed by Cornell Lab of Ornithology, www.ebird.org. Overall, there were 240 unique species observed along the Lower Santa Cruz, including several wading birds like great blue herons, killdeer, and black-necked stilts.

Data source: eBird Basic Dataset. Versions: EBD_relFeb2014, EBD_relNov-2014, and EBD_relFeb-2016. Cornell Lab of Ornithology, Ithaca, New York.

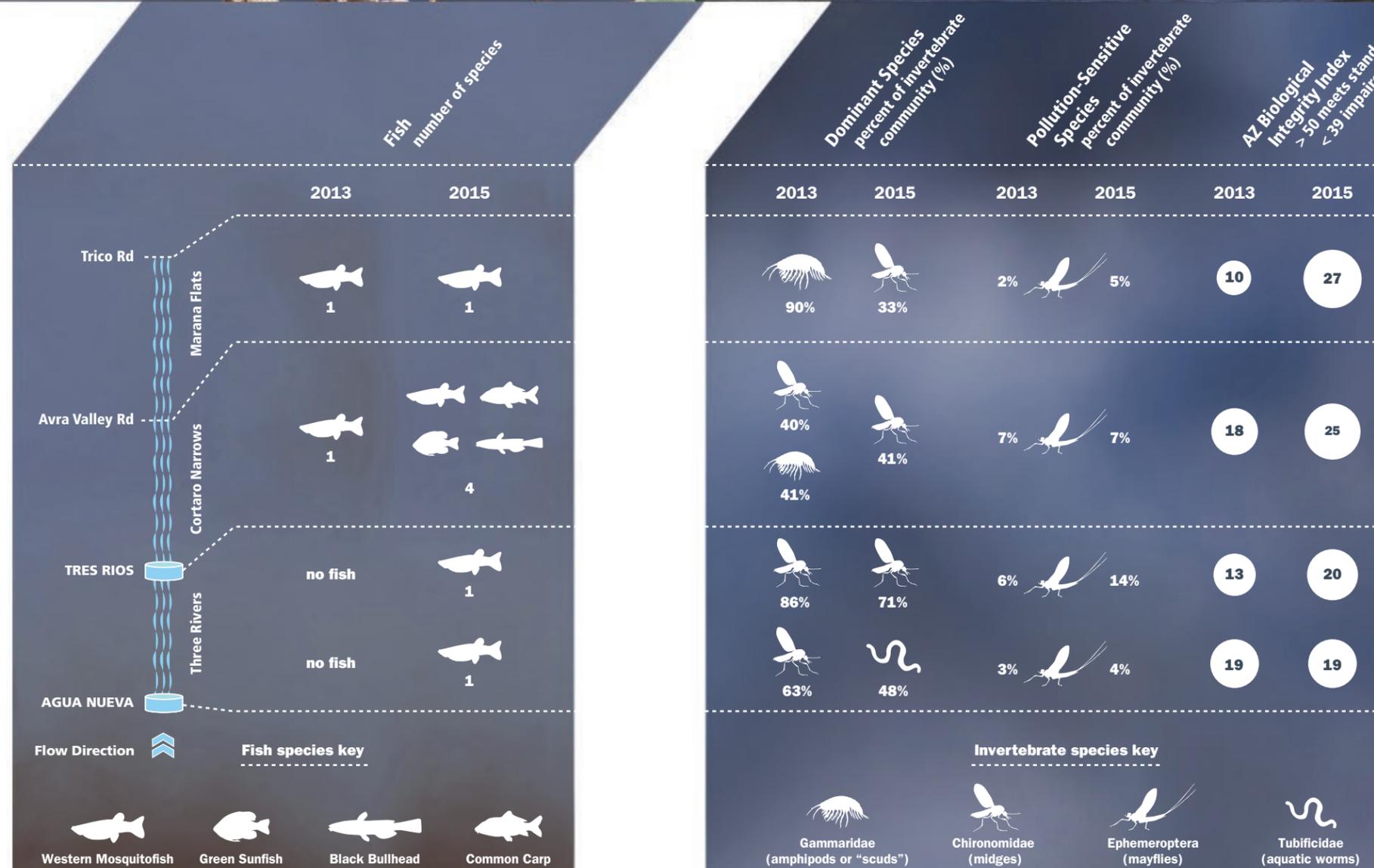


Great blue heron (Ardea herodias)

2015 RESULTS: Aquatic wildlife show some improvement

A fall 2015 fish survey was conducted at four locations along the river to detect fish species. Improvements in water quality have allowed fish to thrive again. Three additional non-native species were caught in Cortaro Narrows, including Common Carp, Green Sunfish, and Black Bullhead. Fish presence has also expanded upstream to Three Rivers, though only Western Mosquitofish were found in that reach. Flows are often very shallow in Three Rivers and may not provide habitat for the other larger species. In time, large floods may bring back native species, since the Longfin Dace and Gila Topminnow are found in the Upper Santa Cruz in Santa Cruz County (see map inset page 2).

A spring 2015 survey of the aquatic invertebrate community was conducted at



the same four locations. Overall, there were signs of improvement. The pollution-tolerant midges (Chironomidae) were still the most common insect. However, diversity is likely higher because at three sites the dominant species made up a smaller percentage of the community. If the dominant species is more than 50% of the community, river life is thought to be impaired. There were also small increases in the percent of pollution-sensitive mayflies (Ephemeroptera). While this increased diversity is supported by an increase in the biological index scores, the scores remain below 39. Scores below 39 suggest that river life is impaired. Continued monitoring will determine the level of improvements.

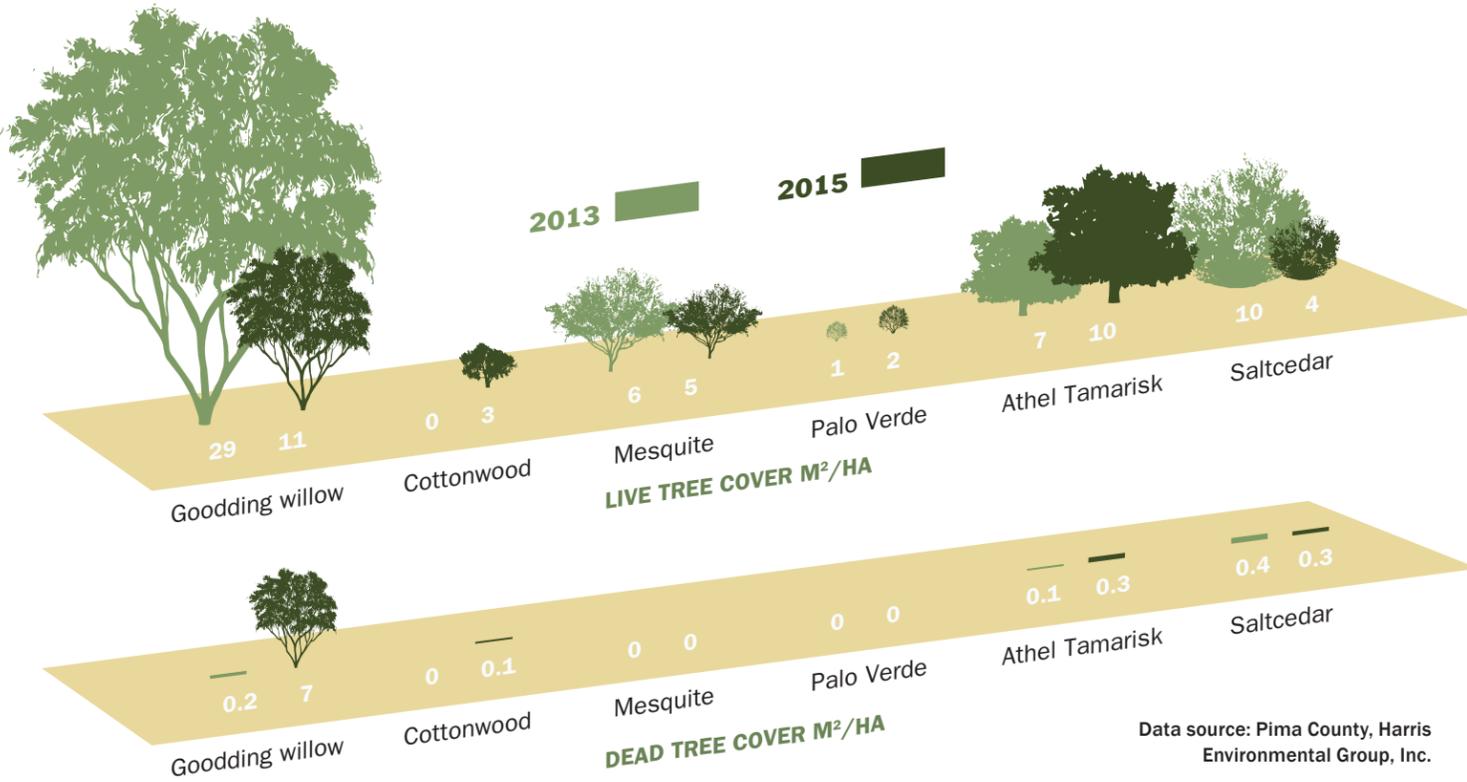
Learn more about aquatic wildlife and view data from 2013-2015 at www.tiny.cc/lr15.

Data source: Arizona Game and Fish Department, Harris Environmental Group, Inc., Pima County, Sonoran Institute, University of Arizona, U.S. Fish and Wildlife Service

RIPARIAN VEGETATION

Just as water is essential for aquatic wildlife, many plants grow only in areas with more water, such as wetlands and riparian areas next to rivers and desert washes. Thus, effluent released into the river is also supporting numerous plants that add to the ecosystem diversity along the Lower Santa Cruz River.

