Arizona Water Protection Fund
Application Cover Page
FY 2024

WPF2405

Title of Project: **Restoring Riparian Health of Sonoita Creek and Patagonia Lake**

Type of Project:
X Capital or Other
☐ Water Conservation
☐ Research

Stream Type:
X Perennial
☐ Intermittent
☐ Ephemeral

Your level of commitment to maintenance of project benefits and capital improvements:
☐ < 5 years ☐ 5-10 years ☐ 11-15 years X 16-20 years

Applicant Information:
Name/Organization: **Tucson Audubon Society**
Address 1: **300 E University Blvd #120**
Address 2:
City: **Tucson**
State: **AZ**
ZIP Code: **85705**
Phone: **(520) 629-0510**
Fax: **520-232-5477**
Tax ID No.: [redacted]

Inside an AMA: Yes X No ☐

If yes, which AMA:
☐ Douglas
☐ Phoenix
☐ Tucson
☐ Prescott
☐ Pinal
X Santa Cruz

Type of Application:
X New
☐ Continuation

Contact Person:
Name: Jonathan Horst
Title: Director of Conservation + Research
Phone: 520.971.6238
Fax: 520-232-5477
e-mail: jhorst@tucsonaudubon.org

Any Previous AWPF Grants:
X Yes ☐ No

If yes, please provide Grant #(s):
00-115WPF, 04-123WPF, 05-132WPF, 08-160WPF

Arizona Water Protection Fund Grant Amount Requested:

$ 427,117

If the application is funded, will the Grantee intend to request an advance:
☐ **Yes** X **No**

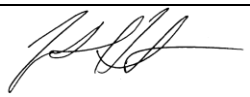
Matching Funds Obtained and Secured:

Applicant/Agency/Organization:	Amount ($):
1. Applicant (Tucson Audubon Society)	$113,952
2. Patagonia Lake State Park	$14,982

Total: $128,934

Has your legal counsel or contracting authority reviewed and accepted the Grant Award Contract General Provisions?
☐Yes ☐No XN/A

Signature of the undersigned certifies understanding and compliance with all terms, conditions and specifications in the attached application. Additionally, signature certifies that all information provided by the applicant is true and accurate. The undersigned acknowledges that intentional presentation of any false or fraudulent information, or knowingly concealing a material fact regarding this application is subject to criminal penalties as provided in A.R.S. Title 13. The Arizona Water Protection Fund Commission may approve Grant Awards with modifications to scope items, methodology, schedule, final products and/or budget.

Jonathan Horst	Director of Conservation and Research 520.971.6238
Typed Name of Applicant or Applicant's Authorized Representative	**Title and Telephone Number**
	8/25/2023

Restoring Riparian Health of Sonoita Creek and Patagonia Lake
Executive Summary

Nestled between the Patagonia Mountains and Grosvenor Hills, Patagonia Lake State Park (PLSP) has been a recreational haven since its establishment in 1975. Located along Highway 82, southwest of the town of Patagonia, the park draws over 200,000 visitors each year. Central to its allure is the 265-acre lake, stretching over 2.5 miles, which has become a magnet for anglers, boaters, and nature enthusiasts alike.

Unfortunately, serious concerns persist regarding the health of Sonoita Creek and the riparian-corridor vegetation leading into the lake on the eastern edge of the park. Due to a lack of appropriate fencing, trespass cattle have roamed freely within the park's boundaries and caused bank erosion and floodplain soil compaction. These issues, along with channel entrenchment, have caused a decline in water-storage capacity, increase in-channel flow velocities, and a reduction in the creek's meandering. In turn, these unfavorable flow conditions have led to invasive plant species replacing native plants, threatening the overall health of the riparian area.

To counter these challenges, Tucson Audubon, in partnership with Arizona State Parks and Trails and Friends of Sonoita Creek (FoSC), proposes a comprehensive project to enhance water quality and availability, as well as overall riparian health, along Sonoita Creek, by reducing erosion-induced dewatering of the floodplain, biological contaminants and sediment, and invasive plants. To accomplish these goals, the project will:

1. Install wildlife-friendly fencing along the eastern boundary of PLSP to prevent erosion, sedimentation, and water-quality degradation stemming from cattle impacts.
2. Complete mapping and treatment of invasive plant species focusing on tree of heaven, johnsongrass, and common cocklebur.
3. Create an Erosion Hazard Plan that maps and documents features and proposes remediation actions.
4. Commit to regular monitoring and maintenance of the perimeter fencing for a minimum of 20 years to ensure the sustained protection of the riparian corridor.

The project endeavors to safeguard the region's ecological balance, ensure its long-term water availability, and nurture its biodiversity. By addressing erosion, invasive species, and ecological degradation, the project aims to secure the future of Sonoita Creek and Patagonia Lake as not only a recreational paradise but also an essential cornerstone for the local economy and ecosystem.

Restoring Riparian Health of Sonoita Creek and Patagonia Lake
Project Overview

Background: Patagonia Lake State Park (PLSP), established in 1975, is located southwest of the town of Patagonia along Highway 82, in the valley between the Patagonia Mountains and Grosvenor Hills and at roughly the midpoint of the course of Sonoita Creek. Managed by Arizona State Parks and Trails as a major recreational site, PLSP attracts over 200,000 annual visitors, largely due to the 2.5-mile long, 265-acre lake and riparian area.

The area of Sonoita Creek flowing from the park's eastern boundary into the lake combines several habitat types that support a diversity of bird species, earning the park, and adjacent Sonoita Creek State Natural Area, recognition as an Important Bird Area of continental significance and drawing thousands of birders to the area annually. With 333 recorded species, PLSP boasts the highest diversity of birdlife in Arizona.

Goals: The proposed project will enhance water quality and availability, as well as overall riparian health, along a significant stretch of Sonoita Creek, by reducing multiple harms: erosion-induced dewatering of the floodplain, excess nutrients, biological contaminants including E. coli bacteria, sedimentation, and high-water-use invasive plants along the creek.

Objectives:
Objective #1 - Complete installation of roughly 4 miles of wildlife-friendly fencing proximate to the eastern boundary of PLSP, the portion upstream of the lake, to protect the riparian corridor from trespass cattle and comply with Arizona's open range laws.
Objective #2 - Complete mapping and treatment of invasive plants within the project area to reduce both fire risk and inappropriate water use by non-native plants, leading to increased canopy cover that will in turn reduce water temperatures and improve overall habitat value.
Objective #3 - Complete full assessment of erosional issues along the creek within the project area and create a prioritized plan for addressing each issue.
Objective #4 - Ensure regular monitoring and maintenance of the perimeter fencing including repairs and reinstallation of break-away sections at flow crossings for a minimum of 20 years.

Statement of Problems/Causes: Beginning in the early 2000s, many local community groups began expressing concern about impacts to Sonoita Creek hydrology, degradation of the riparian corridor vegetation, and an influx of invasive species. Within the Park, the creek banks have been disturbed by trespass cattle moving in and out of the stream, leading to bank erosion and floodplain soil compaction. In the past decade, a headcut has progressed from the lake delta upstream for over a kilometer. Its progress has created entrenchment by incision of vertical cutbanks that are even more susceptible to erosion by both hydraulic forces and animal impacts.

This entrenchment has resulted in poor floodplain connectivity, leading to reduced water storage, increased in-channel flow velocities and reduced meandering, all of which make the creek and historic floodplain more erosive. Reduction in native vegetation cover due to unfavorable flow, along with failed growth of woody species from browsing and loss of riparian bunchgrass from overgrazing, has exacerbated the rapid encroachment of invasive plants ill-suited to provide habitat for native fauna.

Three invasive plant species cause special concern. Tree of heaven (*Ailanthus altissima*) crowds out native species and secretes a chemical into the soil that is toxic to surrounding plants. Johnsongrass (*Sorghum halepense*) is considered one of the top ten worst weeds in the world, and the Town of Patagonia's Flood and Flow Committee has identified it as a priority threat to the watershed. Common cocklebur (*Xanthium strumarium* L.) not only produces notoriously irritating burrs, but its seedlings, though rarely ingested, will poison dogs, cattle, and horses, and can be fatal.

Statement of Solutions:

As noted in AWPF values of riparian areas, this project will address all of the following:

- ➢ Improve water quantity by storing water in streambanks.
- ➢ Improve water quality by trapping sediments from surface water runoff.
- ➢ Provide flood control by slowing and absorbing flood waters.
- ➢ Provide highly valued recreational opportunities.
- ➢ Sustain high biodiversity of plant and animal species.
- ➢ Provide important wildlife habitat.
- ➢ Help stabilize water temperatures for native aquatic species.
- ➢ Provide economic benefits.

Perimeter Fencing: Tucson Audubon (TA), in partnership with Arizona State Parks and Trails, and Friends of Sonoita Creek (FoSC), is proposing a new fence line of roughly four miles along the eastern perimeter of PLSP, encompassing the floodplain of Sonoita Creek. Installation of wildlife-friendly fencing will be contracted to a professional wildland fencing company. Tear-away or other appropriate fencing will be installed to cross sections of washes and Sonoita Creek to provide secure fencing that can be easily maintained and repaired after flood flows.

Appropriately fencing PLSP is a priority category action in the Sonoita Creek Watershed Management Plan as it will prevent future impacts to the creek banks by reducing erosion, channel entrenchment, sedimentation, and E. coli. Each of these avoided impacts will benefit the waters of Sonoita Creek and help maintain a healthy floodplain that increases long-term water availability downstream. These actions may also help stop the progression of the channel headcut, benefitting upstream water users by avoiding future impacts to their floodplain areas.

Invasive plant removal: TA's licensed invasive plant crews, PLSP staff, and volunteers will remove tree of heaven, Johnsongrass, cocklebur, and other invasive plants encountered. Species will be treated with a mixture of manual and chemical approaches as appropriate for each. The approach follows the tenets of Integrated Pest Management, where the least toxic yet effective combination of methods are used, which is especially important in sensitive riparian areas.

Erosion Hazard Remediation Planning: All qualifying erosion hazards (e.g., cutbanks, headcuts, incised washes, scour) will be documented within the project area. Preferred remediation actions will be outlined for each documented feature. Creation of an erosion hazard remediation plan will guide future work to stabilize and restore the hydraulic function of Sonoita Creek, reducing the potential negative impacts of erosion on both the environment and the future enjoyment of the Park.

Statement of Project Years of Benefit to the Resource and General Public:

PLSP is committed to keeping the perimeter fencing intact well beyond the minimum 20-year commitment needed for this project to prevent future impacts to the creek banks and riparian vegetation by future trespass cattle. The economic stability of the region is highly dependent on the health and prosperity of PLSP. The combination of new fencing, invasive species removal, and erosion control will ensure the Park can continue to provide highly valued recreational opportunities for generations to come.

Project Location & Environmental Contaminant Information
FY 2024

Project Location Information

1. County: Santa Cruz	2. Section(s): 19,20,24,25,29,30	3. Township: 22S	4. Range: 14E, 15E

5. Watershed: Sonoita Creek
6. 8 or 10 Digit Hydrologic Unit Code (HUC): 1505030102
7. Name of USGS Topographic Map where project area is located: Cumero Canyon, and Patagonia
8. State Legislative District: 21
   (Information available at: https://redistricting-irc-az.hub.arcgis.com/pages/official-maps
9. Land ownership of project area: Arizona State Parks and Trails
10. Current land use of project area: Public Recreation
11. Size of project area (in acres): 615
12. Stream Name: Sonoita Creek
13. Length of stream through project area: 1.2 miles
14. Miles of stream benefited: 2 miles
15. Acres of riparian habitat: 118 acres will be:
    - ☐ Enhanced
    - ☐ Maintained
    - X Restored
    - ☐ Created

16. General description and/or delineation for the area of impact of the project within the watershed.

This project will benefit the 1.2 miles of Sonoita Creek upstream of Patagonia Lake SP within the boundaries of where the work occurs. This is in roughly the middle of the Sonoita Creek Watershed

17. Provide directions to the project site from the nearest city or town. List any special access requirements:
From Patagonia: Go southwest on AZ-82W 7 miles to Lake Patagonia Road. Turn east and proceed 3.5 miles to the Park.
From Nogales: Go northeast on AZ-82E 10 miles to Lake Patagonia Road. Turn east and proceed 3.5 miles to the Park.

Environmental Contaminant Location Information

1. Does your project site contain known environmental contaminants? ☐**YES** X **NO** If yes, please identify the contaminant(s) and enclose data about the location and levels of contaminants:

2. Are there known environmental contaminants in the project vicinity? ☐**YES** X **NO** If yes, please identify the contaminant(s) and enclose data about the location and levels of contaminants:

3. Are you asking for Arizona Water Protection Fund monies to identify whether or not environmental contaminants are present? ☐**YES** X **NO**

Restoring Riparian Health of Sonoita Creek and Patagonia Lake
Scope of Work

TASK # 1: Permits, Authorizations, Clearances and Agreements

Task Description
Grantee working with Patagonia Lake SP/AZ State Parks & Trails staff to secure SHPO clearance for the fencing installation; ESA section 7 compliance if deemed necessary; formal access agreement between Grantee and PLSP; or any additional clearances deemed necessary.

Task Purpose/Objective
To comply with all local, state, and federal permit requirements, and obtain legal access to project area.

Deliverable Description
Copies of all approved permits, authorizations, clearances, and agreements.

Deliverable Due Date
Prior to any ground-disturbing activities

Responsible Personnel
Grantee and PLSP/AZSP&T staff

Task Cost (rounded to the nearest dollar)
$6,504 (total) | $3,119 (grant); $3,385 (match)

TASK # 2: Finalization of detailed project implementation plans

Task Description
Complete detailed implementation plans for each of the following project activities
1. spatial mapping and invasive treatment plan by species
2. wildlife-friendly fence siting and construction details including tearaway/creek crossing fencing design
3. design of erosion hazard mapping and quantification

Task Purpose/Objective
To ensure that project implementation will follow established best practices and meet design criteria and overall project goals

Deliverable Description
A separate report for each product activity will be produced:
1. Invasive Plant treatment
a. Site infestation map
b. Invasive plant treatment plan quantifying preferred and alternative treatments by species
2. Map of final preferred wildlife-friendly perimeter fence location and description of construction prescriptions
3. Report summarizing the preferred techniques and data collection methods to map erosion hazards throughout the project area

Deliverable Due Date
Prior to any ground-disturbing activities or invasive plant treatment

Responsible Personnel
Grantee and PLSP/AZSP&T staff

Task Cost (rounded to the nearest dollar)
$15,579 (total) | $2,966 (grant); $12,613(match)

TASK # 3: Contract perimeter fence construction installation

Task Description
Secure qualified backcountry/wildland fencing construction contract including 25% down payment (existing $350,000 bid)

Task Purpose/Objective
To make possible the necessary wildlife-friendly perimeter fence to exclude trespass cattle from PLSP and protect the fragile riparian zone from future impacts

Deliverable Description
Signed contract with wildland fencing subcontractor

Deliverable Due Date
9 months after compliance completion

Responsible Personnel
Grantee and PLSP staff

Task Cost (rounded to the nearest dollar)
$92,583 (total) | $92,348 (grant); $235 (match)

TASK # 4: Fence construction installation, Mile 1

Task Description
Selected contractor installs Mile 1 of the perimeter fencing

Task Purpose/Objective
Prevent future impacts to the fragile riparian zone

Deliverable Description
Photographs and mapping documenting appropriate extent of fence installation

Deliverable Due Date
6 months after fencing contract signed

Responsible Personnel
Subcontractor, Grantee

Task Cost (rounded to the nearest dollar)
$70,836 (total) | $69,379 (grant); $1457 (match)

TASK # 5: Fence construction installation, Mile 2

Task Description
Selected contractor installs Mile 2 of the perimeter fencing

Task Purpose/Objective
Prevent future impacts to the fragile riparian zone

Deliverable Description
Photographs and mapping documenting appropriate extent of fence installation

Deliverable Due Date
8 months after fencing contract signed

Responsible Personnel
Subcontractor, grantee

Task Cost (rounded to the nearest dollar)
$70,836 (total) | $69,379 (grant); $1457 (match)

TASK # 6: Fence construction installation, Mile 3

Task Description
Selected contractor installs Mile 3 of the perimeter fencing

Task Purpose/Objective
Prevent future impacts to the fragile riparian zone

Deliverable Description
Photographs and mapping documenting appropriate extent of fence installation

Deliverable Due Date
10 months after fencing contract signed

Responsible Personnel
Subcontractor, grantee

Task Cost (rounded to the nearest dollar)
$70,836 (total) | $69,379 (grant); $1457(match)

TASK # 7: Fence construction installation, Mile 4

Task Description
Selected contractor installs Mile 4 of the perimeter fencing

Task Purpose/Objective
Prevent future impacts to the fragile riparian zone

Deliverable Description
Photographs and mapping documenting appropriate extent of fence installation

Deliverable Due Date
1 year after fencing contract signed

Responsible Personnel
Subcontractor, grantee

Task Cost (rounded to the nearest dollar)
$70,836 (total) | $69,379 (grant); $1457 (match)

TASK # 8: Creek+Wash crossing fence construction

Task Description
Installation of tear-away or other appropriate fencing to cross sections of washes and Sonoita Creek

Task Purpose/Objective
Provide secure perimeter fencing that, by design, can be easily maintained and/or repaired after flood flows

Deliverable Description
Photographic documentation and design schematics of the completed installation of easily repaired/maintained fencing where it crosses washes and Sonoita Creek

Deliverable Due Date
Concurrent with deadline for completion of non-creek-crossing fencelines (1 year after fence construction contract signed)

Responsible Personnel
Grantee, PLSP staff

Task Cost (rounded to the nearest dollar)
$21,028 (total) | $10,106 (grant); $10,922 (match)

TASK # 9: Invasive Plant Treatment, year 1

Task Description
First round of treatment of invasive plants within the project

Task Purpose/Objective
First round removal and treatment of tree of heaven, Johnsongrass, cocklebur and any other invasive plants encountered and mapped to begin restoring riparian vegetation health

Deliverable Description
Photographic report and updated maps detailing treated areas (GIS polygons provided upon request); AZDA herbicide application logs (no herbicide application in WOTUS).

Deliverable Due Date
Nov 2024

Responsible Personnel
Grantee

Task Cost (rounded to the nearest dollar)
$56,470 (total) | $9,907 (grant); $46,563 (match)

TASK # 10: Invasive Plant Treatment, year 2

Task Description
Second round of treatment of invasive plants within the project

Task Purpose/Objective
Remove or treat tree of heaven, Johnsongrass, cocklebur and any other invasive plants encountered and mapped to continue restoring riparian vegetation health and ability of native plants to reestablish

Deliverable Description
Photographic report and updated maps detailing treated areas (GIS polygons provided upon request); AZDA herbicide application logs (no herbicide application in WOTUS).

Deliverable Due Date
Nov 2025

Responsible Personnel
Grantee

Task Cost (rounded to the nearest dollar)
$34,048 (total) | $7,151 (grant); $26,897 (match)

TASK # 11: Invasive Plant Treatment, year 3

Task Description
Third round of treatment of invasive plants within the project

Task Purpose/Objective
Remove or treat tree of heaven, Johnsongrass, cocklebur and any other invasive plants encountered and mapped to continue restoring riparian vegetation health and ability of native plants to reestablish

Deliverable Description
Photographic report and updated maps detailing treated areas (GIS polygons provided upon request); AZDA herbicide application logs (no herbicide application in WOTUS).

Deliverable Due Date
Nov 2026

Responsible Personnel
Grantee

Task Cost (rounded to the nearest dollar)
$21,673 (total) | $5,996 (grant); $15,677 (match)

TASK # 12: Erosion Hazard feature mapping, documentation, and remediation plan

Task Description
Following the Erosion Hazard mapping plan in Task 2, evaluate and document all qualifying erosion hazards (e.g. cutbanks, headcuts, incised washes, scour) within the project area. Each feature will be

mapped in GIS with pertinent metrics quantified. Photographs will provide visual documentation. Preferred remediation actions will be outlined for each documented feature .

Task Purpose/Objective
To scope and guide future work to stabilize and restore the hydraulic function of Sonoita Creek

Deliverable Description
Map (GIS layers provided upon request) of all features and a report outlining the preferred remediation options for each

Deliverable Due Date
2 months before contract termination

Responsible Personnel
Grantee and partners (Friends of Sonoita Creek)

Task Cost (rounded to the nearest dollar)
$15,230 (total) | $8,495 (grant); $6,735 (match)

TASK # 13 Final Report and oral presentation to Commission

Task Description
Providing the required final documentation of project implementation results to AWPF and to the public

Task Purpose/Objective
To ensure Commission and State of Arizona that all portions of the funded project are satisfactorily completed

Deliverable Description
Written report compiling documentation of completion of all project components and oral presentation to AWPF Commission

Deliverable Due Date
Within 90 days of contract termination

Responsible Personnel
Grantee

Task Cost (rounded to the nearest dollar)
$9,592 (total) | $9,513 (grant); $79.00 (match)

Arizona Water Protection Fund Grant Application Detailed Budget

Task 1: Permits, Authorizations, Clearances and Agreements

	Quantity	Unit	Unit Cost	Total	Notes
Direct Labor Costs					
Watershed Project Manager	50.0	hours	$ 30.000	$1,500.00	wage+fringe @ 33%
Watershed Specialist	20.0	hours	$ 33.000	$660.00	wage+fringe @ 33%
Director of Conservation	12.0	hours	$ 55.000	$660.00	wage+fringe @ 33%
Accountant	5.0	hours	$ 30.000	$150.00	wage+fringe @ 33%
Direct Labor Subtotal				**$2,970.00**	
Outside Service Costs					
				$0.00	
				$0.00	
				$0.00	
				$0.00	
Outside Services Subtotal				**$0.00**	
Other Direct Costs					
Travel	**0**	**miles**	**$ 0.625**	$0.00	
				$0.00	
				$0.00	
				$0.00	
Other Direct Subtotal				**$0.00**	
Capital Outlay, Equipment, Supplies, etc.					
				$0.00	
				$0.00	
				$0.00	
				$0.00	
				$0.00	
Other Direct Subtotal				**$0.00**	
Task Subtotal				**$2,970.00**	

Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$149.00**		
			Task 1 Total	**$3,119.00**		
Task 2: Finalization of detailed project implementation plans						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	25.0	hours	$ 30.000	$750.00	wage+fringe @ 33%	
Watershed Specialist	50.0	hours	$ 33.000	$1,650.00	wage+fringe @ 33%	
Director of Conservation	5.0	hours	$ 55.000	$275.00	wage+fringe @ 33%	
Accountant	5.0	hours	$ 30.000	$150.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$2,825.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		

Task Subtotal				**$2,825.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$141.00**		
			Task2 Total	**$2,966.00**		
Task 3: Contract perimeter fence construction installation						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	5.0	hours	$ 30.000	$150.00	wage+fringe @ 33%	
Watershed Specialist	0.0	hours	$ 33.000	$0.00	wage+fringe @ 33%	
Director of Conservation	0.0	hours	$ 55.000	$0.00	wage+fringe @ 33%	
Accountant	10.0	hours	$ 30.000	$300.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$450.00**		
Outside Service Costs						
Wildand/backcountry Fencing subcontractor (25% downpayment)	$ 1	lump	$ 87,500.000	$87,500.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$87,500.00**		
Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		

				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$87,950.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$4,398.00**		
			Task 3 Total	**$92,348.00**		
Task 4: Fence construction installation, Mile 1						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	10.0	hours	$ 30.000	$300.00	wage+fringe @ 33%	
Watershed Specialist	0.0	hours	$ 33.000	$0.00	wage+fringe @ 33%	
Director of Conservation	0.0	hours	$ 55.000	$0.00	wage+fringe @ 33%	
Accountant	5.0	hours	$ 30.000	$150.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$450.00**		
Outside Service Costs						
Wildand/backcountry Fencing subcontractor (1/4 of contract remainder)	$ 1	lump	$ 65,625.000	$65,625.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$65,625.00**		
Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Capital Outlay, Equipment, Supplies, etc.						

