

Pima County
**MULTI-SPECIES
CONSERVATION PLAN**
2018 Annual Report



March 1, 2019

Submitted to the U.S. Fish and Wildlife Services, Southwest Region in partial fulfillment of Incidental Take Permit: TE-84356A-0

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Cover photo: Santa Catalina Mountains from Six Bar Ranch, photo by Brian Powell.

Cover species: Mexican long-tongued bat, Sonoran desert tortoise, lowland leopard frog



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1 Introduction

Pima County’s Section 10(a)(1)(B) Incidental Take permit (herein Section 10 permit or permit) for the Pima County Multi-species Conservation Plan (MSCP; Pima County 2016) was signed by the Pima County Administrator on July 13, 2016. This report is prepared for the U.S. Fish and Wildlife Service (USFWS) under Incidental Take permit #TE84356A and covers the time period January 1 through December 31, 2018.

Most of the activities discussed in this annual report occur on lands managed or regulated by Pima County and/or Pima County Regional Flood Control District (RFCD), the two permittees under the Section 10 permit. (Pima County and RFCD are herein referred to collectively as “Pima County” unless otherwise noted).

The permit area is located within Pima County, Arizona (Figure 1). Land ownership in Pima County is primarily tribal, federal and state trust land (Figure 2).

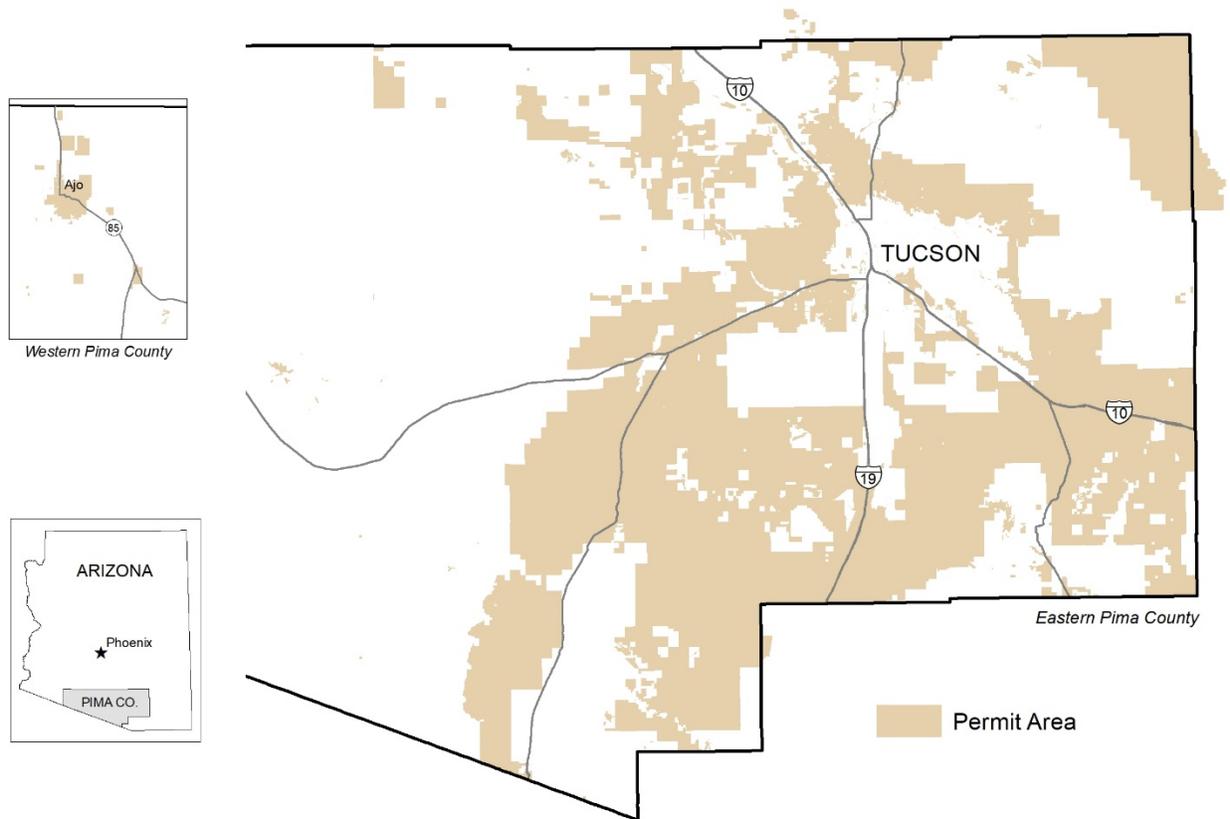


Figure 1. 2018 Permit Area of Pima County’s Multi-species Conservation Plan.

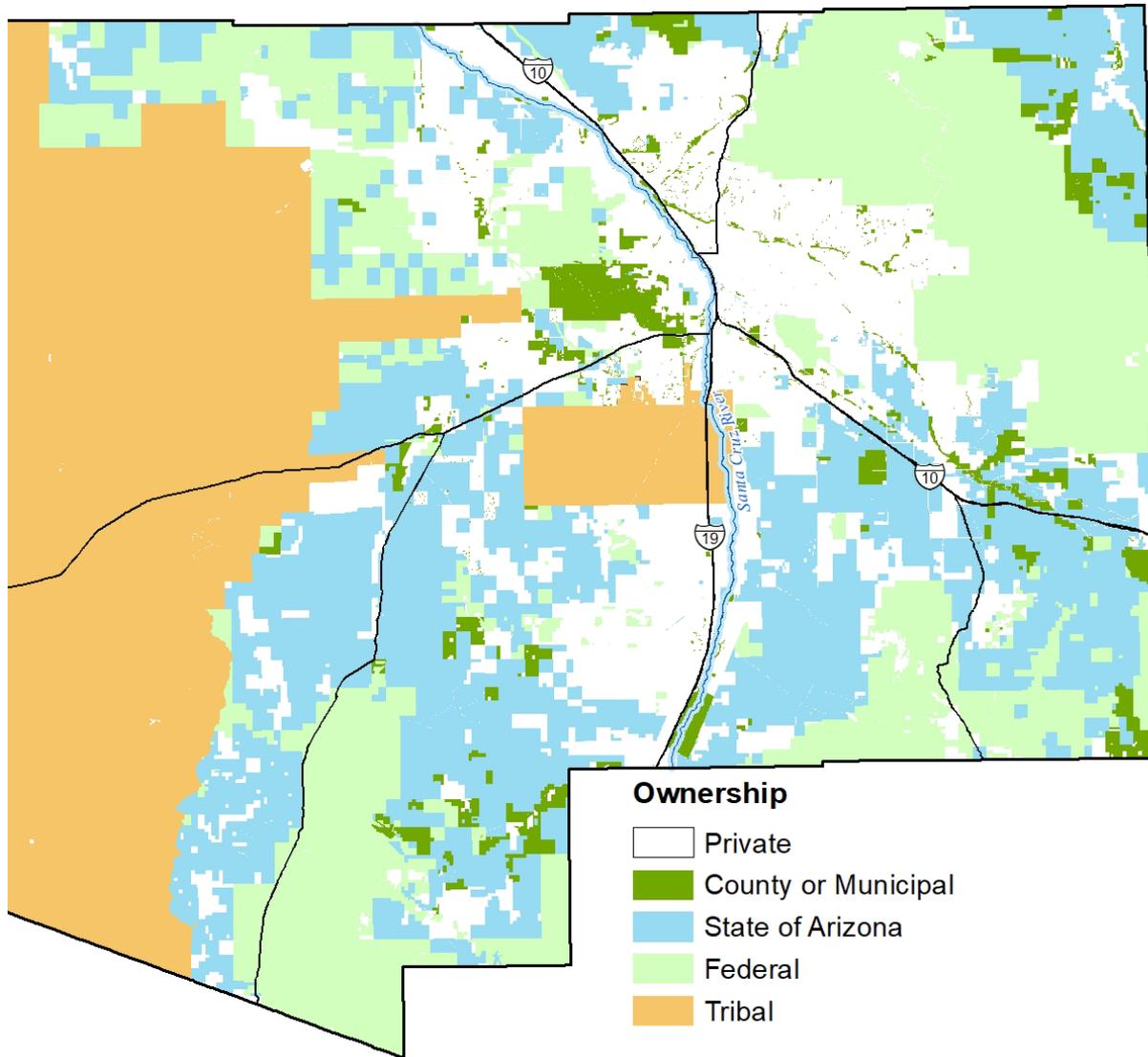


Figure 2. Land ownership in eastern Pima County, as of December 31, 2018. See Figure 3 for location of changes in land ownership during the reporting period.

Annual reporting is required under the terms of the permit. The primary purposes of this annual report, as described in Chapter 9 of the MSCP, are to:

1. Quantify impacts of Covered Activities and mitigation for these impacts;
2. Provide updates on the implementation of the MSCP; and
3. Inform the decision-making process if conditions of the permit or Implementing Agreement are not being met, or when adaptive management is needed.

The format of this report follows the template in the Appendix P of the MSCP. A glossary of terms and acronyms (Pages 60-62) is included to assist the reader and ensure consistency between this document and the MSCP.

2 Permit Changes

No amendments to the MSCP or permit language changes occurred during the reporting period.

3 Administrative Changes

3.1 Permit Area

The Permit Area represents the area within which Covered Activities could occur and has changed slightly during 2018 (Figure 3)—as compared to its description in the MSCP—for the following reasons:

- Annexation has the effect of slightly reducing the Permit Area in which coverage of private activities would become available. Annexations are shown in blue in Figure 3.
- Federal land acquisitions (red in Figure 3) reduce the permit area. Private land acquisitions of state trust land (green in Figure 3) reduce the permit area.

The permit area also includes locations where Covered Activities by the Permittees occur, principally on the potential mitigation lands in other counties and where the Permittees work in incorporated areas. In 2018, Pima County acquired land in Pinal County.

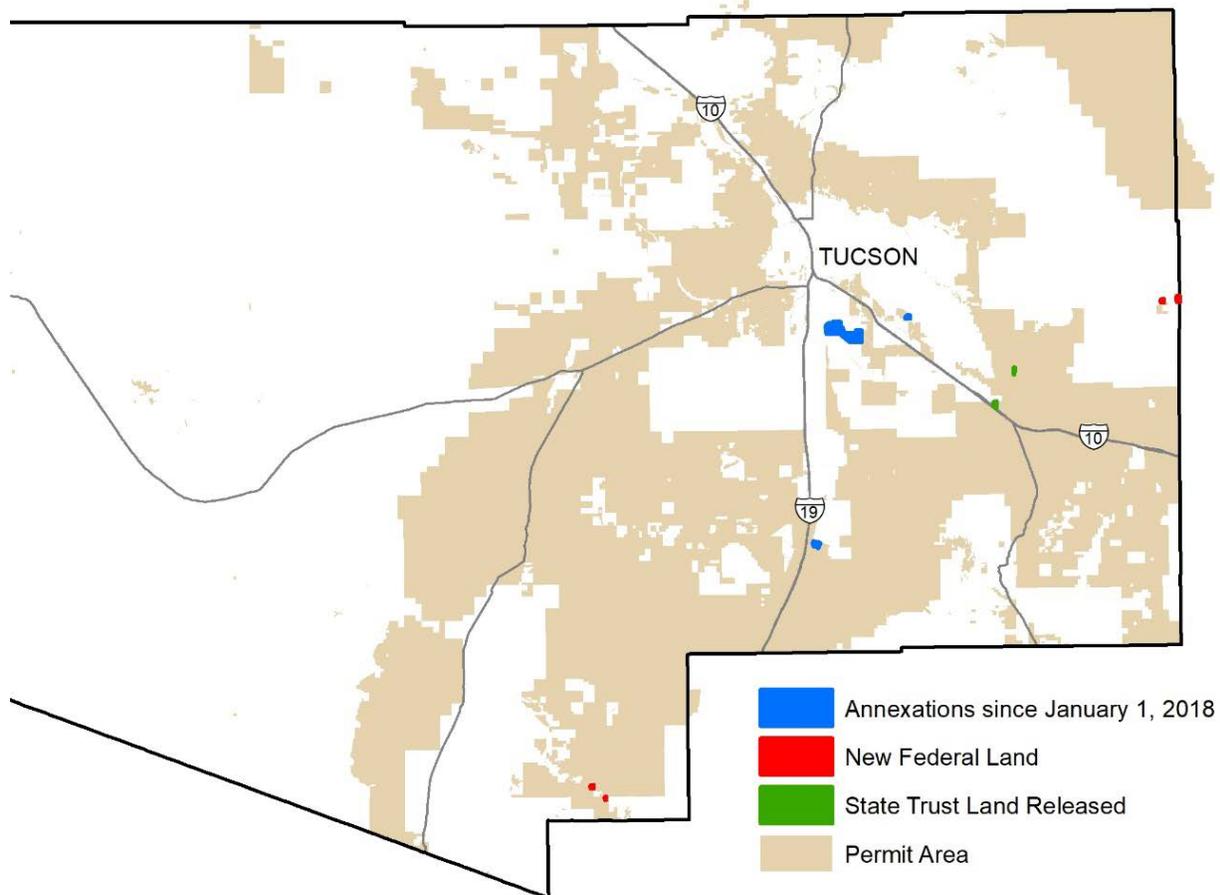


Figure 3. Permit Area changes for Pima County’s Multi-species Conservation Plan, January 1 through December 31, 2018. Annexations and a federal land acquisition slightly diminished the Permit Area extent; state land released to private development increased it near Vail.

3.2 Land Protection

Restrictive covenants were not added to potential mitigation lands during 2018. Potential mitigation lands are discussed further in Chapter 10.

3.3 Army Corps of Engineers Programmatic Consultation

Pursuant to the programmatic consultation with U. S. Army Corps of Engineers (Corps), Pima County worked with the USFWS and the Corps streamline Endangered Species Act compliance for the 18 nationwide and regional general Clean Water Act permits listed in the MSCP. The USFWS, Corps, and Pima County agreed to report annually on the status of Corps permits issued in relation to the Section 10 permit. The report is included in Appendix 1. The reporting process is still being worked out with the Corps, but in general, it lists the status of projects where the Corps issued a Section 404 permit contingent on the MSCP. In 2018, the Corps did not issue any 404 permits for projects that relied on this streamlined process (Kevin Grove, Michael Cabrera, personal communications to Julia Fonseca).

3.4 Miscellaneous Administration Items

- There were no changes to habitat models or Priority Conservation Areas.
- The Lesser Long-Nosed Bat was removed from the federal list of Endangered and Threatened Wildlife due to recovery actions. The bat will continue as a covered species under this plan.
- The Sonoyta mud turtle is proposed for critical habitat. This is not a covered species and there is no potential for take in the permit area.
- There were no information requests in 2017 by the USFWS to Pima County for the purpose of assessing whether the terms and conditions of the permit are being met.
- USFWS staff reviewed the draft Bingham Management Plan and provided comments, which have been addressed in the current version (Appendix 2).
- USFWS concluded Pima County does not need a 10(a)(1)(A) permit for use of topminnow as vector control, as they are already permitted under the MSCP.
- USFWS clarified that Pima County is no longer required (as specified in incidental take permit TE84356A-0) to obtain a special use permit under the Migratory Bird Treaty Act. A December 22, 2017 Solicitor's Opinion now holds that the take of a migratory bird, its nest or eggs due to incidental (and otherwise lawful) activities does not violate the MBTA.
- USFWS determined there are no additional regulatory requirements pertaining to covered species for the District's activities in Santa Cruz River habitat of topminnow. The USFWS requested to be advised if potential effects to covered species could be reduced through salvage and relocation, or the temporary holding of animals (see Appendix 3).
- USFWS advised that the permanent educational display of Gila topminnow at County facilities such as Agua Caliente Park is a covered activity under the MSCP (personal communication from Scott Richardson to Brian Powell, October 3, 2018).
- For approved adjustments to ecological monitoring, see Chapter 7
- USFWS advised that Pima County may move Pima Pineapple Cactus salvaged from one County-owned property to another County-owned property without additional federal permits or monitoring obligations (personal communication from Julie Crawford to Julia Fonseca, Feb. 22, 2018). The local office would appreciate any follow-up information on how transplants fare.

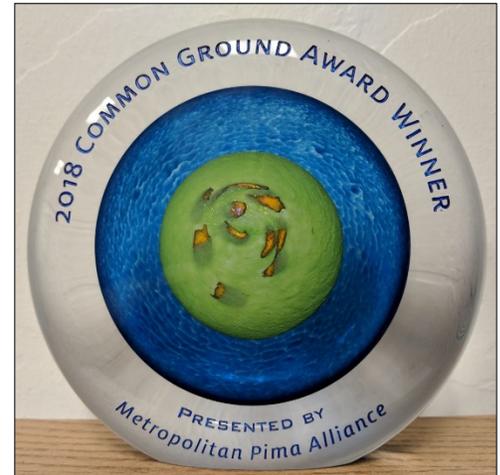
4 Incidental Take

This section describes incidental take caused by the covered activities identified in the MSCP. As noted in section 3.7.1 of the MSCP, incidental take is determined by acres of habitat loss and reported take of individuals.

4.1 Certificates of Coverage - Development on Private Land

The Certificate of Coverage Program (www.pima.gov/S10PrivateLand) affords the developer of a home, subdivision, commercial, or industrial project an opportunity to comply with the ESA for activities that are permitted by the County. Participation in the program is voluntary and in the sole discretion of the private developer. A total of 151 projects have been authorized to receive coverage since the program began in 2017. Authorization for incidental take remains in effect for six years from the date of issuance; coverage is granted when project grading is complete. To date, no certificates have expired and a total of 58 projects have received coverage.

In 2018, 44 projects received coverage subsequent to completion of grading (Table 1, Figure 4) resulting in a loss of approximately 156 acres of habitat.



The Certificate of Coverage Program won the 2018 Metropolitan Pima Alliance Common Ground “Programs and Policies” Award, which honors “programs that have made significant contributions toward bridging divides and finding solutions to complex challenges in creative ways.”

Table 1. Certificates that provided permit coverage for private development in 2018, Pima County.

Certificate of Coverage #	Actual Habitat Loss Acreage
P17CC00010	34.17
P17CC00011	3.34
P17CC00021	7.71
P17CC00023	1.65
P17CC00028	0.91
P17CC00029	5.01
P17CC00030	3.48
P17CC00031	1.09
P17CC00032	3.79
P17CC00033	4.05
P17CC00034	4.81
P17CC00035	2.17
P17CC00038	1.46
P17CC00039	1.01
P17CC00040	1.42
P17CC00042	1.05
P17CC00043	3.08
P17CC00044	1.49
P17CC00050	1.64
P17CC00051	2.44

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P17CC00052	0.72
P17CC00053	3.73
P17CC00054	4.90
P17CC00055	3.38
P17CC00057	1.35
P17CC00062	1.03
P17CC00065	1.30
P17CC00066	0.92
P17CC00068	3.49
P17CC00069	4.26
P17CC00070	1.61
P17CC00072	0.95
P18CC00001	1.56
P18CC00002	4.11
P18CC00007	3.47
P18CC00009	1.64
P18CC00010	3.79
P18CC00012	1.10
P18CC00013	4.20
P18CC00014	4.39
P18CC00016	9.63
P18CC00017	4.14
P18CC00019	1.01
P18CC00030	3.33
TOTAL	155.76

4.2 County Capital Improvement Projects

There were 47 County Capital Improvement Program (CIP) projects covered by the permit in 2018 (Appendix 4). Of these, four required mitigation and these are shown on Figure 4. Many of the covered projects listed in Appendix 4 did not cause ground disturbance, and others occurred in the built environment where no mitigation is required. A County CIP project is reported as a Covered Activity whenever it is determined to be “substantially” complete, which is after most of the earthwork is done, but prior to completion of all activities such as landscaping and payment of invoices. Covered Activities also include non-CIP projects and activities that occurred in various locations throughout the permit area but these are not required to be listed each year in the annual report.