Although riparian vegetation represents only a small percentage of the land cover in the Santa Cruz River Watershed, it provides important benefits to the region, such as slowing flood flows, increasing groundwater recharge, reducing erosion potential along stream banks, maintaining habitat for wildlife, and providing recreational and spiritual enjoyment.



2015 RESULTS: Effluent supports wetland species; decreased willow cover in drying areas

In the spring of 2015, measurements of riparian vegetation were taken at seven sites along the river and at one site in a dry area of the river upstream of Agua Nueva. The release of effluent supports wetland species and mature trees that are most abundant downstream of the reclamation facilities. The changes in vegetation observed since 2013 were at the downstream ends of Three Rivers and Marana Flats, where increasingly dry conditions exist because of reductions in flow extent. While there were still wetland plants in these

areas, the plant community may be shifting to plants that grow well in drier, low-nitrogen environments like those found upstream of the Agua Nueva outfall. Decreased flow resulted in reduced cover of mature riparian trees in these areas. Riparian tree cover indicates presence of sufficient soil moisture and is measured as the area covered by tree stems in square meters per hectare (M²/HA). Cover of live Goodding willow notably decreased between 2013 and 2015, while cover of dead Goodding willow increased. This native species has shallow roots and is more sensitive to reductions in soil moisture. The willow decline suggests a shift to more deep-rooted trees and upland plants in drying areas. Learn more about riparian vegetation and view data from 2013–2015 at www.tiny.cc/lr15.



The areas with increasingly dry conditions had a decrease in willows, and vegetation may be shifting to upland plants



Downstream of Agua Nueva and Tres Rios had wetland plants and those growing well with high nitrogen



The dry area upstream of Agua Nueva had upland plants and those growing well with low nitrogen



Effluent flows support wetland vegetation and tree cover

Recreation

The Lower Santa Cruz River is a popular destination for birding and other recreation. There are several parks with access to the river and numerous bridge crossings where you can get a bird's-eye view of this wetland amenity.

While conducting traffic counts on two days in October 2015, volunteers working with Pima Association of Governments counted more than 300 bicyclists and pedestrians along the The Loop recreational path from the Sweetwater Wetlands to the junction of the river with the Cañada del Oro. Go to www.pima.gov/TheLoop to find a detailed map and plan your visit.



SOCIAL IMPACTS

With the release of effluent into the river, reclamation facilities are supporting important wetland habitats and heightening the recreation experience for those enjoying our river parks or walking and biking along The Loop trail adjacent to the river. Even so, unpleasant odors often associated with the reclamation process can lead to negative perceptions of the river. The most common offender is hydrogen sulfide (H₂S), which causes the “rotten egg” smell. Minimizing both the extent and intensity of disagreeable odors coming from the facilities was one of the goals of the reclamation facility upgrades.

Much like a nose sniffing the air, “odor sniffers” (represented in the illustration by the white dots), monitor the concentrations of hydrogen sulfide and other odors that cross over the fenceline at Agua Nueva. When the facility is functioning under normal conditions, only low concentrations escape. Pima County Regional Wastewater Reclamation Department vigilantly investigates and solves any transitory odor problems that arise.

LEVEL OF “ROTTEN EGG” SMELL (HYDROGEN SULFIDE, OR H₂S, IN PARTS PER BILLION) ASSOCIATED WITH RECLAMATION PROCESS

10

Concentration (ppb) allowed by facility permit

0.5

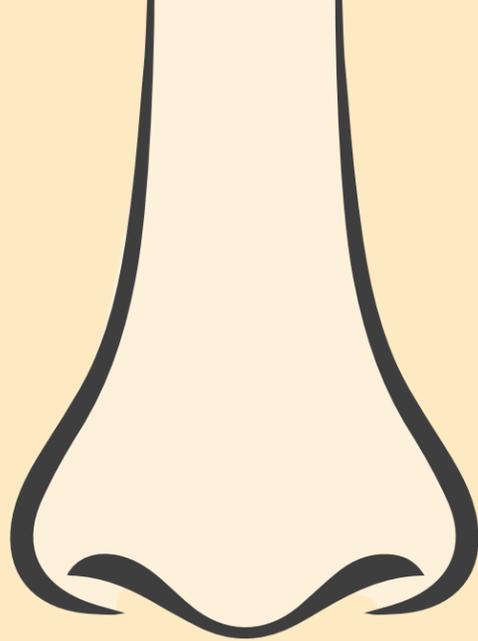
Actual concentration (ppb) for 99% of measures



2015 RESULTS: Little odor leaving facility

As part of the upgrades, odor is monitored continuously at the facilities and at numerous points along the surrounding fencelines. At Agua Nueva, 55 of the 60 monitoring points are on the fenceline. Levels of H₂S at Agua Nueva were very low in 2015, with 99% of the measures taken throughout the year being less than 0.5 parts per billion (ppb). This concentration is far less than the 10 ppb allowed by the facility permit.

Detailed odor data of this kind is not available for years prior to the upgrades, thus comparisons to previous H₂S levels are not possible. Similar data will be available at Tres Rios when that monitoring system is fully installed. Progress was made with the installation of 43 monitoring points in December 2015. Anecdotal observations from people living or recreating in the area indicate that odors are either gone or hardly noticeable compared to past conditions. Learn more about odor at www.tiny.cc/lr15.



LIVING RIVER OF WORDS YOUTH POETRY AND ART CONTEST

The Living River of Words offers local schools the opportunity to participate in a program that encourages young people to explore how water moves through the landscape and the connections that plants, animals, and people have to water.

The *Living River* reports help guide the science-based classroom activities and field trips to the river. These field trips often represent the first opportunity for many students to experience and visit a flowing river. Students then work with local artists to take what they have learned and create poetry or art entries for the contest. The contest is open to all youth 5–19 years old.

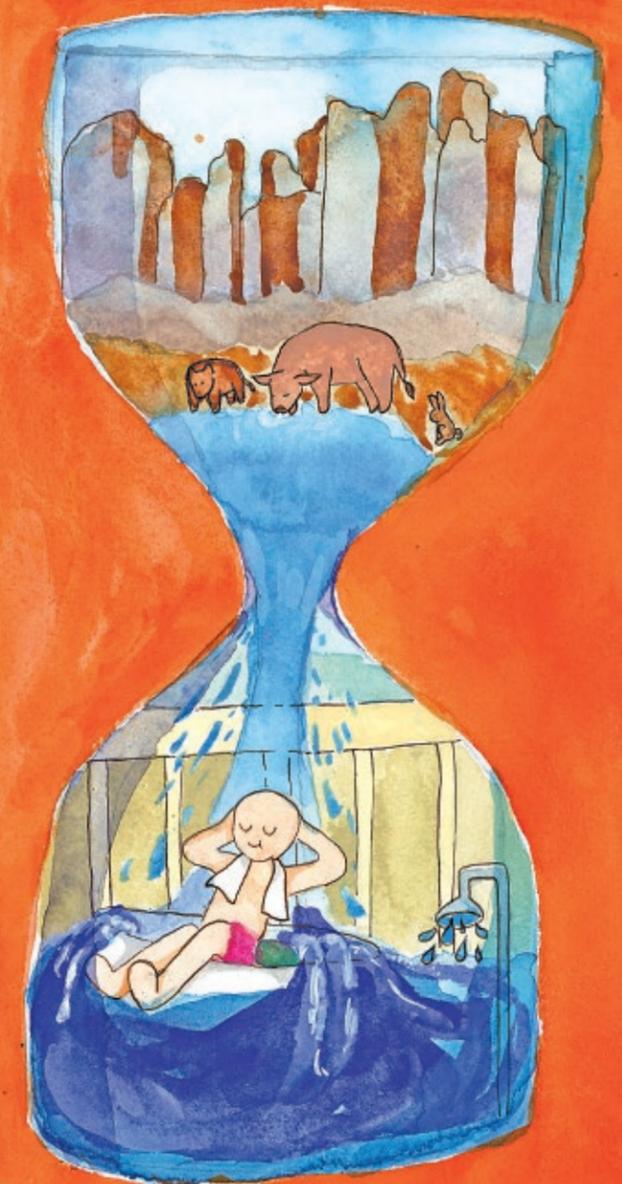
The 2016 Living River of Words Youth Poetry and Art contest received 950 submissions. Included here, and on other pages, are some of the final poetry and art selections featured in the traveling exhibit. Learn more about the program at www.pima.gov/nrpr.

Lucia Meinig-Reeves, age 11 | Paulo Freire Freedom School, Ms. Mohr-Felsen

THE WHISPERING WIND

I hear the wind whispering,
to the willow trees,
telling them the stories,
of everything she's seen.
I hear the wind whispering,
to the river reeds,
bragging about every city she's seen.
If you look closely at the water's edge,
the midges are squirming and butting heads.
Why can't we just open our eyes a little longer?

Madilyn Hanna, age 11
DeGrazia Elementary School, Mr. Mayer



Hannah Bae, age 14 | Basis Oro Valley, Ms. Yom

ACKNOWLEDGEMENTS

Sonoran Institute and Pima County prepared this report with generous funding from the U.S. Environmental Protection Agency, Pima County Regional Wastewater Reclamation Department, Pima County Regional Flood Control District, and community individuals. 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.

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* wetland 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 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.