				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$66,075.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$3,304.00**		
			Task 4 Total	**$69,379.00**		
Task 5: Fence construction installation, Mile 2						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	10.0	hours	$ 30.000	$300.00	wage+fringe @ 33%	
Watershed Specialist	0.0	hours	$ 33.000	$0.00	wage+fringe @ 33%	
Director of Conservation	0.0	hours	$ 55.000	$0.00	wage+fringe @ 33%	
Accountant	5.0	hours	$ 30.000	$150.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$450.00**		
Outside Service Costs						
Wildand/backcountry Fencing subcontractor (1/4 of contract remainder)	$ 1	lump	$ 65,625.000	$65,625.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$65,625.00**		
Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		
				$0.00		
				$0.00		
				$0.00		

Other Direct Subtotal				**$0.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$66,075.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$3,304.00**		
			Task 5 Total	**$69,379.00**		
Task 6: Fence construction installation, Mile 3						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	10.0	hours	$ 30.000	$300.00	wage+fringe @ 33%	
Watershed Specialist	0.0	hours	$ 33.000	$0.00	wage+fringe @ 33%	
Director of Conservation	0.0	hours	$ 55.000	$0.00	wage+fringe @ 33%	
Accountant	5.0	hours	$ 30.000	$150.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$450.00**		
Outside Service Costs						
Wildand/backcountry Fencing subcontractor (1/4 of contract remainder)	$ 1	lump	$ 65,625.000	$65,625.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$65,625.00**		
Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		

				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$66,075.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$3,304.00**		
			Task 6 Total	**$69,379.00**		
Task 7: Fence construction installation, Mile 4						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	10.0	hours	$ 30.000	$300.00	wage+fringe @ 33%	
Watershed Specialist	0.0	hours	$ 33.000	$0.00	wage+fringe @ 33%	
Director of Conservation	0.0	hours	$ 55.000	$0.00	wage+fringe @ 33%	
Accountant	5.0	hours	$ 30.000	$150.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$450.00**		
Outside Service Costs						
Wildand/backcountry Fencing subcontractor (1/4 of contract remainder)	$ 1	lump	$ 65,625.000	$65,625.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$65,625.00**		

Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$66,075.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$3,304.00**		
			Task 7 Total	**$69,379.00**		
Task 8: Creek+Wash crossing fence construction						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	50.0	hours	$ 30.000	$1,500.00	wage+fringe @ 33%	
Watershed Specialist	50.0	hours	$ 33.000	$1,650.00	wage+fringe @ 33%	
Director of Conservation	25.0	hours	$ 55.000	$1,375.00	wage+fringe @ 33%	
Accountant	10.0	hours	$ 30.000	$300.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$4,825.00**		
Outside Service Costs						
				$0.00		
				$0.00		

				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel		**miles**	**$ 0.625**	$0.00		
Tearaway fencing section materials	**6**	crossings	$ 800.000	$4,800.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$4,800.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$9,625.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$481.00**		
			Task 8 Total	**$10,106.00**		
Task 9: Invasive Plant Treatment, year 1						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	50.0	hours	$ 30.000	$1,500.00	wage+fringe @ 33%	
Watershed Specialist	50.0	hours	$ 33.000	$1,650.00	wage+fringe @ 33%	
Director of Conservation	2.0	hours	$ 55.000	$110.00	wage+fringe @ 33%	
Accountant	10.0	hours	$ 30.000	$300.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$3,560.00**		

Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		
PPE (per-person kits)	5	person-kits	$ 500.000	$2,500.00		
First Aid kit	1	each	$ 125.000	$125.00		
Herbicide (for use outside WOTUS)	20	gallons	$ 60.000	$1,200.00		
Backpack sprayer kit	2	each	$ 350.000	$700.00		
Chainsaw, battery, chains and consumables	3	saw-kit	$ 450.000	$1,350.00		
Other Direct Subtotal				**$5,875.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$9,435.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$472.00**		
			Task 9 Total	**$9,907.00**		
Task 10: Invasive Plant Treatment, year 2						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	25.0	hours	$ 30.000	$750.00	wage+fringe @ 33%	

Watershed Specialist	25.0	hours	$ 33.000	$825.00	wage+fringe @ 33%	
Director of Conservation	2.0	hours	$ 55.000	$110.00	wage+fringe @ 33%	
Accountant	10.0	hours	$ 30.000	$300.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$1,985.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		
PPE (per-person kits)	5	person-kits	$ 500.000	$2,500.00		
First Aid kit	1	each	$ 125.000	$125.00		
Herbicide (for use outside WOTUS)	10	gallons	$ 60.000	$600.00		
Backpack sprayer kit	2	each	$ 350.000	$700.00		
Chainsaw, battery, chains and consumables	2	saw-kit	$ 450.000	$900.00		
Other Direct Subtotal				**$4,825.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$6,810.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$341.00**		
			Task 10 Total	**$7,151.00**		

Task 11: Invasive Plant Treatment, year 3						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	25.0	hours	$ 30.000	$750.00	wage+fringe @ 33%	
Watershed Specialist	25.0	hours	$ 33.000	$825.00	wage+fringe @ 33%	
Director of Conservation	2.0	hours	$ 55.000	$110.00	wage+fringe @ 33%	
Accountant	10.0	hours	$ 30.000	$300.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$1,985.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		
PPE (per-person kits)	5	person-kits	$ 500.000	$2,500.00		
First Aid kit	1	each	$ 125.000	$125.00		
Herbicide (for use outside WOTUS)	5	gallons	$ 60.000	$300.00		
Backpack sprayer kit	1	each	$ 350.000	$350.00		
Chainsaw, battery, chains and consumables	1	saw-kit	$ 450.000	$450.00		
Other Direct Subtotal				**$3,725.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$5,710.00**		

Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$286.00**		
			Task 11 Total	**$5,996.00**		
Task 12: Erosion Hazard feature mapping, documentation, and remediation plan						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	80.0	hours	$ 30.000	$2,400.00	wage+fringe @ 33%	
Watershed Specialist	80.0	hours	$ 33.000	$2,640.00	wage+fringe @ 33%	
Director of Conservation	40.0	hours	$ 55.000	$2,200.00	wage+fringe @ 33%	
Accountant	5.0	hours	$ 30.000	$150.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$7,390.00**		
Outside Service Costs						
GIS subcontract	10	hours	$ 70.000	$700.00	long-term GIS partnership	
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$700.00**		
Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		

Task Subtotal				**$8,090.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$405.00**		
			Task 12 Total	**$8,495.00**		
Task 13: Final Report and oral presentation to Commission						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	100.0	hours	$ 30.000	$3,000.00	wage+fringe @ 33%	
Watershed Specialist	80.0	hours	$ 33.000	$2,640.00	wage+fringe @ 33%	
Director of Conservation	60.0	hours	$ 55.000	$3,300.00	wage+fringe @ 33%	
Accountant	4.0	hours	$ 30.000	$120.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$9,060.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel	**0**	**miles**	**$ 0.625**	$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		

				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$9,060.00**		
Optional: AWPF Administrative Costs (not to exceed 5% of Task Subtotal)				**$453.00**		
			Task 13 Total	**$9,513.00**		
Arizona Water Protection Fund Grant Application Fund Request				**$427,117.00**		

Matching Funds / Cost Share Budget

Task 1: Permits, Authorizations, Clearances and Agreements					
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**
Direct Labor Costs					
Watershed Project Manager	20.0	hours	$ 30.000	$600.00	wage+fringe @ 33%
Watershed Specialist/Program Manager	20.0	hours	$ 33.000	$660.00	wage+fringe @ 33%
Director of Conservation	12.0	hours	$ 55.000	$660.00	wage+fringe @ 33%
Invasive Plant Stike Team	0.0	hours	$ 31.000	$0.00	wage+fringe @ 33%
Direct Labor Subtotal				**$1,920.00**	
Outside Service Costs					
				$0.00	
				$0.00	
				$0.00	
				$0.00	
Outside Services Subtotal				**$0.00**	
Other Direct Costs					
Travel (at paid GSA rate)	**600**	**miles**	**$ 0.665**	$399.00	travel to and from site; to meetings
				$0.00	
				$0.00	
				$0.00	
Other Direct Subtotal				**$399.00**	
Capital Outlay, Equipment, Supplies, etc.					
				$0.00	
				$0.00	
				$0.00	
				$0.00	
				$0.00	
Other Direct Subtotal				**$0.00**	
Task Subtotal				**$2,319.00**	

Optional: Administrative Costs - 17.5% organizational IDC				**$406.00**	
NON-GRANTEE MATCH (in-kind)					
Non-Grantee Labor Costs (no overhead)					
Volunteers		hours	$ 13.500	$0.00	
PLSP staff	20.0	hours	$ 33.000	$660.00	wage+fringe
Other In-kind costs					
In-Kind Travel GSA rate)		**miles**	**$ 0.665**	$0.00	travel to and from site; to meetings
			Task 1 Total	**$3,385.00**	
Task 2: Finalization of detailed project implementation plans					
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**
Direct Labor Costs					
Watershed Project Manager	100.0	hours	$ 30.000	$3,000.00	wage+fringe @ 33%
Watershed Specialist	50.0	hours	$ 33.000	$1,650.00	wage+fringe @ 33%
Director of Conservation	20.0	hours	$ 55.000	$1,100.00	wage+fringe @ 33%
Invasive Plant Program Manager	50.0	hours	$ 47.000	$2,350.00	wage+fringe @ 33%
Direct Labor Subtotal				**$8,100.00**	
Outside Service Costs					
GIS subcontract	$ 10	hours	$ 70.000	$700.00	long-term GIS contractor relationship
				$0.00	
				$0.00	
				$0.00	
Outside Services Subtotal				**$700.00**	
Other Direct Costs					
Travel (at paid GSA rate)	**1200**	**miles**	**$ 0.665**	$798.00	
				$0.00	
				$0.00	
				$0.00	
Other Direct Subtotal				**$798.00**	
Capital Outlay, Equipment, Supplies, etc.					

				$0.00	
				$0.00	
				$0.00	
				$0.00	
				$0.00	
Other Direct Subtotal				**$0.00**	
Task Subtotal				**$9,598.00**	
Optional: Administrative Costs - 17.5% organizational IDC				**$1,680.00**	
NON-GRANTEE MATCH (in-kind)					
Non-Grantee Labor Costs (no overhead)					
Volunteers	50.0	hours	$ 13.500	$675.00	
PLSP staff	20.0	hours	$ 33.000	$660.00	wage+fringe
Other In-kind costs					
In-Kind Travel GSA rate)		**miles**	**$ 0.665**	$0.00	travel to and from site; to meetings
			Task2 Total	**$12,613.00**	
Task 3: Contract perimeter fence construction installation					
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**
Direct Labor Costs					
Watershed Project Manager	0.0	hours	$ 30.000	$0.00	wage+fringe @ 33%
Watershed Specialist	0.0	hours	$ 33.000	$0.00	wage+fringe @ 33%
Director of Conservation	0.0	hours	$ 55.000	$0.00	wage+fringe @ 33%
Accountant	0.0	hours	$ 30.000	$0.00	wage+fringe @ 33%
Direct Labor Subtotal				**$0.00**	
Outside Service Costs					
				$0.00	
				$0.00	
				$0.00	
				$0.00	
Outside Services Subtotal				**$0.00**	

Other Direct Costs						
Travel (at paid GSA rate)	**300**	**miles**	**$**	**0.665**	$199.50	
					$0.00	
					$0.00	
					$0.00	
Other Direct Subtotal					**$199.50**	
Capital Outlay, Equipment, Supplies, etc.						
					$0.00	
					$0.00	
					$0.00	
					$0.00	
					$0.00	
Other Direct Subtotal					**$0.00**	
Task Subtotal					**$200.00**	
Optional: Administrative Costs - 17.5% organizational IDC					**$35.00**	
NON-GRANTEE MATCH (in-kind)						
Non-Grantee Labor Costs (no overhead)						
Volunteers	0.0	hours	$	13.500	$0.00	
PLSP staff	0.0	hours	$	33.000	$0.00	wage+fringe
Other In-kind costs						
In-Kind Travel GSA rate)		**miles**	**$**	**0.665**	$0.00	travel to and from site; to meetings
				Task 3 Total	**$235.00**	
Task 4: Fence construction installation, Mile 1						
	Quantity	**Unit**	**Unit Cost**		**Total**	**Notes**
Direct Labor Costs						
Watershed Project Manager	30.0	hours	$	30.000	$900.00	wage+fringe @ 33%
Watershed Specialist	0.0	hours	$	33.000	$0.00	wage+fringe @ 33%
Director of Conservation	0.0	hours	$	55.000	$0.00	wage+fringe @ 33%

Accountant	0.0	hours	$ 30.000	$0.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$900.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel (at paid GSA rate)	**300**	**miles**	**$ 0.665**	$199.50		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$200.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$1,100.00**		
Optional: Administrative Costs - 17.5% organizational IDC				**$192.00**		
NON-GRANTEE MATCH (in-kind)						
Non-Grantee Labor Costs (no overhead)						
Volunteers		hours	$ 13.500	$0.00		
PLSP staff	5.0	hours	$ 33.000	$165.00	wage+fringe	
Other In-kind costs						
In-Kind Travel GSA rate)		**miles**	**$ 0.665**	$0.00	travel to and from site; to meetings	

			Task 4 Total	**$1,457.00**		
Task 5: Fence construction installation, Mile 2						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	30.0	hours	$ 30.000	$900.00	wage+fringe @ 33%	
Watershed Specialist	0.0	hours	$ 33.000	$0.00	wage+fringe @ 33%	
Director of Conservation	0.0	hours	$ 55.000	$0.00	wage+fringe @ 33%	
Accountant	0.0	hours	$ 30.000	$0.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$900.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel (at paid GSA rate)	**300**	**miles**	**$ 0.665**	$199.50		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$200.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$1,100.00**		

Optional: Administrative Costs - 17.5% organizational IDC				**$192.00**		
NON-GRANTEE MATCH (in-kind)						
Non-Grantee Labor Costs (no overhead)						
Volunteers		hours	$ 13.500	$0.00		
PLSP staff	5.0	hours	$ 33.000	$165.00	wage+fringe	
Other In-kind costs						
In-Kind Travel GSA rate)		**miles**	**$ 0.665**	$0.00	travel to and from site; to meetings	
			Task 5 Total	**$1,457.00**		
Task 6: Fence construction installation, Mile 3						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	30.0	hours	$ 30.000	$900.00	wage+fringe @ 33%	
Watershed Specialist	0.0	hours	$ 33.000	$0.00	wage+fringe @ 33%	
Director of Conservation	0.0	hours	$ 55.000	$0.00	wage+fringe @ 33%	
Accountant	0.0	hours	$ 30.000	$0.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$900.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel (at paid GSA rate)	**300**	**miles**	**$ 0.665**	$199.50		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$200.00**		

Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$1,100.00**		
Optional: Administrative Costs - 17.5% organizational IDC				**$192.00**		
NON-GRANTEE MATCH (in-kind)						
Non-Grantee Labor Costs (no overhead)						
Volunteers		hours	$ 13.500	$0.00		
PLSP staff	5.0	hours	$ 33.000	$165.00	wage+fringe	
Other In-kind costs						
In-Kind Travel GSA rate)		**miles**	**$ 0.665**	$0.00	travel to and from site; to meetings	
			Task 6 Total	**$1,457.00**		
Task 7: Fence construction installation, Mile 4						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	30.0	hours	$ 30.000	$900.00	wage+fringe @ 33%	
Watershed Specialist	0.0	hours	$ 33.000	$0.00	wage+fringe @ 33%	
Director of Conservation	0.0	hours	$ 55.000	$0.00	wage+fringe @ 33%	
Accountant	0.0	hours	$ 30.000	$0.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$900.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		

Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel (at paid GSA rate)	**300**	**miles**	**$** **0.665**	$199.50		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$199.50**		
Capital Outlay, Equipment, Supplies, etc.						
		miles	**$** **0.625**	$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$1,100.00**		
Optional: Administrative Costs - 17.5% organizational IDC				**$192.00**		
NON-GRANTEE MATCH (in-kind)						
Non-Grantee Labor Costs (no overhead)						
Volunteers		hours	$ 13.500	$0.00		
PLSP staff	5.0	hours	$ 33.000	$165.00	wage+fringe	
Other In-kind costs						
In-Kind Travel GSA rate)		**miles**	**$** **0.665**	$0.00	travel to and from site; to meetings	
			Task 7 Total	**$1,457.00**		
Task 8: Creek+Wash crossing fence construction						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	50.0	hours	$ 30.000	$1,500.00	wage+fringe @ 33%	
Watershed Specialist	50.0	hours	$ 33.000	$1,650.00	wage+fringe @ 33%	

Director of Conservation	25.0	hours	$ 55.000	$1,375.00	wage+fringe @ 33%	
Field Crew	100.0	hours	$ 32.000	$3,200.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$7,725.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel (at paid GSA rate)	**1200**	**miles**	**$ 0.665**	$798.00		
Tearaway fencing section materials				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$798.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$8,523.00**		
Optional: Administrative Costs - 17.5% organizational IDC				**$1,492.00**		
NON-GRANTEE MATCH (in-kind)						
Non-Grantee Labor Costs (no overhead)						
Volunteers	50.0	hours	$ 13.500	$675.00		
PLSP staff	5.0	hours	$ 33.000	$165.00	wage+fringe	
Other In-kind costs						
In-Kind Travel GSA rate)	**100**	**miles**	**$ 0.665**	$67.00	travel to and from site; to meetings	

			Task 8 Total	**$10,922.00**		
Task 9: Invasive Plant Treatment, year 1						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	40.0	hours	$ 30.000	$1,200.00	wage+fringe @ 33%	
Invasive Plant Program Manager	30.0	hours	$ 47.000	$1,410.00	wage+fringe @ 33%	
Director of Conservation	20.0	hours	$ 55.000	$1,100.00	wage+fringe @ 33%	
Invasive Plant Stike Team	880.0	hours	$ 31.000	$27,280.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$30,990.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel (at paid GSA rate)	**2400**	**miles**	**$ 0.665**	$1,596.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$1,596.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		

Task Subtotal				**$32,586.00**	
Optional: Administrative Costs - 17.5% organizational IDC				**$5,703.00**	
NON-GRANTEE MATCH (in-kind)					
Non-Grantee Labor Costs (no overhead)					
Volunteers	300.0	hours	$ 13.500	$4,050.00	
PLSP staff	128.0	hours	$ 33.000	$4,224.00	wage+fringe
Other In-kind costs					
In-Kind Travel GSA rate)		**miles**	**$ 0.665**	$0.00	travel to and from site; to meetings
			Task 9 Total	**$46,563.00**	
Task 10: Invasive Plant Treatment, year 2					
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**
Direct Labor Costs					
Watershed Project Manager	20.0	hours	$ 30.000	$600.00	wage+fringe @ 33%
Invasive Plant Program Manager	30.0	hours	$ 47.000	$1,410.00	wage+fringe @ 33%
Director of Conservation	10.0	hours	$ 55.000	$550.00	wage+fringe @ 33%
Invasive Plant Stike Team	440.0	hours	$ 31.000	$13,640.00	wage+fringe @ 33%
Direct Labor Subtotal				**$16,200.00**	
Outside Service Costs					
				$0.00	
				$0.00	
				$0.00	
				$0.00	
Outside Services Subtotal				**$0.00**	
Other Direct Costs					
Travel (at paid GSA rate)	**1200**	**miles**	**$ 0.665**	$798.00	
				$0.00	
				$0.00	
				$0.00	
Other Direct Subtotal				**$798.00**	

Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$16,998.00**		
Optional: Administrative Costs - 17.5% organizational IDC				**$2,975.00**		
NON-GRANTEE MATCH (in-kind)						
Non-Grantee Labor Costs (no overhead)						
Volunteers	200.0	hours	$ 13.500	$2,700.00		
PLSP staff	128.0	hours	$ 33.000	$4,224.00	wage+fringe	
Other In-kind costs						
In-Kind Travel GSA rate)		**miles**	**$ 0.665**	$0.00	travel to and from site; to meetings	
			Task 10 Total	**$26,897.00**		
Task 11: Invasive Plant Treatment, year 3						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	20.0	hours	$ 30.000	$600.00	wage+fringe @ 33%	
Invasive Plant Program Manager	20.0	hours	$ 47.000	$940.00	wage+fringe @ 33%	
Director of Conservation	10.0	hours	$ 55.000	$550.00	wage+fringe @ 33%	
Invasive Plant Stike Team	160.0	hours	$ 31.000	$4,960.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$7,050.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		

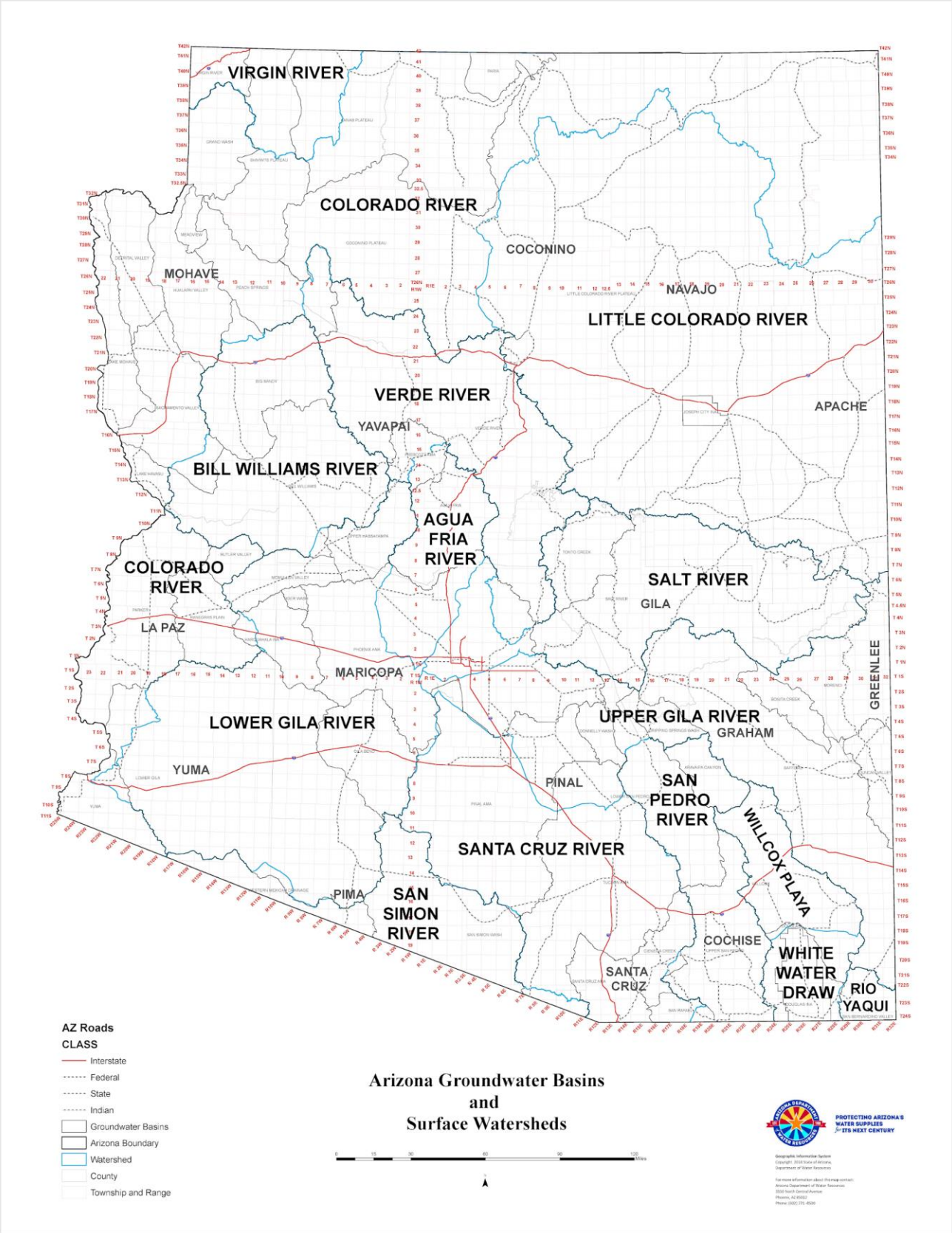
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel (at paid GSA rate)	**600**	**miles**	**$ 0.665**	$399.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$399.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$7,449.00**		
Optional: Administrative Costs - 17.5% organizational IDC				**$1,304.00**		
NON-GRANTEE MATCH (in-kind)						
Non-Grantee Labor Costs (no overhead)						
Volunteers	200.0	hours	$ 13.500	$2,700.00		
PLSP staff	128.0	hours	$ 33.000	$4,224.00	wage+fringe	
Other In-kind costs						
In-Kind Travel GSA rate)		**miles**	**$ 0.665**	$0.00	travel to and from site; to meetings	
			Task 11 Total	**$15,677.00**		
Task 12: Erosion Hazard feature mapping, documentation, and remediation plan						
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**	
Direct Labor Costs						
Watershed Project Manager	40.0	hours	$ 30.000	$1,200.00	wage+fringe @ 33%	

Watershed Specialist	40.0	hours	$ 33.000	$1,320.00	wage+fringe @ 33%	
Director of Conservation	10.0	hours	$ 55.000	$550.00	wage+fringe @ 33%	
Accountant		hours	$ 30.000	$0.00	wage+fringe @ 33%	
Direct Labor Subtotal				**$3,070.00**		
Outside Service Costs						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Outside Services Subtotal				**$0.00**		
Other Direct Costs						
Travel (at paid GSA rate)	**1200**	**miles**	**$ 0.665**	$798.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$798.00**		
Capital Outlay, Equipment, Supplies, etc.						
				$0.00		
				$0.00		
				$0.00		
				$0.00		
				$0.00		
Other Direct Subtotal				**$0.00**		
Task Subtotal				**$3,868.00**		
Optional: Administrative Costs - 17.5% organizational IDC				**$677.00**		
NON-GRANTEE MATCH (in-kind)						
Non-Grantee Labor Costs (no overhead)						
Volunteers	150.0	hours	$ 13.500	$2,025.00		
PLSP staff	5.0	hours	$ 33.000	$165.00	wage+fringe	
Other In-kind costs						

In-Kind Travel GSA rate)		**miles**	**$ 0.665**	$0.00	travel to and from site; to meetings
			Task 12 Total	**$6,735.00**	
Task 13: Final Report and oral presentation to Commission					
	Quantity	**Unit**	**Unit Cost**	**Total**	**Notes**
Direct Labor Costs					
Watershed Project Manager	0.0	hours	$ 30.000	$0.00	wage+fringe @ 33%
Watershed Specialist	0.0	hours	$ 33.000	$0.00	wage+fringe @ 33%
Director of Conservation	0.0	hours	$ 55.000	$0.00	wage+fringe @ 33%
Accountant	0.0	hours	$ 30.000	$0.00	wage+fringe @ 33%
Direct Labor Subtotal				**$0.00**	
Outside Service Costs					
				$0.00	
				$0.00	
				$0.00	
				$0.00	
Outside Services Subtotal				**$0.00**	
Other Direct Costs					
Travel (at paid GSA rate)	**100**	**miles**	**$ 0.665**	$66.50	
				$0.00	
				$0.00	
				$0.00	
Other Direct Subtotal				**$67.00**	
Capital Outlay, Equipment, Supplies, etc.					
				$0.00	
				$0.00	
				$0.00	
				$0.00	
				$0.00	
Other Direct Subtotal				**$0.00**	

Task Subtotal				**$67.00**		
Optional: Administrative Costs - 17.5% organizational IDC				**$12.00**		
NON-GRANTEE MATCH (in-kind)						
Non-Grantee Labor Costs (no overhead)						
Volunteers		hours	$ 13.500	$0.00		
PLSP staff		hours	$ 33.000	$0.00	wage+fringe	
Other In-kind costs						
In-Kind Travel GSA rate)		**miles**	**$ 0.665**	$0.00	travel to and from site; to meetings	
			Task 13 Total	**$79.00**		
Matching Funds / Cost Share Budget				**$128,934.00**		