Appendix B of the MSCP describes the methodology used to calculate take for Covered Activities. For the impacts caused by the County, this involves tracking the location and size of areas altered by CIP projects. The tracking process for CIP projects has been in place for several years and requires the submittal of Geographic Information System (GIS) “polygons” which describe the location and aerial extent of completed projects. This tracking process is discussed in greater detail in Section 5.2 of this report. Private sector impacts are tracked using a combination of Accela and ArcGIS. GIS acres, not survey data, are the basis for impact acreages.

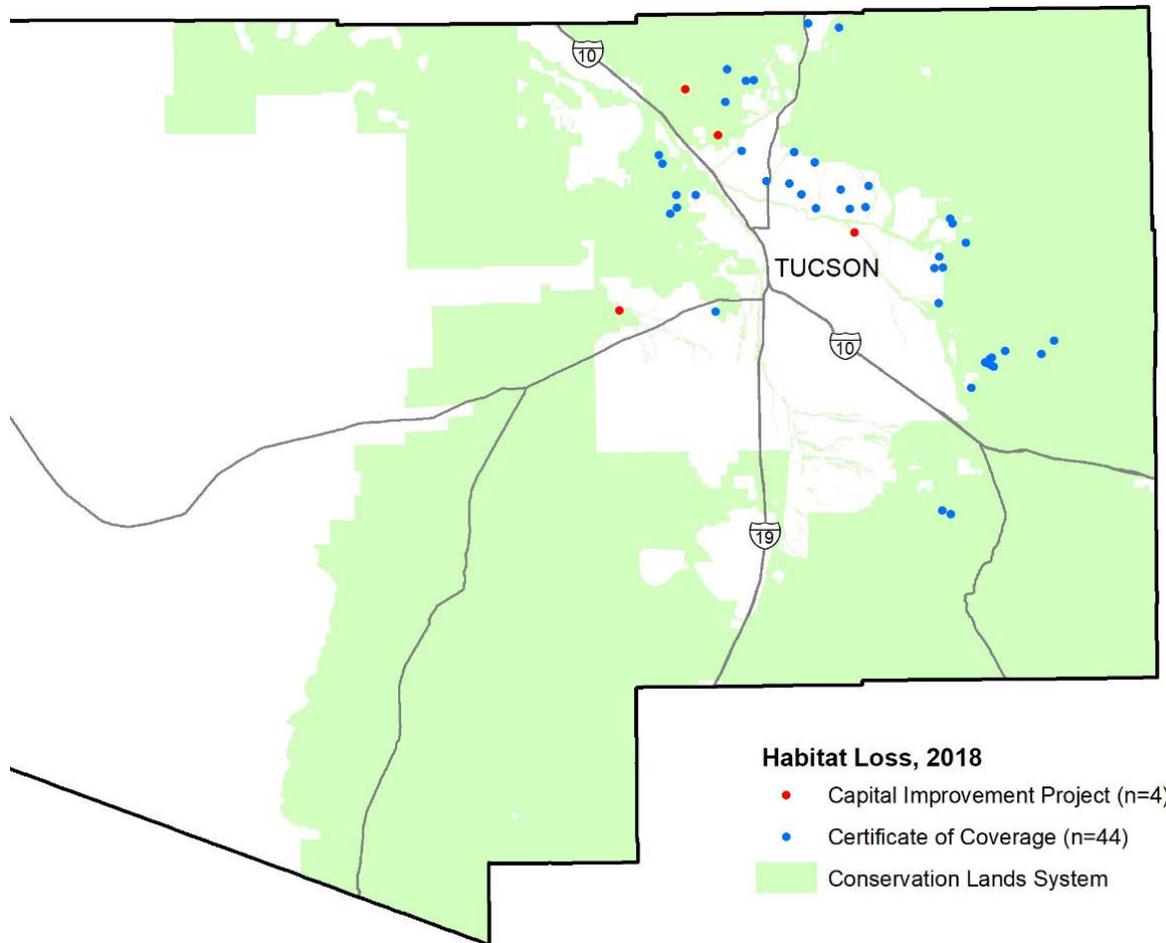


Figure 4. Location of habitat loss due to Covered Activities, January 1- December 31, 2018. Locations are enlarged for clarity. All ground-disturbing County Capital Improvement Program (CIP) projects outside the built environment so none required mitigation. Private projects may elect coverage through the Certificate of Coverage program, and each such project receives mitigation.

The built environment layer used for tracking impacts is not always accurate, and this resulted in the need to discuss how to do impacts tracking for several park projects with USFWS. Parks are often a mixed of developed and natural areas. In 2017, activities at Agua Caliente and Canoa Ranch parks affected developed area and USFWS agreed that they did not require mitigation. As part of the landscape pattern protocol, Pima County intends to present a comprehensive update of the built environment based on the 2016 Land Use-Land Cover mapping by Regional Flood Control District that would provide a more accurate and comprehensive basis for CIP impacts tracking in the future.

4.3 Covered Activities Impacts

Polygons for ground-disturbing CIP projects that were substantially completed on or before December 31, 2018 were used to calculate impacts. The project polygons were checked to ensure ground disturbance was correctly identified. The list of ground-disturbing projects was then screened to eliminate any on federal or tribal lands, as these impacts are not covered under the permit. The remaining projects were intersected with the Built Environment GIS

layer (known as [CIPBUILT](#)). Those portions outside the built environment, or federal or tribal lands, were then intersected with the Maeveen Marie Behan Conservation Lands System (CLS) to determine the habitat loss, as described in Appendix B of the MSCP. Each CLS category has a specific mitigation ratio that is used to calculate the MSCP mitigation obligation (as described in Section 4.3.1. of the MSCP).

In 2018, four ground-disturbing CIP projects (Figure 4; Appendix 4; totaling 75.0 impact acres) required the County to provide 343.9 acres of CLS mitigation. The largest project requiring mitigation this year was the Tangerine Road project. Private sector impacts required 630.6 acres of mitigation.

Table 2 summarizes the total acres of impact for both CIP and private development, along with the CLS category and mitigation ratios applicable to these impacts. There was 230.8 acres of loss in 2018; consequently, Pima County will provide 974.4 acres of mitigation to compensate for impacts occurring in 2018.

Table 2. Habitat loss and associated mitigation ratios for 2018, Pima County MSCP.

CLS category	Habitat Loss Acreage	Mitigation Ratio	Mitigation Obligation
Biological Core	73.0	5:1	364.9
Important Riparian Area	23.6	5:1	117.7
Multiple Use Management Area	47.2	3:1	141.5
Special species management area (outside other categories)	58.7	5:1	293.6
Outside the CLS	28.4	2:1	56.7
Total	230.8		974.4

5 Conservation Measures

5.1 Avoidance and Minimization

5.1.1 Changes to Ordinances and Standards

In 2018, there were no changes to avoidance and minimization measures as described in Section 4.2 of the MSCP.

5.1.2 Certificate of Coverage-Native Plant Preservation Streamlining

In 2018 Pima County developed a procedure that allows private developments to rely on a Certificate of Coverage to streamline compliance with certain provisions in Pima County Code 18.72 – Native Plant Preservation. Specifically, this procedure allows the Pima pineapple cactus (PPC), needle-spined pineapple cactus (NSPC), and Huachuca water-umbel (HWU) mitigation the County provides for a private development project receiving a Certificate of Coverage to be used as off-site mitigation for purposes of complying with the Native Plant Preservation Ordinance (NPPO). Under this new procedure, private developments will be allowed to rely on a Certificate of Coverage to serve as off-site mitigation for purposes of fulfilling replacement and supplemental PPC, NSPC, or HWU, consistent with the NPPO requirements (Section 18.72.090.B).

One private development utilized this new procedure in 2018, the Sycamore Vista (formerly “New Tucson”) development. The developer obtained two authorized Certificate of Coverages (P18CC00042 and P18CC00043) for two phases of the development and relied on those to meet mitigation obligations under the County NPPO requiring replacement and supplemental PPC. The developer was further allowed to rely on those Certificates to meet mitigation obligations for PPC as required under the development’s existing Clean Water Act Sec. 404 permit (Permit No. SPL-2002-00992-KAT), per an agreement with USFWS and the Army Corps of Engineers.

5.2 CIP Screening and Reporting Process

No substantive changes in the CIP screening and reporting process occurred in 2018, however additional trainings were held to ensure project managers comply with procedures for close-out polygons. The screening process notifies CIP project managers of the intersections between proposed project locations, site-specific natural resources, and protected areas in order to promote avoidance and minimization during planning. The Pima pineapple cactus Priority Conservation Area, burrowing owl Priority Conservation Area, potential bat habitat under bridges, and the need for floodplain compliance are specifically included. A new enhancement allows project managers to view past CIP projects relative to proposed CIP projects.

Advice on avoidance and minimization for individual projects is provided by environmental compliance personnel in various County departments, and by Office of Sustainability and Conservation as requested.

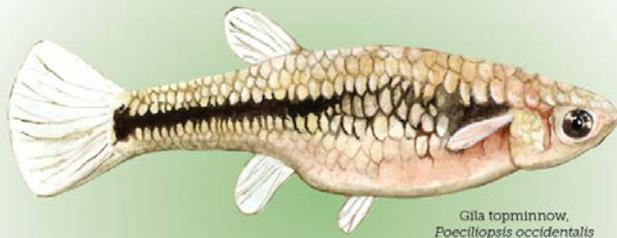
5.3 Gila Topminnow for Vector Control

In 2017, County staff began using Gila topminnow for vector control, as outlined in section 3.4.1.2.1 of the MSCP. In 2018, only one “green pools” or cisterns was stocked with Gila

topminnow by the Health Department (Figure 5, Appendix 5), as homeowners have been treating or otherwise draining their pools. Several others were evaluated, but found inappropriate due to limited volume or oily water. Health Department received several calls from pool owners who would like to obtain the topminnow, but upon contact, the homeowners wanted the fish to place in their fish tank or ponds that already had gold fish or Gambusia fish in them.

Placement of topminnow is subject to numerous requirements intended to ensure the topminnow do not inadvertently escape from the swimming pools and other contained, mosquito-ridden water bodies where Health Department staff may place them. For example, topminnow are not placed in washes or locations that may overflow into washes. There is no obligation for the owner who accepts fish from the Health Department to feed or maintain the fish, and take is reported when the animals are stocked at the site.

Fish at Work!



This neglected pool has been treated with fish to control mosquito breeding.

Do not put chemicals in the water!

If you need to correct the pool or have questions, call 520-724-7908 or visit pima.gov/health



3950 S. Country Club Road, Suite 100 • Tucson, AZ 85714

Figure 5. Health Department placard used on fetid pools that are treated with topminnows.

Pima County is the first Health Department in the state to use the Gila topminnow, and another county has expressed interest in utilizing the species as a tool for reducing the threat of mosquito-borne diseases. During 2018, David Ludwig presented on the topic at the 2018 Vector Conference in Maricopa County. Health Department has also promoted the topminnow at Tucson Meet Yourself and other community events.

5.4 Riparian Avoidance and Minimization Measures

The RFCD reported a substantial increase in the number of riparian habitat reviews over last year. Last year 1745 reviews occurred versus 2292 for 2018. Of these, 95.8% of the applicants avoided impacting regulated riparian habitat. In other words, there were 2,196 instances of avoidance of regulated riparian habitat impacts. There were 81 minimization actions, where impacts were limited to less than 1/3 of an acre disturbance. Fifteen (15) instances required riparian mitigation in addition to minimization.

5.5 Other Avoidance and Minimization Measures

- The Priority Conservation Area for the Pima pineapple cactus is shown on the Sonoran Desert Conservation Plan Mapguide as required by the MSCP.
- No weed ordinance letters or violations were issued on MSCP or potential MSCP mitigation lands.
- Two hundred and forty-nine (249) weed and trash ordinance letters were sent to private property owners this year.
- Five buffelgrass advisement letters were issued. None of the complaints were regarding any County or RFCD-managed potential mitigation lands.

5.6 Mitigation and Allocated Lands

To compensate for the take of Covered Species, Pima County allocates credits as described in Appendix B of the MSCP. Land that has become allocated is known herein as Mitigation Land. Bingham Cienega Natural Preserve, located along the San Pedro River was the County's first Mitigation Land property. This year, credits from additional lands in the Bingham Planning Area have been allocated, along with credits from allocated lands in the Cienega Natural Preserve (Figures 6 and 7).

The number of acres of credits available is determined by the Mitigation Land's acreage and the level of legal protection that the property has. When Mitigation Land is owned in fee title (as opposed to owning partial rights or a grazing lease), the property acreage is eligible for 100% credit.

The inventory of potential mitigation lands and where allocations have occurred are represented in Figure 6 and in [MSCPPORT](#), a GIS layer that summarizes the diverse portfolio of lands which may be used for credit under the MSCP. (This layer may now be viewed in greater detail by the public on the [SDCP Mapguide](#) site.) Appendix 6 provides a parcel list of lands allocated so far.

The CLS designations are an index to an area's biological value and are used to ensure the quality of Mitigation Land is of equal or higher value than the land where take occurred (see

Appendix B and page 49 of the MSCP for more information). The Bingham allocations are primarily Important Riparian Area and is also a CLS-designated Special Species Management Area. The deeded lands allocated in the Cienega Creek Natural Preserve are primarily CLS-designated Important Riparian Areas and Biological Core. The new allocations provides habitat for many different covered species than were available in the Bingham Planning Area alone.

The credits for deeded lands allocated at Bingham and in Cienega Creek Natural Preserves exceed the mitigation obligation for take for 2016-2018 (Table 3), therefore the mitigation obligation has been satisfied. The 2016-2018 CLS obligations are summarized in Table 4. CLS obligations for Multiple Use and Outside of CLS can be met by any higher categories, such as Biological Core, Important Riparian Area, or Special Species Management Areas. Bingham is primarily Important Riparian Area, but the Cienega Creek offers a wider array of CLS categories, including Special Species Management Area.

Allocations trigger a timeline for management plans. The Bingham Management Plan is completed and is discussed further in Section 6 of this report. A new management plan will be prepared for the Cienega Creek Natural Preserve and its environs by March 1, 2021.

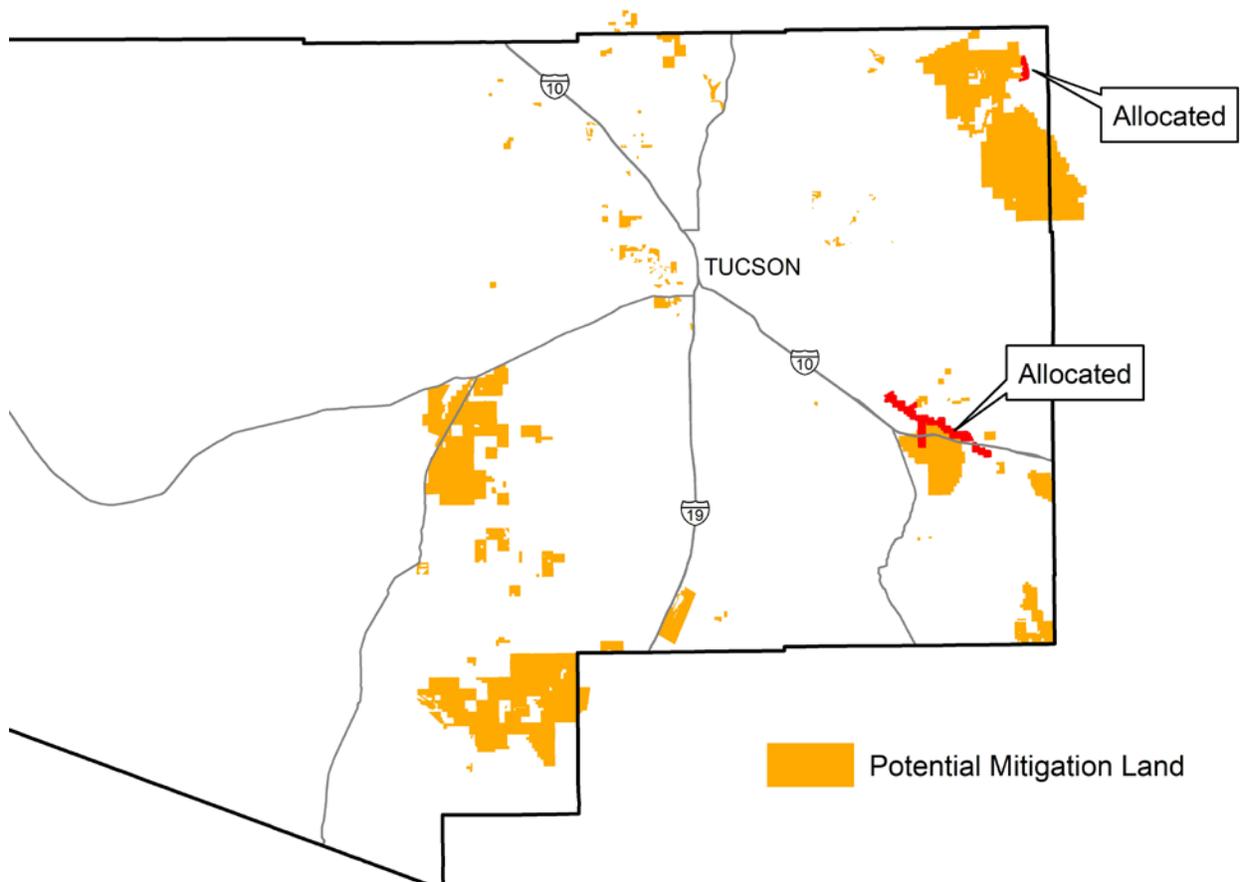


Figure 6. Location of all mitigation lands allocated under the MSCP to date. These areas consist of the Bingham Planning Area and the allocation of the Cienega Creek Natural Preserve, shown in relation to other potential mitigation lands managed by Pima County.

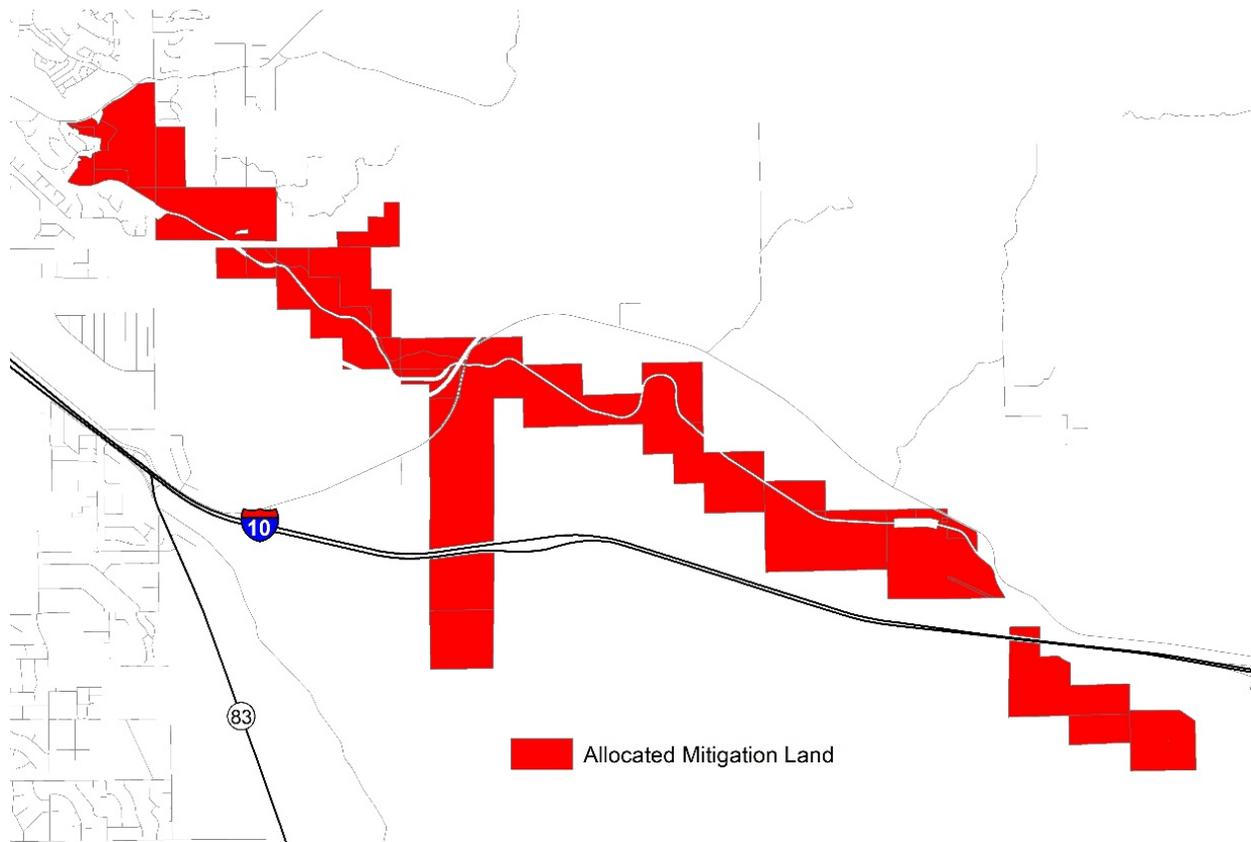


Figure 7. Detail of the allocation of Mitigation Land in the Cienega Creek Natural Preserve to offset take that occurred during the 2018 Section 10 permit reporting period. The allocation outlined in blue does not include a small parcel of land under the Colossal Cave bridge (not visible at this scale).