Raine Ugstad, age 11 | Paulo Freire Freedom School, Ms. Mohr-Felsen

SPARKLING WATER

Drifting through our world
During the rise of day and the show of night
Through cracks of our dry desert land
To care for every living creature

Alexie Gonzalez, age 10
Mesquite Elementary School, Ms. Collins

THE RIVER

The river sounds
Like a bird tweeting
It smells like mint
The air blooms into
The flowers. The flowers
are blooming and floating

Giselle Cardenas, age 8
Borton Magnet School, Mrs. Cavazos



Lucas Knoll, age 8 | Presidio School, Ms. Cohn

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- Jennifer Duan**, University of Arizona
- Edward Curley**, Pima County Regional Wastewater Reclamation Department (retired)
- Eve Halper**, Bureau of Reclamation
- Akitsu Kimoto**, Stantec
- John Kmiec**, Town of Marana
- Kendall Kroesen**, Tucson Audubon Society
- Michael F. Liberti**, City of Tucson, Water Department
- Christopher Magirl**, U. S. Geological Survey
- Jean McLain**, University of Arizona
- Brian Powell**, Pima County Office of Sustainability and Conservation
- E. Linwood Smith**, Consulting Ecologist
- Patrice Spindler**, Arizona Department of Environmental Quality
- Juliet Stromberg**, Arizona State University
- Robert Webb**, University of Arizona (retired)
- Claire Zucker**, University of Arizona
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- Laura Hagen Fairbanks**, Pima County Regional Flood Control District
- Jacob Prietto**, Pima County Regional Flood Control District

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- James DuBois** and **Anna Martin**, Pima County Regional Wastewater Reclamation Department
- Julia Fonseca** and **Brian Powell**, Pima County Office of Sustainability and Conservation
- Wendy Burroughs**, Pima County Natural Resources, Parks and Recreation
- Claire A. Zugmeyer** and **Ian Dowdy**, Sonoran Institute
- Elizabeth Goldmann**, U. S. Environmental Protection Agency, Region 9

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Data synthesis, writing, and production: **Claire A. Zugmeyer, Evan Canfield, and Anna Martin**

Editing: **Audrey Spillane**

Charts and info graphics: **Claire A. Zugmeyer and Terry Moody**

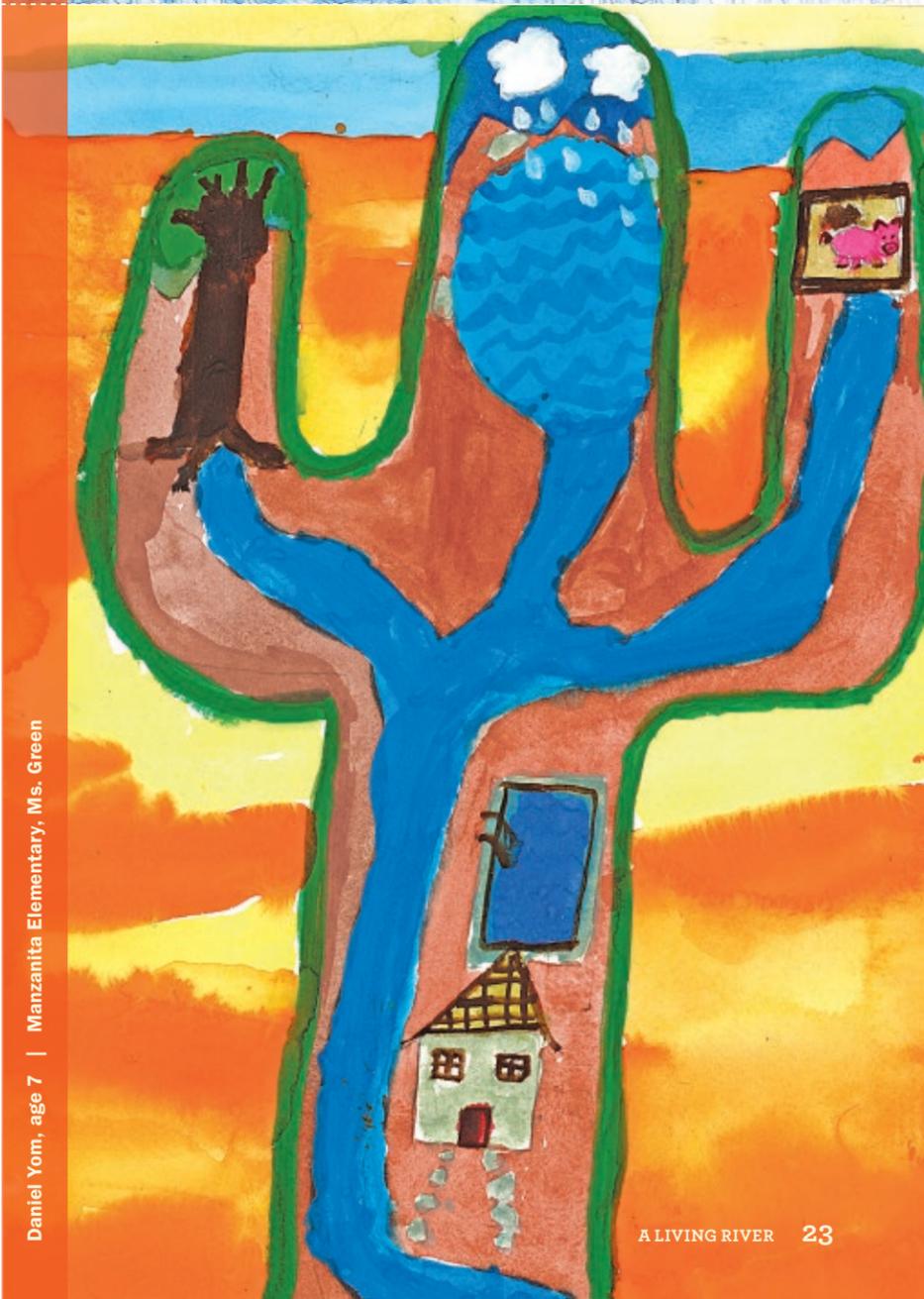
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Anmalina Whillock, age 6 | Roadrunner Elementary, Ms. Carroll



Daniel Yom, age 7 | Manzanita Elementary, Ms. Green

SONORAN INSTITUTE

The Sonoran Institute's mission is to connect people and communities with the natural resources that nourish and sustain them. We work at the nexus of commerce, community, and conservation to help people in the North American West build the communities they want to live in while preserving the values which brought them here. We envision a West where civil dialogue and collaboration are hallmarks of decision making, where people and wildlife live in harmony, and where clean water, air, and energy are assured.

The Sonoran Institute is a nonprofit organization with offices in Tucson and Phoenix, Arizona; and Mexicali, Baja California, Mexico. Visit our website to learn more www.sonoraninstitute.org.



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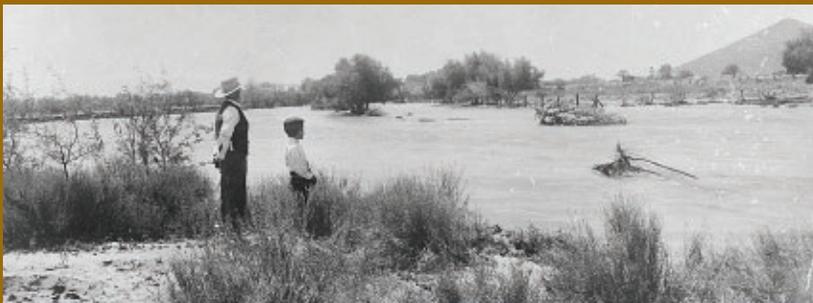
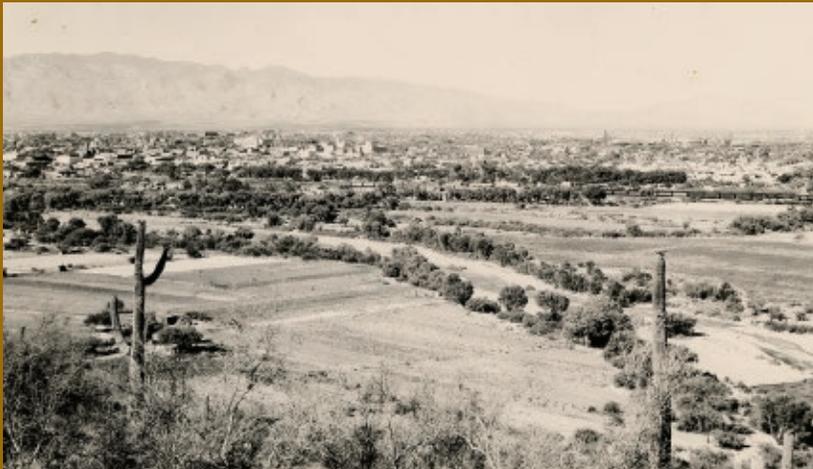
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GET INVOLVED

- Have your child enter the 2017 Living River of Words Youth Poetry and Art Contest. Sign up at www.pima.gov/nrpr.
- Take a water harvesting class. Water harvesting is a great way to improve the resilience of our community by using water more efficiently. Learn how with Watershed Management Group www.watershedmg.org.
- Save water, save rivers, and build community by joining Tucson's Conserve 2 Enhance (C2E) program. C2E connects conservation with community action. Learn more at www.conserve2enhance.org/Tucson.
- Visit the river for yourself! One easy entrance point is from the Crossroads and Silverbell District Park in Marana. You can walk out to The Loop and easily watch the river flow by. If you're lucky you might see a Great Blue Heron fishing for his dinner!



PIMA COUNTY

Pima County Regional Flood Control District
www.pima.gov/floodcontrol

Pima County Wastewater Reclamation Department
www.pima.gov/wastewaterreclamation

Pima County Office of Sustainability and Conservation
www.pima.gov/government/sustainability_and_conservation

www.pima.gov

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ATTACHMENT 2

YOUR LIVING RIVER

CHANGES ALONG THE LOWER SANTA CRUZ RIVER - 2013 TO 2015



The Lower Santa Cruz River in northwest Tucson and Marana flows year-round and provides the principal wetland habitat in Pima County. River flows are sustained by the release of effluent, highly-treated wastewater, from two regional facilities.