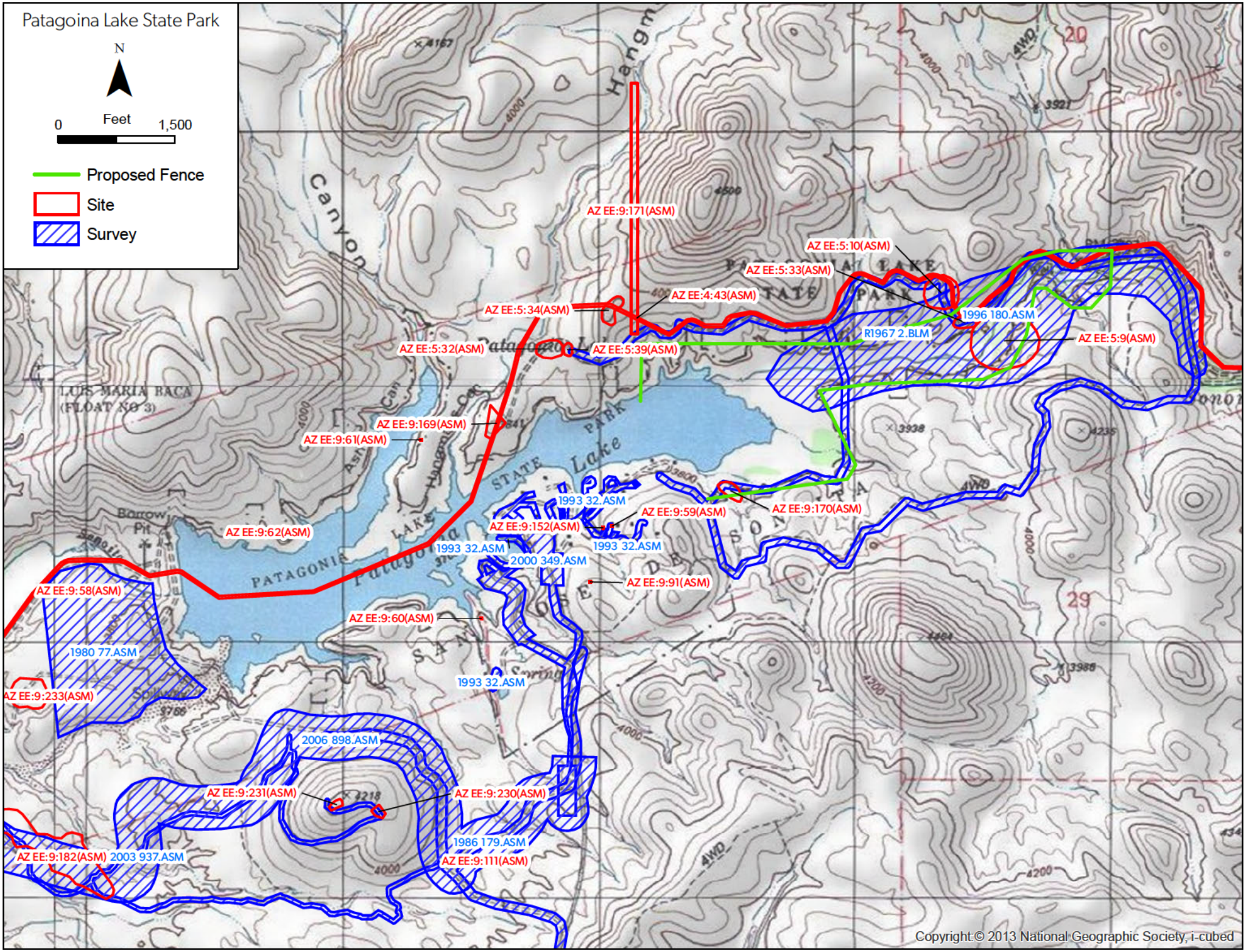
Arizona Watershed Map
FY 2024



Title of Project: Restoring Riparian Health of Sonoita Creek and Patagonia Lake

Location: (Township/Range/Section): 22S/ 14S, 15S/ 19,20,24,25,29,30

★


Patagoina Lake State Park
N
0
Feet
1,500
Proposed Fence
Site
Survey
AZ EE:9:171(ASM)
AZ EE:5:10(ASM)
AZ EE:5:33(ASM)
AZ EE:4:43(ASM)
AZ EE:5:34(ASM)
1996 180.ASM
R1967 2.BLM
AZ EE:5:9(ASM)
AZ EE:5:32(ASM)
AZ EE:5:39(ASM)
AZ EE:9:169(ASM)
AZ EE:9:61(ASM)
1993 32.ASM
AZ EE:9:59(ASM)
AZ EE:9:170(ASM)
AZ EE:9:152(ASM)
AZ EE:9:62(ASM)
1993 32.ASM
1993 32.ASM
2000 349.ASM
AZ EE:9:91(ASM)
AZ EE:9:58(ASM)
AZ EE:9:60(ASM)
1980 77.ASM
AZ EE:9:233(ASM)
1993 32.ASM
2006 898.ASM
AZ EE:9:231(ASM)
AZ EE:9:230(ASM)
1986 179.ASM
AZ EE:9:182(ASM)
2003 937.ASM
AZ EE:9:111(ASM)
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PLSP AWPF Project Area

8/25/2023

PLSP_owned

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

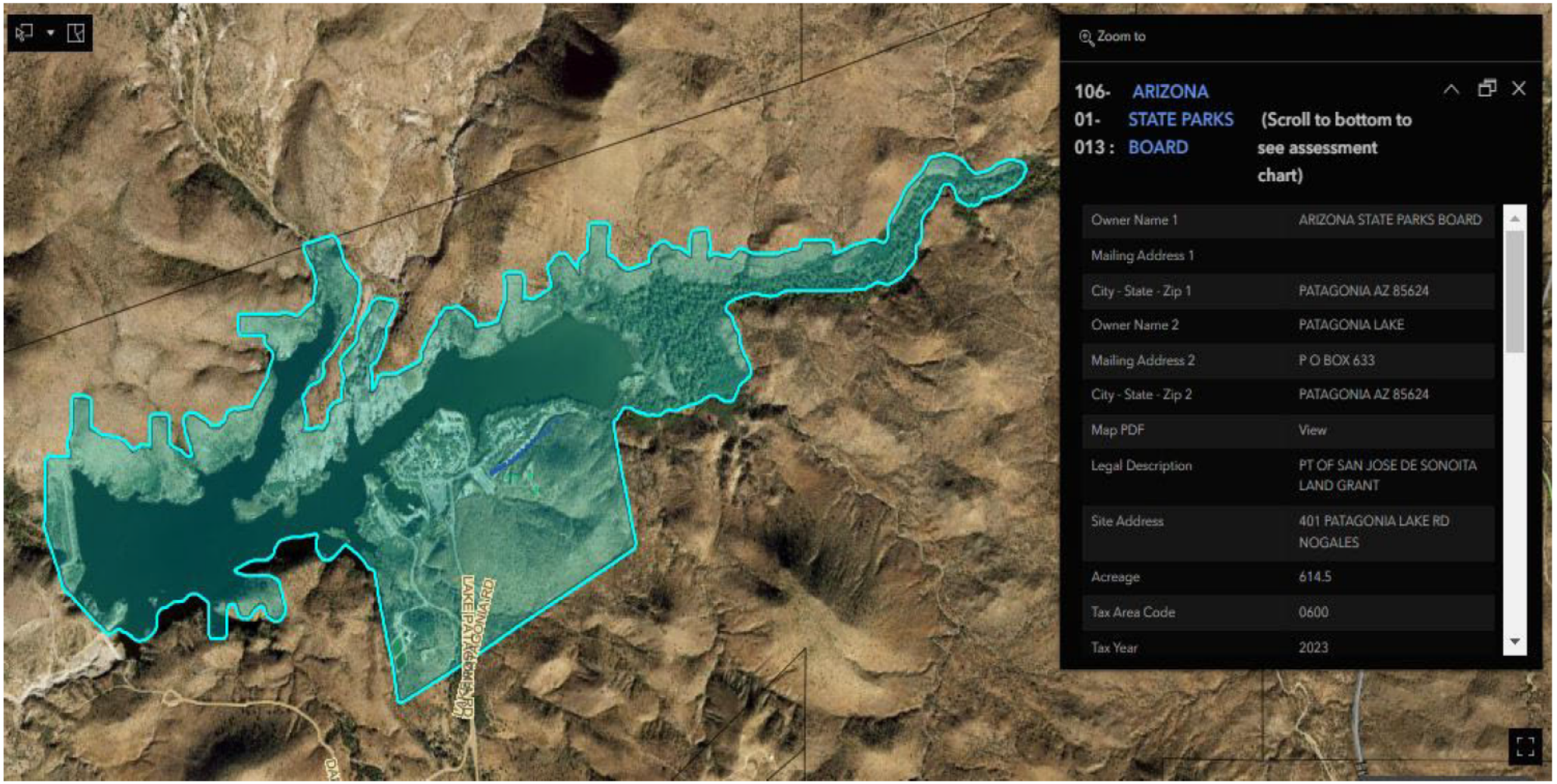
2.4m Resolution Metadata

1:8,306

0 0.05 0.1 0.2 mi

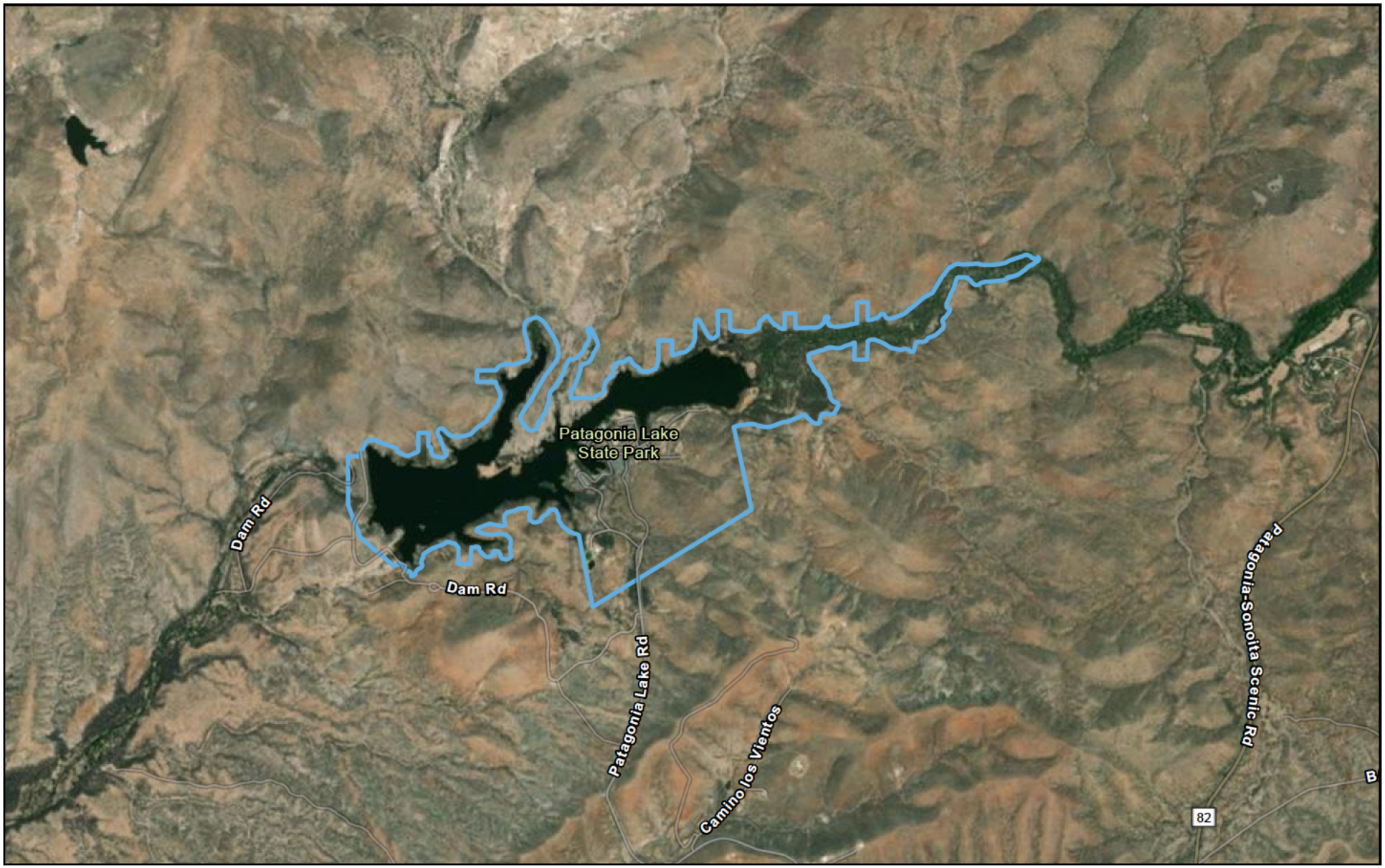
0 0.07 0.15 0.3 km

Patagonia Lake State Park Land Ownership



Source: Santa Cruz County, AZ Assessor's Office 2023

Patagonia Lake State Park



8/25/2023

PLSP_owned

World Imagery

Low Resolution 15m Imagery

High Resolution 60cm Imagery

High Resolution 30cm Imagery

Citations

9.6m Resolution Metadata

1:36,112

0 0.25 0.5 1 mi

0 0.4 0.8 1.6 km

CONANP, Esri, HERE, Garmin, Foursquare, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, US

Applications: Restoring Riparian Health of Sonoita Creek and Patagonia Lake

Profile
jhorst@tucsonaudubon.org

Project Title
Restor ng R par an Hea th of Sono ta Creek and Patagon a Lake

Organization Name
Tucson Audubon Soc ety

Application Cover Page
App cat on Cover Page_AWPF_FY2024.docx

Executive Summary
Execut veSummaryTemp ate_AWPF_FY2024.docx

Project Overview
ProjectOverv ew_AWPF_FY2024.docx

Project Location and Environmental Contaminant Information
ProjectLocat on_Env ronmenta Contam nantInformat onForm_AWPF_FY2024_0.docx

Scope of Work
Scope of Work_AWPF_FY2024.docx

AWPF Detailed Budget
AWPF_App cat onDeta edBudget_FY2024-Rounded.x sx

Matching / Cost Share Budget
Match ngFunds_CostShare_App cat onDeta edBudget-Rounded.x sx

Arizona Watershed Map
Ar zonaWatershedMapForm_AWPF_FY2024.docx

Project Location: Schematic Maps
PALA_AZSITE2.pdf

Project Location: Schematic Maps (cont.)
PLSP_Project_Area.pdf

Project Location: Ownership Maps
PALA_ownersh p.pdf

Project Location: Ownership Maps (cont.)
PLSP_Boundary.pdf

State Historic Preservation Office (SHPO) Review Forms
StateH stor cPreservat onOff ceForms_AWPF_FY2024.docx

State Historic Preservation Office (SHPO) Review Forms (cont.)
ASPT-SHPO Consu tat on Form - PALA Fenc ng.docx

State Historic Preservation Office (SHPO) Review Forms (cont.)

State Historic Preservation Office (SHPO) Review Forms (cont.)

State Historic Preservation Office (SHPO) Review Forms (cont.)

Key Personnel
[Project Coord nator] Howard Buchanan, Watershed Spec a st, s Tucson Audubon s L a son to AZ State Parks for a ssues surround ng b rd ng and restorat on at Patagon a Lake State Park. He serves as the TA Representat ve to Town of Patagon a s F ood and F ow Comm ttee and as an Adv sory Board Member of the Fr ends of Sono ta Creek. He has been b rd ng and engaged n hab tat nventory and mon tor ng at State Parks for 15 years.

Tony F gueroa, Invas ve P ant Program Manager, heads a team of 20 fu t me staff work ng on nvas ve p ant mapp ng and treatment efforts throughout the Desert Southwest. He s regu ar y consu ted by state and federa agenc es for recommendat ons on the best treatment processes for a w de range of nvas ve p ants.

Jonathan Horst, D rector of Conservat on and Research, has gu ded Tucson Audubon s hab tat and ecosystem restorat on efforts s nce 2012, started and s the Qua fy ng Party for Tucson Audubon s Pest c de bus ness cense (AZDA 10096), and set n mot on secur ng Tucson Audubon s new RC-21 Contract ng L cense (ROC 346691). He s tra ned as a desert eco og st spec a z ng n nvas ve p ants and p ant-an ma hab tat nteract ons.

Co t A ford has worked for 22 years at Ar zona State Parks and Tra s. He s the Manager and ead aw enforcement off cer for Patagon a Lake State Park. He manages the 5,000 acre Sono ta Creek State Natura Area, and the 22,000 acre San Rafae State Natura Area.

Key Personnel (cont.)
2023 TA personne resumes.pdf

Project Site Photographs
AWPF_PALA_Photos.pdf

Project Implementation Plans
Invas ve P ant Mon tor ng: Tucson Audubon has a we deve oped GIS for mapp ng, mon tor ng, and track ng treatment of nvas ve p ants. Po ygons are created by f e d surveyors annotat ng spec f c dens ty and extent of nvas ve p ant coverage for each spec es encountered (nd v dua s or very sma groups are marked as po nts nstead of po ygons) wh e n the f e d compar ng aer a magery and the r prec se ocat on on the map. Th s produces h gh reso ut on nformat on about nvas ve p ants and a ows track ng through t me by fo ow-up mon tors.

Project photo po nts: Tucson Audubon has used repeat photo mon tor ng on numerous projects as a way of convey ng to funders and other stakeho ders an eas y nterpretab e exam nat on of project resu ts. We e ther nsta a permanent photo stake, depend ng on cu tura c earance ssues, or another permanent marker on a natura object to then take standard zed repeat photographs. The or entat on and f e d of v ew are carefu y de neated on data sheets to capture project-re evant nformat on. Photos are appended to a track ng report after each v s t.

R par an Stream Rap d Assessment: th s standard zed protoco a ows for quant f cat on of stream hea th a ong a def ned set of metr cs appropr ate to the ar d Southwest. The RSRA protoco (Stacey et a . 2013) was deve oped to prov de a mechan sm to object ve y determ ne the funct ona cond t on of both the aquat c and r par an components of sma and med um s zed streams and r vers n the Amer can Southwest and n other s m ar ar d and sem -ar d reg ons. Patagon a Lake State Park, Fr ends of Sono ta Creek a ong w th TNC and TAS have been part c pat ng n these assessments s nce 2014 and they extend from the upstream boundary of the park through the project area westward to Patagon a Lake.

Existing Plans / Reports / Information
Ex st ng P ans - Restor ng R par an Hea th of Sono ta Creek and Patagon a Lake.pdf

Existing Plans / Reports / Information (cont.)

Existing Plans / Reports / Information (cont.)

Letters of Community Support
LOS_AWPF-merged.pdf

Letters from Entities Pledging Matching Funds
AWPF-match ng fund p edges.docx

Evidence of Control and Tenure of Land
AWPF-ev dence of Contro and Tenure of Land nc ud ng ega access.docx

Evidence of Control and Tenure of Land (cont.)

Project Site Access / Permission to Conduct Work
Ar zona State Parks and Tra s Patagon a Lake State Park s a major partner on th s proposed project and has agreed to prov de Tucson Audubon, subcontractors, add t ona project partners, and vo unteers w th a R ght of Entry agreement a ow ng execut on of th s project.

Evidence of Physical and Legal Availability of Water
Ev dence of Water N_A.docx

Evidence of Physical and Legal Availability of Water (cont.)

OPTIONAL: Additional Project Information
Ar zona State Parks and Tra s Patagon a Lake State Park has a ready begun the process of SHPO comp ance. We f ed out the requ red form, but a so up oaded ASPT's form wh ch has a ready been sent to SHPO and has more spec f c deta s than Tucson Audubon cou d convey n our grant form.

OPTIONAL: Additional Project Information

OPTIONAL: Additional Project Information

OPTIONAL: Additional Project Information

OPTIONAL: Additional Project Information

OPTIONAL: Additional Project Information

View Budget Worksheet

View Application Goals
https://porta .ec v s.com/#/peerGoa s/C9B301BE-F335-40A3-B7F8-8769CE85BA48

Applications: File Attachments

Application Cover Page
App cat on Cover Page_AWPF_FY2024.docx

Executive Summary
Execut veSummaryTemp ate_AWPF_FY2024.docx

Project Overview
ProjectOverv ew_AWPF_FY2024.docx

Project Location and Environmental Contaminant Information
ProjectLocat on_Env ronmenta Contam nantInformat onForm_AWPF_FY2024_0.docx

Scope of Work
Scope of Work_AWPF_FY2024.docx

AWPF Detailed Budget

AWPF_App cat onDeta edBudget_FY2024-Rounded.x sx

Matching / Cost Share Budget
Match ngFunds_CostShare_App cat onDeta edBudget-Rounded.x sx

Arizona Watershed Map
Ar zonaWatershedMapForm_AWPF_FY2024.docx

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PALA_AZSITE2.pdf

Project Location: Schematic Maps (cont.)
PLSP_Project_Area.pdf

Project Location: Ownership Maps
PALA_ownersh p.pdf

Project Location: Ownership Maps (cont.)
PLSP_Boundary.pdf

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State Historic Preservation Office (SHPO) Review Forms (cont.)
ASPT-SHPO Consu tat on Form - PALA Fenc ng.docx

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2023 TA personne resumes.pdf

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AWPF_PALA_Photos.pdf

Existing Plans / Reports / Information
Ex st ng P ans - Restor ng R par an Hea th of Sono ta Creek and Patagon a Lake.pdf

Letters of Community Support
LOS_AWPF-merged.pdf

Letters from Entities Pledging Matching Funds
AWPF-match ng fund p edges.docx

Evidence of Control and Tenure of Land
AWPF-ev dence of Contro and Tenure of Land nc ud ng ega access.docx

Evidence of Physical and Legal Availability of Water
Ev dence of Water N_A.docx

STATE HISTORIC PRESERVATION OFFICE
Review Form

In accordance with the State Historic Preservation Act (SHPO), A.R.S. 41-861 *et seq*, effective July 24, 1982, each State agency must consider the potential of activities or projects to impact significant cultural resources. Also, each State agency is required to consult with the State Historic Preservation Officer with regard to those activities or projects that may impact cultural resources. Therefore, it is understood that **recipients of state funds are required to comply with this law** throughout the project period. All projects that affect the ground-surface that are funded by AWPF require SHPO clearance, **including those on private and federal lands.**

The State Historic Preservation Office (SHPO) must review each grant application recommended for funding in order to determine the effect, if any, a proposed project may have on archaeological or cultural resources. To assist the SHPO in this review, the following information MUST be submitted with each application for funding assistance:

- A completed copy of this form, and
- A United States Geological Survey (USGS) 7.5-minute map
- A copy of the cultural resources survey report if a survey of the property has been conducted, and
- A copy of any comments of the land managing agency/landowner (i.e., state, federal, county, municipal) on potential impacts of the project on historic properties.

NOTE: If a federal agency is involved, the agency must consult with SHPO pursuant to the National Historic Preservation Act (NHPA); a state agency must consult with SHPO pursuant to the State Historic Preservation Act (SHPA),

OR

- A copy of SHPO comments if the survey report has already been reviewed by SHPO.

Please answer the following questions:

1. Grant Program: Arizona Water Protection Fund

2. Project Title: Restoring Riparian Health of Sonoita Creek and Patagonia Lake

3. Applicant Name and Address: Tucson Audubon Society; 300 E University Blvd #120, Tucson AZ 85805

4. Current Land Owner/Manager(s): Arizona State Parks and Trails

5. Project Location, including Township, Range, Section: Section(s): 19,20,24,25,29,30 Township: 22S Ranges: 14S, 15S

6. Total Project Area in Acres (or total miles if trail, fence line, etc.): 4 miles fence; 118 acres

7. Does the proposed project have the potential to disturb the surface and/or subsurface of the ground?
X YES ☐ NO

8. Please provide a brief description of the proposed project and specifically identify any surface or subsurface impacts that are expected: Installation of t-post style fenceposts

9. Describe the condition of the current ground surface within the entire project boundary area (for example, is the ground in a natural undisturbed condition, or has it been bladed, paved, graded, etc.). Estimate horizontal and vertical extent of existing disturbance. Also, attach photographs of project area to document condition: primarily undisturbed

10. Are there any known prehistoric and/or historic archaeological sites in or near the project area? X YES ☐ NO

11. Has the project area been previously surveyed for cultural resources by a qualified archaeologist? ☐ YES ☐ NO X UNKNOWN

If YES, submit a copy of the survey report. Please attach any comments on the survey report made by the managing agency and/or SHPO

12. Are there any buildings or structures (including mines, bridges, dams, canals, etc.), which are 50-years or older in or adjacent to the project area? ☐ YES X NO

If YES, complete an Arizona Historic Property Inventory Form for each building or structure, attach it to this form and submit it with your application.

13. Is your project area within or near a historic district? ☐YES X NO

If YES, name of the district:

Please sign on the line below certifying all information provided for this application is accurate to the best of your knowledge.

/8/25/2023 Jonathan Horst

Applicant Signature /Date Applicant Printed Name

FOR SHPO USE ONLY
SHPO Finding: ☐ Funding this project will not affect historic properties. ☐ Survey necessary – further GRANTS/SHPO consultation required (*grant funds will not be released until consultation has been completed*) ☐ Cultural resources present – further GRANTS/SHPO consultation required (*grant funds will not be released until consultation has been completed*)
SHPO Comments:
For State Historic Preservation Office: Date:

STATE OF ARIZONA
HISTORIC PROPERTY INVENTORY FORM

Please type or print clearly. Fill out each applicable space accurately and with as much information as is known about the property.

PROPERTY IDENTIFICATION

For properties identified through survey: Site No. _____ Survey Area:

Historic Names (e*nter the name(s), if any that best reflect the property's historic importance*):

Address:

City or Town: _____ ☐ Vicinity County: _____ Tax Parcel No.:

Township: _____ Range: _____ Section: _____ Quarters: _____ Acreage:

Block: _____ Lot(s): _____ Plat (Addition): _____ Year of plat (addition):

UTM Reference – Zone: _____ Easting: _____ Northing:

USGS 7.5' quadrangle map:

ARCHITECT: _____ ☐ not determined ☐ known Source:

BUILDER: _____ ☐ not determined ☐ known Source:

CONSTRUCTION DATE: _____ ☐ known ☐ estimated Source:

STRUCTURAL CONDITION

☐ Good (*well maintained; no serious problems apparent*)
☐ Fair (*some problems apparent*) Describe:
☐ Poor (*major problems; imminent threat*) Describe:
☐ Ruin/Uninhabitable

USES/FUNCTIONS

Attach a recent photograph of property in this space.
Additional photographs may be appended.