Table 3. Mitigation credits obligated and allocated for the Pima County MSCP by year

Year Obligated	Mitigation Obligation	Mitigation Allocated
2016	52.6	267.0
2017	171.7	0
2018	977.3	4140.5
Total (to date)	1201.6	4140.5

Table 4. Cumulative CLS mitigation credits obligated and allocated for the Pima County MSCP.

Category	CLS Obligation	Cumulative Allocation
Biological Core	404.7	2059.2
IRA	215.1	2122.3
Multiple Use	159.0	223.4
Outside	129.1	2.7
SSMA on MU or Outside*	293.6	0
TOTAL (to date)	1201.6	4407.5

*These obligations are met with any combination of Biological Core, IRA, or SSMA.

As part of the 10-year review, Pima County will review the habitat equivalency for individual species (as discussed in MSCP Section 4.3.3.) such that a minimum 1:1 ratio of habitat loss: acres of mitigation will be maintained for each Covered Species.

No replacement of lost mitigation credit was needed in 2018.

5.6.1 Water Rights in Relation to Mitigation Lands

The restrictive covenants for the deeded Mitigation Lands limit the kinds of uses to which water can be put by the County, and prohibit increased levels of surface water or groundwater use by County without permission from USFWS and others.

A portion of the new allocations of land in the Cienega Creek Natural Preserve are located in the Tucson Active Management Area, an area where groundwater uses are subject to regulation. Pima County holds some groundwater rights on the allocated properties.

Pima County has a policy of managing water rights on County land and to do this, Pima County has a process to assure that water right claims are transferred to the County or RFCDD upon acquisition of a property. Water rights quantify amounts and uses to which surface waters may be placed, and identify priorities in times of shortage. There are a number of historic water claims and other uses which Pima County inherited with land acquisitions.

Pima County and the District are participating in the adjudication of water rights in the Gila River watersheds, along with many other parties in the state. The San Pedro watershed is being adjudicated first. The Sands and the Clyne ranches, County-owned MSCP lands, are located at the very top of the Babocomari watershed, a major tributary to the San Pedro River. In 2017 and 2018, the Special Master accepted the County's stock pond and stockwatering claims for both ranches into the court's catalog of proposed water rights for the watershed.

The affected claims have now migrated from their former status as "claims", to their present status as water rights proposed by the Special Master for confirmation in the Gila Adjudication. While this is a favorable development, it needs to be mentioned that there are tens of thousands of other such claims that the court needs to address before anything approaching a final decision can be expected.

For the claims the County and RFCDD own in the San Pedro River watershed and the Santa Cruz River watershed, efforts are ongoing to correct the location, the claimed uses, and the consumption data at sites where historic claims affect MSCP lands in the Edgar, Buehman, and Peck watersheds, and along the San Pedro mainstem. Pima County will continue to protect our water rights at Bingham Cienega and other potential mitigation lands in the San Pedro watershed through participation in the San Pedro Adjudication, and through appropriate filings in the Gila Adjudication with ADWR and the Maricopa County Superior Court. The County Attorney's Office monitors new requests for surface water appropriations for threats to the County's own water rights, and continues to research the availability of additional pre-Statehood water rights claims to bolster the County's legal standing defense in the Adjudication.

6 Land Management

Land management actions on allocated lands must be reported annually. Therefore, this section summarizes management activities at Bingham Cienega Natural Preserve, our first allocated Mitigation Lands (see Section 5 of this report). Because of the importance of land management—and of the many actions Pima County is undertaking to promote sound stewardship of our extensive portfolio of mitigation lands—this section will also highlight key management actions and initiatives that impact this broader suite of conservation lands.

6.1 Park Designations

There were no new park designations on existing or potential mitigation lands in 2018.

6.2 Inspections for Restrictive Covenants

During 2018, ALWT reviewed biennial inspection reports submitted in 2017. The reviews were completed satisfactorily. The biennial inspection reports filed in 2017 identified an encroachment on one of the potential mitigation lands owned by the RFCD in Avra Valley. In 2018, the District addressed this encroachment. ALWT's reviews of biennial inspection reports provide an additional safeguard to USFWS's enforcement power under the restrictive covenants.

6.3 Land Management Activities and Planning: Allocated Lands

Pima County is required to report on management activities that took place on all allocated mitigation lands. As noted in Section 5, Bingham Cienega Natural Preserve is the first property to be allocated, and therefore, management actions and planning actions there will be the primary focus for this report. However, many other management practices have taken place on County-controlled lands that have an impact on Covered Species. Those actions will also be briefly reviewed.

6.3.1 Bingham Cienega Natural Preserve (Preserve)

The Preserve was established by RFCD in 1989 and is located on the west side of the San Pedro River, just north of Redington, Arizona and the confluences of Buehman, Edgar, and Redfield canyons. The Preserve historically provided habitat for threatened and endangered species such as the Huachuca water umbel and the Southwestern willow flycatcher.

The Preserve was originally purchased because of the Arizona ash-dominated Cienega and associated spring flows. Early management efforts focused on restoring abandoned farmlands with sacaton grass, mesquite and other native species. Site conditions changed significantly over the years as a result of drought and groundwater pumping outside of the Preserve, leading to a decline in groundwater levels at the Preserve that was documented in 2016 for the permit baseline.

6.3.1.1 Bingham Management Plan

Allocation of the Preserve in March 2017 triggered a two-year window to develop a management plan to be completed on or before March 1, 2019. The planning area (Figure 8), which includes portions of the M Diamond Ranch west of the San Pedro River Road, is larger than the area allocated in 2016 for mitigation in order to accommodate future allocations.

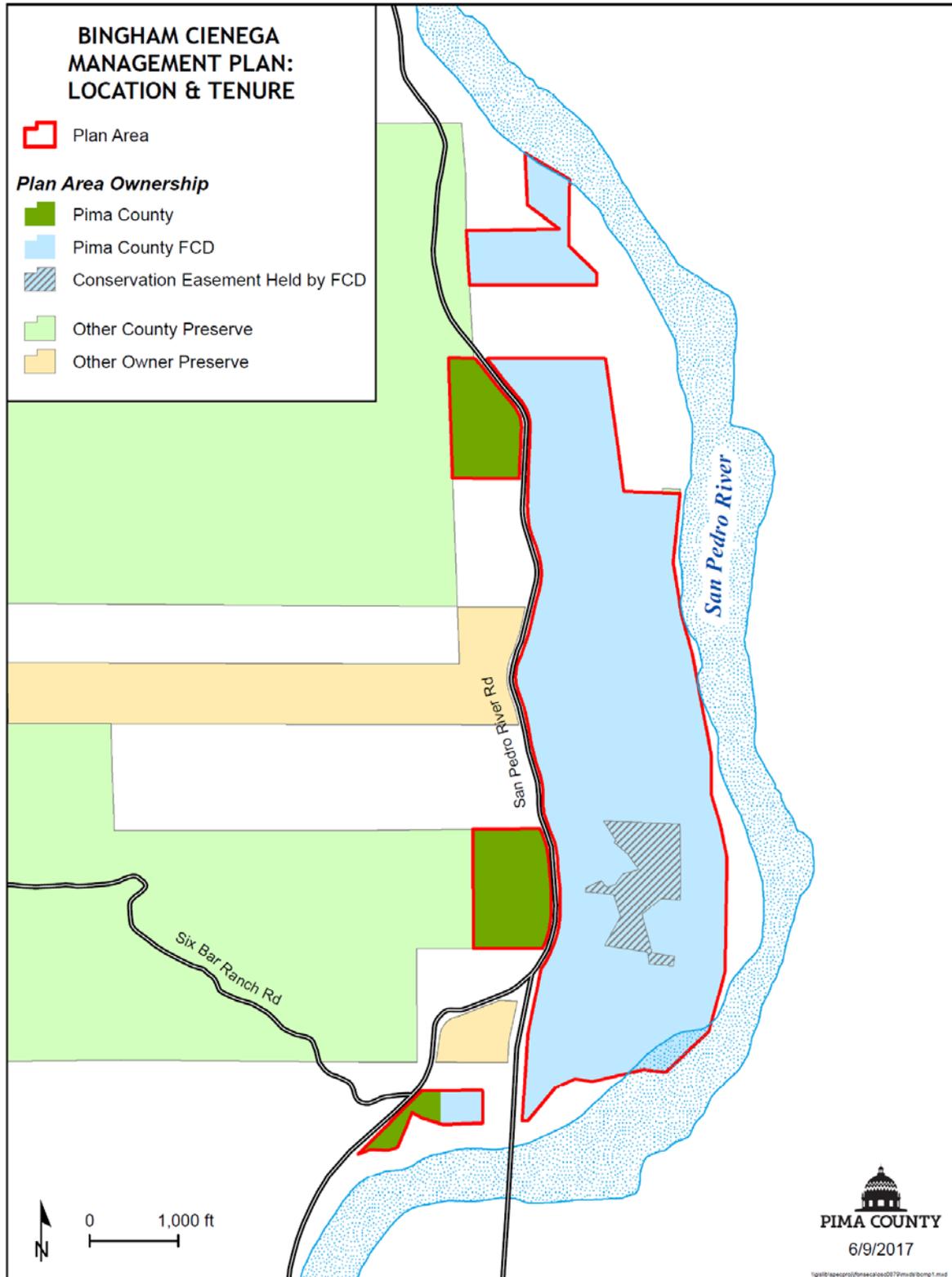


Figure 8. Map of the 405-acre Bingham management planning area. The 19-acre life estate (shown in hatched) is included in the management plan area, as well as the entire 267 acres of the Bingham Cienea Natural Preserve.

In 2018, USFWS, RFCD, and Pima County reviewed various drafts of the Management Plan. The draft plan was revised to address USFWS comments and is included as a final document in Appendix 2.

One of the principal planning needs was to prepare for the end of the life estate. The life estate land, includes a residence, an orchard, a pond, and ancillary agricultural lands and structures. Although it is not allocated as mitigation land, its use can affect the mitigation lands that surround it. The life estate inholding is subject to a conservation easement held by The Nature Conservancy (cross-hatched on Figure 8). The end of the life estate will trigger a need for cooperative action between Pima County and the RFCD to provide maintenance of the homestead. The management plan provides two principal alternative futures for the homestead, although hybrids are also possible: either an M Diamond Ranch personnel will occupy the home, or a non-ranch caretaker. Either way, we recommend that the resident be obligated to provide stewardship services for the 19-acre inholding, if not a larger area.

The plan provides potential opportunities for the rancher to use various facilities, including the pond, within the 19-acre inholding. One important limitation to future agricultural and ranch use in the inholding is the water budget. Under the terms of the restrictive covenant, the water budget may not be increased above the baseline set in 2016.

The water table in the area has been declining for many years and seems to be related to a lack of natural recharge and pumping outside the planning area. The declining water table represents a major planning uncertainty. While goals and objectives have been drafted around the current conditions, we ultimately have no control over climate conditions and offsite pumping. Our draft strategies emphasize improving the health of watersheds around the planning area, in particular M Diamond and Six Bar ranches, and understanding the effects of the pumping regime on areas upstream and adjacent to the Preserve along the San Pedro River.

The Preserve was once home to the Huachuca water umbel and lowland leopard frog, two covered species in the Section 10 permit. The Arizona Game and Fish Department also introduced the long-fin dace to the natural wetlands on the property. The lowered water table eliminated natural habitats for these species a decade ago. The pond in the life estate is maintained by groundwater pumping for sport fishing and irrigation, and is not allocated as mitigation. The non-native fish inhabiting the pond minimize native aquatic species potential, and while lowland leopard frogs have historically been observed in the pond, these individuals are likely prevented from successfully reproducing/colonizing this water body due to predation by the nonnative fish. After the life estate is completed, the pond could be managed for native species in concert with meeting ranch goals, or alternatively, we might provide covered species habitat at or near the former springhead. Either alternative would require continued groundwater pumping given the groundwater trends.

The last two decades of drought represent a period of elevated fire risks in the Preserve Planning Area. Arson and utility lines previously caused fires at the site in 2006. Past actions to reduce fire risk included installation of water-supply standpipe, clearing of the utility line, widening and extending existing fire lanes, and removing deadfall at the former springhead to

protect the nearby residence and improve access for fire suppression. Although no fires have occurred recently, the risks remain high. Restrictions on recreational access to the property, education of the new caretaker, and maintaining firebreaks are the principal strategies for reducing risk, along with the potential for targeted grazing of lands owned by RFCD to reduce fire fuels. We propose incorporating fire management strategies into a larger, multi-partner plan in the future.

Past activities and associated data for the Preserve is extensive, and includes restoration activities, hydrologic models and data, and a previous set of management plans, workplans, and fire management plans. However, many of these documents are outdated relative to current conditions. Also, relatively little was known about the other newly acquired properties within the planning area. Thus the focus of the planning team's work in 2018 has been to continue and initiate new studies of the plan area.

Work started in 2017 to document vegetation community extent and condition, and an update to the flora checklist is expected to be completed in 2019. Cultural Resource surveys were completed in 2018.

Oral interviews from the Kelly family are also informing the management planning. The Kelly's ran the M Diamond Ranch from their Bingham Cienega homestead prior to the sale of the ranch to Pima County in 2012, and currently maintain the 19-acre life estate parcel. In addition, and as part of a larger cultural resources outreach effort, the County is consulting with Native American tribes about the cultural significance of the property.

Staff has identified a number of conservation targets for the plan, and is discussing management objectives for each:

- Shallow groundwater and discharge,
- Tributary streamflow and recharge,
- Mesquite bosque and other distinct plant communities,
- Wildlife connectivity,
- Native aquatic species
- Cultural resources.

6.3.1.2 Management Actions at Bingham

The following are actions that took place at the Preserve through July 2018 (the most current reporting period).

Groundwater level monitoring. Depth to groundwater is measured at two wells on the property and one well just to the west. At all three wells, depth to water decreased an average of 2.5% during the reporting period, thereby showing slightly improved groundwater conditions.

Precipitation. Precipitation was recorded daily at the Preserve. There were 18.0 inches of rainfall recorded during the reporting period, similar to the average from 2007-2017 (17.1 inches; also a drought period), below the average from 1999-2017 (22.8 inches).

Fire management. Prior to permit issuance, changing conditions necessitated that management focus shift from restoration of the farm fields to fire management. Creating, expanding, and maintaining fire breaks (Figure 9) and promoting fire suppression actions—in part to protect the health and safety of the residents in the inholding within the Preserve —began in 2005 and continued as documented in last year’s MSCP annual report. The RFCD and Pima County Natural Resources, Parks and Recreation (NRPR) staff maintain firebreaks at the Preserve. Annual to semi-annual vegetation maintenance for this work includes vegetation clearing along specified routes to approximately 16 feet wide, such that a Type-6 Tinder Fire Response Vehicle may have ready access. Arizona Public Service (utility) previously cleared a 30-foot wide swath within their existing utility easement, and therefore RFCD incorporated this clearing into the maintained firebreaks.

Water Station. In 2018, operational signage was installed at the all-weather water station that was constructed in 2017 in the southern portion of fire unit 6 (Figure 10). The RFCD and NRPR believes annual testing of the water station will be necessary in 2019, since testing wasn’t completed in 2018. No pumped water was discharged for fire response in 2018. The current restrictive covenant language would require any future discharges for this purpose to be reported as a potential violation unless the “[RFCD] Board of Directors determines, based on clear and convincing evidence presented to said Board, is necessary to protect the public health, safety or welfare.” (Section 5.4 MSCP Restrictive Covenants). An update to the 2006 Fire Management Plan is contemplated due to changing condition of the vegetation and fuel-related hazards. Approval of the fire management plan by the RFCD Board of Directors and Supervisors will provide a basis for an exemption.

Fence maintenance. Perimeter fence repairs continued to be a focus in 2018, primarily as a result of falling trees that died due to past wildfires and continuing drought. In 2018, the Arizona Conservation Corp returned to the Preserve for the fourth consecutive year to work on fences and to assist with fire risk suppression efforts.

Remote Cameras. Two remote wildlife cameras were installed by RFCD and NRPR in 2018 for documenting feral pig egress through the site. Feral pigs have been known to utilize the Preserve off and on. Neighboring residential property owner’s work together to eliminate the feral pigs that move up and down the San Pedro corridor. In the early 2000’s there was concerted, yet unsuccessful, efforts to trap feral pigs in the Preserve. There continues to be feral pig sign including tracks, scat, and evidence of rooting in the historic Cienega Spring outflow at its confluence with the San Pedro. Pigs are not known to currently be wallowing in any areas of the Preserve, as they have done in the past. Two photos of pigs were recorded in 2018. RFCD and NRPR staff are discussing options and feasibility to maintain additional remote wildlife cameras.