In December 2013, Pima County completed the largest public works project in Southern Arizona by investing over \$600 million to upgrade the treatment process. Improved treatment affords the opportunity to enhance the aquatic environment along the river, reduce odors, and increase re-use of reclaimed water.

The Living River reports were developed to annually gauge conditions of this valuable ecosystem and track the impacts of our community investment. This fact sheet summarizes changes and observations from the 2013, 2014, and 2015 water years.

All Living River reports can be found on the Sonoran Institute website at www.sonoraninstitute.org

CHANGES IN WATER QUALITY AND WETLAND CONDITIONS

- **Ammonia no longer limiting life:** Ammonia, which can be toxic to aquatic organisms, was appreciably reduced to low levels.
- **Oxygen availability not a stressor:** Dissolved oxygen, essential for aquatic life, remained at steady levels or increased. Biochemical oxygen demand (an indirect measure of pollutants that use up oxygen in the water) declined to nearly non-detectable levels, indicating that there is more oxygen available for organisms to thrive.
- **Water clarity much improved:** Sediments and other particles carried in the water decreased, resulting in clear river water on normal non-flooding days. Elevated levels of materials in the water can increase water temperature, thereby decreasing available dissolved oxygen.
- **More diverse life:** Several species of fish and increased diversity of aquatic invertebrates (which include insects, crustaceans, and worms) are being seen in the river.
- **Wetland plants reduced in drying sections:** Overall the release of effluent supports wetland plants and trees. In the sections that are drying, there is a decrease in willows and a shift towards upland plants.
- **Reduced flow extent:** The length of the flowing river has decreased, likely the result of a combination of factors including increased water infiltration from reduced nutrient levels and scouring floods.
- **Very little odor escaped the reclamation facility boundary:** Odor levels far below levels required by facility permits and anecdotal observations of odor as hardly noticeable near the facility boundaries.



Cloudy water, before upgrade



Clear water, after upgrade



American Coot, *Fulica americana*

OTHER OBSERVATIONS

- **Increased infiltration & groundwater recharge:** The amount of water that recharged local aquifers more than doubled between 2013 and 2015. This is likely from increased rates of infiltration resulting in part from improved water quality and scouring floods in September 2014 and January 2015 which helped reduce the “clogging layer” in the riverbed.
- **Many kids are seeing a flowing river for the first time:** The Living River of Words youth art and science program provided the first contact with a flowing stream for numerous Tucson schoolkids. The Lower Santa Cruz River provided meaningful inspiration for youth art and poetry projects.

ACKNOWLEDGEMENTS

We thank the U.S. Environmental Protection Agency, Pima County Regional Flood Control District, Pima County Regional Wastewater Reclamation Department, and individual community donors for funding the Living River Project.

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Page 1: Black Neck Stilts by **Doris Evans**; Mayfly (*ephemeroptera*) by **Shutterstock**; Sonora Mud Turtle by **Timothy R. Burkhardt**. Page 2: cloudy and clear water photos by **Jennifer Duan**; coot by **Paul and Joyce Berquist**

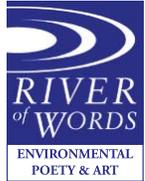
ATTACHMENT 3



For more information about *Living River of Words: Youth Arts and Science* contact:
**Pima County Natural Resources,
 Parks and Recreation
 Environmental Education**
 Phone: (520) 615-7855
 Email: eeducation@pima.gov
 Website: www.pima.gov/nrpr

All of the Living River Reports and associated documents for the lower Santa Cruz River are available for download at the Sonoran Institute website www.tiny.cc/lscr

Photo: Doris Evans



Shaping the Future of the West
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**U.S. Environmental
 Protection Agency**

**Friends of Agua
 Caliente Park**

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 Regional Flood Control District
 Office of Sustainability and Conservation
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PIMA COUNTY NATURAL RESOURCES, PARKS AND RECREATION

- Chris Cawein, Director

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The Mountain Lion of the Rocky Mountains

*Bailey Puls, age 9
 Presidio School • Ms. Cohn
 Grand Prize–Art–Category 2*

This book is dedicated to 2016 Living River of Words

Teachers of the Year:

Susan Cohn – Presidio School

and

Robert Mayer – DeGrazia Elementary School

*And all the teachers and parents/guardians that promote and support
the integration of science and the arts while creating opportunities
for children to connect with nature.*

Living River of Words 2016 – 2017 Traveling Exhibit Schedule

April 16 – May 30, 2016

Wheeler Taft Abbott Sr. Branch Library • 7800 N. Schisler Dr.

June 4 – July 6, 2016

Agua Caliente Park – Ranch House Art Gallery • 12325 E. Roger Rd.

July 9 – July 31, 2016

Martha Cooper Branch Library • 1377 N. Catalina Ave.

August 2 – August 31, 2016

Murphy-Wilmot Branch Library • 530 N. Wilmot Rd.

September 2 – September 30, 2016

Joel Valdez Main Library • 101 N. Stone Ave.

October 2 – November 11, 2016

Dusenberry-River Branch Library • 5605 E. River Rd., #105

November 15, 2016 – January 9, 2017

Mission Branch Library • 3770 S. Mission Rd.

January 11 – February 5, 2017

Valencia Branch Library • 202 W. Valencia Rd.

February 7 – March 10, 2017

Quincie Douglas Branch Library • 1585 E. 36th St.

The Whispering Wind

I hear the wind whispering,

to the willow trees,

telling them the stories,

of everything she's seen.

I hear the wind whispering,

to the river reeds,

bragging about every city she's seen.

If you look closely at the water's edge,

the midges are squirming and butting heads.

Why can't we just open our eyes a little longer?

Madilyn Hanna, age 11

DeGrazia Elementary School • Mr. Mayer

The Great Saguaro

As a tiny Elf owl sits on my arm

the wind howls throughout the desert

Whish! Wooo! Swish!

He awakens to the sound of a scorpion

scurrying along the sand

Scritch! Scratch! Scritch! Scratch!

I stand tall in the moonlight

forming an eerie shadow

as a bat drinks my nectar

A bobcat prowls around me

bolting into the moonlight

A pack of coyotes howls Awooo! How!!

The wind sways

and rocks the leaves of the mesquite tree

Whish! Wooo! Swish!

The sun ascends above the desert,

day is nearing

Sara Gorny, age 9

Manzanita Elementary School • Ms. Fisher

The Owl

The wind howled in the night sky.
Bright yellow eyes shone in the darkness.
Watching...
Every scurry of living things is observed.
Wings flap as it takes flight in the wind.
Hooting a call to its mate nearby,
Scattering...
of mice and rodents on the run.
The Rattlesnake stays coiled next to the saguaro.
Perched up high, above, the ever watchful owl...
Waiting!

Jocelynn Garcia, age 12
DeGrazia Elementary School • Ms. Mirlocca

The Desert Tortoise

In the stormy night the desert tortoise,
protected by his coated shell, floated into a waterfall
Kaboom...He fell landing with his head inside
his shell, surviving just by a little.
He slowly walked in the wet night back to his den.
The next morning the flowers grew,
and the weeds washed away.
It was a perfect day.
Wiggly worms and cautious curious caterpillars
could be seen in every direction.

Allie Vogelsberg, age 8
Sewell Elementary School • Ms. Martin

Living River of Words (LROW) sets the stage for learning, inspires science inquiry, and excites creativity. The cycle begins with teachers who invite *LROW* arts and science instructors to their classrooms. Students are introduced to the concept of watersheds and study wetland habitats through a multi-disciplinary series of science investigations and the practice of poetry and visual arts. After exploring these topics, children ages 5–19 have the opportunity to share their impressions with entries of poetry and/or visual art to *Living River of Words: Youth Poetry and Art Contest*. In these pages you see the award winning youth poetry and art works that are the result of the field trips, school residencies, and independent study.



Photo: Dominic Flores

Living River of Words is a regional coordinator providing local support for the national River of Words. Several dedicated teachers in Pima County, Arizona brought their classes on outdoor excursions to the Santa Cruz River or spent a day by the pond at Agua Caliente Park to learn about watersheds and wetlands habitats.

Our field study sites – the lower Santa Cruz River and Agua Caliente Park

Thanks to the release of highly treated wastewater into the riverbed the Santa Cruz River in northwest Tucson and Marana, the river is alive with perennial flows, lush trees lining the river banks, and diverse wildlife. Effluent in this reach of the Santa Cruz River is not new; two wastewater treatment plants have been operating on this section of the river since the 1970s. What has changed is the quality of the effluent being released. Pima County recently completed the upgrade of the two wastewater treatment plants. The upgrade significantly improved the quality of water released into the river, a key ingredient for a healthier river. The river now attracts walkers, bikers, and is a popular birding destination from the Sweetwater Wetlands to the



Photo: Doris Evans

Marana Flats. The Living River Project aims to gauge conditions of this valuable ecosystem and track the impacts of our community investment. *Living River of Words* plays a role in the broader Living River Project by introducing students, teachers and parents to the lower Santa Cruz River. While at the river students conduct water quality tests, record wildlife sightings, and survey riparian vegetation, using methods that

mirror the Living River Project indicator assessments. A visiting poet or artist spends time with the students by the river to guide their journaling and drawing in preparation for poetry writing and artwork back in the classroom.