Describe how the property has been used over time, beginning with the original use:

Sources:

PHOTO INFORMATION

Date of photo:
View Direction (looking towards):

SIGNIFICANCE

To be eligible for the National Register, a property must represent an important part of the history or architecture of an area. The significance of a property is evaluated within its historic context, which are those patterns, themes, or trends in history by which a property occurred or gained importance. Describe the historic and architectural contexts of the property that may make it worthy of preservation.

A. HISTORIC EVENTS/TRENDS – *Describe any historic events/trends associated with the property:*

B. PERSONS – *List and describe persons with an important association with the building:*

C. ARCHITECTURE – Style: _____ ☐ no style

Stories: _____ ☐ Basement Roof Form:

Describe other character-defining features of its massing, size and scale:

INTEGRITY

To be eligible for the National Register, a property must have integrity (i.e. it must be able to visually convey its importance). The outline below lists some important aspects of integrity. Fill in the blanks with as detailed a description of the property as possible.

Location - ☐ Original Site ☐ Moved: Date: _____ Original Site:

DESIGN

Describe alterations from the original design, including dates:

MATERIALS

Describe the materials used in the following elements of the property:

Walls (structure):

Walls (sheathing):

Windows:

Roof:

Foundation:

SETTING

Describe the natural and/or built environment around the property:

How has the environment changed since the property was constructed?

WORKMANSHIP

Describe the distinctive elements, if any, of craftsmanship or method of construction:

NATIONAL REGISTER STATUS (*if listed, check the appropriate box*)

☐ Individually Listed; ☐ Contributor; ☐ Non-contributor to _____ Historic District

Date Listed: _____ ☐ Determined eligible by Keeper of National Register (date: _____)

RECOMMENDATIONS ON NATIONAL REGISTER ELIGIBILITY (opinion of SHPO staff or survey consultant)

Property ☐ is ☐ is not eligible individually.

Property ☐ is ☐ is not eligible as a contributor to a listed or potential historic district.

☐ More information needed to evaluate.

If not considered eligible, state reason:

ASPT-SHPO CONSULTATION FORM
FOR COMPLIANCE WITH THE STATE HISTORIC PRESERVATION ACT
(Revised May 2023)

SECTION 1. PROJECT INFORMATION

Today's Date: 8/10/2023 ASPT Project Name & Number: PALA Fencing Project

Contact Name: Jeff Schmidt Contact Email: jschmidt@azstateparks.gov Phone: 480-340-1305

Location Where Work is to be Conducted (Park [if applicable], City, County): Work will be completed at Patagonia Lake State Park located at 400 Patagonia Lake Rd, Patagonia, AZ 85624.

Project Area Section(s), Township, Range: T22S, R15E, Sections 19,30

☐ This is an Emergency (immediate health, safety concerns – must justify below)
Justification:

SECTION 2. CONSULTATION – check all that apply

Initial Consultation ☒ Continuing Consultation ☐ SHPO #

ASPT Project Type: Maintenance ☐ Rehabilitation ☐ New Construction ☒

SECTION 3. FUNDING – check all that apply

State ☐ Private ☐ Federal ☐ Type of Funding (e.g., LWCF, RTP, ARPA, OHV): **Project will be completed using internal State Parks funding.**

AGENCIES INVOLVED
What other agencies are involved (consider land jurisdiction, funding, permitting, etc.)?:

Arizona State Parks, State Historic Preservation Office

SECTION 4. BUILT ENVIRONMENT
Does the Project Involve a Historic Building or Structure (listed or eligible for listing on the A/NRHP)?

No

Year Historic Building Was Constructed?

Is the Project Within 500 ft of a Historic Building? YES ☐ No ☐

If Yes, Estimated Distance:

ASPT – SHPO CONSULTATION FORM

SECTION 5. PROJECT DESCRIPTION/SCOPE OF WORK

5.1 For buildings and structures, provide a full written project scope including proposed building alterations such as removals, repairs, replacement, and/or new construction. Note associated building components such as roofing, siding, walls, floors, ceilings windows, doors, HVAC, plumbing, electrical, and site features. Existing conditions photographs should accompany the consultation, as well as drawings if available.

5.2 For ground-disturbing activities, provide the location and extent (length, width, depth) of disturbance (including staging areas and access roads), equipment to be used, and address impacts to known sites. **Show all site locations and impact areas on Google earth map if project occurs within 100 ft of sites.**

State Parks proposes installing fencing along the eastern boundary of the park in order to prevent unauthorized access.

SECTION 6. ARCHAEOLOGY REVIEW

HAS PROJECT AREA BEEN SURVEYED FOR CULTURAL RESOURCES?

Unknown ☐ No ☐ Yes ☒ (fill in the information below)

ASM Project No.	Report Author(s)	Report Year	Report Title	Sites Within 100 ft of Project Area
R1967-2.BLM	No Report	No Report	Sonita Creek Ranch Survey/Patagonia Dam Survey	AZ EE:5:9(ASM)
1986-179.ASM	James Smithwick	1986	Preliminary Report on the Patagonia State Park Access Road	AZ EE:9:170(ASM)
1993-32.ASM	Laurene G. Montero	1993	PATAGONIA LAKE STATE PARK	AZ EE:4:43(ASM)
1996-180.ASM	Mark E. Sullivan	1996	A Cultural Resource Inventory of Approximately 7.6 Miles of Trails on State Land Surrounding Patagonia Lake, Santa Cruz County, Arizona	
2000-349.ASM	C.Scott Crownover	2000	Cultural Resources Assessment Proposed Patagonia Lake State Park Improvements, Santa Cruz County, Arizona.	
2006-898.ASM	Slawson. Laurie	2006	A Class 1JI Archaeological Survey o(Proposed Activity Areas, Roads, Trails, and Fencelines Within the Sonoita Creek State Natural Area, Santa Cruz County, Arizona	

ASPT – SHPO CONSULTATION FORM

SECTION 7. ATTACHMENTS – check all included with SHPO consultation

Maps should be of sufficient size to see project location, area(s) to be affected, known sites, etc. For buildings and structures provide current photos of the building or structure and areas affected by the proposed action; and drawings and/or product/materials specifications for the proposed work.

Project location map(s) ☐ Design drawings/sketches/plans ☐ Product Specifications ☐

Photographs ☐ Google Earth Map ☐ Background Research Results Map (AZSITE) ☒

Survey Report (Technical Report or Survey Report Summary Form) ☐

Monitoring & Discovery Plan ☐ Monitoring Results Report ☐ Other:

SECTION 8a. SHPO RESPONSE

Archaeological Survey Recommended ☐

Site avoidance necessary ☐

Monitoring recommended ☐

Continued Consultation is Necessary ☐ (see comments)

No Concerns ☐

SECTION 8b. SHPO PROJECT FINDINGS

No Impacts / No Historic Properties Affected ☐

Conditional No Adverse Impacts / Conditional No Adverse Effects ☐

No Adverse Impacts / No Adverse Effects ☐

Adverse Impacts / Adverse Effects ☐ (see comments)

SHPO CONCERNS / COMMENTS:

We remind ASPT that the views of Indian tribes are based on expertise and information not available and/or possessed by our staff, but are critical to informing the Section 106 & State Historic Preservation Act review process. ASPT remains responsible for consulting with and considering the views of

Indian tribes. We request that consultant provide our office with a summary of any views conveyed by Indian tribes that are not in agreement with SHPO's response, and in so doing SHPO reserves the right to exercise our responsibility to respond to new information and modify our findings, as necessary.

SHPO Compliance Specialist Signature/Date: _____

SECTION 9. DISCOVERY CLAUSE

If potential burials or previously unreported cultural resources are encountered during any project ground-disturbing activities, ASPT will stop all work within 100 feet of the discovery and the Arizona State Museum, the land managing agency, and SHPO shall be immediately notified. No photographs of human burials are allowed, and the area must be secured from public view. No work shall continue in the area of the discovery until SHPO has been notified that all investigations are completed.

ASPT – SHPO CONSULTATION FORM

SECTION 10. TRIBAL CONSULTATION (to be completed by ASPT Tribal Liaison)
Consultation with Tribes is dependent on the nature and scope of the project, as well as the results of Class I or Class III survey (i.e. archaeological sites present). https://sites.google.com/view/az-consultation-toolkit/consultation-map

Check tribes affiliated with this project only.

Ak Chin Indian Community ☐
Cocopah Indian Tribe ☐
Fort McDowell Yavapai Nation ☐
Fort Still Apache Tribe ☐
Gila River Indian Community ☐
Hopi Tribe ☒
Havasupai Tribe ☐
Kaibab Band of Paiute Indians ☐
Moapa Band of Paiute Indians ☐
Las Vegas Tribe of Paiute Indians ☐
Pascua Yaqui Tribe ☒
Pueblo of Zuni ☒
San Carlos Apache Tribe ☐
Tohono O'odham Nation ☒
Ute Mountain Ute ☐
Yavapai-Apache Nation ☐

Chemehuevi Indian Tribe ☐
Colorado River Indian Tribes ☐
Fort Mojave Indian Tribe ☐
Fort Yuma-Quechan Tribe ☐
Havasupai Tribe ☐
Hualapai Tribe ☐
Hopi Tribe ☒
Mescalero Apache Tribe ☐
Navajo Nation ☐
Paiute Indian Tribe of Utah ☐
Pueblo of Acoma ☐
Salt River Pima-Maricopa Indian Community ☐
San Juan Southern Paiute ☐
Tonto Apache Tribe ☐
White Mountain Apache Tribe ☒
Yavapai-Prescott Indian Tribe ☐

Jonathan Horst

Director of Conservation and Research, Tucson Audubon

300 E University Blvd #120 520.971.6238
Tucson, AZ 85705 jhorst@tucsonaudubon.org

EDUCATION

M.S. Ecology & Evolutionary Biology, UNIVERSITY OF ARIZONA, Tucson AZ December 2011
B.A. Biology, GOSHEN COLLEGE, Goshen, IN, May 2002
B.A. Bible, Religion, and Philosophy, GOSHEN COLLEGE, Goshen IN, May 2002

WORK HISTORY

TUCSON AUDUBON SOCIETY, *2012-present | Director of Conservation and Research + Conservation Director + Restoration Ecologist + Restoration Biologist*

UNIVERSITY OF ARIZONA, DEPARTMENT OF ECOLOGY & EVOLUTIONARY BIOLOGY – VENABLE LAB, *2006-2012 | Research Specialist*

UNIVERSITY OF ARIZONA, SCHOOL OF NATURAL RESOURCES AND THE ENVIRONMENT – CONWAY LAB, *2004-2006 | Data/DB Management + Avian Research Field Technician*

THE ROSETTA STONE, *2002-2004 | Application Development Researcher + Assistant Dir of Kiosk Operations*

PUBLICATIONS + TECHNICAL REPORTS

*peer reviewed

Horst, J.L. and MacFarland, J. 2020. The Martins of the Desert. The Purple Martin Update, **29(4)**:8-12.

Horst, J.L. 2020. Fire on the Mountain…and in the Desert. The Vermilion Flycatcher, **65(4)**:6-9.

MacFarland, J. and **J.L. Horst.** 2019. Yellow-billed Cuckoo Surveys on the Coronado National Forest within Three Sky Island Mountain Ranges in Southeast Arizona in 2019. Technical report prepared for the Coronado National Forest.

Horst, J.L. 2019. Cottonwood Standing Stock Production Plan for Buenos Aires National Wildlife Refuge. Technical report prepared for the Buenos Aires National Wildlife Refuge.

***Horst, J. L.** and Venable, D. L. 2018. Frequency-dependent seed predation by rodents on Sonoran Desert winter annual plants. Ecology, **99**:196–203. doi:10.1002/ecy.2066.

MacFarland, J. and **J.L. Horst.** 2017. Yellow-billed Cuckoo Surveys on the Coronado National Forest within Five Sky Island Mountain Ranges in Southeast Arizona in 2017. Technical report prepared for the Coronado National Forest.

Horst, J.L. and Barclay, A. 2016. Resource Brief: Western Yellow-billed Cuckoos: Guides for future restoration. In Sky Island Restoration Cooperative Annual Report, Fiscal Year 2015.

Horst, J.L. and Campbell, C. 2016. Resource Brief: Native Vegetation Screening at the Oracle Road Wildlife Overpass. In Sky Island Restoration Cooperative Annual Report, Fiscal Year 2015.

Bennett, A. and **J.L. Horst.** 2016. Arnett Creek Project Baseline Condition Report: Vegetation, Lowland Leopard Frog, western Yellow-billed Cuckoo. Technical report prepared for the Arizona Wilderness Coalition.

MacFarland, J. and **J.L. Horst.** 2015. Yellow-billed Cuckoo Surveys on the Coronado National Forest within Eight Sky Island Mountain Ranges in SE Arizona. Technical report prepared for the Coronado National Forest. (Agency and Public versions).

***Horst, J.L**, S. Kimball, J.X. Becerra, K. Noge, and D.L. Venable. 2014. Documenting the early stages of a plant invasion (*Matthiola parviflora*), and predicting its spread in North America. The Southwestern Naturalist **59(1)**:47-55.

*Angert, A.L., **J.L. Horst**, T.E. Huxman, and D.L. Venable. 2010. Phenotypic plasticity and precipitation response in Sonoran Desert winter annuals. American Journal of Botany **97**:405-411.

CERTIFICATIONS + LICENSES

Yellow-billed Cuckoo Surveyor – since 2015 (on Tucson Audubon survey permit)
Southwest Willow Flycatcher Surveyor – since 2017 (on Tucson Audubon survey permit)
Burrowing Owl Clearance Survey Certificate – since 2021
Certified Qualified Pesticide Applicator (AZ), License #31895 Exp 5/31/2023 Categories – Right of Way, Turf and Ornamental
CRAM – episodic streams module – since 2023

Howard Buchannan

Saint David, AZ

WORK HISTORY

TUCSON AUDUBON SOCIETY
Watershed Specialist—Sonoita Creek, May 2018-present

- Engaged with regional Watershed Management Plan creation and monitoring with partner organizations
- Topical watchdog for the organization and primary liaison for mining and watershed impacts within the Sonoita Creek Watershed
- Paton Site Management backup
- Liason to AZ State Parks for all issues surrounding birding and restoration at Patagonia Lake State Park
- Tucson Audubon Representative to Town of Patagonia's Flood and Flow Committee
- Grant applications for watershed-based restoration and collaborative planning efforts.

ARIZONA STATE PARKS
Family Campout & Stewardship Americorps Program Coordinator, 2012 – 2014

- Developed programs, lessons, and events for families new to camping and environmental stewardship; designed and coordinated program schedules and logistics. Recruited and managed volunteer presenters and workers. Instructed and facilitated weekend programming: teaching science, environmental education and stewardship, recreation, camping skills, fitness, and nutrition.Vegetation monitoring and censusing in Sonoran Desert

RRM, Inc.,
Marina Supervisor, Patagonia Marina, 2006 – 2010

- Supervision of the operation of the marina store, boat rental services, and staff; reconciliation and reporting of daily receipts;
- Procured equipment of hard-goods and livery inventory for marina and campground stores.
- Developed and maintained inventory and sales databases, management plans and budgets for future expenditure, reporting sales, projections and inventory to corporate management.
- Supervised the maintenance of livery watercraft, and trained staff on the safe operation of watercraft.

METRO RECORDS, LLC
Manager/Partner, 2003 – 2005

- Business-plan development; vendor, banking, and creditor relations; managed internet sales and shipping.

CHEAPO MUSIC OF MINNESOTA, Inc
Senior Manager, Moby Disc Stores, 2002 – 2003

- General management of regional chain; supervised management of multiple locations, supporting retail and internet-order fulfillment operations, human resources, payroll, inventory control, P&L, and budget controls.
- Established and managed vendor accounts and lease agreements.

DJANGOS.COM, INC,
Manager, Djangos Moby Disc, Sherman Oaks 2000-2002

- Directed conversion of 100,000 sku product inventories to new live product e-tail system.
- Developed process to merge new product re-ordering systems; reduced man-hours over 50%.
- Achieved and maintained highest internet order fill-rate and best dollar per square foot sales over 30 stores.
- With a team created system of integrated financial and performance reports to senior management and corporate partners.
- Trained and consultant to managers of new stores in conversions to "click and brick" retailing.

MOBY DISC RECORDS, INC,
Manager Supervisor, 1991-2000

- Co-coordinated the development of proprietary inventory and POS systems; trained store managers in the recruitment, development, and retention of high-quality employees, resolution of customer conflict, inventory management, and budgeting.
- Co-developed feedback and incentive programs to improve management and associate performance, and co-developed customer feedbacks to help the company address needs of community.
- Created and analyzed reports to identify trends and optimize inventory distribution between stores.
- Co-managed chain-wide product purchases; Co-managed development of web site for retail and wholesale of collectible and surplus inventory.
- Managed flagship store ranked #1 in chain sales for 95 consecutive months. The store maintained 10% average annual sales increase, 4% growth in gross margin, and topped corporate sales quotas and profit-margin bonus schedule 69 of 77 months.

VOLUNTEER EXPERIENCE

TUCSON AUDUBON IMPORTANT BIRD AREAS Volunteer
2008-Present

COMMUNITY WATERSHED ALLIANCE OF THE MIDDLE SAN PEDRO. Board of Directors
2011-Present

FRIENDS OF SONOITA CREEK, Board of Directors
2019?-Present

BIRDING FIELD TRIP LEADER
Arizona State Parks –
Southwest Wings Festival –
Tucson Audubon –
Maricopa Audubon –

AMERICORPS Urban Youth Outdoors Pilot Program
2012-2014

PERMITS

Western Yellow-Billed Cuckoo Survey Permit
2015-present

Hummingbird Bander / Site Manager with Hummingbird Monitoring Network for AZ State Park's Research, Inventory & Monitoring program
2008-2014

Anthony Albert Figueroa
9522 E 32nd St
Tucson, AZ 85748 US
Mobile: 5202453508
Email: TFigueroa@tucsonaudubon.org

Work Experience:

Tucson Audubon Society
300 E University Blvd. #120
Tucson, AZ 85705

08/2020 - Present
Invasive Plant Program Manager Supervisor for four field crews that work on a variety of invasive plant monitoring and treatment projects. Crews work primarily in Tucson, but will travel to remote work sites, in Arizona and New Mexico. Collaboration with Federal agencies, Pima county and HOAs to combate area specific non-native species threats. Mapping and surveys of invasive species via handheld devices or smartphones, using Field Maps and Survey123. Treatment of plants is done with herbicide, via backpacks primarily, other methods include cut/stump applications to woody species, use of UTV/vehicle mounted sprayers, small volume handheld sprayers, and snip and drip applications. Non-chemical treatments include, hand pulling of plants, with diggers and geopicks, removing all growing material, we have also used brush cutters and saws on larger vegetation that required thinning.

12/2019 - 12/2020

CoATIS Crew Lead
Point of contact for federal partners, Fish and Wildlife Service, and National Park Service, on all operations related to work on federal lands. Function as leader of agency staff, my field crew, Arizona Conservation Corp crews and any volunteers that may be working with our crew. Conducted chemical and non-chemical treatments of non-native invasive species, in Arizona and New Mexico. Working on National Wildlife Refuges, National Parks and Monuments, closely with land managers. Treatment of plants is done with herbicide, via backpacks primarily, other methods include cut/stump applications to woody species, use of UTV/vehicle mounted sprayers, small volume handheld sprayers, and snip and drip applications. Non-chemical treatments include, hand pulling of plants, with diggers and geopicks, removing all growing material, we have also used brush cutters on larger vegetation that required thinning. Mapping and surveys of invasive species via handheld devices or smartphones, using Collector and Survey123. Camping in remote locations for 8 days hitches, when necessary.

Grand Canyon National Park
17 S Entrance Rd
Grand Canyon Village, AZ 86023

04/2019 - 09/2019

Hours per week: 40
Invasive Species Bio-tech
Duties, Accomplishments and Related Skills:
Main responsibility was treating a variety of non-native invasive species that grow on the south rim of the Grand Canyon, along trails, backcountry, amongst the lodges and along the roadsides. I treated these plants with both herbicide and manual removal. I lead an ACE intern, in the field and office, for the entirety of the season, with guidance of my crew lead. We mapped populations that we treated throughout the park.

Albertsons Llc
6600 E Grant Rd
Tucson, AZ 85715 United States

02/2004 - 10/2019
Pharmacy Technician
Duties, Accomplishments and Related Skills:
While working in a retail pharmacy I have developed great working relationships with a variety of people from varied backgrounds. I have been able to interact with the public on a daily basis and have great personal communication skills in face-to-face situations. Dealing with the public has made me better at dealing with difficult situations in person and explaining things in a way that can resolve the conflict. The professionalism required in healthcare and the necessity of precision in everything that I do are ingrained in my character, and these traits will translate to any activity in life or career. I have also been able to educate coworkers and new hires on proper policy and procedures related to the job. I enjoy teaching, I am patient and willing to try to explain an answer in a multitude of ways to ensure the message is understood. Other tasks include; inventory management including drug ordering, expired drug returns, daily on-hand inventory audits, prescription verification and inputting, insurance verification and inputting, counting medication, filling prescriptions, filing hard copies of prescriptions, customer relations, checking out prescriptions to the patient, cash-register operations, calling insurance companies to resolve billing issues, calling our helpdesk to resolve computer issues, calling and faxing requests to medical facilities and assistance with non-pharmacist-related questions.
Supervisor: Joe Pellerito (5207222929)

AmeriCorps - American Conservation Experience
3693 S Old Spanish Trail
Tucson, AZ 85730 United States
06/2018 - 11/2018
Invasive Plant Management Intern
Duties, Accomplishments and Related Skills:
The primary responsibilities of the project were the management of invasive plants with chemical or mechanical treatments. There are several invasive kinds of grass that were targeted, but buffelgrass was

the primary target.

Typical days consisted of preparing chemical backpack sprayers, we mixed chemicals inside the sprayers which were housed inside of safety containment bins, proper personal protective equipment was always worn because we were handling herbicides. We loaded sprayers and all essential spill, crew, and mix kits needed into trucks and drove to our work site, via paved or dirt roads. We would hike out with backpack sprayers and personal daypacks to the field locations. We were using a systematic approach to treating buffelgrass in areas that had been treated in previous years chemically or mechanically.

The park has been divided up into subunits and all treatments have been recorded using handheld data collector devices with GPS. We would work as a team in rough terrain with loose rocks, steep slopes, and cactus forests, it was important to always look out for self/coworkers safety. Plant identification is a required skill because there are several native kinds of grass that could be mistaken for our invasive targets, and I have developed a good eye for identifying target species at all phenophases. We sprayed invasive grasses, with solutions of 3% glyphosate, as we came across them and we would record the new treatments with our data collector, Juno Trimble.

Every two weeks we would clean and repair our sprayers to maintain our equipment. When

conditions were not right for spraying we used rock picks to help pull grasses manually.

Near the end of our term, we educated a group of Arizona Conservation Corps members on proper safety and techniques, as they were going to be doing similar work later in the season.

I have led small groups for herbicide application treatments without supervision.

In addition to field work, we had other responsibilities such as assuring treatment logs are completed and accurate on a daily basis, participate in daily briefings and debriefings, ensured safety circle discussions were conducted and documented, filled water coolers, checked out/ checked in all GPS devices and handheld radios, flag nonfunctional equipment and notify crew leaders, stock supplies as they came in, maintained limited access to herbicide lockers, provided crew with personal protective equipment as needed, and performed vehicle maintenance inspections bi-weekly.

In addition to our invasive plant treatments, we did high elevation surveys of the park, we hiked up to and camped at Manning Camp at the top of the Rincon Mountains, 8000 ft elevation, and performed systematic mapping surveys, we documented forest health issues, such as bark beetle infestations, mistletoe, soil depth, locations of new springs, and plants of interest records. I also went on several rare plant surveys with the park botanist and assisted him with plant collections and pressings. I also went on frog and water surveys in the canyons of the park, recording numbers of frogs and depth of water at specific locations that have been surveyed in the past.

I also went to the Kofa National Wildlife Refuge to assist the US Fish and Wildlife Service with invasive

plant documentation, we performed systematic mapping surveys to build a more complete record of the invasive plants in the region.
Supervisor: Michael Turner (5207335187)

Sparks Granite LLC
6340 S Kolb Rd
Tucson, AZ 85756 United States

01/2018 - 05/2018
Laborer
Duties, Accomplishments and Related Skills:
Manual labor, fabricating and installing granite countertops. Increasing personal craftsmanship skills and the pride of seeing the finished product that is the result of hard work. Exposure to a new type of work, outdoors work, heavy lifting, use of power tools for cutting and polishing granite, forklifts, and practice backing up trucks with a trailer attached. Working as a team to move heavy slabs of granite with precision and care.
Supervisor: Ken Sparks (5202560495)

Volunteer:
Saguaro National Park
3693 S Old Spanish Trail
Tucson, AZ 85730 United States
01/2019-02/2019
Hours per week: 8
Duties, Accomplishments and Related Skills:
I am assisting a Park Employee with vegetation regrowth study plots, that are monitoring the effects of grazing that occurred in the region until 1978. We have ten plots with 20 m x 40 m in size, then we make transects every 2.5 m, and record the location and scientific name along the line. Additionally, a recording of all plants over 0.25 m is recorded for 2 plots (5m x 20 m) within the larger plot. **Supervisor:** Ryan Summers (4803906022)

Education:
The University of Arizona Tucson, AZ United States
Bachelor's Degree 05/2018
GPA: 3.357 of a maximum 4
Major: Wildlife Conservation and Management

Pima Community College Tucson, AZ United States
Associate's Degree 05/2006

Job Related Training:

Arizona Department of Agriculture - Agricultural Commercial Applicator Certification # PUC 62666
Arizona Department of Agriculture - Pest Management Division # 200784
Licensed categories: 3- Ornamental and Turf, 4 - Right of Way and 5 - Aquatic
U.S. EPA - Agricultural Worker Protection Standard Trainer - Certification # 8644

Affiliations:

Member of the University of Arizona Fisheries and Wildlife Society - Member, Fall 2016 – Spring 2018

References:

Name	Employer	Title	Phone	Email
Michael Turner	National Park Service	Restoration and Invasive Plant Crew Leader	5207335187	michael_turner@nps.gov
Perry Grissom	Saguaro National Park	Restoration Ecologist - retired	5207335179	pgrissom048@gmail.com
Dr. Steve Smith	The University of Arizona	Professor	5206215325	sesmith@email.arizona.edu
Dr. Mitch McClaran	The University of Arizona	Professor	5206211673	McClaran@email.arizona.edu
Kenneth “Mac” McColley	Albertsons Llc - Retired	Pharmacy Manager	5205482264	macmc48@gmail.com

Additional Information:

- Valid Arizona Driver's License with a clean driving record.
- I have a personal identity verification (PIV) card for accessing Federal computers.
- The employee of the Month Albertsons Store 959, March 2016.
- Received ten Service Excellence Five Star Awards from Albertsons, LLC 2006 – 2014.
- Hispanic Athlete of the Year – Sahuaro High School - Tucson, AZ 2003.
- Captain of the Football Team and Cheer Squad – Sahuaro High School 2002 – 2003

Friends of Sonoita Creek's RSRA team measuring cross-section profile of creek upstream of head cut in area described as a reference reach for riparian community and floodplain connectivity in 2018 RSRA assessment. Note standard two meter pole.

