KERP

Pima County's Urban Oasis

PIMA COUNTY

INTRODUCTION

We are standing on the edge of a vast basin that's nearly invisible from the surrounding streets. A 2.2-mile paved path for pedestrians and bicyclists hugs the perimeter and is often used by office workers from the nearby government buildings as a place for lunch hour exercise.

A member of the Tucson Audubon Society looks into this giant basin near Kino Parkway and Ajo Way and remarks on the ponds and lush vegetation, including willow, ash, cottonwood and mesquite trees that were planted in what was once little more than a barren mud flat.

The nearby office buildings disguise the surrounding natural environment. It takes some effort to remember we are in the middle of the Sonoran Desert, where 12 inches of rain in a 12-month period is considered a wet year. The Audubon member is looking through the trees at a Great Egret standing motionless on the bank of the pond. A moment later a flash of red darts across his field of vision, and an Anna's Hummingbird settles lightly on a thin mesquite branch.

Due to the high diversity of birds at KERP, it has become a popular birding location

In less than an hour of wandering the periphery of this manmade flood control and environmental restoration project, the birder points out two Night Herons, a Neotropic Cormorant, a Yellow-rumped Warbler, a Great Blue Heron perched on an iron rail, a Cooper's Hawk and two swallows.

The giant basin is the Ed Pastor Kino Environmental Restoration Project, or KERP, named for the Arizona congressman instrumental in shepherding the project through Congress. It is a tranquil oasis where the practical and the aesthetic are perfectly blended.

Its practical value is no more obvious than the fact that most of Tucson is built on sedimentary deposits that generally slope downhill from the southeast to the west. Were this not true, the ponds where birdwatchers congregate would not exist. The ponds are there because of a carefully designed flood control project that collects and captures in a series of detention basins the rainwater from a 17-square mile watershed that extends westward to include Davis-Monthan Air Force Base.

KERP is the end result of a multipurpose environmental restoration and stormwater harvesting project. The harvested stormwater is used to sustain the lush wildlife habitat within KERP, and extra stormwater is utilized to irrigate Pima County's Kino Sports Complex and surrounding landscaping, providing a signficant cost savings to taxpayers.

The lush wildlife habitat attracts a wide variety of wildlife and wildlife watchers. Most important, the detention basin that contains KERP also protects homes and businesses downstream from the devastating flooding that would result were water allowed to flow unchecked from the east side of Tucson to the Santa Cruz River.

WATER IN THE DESERT

If you stand today on the banks of the Santa Cruz River near downtown Tucson or the Rillito Creek at Craycroft Road, you would be forgiven if you didn't recognize that these now dry riverbeds used to provide year-round water for the lush forests and wildlife that once thrived there.

Some 15,000 years ago, the physical environment of the region was markedly different than it is today. With the wetter and cooler climate during the last Ice Age, large mammals that have long been extinct – the Pleistocene bison, mammoth and camels, for example – could be found grazing in the grasslands and drinking from the rivers and streams.

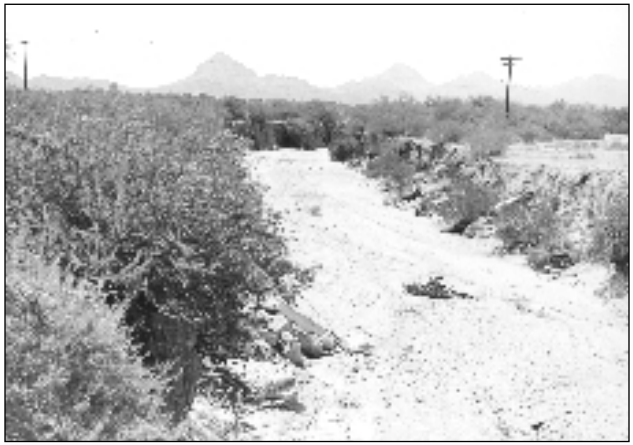
Evidence of this history was found at the KERP site in 1990 when a County employee inspecting erosion cuts found a Pleistocene mammoth tusk buried in a prehistoric stream channel along the edge of the earthen basin.