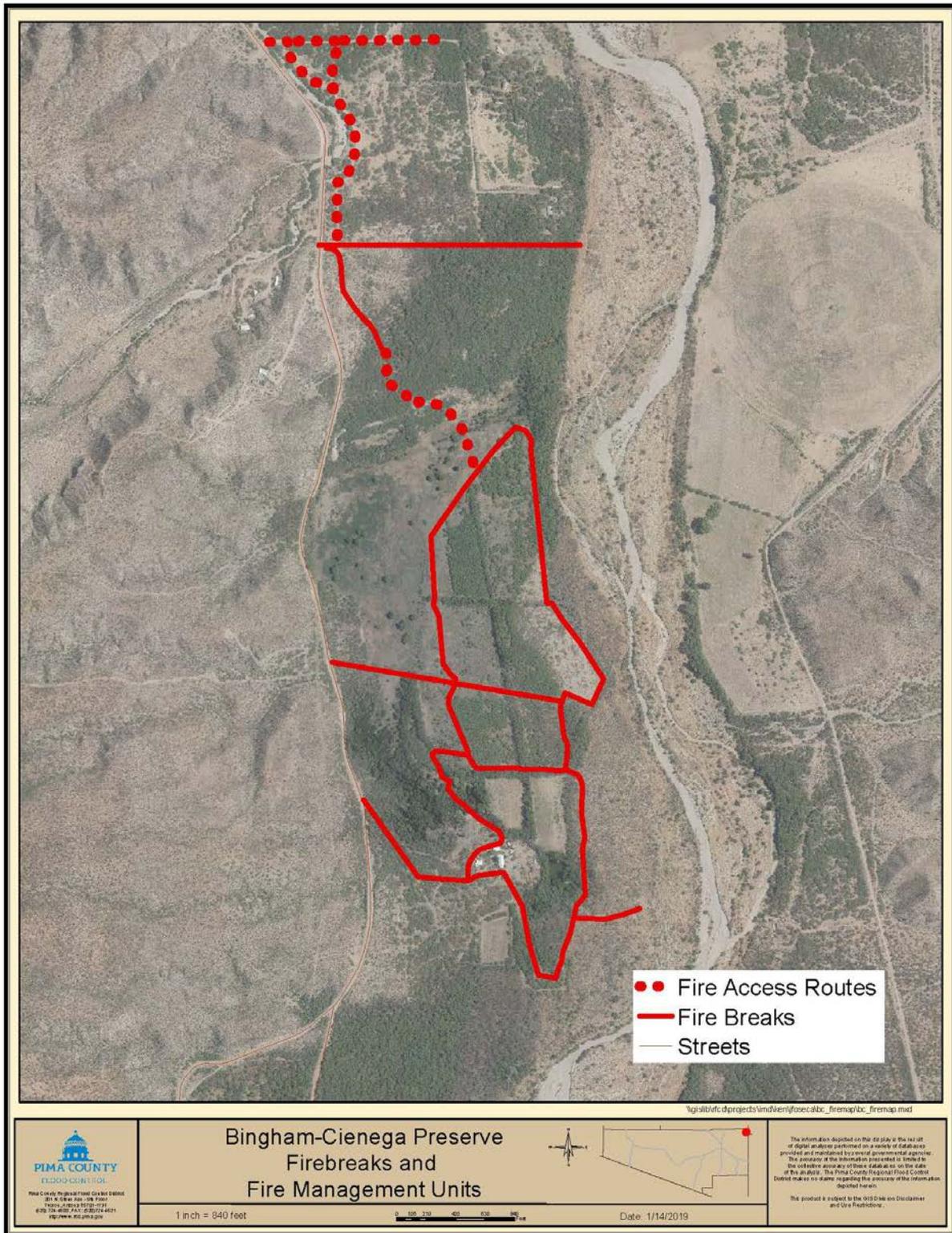


Figure 9. Existing firebreaks and fire lanes in Bingham Cienega Natural Preserve.



Figure 10. All-weather water station installed in 2017 and operational signage installed in 2018 at the Bingham Cienega Natural Preserve.

6.4 Land Management Activities and Planning: Unallocated Mitigation Lands

Staff from three Pima County departments also participate in a wide range of management activities on unallocated lands that help to preserve the value of these lands to Covered Species and their habitats. Key highlights of these management actions are included here, but this is not an exhaustive list.

6.4.1 Land-use Planning

6.4.1.1 Lower Altar Valley Area (LAVA) Resource Management Plan

Pima County is undertaking a landscape-level resource management planning process for the conservation properties in the Northern Altar Valley Reserve (at the northern, or lower, end of the Altar Valley). These include the County's Diamond Bell Ranch, King 98 Ranch, Buckelew, Verdugo, and Madera Highlands properties totaling approximately 37,270 acres (2,185 ac Pima County fee land, 35,085 ac AZ state trust land). Most of these properties are actively managed as working ranch lands, however they host a number of MSCP covered species including most notably dense populations of both Pima pineapple cactus and cactus ferruginous pygmy-owl. Additionally, the Northern Altar Valley Area habitat restoration project (highlighted below) is located within this planning area. The planning effort is being led by NRPR staff, with OSC and RFCD staff assisting as appropriate. The Altar Valley Conservation Alliance is a major partner in this effort, and other stakeholders will be brought into the process once initial goals and objectives are established. This resource management planning process has several goals:

1. Describe the known biological, cultural, and physical resources present within the planning area.

2. Highlight focal areas within the planning area important for different county programs, such as habitat conservation, range management, outdoor recreation, and cultural resource preservation.

3. Designate broad conservation goals and objectives which will inform individual resource management plans (i.e. ranch management plans) and county operations within the planning area.

6.4.2 Invasive Species Control

Pima County has a long history of making significant commitments to controlling invasive species, as evidenced by our being a founding member of the Southern Arizona Buffelgrass Coordination Center. Currently, staff in multiple departments participate in the newly formed Sonoran Desert Cooperative Weed Management Area focus group which provides a mechanism to increase collaboration and funding, exchange information, prioritize management goals, and highlight newly emerging invasive plant species in the region. Focal species for eradication efforts have included giant reed grass (*Arundo donax*), fountaingrass (*Pennisetum setaceum*), saltcedar (*Tamarisk* sp.), and especially buffelgrass (*Pennisetum ciliare*).



Figure 11. The Arizona Conservation Crew removes buffelgrass from the District's Rancho Fundoshi open space property (photo date 3/16/2018).

In 2018, Pima County staff, contractors, and volunteers mechanically removed or chemically treated approximately 1,300 acres of buffelgrass on County preserve lands (Figure 11). Pima County also treated and/or removed buffelgrass from approximately 15 miles of road right-of-ways.

6.4.3 Habitat Restoration Activities

Both the NRPR and RFCD departments have staff focused on habitat restoration activities, and this section highlights several projects that were initiated or completed in 2018.

6.4.3.1 Illegal Dumpsite Cleanup

During 2018, NRPR staff focused efforts on cleaning up rampant illegal dumping across roughly 4,700 acres of State Trust land on the northern part of Pima County's Diamond Bell Ranch. Approximately 90 tons of garbage were removed from these lands, including construction debris, household trash, target shooting debris, landscaping debris, and 205 tires. Additionally, the Pima County Summer Youth Crew removed several 40-cubic-yard dumpsters of trash from the District's Black Wash properties (Figure 12).



Figure 12. Removing illegally dumped trash from Black Wash floodplain (July 3, 2018 photo).

6.4.3.2 Northern Altar Watershed Area Project

Pima County's Northern Altar Valley Watershed Area (NAWA) is a large-scale landscape restoration project aimed at restoring ecological function, native plant cover, and hydrological function on abandoned and degraded agricultural lands on the County's King 98 Ranch. Begun in 2016, this project has so far consisted of two phases, the latter of which is planned for completion in 2019. Collaborating with the Altar Valley Conservation Alliance and the USFWS Partners for Fish and Wildlife program, Pima County has created a series of low dirt berms and installed erosion-arresting rock structures, as well as plowing and seeding with native plants on the upstream edges of the berms. Key successes of this restoration site thus far indicate that the capture, storage, and release of sheet flow was improved, soil erosion was reduced, and native plants responded favorably. During 2018, County staff strategically planted 188 plants from Pima County's Native Plant Nursery to further bolster revegetation of the site. Additionally, County staff worked with the Arizona Conservation Corps to remove invasive vegetation from the site (Figure 13).



Figure 13. Pima County partnered with the Arizona Conservation Corps to remove invasive weeds on the King 98 Ranch agricultural land restoration site. During two weeks in October-November 2018, the Conservation Corps team removed 268 bags of weeds.

Pima County has also partnered with Dr. Joseph Blankinship, a soil biogeochemist from the University of Arizona's Department of Soil, Water, and Environmental Science to test the

potential value of compost and biochar, a charcoal-like substance that is used as a soil amendment, to facilitate native perennial grass establishment and enhance soil health. In 2018, Dr. Blankinship and his lab installed, fenced, and seeded a full factorial design of research plots (in a randomized block design) on a small portion of the NAWA site to study the utility of compost, seeding, and biochar as a landscape restoration tool in the Sonoran Desert. Soil and vegetation assessments will be done annually for five years and will benefit landscape restoration efforts in the Sonoran Desert.

6.4.4 Open-space Infrastructure Mapping

Pima County is using GPS units to map infrastructure and camping use on all of the County's properties, in particular the ranch properties. Four of the County's ranches—including Bingham Cienega Natural Preserve—have been completed thus far. To accommodate this new information, NRPR created a geo-database and standard operating procedures for the collection, storage, and mapping of this information, which is used in development of coordinated resources management plans (see section 5.2 of the MSCP) and to inform the placement of long-term monitoring plots for vegetation and soils (see Appendix Q of the MSCP).

6.4.5 Off-Highway Vehicle Management

Management of off-highway vehicular traffic is a continuing issue. Short-term strategies include specific treatments to prevent OHV abuse of potential mitigation lands and other open space properties (Figure 14). Long-term strategies include planning for motorized vehicular uses on County-owned parcels and ongoing inventories of trails, roads, and campsites on ranches.



Figure 14. Installation of cable and post to prevent OHV access at an open space property along the Pantano Wash (photo date 12/20/2018).

6.4.6 Water Rights Management

Pima County has a policy of managing water rights on County land and to do this, Pima County has a process to assure that water rights are transferred to the County or RFCD upon acquisition of a property.

Pima County is also participating in the adjudication of water rights in the Gila River watersheds, along with many other parties in the state. The San Pedro watershed is being adjudicated first. The Sands and the Clyne ranches, County-owned MSCP lands, are located at the very top of the Babocomari watershed, a major tributary to the San Pedro River. In 2017 and 2018, the Special Master accepted corrections proposed to the records for stockwatering claims.

The affected claims have now migrated from their former status as “claims”, to their present status as water rights proposed by the Special Master for confirmation in the Gila Adjudication. While this is a favorable development, it needs to be mentioned that there are tens of thousands of other such claims that the court needs to address before anything approaching a final decision can be expected.

For the claims we own in the San Pedro River watershed and the Santa Cruz River watershed, efforts are ongoing to correct the location, the claimed uses, and the consumption data at sites where historic claims affect MSCP lands in the Edgar, Buehman, and Peck watersheds, and along the San Pedro mainstem. Pima County will continue to protect our water rights at Bingham Cienega and other potential mitigation lands in the San Pedro watershed through participation in the San Pedro Adjudication, and through appropriate filings in the Gila Adjudication with ADWR and the Maricopa County Superior Court. The County Attorney's Office monitors new requests for surface water appropriations for threats to the County's own water rights, and continues to research the availability of additional pre-Statehood water rights claims to bolster the County's legal standing in the Adjudication.

6.4.7 Adaptive Management

No reported actions

7 Monitoring

The Pima County Ecological Monitoring Program (PCEMP) is a key requirement of the MSCP and while it officially began at the time of permit issuance, many of the elements within this program have long received some degree of monitoring or data collection as important parts of Pima County's Sonoran Desert Conservation Plan (SDCP). The PCEMP's goals include monitoring a variety of parameters that are covered by five basic themes-- species, habitat, landscape pattern, threats, and climate. The MSCP is structured such that the many elements covered by the PCEMP are rolled out in a phased approach. A primary focus during the first few years includes completing first rounds of species monitoring, continuing with basic inventories of County preserves, setting up long-term soils and vegetation monitoring plots (i.e., habitat monitoring), and concentrating on water resources monitoring at springs and streams. The below sections highlight these and other elements accomplished by the PCEMP in 2018.

7.1 Property Inventories and Assessments

County staff continued preserve land property inventories and assessments in 2018, particularly while evaluating the distribution of Sonoran desert tortoises across County lands in advance of the first round of tortoise monitoring during the 2018 monsoon season. During these property assessments, staff record incidental observations of species of interest, threats, infrastructure issues, or other features of interest. Observations related to threats or resource damage were passed along to the appropriate Pima County managing department.

Pima County staff performed 99 individual visits to 31 properties from January through December 2018 (Figure 15). Staff visited Tucson Mountain Park more than any other property, due to Sonoran desert tortoise monitoring efforts (N=43). A key feature of property inventories was the collection of observations on Covered Species. Towards this end, staff made 1,193 separate observations, of which 427 (36%), 304 (25%), and 257 (22%) were of Sonoran desert tortoise, needle-spined pineapple cactus, and Pima pineapple cactus, respectively (Table 5). Staff made observations on 18 of the 32 (56%) vertebrate and plant Covered Species. The Sonoran desert tortoise and the rufous-winged sparrow were found at the most preserves (Table 6; N=11).

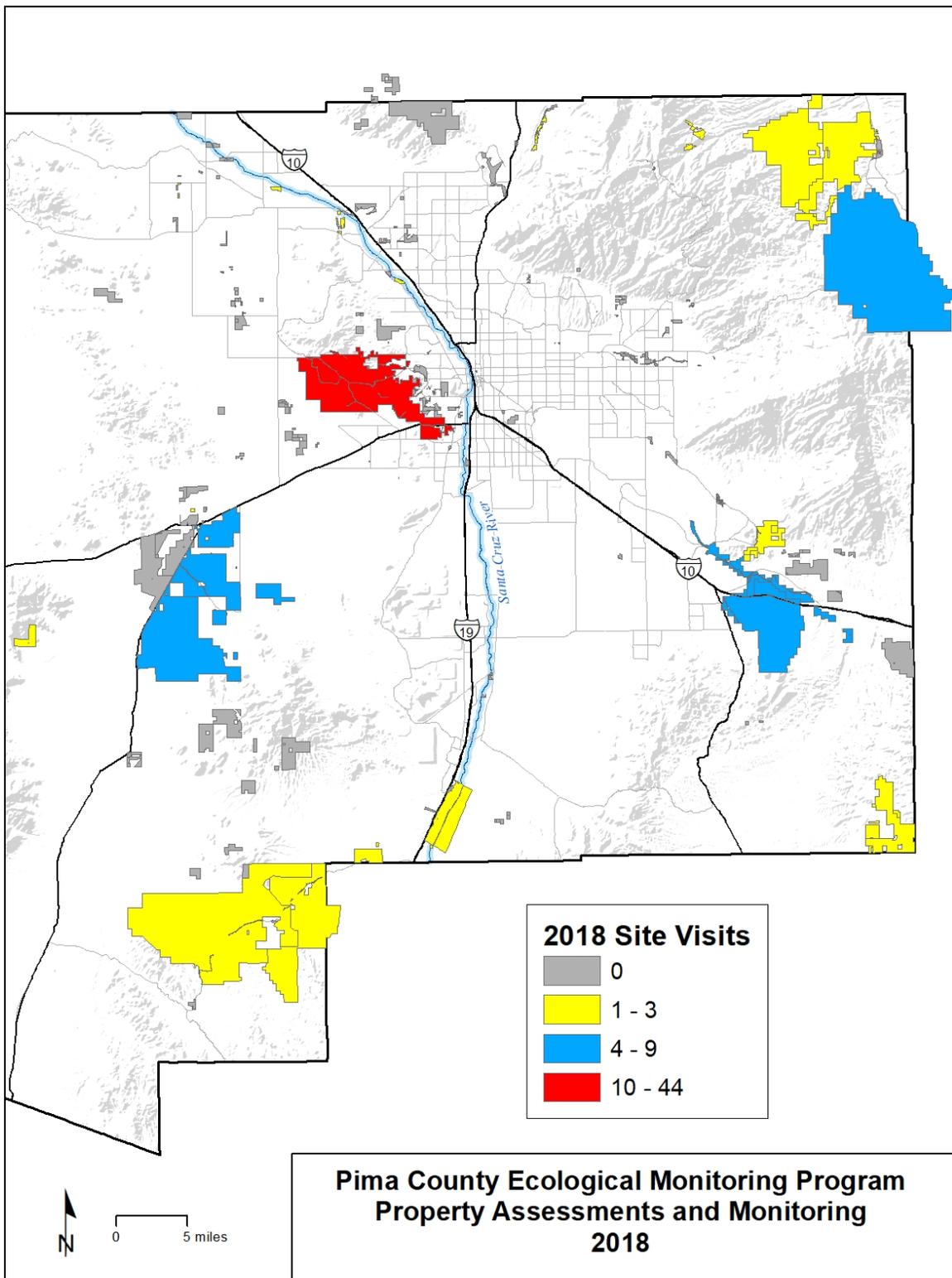


Figure 15. Number of property site visits in 2018 by PCEMP staff. Visits made by other Pima County staff are not reported here. Tucson Mountain Park was visited 43 times during tortoise monitoring efforts.

Table 5. Number of observations of Covered Species, 2018. For many species, the number of observations does not correspond to the number of individuals; however, those data are recorded. For the Sonoran desert tortoise and talussnail, the number of observations includes both live individuals and sign such as scat and carcasses/empty shells. For, Chiricahua leopard frogs, lowland leopard frogs, fishes, and bats, reported numbers represent the number of occupied sites.

Taxon Group	Species	Number of observations
Plants	Huachuca water umbel	0
	Needle-spined pineapple cactus	304
	Pima pineapple cactus	257
	Tumamoc globeberry	6
Mammals	Merriam's mouse	0
	Lesser long-nosed bat	0
	Mexican long-tongued bat	4
	California leaf-nosed bat	3
	Townsend's big-eared bat	3
	Western red bat	0
	Western yellow bat	0
Birds	Abert's towhee	10
	Arizona Bell's vireo	47
	Cactus ferruginous pygmy owl	1
	Rufous-winged sparrow	65
	Southwestern willow flycatcher	0
	Swainson's hawk	0
	Western burrowing owl	0
	Western yellow-billed cuckoo	8
Fishes	Desert sucker	0
	Sonora sucker	0
	Gila chub	6
	Gila topminnow	2
	Longfin dace	7
Reptiles	Desert box turtle	1
	Giant spotted whiptail	0
	Groundsnake (valley form)	0
	Northern Mexican gartersnake	0
	Sonoran desert tortoise	427
	Tucson shovel-nosed snake	0
Amphibians	Lowland leopard frog	9
	Chiricahua leopard frog	2
Invertebrates	Talussnail species	31
Total observations		1,193

Table 6. Covered Species and Pima County properties where each was found in 2018. Includes only those properties where live individuals were found by either county staff or a partner organization (e.g., Tucson Audubon Society) working on a County preserve.

Species	Property	Species	Property
Mexican long-tongued bat	Buehman Canyon Cienega Creek Natural Preserve Colossal Cave Mountain Park	Sonoran desert tortoise	A7 Ranch Agua Verde Creek Preserve Bar V Ranch Diamond Bell Ranch M Diamond Ranch McKenzie Ranch Marley Ranch Old Hayhook Ranch Rancho Seco Six Bar Ranch Sweetwater Preserve Tucson Mountain Park
California leaf-nosed bat	Rancho Seco Tucson Mountain Park		
Townsend's big-eared bat	Colossal Cave Mountain Park Rancho Seco		
Abert's Towhee	Blanco Wash FLAP MHPERP		
Arizona Bell's Vireo	A7 Ranch Buehman Canyon M Diamond Ranch MHPERP Oracle Ridge Rancho Seco Sands Ranch	Lowland leopard frog	A7 Ranch Buehman Canyon Cienega Creek Natural Preserve M Diamond Ranch
Western yellow-billed cuckoo	M Diamond Ranch	Chiricahua leopard frog	Clyne Ranch Sands Ranch
Rufous-winged sparrow	Cienega Creek Natural Preserve Colossal Cave Mountain Park Diamond Bell Ranch FLAP properties Old Hayhook Ranch Rancho Seco Sopori Ranch Tucson Mountain Park	Gila chub	Cienega Creek Natural Preserve
		Gila topminnow	Cienega Creek Natural Preserve
Talusnail species	Buehman Canyon Los Morteros Old Hayhook Ranch	Pima pineapple cactus	Bar V Ranch Diablo Village Estates Diamond Bell Ranch Rancho Seco Sopori Ranch
Tumamoc globeberry	Painted Hills (adjacent to)	Needle-spined pineapple cactus	A7 Ranch Bar V Ranch Cienega Creek Natural Preserve M Diamond Ranch Six Bar Ranch

7.2 Covered Species

The MSCP identified species-level monitoring elements for 15 of 44 covered species (see Appendix Q of the MSCP). PCEMP activities during 2018 that were related to these efforts were divided into two categories: 1) initiation of the first round of required monitoring protocols, and 2) collecting further background information necessary to develop future monitoring protocols.