Photo: Gladis Miranda

Pima County's Agua Caliente Park offers a natural spring and pond teeming with life. Situated at the base of the Santa Catalina Mountains, Agua Caliente Park is a popular destination for bird watching or a family picnic by the pond.

The education center at the park offers amenities for the student field study trips. As with the Santa Cruz River study site, while at the park on a *LROW* field study trip the students take water samples from the pond to conduct water quality tests and study under the microscope. They also spend time journaling, sketching and recording their observations to inform their poetry writing and art work.

Perhaps you too will feel the richness and wonder of these special places through the eyes of the *Living River of Words 2016* award winning youth poets and artists.

We thank the U.S. Environmental Protection Agency, Pima County Regional Flood Control District, Pima County Regional Wastewater Reclamation Department, Pima County Office of Sustainability and Conservation, Pima County Communications Office, Pima County Natural Resources, Parks and Recreation, The Friends of Agua Caliente Park, and individual community donors for funding the Living River Project. This partnership made possible the continuation of the environmental science, poetry, and art residencies for students to prepare entries to the *Living River of Words: Youth Poetry and Art Contest*.

Thank you!

Many thanks to the community partners, school administrators, teachers, science, poetry and art instructors, judges, and graphic designers that worked diligently to bring *Living River of Words* through the annual cycle of activities: Yajaira Gray, Wendy Burroughs, Jeffrey Babson, Sandy Reith, Julie Strom, Gavin Troy, Carolyn King, Doris Evans, Rebecca Seiferle, Kimi Eisele, Josh Schachter, Brian Powell, Bret Muter, Leia Maahs, Randy Metcalf, Gerry Loew, Edie Price, Helen Wilson, and NRPR interns Esperanza Zepeda, Selena Madrigal, Arturo Valdenegro, and Nikolas Espinosa.

The Desert Owl

The desert owl in the sunny morning
was very hungry and quickly glided to a nearby saguaro.
The saguaro was holding lots of water from the desert rain.
The clouds started to come in and made the curvy ground
look like water from the ocean splashing, splash, splash.
The flowers in the distance were blue and white
and looked like butterflies and berries.

Aaliyah Thomas, age 10
Bloom Elementary • Ms. Martin

The Storm

The cliff is so still,
one day you will see it in your eyes.
When monsoon comes
the trees will move,
it will be windy.
Discover it.
One day you will have
the courage to do it.
When it is night,
you will see an owl.
You will have the owl
in your dreams.
Over the night,
imagine that owl
in that thunderstorm.

Drew Hartigan, age 8
Agua Caliente Elementary School • Ms. Johnson

Shivering Trees

Rain is like air, is like an owl.
The mountains look like fire.
Deep in a dream,
the perfect hawk
will close eyes to sleep
and sings
to the river trees.
Shivering clear together.

Ivy Morrison, age 7
Agua Caliente Elementary School • Ms. Johnson

The Finch

He climbs the sky
to see himself fly
To see the river and the wind
it was for him
He was free to be all his life
his wings to the wind
as a knife
River robbed the sky of colors
his life was like no other
He felt like he was brave and free
but was he only trying to flee
The ground from which
he broke free
As he whistled a song on the breeze

Briant Johnson, age 11
DeGrazia Elementary • Mr. Mayer

The Tortoise and The Rattlesnake

The rattlesnake is fighting
with a tortoise in the rain.
He likes to eat eggs.
He is standing up.
He has scary eyes.
He smells with his tongue.

Joel Amavizca, age 6
Holladay Elementary School • Ms. Martin
Grand Prize–Poetry–Category 1

Everything is Running Down

Everything is running
down the path of the moonlight
in the earth's sleep.
The fast hours run down the stream.
The doves dream.
Everything is running
down the path of moonlight;
the ducks, turtles and toads.

Troy Chabot, age 8
Agua Caliente Elementary School • Ms. Gwozdz

I Am

I am the river going through the flow of life
I am an otter swimming with my kids and wife
I am the moss on the wall
I am the river cane about to fall

I am a fly about to die sitting on the road
I am a hawk swooping down to eat a horny toad
I am a kid learning about the water cycle
Watching the flow of life go by like a bicycle

Isaiah J. Montoy, age 11
Ochoa Community Magnet School • Ms. Elvick

Used to Be

Water flows.
Plants grow.
Birds alight on branches.

Convenient lies disguising an inconvenient truth.
The faded memory of a river.
A river that brought life
now an empty wash.

We chose lawns and swimming pools.

We complain that the river is gone.
We pump water back into the land but only after we have used it.

But water is not a river.
Airplanes are not birds.
Being alive is not living.

A promise to return what we have taken.
A fated apology to the land.

We are child knocking over a towers of blocks.
We scream and cry when the blocks fall.

We try to build the tower up again but it is never the same.

But children learn.
We are learning.

Perhaps next time we will leave the tower standing.

Hannah Providence, age 16
City High School • Ms. Acosta
Grand Prize – Poetry – Category 4

River

One sunny morning I looked out the window
and saw a river
Water had shining rocks
I wanted to keep the rocks
so I decided to make my own river
and it had shining rocks and crystals
and I took the rocks from the other river
I got a shovel to make my own river
I wanted to make a river to show my family
How cool my river will look like
If my river could talk it would say
Please take of me

Jasmine Bernal, age 9
Ochoa Community Magnet School • Ms. Selden

The Gila Monster

As the long venomous Gila monster
slowly crawls out of his hole,
he sets out to find a lake of water to drink from.
While the saguaro protects his house,
he safely leaves his babies behind with
the protection from the tall green prickly cactus.
As he gets through the rocky plain,
he finds a diamondback snake who took over the lake.
He fights off the snake, takes a drink and leaves.
When he gets back to his hole,
which was protected by the trustworthy cactus,
he sees his babies alive and awake.

Abraham Alvarez, age 10
Sewell Elementary School • Ms. Martin

Katydid

I found a leaf
I found a leaf but something was moving
The legs on the leaf moved
it was a katydid
it had six legs
it was walking on a stick
it was an insect
it was green
I think it eats plants
I touched the katydid
It was walking on my palms

Ba`ag Wilson, age 8
Borton Magnet School • Ms. Cavazos

I Am the River

I am the river with no pain
No sorrow
Swimming with an otter
Providing with my mother
And my long line of rivers
Waiting to be the best
At what I do
I sleep under a blanket of stars
With the moon as a light
To guide me through my day
And a cloud as a pillow
I sleep dreaming of one day
Being a swirl of stars
A universe of water
A graceful leap of water
There is no limit to what I can be
As long as I believe

Zaxarie Silva, age 10
Ochoa Community Magnet School • Ms. Elvick

Jackrabbit

Fire-red ears
Beige fur
Yellow eyes
Curved whiskers
Drinks the melting snow

Adam Mohamed Omar Makram, age 6
Sewell Elementary School • Ms. Martin

The White Green River

The white green river
gribbles like a gravel into a pool –
wsshhh!
I see the small green leaf
and say, "Hello!"
I see a bumpy leaf
swooshing into a pool –
wsshhh!
The black beetle walks
around in the smooth, smooth sand.

Christian Rubio, age 9
Borton Magnet School • Ms. Cavazos
Grand Prize–Poetry–Category 2

Sparkling Water

Drifting through our world
During the rise of day and the show of night
Through cracks of our dry desert land
To care for every living creature

Alexie Gonzalez, age 10
Mesquite Elementary School • Ms. Collins

Wish Washer

The river washed my wishes away,
Where did they go?
Did they go to the tourist,
Who is watching the hawk?
Did it go to the hawk,
Who is stalking his prey,
Who jumped the bushes?
Did it go to the bush,
Who provides yummy berries for the birds?
Did it go to the bird,
Who landed right in front of the little girl?
Did it go to the little girl,
Who was wondering where her wish went?

Victoria Holloway, age 12
DeGrazia Elementary School • Ms. Mirlocca
Grand Prize–Poetry–Category 3

A Summer Rain Storm

On a bright summer morning
The clouds started blowing strongly in the wind
to say a storm was coming.
The rain started plip plopping on the pond
as if there were lots of rocks being flung into the water.
The rattlesnake silently slithered into a rabbit hole
to seek shelter and to have a tasty snack.
After the rain everything was still.
The saguaro had its drink.
The rivers were full.
The puddles were thick.
The storm was over as
the animals came out hiding.

Addyson Keeling, age 9
Bloom Elementary School • Ms. Martin



Jesus Peña, age 11
Hollinger K-8 • Ms. Denson



Samantha Brownell, age 11
Hollinger K-8 • Ms. Denson



The Desert and the River

*Stella Xu, age 8
Presidio School • Ms. Cohn*



*Gabriel Mahtapene, age 11
Hollinger K-8 • Ms. Denson
Grand Prize–Photography–Category 1*

Gambel's Night

It was a stormy night,
rain drops falling, lightning striking
and clouds swiftly moving around the sky.
Gambel's Quail was wearing his feathery hat.

Rain was pouring on him
because he forgot his black and white coat.
He ran until he bumped into Spanish Scorpion.

Scorpion found a palo verde tree and
invited Gambel into the cavity of the trunk.

They stayed there for the night.
In the morning the sun was shining
at the circle shaped rainbow.