The reasons for the transition from lush aquatic areas to the dry arroyos we see today are numerous, but the rapid increase in the human population beginning in the 1880s and the subsequent urban expansion and groundwater pumping are the main culprits for the more recent drying.

By the year of Arizona's statehood (1912), the Santa Cruz River near downtown was no longer flowing year-round.

But intense rains – especially the summer rains – still cause flooding and turn the Santa Cruz and other area waterways and washes into raging rivers.

The Santa Cruz River at the base of "A" Mountain near downtown Tucson in 1904.



Picture of the old arroyo just downstream from present-day KERP, 1961.

Summer rains come fast and hard, and desert soils are incapable of absorbing more than a small percentage of this rainfall. Rain that's not absorbed into the soil very quickly begins to run laterally across the ground surface, gathering speed and force as it flows downhill. Urban development – pavement in particular – aggravates the situation.

Less than 100 years ago, the area south of downtown Tucson was a broad mesquite-lined wash surrounded by creosote desert that stretched largely unbroken to the south, east and west of the city.

As Davis-Monthan Air Force Base grew and the city expanded to the east, more of the desert was inevitably covered by rooftops and pavement. Paved streets and runways offered less resistance to the rainwater that fell in the east and began flowing downhill more rapidly.

For example, the National Weather Service ranks an August 9, 1945, storm as one of the top ten weather/climate stories to impact Tucson in the last century:

Thunderstorms with heavy rain overflowed the banks of an ordinarily dry wash on Tucson's south side. Floodwaters washing down this normally dry wash tore a 15-foot gap in the bridge on Benson Highway. Four automobiles plunged into the raging torrents where ten people were drowned while four others struggled out of the floodwaters.

US Army Corps of Engineers®

Flood control became a priority and in 1948 the area's first major flood control project, the Tucson Diversion Channel, was authorized. The long concrete and earthen channel collects rainwater beginning near the northwest edge of Davis-Monthan, northwest of Alvernon Way and Golf Links Road, and along its length across Tucson's south side, dumping it into the Santa Cruz River southwest of the Interstate 10/Interstate 19 interchange.

The channel did an effective job of collecting and directing water from the Air Force base, but significant flooding downstream from the base led to the next major project in the area. The U.S. Army Corps of Engineers constructed the Ajo Detention Basin in 1966 in the present-day site of KERP to collect water from the diversion channel northwest of Country Club Road and Ajo Way. The $6 million project resulted in a bare, flat-bottomed pit about 90 acres in size – essentially a mud flat with volunteer scrub trees and grasses growing along the edges.

In 1999, Congress authorized construction of the Tucson (Ajo) Detention Basin Environmental Restoration Project to 1) continue flood control, 2) harvest and store for irrigation use stormwater that would have previously seeped or evaporated from the unlined basin, and 3) establish or reestablish natural habitat representing Arizona's southwest riparian environment throughout the detention basin.

Construction of KERP began in 2000 and was completed in 2001 at a total cost of approximately $11 million. The project was funded by the U.S. Army Corps of Engineers and Pima County Regional Flood Control District ($6 million local share).

The final footprint of KERP covers 141 acres and includes constructed stream courses, five vegetation-lined ponds, restored native vegetation communities, flood control structures, and a recreational path that surrounds the basin.

Aerial photograph of KERP looking south.

The project included installation of approximately 850,000 square feet of rubberized liner under the ponds and constructed stream courses. The project also includes a 6-acre, 50-foot-deep, cement-lined, water harvesting basin used to collect and supply the storm water used for irrigation.

The streams are fed by an elaborate stormwater recirculation system, and these streams support over 30 acres of open water ponds, emergent wetlands, ephemeral cienegas, stream courses, and mesquite bosque (bosque is a Spanish term meaning forest). This riparian, or river-supported, area is surrounded by nearly 100 acres of upland vegetation communities.

Kino Sports Complex - Pima County Stadium District maintains the basin in partnership with the Pima County Regional Flood Control District and the Regional Wastewater Reclamation Department. Basin managers work closely with state and federal agencies to ensure KERP meets the state and federal guidelines set forth for the reestablishment and restoration of natural habitat.