2020 photo of area subject to headcutting.

2019 photo of bank trampling by cattle.

2019 Rapid Stream Riparian Assesment (RSRA) survey team measuring cross-section of recently incised creek downstream of head cut. Poles are standard 2 meters in length.

2022 RSRA survery team resting on fresh cut bank downstream of head cut. Note shade is provided by invasive Ailanthus which in this patch is coming to dominate the mid-canopy.

Typical spring emergence of cocklebur (Xanthium strumarium), which will dominate several acres by end of summer.

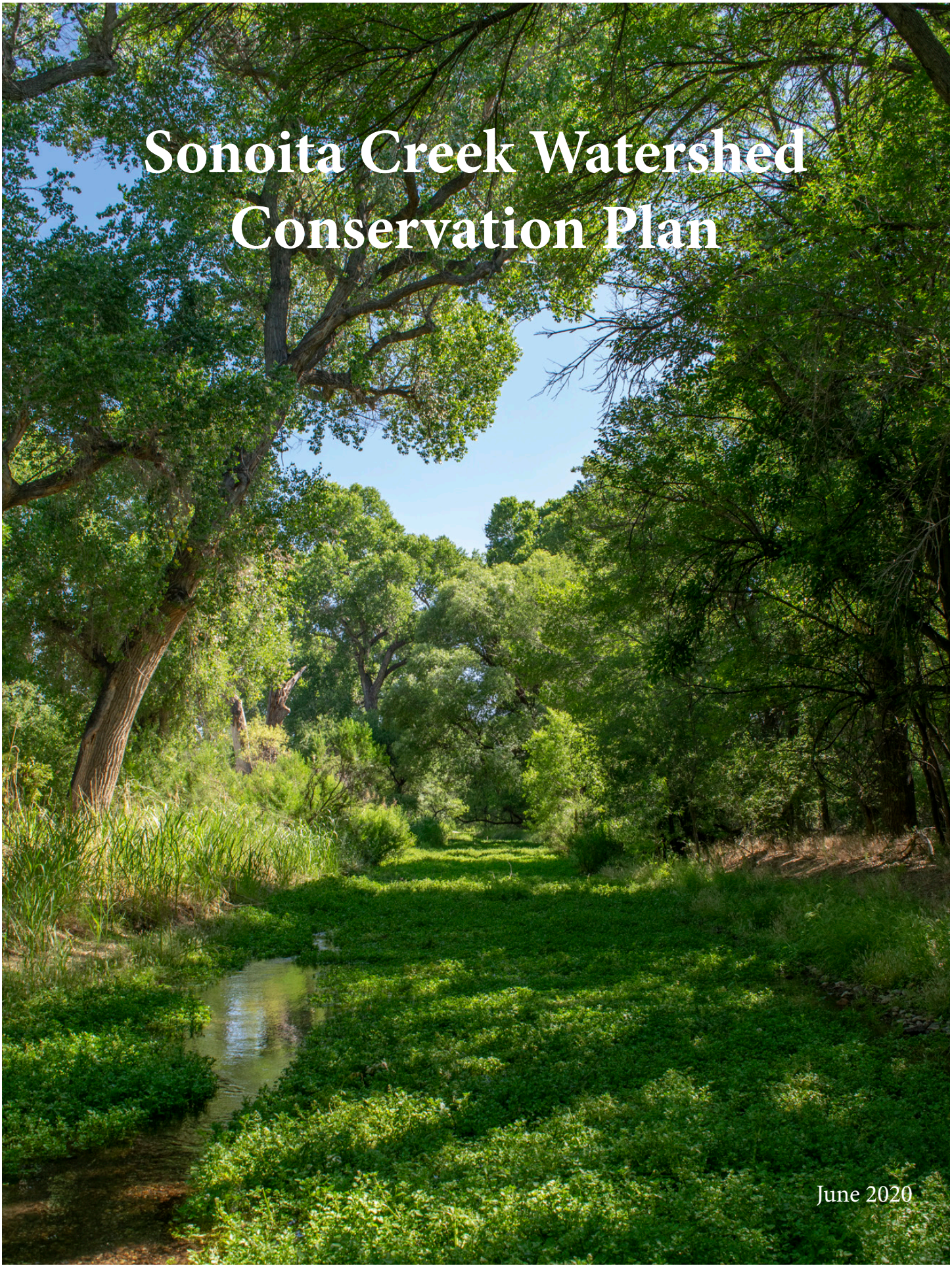
Cocklebur dominates ground cover and mid-cover in open spaces in areas frequented by cattle.

Park staff and volunteers spent 372 hours removing cocklbur in 2022.

Existing Plans, Reports, Information for the project:
"Restoring Riparian Health of Sonoita Creek and Patagonia Lake"

1. Sonoita Creek Watershed Conservation Plan, 2020.

   This plan is attached in full and details broader plans for the upper Sonoita Creek Watershed



Sonoita Creek Watershed Conservation Plan

June 2020

Partners in this plan

Sonoita Creek Watershed Conservation Plan was prepared by four organizations that own and manage land for conservation purposes in the watershed.

Borderlands Restoration Network's mission is to foster ecological and cultural place-based learning and leadership, to restore and support healthy, regenerating water sources and flourishing plant and animal communities, and to support prosperous borderland communities by expanding a vibrant and sustainable restoration economy. Within that mission, BRN's lifelong-learning programs fill critical local and regional socio-ecological needs by integrating environmental, educational, and economic development programs.

Tucson Audubon inspires people to enjoy and protect birds through recreation, education, conservation, and restoration of the environment upon which we all depend. We work throughout southeastern Arizona to preserve and restore critical landscapes and riparian areas. Tucson Audubon has worked on Sonoita Creek since joining with TNC to protect the Fremont Cottonwood gallery by forming the Patagonia-Sonoita Creek Preserve, has identified and achieved designation for multiple Important Bird Areas in the watershed, and now manages the world-famous Paton Center for Hummingbirds in Patagonia.

The Circle Z Ranch has been in operation as a dude ranch just outside of Patagonia for more than 90 years. In addition to offering unique vacation experiences to our guests, we are committed to preserving the canyons, riparian areas, and grasslands for the health of Southern Arizona. In addition to introducing guests to all this desert oasis has to offer, we also sustainably graze cattle and horses on our more than 6500 acres.

The mission of The Nature Conservancy is to conserve the lands and waters on which all life depends. From our historic work in land acquisition to our cutting-edge research that influences global policy, The Nature Conservancy is constantly evolving so that we can take on the world's most important challenges. Since our start in 1951, the Conservancy has grown to work in 72 countries around the globe. The founding of our Arizona Chapter was marked by the establishment of the Patagonia-Sonoita Creek Preserve in 1966. Each year, thousands of visitors come to the Preserve to enjoy this spectacular Southwestern oasis and its abundant wildlife.

Sonoita Creek Watershed Conservation Plan

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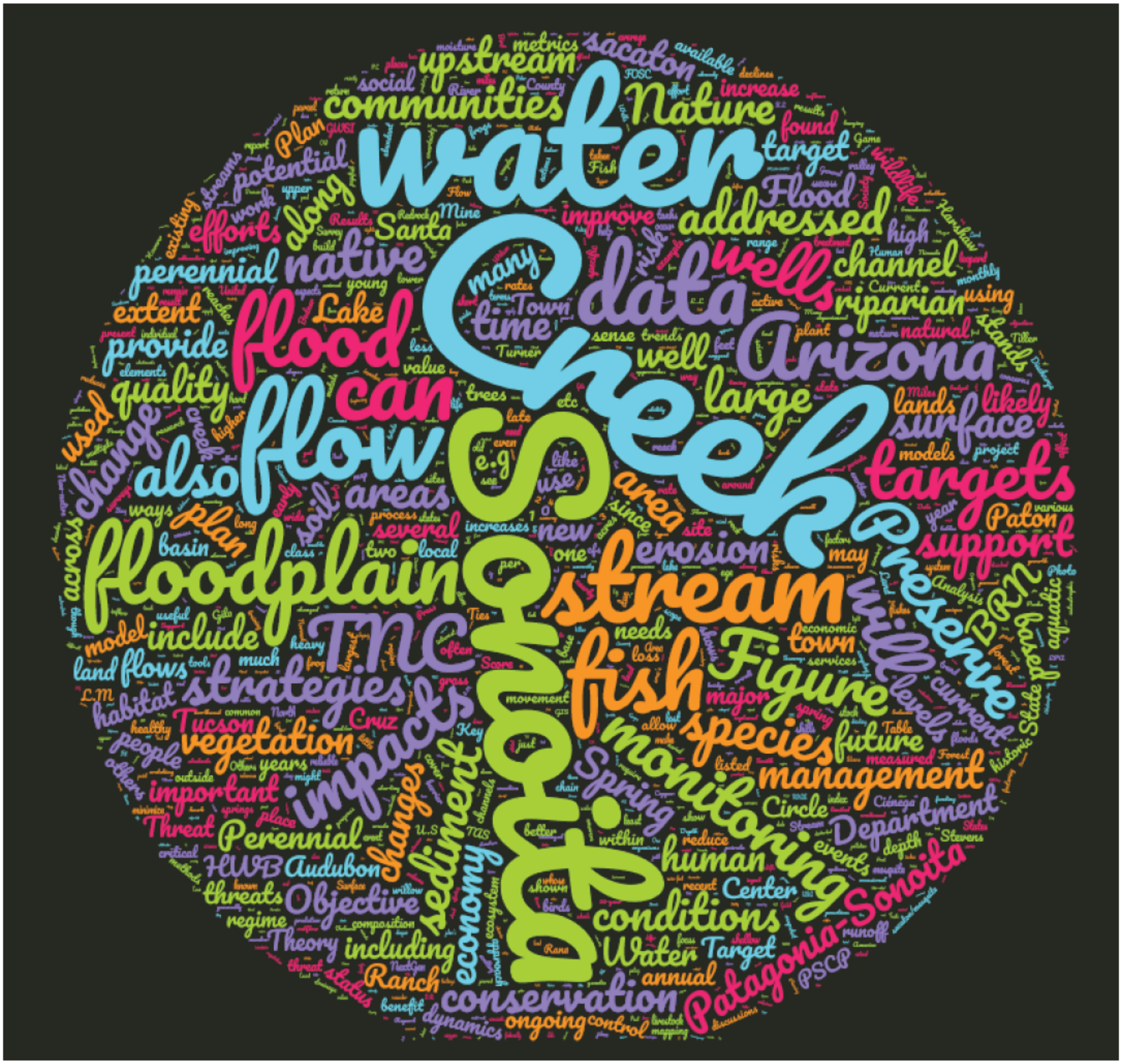

Word cloud for all the text in this plan. Word size is proportional to frequency of use, with common "connector words" omitted.

Vision Statement for Sonoita Creek Watershed

We envision a broadly engaged community that invests in and is supported by healthy social and natural environments within the Sonoita Creek watershed, including a sustainable nature-based economy.

Scope

This plan addresses the Sonoita Creek watershed above the dam at Patagonia Lake (Figure 1). This geographic scope was based on the active interests of the partners involved in the plan, and on recognition that conditions and issues are somewhat different below the dam. In addition, non-native fish and frogs from the lake have significant effects on native species upstream in the creek, while stream flow and sediment in the creek have effects on conditions in the lake.

The watershed covers approximately 146,054 acres, or 228 square miles. It has more than a mile of vertical relief, ranging in elevation from 9,456 feet at Mount Wrightson in the Santa Rita Mountains to 3,766 feet at Patagonia Lake dam. There is perennial flow in Sonoita Creek for approximately 10 miles beginning in the town of Patagonia, along with shorter perennial reaches in some of the tributary streams. Several large springs occur in the upper valley that sustain short stretches of perennial stream flow. At the highest elevations of the watershed (6,000+ ft) steep, rocky slopes are forested with ponderosa pine (*Pinus ponderosa*), Southwestern white pine (*P. strobiformis*), Douglas-fir (*Pseudotsuga menziesii*), Chihuahua pine (*P. leiophylla*) and a mixture of oaks (*Quercus gambelii, Q. hypoleucoides,* and *Q. arizonica*). Vegetation cover at middle elevations consists of evergreen oak-alligator juniper woodlands. At lower elevations, vegetation includes upper Sonoran semi-desert grasslands, and within the riparian zone of Sonoita Creek are found mesquite bosque, sacaton grassland, Fremont cottonwood-Goodding willow gallery forests, and ciénegas.

The primary human community in the watershed is the town of Patagonia.

Sonoita Creek is one of very few remaining streams in Arizona that support four or more native fish species. At least 267 species of birds have been observed on The Nature Conservancy's Patagonia-Sonoita Creek Preserve (PSCP), and 233 at Tucson Audubon Society's Paton Center for Hummingbirds (ebird.org, on 8/30/2019). Sonoita Creek is one of the most important recreational bird-watching sites in the United States, with visitors contributing a significant benefit to the local economy.

The Sonoita Creek watershed's relatively unfragmented uplands, riparian corridors, and perennial water provide resiliency and a critical corridor of connectivity within the larger landscape linking the Rocky Mountains and Sierra Madre Occidental.

Conservation Targets

<u>Cottonwood/willow community</u>

The watershed includes about 366 acres of Fremont cottonwood-Goodding's willow riparian forest along Sonoita Creek between Town of Patagonia and Patagonia Lake, and upstream from Cottonwood Spring (Figure 2). Many of the cottonwood-willow riparian forests in the Southwest were altered, degraded, or lost in the last century. Sonoita Creek supports some of the largest known Fremont cottonwood trees.

These forests generally consist of linear bands of cottonwood and willow (with lesser amounts of ash and walnut) trees of same-aged cohorts which parallel primary and/or secondary stream channels. Optimal conditions for forest development are found along depositional environments, where

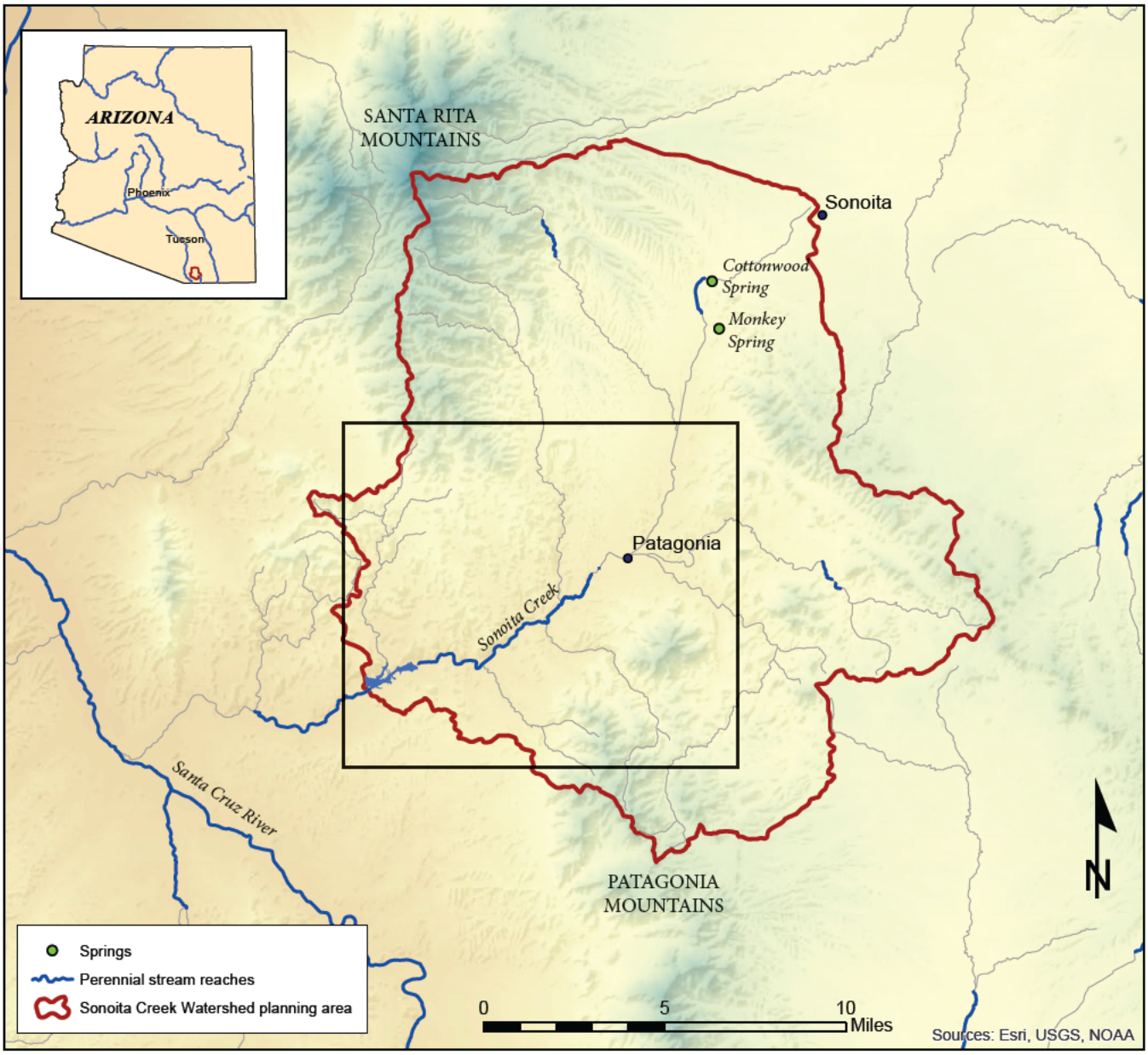

Figure 1. Sonoita Creek watershed planning area. Black box shows location of Figure 2.

fine-grained alluvial substrates are present in the floodplain. The channels of such streams undergo continual lateral adjustment, as they meander, migrate, and form new alignments.

Cottonwoods and willows are both pioneer species colonizing newly disturbed areas. Flooding is the primary disturbance factor shaping cottonwood-willow systems. As a result, germination and establishment of many cottonwoods and willows temporally coincide with flood events that occur during or prior to the year of establishment. Sparsely vegetated, bare alluvium, or mineral soil along primary or secondary stream channels with little or no post-germination flooding are prerequisites for cottonwood-willow germination and seedling survival (Stromberg et al. 1991). Sustained high spring flows or episodic spring flooding or rains enhance germination, as well. Of utmost importance for germination is abundant soil moisture. Sufficient soil moisture during early seedling growth is critical to seedling survival as mortality is likely if the return to base flow conditions is too rapid to allow root growth to keep pace with declining water tables (as is characteristic with well-entrenched streams).

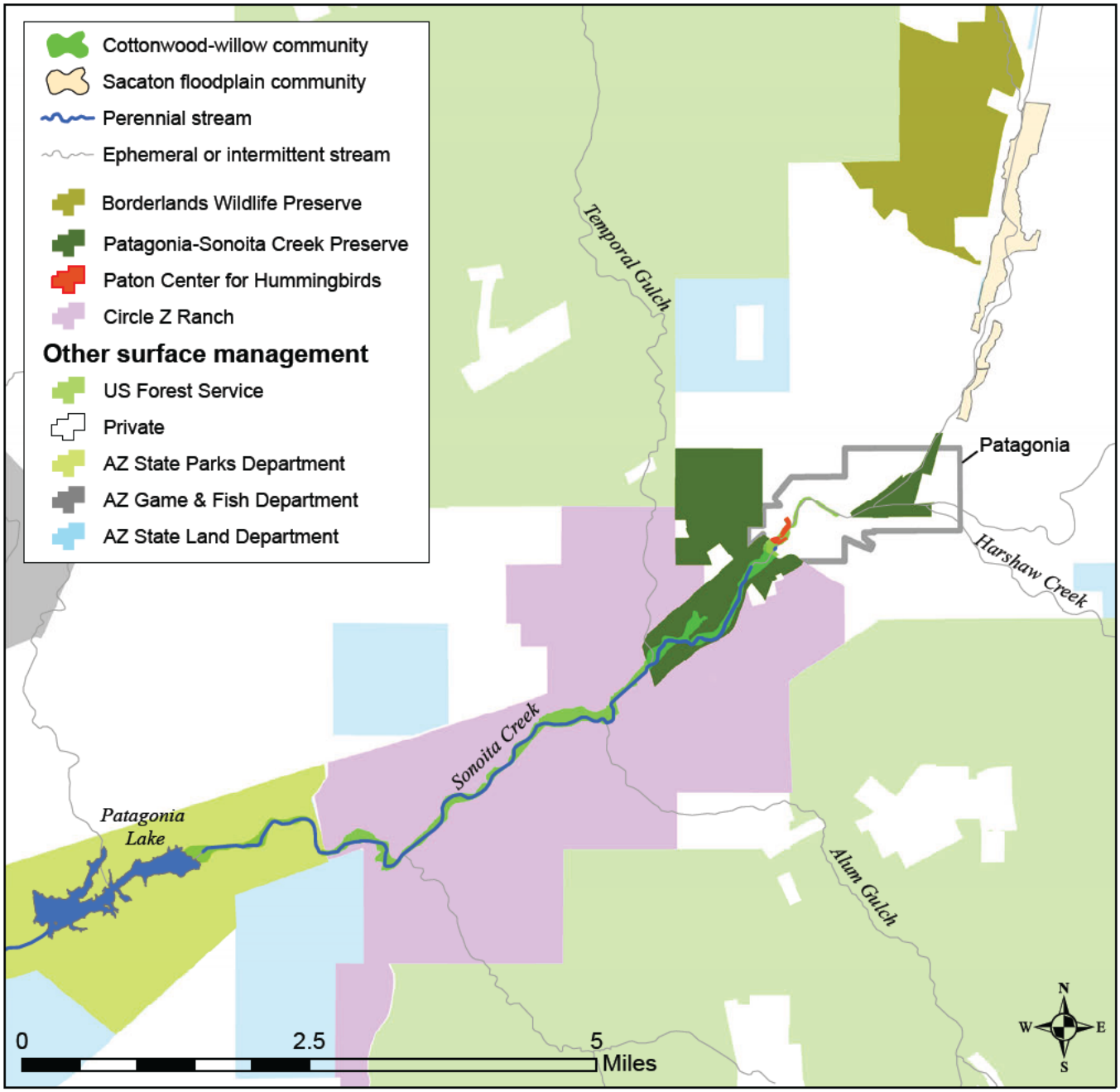

Figure 2. Conservation targets and land management in the vicinity of Patagonia.

In areas with vigorous cottonwood-willow communities, stands of young cohorts typically have much higher densities than older cohorts. Entrenchment of streams which reduces the frequency and degree of overbank flooding can lead to reductions in recruitment of young cohorts. Livestock grazing also reduces or eliminates cottonwood and willow seedlings through browsing and/or erosion.

These riparian forests support some of the highest breeding bird densities in the United States. Cottonwood-willow and mixed deciduous broadleaf riparian forests in the basin support a population of the western yellow-billed cuckoo (*Coccyzus americanus*, federally listed as Threatened). They also provide habitat for an unusual assemblage of other neotropical migrant birds, many of which reach their northern range limits in southern Arizona, including rose-throated becard, green kingfisher, northern gray hawk, zone-tailed hawk, common black hawk, violet-crowned hummingbird, northern beardless tyrannulet, thick-billed

kingbird, and tropical kingbird.

Perennial stream community

This conservation target includes perennial flow segments of streams in the watershed that support native fish and frog species: Sonoita Creek upstream from Cottonwood Spring, Sonoita Creek between the Town of Patagonia and Patagonia Lake, Redrock Canyon, Harshaw Creek, and Big Casa Blanca Canyon.

The Sonoita Creek watershed historically supported seven native fish species, and at least seven nonnative fish species. Current occupants include Longfin dace (*Agosia chrysogaster*), Desert sucker (*Pantosteus clarki*), Speckled dace (*Rhinichthys osculus*), and Gila topminnow (*Poeciliopsis o. occidentalis*, listed as Endangered). The topminnow is rarely found on the Patagonia-Sonoita Creek Preserve, and the only persistent population within the planning area seems to be in Redrock Canyon.

The watershed once held the Monkey Spring pupfish (*Cyprinodon arcuatus*) and Gila chub (*Gila intermedia*). The pupfish was formerly distributed throughout the upper Santa Cruz River watershed, but was last collected from Sonoita Creek in 1927 and was only found at Monkey Spring in later decades. It went extinct in the late 1960s during modification of an irrigation system fed by the spring (Minckley et al. 2002). The chub was never taken from Sonoita Creek, but was historically abundant in Monkey Spring and associated ponds on the Rail X Ranch. It was last documented there in 1968.

The Sonora sucker (*Catostomus insignis*) was collected from Sonoita Creek in 1904, but not since.

Sonoita Creek also supports the federally protected Mexican garter snake (*Thamnophis eques megalops*, listed as Threatened) and Huachuca water umbel (*Lilaeopsis schaffneriana* ssp*. recurva*, listed as Endangered). The creek and its tributaries have historically supported Lowland leopard frog (*Rana yavapaiensis*), Chiricahua leopard frog (*Rana chiricahuensis*, listed as Threatened), and Tarahumara frog (*Rana tarahumarae*), though we lack data on the current status of all those native frogs.