County staff completed the first round of scheduled monitoring for Sonoran desert tortoise, covered bat species (for cave and mine dwelling covered species), and Chiricahua and lowland leopard frogs. Monitoring was delayed for Pima pineapple cactus (PPC) in lieu of additional property inventory efforts to more completely identify areas of high enough population density to include in a distance sampling frame. Lastly, County staff contributed field support to a Sonoran talussnail research effort in partnership with Drs. Aaron Flesch and Hans Werner-Herrmann from the University of Arizona. The following provides a brief summary of findings from 2018 monitoring efforts, along with a progress update for delayed elements such as PPC. Additional information containing full monitoring protocols and results can be found in respective appendices.

7.2.1 Required Monitoring – first round completed

7.2.1.1 Sonoran Desert Tortoise

Between 2016 and 2018, Pima County implemented a broad inventory effort to identify areas of high Sonoran desert tortoise density on County preserve lands in preparation for the first round of scheduled monitoring in 2018. Staff identified significant tortoise populations in the Tucson Mountains, Tortolita Mountains, and the lower San Pedro River valley. In 2018, Pima County implemented the first round of Sonoran desert tortoise monitoring. In consultation with USFWS staff, Pima County determined that using a parameter based on occupancy protocol to monitor tortoise populations on three County properties in the Tucson Mountains (Tucson Mountain Park, Sweetwater Preserve, and Painted Hills Preserve) would be most effective. Occupancy has been broadly used to monitoring Sonoran desert tortoise populations in the surrounding area, and is more cost-effective than monitoring density, thereby allowing for a better local and regional understanding of tortoise population dynamics over the lifetime of the MSCP. Restricting monitoring efforts to the Tucson Mountains allowed for the maximum allocation of time to monitoring rather than travel, thereby allowing for more monitoring plots to be established and for each plot to be visited more times per monitoring season than more remote sites. Additionally, by locating monitoring plots in this area, Pima County is well poised to be able to investigate potential impacts related to nonnative invasive plants and other impacts related to this preserves juxtaposition with the urban-wild interface. Monitoring surveys were implemented during the monsoon season (July – September), with 20 monitoring plots established, each surveyed three times. Forty-two tortoises were detected across all plots with an additional two incidental detections just off of sampling plots. The County's occupancy study design and field sampling protocol are both outlined in more detail in Appendix 7.

We processed (recorded mass, midline carapace length (MCL), etc.) 40 tortoises (including two individuals found just outside of occupancy plots. These included 11 females, 16 males, and 13 juveniles. We found four tortoises on plots and inside of shelter sites during temperatures that

we considered too warm to safely extricate and process them, and these individuals were not marked or processed. Female and male tortoises did not differ in mass or MCL. Consequently, mean adult mass was 2410 ± 101 g and mean adult MCL was 220 ± 4 mm (Fig. XX). On average, juveniles (individuals < 180 mm MCL) were 624 ± 131 g and 126 ± 11 mm MCL. Maximum adult mass and MCL was 260 mm and 3,350 g, while minimum juvenile mass and MCL was 63 mm and 53 g. Eight of the 40 tortoises voided during processing (4 males, 1 female, and 1 juvenile). Two adult tortoises, on two different plots had overt symptoms of a respiratory infection including wheezing and/or wet/crackly sounding breathing. However, only one of these individuals had nasal discharge. An additional nine tortoises showed mild swelling of the eyelids (sometimes associated with some inflammation of the conjunctiva), but these individuals were generally otherwise healthy in appearance with no other evident symptoms of illness.

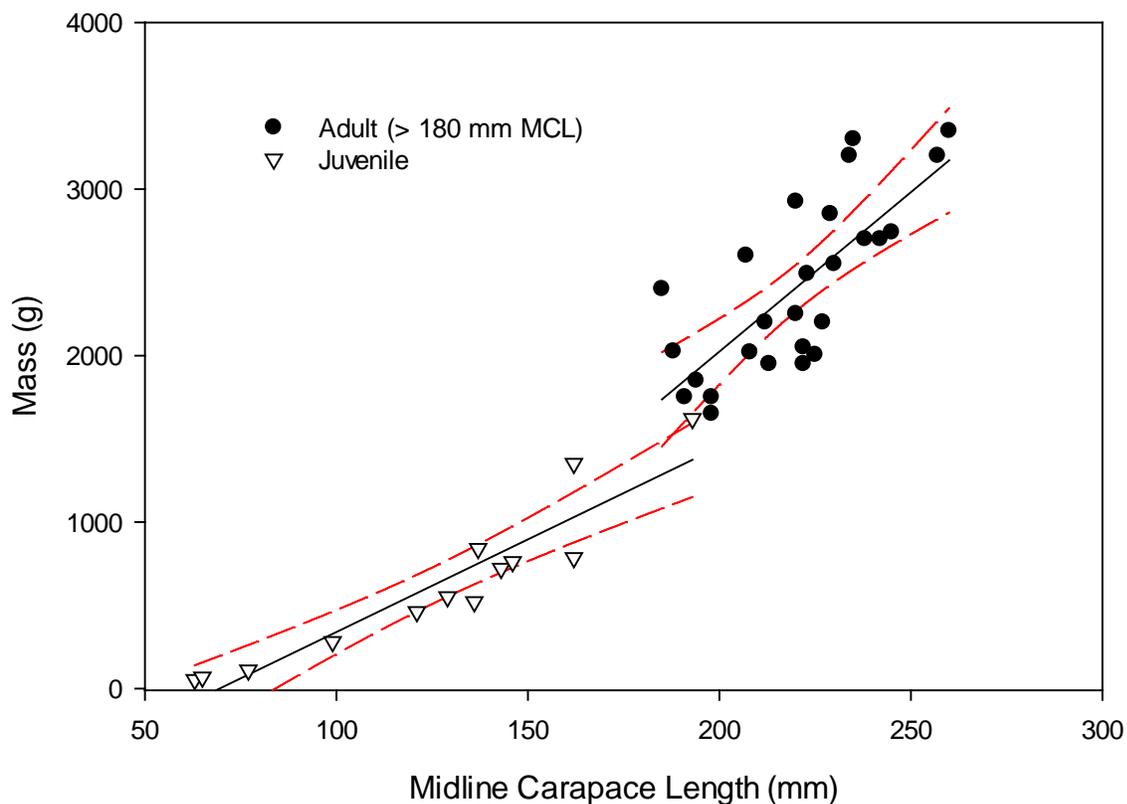


Figure 16. Plotted 95% Confidence intervals on relationship between length and mass for juvenile (< 180 mm MCL) and adult tortoises. Note that we could not sex one individual > 180 mm MCL.

We used program PRESENCE to analyze monitoring data and estimate percent area occupied and detectability. PRESENCE allows users to determine the relative importance of potential covariates on both occupancy and detection. We estimated overall percent area occupied to be 0.62 (95% CI = 0.53 - 0.72) across all top-ranking models. Number of available shelter sites was the strongest predictor of occupancy, with presence of an incised wash and average percent vegetation cover being moderately and weakly predictive. Detection (p) decreased slightly as across survey periods, with $p_1 = 0.71$, $p_2 = 0.67$, and $p_3 = 0.55$. Overall detection was estimated at 0.64 (95% CI = 0.59 - 0.70) across all three entire season. Observer experience strongly

influenced detection, while air temperature during the survey was weakly related. Our estimates of percent area occupied were slightly lower than a comparable study at 0.72 (95% CI = 0.56 - 0.89); however, detection was considerably higher than the estimate from same study at 0.43 (95% CI = 0.33 - 0.52) (Zylstra et al. 2010). We attribute this to a smaller area surveyed within our sampling frame, whereas the prior study surveyed sites in both the Tucson and Rincon Mountains. Additionally, our study had a smaller team of more experienced observers, whereas the prior study had more observers with a larger range of experience levels.

Additionally, tied with the tortoise monitoring efforts in the Tucson Mountain Park and adjacent preserve lands, County staff produced an informative brochure to inform the public about Pima County’s tortoise monitoring efforts and the County’s MSCP (Appendix 8). These brochures will be distributed at various kiosks in Tucson Mountain Park and Sweetwater Preserve.

7.2.1.2 Cactus Ferruginous Pygmy Owl

Pima County collaborated with Dr. Aaron Flesch (University of Arizona) to develop a monitoring program and a habitat suitability model for the cactus ferruginous pygmy owl (CFPO) on County preserves. Dr. Flesch completed the first round of monitoring during 2017, surveying 11 transects three times each for CFPO, resulting in a high of 20 occupied owl territories (see 2017 MSCP annual report). Dr. Flesch’s completed his final report in 2018 discussing the survey results and habitat model (Appendix 9).

7.2.1.3 Bats

The County has committed to regularly monitoring four species of bats at 10 roost sites on County preserves; those species are the lesser long-nosed bat (*Leptonycteris yerbabuenae*), Mexican long-tongued bat (*Choeronycteris mexicana*), California leaf-nosed bat (*Macrotus californicus*), and pale Townsend’s big-eared bat (*Corynorhinus townsendii pallescens*). All four species are cave-dwelling and frequently roost in caves and historic mine features, although there are currently no known lesser long-nosed bat roosts on Pima County preserve lands. Through the Tucson Audubon Society, the County contracted with bat biologist Sandy Wolf to monitor these sites during 2018, with surveys running from May – December, including two visits to most sites. A variety of methods were used depending on the bat species and site, including roost exit counts, internal surveys of mine adits, installation of guano sheets, and eDNA analysis of collected guano. Covered bat species were confirmed to be using at least six of the monitored sites, including a maternity colony of Townsend’s big-eared bats on Rancho Seco, and substantial colonies of southwestern cave myotis at Rancho Seco and Buehman Canyon Preserve (Table 7). An in depth report and protocol will be completed in 2019.

Table 7. Bat species documented at monitoring sites on Pima County preserve lands, 2018.

Site Name	County Preserve	Species Present	Notes
Karen’s Cave Soil Piping Feature	Cienega Creek Natural Preserve	Mexican long-tongued bat	1 and 2 individuals present in May and September
Korn Kob Mine	Buehman Canyon Preserve	Southwestern cave myotis*	Large roost; >1000 individuals
Las Guijas Mine	Rancho Seco	Southwestern Cave myotis**	2 adjacent adits; ~7500 counted exiting in June

Good Enough Mine Complex	Rancho Seco	Townsend’s big-eared bat	4 adits; maternity colony with 50 adults and young
Silver Hill Mine Complex	Rancho Seco	California leaf-nosed bat	2 adits; 24 individuals in September
Arkenstone Cave	Colossal Cave Mountain Park	Mexican long-tongued bat	3 and 5 individuals exiting in May and September
Colossal Cave	Colossal Cave Mountain Park	Southwestern cave myotis and Townsend’s big-eared bat	3 cave entrances; video recorded 502 bats across all entrances; harp trapped 99 cave myotis and 18 big-eared bats
Singleton Mine	Tucson Mountain Park	California leaf-nosed bat	738 individuals in December
Golden Star Mine	Rancho Seco	Southwestern cave myotis***	6 individuals, tentative ID
New Colorado Mine	Rancho Seco	Unknown***	No internal survey due to bees

*This site contains a large roost of southwestern cave myotis and it is not possible to determine if other less numerous species may be using the shaft at the same time.

** This site contains a large roost of southwestern cave myotis (~7,500 counted 9 June 2018) and in the past, small numbers of Townsend’s big-eared bats have also been netted emerging from this site. It was not possible to determine if other less numerous species were using the site using an exit count.

***These sites were selected based on initial survey results made by BLM and Bat Conservation International staff in 2015 that indicated potential presence of covered bat species.

7.2.1.4 Lowland Leopard Frog

The County has committed to monitoring six known lowland leopard frogs (LLF) sites every three years. These sites include Buehman, Bullock, Edgar, Espiritu, and Youtcy Canyons on the east side of the Catalina and Rincon Mountains, and lower Cienega Creek in Cienega Creek Natural Preserve (Figure 18). From previous monitoring efforts, County staff understood that several of these sites were further divided into intermittent wetted reaches during the driest periods of the year. Channel structure, sediment flow, and water availability are dynamic within all monitoring sites, and subsequently occupancy of LLF populations within these reaches are also dynamic. The decision to monitor on a three-year interval is meant to assess long-term site persistence rather than more detailed inter-annual population dynamics.

County staff monitored LLF sites from 7-13 June 2018 in conjunction with annual wet-dry mapping efforts. Surveys consisted of diurnal visual encounter surveys, where one or more observers surveyed first for suitable habitat (i.e. pools, wetted reach, tinajas). Once suitable habitat was identified, observers used binoculars to survey features for all life stages of LLF. Date, time, and length of area surveyed, along with number of LLF observed by life stage (adult, juvenile, larval [tadpole]) are summarized in Table 8 below. Full monitoring protocol and 2018 monitoring results can be found in Appendix 10.

Table 8. Summary lowland leopard frog monitoring results by site, 2018.

Site Name	Reach (Length)	Date Surveyed (Time of Survey)	# Observed (by age class)*
Cienega Creek	12.9 km**	23 March 2018 5 June 2018 18 September 2018 17 December 2018	March: 1 adult June: unidentified frog tadpoles in 3 stretches; 1 unidentified adult/juvenile*** September: 4 adult/juveniles in 3 different stretches December: ~120 tadpoles in one pool
Buehman Canyon	Upper (2.02 km)	12 June 2018 (42 min)	None
	Lower - upstream (3.03 km)	12 June 2018 (47 min)	200 tadpoles
	Lower - spring (1.24 km)	12 June 2018 (39 min)	110 juvenile, 905 tadpoles
	Lower - tinajas (1.9 km)	12 June 2018 (123 min)	28 juvenile, 253 tadpoles
Bullock Canyon	N/A (1.5 km)	12 June 2018 (117 min)	60-100 juvenile, 150-200 tadpoles
Edgar Canyon	N/A (0.5 km)	13 June 2018 (51 min)	1 adult, 86 juveniles, 420 tadpoles
Espiritu Canyon	Upper (3.8 km)	7 June 2018 (120 min)	None
	Lower (1.83 km)	7 June 2018 (136 min)	2 juvenile, 250 tadpoles
Youtcy Canyon	Spring (1.08 km)	12 June 2018 (94 min)	10 adult, 220 juvenile, 1,050 tadpoles

*Numbers of tadpoles and juvenile leopard frogs are estimates.

**The length of stream that is monitored during quarterly wet-dry mapping efforts.

***A number of unidentified ranid frog tadpole observations were recorded, while they were not confirmed to be lowland leopard frog tadpoles, bullfrogs are not currently reproducing in the creek channel and given the approximate tadpole size and the confirmed leopard frog tadpoles in nearby or similar sites by PCEMP surveyors, these observations are likely of LLF.

7.2.1.5 Chiricahua Leopard Frog

Pima County committed to monitoring any sites where Chiricahua leopard frogs (CLF) establish on an annual basis for the first three years followed by every three years thereafter (Figure 18). Chiricahua leopard frogs naturally recolonized Hospital Tank on the Clyne Ranch in September 2016, and have been regularly monitored by David Hall, University of Arizona wildlife biologist, since then. Pima County staff also monitor this site annually using the USFWS-approved visual survey protocol and datasheet. During June of 2018, County staff confirmed the presence of 21 juvenile and adult CLF (including one calling male), as well as many large tadpoles which were likely a combination of CLF and bullfrog tadpoles (tadpoles were not captured for confirmation). David Hall and his team regularly monitor this site for nonnative bullfrogs and have repeatedly made efforts to eliminate this species whose presence presents an impediment to CLF population establishment at this site. Despite repeated efforts in 2017, bullfrogs successfully bred in Hospital Tank late in 2017, resulting in 316 large bullfrog tadpoles observed on 23 May

2018. On this same date, 44 adult CLF and 105 CLF tadpoles were observed, along with one adult bullfrog (David Hall, personal communication).

David Hall and his team of biologists continue to monitor this site and remove bullfrogs, but some bullfrog tadpoles survived to metamorphosis during 2018 as demonstrated by juvenile bullfrogs observed in November. Surveys between November and December confirm the presence of juvenile and adult CLF at this site. Nonnative and invasive mosquitofish remain abundant at this site, but there have been no reports of any other nonnative fish, such as green sunfish, which were successfully removed in 2012. Pima County staff will revisit Hospital Tank again in June 2019.

Goat Well Pond, on the Sands Ranch, was created in 2016 as a wildlife water source and potential habitat for the CLF. This site contains permanent water that is supplied from nearby Goat Well. In April 2018, David Hall and his team reported that CLF had colonized this site, located about 3.2 km from Hospital Tank. During nocturnal surveys of this site, Hall and his team observed a maximum of 21 adult CLF at this site (David Hall, personal communication). County staff visited Goat Well Pond in June 2018, and observed at least nine confirmed or likely CLF, including two calling males, one large female, and one CLF egg mass (Figure 17). Bullfrogs have not been detected at this site, and David Hall's team continues to monitor this site for bullfrog presence; if they are detected they will be removed. Pima County staff will revisit Goat Well pond in June 2019. Full monitoring protocol and 2018 monitoring results can be found in Appendix 10.



Figure 17. Chiricahua leopard frog egg mass in Pima County's constructed Goat Well Pond, Sands Ranch, June 2018.

7.2.1.6 Southwestern Willow Flycatcher

Pima County Staff completed the first round of monitoring for the Southwestern Willow Flycatcher (SWFL) on Bingham Cienega and Cienega Creek Natural Preserves in 2017 utilizing the USFWS-approved call playback survey protocol (Sogge et al. 2010), and results from that monitoring effort were first included in the 2017 MSCP Annual Report. The final Southwestern Willow Flycatcher Monitoring Protocol is included as Appendix 11 of the 2018 MSCP Annual Report.

7.2.1.7 Western Yellow-billed Cuckoo

Pima County Staff completed the first round of monitoring for the Western Yellow-billed Cuckoo (WYBC) in 2017, utilizing the USFWS-approved call playback survey protocol (Halterman et al. 2015). Staff implemented full survey protocols on Bingham Cienega and Cienega Creek Natural Preserves, and exploratory surveys on Lower Buehman Canyon, Edgar Canyon, Posta Quemada Canyon, and Davidson Canyon; results from that monitoring effort were first included in the 2017 MSCP Annual Report. The final Western Yellow-billed Cuckoo Monitoring Protocol is included as Appendix 12 of the 2018 MSCP Annual Report.

7.2.2 Required Monitoring – data acquisition and monitoring plan development

7.2.2.1 Pima Pineapple Cactus

Pima County staff proposed using distance sampling to monitor Pima Pineapple Cactus (PPC) populations after completing a pilot project with Dr. Aaron Flesch (University of Arizona) that confirmed the utility of this monitoring method. However, County staff had not yet identified enough areas with suitable densities of PPC on County preserve lands to meet the statistical assumptions of distance sampling. Consequently, instead of the first round of PPC monitoring that was to begin in 2019, USFWS staff approved Pima County's request to continue to complete inventories of PPC populations on County preserve lands through 2018 and 2019 (S. Richardson, personal communication, 29 January 2018). These efforts will inform the construction of the PPC monitoring sampling frame from which randomly selected distance sampling plots would be selected and monitored. During 2018, County staff surveyed several areas across four County ranch properties (Diamond Bell Ranch, Rancho Seco, Sopori Ranch, and Bar V Ranch) totaling approximately 110 hectares surveyed (276 km x 40 m wide belt transect) and approximately 205 new cacti identified. These surveys represent a large majority of the known PPC habitat on Pima County managed lands, however several more surveys are planned in spring 2019 to fill in areas that were missed. These efforts will lead to a strong monitoring program for PPC when the first round of monitoring is implemented in 2022.