Routine monitoring and treatment of mosquitoes is done to protect public safety. Management to remove non-native invasive plant and animal species (e.g. buffelgrass, bullfrogs) helps to conserve urban native species diversity. Treated effluent is purchased from the City of Tucson to supplement irrigation needs of riparian vegetation when stormwater is unavailable.

The project won the 2006 U.S. Army Corps of Engineers Chief of Engineers Award of Excellence for Environmental projects. According to the Corps, "*This is truly an exceptional project. It takes an existing mud flat in an arid area and creates aesthetic landscapes, recreation features, flood control, and is a prototype for water harvesting. It is technically sophisticated while appearing natural. It has proved sustainable over the recent drought years.*"

THE BENEFITS

Kino Evironmental Restoration project was designed and constucted for ecosystem benefits in a flood contol basin, but the project provides additional economic and public restoration benefits.

Flood Control Benefits

On September 15, 2011, 2.64 inches of rain was recorded at Davis-Monthan. More than 16,000 gallons per second of stormwater was flowing from the Tucson Diversion Channel into KERP.

But because KERP is able to temporarily detainover 400 million gallons (1,230 acre-feet) of stormwater, the outflow westward into the Tucson Diversion Channel was reduced by over a third to less than 10,250 gallons per second.

During a 100-year storm KERP is designed to reduce the peak flow rate of from 85,260 gallons per second to 35,840 gallons per second.

Had KERP and a series of other detention basins constructed over the years, including the Rodeo, Kolb Road, Arroyo Chico and Cherry Field detention basins, not been in place on September 15th, "...there would have been significant flood damage in developed Tucson, including the downtown area," Pima County Administrator Chuck Huckelberry said in a September 22, 2011, memo to the Board of Supervisors.

HARVESTED STORMWATER

Year	Gallons
2002	39,099,480
2003	28,349,074
2004	10,003,639
2005	21,147,758
2006	0*
2007	21,489,902
2008	31,234,361
2009	0**
2010	28,847,627
2011	16,363,011
2012	11,988,074
2013	41,322,247
2014	48,674,288

** Maintenance operation issues*
*** Lack of rain and stormwater*

Water Harvesting Benefits

Water harvesting involves collecting runoff for productive purposes. It is an ancient practice: native people used water harvesting techniques to capture runoff for farming in southern Arizona at least a thousand years ago.

KERP differs from most other water harvesting projects by capturing runoff from a stream channel, rather than directly from rooftops or paved areas.

KERP captures and directs runoff from a 17.7 square mile watershed into a large system of lined basins. Upon draining after a basin-filling flood event, KERP retains over 114 million gallons (350 acre-feet) of water in the constructed ponds. This harvested water is then available for irrigation needs.

Economic Benefits

KERP'S key objectives include the harvesting of stormwater to improve ecosystem function and meet surrounding irrigation needs. Stormwater is harvested and recirculated through the stream courses in the basin to support environmental benefits. Stormwater is also diverted and used to irrigate the Kino Sports Complex ball fields, other turf, and landscaping at University Medical Center South, Herbert Abrams Public Health Center, Sam Lena Park, and the Public Defenders, Juvenile Court, and Adult Probation buildings along Ajo Way.

An annual average of 64 acre-feet of excess stormwater is harvested for the sports complex and other surrounding area landscape irrigation needs. In addition, the vegetation and habitat amenities in KERP are sustained by an annual average of 200 acre-feet of stormwater.

If not for use of reclaimed water and storm water that flows into the project, the KERP basin, sports complex, and nearby landscape would be irrigated with potable water. Based on the value of potable water calculated at the commercial rate, the use of stormwater has provided taxpayers a cumulative savings of $4.16 million dollars since project construction. It is projected that the $6 million local share of the KERP construction cost will be paid off by 2018.

Public Recreation Benefits

Proposals to add recreational features to the Ajo Detention Basin came within a decade of its completion. A master plan prepared by Pima County and the U.S. Army Corps of Engineers resulted in the constuction of Sam Lena Park in 1986. Sam Lena Park has two lighted softball fields, a basketball court, nine ramadas with grills, public restrooms and drinking fountains.