*Violeta Fernández, age 8
Sewell Elementary • Ms. Martin*

Rain

A coyote
Danced in the rain
During the monsoon
Up in the mountain
To cool off

*Riley Blute, age 10
Mesquite Elementary School • Ms. Collins*

The River

The river sounds
Like a bird tweeting
It smells like mint
The air blooms into
The flowers. The flowers
are blooming and floating

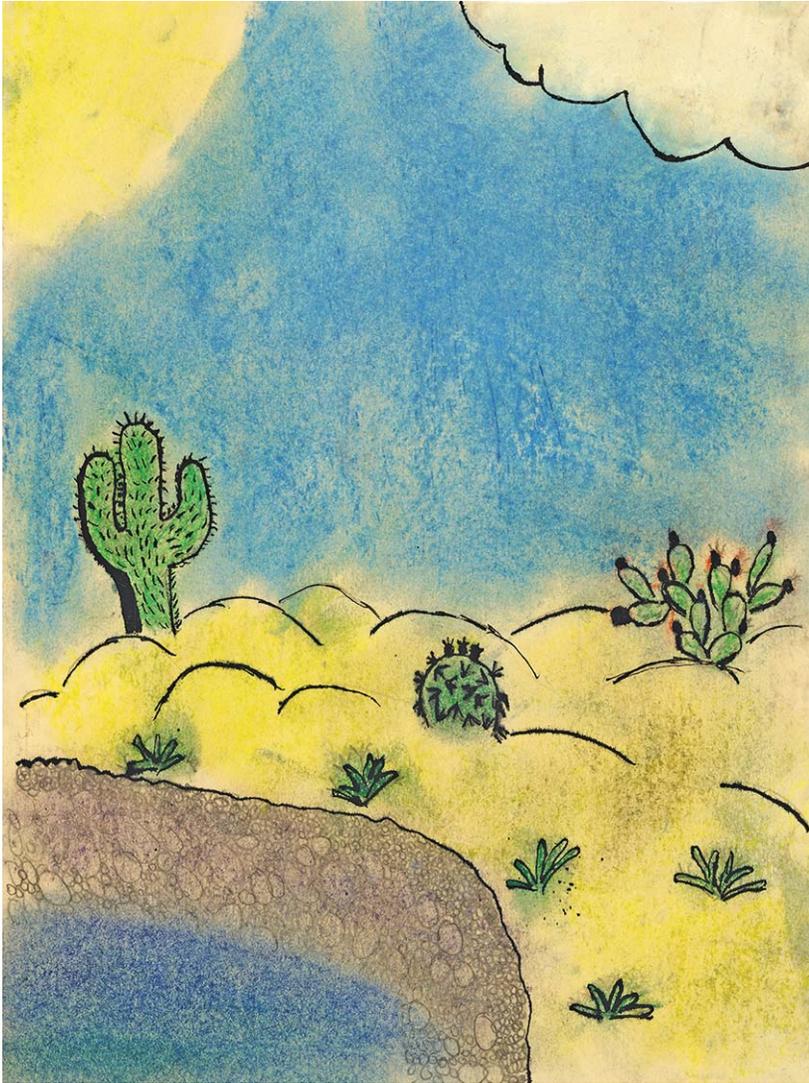
*Giselle Cardenas, age 8
Borton Magnet School • Ms. Cavazos*



Hummingbirds in the Rain
Elizabeth Crandell, age 7
Henry Elementary • Ms. Martin



Colorful Desert
Alicia Romero, age 8
Agua Caliente Elementary • Ms. Johnson



The Watering Hole
Simone McCarthy, age 10
Basis Tucson North • Ms. Vonier



Beautiful Lands
Anmalina Whillock, age 6
Roadrunner Elementary • Ms. Carroll
Grand Prize—Art—Category 1



Magnificent Mountain Lion
Christian Jack Badinger, age 8
Erickson Elementary • Ms. Martin



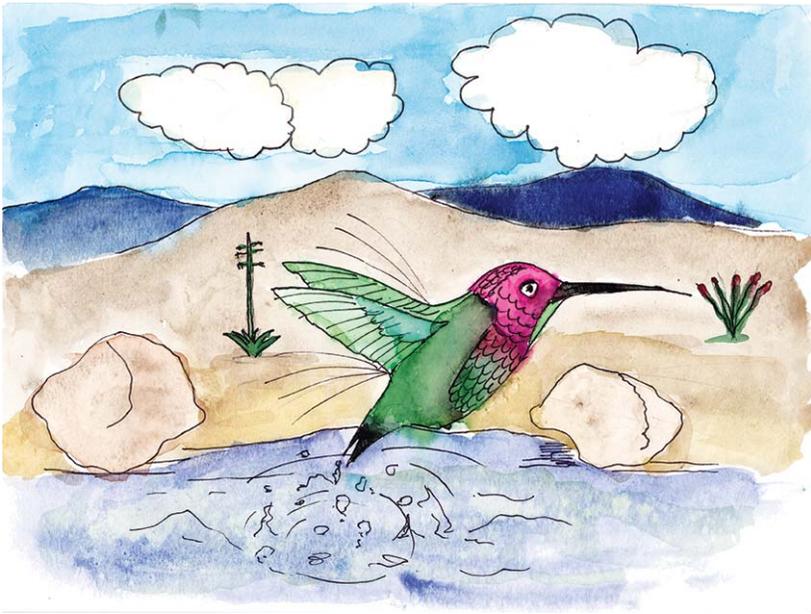
Turtle Desert Land
 Jonah Alcaraz, age 8
 Presidio School • Ms. Powers



Bird's Eye View
 Eduardo Lemus, age 18
 Amphitheater High School • Ms. Hollman
 Grand Prize–Art–Category 4



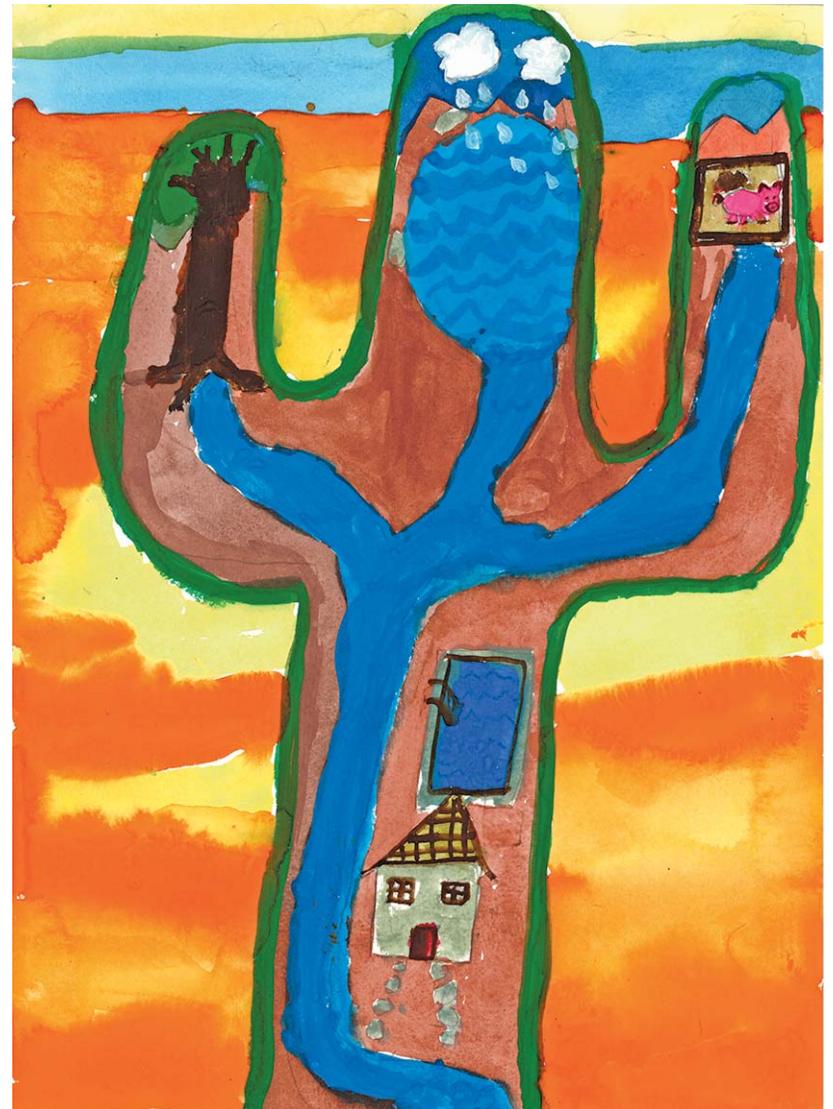
Desert
 Rebeca Contreras Cortez, age 8
 Presidio School • Ms. Powers