Ciénega wetlands

A ciénega is a freshwater marsh in southwestern North America, typically supported by shallow or upwelling groundwater. Ciénegas are known to support a large number of rare species, and provide important habitat for migratory birds. A high proportion of ciénegas in this region have been lost due to dewatering or severe alteration, and many of those which remain have little or no protection (Minckley et al. 2013).

Ciénega wetlands occur downstream from Cottonwood Spring and on the Patagonia-Sonoita Creek Preserve.

Spongy uplands

The grasslands and woodlands at higher elevations in the watershed support valuable plant and animal communities. For this plan, we identified primarily their value for capturing precipitation, releasing it slowly to plants, and storing some as groundwater. This is important because precipitation increases with elevation, so the higher areas of the watershed contribute a disproportionate share of both storm water runoff and groundwater that appears in Sonoita Creek. Average precipitation at Patagonia is about 19 inches/year, while the upper portions of Mount Wrightson are estimated to get about 37 inches/year.

Sacaton/mesquite floodplain community

Grasslands dominated by big sacaton (*Sporobolus wrightii*) once occupied millions of acres of alluvial floodplains in semi-arid southwestern North America, forming nearly pure stands of this robust, tussock-forming perennial grass. Sacaton riparian grasslands are recognized for their important ecological functions and landscape values — absorbing flood flows, controlling soil erosion, and intercepting and retaining sediments. As the most productive of semi-arid grassland communities, they provide abundant forage for livestock and habitat for wildlife. Across the region, these grasslands now occupy less than 5% of their original distribution. Causes of decline include agricultural conversion, historical downcutting of rivers and consequent reductions in overbank

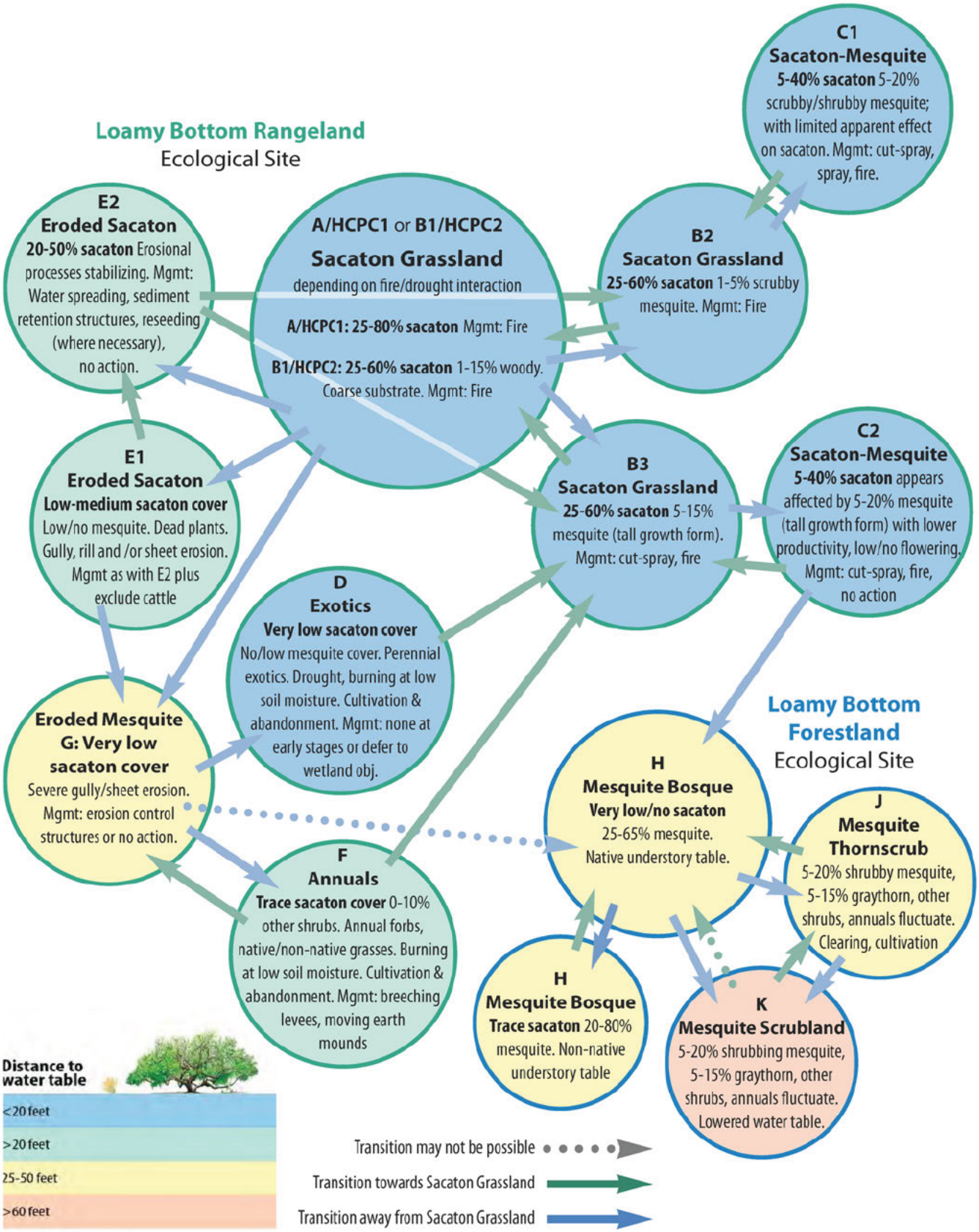

Figure 3. State and transition model for sacaton/mesquite floodplain community. Model was refined for at Las Cienegas National Conservation Area. Reprinted from Tiller et al. 2012.

flow, dropping of water tables from groundwater pumping and stream diversion, sheet erosion, overgrazing, and shrub encroachment. Despite steep declines, sacaton grasslands can be found scattered across much of their former range, often occurring in smaller patches or less productive states than historic accounts suggest (Tiller et al. 2012).

The Sonoita Creek watershed has several large remaining sacaton/mesquite communities, including both big sacaton (*S. wrightii*) and alkali sacaton (*Sporobolus airoides*). These include floodplain terraces along Sonoita Creek from Cottonwood Spring ciénega downstream to the Town of Patagonia (Figure 2), and along Redrock Creek just above its confluence with Harshaw Creek. Several small but high quality bosques and grasslands occur in mouths of small tributaries of Sonoita Creek west of Route 82. The majority, approximately 212 acres, occurs on Sonoita Creek Ranch, recently purchased as mitigation lands for the proposed Rosemont Copper Mine.

Fire, groundwater elevation, and grazing can all affect the health and persistence of sacaton, and can be used to drive communities from one compositional state to another. These are summarized in Figure 3, and were described in detail by Tiller et al. (2012).

Human well-being targets

The planning partners recognized that human well-being is inextricably linked to our conservation work, both in the services provided to people by Nature and the support that people can provide to Nature.

Positive sense of place and community

Residents of the area describe positive aspects of this community in terms of both human and ecological attributes, and the ability of the two components to support one another. The cottonwood/willow forest along Sonoita Creek plays an important role in the attractive character of Patagonia. That was described in the Santa Cruz County Comprehensive Plan (2016) and the Town of Patagonia General Plan (2009).

Flood protection

Approximately 65% of Patagonia is in the designated 100-year floodplain (Figure 11). The State Highway 82 bridge over Sonoita Creek is the major constriction, and poses the most serious threat of aggravating the flood problems in the town area. The bridge over Harshaw Creek located outside the northeast corner of town is another major constriction to floodwaters.

A healthy watershed and a properly functioning floodplain may be the cheapest and most durable forms of flood protection available, since they use natural processes to reduce the peak flow rate during floods. Conservation of cottonwood-willow, perennial stream, and sacaton-mesquite floodplain communities therefore has the double benefit of limiting additional building in flood-prone areas, and reducing flood impacts to existing structures.

Water security for residents and businesses

Human demands for water may compete with the environmental water needs that contribute to the quality of life, such as riparian areas and wildlife habitat. In the face of predictions for a hotter, drier climate, solutions for water security need to incorporate both.

A healthy watershed and properly functioning floodplain can improve water security by increasing the amount of precipitation that gets captured as groundwater. This benefits residents in the town of Patagonia, and also those in the much larger city of Nogales, Arizona. By state law, Nogales has rights to 4,200 acre-feet of water annually from Patagonia Lake. While the infrastructure to deliver that water has not been constructed, preliminary plans have been developed and the city may depend on that water during times of extended drought.

Nature based economy

The primary human community in the watershed is Patagonia, and Nature-related efforts provide significant contributions to the community's economy. This includes tourism dollars spent by wildlife-watching and other visitors to the PSCP and Paton Center, dude ranch visitors to Circle Z Ranch, restoration contract work done by Borderlands Restoration Network, and spending by hunters on their way to and from nearby public lands. Visitation estimates include more than 10,000/year to PSCP, and more than 16,000/year to Paton. Arizona residents spend more than 236,000 days/year at Patagonia Lake (Audubon Arizona 2019).

A 2018 survey of Arizona residents showed 30,700 visitors annually engaged in outdoor recreation along Sonoita Creek, spending about 96 thousand visitor days there. Wildlife watching in Santa Cruz County contributes $21.2 million to the county's economy (Tucson Audubon Society 2013).

These contributions are important since the population of Patagonia is estimated at less than 1,000 people, and is more impoverished than the state of Arizona as a whole. Median household income is $28,594 (vs. $53,510 for AZ). The unemployment rate is 6.7% (7.1% for AZ). People whose income is below the poverty level comprised 23.7% of the population (17.0% for AZ). (American Community Survey estimates for 2017; factfinder.census.gov, downloaded 13 May 2019.)

Multi-generational community

The local area's limited economy has resulted in a net outflow of young people seeking employment opportunities elsewhere, and limited recruitment of new young residents. As a result the population of Patagonia is older than the state of Arizona as a whole, with a median age of 51.6 years, and 46% of residents being 55 or older (vs. 37.2 years and 28% for Arizona, respectively) (factfinder.census.gov, downloaded 13 May 2019).

Restoring a multi-generational community will require developing a more resilient economy while maintaining the attractive qualities of the area. These attractive qualities include a shared sense of optimism and willingness to invest in the future of the community; these, in turn, are supported by a belief that ecological systems are healthy enough to persist into the future, and that human activities are at least somewhat sustainable.

Hydrology

Sonoita Creek and the riparian forest it supports are central to conservation and social interests in the watershed. The perennial stream flow is supported by groundwater, which is recharged by rainfall across the watershed. Analyses of the available data suggest that streamflow has been declining in recent decades while precipitation has not changed. This implies that some other factor has affected streamflow, likely through impacts to groundwater supplies.

Surface flow in the PSCP and Circle Z is generally derived from groundwater, which gets pushed to the surface by a subsurface ridge of rock crossing the basin just downstream of Patagonia. For the base flow of Sonoita Creek, 50% to 70% is derived

Table 1. Water budget for Sonoita Creek basin.

Inflow	Volume (acre-feet/year)	**Outflow**	Volume (acre-feet/year)
Precipitation	207,000	Evapotranspiration	187,000
Groundwater flow	4,000	Surface water discharge	6,000
Total	**211,000**	Groundwater flow	3,000
		Groundwater pumping	less than 500
		Total	**196,000**

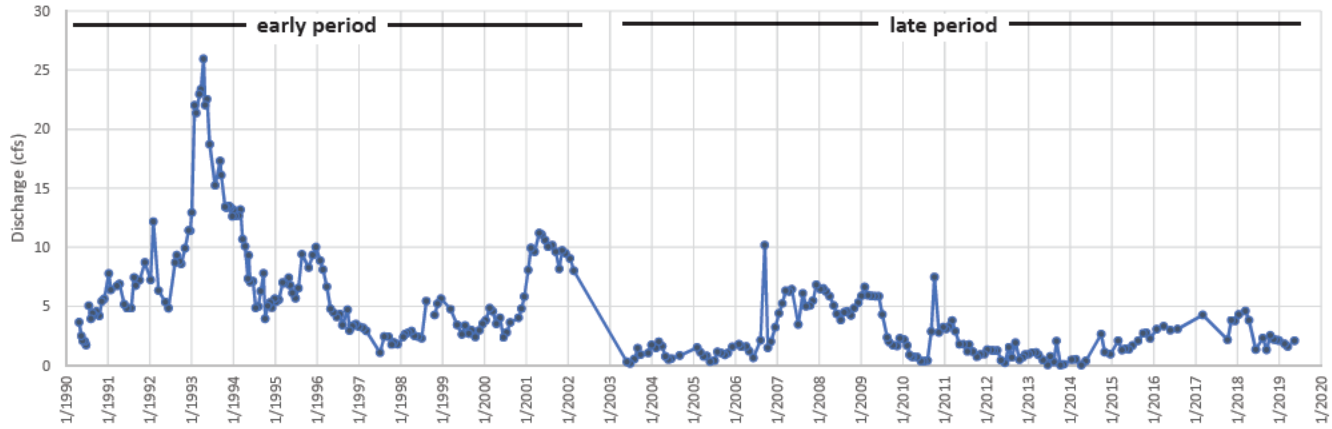

Figure 4. Sonoita Creek flow at Patagonia-Sonoita Creek Preserve. Discharge is measured in cubic feet per second (cfs).

from the alluvial aquifer in the valley northeast of Patagonia. The remaining contributions are equally divided between groundwater inflows from the Patagonia and Santa Rita Mountains (Gu et al. 2008).

E.L. Montgomery and Associates (1999) developed a water budget for Sonoita Creek basin (Table 1). Assuming that the hydrologic system in Sonoita Creek basin is in steady-state equilibrium, average inflow to the basin should equal average outflow from the basin. However, the water balance shows a discrepancy of about 15,000 acre-feet, or 8 percent of total estimated inflow. This is attributed to uncertainty around individual components of the water balance, most likely precipitation or evapotranspiration. Typical uncertainty for a basin-wide hydrologic water balance is 10 percent (E.L. Montgomery and Associates, 1999).

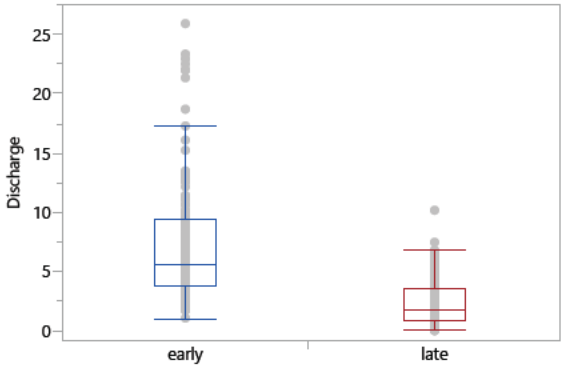

Figure 5. Sonoita Creek flow during 1990-2002 and 2003-2019.

Stream flow

The US Geologic Survey operated a stream gauge from 1930 to 1972 on Sonoita Creek within Circle Z Ranch, about 1.2 miles upstream from Patagonia Lake. That recorded a mean annual flow of 8.1 cubic feet per second (cfs).

Stream flow in Sonoita Creek has been measured regularly at the PSCP since 1990 (Figure 4), with occasional measurements taken in 1979-1989. These have been manual flow measurements taken monthly by Conservancy staff near the MW-1 well. These do not include flood flows, and thus are meant to represent base flow supported by groundwater. The 30-year (1990-2019) median flow was 3.6 cfs (mean = 4.8 cfs). Preliminary analysis suggests that period shows a declining trend, but it includes a wet period in 1993-1994. The early period, 1990-2002, had higher flows than a later period, 2003-2019 (Figure 5). Despite some year-to-year fluctuations in the later period, there was no apparent trend in flows from 2003-2019.

Precipitation

Precipitation has been consistently measured at the Paton Center in Patagonia from 1921 to present, with an annual average of 18.02 inches (Figure 6; wrcc.dri.edu/cgi-bin/cliMAIN.pl?az6280). While it is a great record, that represents just one site in a large watershed where precipitation varies with elevation. Mount Wrightson, the highest point of the watershed, is estimated to receive

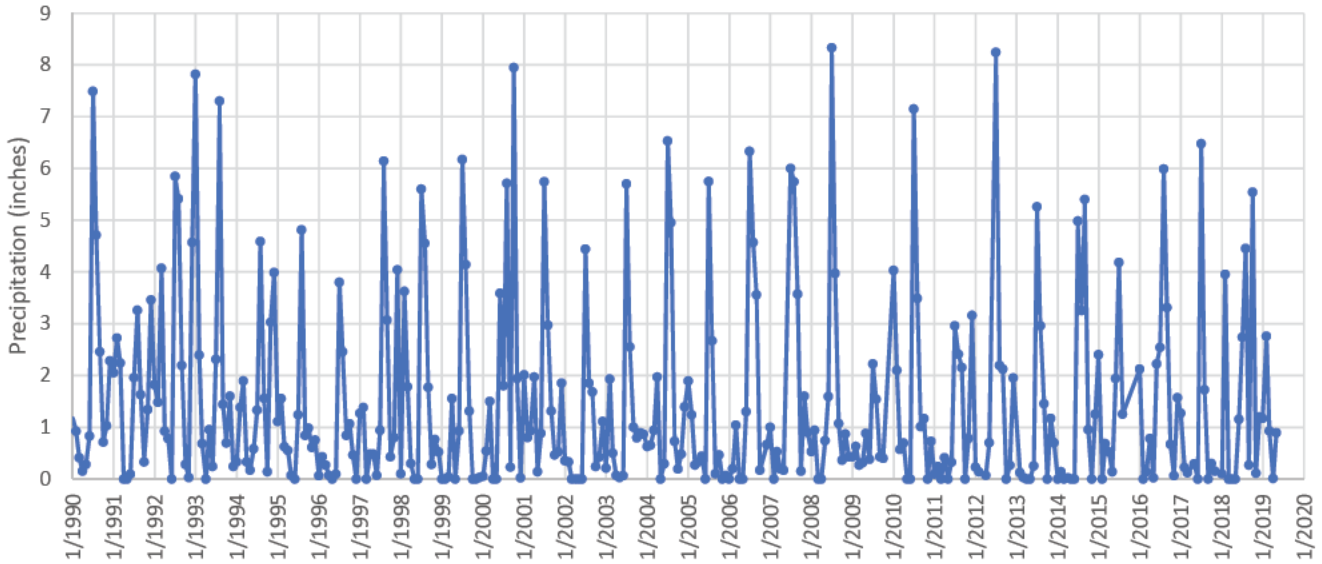

Figure 6. Monthly precipitation totals at Paton Center in Patagonia.

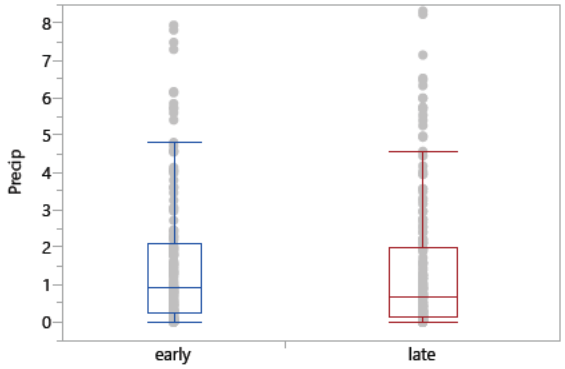

Figure 7. Precipitation during 1990-2002 and 2003-2019.

36.9 inches/year (PRISM 30-year normal, 1981-2010; www.prism.oregonstate edu).

In contrast to stream flows, the available data for precipitation shows only a slight difference between those two periods. The monthly precipitation totals for the Paton Center show a declining trend over the 30-year period, but only a slight difference between the two periods (Figure 7).

Groundwater

Groundwater has been measured monthly in 27 monitoring wells on the PSCP during the past 30 years (Figure 8), but there is wide variation in the period of record for different wells. Most of the wells with long records have fairly stable groundwater levels over time (Figure 9). However, those wells closest to the upstream end of the preserve show much higher fluctuations, sometimes changing more than ten feet between years. None of those upstream wells have been monitored since 2012, but there is a well just upstream of the preserve that has had annual monitoring by Arizona Department of Water Resources through this year as part of their Groundwater Site Inventory (shown as "GWSI" on Figure 9).

The data and physical arrangement of these wells suggests that groundwater pumping in town has affected groundwater on the upstream end of the preserve, but that additional groundwater moves in as you shift downstream. There is evidence of groundwater inflow from several "seepage runs," sequential flow measurements along the stream conducted in 1996 and 1998. Those showed steadily increasing surface flow from the beginning of the perennial reach until a half-mile downstream of the confluence with Temporal Gulch, and then fairly consistent flow for more than two miles.

The Sonoita Creek watershed includes two major springs that support riparian and aquatic communities (Figure 1). Monkey Spring, with an estimated discharge of 430 gallons per minute, and Cottonwood Spring, with an estimated discharge of 150 gallons per minute (ADWR 2009). The watershed also includes a spring-fed ciénega on the PSCP.

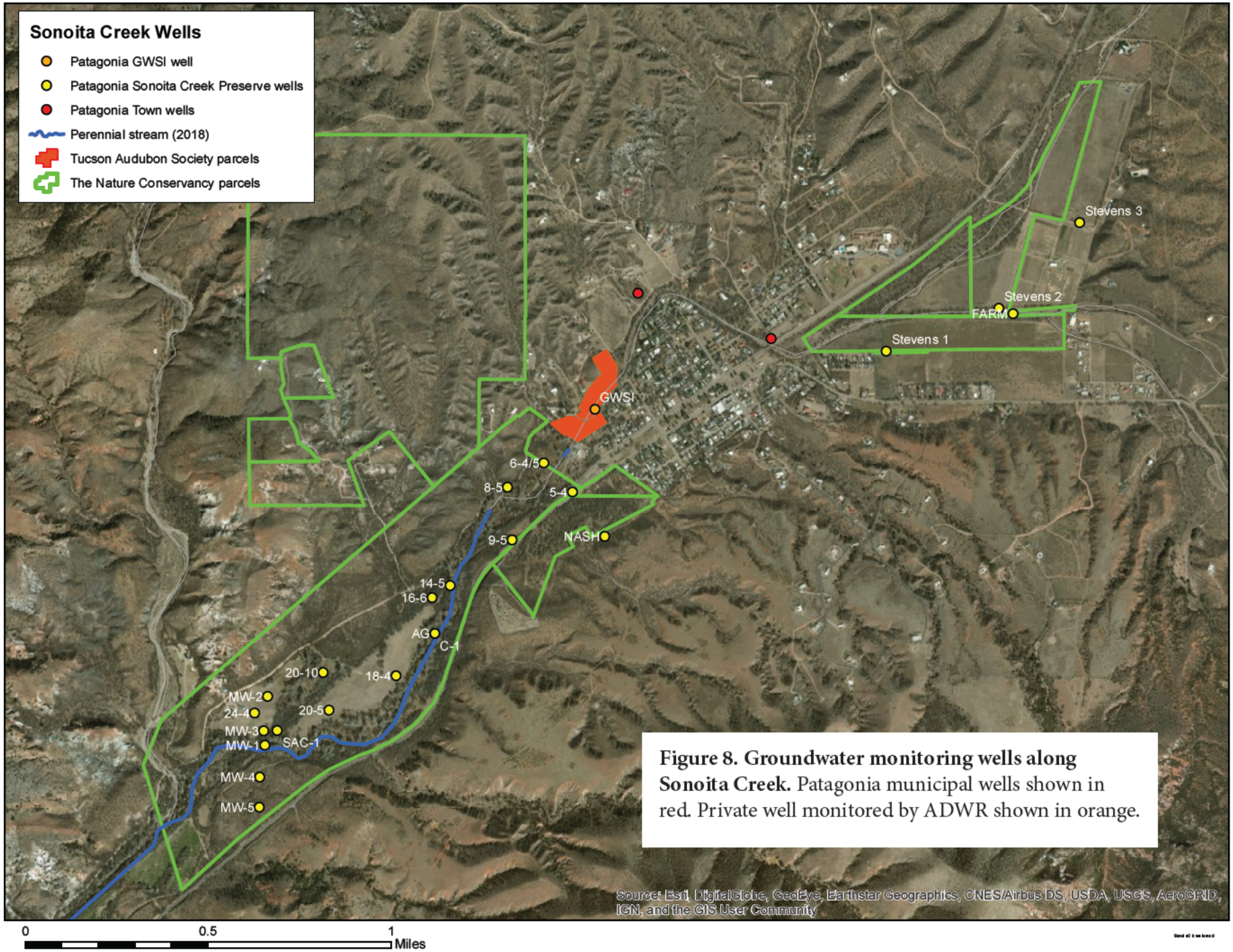

Figure 8. Groundwater monitoring wells along Sonoita Creek. Patagonia municipal wells shown in red. Private well monitored by ADWR shown in orange.

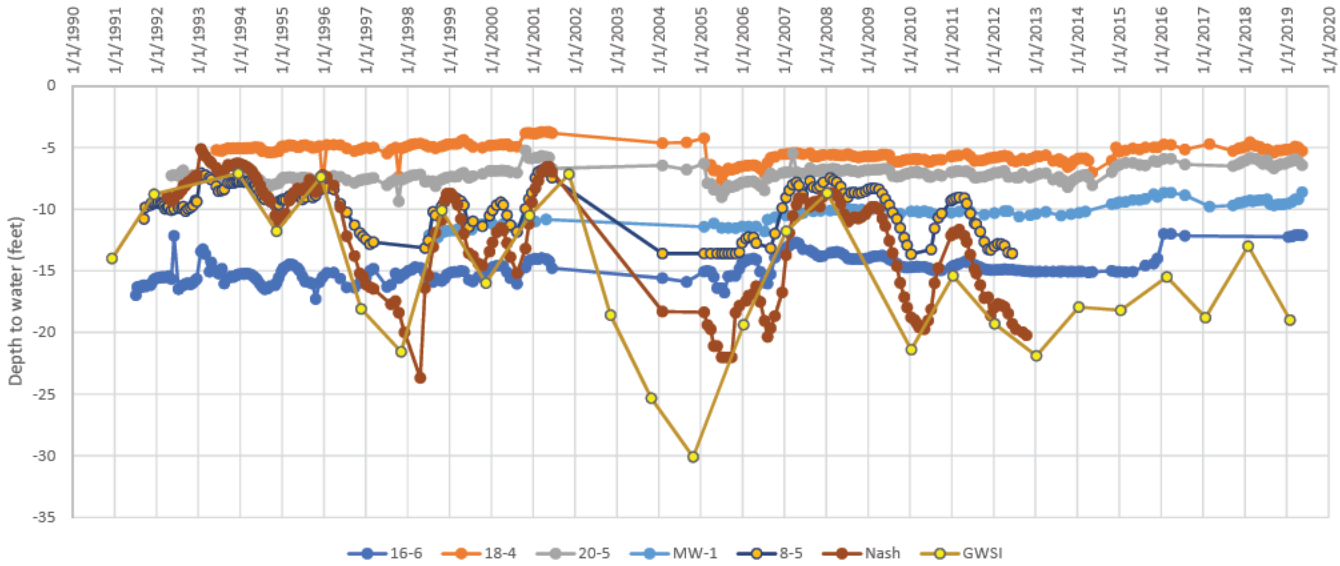

Figure 9. Depth to water in select monitoring wells. Well locations shown in Figure 8.