County staff have also developed a draft PPC condition monitoring rubric to assess the general health condition of individual cacti in a repeatable and quantitative manner (Appendix 13). Current survey efforts have yielded qualified descriptions of condition (i.e. "excellent", "good", "fair", and "poor"), whereas this rubric will be quantitative in nature. This effort is useful for assessing general health of PPC during incidental observations as well as those that are monitored regularly (i.e. PPC mitigation banks and distance sampling plots). Using this methodology, the status of individuals that are revisited regularly may be tracked and

compared, and other managers could potentially use this condition assessment allowing for more comprehensive and directly comparable estimates of PPC trends over time.

7.2.3 Species Monitoring Not Required

7.2.3.1 Talussnails

Pima County has collaborated with University of Arizona researchers Dr. Aaron Flesch and Dr. Hans Werner-Herrmann in the form of in-kind match contributions of field surveys to better understand the distribution and biogeography of talussnails, 12 species of which are covered under the MSCP. Their recently funded grant, titled “Status, distribution, habitat, and stressors of the Sonoran talussnail” seeks to better understand the species status of the Sonoran talussnail, an MSCP-covered species that is also currently under review for potential listing by the USFWS. Any field surveys that County staff complete for talussnails on County preserves will follow the survey protocol used by Drs. Flesch and Werner-Herrmann and the AZGFD, which facilitates direct comparisons of data. During 2018, the project PIs trained County staff in their talussnail survey protocol and County staff completed 14 talussnail survey protocols, resulting in documenting 11 live talussnails and approximately 200 empty talussnail shells.

County staff also analyzed the site specific environmental characteristics (such as slope, aspect, and solar radiation) of more than 800 talussnail observations (empty shells) found across County lands, which culminated in an oral presentation at the 2018 Madrean Conference. This bi-national conference, hosted by Sky Island Alliance, brought together over 300 scientists, researchers, and conservationists, primarily from southeastern Arizona and northern Mexico. Key results included the finding that talussnail habitat is highly variable across sites/mountain ranges including the finding that the aspect of sites where snails are observed varies by mountain range and that in some cases snails are predominantly observed on southerly or southeasterly aspects (a common assumption is that talussnails are primarily restricted to cooler, more northerly aspects). Additionally, in some, but not all cases, areas where talussnails are observed receive significantly less solar radiation than other, nearby sites. This work contributes to the development of a better understanding of what is and is not talussnail habitat, and may result in an enhanced ability to assess any potential development-related impacts to these organisms as well as inform management efforts for this species group.

7.3 Habitat Monitoring

All species rely on their associated habitat to persist and thrive; therefore, changes in the structure or function of those habitats are likely to subsequently affect associated species. The MSCP identified several habitat elements suited for long-term monitoring: vegetation and soils, surface and groundwater resources, caves and mines, and talus deposits. These elements represent many of the habitats utilized by MSCP covered species. Therefore understanding how these habitat resources change over the lifetime of the MSCP may inform the species populations trends observed through the County’s species-monitoring efforts and may also be an index for the status of other species which the County does not have explicit monitoring efforts.

7.3.1 Long-term Vegetation and Soils Monitoring Plots

In 2018, the County continued its collaboration with the National Park Service's (NPS) Sonoran Desert Inventory and Monitoring Program and Tucson Audubon Society (TAS) to establish 20 new vegetation and soils monitoring plots. This adds to the 24 plots that were completed in 2017 for a total of 44 and puts the County slightly ahead of its targeted plan to set up 20 monitoring plots per year for the first five years (Figure 18). The partnership between the County, NPS, and TAS to implement the vegetation and soils protocol has been working well, and we expect future years to follow suit. During 2019, the County and NPS will use a power analysis to assess the first two years of data and determine if changes to the proposed number of plots per strata (strata are based on elevation and the rock content of soils) are warranted.

7.3.2 Perennial Water Sources

Perennial surface waters and their associated riparian vegetation make up a relatively small area across Pima County preserves, but are critical to maintaining ecologically functioning landscapes with their complete suite of native flora and fauna (including many of the MSCP covered species), a key goal of Pima County's Sonoran Desert Conservation Plan.

Pima County has long monitored the status of these water sources, during the hottest and driest period of the year before the onset of the summer monsoons. For example, in collaboration with the Pima Association of Governments, Pima County has been tracking surface water at the Cienega Creek Natural Preserve since the 1980s. These efforts continued during 2018, a time of exceptional to extreme long-term drought, according to U. S. Drought Monitor classifications.

Pima County expanded this monitoring effort starting in 2011 to incorporate monitoring of unsupplemented surface water on other County preserve lands on an annual basis. Pima County biologist Brian Powell recently completed a report summarizing these annual wet-dry mapping efforts between 2011-2017 (Powell 2018; Appendix 14). Across Pima County's open space lands, 20 sites that were visited in at least two different years (most sites were visited each year) had surface water on each visit during the hottest time of the year. These sites included five stock tanks, six springs, and nine streams, features that are important to many of the species covered by the MSCP. In cooperation with the Arizona Game and Fish Department and the U.S. Fish and Wildlife Service, Pima County has been working on an aquatic and riparian species management plan to guide aquatic species stewardship efforts including the maintenance and potential translocation of aquatic and riparian species, which will be forthcoming in 2019.

7.3.3 Shallow Groundwater

The Pima County Regional Flood Control District (RFCD) has a long history of monitoring shallow groundwater, starting first with the Cienega Creek Natural Preserve and now expanded to six shallow groundwater areas in eastern Pima County and producing results in annual reports (Appendix 15). Future reports will continue to support the MSCP monitoring objectives for assessing depth to water in select shallow groundwater systems, as outlined in Appendix Q of the MSCP.

7.3.4 Cave, Mine and Adit Inventory

All cave and mine features visited as part of the County's 2018 bat species monitoring element were assessed as to their condition and for any potential management needs. The final bat monitoring report will be issued in 2019, but already these efforts have led to the identification of and potential implementation of improvements or repairs to bat-friendly gates at two sites. All sites will be revisited in three years along with the second round of bat species monitoring. Any changes in documented site conditions from the initial inventories will be addressed as appropriate.

In addition to on-site condition inventories, County staff are consolidating all available data on cave and mine feature locations across all County conservation lands. Due to multiple land ownerships within County conservation lands, these records had not been previously consolidated. This comprehensive record of cave and mine features will allow for County staff to inspect them for bat occupancy as time allows.

7.4 Threats Monitoring

7.4.1 Invasive Species

PCEMP staff report on the occurrence and location of a variety of invasive plants including buffelgrass, fountain grass, African sumac, natal grass, and others. In 2018, PCEMP staff made 106 observations and follow-up reports to County managers of these and other invasive plants. Staff also report on invasive aquatic animal species, including American bullfrogs, which could negatively affect covered species populations if not promptly addressed. Efforts to streamline incidental species observations (see section 7.6.1) have allowed for more expedient reporting of emerging invasive species observations to the appropriate management staff.

7.5 Other Monitoring Elements

In addition to required species and habitat-related monitoring efforts, County staff made progress on additional elements described below:

7.5.1 Geodatabase Development

PCEMP staff acquired two ruggedized, GPS-enabled Panasonic Toughpad tablets and implemented the first monitoring protocol with exclusively digital data collection (Sonoran desert tortoise monitoring) in 2018. These tools have allowed field staff to increase the efficiency of field data collection and data quality control.

Additionally, Pima County IT staff have designed an interdepartmental incidental observation database designed to readily share observations (i.e. threats, infrastructure issues) from field staff with the appropriate managing departments. For example, field staff may observe a downed livestock fence, record that data point using the tablet, and the County range program manager will be automatically notified once the data are synchronized. Additionally, staff from other departments may observe MSCP covered species, record that data point, and PCEMP staff will be automatically notified about that observation. This tool has the ability to increase efficiency in geospatial data management, as well as allow for immediate notification of appropriate management staff that may limit the potential impact to resources.

7.6 Science and Technical Advisory Team

The PCEMP Science and Technical Advisory Team (STAT) met in spring of 2018 for a half-day field trip to Cienega Creek Natural Preserve. One goal with STAT is to have all seven members not only be experts in species/landscape monitoring but to also be familiar with the County conservation lands. Discussions during the field trip revolved around upcoming monitoring elements for 2018 (monitoring protocols and field efforts) along with how STAT members would prefer to interact with PCEMP staff. Additional discussions centered on potential collaborations between the County and other conservation partners as well as outreach opportunities involving the PCEMP.

STAT reviewed all species-level monitoring protocols submitted with the 2018 annual report (Sonoran desert tortoise, Chiricahua and lowland leopard frogs). Several future PCEMP monitoring elements will require further STAT discussion, such as the most appropriate monitoring interval for Sonoran desert tortoise and questions related to the construct the PPC sampling frame and allocation of monitoring transects.

7.7 Non-MSCP Covered Species

7.7.1 Arizona Eryngo

In 2018, County staff evaluated an effort to restore a rare wetland plant, the Arizona Eryngo (*Eryngium sparganophyllum*), to Agua Caliente Park, where it historically occurred (Fonseca 2018; Appendix 16). While nursery propagation of this species has been successful at Pima County's native plant nursery, the first transplants suffered from placement in inhospitable sites, and from depredation by javelina. A new effort is underway to test additional transplant sites at Agua Caliente Park, and transplanted Arizona eryngo are being monitored by a local high-school student.

Additionally, Pima County Regional Flood Control District (RFCD) has granted permission to Dr. Max Li Yue (University of Arizona) to study the life history and population structure of this plant on property owned by the RFCD (one of the two known wild populations in the United States), under the terms of a USFWS Section 6 grant to Dr. Li. This project will provide information important to the conservation and management of this plant species, including its status on RFCD land. The RFCD is also considering establishing populations of Arizona eryngo in other areas of suitable habitat on RFCD land.

7.8 Changes to PCEMP Protocols and Timing

7.8.1 Southwestern Willow Flycatcher

Pima County had agreed to monitor for the presence of the southwestern willow flycatcher (SWFL) every three years, at three sites on County lands, including Bingham Cienega Natural Preserve, Cienega Creek Natural Preserve, and at parts of the A7 Ranch adjacent to the San Pedro River (Pima County 2016). However, leading up to Pima County's first round of monitoring for SWFL in 2017, Pima County staff in consultation with USFWS staff concluded that there was no potential breeding habitat for SWFL on the A7 Ranch, and that it was appropriate to drop this site from the County's monitoring commitments. After Pima County's

first round of monitoring for SWFL, the County concluded that there was no longer any suitable habitat for this species at Bingham Cienega due to long-term drying of the riparian habitat. Pima County's request to drop Bingham Cienega as a SWFL monitoring site has been approved by USFWS staff (S. Richardson, personal communication, 13 December 2018), on condition that this that Pima County must evaluate riparian habitat at least every three years at Bingham Cienega and pending any return of habitat suitable for SWFL, the County must resume regular monitoring for this species at this site. Pima County will continue regular monitoring for SWFL at Cienega Creek Natural Preserve as identified prior to this change.

7.8.2 Bat Monitoring Protocol

Pima County has agreed to monitor the roost site condition and occupancy of the MSCP covered bat species including the lesser long-nosed bat, California leaf-nosed bat, Townsend's big-eared bat, and Mexican long-tongued bat at ten roost sites (combined, for all of these species) every three years. The County has contracted through the Tucson Audubon Society for bat biologists Sandy Wolf and Dave Dalton to complete this monitoring and protocol development. The fieldwork has been completed and more than ten sites have been inventoried, many of them more than once. The monitoring results and protocol will be completed in 2019, approximately a year behind the original schedule.

7.8.3 Precipitation Monitoring Protocol

Pima County had agreed to complete a protocol for collecting precipitation across County lands within two years of the County's Section 10 permit. Pima County staff have investigated new and less expensive ways to collect rainfall data as well as ways to host and visualize collected precipitation data using an app developed by Dr. Michael Crimmins and his team at the University of Arizona (myRAINgelog, <https://myraingelog.arizona.edu/>). Additionally, the PCEMP is coordinating with the Pima County Range Monitoring Program to explore ways to leverage already existing rain gauges on County ranches. However, County staff have not yet developed this protocol, and will be at least another year in completing this element of the PCEMP.

7.8.4 Pima Pineapple Cactus Monitoring

The USFWS has approved Pima County's request to continue assessments of PPC distribution across County lands during 2018 and 2019, in lieu of the County's first round of scheduled PPC monitoring, using distance sampling, that was scheduled to begin in 2019. Consequently, the first round of PPC monitoring will be initiated in 2022. See Section 7.2.2.1.

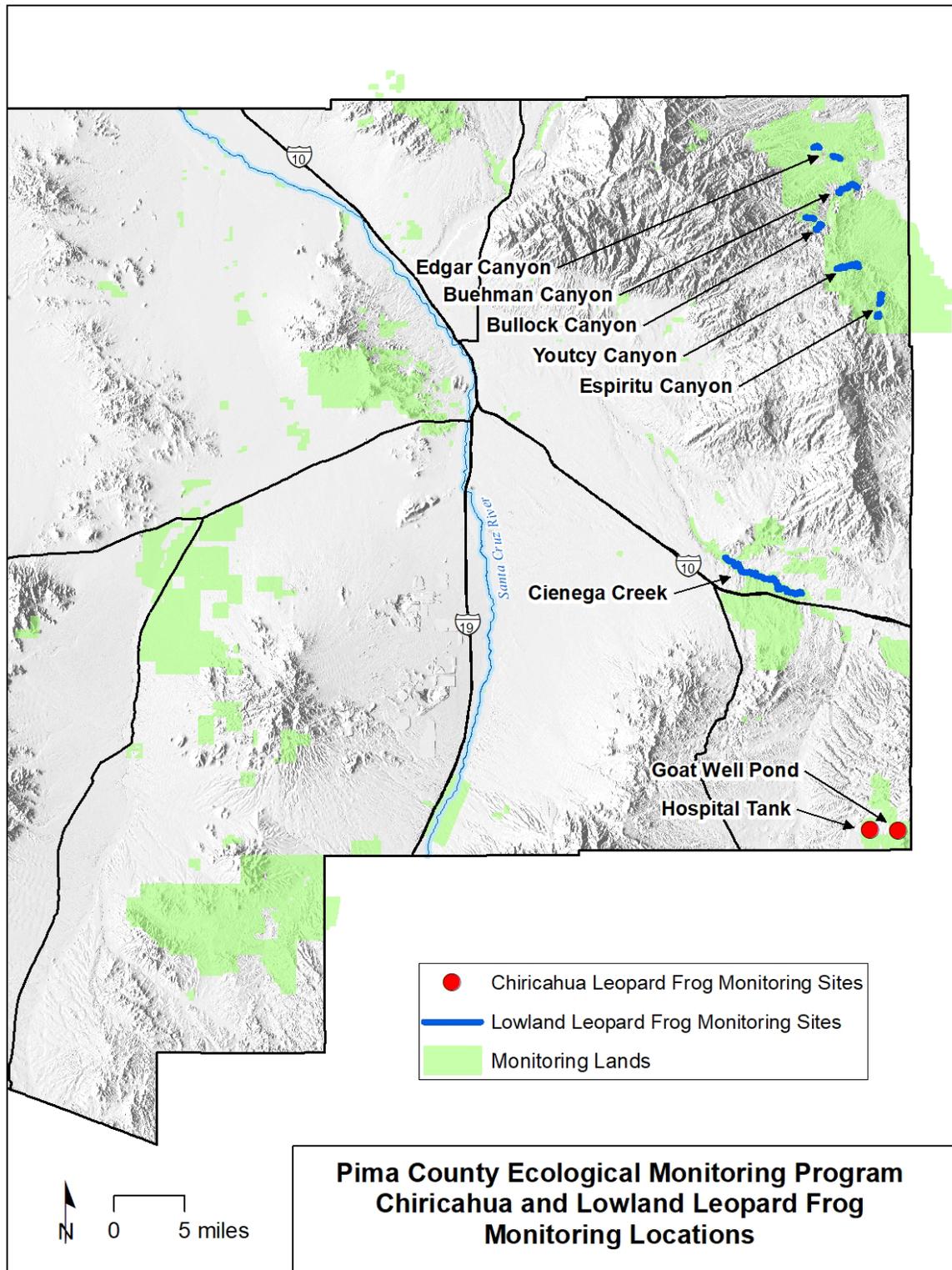


Figure 18. Chiricahua and lowland leopard frog monitoring sites on Pima County Conservation Lands.

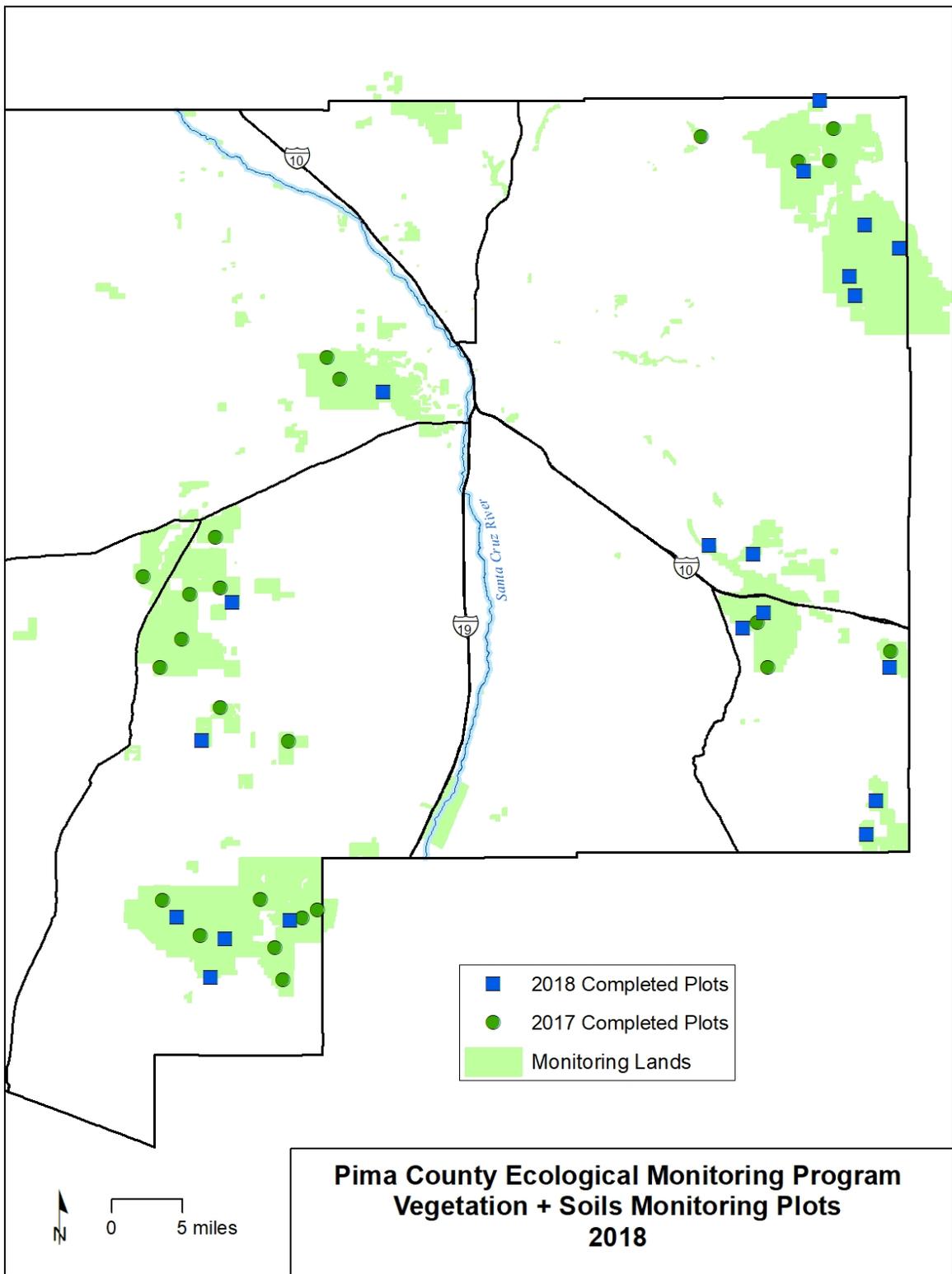


Figure 19. Completed vegetation and soils monitoring plots in partnership with the National Park Service, Sonoran Desert Inventory and Monitoring Network and the Tucson Audubon Society, 2017-2018.