Later developmment included trails from Sam Lena Park to Interstate 19, and a 2.2-mile paved path encircling the KERP basin for walking, jogging, bicycling, and wildlife viewing.

In 1997, Kino Sports Complex, the largest professional sports and entertainment venue of its kind in Pima County, was constructed near the basin. It includes the 11,000-seat Kino Veterans Memorial Stadium. Pima County recently completed converting the complex north of Ajo Way into six soccer fields, which can also be used for other grass sports. This redevelopment includes the 2,900-seat North Stadium, which is home to the FC Tucson soccer club.

Kino Sports Complex and Sam Lena Park facilities are managed by the Kino Sports Complex - Pima County Stadium District, and are available for youth, high school and collegiate sports, social gatherings, concerts, and community events.

The Loop

KERP and Kino Sports Complex are also on The Loop, more than 100 miles of paths around metropolitan Tucson with links to Marana and Oro Valley, for Pima County residents and visitors on foot, bikes, skates and horses. The Loop connects the Rillito River Park, the Santa Cruz River Park, the Julian Wash Greenway, the Harrison Greenway and the Pantano River Park.

SAM LENA PARK

HERBALIFE
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KINO SPORTS COMPLEX AREA MAP

KINO SPORTS COMPLEX AREA MAP

KERP is embedded within a complex of sports facilities, municipal service buildings, and health services facilities, most notably the UA Medical Center-South Campus, which serves residents south of downtown Tucson.

Environmental Benefits

KERP provides open water plus both riparian and upland plant communities. A riparian habitat is made up of the plants and animals associated with streams and rivers. In the desert these areas are important to many wildlife species. Eighty percent of Arizona's wildlife species utilize or depend upon the resources of riparian areas. The terrain in KERP, visible from a paved walkway around the perimeter, has several different environments and plant communities:

Open Water

In ponds and lakes, open water is the habitat found beyond the shallow water and plants of the shore. Diving ducks feed in open water, seeking out water insects, snails and aquatic plants. Four species of native toads utilize the ponds including the Great Plains toad, the Great Plains Narrow-mouth toad, Couch's Spadefoot toad, and Sonoran Desert toad. Sustainable populations of native aquatic invertebrates provide natural mosquito control. Open water birds to look for are Mallard, Northern Shoveler, Ringnecked Duck and the Belted Kingfisher.

Marsh

Marsh vegetation communities are found in wetlands, where land meets water at the edge of a pond, lake or river. Wildlife thrives in wetland habitat because of the abundant water and the cover provided by wetland plants like reeds and cattails. Migratory waterbirds rely on wetlands as stopover points during their long journeys in the spring and fall. Wetland birds to look for are the American Coot, Red-winged Blackbird, Great Blue Heron and the Black-necked Stilt.

Cottonwood Willow

Riparian trees like cottonwoods, ash and narrow-leaf willow depend on abundant near-surface water available in the river bottoms and banks. Birds to look for in this lush habitat are the Wilson's Warbler, Black Phoebe, Song Sparrow and the White-winged Dove.

Mesquite Bosque

A dense stand or "forest" of mesquite trees is called a bosque. Mesquite trees are especially adapted to our dry climate, sending taproots down as deep as 150 feet to reach water during times of drought. Mesquite bosques provide shade and shelter for wildlife and other plants. Mesquite seeds are rich in protein and are an important food source for many animals. Mesquite bosque birds to look for are the Gila Woodpecker, Ladder-backed Woodpecker, Vermilion Flycatcher and the White-crowned Sparrow.

Grassland

This habitat contains native grasses and small herbaceous plants. It provides forage, nesting and cover for reptiles, small mammals, birds and insects. Grassland birds to look for include Burrowing Owls plus various finches and sparrows.