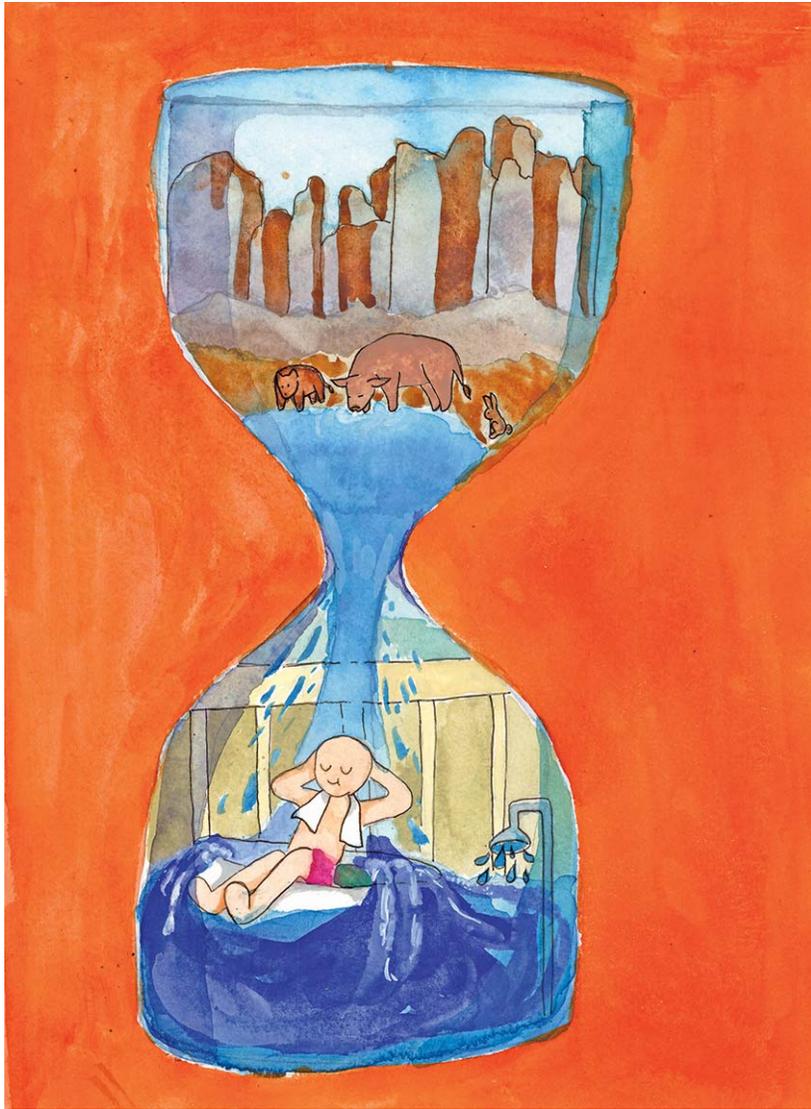
Myles Walker, age 12
 Paulo Freire Freedom School • Ms. Mohr-Felsen



Desert of Life
 Renee Li, age 10
 Basis Tucson North • Mr. McDonald



Water in the Desert
 Daniel Yom, age 7
 Manzanita Elementary • Ms. Green



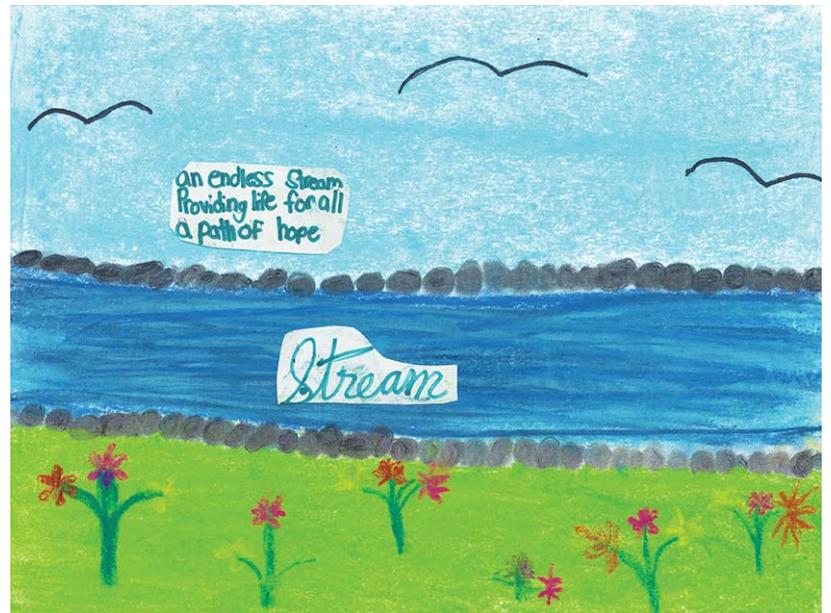
The Limited Water Resources

Hannah Bae, age 14
Basis Oro Valley • Ms. Yom



Desert Rain

Madilyn Hanna, age 11
DeGrazia Elementary • Mr. Mayer

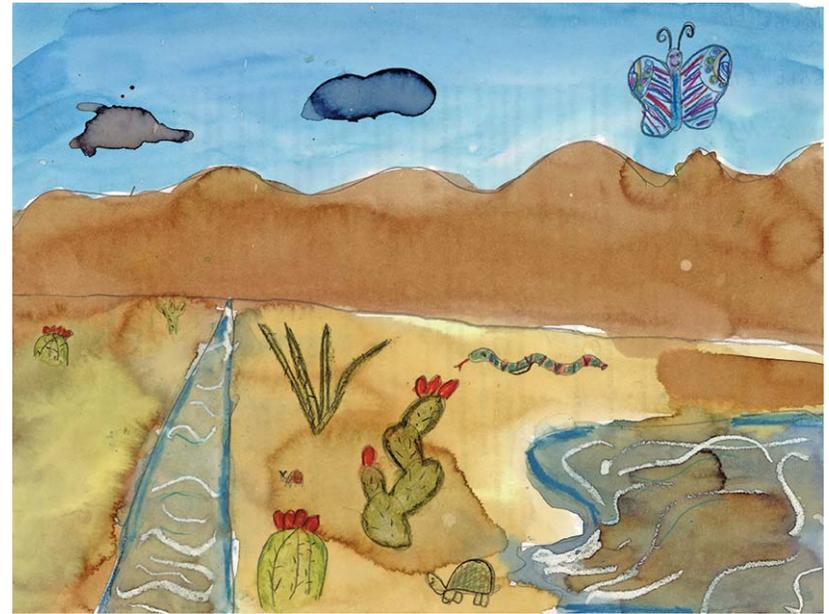


Stream of Hope

Malya Hersha, age 11
Basis Tucson North • Ms. Vonier



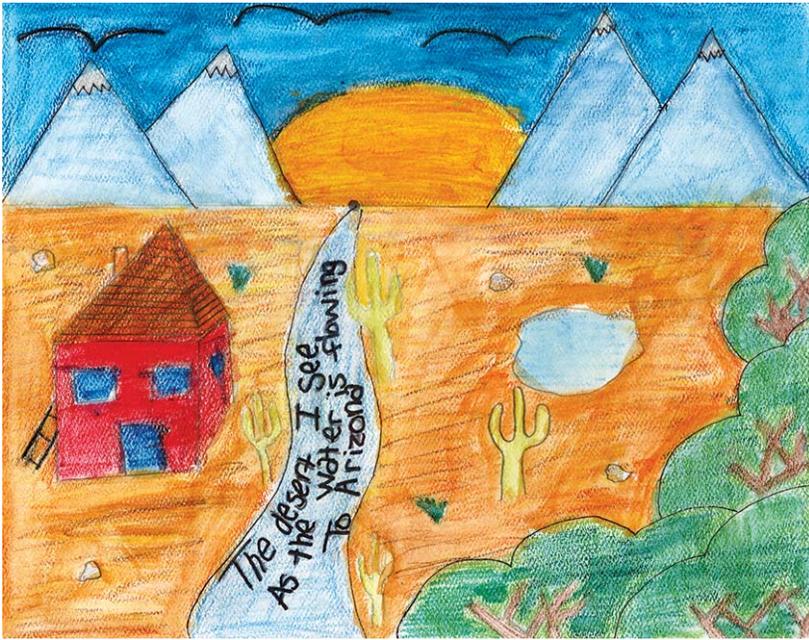
River Bird
 Lucas Knoll, age 8
 Presidio School • Ms. Cohn