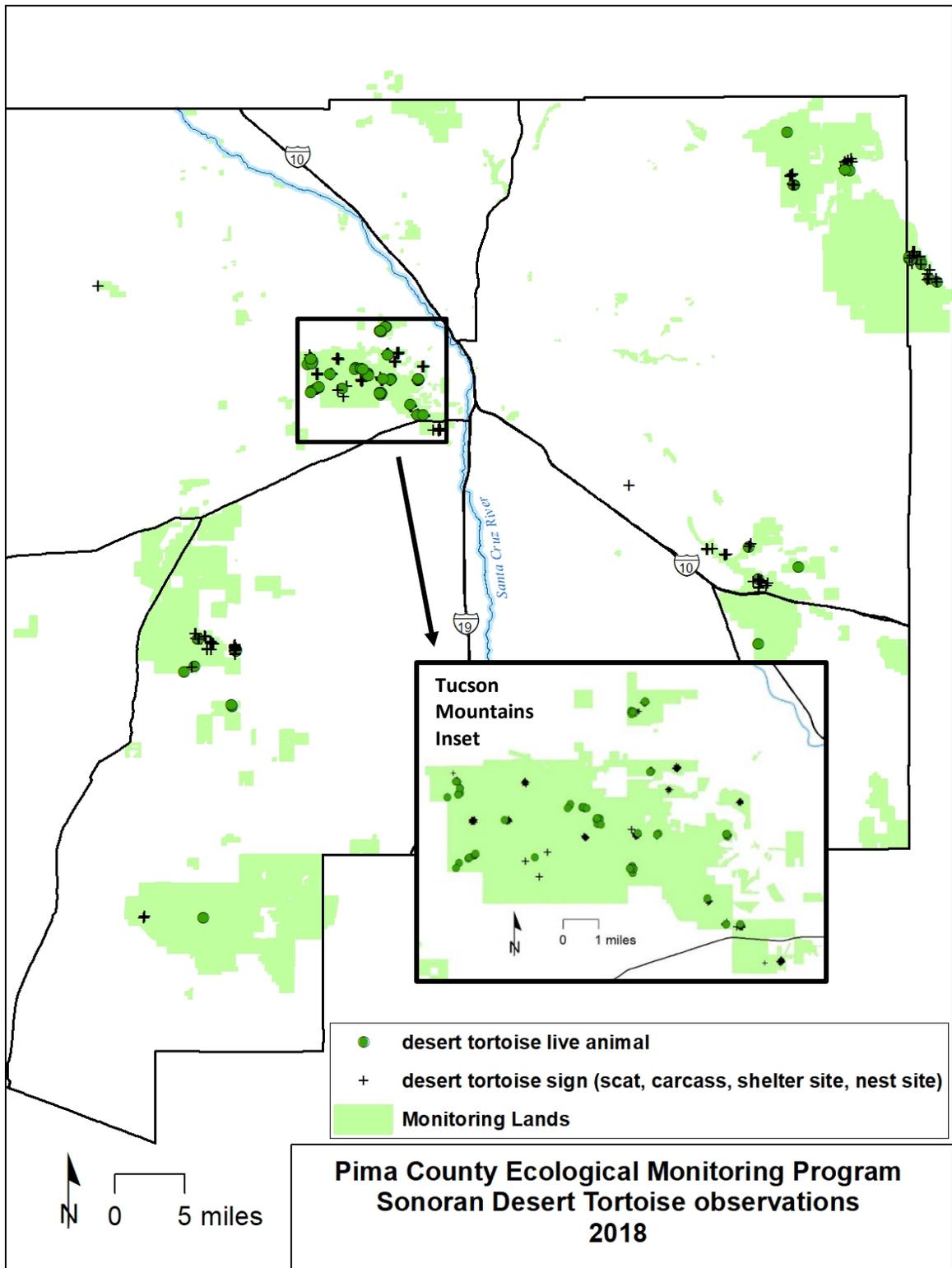


Figure 20. Observations of Sonoran desert tortoise (live individuals and sign) were made on nine properties in 2018, and include observations made during occupancy monitoring on and near Tucson Mountain Park.

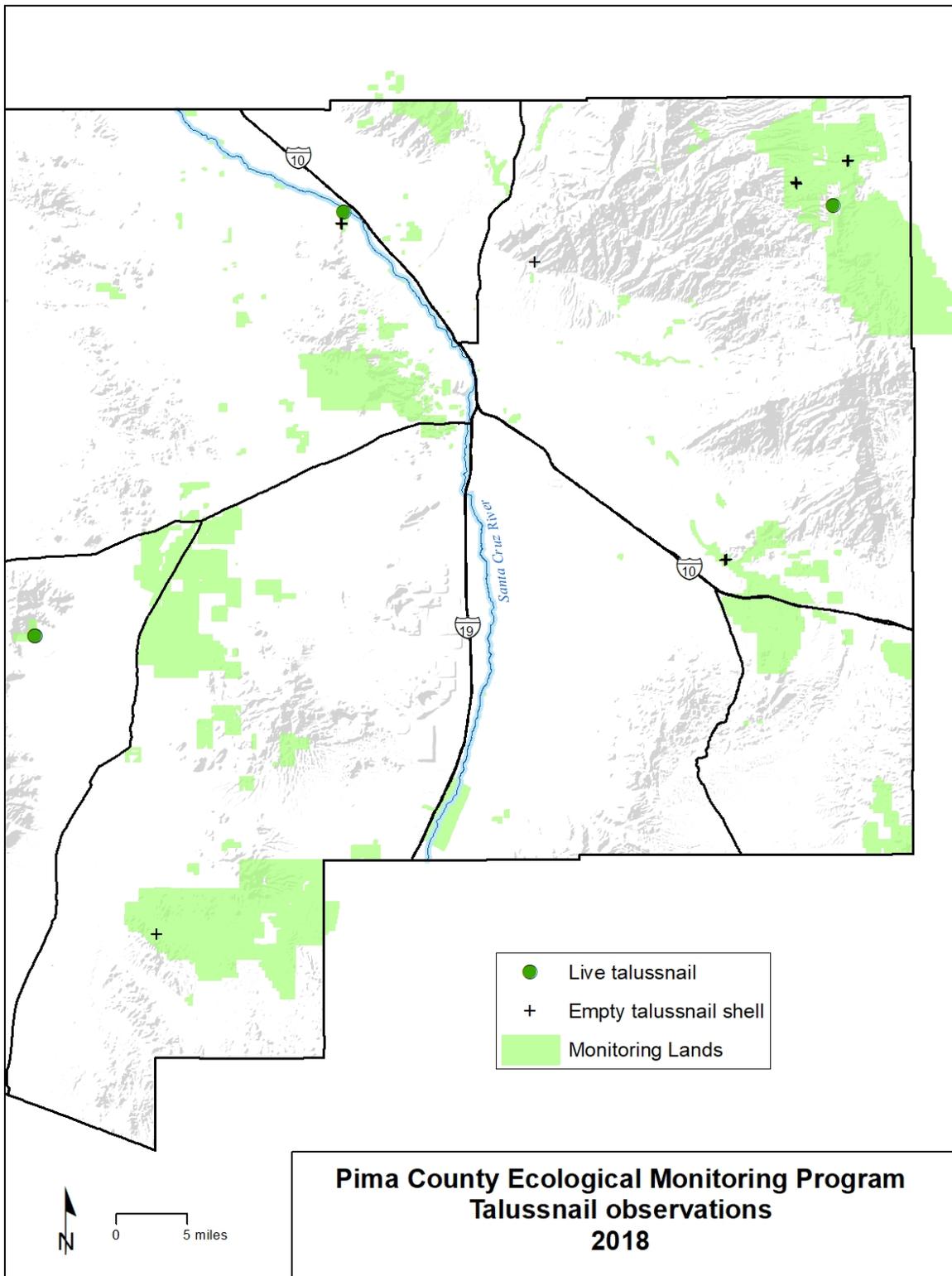


Figure 21. Observations of talussnails on County preserves in 2018. These observations contributed to a research project examining talussnail distributions led by Drs. Flesch and Werner-Hermann from the University of Arizona.

8 Changed or Unforeseen Circumstances

Changed circumstances are scenarios that could affect Covered Species (Table 7.1 of the MSCP) and are differentiated from unforeseen circumstances (Table 7.2 of the MSCP) in that the latter cannot reasonably be anticipated.

8.1 Changed Circumstances

Changed circumstances are those “affecting a species or geographic area covered by a Habitat Conservation Plan (HCP) that can reasonably be anticipated by Plan developers and the [USFWS] and that can be planned for” (50 CFR §17.3).

As discussed with the USFWS Tucson Field Office, we report changed circumstances for the 2018 calendar year (Table 9). In 2017, the Gila topminnow was detected in the Santa Cruz River and confirmed by subsequent surveys in the effluent-dependent stream. Daily discharges of effluent from the two County water treatment facilities have maintained persistent flows along the Santa Cruz River downstream reach, despite the regional drought, but there is no formal allocation of reclaimed water to the river.

Some changed circumstances cannot be fully evaluated until new ecological monitoring programs and reporting mechanisms are underway. In 2016, we listed the reporting frequency for changed circumstances along with the proposed methods of evaluation. A number of changed circumstances determinations will be based on ecological monitoring data for species, vegetation or landscape-related elements.

One example of a changed circumstance that would be evaluated at a later date is vegetation change along the effluent-dependent Santa Cruz River downstream of Tucson, in Pima County. Thanks to monitoring that has been performed by RFCD, we know that length of effluent flow during June has fluctuated from 22.1 miles in 2016, to 21.4 miles in 2017, and 22.3 miles in 2018. According to the Pima County Effluent Generation Report, 2017 effluent discharges were reduced by over 2000 acre-feet from 2016 conditions. Length and volume of effluent discharged to the Santa Cruz River are not the only factors that affect vegetation and other habitat for covered species, but it serves as an indicator. When Pima County implements the landscape pattern monitoring protocol in the upcoming years, we will have a basis for reporting whether a changed circumstances has occurred to the vegetation.

8.1.1 Crayfish and other invasive aquatic species

In 2018, we became aware of crayfish observations in the effluent-dependent Santa Cruz River (Figure 22) downstream of Tucson. Crayfish have not been documented in the CAP canal and consequently this is not likely to be the source for the crayfish in the lower Santa Cruz River.



Figure 22. Crayfish from Marana and Hardin Roads, Santa Cruz River, 2018. Photograph provided by Dr. Michael Bogan, University of Arizona.

In the 2017 MSCP Annual Report, we passed along a report of invasive species in the Central Arizona Project canal. There is no reason to believe that the canal was a source of any new (post-permit) invasive species entering a natural ecosystem. Pima County conferred with Tucson Water regarding quagga mussels due to the 2017 observations of this species in the CAP canal near Red Rock. While Asiatic freshwater clams are regularly observed in Tucson’s Central Avra Valley Recharge Basins, the quagga mussel is not (Dick Thompson, Tucson Water, personal communication to Julia Fonseca). Furthermore, Tucson Water does not discharge raw CAP water into any watercourse.

Neither Asiatic freshwater clams nor quagga mussels have been observed in the Santa Cruz River effluent-dependent reach downstream of Tucson studied by Dr. Michael Bogan and his students in 2017 and 2018 (M. Bogan, pers. comm. to Julia Fonseca). Dr. David Walker, University of Arizona, also reports he has looked for larval-stage molluscs (veligers) in water samples from the effluent-dependent Santa Cruz River as recently as June 2018 with no success.

8.1.2 Desiccation of groundwater-dependent riparian ecosystems

Pima County has been experiencing long-term drought conditions rated as extreme to exceptional according to U. S. Drought Monitor classifications. In the past twenty years, Pima County has experienced a 14 percent decline in precipitation, a deficit of 34.81” of rain. During the same time, annual average temperatures have been increasing, part of the long term trend evident for decades. The four-year period of 2014-2017 ranks as the warmest on record (Pima County 2018, Appendix 17). These drought conditions are not in and of themselves considered

changed circumstances, but may be contributing factors to desiccation of certain groundwater-dependent riparian ecosystems.

In 2017, we presented groundwater data that suggest declining conditions along Sopori Wash and Arivaca Creek. Conditions in ADWR’s monitoring well on Sopori Wash improved in late 2018, probably due to a large flow event that contributed natural recharge (Figure 23). ADWR’s monitoring well at Arivaca Creek did not show considerable difference in water level as compared to 2017 (Figure 24).

8.2 Unforeseen Circumstances

The USFWS did not identify any unforeseen circumstances that affect covered species or their habitats in 2018.

Table 9. Status of changed circumstances during the 2018 reporting period. Because changed circumstances can require management actions, the County’s responses are also included.

Circumstance/Scenario	Occurred during reporting period?	Evidence	If yes, what Response(s)
Invasive aquatic species (crayfish) enter other aquatic sites from non-Central Arizona Project sources.	Unknown but observed during 2018	Photograph	Notified AZGFD. County staff will report future observations. AZGFD currently prohibits the possession and transport of live crayfish (except for in Yuma and part of La Paz County), and only allows use of live crayfish as bait if captured in the same body of water that is being fished.
Delisting of Lesser Long-nosed Bat by USFWS on December 6, 2018	Yes	USFWS announcement	USFWS will circulate a post-delisting monitoring plan for review in 2019
Designation of critical habitat for Sonoyta mud turtle, a species that is not covered under the permit	Yes	USFWS announcement	Limited to occupied habitat in Organ Pipe Cactus National Park, outside the permit area. No action.
State land is conveyed to private sector in Permit Area	Yes	Based on GIS inquiry, see Figure 3	Automatically becomes part of the Permit Area per the terms of the MSCP. See Section 3.1 of this report
Taxonomic changes: new genetic information reclassifies chub species; Tucson shovel-nosed snake confirmed as subspecies <i>klauberi</i>	No	2017 American Fisheries announcement for Chub; Crother et al. 2017	USFWS is evaluating the information; the draft recovery plan for chub is not yet finalized. No change in legal status.

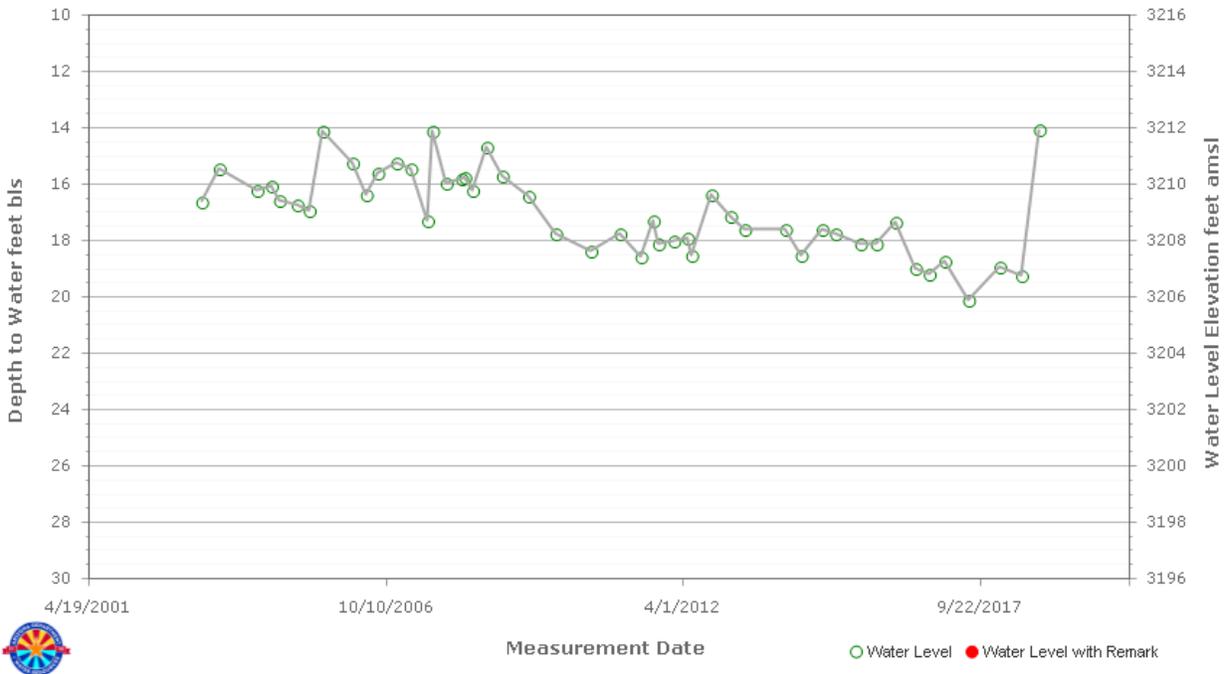


Figure 23. Arizona Department of Water Resources (ADWR) GWSI well hydrograph from Sopori Wash (20-12-05 aac) showing reversal of a declining trend in a portion of Santa Cruz County downstream of Pima County’s Sopori Ranch

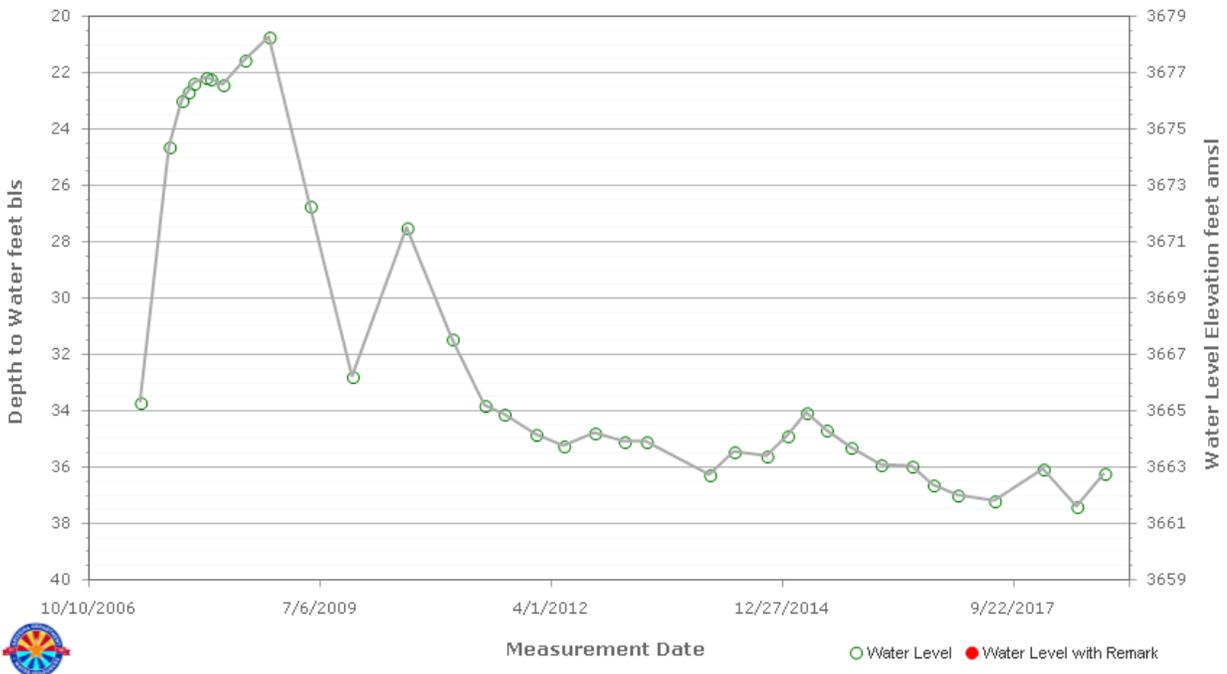


Figure 24. ADWR GWSI well hydrograph from Arivaca Creek (21-10-35ccd) showing a trend that could be causing riparian habitat impacts downstream of Arivaca Lake.