Patagonia Town water pumping has a reliable monthly record from 2008 to date. For January 2008 through August 2016 this record shows an average annual groundwater pumpage of 39.8 million gallons per year or 122 AF/yr (NextGen 2017). The current town wells were installed in 1965 and 1974.

There are approximately 780 wells in the Sonoita Creek watershed (ADWR Wells-55 database, Oct. 2015). About 40% of those are within a 1 mile radius of Patagonia (Figure 10). Most of the large agricultural wells are up the valley to the northeast, while all of the large mining wells are in the Patagonia Mountains to the south. The boundaries of the groundwater basin do not exactly match the surface water basin in the vicinity of the town of Sonoita, so additional wells around Sonoita (outside the surface water basin) may be drawing groundwater that would otherwise appear in Sonoita Creek.

There is one wastewater treatment facility in the watershed, located on the southwest side of Patagonia. This facility serves 945 people and generates 73 acre-feet of effluent per year, discharged into Sonoita Creek (ADWR 2009).

Threats

We identified major threats to all our conservation targets, listed below, and ranked their relative importance by evaluating the scope, severity, and reversibility of impacts to each target. We also identified the major contributing factors to those threats, looking for the systemic drivers (Appendix 1). That analysis provided a strong basis for discussions of strategies. Some of these contributing factors drive multiple threats and have large cumulative effects on targets. For example, poorly regulated mining and its expanding infrastructure in and around this watershed drives major threats to water quality and quantity, altered flood regimes, wildlife movement connectivity, and major disruptions to human well-being targets of Nature-based Economy and Positive Sense of Place and Community.

Altered flood regime

Within the Sonoita Creek watershed, several factors have altered the natural flood regime in ways that can make floods more destructive and more frequent.

Sonoita Creek has a long history of deliberate channel and floodplain alterations. The 1880s saw

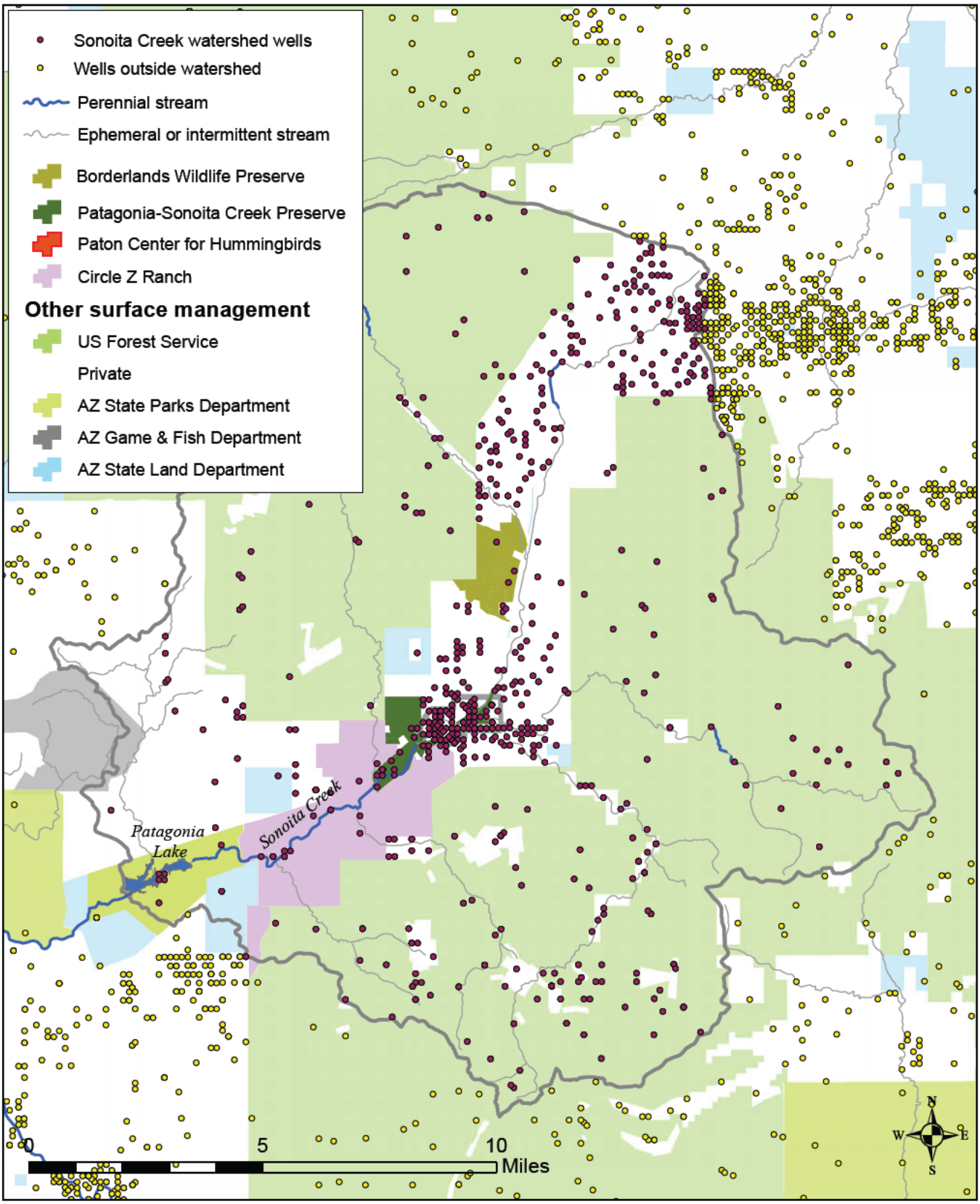

Figure 10. Wells in and near the Sonoita Creek watershed.

the completion of a railroad through the Sonoita Creek valley. That included straightening of the creek channel to allow construction of berms. Those berms, and associated abutments for bridges, constrict streamflow during flood events thereby preventing natural dissipation of water across the floodplain and prevents the stream from its natural tendency to meander. Despite that, the stream channel seems to have reached a new equilibrium such that any attempts to induce meandering carry risks of destabilizing the system.

Entrenchment of the stream coupled with groundwater depletion affect the height of the water table, soil moisture, and sediment deposition which, in turn, are limiting factors to recruitment of cottonwood, willow, sacaton, and mesquite. Stream entrenchment reduces habitat diversity, increases duration and severity of flood events, and increases scouring.

One of the most solid scientific predictions about climate change has long been greater extremes of precipitation, as the climate warms and the atmosphere's capacity to hold water increases. While overall precipitation in the Southwest has been declining, occasional heavy rainfall events have become more common. Evidence for this has been reported for the global and continental scale, and a recent study in the San Pedro River basin found intensification of brief monsoon rainfall intensities starting in the mid-1970s (Kunkel et al. 2010, Demaria et al 2019). More intense events can cause devastating flash floods with increased erosion, and may accelerate the transition of grassland to shrublands (Zhang et al. 2012).

Another well-documented effect of climate change has been increasing size and frequency of catastrophic wildfires (Abatzoglou and Williams 2016). In the aftermath of such fires, large flash floods are common and can cause tremendous damage to human communities and riparian vegetation. The southern drainages of the Santa Rita Mountains have not experienced a large fire in more than 35 years and thus are at high risk (www.mtbs.gov; referenced 10/2/2019).

Increased erosion and sedimentation

Historic overgrazing by livestock in the Sonoita Creek watershed produced lasting effects on watershed condition and thus on the flood regime. Watershed quality is largely determined by upland semi-desert grassland conditions. Increased perennial grass and light shrub cover "anchor" the landscape, providing greater infiltration of precipitation, less surface runoff, reduction of flood peaks, less soil movement, and higher water quality through reduced sedimentation. Perennial grasses also produce litter that gives soil greater aggregate stability, increases soil fertility, and permit increased infiltration. The composition and structure of semi-desert grasslands have changed significantly since 1900 as a result of fire suppression and intense cattle grazing (Hastings and Turner 1965; Branson et al. 1981).

As noted above, catastrophic wildfires in the watershed pose an additional threat to the stream. After large fires, flash floods cause increased erosion of stream channels in some places and large sediment deposits in others. In Sonoita Creek, there is risk that stream segments with perennial flow could be buried by sediment, eliminating habitat for fish and other aquatic species.

A potential threat involves a proposed mitigation project on Sonoita Creek Ranch for the Rosemont Mine, proposed for an area outside the Sonoita Creek watershed. Current plans by Hudbay, developers of the Rosemont Mine, involve constructing a new channel for Sonoita Creek. As designed, the new channel would have a very sinuous alignment (Hudbay 2017). This creates significant risk that the creek would cut a straighter path during large flood events (EPA 2017). Such an event would transport large volumes of sediment downstream, potentially causing greater flood risks in Patagonia and burying the perennial stream flow in the Patagonia-Sonoita Creek Preserve (Figure 11).

In a slower example of increased erosion, an active headcut in Sonoita Creek is currently moving upstream from Patagonia Lake State Park. If it continues to expand, it carries a risk of incising a much deeper channel through the floodplain

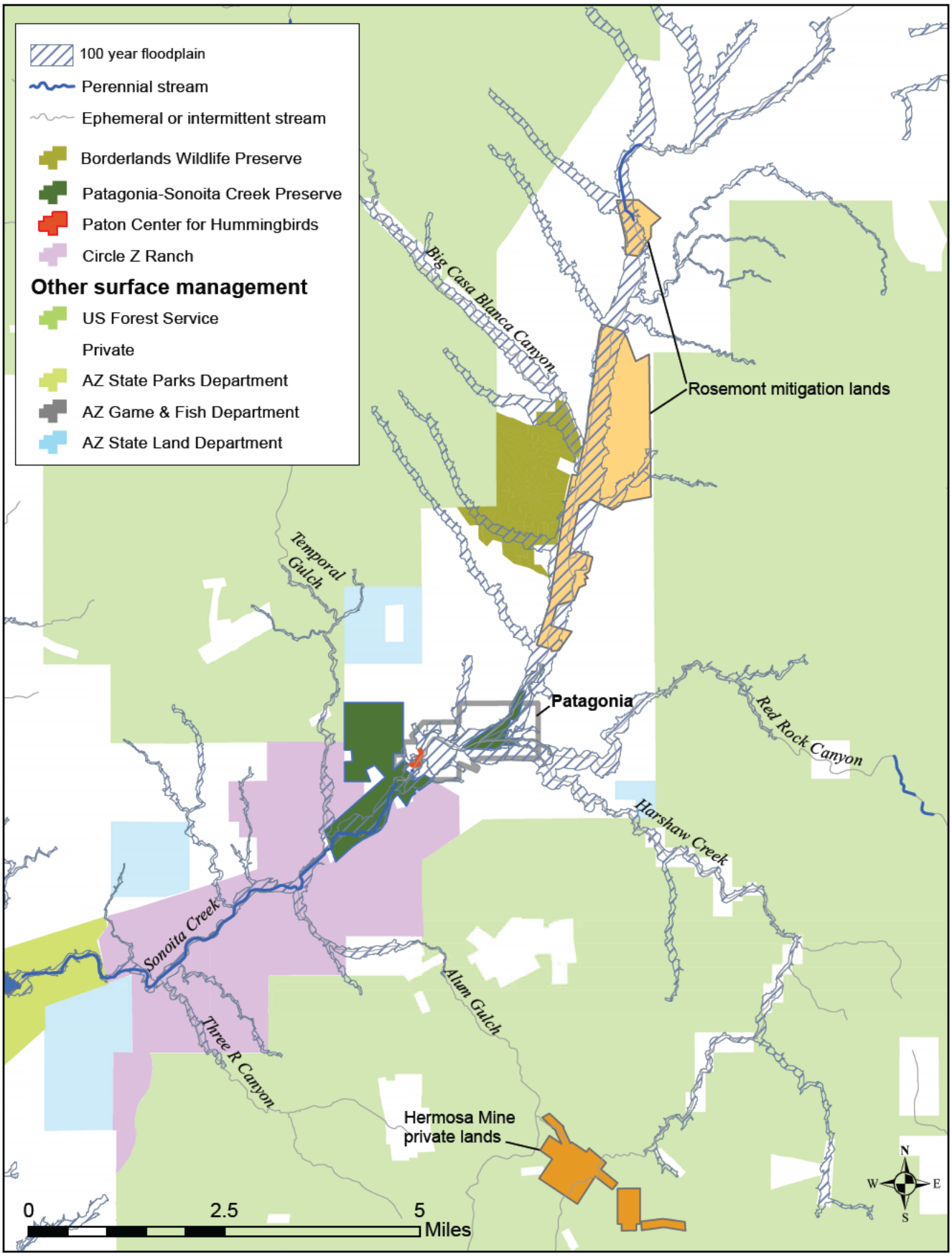

Figure 11. Floodplains and current mine-related projects in the Sonoita Creek watershed.

which could lower the adjacent groundwater levels, damaging the riparian community. That incision would change the flood regime by focusing floodwaters and increasing their erosive ability. It would also change fish habitat in the stream, potentially eliminating one or more native species.

Competition by non-native plants

Deliberate and accidental introduction and spread of non-native plants throughout the watershed reduces species diversity and the amount of suitable habitat and forage for native fauna that have evolved with native flora. Non-native plants may increase their abundance and distribution due to competitive advantages that can be exacerbated by the effects of climate change, further reducing overall biodiversity and habitat resilience. Notable problems in this watershed have been found with Johnson grass (*Sorghum halepense*) in floodplains and Lehmann lovegrass (*Eragrostis lehmanniana*) on grassland slopes.

Increased predation on fish, birds

Non-native fishes are generally recognized as the biggest threat to the survival of native fishes in the Southwest (Minckley and Marsh 2009). Some of them are major predators on native fish, while others directly compete for food and other resources. Non-native fish (e.g., mosquitofish, bass, green sunfish, red shiner) migrate upstream from Patagonia Lake, and can be swept into the creek from upstream springs and stock tanks.

Non-native crayfish are also known to significantly reduce the biodiversity of stream systems because they voraciously feed on native fish, frog tadpoles, young gartersnakes, and aquatic invertebrates.

Introduced bullfrogs have been implicated in the decline or displacement of many amphibians and a few reptiles, including Mexican garter snakes (*Thamnophis eques*), lowland leopard frogs (*Rana yavapaiensis*), and Chiricahua leopard frogs (*Rana chiricahuensis*) (Schwalbe and Rosen, 1988). Bullfrog populations do not reach high levels in streams that experience regular flooding, since their tadpoles can be washed away during the months or years required to metamorphose, but they can recolonize Sonoita Creek from Patagonia Lake or stock tanks in the watershed.

Feral cats and free-ranging pet cats kill 1.3–4.0 billion birds and 6.3–22.3 billion mammals annually in the U.S. (Loss et al. 2013). Their abundance and impacts along Sonoita Creek have not been studied, but the proximity of Patagonia suggests they are common and likely reduce local wildlife populations.

Reduced groundwater levels

Stream flow in Sonoita Creek and health of the riparian corridor depend on groundwater supplies. Preliminary analysis suggests a declining trend in stream flow, and the limited groundwater data available for the town of Patagonia suggests that pumping there has direct effects on groundwater levels. While not the only wells in the area, the town's two primary wells for drinking water are adjacent to the creek channel (Figure 8). A large well for industrial purposes was recently drilled near the mouth of Harshaw Creek, with the potential to intercept groundwater inflows from that tributary. If pumping within the town boundaries increases substantially, due to population growth or other causes, it could rapidly affect flow in the creek downstream. Other wells in the watershed, whether higher along Sonoita Creek or along tributary canyons, would also capture groundwater from the creek but the effects on perennial flow would be delayed.

Any changes that reduce aquifer recharge would also lower groundwater tables, harming the humans and ecosystems that depend on shallow groundwater. Long-term drought, climate change, and land use changes in upper elevation recharge zones pose long-term threats that would be hard to reverse.

Diversion of spring flow

The watershed has a number of springs but the largest, Monkey Spring, has been highly altered to divert water for agricultural and other uses. The ecological impacts have been very high, including loss of species and habitat.

The next largest spring, Cottonwood Spring, has been conservatively managed by private owners. The Nature Conservancy holds a conservation easement over an adjacent reach of Sonoita Creek.

Impaired water quality

The water quality in Sonoita Creek is affected by materials from throughout its watershed. This includes heavy metals from historic mining waste and naturally fractured bedrock. Arizona Department of Environmental Quality has rated Sonoita Creek as impaired due to high zinc and low dissolved oxygen levels. Metals and acidity in tributary stream reaches of Alum Gulch and Harshaw Creek have exceeded standards for aquatic and wildlife, partial body contact, and livestock watering (ADWR 2009), though some recent testing found lower contaminant levels and official impairment status is under review. The area also experienced high profile releases of metallic and acidic mine drainage after large rainstorms. The complex network of tailings, tunnels, and rock fractures makes predicting and remediating this type of contamination difficult (Norman et al. 2008).

There is the potential for additional pollution from the Hermosa Mine, currently under development in the Patagonia Mountains.

Impaired water quality poses a threat to human well-being targets on both chronic and episodic time scales. Many wells in the area have tested above drinking water standards for cadmium, copper, arsenic, fluoride, and lead (ADWR 2009). Ongoing remediation and research by USGS and others will likely provide better data on the magnitude of the water quality problems from old mining activities and options for addressing these, but easy and inexpensive solutions are unlikely.

There is also potential for contamination from aging infrastructure at the Patagonia wastewater treatment plant and from aging septic systems. Additional nitrogen and fecal contamination is likely provided by livestock in the watershed.

Existing pollution in Sonoita Creek at current levels appears to be a chronic condition that might impair aquatic life but allow it to persist. However, the potential for a major toxic spill or greater inflows from an existing site remain active threats.

Persistence of historic degradation

Some impacts from historical human activities in the Sonoita Creek watershed have persisted long after the initial disturbance. These include the legacy of heavy grazing impacts, which changed the vegetation community, the soil structure that supports vegetation, and the hydrologic function of tributary watersheds. The lasting impacts of early mining exploration and development include polluted water drainage, piles of waste rock that provide little or no support for native plants and animals, and abandoned shafts and adits that can trap wildlife (though old mines can also provide important roost sites for bats). Old roads, often constructed for mining purposes, change surface water flow patterns and can increase erosion. Old roads, even when not maintained, attract recreational off-road vehicle use which can extend the impacts beyond the original road alignment.

Among the most visible impacts is that of the old railroad alignment along Sonoita Creek. While the tracks are long gone, its earthen berm disrupts surface water flows from tributary areas, the Sonoita Creek channel was straightened in places, and several bridge abutments prevent the channel from shifting across its floodplain.

Objectives and Strategies

The partners in this plan collectively identified objectives and strategies that will address some of the major threats in the watershed. Some of the strategies directly focus on known threats, while others focus on gathering information and preparing conditions for future strategies. Leadership on individual strategies is noted in parentheses, while details about implementation, funding, and other support roles will be determined in the future. Results chains showing the logic behind many of the strategies are presented in appendices.

Objective 1: By 2030, stabilize or improve groundwater conditions across the watershed to levels that will support conservation target communities.

Strategy: Support Patagonia's town-sanctioned Flood and Flow Committee in groundwater data collection and analysis of trends. (TNC)

Support development of a groundwater model. (TNC)

Monitor and analyze groundwater and surface flow data at TNC Preserve. (TNC)

Convene discussions within community about groundwater management when NextGen report is available, based on better understanding of conditions. (BRN)

Target addressed: Cottonwood-willow community, Perennial stream community, Ciénega, Sacaton-mesquite floodplain community, Water security for residents and businesses

Threat addressed: Reduced groundwater levels

Theory of change: Groundwater is essential for maintaining plant, animal, and human communities in the Sonoita Creek watershed. In the face of potential changes in human demand for water and a drier climate, water management will require a much better understanding of impacts from proposed activities, and of trade-offs between possible management options. A groundwater model would allow testing of scenarios, such as predicting impacts from new groundwater pumping or recharge projects. It could also be used to evaluate questions like whether moving the Patagonia town wells upstream could minimize impacts to streamflow while maintaining a reliable water supply. The accuracy and precision of a model depends on the data available, so maintaining and expanding the network of groundwater and surface water monitoring sites will improve the value of the model. How a model is used, and how decisionmakers respond to results, depends on how the process of developing a model engages with the community and develops trust in the process. This strategy is focused on improving our tools and shared knowledge base. Future discussions will be needed to develop strategies that directly target maintaining or improving groundwater conditions. (Appendix 2)

Objective 2: Restore a healthy cottonwood-willow community with multiple age cohorts of trees.

Strategy: Develop pole planting project on Patagonia-Sonoita Creek Preserve. (TNC, BRN)

Target addressed: Cottonwood-willow community, Positive sense of place and community, Flood protection, Nature based economy

Threat addressed: Altered flood regime

Theory of change: Sonoita Creek has seen very little recruitment of new cottonwood trees in recent decades. While this is probably not a crisis yet, the existing trees will need replacement in the foreseeable future. Developing a project to grow and plant a new cohort of young trees will provide those replacements while supporting the nature-based restoration economy of Patagonia. Engaging local residents to help with the planting will increase their appreciation for the cottonwood/willow forest as they see the trees grow and document progress (Appendix 3). Maintaining or improving the cottonwood-willow community will also support the resident and migrant bird

populations, which provide a major economic driver for Patagonia, support the positive sense of place for human residents, and provide a recreational benefit to visitors from across Arizona and the rest of the country.

Objective 3: Increase native vegetation communities in the Sonoita Creek floodplain.

Strategy: Replace Johnson grass with sacaton on the Johnston parcel. (TAS)

Restore sacaton and other grasses on the Stevens parcel. (BRN)

Create Cooperative Weed Management Area and compile best management practices for weed control. (TAS)

Revegetate with locally adapted native species (TAS, BRN, TNC)

Target addressed: Sacaton-mesquite floodplain community

Threat addressed: Altered flood regime, Competition by non-native plants

Theory of change: Sacaton communities have been lost or degraded through most of their historic range. Some large patches remain relatively intact along Sonoita Creek, but others have been cleared for historical agriculture. One of the major threats to sacaton recovery here is non-native plants, and there are opportunities to directly address that threat. Removal of Johnson grass and other weeds, followed by planting of sacaton, has potential for restoring large patches. Past experience with weed management and sacaton planting has shown wide variations in effectiveness, so compiling and sharing best practices would improve the chances of success. Restored sacaton communities in the Sonoita Creek floodplain will slow floodwaters and reduce the risk of severe erosion during high flow events. (Appendix 4)

Objective 4: Sustain geomorphic floodplain function of sacaton/mesquite community to regulate sediment movement and attenuate large flood flows.

Strategy: Support LiDAR data collection of current floodplain elevations, and modeling of floodplain and sediment dynamics that can compare alternatives for floodplain and channel management, using a process that develops public support for the model and its application. (TNC)

Develop ways to avoid or minimize damage from the planned Hudbay project on Sonoita Creek Ranch. (TNC)

Increase community awareness of upstream floodplain values for Patagonia. (BRN)

Target addressed: Perennial stream community, Sacaton-mesquite floodplain community

Threat addressed: Altered flood regime, Increased erosion and sedimentation

Theory of change: The largest remaining sacaton community in the watershed is on Sonoita Creek Ranch. Current plans by Hudbay involve uprooting many of the plants as part of constructing a new channel for the creek, and burying additional plants under the excavated soil. Some of the plants would be replanted into soil placed on the existing channel. As proposed, the newly constructed, highly sinuous channel alignment carries a high risk of failure in the form of large flood events cutting a straighter path. This might transport large volumes of sediment downstream, potentially causing greater flood risks in Patagonia, and burying the perennial stream flow in the Patagonia-Sonoita Creek Preserve. Developing a better scientific understanding of those hazards will increase the options for minimizing or avoiding serious impacts. These could include revegetation or other floodplain projects on TNC lands upstream from Patagonia that might capture sediment and reduce flood peaks.

Gila topminnow in the Santa Cruz River, Sonora, Mexico.

Photo © *Dale Turner/TNC*

Objective 5: Reduce erosion, increase infiltration, and prolong soil moisture in strategic places in the watershed.

Strategy: Analyze the watershed for the most strategic places for restoration projects. (BRN)

Develop and raise funds for watershed restoration projects. (BRN)

Conduct restoration projects. (BRN)

Work with Patagonia, Nogales, and Santa Cruz County to influence Forest Service management and funding priorities, e.g. apply for designation of a Municipal Watershed. (TNC)

Work with USFS, ASLD, and private landowners to improve range and forest condition by ensuring that broader land management actions support healthy vegetation cover across the watershed, e.g. by engaging on sustainable grazing, fire management, erosion control, and limiting impacts from roads and other infrastructure. (TNC, BRN)

Target addressed: Spongy uplands, Nature based economy

Threat addressed: Reduced groundwater levels, Altered flood regime, Increased erosion and sedimentation, Persistence of historic degradation

Theory of change: The Sonoita Creek watershed stills shows the legacy of historical grazing impacts, resulting in flashy response to rain events that causes ongoing erosion and poor infiltration. The most effective approach to restoring watershed conditions is often construction of many small structures to slow runoff and capture sediment in first- and second-order stream channels. While that approach would require a huge effort to cover the whole watershed, there may be subwatersheds with strategic importance that can be identified by entities such as U.S. Geological Survey, while the U.S. Forest Service's designation of the Sonoita Creek uplands that include the Patagonia Mountains as a Municipal Watershed could leverage federal support and approvals that also align with federal goals for managing public lands. Improving watershed health would increase water security for residents of both Patagonia and Nogales, reducing potential impacts of prolonged droughts, enhancing vegetation productivity and resilience, and supporting the nature-based economy more broadly.