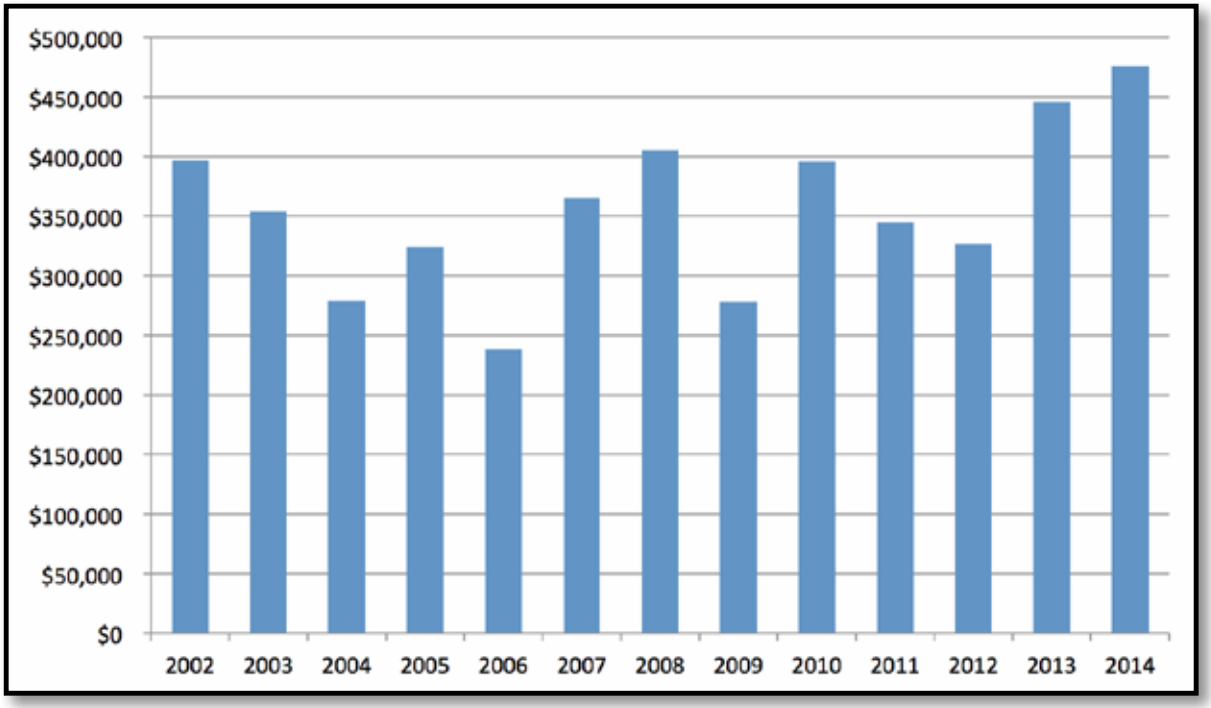
Arizona Uplands

Tucson is located in the Arizona Upland Subdivision of the Sonoran Desert where Palo Verde trees, saguaro, cholla and prickly pear cacti are common. Desert birds nest and forage within the protection of these thorny plants, and other animals like javelina, jackrabbits and desert tortoises feed on the cactus pads and fruit. Arizona Upland birds to look for are the Red-tailed Hawk, Gambel's Quail, Curve-billed Thrasher, Cactus Wren and the Greater Roadrunner.