9 Fiscal Year Funding

9.1 Expenditures

Pima County spent over \$3,000,000 in services to implement the MSCP in 2018 (Table 8). Many of these programs existed long before the MSCP and fulfill other County needs, but they are included here because their continued existence contributes to conservation, enforcement, management, monitoring, and administration of MSCP elements. These estimates are based primarily on the percentages of various budget units for the adopted budget for the Fiscal Year ending June 2018, except for the Sheriff’s estimate, which is based on calendar year 2018 visits to potential mitigation land addresses.

Table 10. Estimated expenditure (in thousands of dollars) by County department for avoidance, minimization, management, and monitoring activities in support of Pima County’s Multi-species Conservation Plan, July 2018-June 2019.

Department	Expenditure (thousands of dollars)
County Administrator	77
Communications	0
Development Services	124
Regional Flood Control District	559
Information Technology	75
Natural Resources, Parks and Recreation	1,467
Public Works Administration (Real Property)	230
Sheriff’s Department	24
Office of Sustainability and Conservation	677
Transportation	208
MSCP and Section 10 Program Total	\$3,439

In general, the County funding resources have not materially changed from the estimates provided in Chapter 8 of the MSCP. Two departments, Development Services and Transportation, reported decreased budgets but these do not affect the avoidance and minimization activities they provide for the MSCP.

Highlights from the reporting period for the departments listed in Table 10 include:

- The **County Administrator’s Office** explored options to acquire additional lands in 2018.
- **Communications** helped provide publicity for the Certificate of Coverage program, the Tucson Mountains tortoise monitoring effort, the Tesoro Nueve acquisition, and others.
- **Development Services** continued to administer various avoidance and minimization measures embedded in existing ordinances.
- **Information Technology** department provided assistance in preparing the MSCP and subsequent reporting. This year they substantially completed work supporting ecological data collection.
- **Sheriff’s Department** enforced laws on mitigation lands and provided search and rescue at levels similar to last year

- **Department of Transportation** minimized impacts along roadways using Environmentally Sensitive road design and Environmental Assessment and Mitigation Reports.
- **Public Works Administration** (Real Property staff) worked to acquire several new floodprone lands and donations, and helped with legal protections for the fee-owned mitigation lands.
- **Natural Resources, Parks, and Recreation** (NRPR) manages most of the potential mitigation lands. NRPR created a new position, now filled by Brian Powell, to support Division Manager Karen Simms. NRPR hired Maria Williams, an intermittent range technician, to support the ranch conservation program.
- **Regional Flood Control District** fulfills a key role in minimizing effects on habitat for riparian species and supports management of mitigation land, including the allocated land at Bingham Cienega. This year they provided a new report on shallow groundwater monitoring, and achieved even higher rates of avoidance and minimization.
- **Office of Sustainability and Conservation** supports the land managers with information and monitoring data, and administers the Certificate of Coverage Program. Brian Powell vacated his position in late 2018 to work for NRPR. Cultural resource staff also support management of lands, and this is now reflected in the budget.

9.2 Revenue

The Certificate of Coverage Program has two revenue-generating elements that are applicable only to residential subdivision, commercial, or industrial projects: 1) an Application Fee (\$720.00) and 2) Compliance Monitoring Fee (\$2450.00). When any of the eligible types of residential subdivision, commercial, or industrial projects request a Certificate of Coverage, an Application Fee is collected. Subsequently, a Compliance Monitoring Fee is collected only when the project provides natural open space to be used as MSCP mitigation. For the 2018 calendar year, the Certificate of Coverage Program generated a total of \$1,440.00 in revenue (all of it derived from Application Fee receipts for two residential subdivision projects). Compliance Monitoring Fees were not collected as neither project provided natural open space to be used for MSCP mitigation.

The OSC utilizes these funds to administer the Certificate of Coverage Program, including monitoring of MSCP mitigation land generated through this program.

9.3 Grants

The USFWS's Partners for Wildlife program granted Pima County monies prior to permit issuance of the Section 10 permit for several projects. One grant was for erosion-control work at Peck Spring, a site that until recently, contained lowland leopard frogs (in an associated tank), a Covered Species. There were no new grant monies or received by Pima County or the RFCD since permit issuance that contributed to fulfilling MSCP requirements. However, we benefitted from partnerships with a number of organizations, some of which received grants to improve habitat or monitor species or their habitats. These are described in relevant sections of this report.

10 Other Land Transactions and Processes

In the parlance of the Section 10 permit, mitigation lands are those lands that have been allocated to offset impacts that have already occurred. Other land transactions can affect the pool of lands available to offset future impacts, therefore we report on significant changes here (Figure 21, Appendix 18).

During 2018, several requests to utilize potential mitigation lands were received from outside entities resulting in only one adjustment to the portfolio of potential mitigation lands. A single request led to the removal of 1.15 acres which was authorized by ALWT and USFWS as well as the County Board of Supervisors and Flood Control District Board of Directors.

Additionally, the Pima County acquired the 3,318.3 ac Tesoro Nueve Ranch property and grazing lease on the east side of the Santa Catalina Mountains in June 2018. This property contains the best remaining perennial spring in the Buehman Canyon drainage, and represents the last portion of the drainage that was not yet conserved.

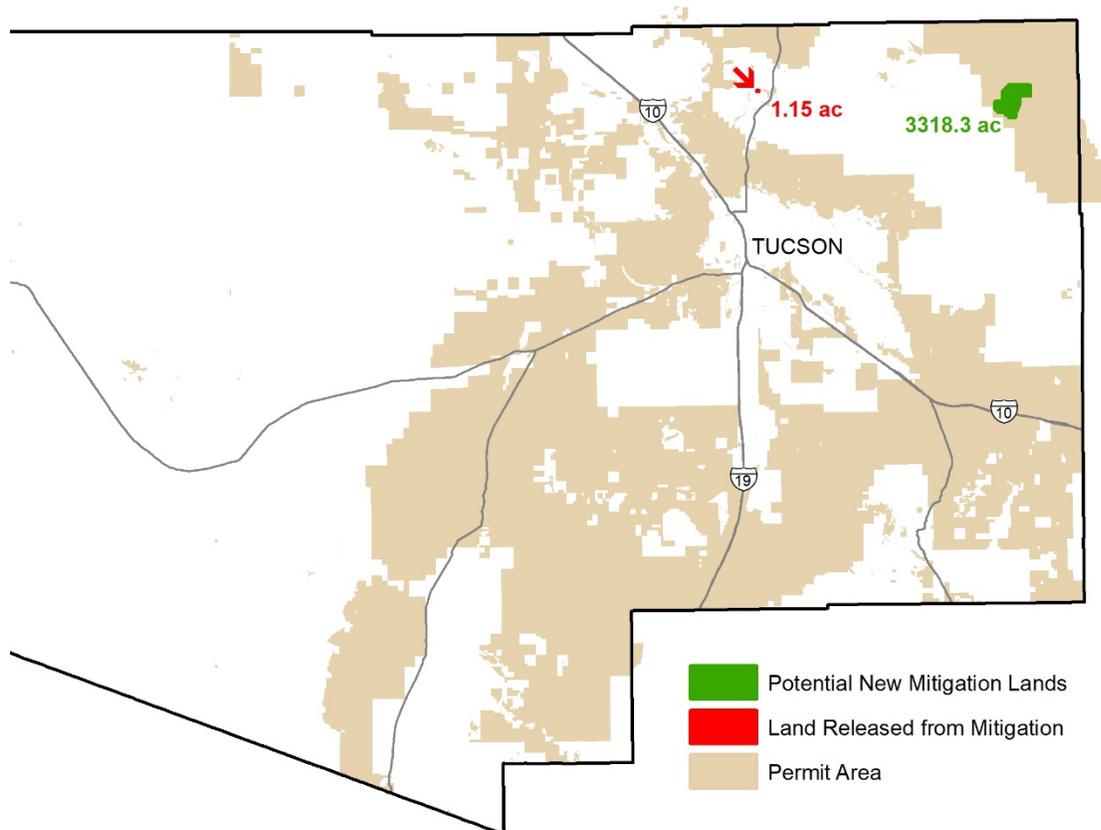


Figure 25. MSCP potential mitigation land acquisitions and releases during 2018.

11 Partnerships

11.1 Arizona Conservation Corps

Arizona Conservation Corps (AZCC) aims to continue the legacy of the Civilian Conservation Corps of the 1930s by connecting youth, young adults, and recent-era military veterans with conservation projects on public lands. Pima County's NRPR has utilized the services of AZCC for a number of years to assist with management of potential MSCP mitigation lands. Local and urban youth from metropolitan areas in southern Arizona work with NRPR staff to construct and repair fences, remove invasive species, plant native species, and clean up wildcat dumps. Pima County open space lands that benefited from the AZCC in 2018, included King 98 Ranch, Bar V Ranch, Bingham Cienega, and Six Bar Ranch.

11.2 Arizona Land and Water Trust

Pima County has an agreement with the ALWT to provide Pima County with third-party beneficiary for both types of restrictive covenants. ALWT evaluated the property inspections provided to them in 2017, and reviewed and approved new additions and the disposal of one property (see Section 10 for details).

11.3 University of Arizona

Pima County is working with Drs. Aaron Flesch and Hans Werner-Hermann (both of the University of Arizona) on a recently funded AZGFD Heritage Fund grant project to survey for and study the habitat of the Sonoran talussnail, as well as other talussnails, on Pima County preserve lands. University of Arizona wildlife biologist David Hall and his crew continue to monitor Hospital Tank and Goat Well Pond on Pima County's Clyne and Sands Ranches, for bullfrogs and other invasive species, and to perform removal efforts as needed. This work is critical for maintaining the Chiricahua leopard frog populations at these sites, the only known ones on County lands.

11.4 Arizona Game and Fish Department

In 2018, Pima County conferred with AZGFD on the potential sites for future native aquatic species establishment for our Aquatic Species Management Plan. AZGFD also evaluated a site in the Buehman Canyon area for Gila topminnow. Pima County participated in discussions with Bureau of Reclamation and AZGFD regarding the impacts of an Interstate 11 alternative. Pima County also continues to facilitate access to AZGFD biologists to monitor the AZGFD-released black-tailed prairie dog colony on Sands Ranch, which is currently thriving and experiencing recruitment.

11.5 Cienega Watershed Partnership and U. S. Bureau of Reclamation

The Cienega Watershed Partnership (CWP) received a grant from the Bureau of Reclamation (BOR) to evaluate potential sites for remediation of erosion or other water quality issues. We worked with CWP and Watershed Management Group (WVG) to evaluate sites in the Cienega Creek Natural Preserve and in Bar V during in 2018. We also printed a "State of the Watershed" summary for CWP.

11.6 The Nature Conservancy

In 2018, Pima County contributed wet-dry monitoring data to the Nature Conservancy's annual San Pedro monitoring effort.

11.7 National Park Service

Pima County continued its cooperative agreement with the Sonoran Desert Inventory and Monitoring Network (SODN) of the NPS, based in Tucson. This allowed the County to leverage a soils and vegetation monitoring protocol for County lands that has been developed by SODN and is currently in use across federal lands managed by multiple agencies near or adjacent to County lands (allowing meaningful comparisons across a larger scope). Additionally, it streamlines collaborations in data synthesis and interpretation, as well as expertise.

11.8 Tucson Audubon Society

Pima County contracted with the Tucson Audubon Society to assist in the implementation of the NPS soils and vegetation monitoring protocols on County lands as well as to monitor and to develop monitoring protocols for cave and mine-dwelling MSCP covered bat species on County preserves. The County benefited from leveraging the expertise and efforts of Tucson Audubon staff who have considerable experience with both of these monitoring efforts.

11.9 Southern Arizona Quail Forever

This organization focuses on quail hunting and quail habitat enhancement in southeastern Arizona and in the past has supported installation of wildlife water sources on Pima County ranches. During 2018, this organization assisted with land restoration activities on the County's King 98 Ranch through invasive plant removal.

11.10 Northern Arizona University

Dr. Clare Aslan, Northern Arizona University is investigating how habitat fragmentation and development may impact the pollination biology and subsequent fruit set, of the Pima pineapple cactus. One of her field sites (representing a site of 'intermediate fragmentation') is RFCD's Diablo Estates property. During 2018, Dr. Aslan documented a single genus of solitary bee visiting cactus flowers at this site (*Diadasia* sp.), and 71% of the tracked flowers set fruit. These results will be compared to PPC pollination biology at other more fragmented sites, as well as at sites with no fragmentation (i.e., Buenos Aires National Wildlife Refuge).

12 Prospective Issues

- Pima County OSC continues to refine a procedure to address requests to utilize County-owned potential mitigation lands for purposes not allowed by the restrictive covenants. The County is consulting with the USFWS and ALWT on those aspects that pertain to potential modification or release of restrictions.
- During 2019, NRPR intends to update park rules for all types of park lands, with public involvement.
- USFWS agreed to consider species enhancement credits for aquatic species establishments but no framework for such credits yet exists.
- USFWS Section 6 monies to acquire species habitat have not yet been authorized by the Administration.
- The USFWS may list Arizona eryngo in future years. While there is no prohibition against take of the plant, it may be desirable to amend the Section 10 permit to include the species if it will enhance the ability of RFCD or its partners to conserve the species or its habitat.
- Pima County is working to minimize the potential impacts of the SunZia power line, the Interstate 11 road corridor, and the Rosemont mine on potential mitigation lands, and to evaluate any relevant information that these projects generate.
- Pima County will continue to respond to AZGFD and others regarding potential native species introductions, such as the black-tailed prairie dogs introduced to Sands Ranch in 2017. An internal procedure for evaluating proposed species introductions of any kind on County lands will be considered.
- USFWS assistance will be needed to continue dialogue with other federal agencies on streamlining their Section 7 consultations in light of the MSCP.
- Pima County continues to operate under a year-to-year agreement for species monitoring and management on State Trust land.

13 Acknowledgements and Certifications

This report is prepared in partial fulfillment of the terms of permit #TE-84356A-0.

This report reflects the continued collaboration of many County departments who provide stewardship to open space lands or provide basic services like information technology, financial reporting, and law enforcement. Our thanks go to the many individuals in the departments who provided assistance: Information Technology; Natural Resources, Parks and Recreation; Sheriff; County Attorney's Office; County Administration; Regional Flood Control District (RFCD); Finance; Transportation; Environmental Quality; Real Property; Office of Sustainability; Health Department; and Public Works Administration.

We are grateful to the Science Technical Advisory Team, AZGFD and USFWS staff for their advice regarding data collection and analysis methods throughout the year. AZGFD and USFWS also provided much useful information on the aquatic species management plan.

We also appreciate the information shared by AZGFD, University of Arizona, Central Arizona Project, Tucson Water, Pima County and RFCD staff, and others for evaluating changed circumstances.

14 Glossary and Acronyms

14.1 Glossary

Adaptive management. Adaptive management is an iterative learning process that identifies gaps in understanding, facilitates action, and modifies management based on new information (Walters 1986). Pima County will employ two types of adaptive management: 1) those decisions for which a single management action is needed (responsive management actions) and 2) decisions that require recurrent actions (recurrent decisions).

Board. Referred to collectively as the Board of Supervisors for Pima County and the Board of Directors for the Pima County RFCD.

Built environment. The GIS shapefile representing pre-permit land uses in Pima County. It was developed in 2008 by Pima Association of Governments, and updated by Pima County.

Certificate of Coverage Program. The program through which the County will grant Section 10 permit coverage to any property owner, at their discretion. This program affords the developer of a home, subdivision, commercial, or industrial project an opportunity to comply with the ESA for activities that are permitted by the County. Participation in the program is voluntary and in the sole discretion of the private developer.

Changed circumstances. “Changes in circumstances affecting a species or geographic area covered by an HCP that can reasonably be anticipated by Plan developers and the USFWS and that can be planned for (e.g., the listing of a new species, or a fire or other natural catastrophic event in areas prone to such events).” (50 CFR §17.3).

County. When referring to the applicants, Pima County and Pima County RFCD. When referring to mitigation lands, lands managed by either of the two applicants.

Covered Species. Species covered under Pima County’s Section 10 permit.

Fee simple. A term of property law where the owner has title (i.e., ownership) to the land.

Implementing Agreement. Specifies all terms and conditions of activities under the HCP. By signing the Implementing Agreement, USFWS explicitly acknowledges approval of the plan and declares that it meets the requirements of an HCP to allow issuance of appropriate permits for target or other named species, should those species become listed.

Incidental take. Take that results from, but is not the purpose of, carrying out an otherwise lawful activity. Take can be both lethal and non-lethal.

Incidental take permit (also called Section 10 permit). A permit issued under Section 10(a)(1)(B) of the Endangered Species Act to a non-Federal party undertaking an otherwise lawful project that might result in the incidental take of an endangered or threatened species. Application for an incidental take permit is subject to certain requirements, including preparation by the permit applicant of a conservation plan, generally known as an HCP.

Maeveen Marie Behan Conservation Lands System (CLS). The biological reserve system design adopted as the Regional Environmental Element of Pima County's 2001 Comprehensive Plan Update, and any subsequent revisions. The CLS provides the principal basis for the selection of lands for mitigation under the permit.

Mitigation Lands. Those lands, leases, or rights held by Pima County and committed as compensation for impacts to habitat of Covered Species stemming from Covered Activities under Pima County's Section 10 permit. Mitigation lands are either owned in fee simple, leased, or held as a partial property right (e.g. conservation easement or other legally enforceable property right).

Mitigation lands, County-controlled. All mitigation lands for which Pima County has a property interest (e.g., fee simple ownership, conservation easement, or grazing lease). Excludes mitigation lands derived from the Certificate of Coverage Program.

Mitigation lands, County-owned. All lands that are owned by Pima County in fee simple and used as compensation for impacts under the terms of Pima County's Section 10 permit.

Pima County. When referring to the proposed permit holder, the term includes Pima County RFCD, a separate taxing authority that is governed by the same elected officials as Pima County.

Preserve Network (Pima County). Land owned and managed for open space preservation, considered in the aggregate. Includes all County-controlled mitigation lands, as well as other Pima County preserves (e.g., Tucson Mountain Park) for which no habitat mitigation credit is being sought.

Priority Conservation Area. Those areas identified by species experts where conservation is necessary for the Covered Species' long-term survival.

Regional Flood Control District (RFCD). The Pima County RFCD is a separate legal entity from Pima County, and one of the two applicants in the MSCP.

Sonoran Desert Conservation Plan (SDCP). Overarching conservation plan for Pima County. The Pima County MSCP is one element of the plan, which includes cultural resource goals, as well as biological goals.

Unforeseen circumstances: "Changes in circumstances affecting a species or geographic area covered by an HCP that could not reasonably have been anticipated by plan developers and the USFWS at the time of the HCP's negotiation and development, and that result in a substantial and adverse change in the status of the Covered Species." (50 CFR §17.3).

14.2 Acronyms

ADWR	Arizona Department of Water Resources
AZGFD	Arizona Game and Fish Department
ALWT	Arizona Land and Water Trust
AZCC	Arizona Conservation Corps
CFR	Code of Federal Regulations
CIP	Capital Improvement Program
CLS	Maeveen Marie Behan Conservation Lands System
Corps	U.S. Army Corps of Engineers
GIS	Geographical Information System
HCP	Habitat Conservation Plan
MSCP	Multi-species Conservation Plan
NRPR	Natural Resources, Parks and Recreation Department (Pima County)
OSC	Office of Sustainability and Conservation (Pima County)
PCEMP	Pima County Ecological Monitoring Program
RFCD	Pima County Regional Flood Control District
USFWS	United States Fish and Wildlife Service

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