Desert Animals
 Ela Sainz, age 7
 Gale Elementary • Ms. Nguyen



Disappearing Water
 Gayatri Kaimal, age 10
 Basis Tucson North • Mr. McDonald



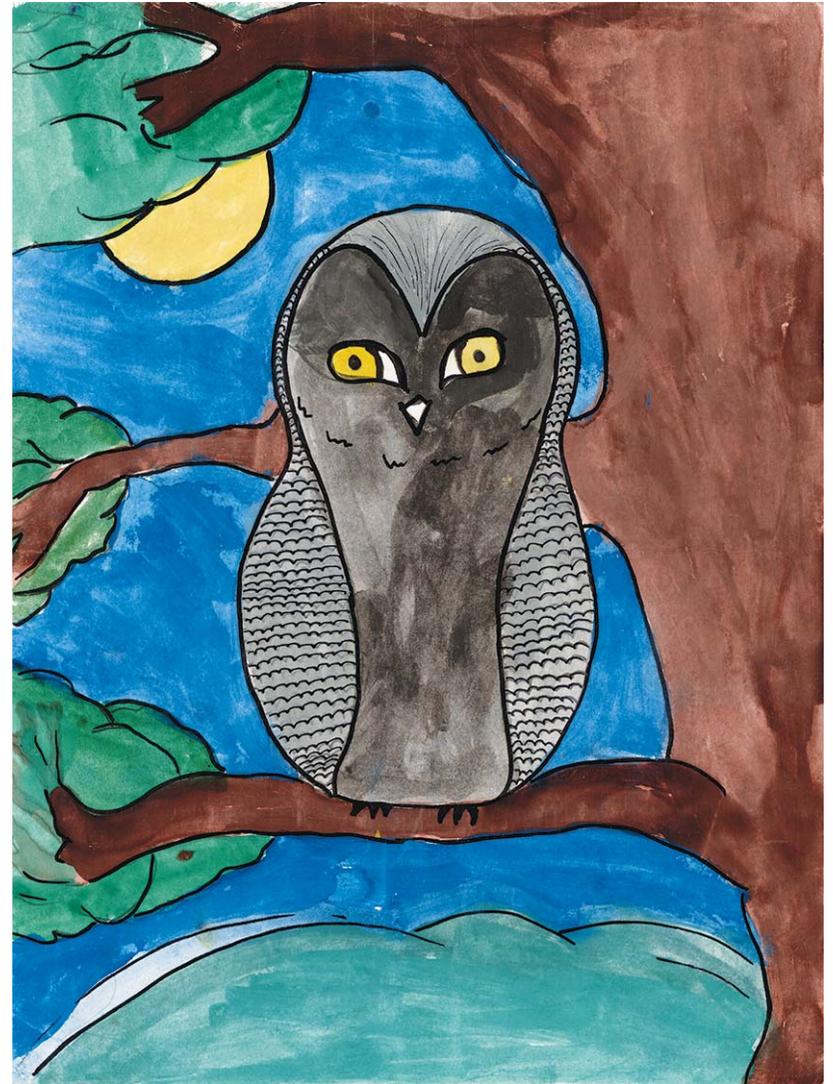
Living River of Words Project

*Bivika Adhikari, age 10
Basis Tucson North • Mr. McDonald*



Beautiful Desert

*Kira Anderson, age 7
Agua Caliente Elementary • Ms. Gwozdz*



Waiting

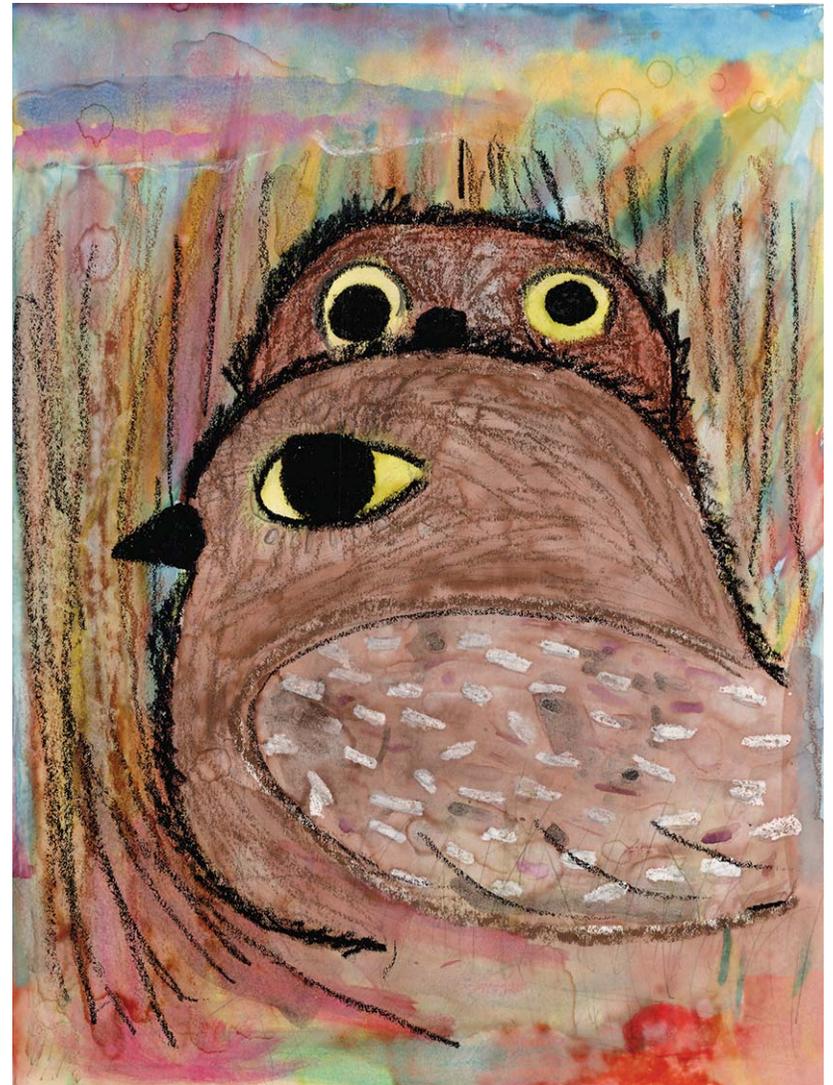
*Jocelynn Garcia, age 12
DeGrazia Elementary • Ms. Mirlocca*



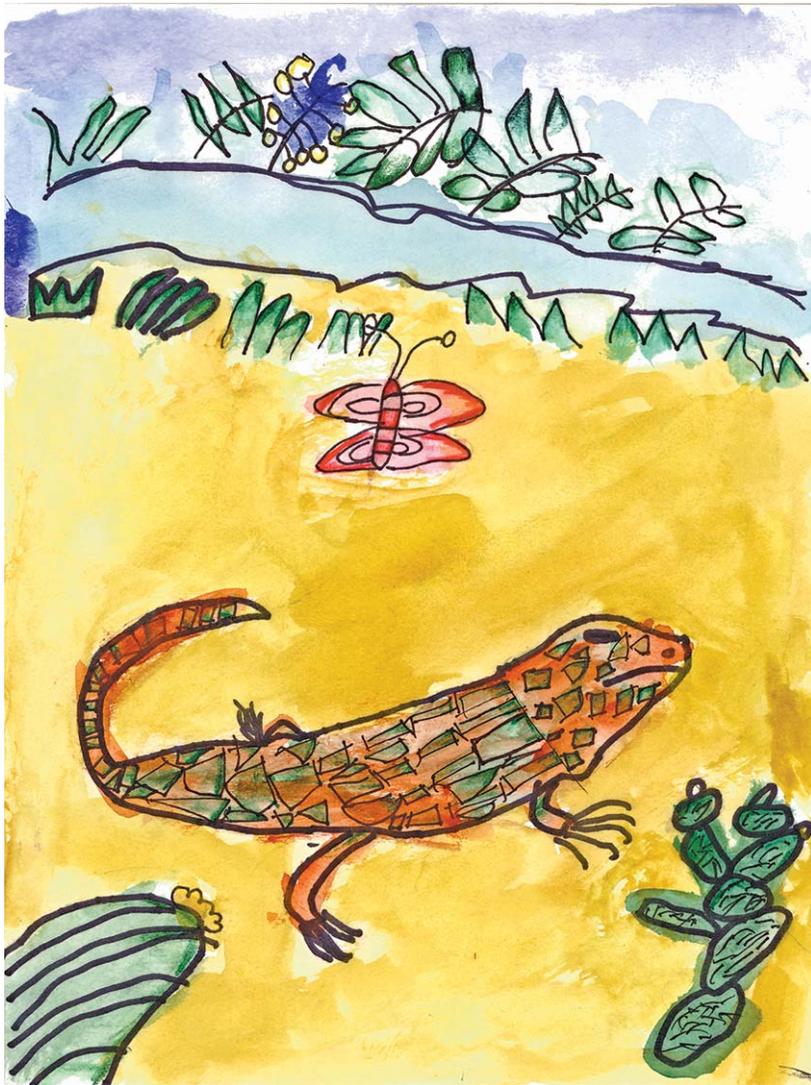
Cold Winter Morning
Vanessa Mora, age 11
DeGrazia Elementary • Mr. Mayer



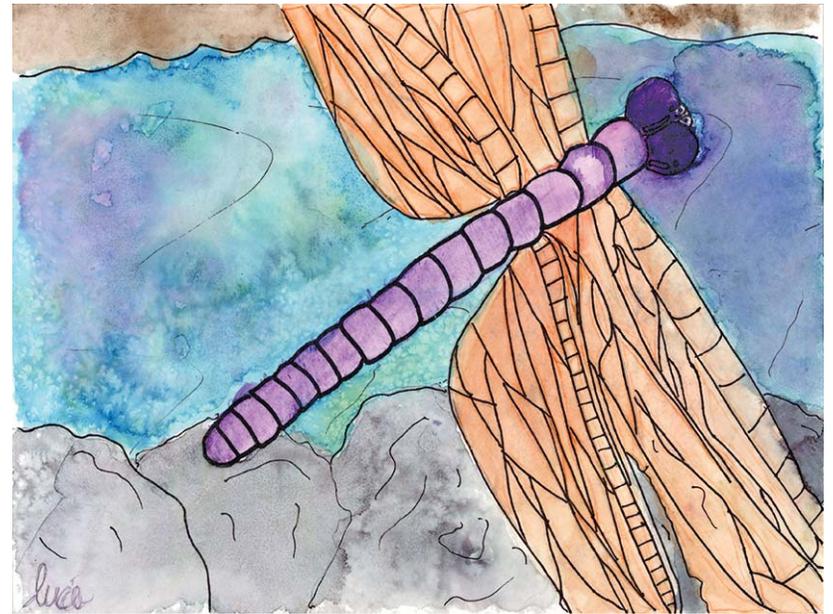
Sunset Scavenger
Raine Ugstad, age 11
Paulo Freire Freedom School • Ms. Mohr-Felsen



Curious Owlets
Gospava Conley, age 12
DeGrazia Elementary • Ms. Minninger



Desert Beauty
Jayden Dwight, age 8
Presidio School • Ms. Cohn



Misty Wings
Lucia Meinig-Reeves, age 11
Paulo Freire Freedom School • Ms. Mohr-Felsen
Grand Prize—Art—Category 3



Bio Cycle
Klay Leh, age 16
Amphitheater High School • Ms. Hollman

ATTACHMENT 4

living river celebration and report release

ELLIE TOWNE FLOWING WELLS COMMUNITY CENTER - 1660 W. RUTHRAUFF RD

July 21 , 2016 6 to 7 pm

Notice anything different along your living river? Few odors, clear water, large fish?
Join us to celebrate the recent improvements to the Lower Santa Cruz River and
release of the third annual report. We hope you can make it!



ACTIVITIES

ENJOY LIGHT REFRESHMENTS

LEARN ABOUT RECENT CHANGES TO THE SANTA CRUZ RIVER

SPECIAL GUEST CHUCK HUCKELBERRY, COUNTY ADMINISTRATOR

GET A COPY OF THE NEW ANNUAL REPORT