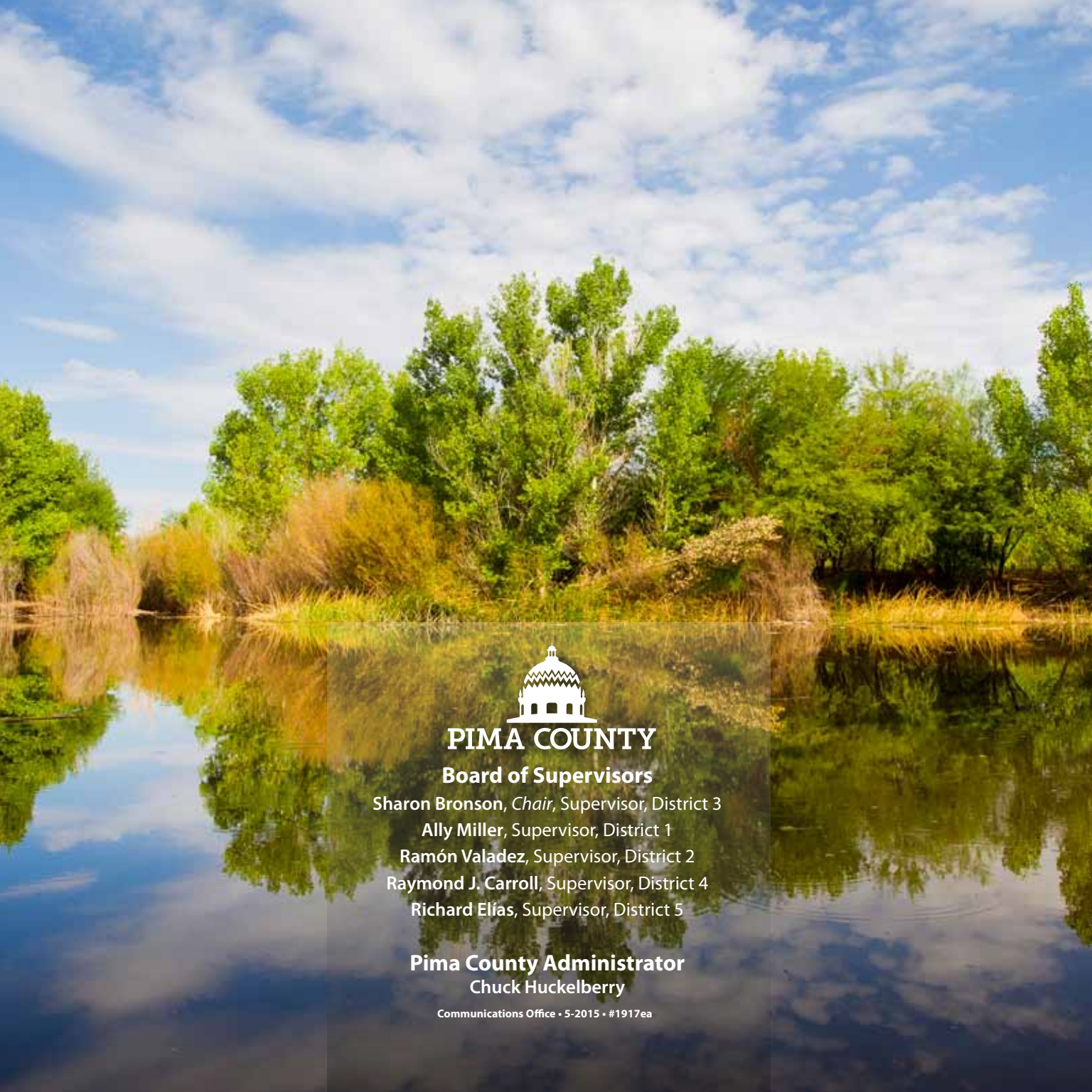
CONCLUSION

After its completion in 2001, the Ed Pastor Kino Environmental Restoration Project had effectively modified the existing Ajo Detention Basin by integrating a harvested stormwater storage component capable of sustaining native habitats for wildlife, plus providing irrigation for Kino Sports Complex and other landscaping needs. So successful are KERP's water harvesting and restoration features that they serve as an example for future stormwater harvesting projects.

In many ways, KERP reflects the changing needs, vision and sophistication of the citizens of eastern Pima County and planners who brought together the multiple goals of flood control, wildlife habitat, recreation, sports, cost savings and environmental stewardship. Realizing these multiple objectives was an important departure from earlier visions such as the Ajo Detention Basin with its single purpose (flood control). Like The Loop trail that is connecting multiple sections of recreation paths throughout the greater Tucson area into a single path, KERP, too, has proven that integration and connection can create something that is much larger than the sum of its parts. Given limited space within an increasingly urbanizing environment, projects that meet multiple needs such as KERP will become increasingly needed and successful, greatly benefiting our community and our environment.



Stormwater used in and harvested from the KERP basin has saved taxpayers an average of $350,000 per year in irrigation costs (calculated at the commercial potable rate).



PIMA COUNTY

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