Objective 6: Protect native fish and prevent erosional loss of Sonoita Creek habitat.

Strategy: Build a fish barrier and grade control structure to block movement of nonnative fish from Patagonia Lake and to stop an active headcut. (TNC lead, support from TAS, BRN, Circle Z)

Conduct annual fish monitoring and control of nonnative fish. (TNC lead, support from BOR, AGFD)

Survey stock tanks in watershed for nonnative fish and initiate control programs where feasible. (AGFD)

Target addressed: Perennial stream community, Cottonwood-willow community

Threat addressed: Increased predation on fish, Increased erosion and sedimentation

Theory of change: The biggest threats to native fish in the desert Southwest are nonnative fish and loss of stream habitats. Patagonia Lake is managed as a recreational fishery, with a variety of predatory nonnative fish present though only rainbow trout are currently stocked. There is also an active headcut in Sonoita Creek, moving upstream from Patagonia Lake State Park. There is potential that both of these could be addressed by construction of a barrier on Sonoita Creek. The Bureau of Reclamation has a mandate and a budget to build several new fish barriers, as mitigation to offset the potential impacts to native fish by the construction of the Central Arizona Project. Sonoita Creek is a potential site for one of their barriers. If further studies support building a barrier now, a suitable site is identified, and the relevant land owner agrees with the associated impacts and conditions, this could be an effective solution. (Appendix 5)

Objective 7: Improve security for Sonoita Creek native fish populations.

Increase public support for native fish conservation.

Strategy: Create an off-channel refuge for Sonoita Creek fish with interpretive materials on Patagonia-Sonoita Creek Preserve or Sonoita Creek Wildlife Corridor. (TNC or BRN)

Target addressed: Perennial stream community, Positive sense of place, Nature based economy

Threat addressed: Increased predation on fish, Increased erosion and sedimentation, Altered flood regime

Theory of change: The Sonoita Creek populations of speckled dace and Gila topminnow are the largest and almost the last in the Santa Cruz River watershed, and may contain unique genetic adaptations for the species. Arizona Game and Fish Department has a goal of maintaining refuge populations for each species of declining native fish, and currently does not have enough populations or individuals of these two species. Developing an off-channel refuge for Sonoita Creek fish would provide greater insurance against the loss of genetic diversity in these species. It would allow reintroduction into Sonoita Creek in the case of catastrophic events, such as a plume of toxic materials from mining waste or a large sediment deposit from a poorly designed upstream channel realignment. Developing a refuge site in the watershed allows infiltration losses from the refuge to return to the creek's aquifer, and any escaping fish would return to their native habitat. A fish refuge would also allow public education about native fish and other aquatic life in Sonoita Creek, in ways that are difficult along the creek itself while providing another attraction for visitors. Potential sites include the Patagonia-Sonoita Creek Preserve and the Sonoita Creek Wildlife Preserve owned by Wildlife Corridors LLC and managed by BRN. (Appendix 6)

Objective 8: Minimize impacts of new mining in the watershed and surrounding area.

Strategy: Research wastewater discharge plans from dewatering the Hermosa Mine and look for opportunities to recharge groundwater. (TNC)

Monitor groundwater levels on the Stevens parcel for impacts from adjacent well operated by South32. (TNC)

Engage with partners to understand opportunities for restoring parts of the watershed and minimizing new impacts.(BRN, TNC)

Proactively engage with mining interests to minimize new impacts. TNC leadership and program staff will develop relationships with mining companies, seeking opportunities to inform mining development and mitigations plans in ways that address concerns and minimize impacts from mining activities. (TNC)

Target addressed: Spongy uplands, Perennial stream community, Cottonwood-willow community

Threat addressed: Reduced groundwater levels, Increased erosion and sedimentation, Persistence of historic degradation

Photo © *Peter Warren/TNC*

Vermilion flycatcher.

Theory of change: New mining activities in the Patagonia Mountains pose a variety of risks to our conservation interests. The partners in this plan are unlikely to directly challenge legal mining activities and prefer to work to minimize the potential impacts, particularly to surface water and groundwater resources. These include watching for groundwater impacts to the Conservancy's Stevens parcel by the mouth of Harshaw Creek. Assuming the Hermosa Mine is developed, there might be opportunities for using water removed from the mine to recharge the aquifer in strategic locations that would benefit Sonoita Creek and the town of Patagonia. There might also be mitigation needed for upland impacts that could result in funding for restoration work elsewhere in the watershed. The Conservancy and partners are well positioned to guide the meaningful use of mitigation funds, as well as encourage mining companies to fully offset the environmental impacts of their operations beyond legal mitigation obligations. Maintaining the quantity and quality of water supplied by Sonoita Creek will be critical to the long-term viability of Patagonia, and possibly Nogales.

Objective 9: Improve the economic viability of Patagonia by addressing regulatory issues.

Strategy: Research additional activities under the Community Rating System that would further lower flood insurance costs. (BRN)

Explore opportunities of upgrading the wastewater treatment plant in ways that increase environmental benefits. (TNC)

Target addressed: Perennial stream community, Cottonwood-willow community, Flood protection, Nature based economy, Positive sense of place, Multi-generational community

Threat addressed: Altered flood regime, Reduced groundwater levels, Impaired water quality

Theory of change: The National Flood Insurance Program's Community Rating System is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum requirements. The system offers discounts from 5% to 45% on flood insurance premiums based on specific public information and floodplain management activities. Recent efforts by the Patagonia Flood and Flow Committee qualified Patagonia to join the Community Rating System, in large part due to recognition of the Patagonia-Sonoita Creek Preserve as meeting the Open Space Preservation activity. The town could see further benefits with additional efforts to preserve or restore natural conditions in the floodplain. This would serve as a useful model for export to other communities in the region.

In a separate regulatory realm, there may be opportunities to improve the wastewater treatment plant with constructed wetlands or other approaches that improve water quality while providing other environmental benefits.

Objective 10: Increase public visitation and understanding of natural areas in the Sonoita Creek watershed.

Strategy: Develop a cooperative birding guide to Paton Center, Patagonia-Sonoita Creek Preserve, and Sonoita Creek Wildlife Corridor. (TAS)

Target addressed: Nature based economy

Threat addressed: Limited local economy

Theory of change: Bird watching is a significant contributor to the economy of Patagonia and has been a major driver of conservation efforts in the watershed. With the recent improvements and expansion of the Paton Center and creation of the Sonoita Creek Wildlife Corridor, there is an opportunity to share resources between conservation groups and encourage further exploration by visitors. A cooperative birding guide could highlight the opportunity to see different bird species at the various protected lands, where complementary materials and demonstrations could extend public interest to associated species, habitats, and restorative/restoration benefits and opportunities.

Objective 11: Explore opportunities to protect key properties in the Sonoita Creek watershed, with a focus on maintaining resilient and connected landscapes and supporting water security.

Strategies: Prepare for the opportunity when the Monkey Spring property goes on the market by researching water availability, including data on outflows and diversions, and researching land ownership and water rights, including those linked to the Hudbay mitigation project. (TNC)

Analyze other strategic places for the potential value and cost of conservation easements or other land protection arrangements, and opportunities to build capacity for local partners to protect key lands and waters. (TNC)

Target addressed: Perennial stream community

Threat addressed: Diversion of spring flow

Theory of change: Monkey Spring is the largest spring in the watershed, and historically supported an important wildlife community. It is privately owned. While the current owner has not taken any apparent actions that would increase consumptive use of the water, that will always be a risk, especially in the event of sale to new owners. This strategy is meant to improve our understanding of the current situation and potential for keeping the water available for wildlife and for maintenance of the Sonoita Creek aquifer. Sonoita Creek Ranch, the proposed mitigation site for the Rosemont Mine, includes surface water rights to 590 acre-feet per year from Monkey Spring, 85% of the annual flow. As proposed, the mitigation project there would use the water in ponds with the intent to support recovery efforts for sensitive species, and overflow into Sonoita Creek.

Additionally, this objective and its strategies are meant to support and improve the conservation community's ability to promote resiliency, maintain and improve landscape connectivity, and sustain biodiversity as climate change impacts are better understood and development and other changes occur in the watershed.

Monitoring framework

Sonoita Creek has been subject of a wide range of research and monitoring activities in the past, and will likely continue to be so into the future. This plan aims to inform collection and use of data specific to targets and strategies for lands in the plan. This Monitoring section identifies several specific monitoring needs, describes an overall approach to monitoring, and gives examples of the types of data collection that could be useful in evaluating the status of ecosystem and human wellbeing targets while tracking progress towards strategy benchmarks. It also provides a framework that can help make use of existing data and information collected for various other purposes. It does not attempt to be comprehensive, but rather illustrates an approach to evidence-based adaptive management that can be built out and refined as needed.

Table 2 lists existing monitoring being done by partners in the plan and shows gaps that could be filled.

Priority monitoring needs

Critical needs: Tracking of several hydrology-related metrics is critical for enabling partners to advocate for the needs of conservation and human wellbeing targets in the Plan. In addition to their immediate value, all of these would contribute to eventual development of a groundwater model. *Monitoring needs include data collection, analysis, interpretation, and communication for the following metrics*:

Depth to groundwater

• Currently measured by TNC in shallow wells on Preserve and nearby TNC-owned lands; needs to be analyzed by professional hydrologists to describe status and trends, refine locations and timing of future monitoring.

• Periodically measured by ADWR in well sweep measurements of index wells (see ADWR 2009); needs to be continued, possibly expanded, and analyzed for status and trends.

• Additional well level data being gathered by Town of Patagonia Flood and Flows committee, needs analysis in conjunction with other water data.

Surface water flows

• Flow rates currently being measured by TNC on Preserve. Needs to be analyzed by professional hydrologists to describe status and trends; and to test for correlations with rainfall, groundwater depth, nearby pumping, and other potential explanatory variables.

Floodplain and sediment dynamics

• A high-resolution Digital Elevation Model (DEM) for the Sonoita Creek floodplain is needed to show current configuration and inform analyses of how flood events are likely to affect the landscape. TNC plans to acquire baseline LiDAR data in 2020, expects to repeat measurements after any major channel/floodplain alteration projects such as the Hudbay proposed mitigation project, and again in the event that a substantial flood event results in significant sediment transport downstream. Professional modeling will be needed to use this DEM data to predict flood and sediment dynamics and to compare alternatives for floodplain and channel management projects.

• Baseline data on sediment dynamics from storm flows. TNC expects to collect water quality data on TNC lands along Sonoita Creek; analyses by a professional hydrologist will then be needed to interpret the data and any changes through time.

Hydrologic monitoring plan

• Preparation of a detailed hydrologic monitoring plan for groundwater and surface water, including locations and timing, frequency of analysis and discussion for adaptive management, and schedule for updating plan. This will increase the return on investment from effort spent on monitoring by helping ensure that data is collected, analyzed, interpreted, and utilized in consistent and targeted ways.

Table 2. Current monitoring efforts. Key concerns with no monitoring efforts listed represent unmet needs.

	Key concerns	TNC	BRN	Audubon	Circle Z	Others
Components key to multiple other targets						
Groundwater	declines in shallow groundwater	30+ years measuring well levels on TNC-owned lands (ongoing; analysis pending)				ADWR tracks depth in index wells (periodic, ongoing); Flood and Flows compiling water depth data from other wells
Surface water flows	declines in flow rates, extent	Baseflow measurements since 1990 (ongoing); will add storm flow measurements				
Water quality	sedimentation; heavy metals; acidification; dissolved oxygen	Planned for 2020: sediment load in stream, PSCP	monitoring sediment retention behind erosion control structures			ADEQ: occasional measurements in several stream reaches. FOSC using Water Sentinel protocols to do seasonal, monthly, and precip-event sampling. Reinthal (UA): Has collected aquatic inverts as bioindicators; heavy metals in bug tissues. USGS: has measured heavy metals, acidity at several locations.
Floodplain sediment dynamics	Large sediment flows entering stream	High-resolution mapping of floodplain topography planned for 2020				
Erosion	expanding gullies, headcuts					Friends of Sonoita Creek (FOSC) tracking movement of headcut above lake

Table 2 (continued)

	Key concerns	TNC	BRN	Audubon	Circle Z	Others
Precipitation	Drought/flood driver of other changes			weather station run since 1921 (ongoing)		NOAA manages data from several surrounding coop weather stations (ongoing)
Conservation targets						
Cottonwood/willow community	missing young trees (lack of recruitment)	mapped 2019; old data on size class distribution		bird counts: Xmas, breeding, IBA		USFWS conducts annual training for Yellow-billed Cuckoo monitoring, starting 2018. USFWS conducts annual training for Yellow-billed Cuckoo monitoring, starting 2018. FOSC have used Rapid Stream Riparian Assessment (RSRA) methods for repeat surveys, 2014 and 2018.
Perennial stream community	loss of native fish, frogs; flow declines	fish and aquatic habitat surveys conducted 1991-2001				Fish surveys UA-AGFD. FOSC see RSRA above.
Ciénega wetlands	flow declines; invasive species					
Spongy uplands	loss of watershed function		developing database of all erosion control structures in the watershed			USGS: research and modeling
Sacaton/mesquite floodplain community	johnsongrass invasion; floodplain function	extent of large sacaton stands mapped 2019	experimental plantings on farm, with UA	planted 5 acres upstream of PSCP, tracking results		

Table 2 (continued)

	Key concerns	TNC	BRN	Audubon	Circle Z	Others
Human well-being targets						
Positive sense of place and community	loss of riparian forest and natural landscape; disconnection from nature					
Flood protection	flood risk areas; flood warning					FEMA mapped risk areas (once unless revised), sets Community Rating System classification
Water security for residents and businesses	declining groundwater supply; water quality impairment					Town of Patagonia: monthly volume pumped from city wells, 2008-present (ongoing) ADWR: well locations, permits; annual effluent discharge (ongoing)
Nature based economy	conflict with extractive economy; recognition of value from ecosystem services	periodic estimates of visitation	periodic estimates of visitation	periodic estimates of visitation, economic impacts from ecotourism	periodic estimates of visitation	US Census (decadal, ongoing), American Community Surveys (annual, ongoing)
Multi-generational community	loss of young and working age residents					US Census (decadal, ongoing), American Community Surveys (annual, ongoing)

Additional value: The following additional metrics would add value in various ways— informing specific strategies, tying the above metrics to other attributes of interest, illustrating links with human wellbeing targets, providing data on possible explanatory variables, providing context, etc. More value-added monitoring suggestions can be found below in the discussions of each target.

• Bird populations in target habitats (community composition, abundance, nesting success, etc.)

• Extent and permanence of surface flows

• Fish population numbers, plus distribution of fishes (native and exotic) and fish diseases across the watershed

• Use of high-resolution LiDAR data, collected for other purposes, to describe current canopy structure of cottonwood-willow (Swetnam and Powell 2010), which would allow for the future comparisons

• Analysis of water quality samples, including tissue samples from aquatic invertebrates and other organisms, to better understand the nature, duration, extent, and severity of water quality problems, and to inform strategies to reduce impacts from water quality impairments

Conservation targets

Describing basic *extent* and *condition* of targets goes a long way towards evaluating status and enabling detection of changes through time. Assessing extent can (often) be distilled into a mapping exercise, with the recognition that various mapping efforts may differ in how they define the target community, and in how accurately they represent what is found on the ground. Scale is especially important: regional-scale mapping efforts may give useful context for how a site like this compares with others, but often are too coarse to accurately represent what is found at any individual site. Mapping extent of a target represents a snapshot in time, a baseline or benchmark. Re-mapping targets to determine change through time must take care to match definitions, scales, and accuracies, and report those whenever possible. Assessing condition can be more nuanced and requires an articulation of what aspects of condition are both relevant to threats and strategies and are feasible to assess and track.

In this case, hydrologic conditions—stream flow dynamics, rainfall runoff and infiltration, depth to groundwater, aquifer recharge dynamics, contamination pathways for surface and groundwater, rates and locations of water withdrawn, etc.—affect all of the conservation and human well-being targets identified here. For this reason, we call out some aspects of hydrologic monitoring separate from the summary comments on individual targets. *These tie directly to objective 1*, and most others indirectly.

Key Ecological Attributes approaches describe and rate the most relevant condition and extent elements for each target (e.g. Turner et al. 2009). Completing this type of Target Viability Analysis is outside the scope of this planning process but could be a useful future addition.

<u>1. Cottonwood/willow community</u>

a. Extent: Mapped by presence of target trees, since these are indicators of the hydrologic and associated conditions needed by other members of the community. Current plan map is based on polygons drawn by eye on high-resolution aerial images (DigitalGlobe, 0.5 m resolution, acquired 11/28/2018), informed by close familiarity with what many of those stands look like on the ground.

i. Tracking changes through time: Would likely require local ground-based surveys or high-resolution imagery. Regional-scale efforts to map riparian vegetative communities (e.g. Southwest Re-Gap, National Land Cover Database) would likely not have the accuracy needed to show changes to cottonwood/willow community extent in this plan's area, or to compare this area with others.

b. Condition: Can be described in any combination of the following terms: Species composition, size/age class distributions, primary productivity, vegetation volume, phenology, percent live cover, etc.

Matt Killeen with TNC monitors stream flow at the Patagonia-Sonoita Creek Preserve. Photo © Brian Prescott

i. Lack of recruitment has been flagged as a problem in this area, with strategies developed to improve size/age class distribution. *Ties to Objective 2.*

2. Perennial stream community

a. Extent: Mapped as extent of surface flow in driest time of the year. Current plan map is based on expert knowledge of participants, who describe perennial water in the following reaches: Sonoita Creek upstream from Cottonwood Spring, Sonoita Creek between the Town of Patagonia and Patagonia Lake, Redrock Canyon, Harshaw Creek, and Big Casa Blanca Canyon. *Ties to Objective 1.*

i. Tracking changes through time: Wet-dry mapping has shown to be a reliable way of tracking changes in perennial stream extent through time, and can be implemented well by citizen scientists. Repeat photography and automated cameras can also be used to document flow timing and permanence in target reaches.

b. Condition: Key components include volume or rate of streamflow, water quality, geomorphology, and composition of flora and fauna that depend on perennial waters. *Ties to Objectives 4, 6, 7.*

i. Health of native fish populations are a key component of this community as conceived in this planning effort. Past monitoring by TNC, Dr. Peter Reinthal (Univ. of Arizona), and AGFD has been one of the most rigorous fish monitoring programs in the state, with ability to estimate population numbers and community composition at several sites. It should be renewed and maintained.

ii. Understanding the distribution of fish and their threats in the watershed would benefit from different monitoring methods. Recent years have brought new "Environmental DNA" tools to aquatic surveys. E-DNA methods, which

screen water samples for the presence of genetic material left by aquatic organisms, are especially useful for detecting the presence of rare or cryptic organisms, so are well suited to surveying for endangered species, invasive species, and diseases. This approach could provide a snapshot of which fish are currently in various reaches of Sonoita Creek and tributaries, and off-channel waters like stock tanks, to inform efforts to control invasives. It could then be used to evaluate success at removing invasives, and doing early-detection screening for re-invasions into the future.

3. Ciénega wetlands

a. Extent: Cienegas, including the two described in this area, have been mapped as point locations across the region but most do not have perimeters mapped.

b. Condition: Repeat photography, aerial image analyses, and vegetation transects have been used at other cienegas to document changes in water, primary productivity, and vegetation conditions (e.g. Wilson and Norman, 2018). Water isotope analyses have been used to describe origin of waters emerging from cienega locations.

4. Spongy uplands

a. Extent: This target was conceived as a way to describe the function of upper watersheds in providing ecosystem services of holding soil in place, providing for productive vegetation communities on hill slopes, absorbing rainfall, and slowly releasing water to plants, streams, and aquifers. In that sense, the extent would be all areas above the riparian zones that are captured in other targets, *except for* areas that no longer provide such services: impervious surfaces (roads, rooftops, parking lots, etc.), highly disturbed areas (e.g. mines, tailings, landfills), and areas where runoff or subsurface water flow is diverted or prevented from contributing to down-gradient water budgets (e.g. mine pits, impermeable holding ponds).

i. Tracking changes through time: NLCD or disturbance datasets could be used to document land use conversion that removes lands from "spongy upland" classification. Efforts to shape land conversion patterns *tie to Objective 8.*

b. Condition: A main goal of many management and restoration projects is to increase the sponginess of existing upland areas. Erosion control structures in drainage channel do this in discrete locations; improved land management that increases vegetative groundcover does this across large areas. If these interventions and vegetation improvements are documented, watershed modeling efforts can estimate the resulting changes in "sponginess" in terms of changes in runoff dynamics, erosion rates, sediment movement, rainfall infiltration and aquifer recharge, and soil moisture. Some relevant models have already been developed and calibrated for this area, and are available for use (Niraula et al. 2012, Boyanova et al. 2017). Models like these can also be used to execute the strategy of identifying where improved sponginess is likely to make the most difference, then focusing rock work and other interventions there. Models can also be used to estimate quantitative benefits from this type of intervention (Norman et al. 2019); such data has already proven highly effective in furthering ecosystem restoration and monitoring projects that iteratively feed back into modeling and other science, and improve reliability and acceptability to funders and to the public of transparent, integrated methods. *Ties to Objective 5.*

5. Sacaton/mesquite floodplain community

a. Extent: This target describes a range of vegetation types, blurring the distinction between extent and condition. Potential extent of sacaton/mesquite floodplain communities could be estimated using NRCS loamy bottom Ecological Sites as a proxy for soil and topographic conditions that can support these communities. Current extent could then be estimated by subtracting areas that have experienced land cover conversions.

b. Condition: Key aspects of condition include geomorphology, floodplain function, depth to groundwater, and vegetation density and composition, including native versus exotic species. *Ties to Objective 3, 4.*

Great blue heron at Sonoita Creek. Photo © Sandy Weaver

i. High-quality "sacaton flats" have been mapped as areas of wide floodplain terrace with dense stands of the target grass (*Sporobolis wrightii* and *S. aeroides*). As with cottonwood-willow stands, surface area of sacaton stands was visually estimated from aerial photographs (DigitalGlobe, 0.5 m resolution, acquired 11/28/2018), informed by close familiarity with what many of those stands look like on the ground (Figure 2).

ii. Other condition classes or ecological states of this community –mesquite bosque stands, mixed mesquite-sacaton stands, regenerating stands of younger and smaller mesquites, etc.— have not been specifically mapped or characterized. In the nearby Cienega Creek watershed, two efforts were used to map similar elements: a "state-mapping" approach mapped sacaton-dominated areas and described conditions (Tiller et al. 2012), and a remote sensing effort worked to distinguish various types of mesquite stands (Petrakis et al. 2019). Similar approaches could be used here.

iii. Tracking changes through time could involve documenting land use conversions, vegetation removal, restored areas with vegetation recovery, and areas showing shifts between states or condition classes. In contrast to documenting changes in vegetation states, shifts in geomorphology and depth to groundwater would indicate changes in site potential that reflect longer-term conditions.

Human well-being targets

As with other targets in this Plan, we are defining the scope of human well-being (HWB) targets as including residents and visitors to the Sonoita Creek watershed upstream of the dam at Patagonia lake, with a concentration of people in and around the town of Patagonia. The HWB targets chosen here include elements from across the six domains described by Biedenweg et al. (2016): physical, economic, social, cultural, psychological, and governance. Others have classified these components in slightly different ways, and have mapped them to ecosystem service elements (Alcamo et al., 2003; Summers et al., 2012; Wu, 2013); any of these frameworks could be used to guide additional work on HWB targets.

Though the plan focuses on this geography, HWB benefits go far beyond these defined boundaries; water-related physical benefits also apply to most of Santa Cruz County's population which lives downstream in Nogales, Rio Rico, and along the Santa Cruz River. Cultural and social benefits are felt much more broadly across the region, especially given the many environmental education and restoration training programs based out of Patagonia. Statewide, Patagonia serves as an important test case for how rural communities can approach water sustainability and economic viability. The international draw of ecotourism in the area would likewise spread spiritual, cultural and psychological benefits across an even broader area, as has been consistently demonstrated by visitors who visit the watershed one time or rarely, and express satisfaction and encouragement that restorative work is underway here, regardless of whether or not the visitor will be physically present to benefit from the work directly.

Flood protection

Of these HWB targets, Flood Protection is perhaps most straightforward to define and track. Flood risk, and the protections that come from mitigating flood risk, can be estimated in a variety of ways, e.g. using FEMA floodplain or other flood maps (e.g. Wing et al. 2018) to assess number of people or value of investments at risk. FEMA maps currently show 65% of Patagonia is in the designated 100-year floodplain. Evaluation criteria in the FEMA Community Rating System could be used to describe the status of efforts to mitigate risks, and the financial benefit to residents from taking these actions. Hydrologic models provide more sophisticated tools for estimating flood-related metrics (runoff, sedimentation, peak flow rates and depths, etc.) and comparing these across time or under different scenarios, e.g. to predict the effects of actions like installation of small-scale erosion control structures in particular locations, or improving vegetation cover over a given area. Such models can also be used to estimate the nature-based services currently provided by spongy uplands, stream channels and flood plains in their current state. *Ties to Objectives 4, 9.*

Unlike many other flood-prone communities in Arizona, there are currently no flood warning stations above Patagonia.

Multi-generational community

US Census reports and the associated American Community Surveys can provide data for assessing some of the HWB indicators such as demographic indicators of a multi-generational community (including current condition examples above). Applying these data to community-based questions and analyzing them though time would provide considerable insight.

Other targets

Other indicators would need supplementary data collecting, with survey tools designed specifically for these targets. Including well established tools like the Connectedness to Nature scale (Mayer and Franz 2004) where possible would deepen the conclusions and expand the relevance of tracking HWB metrics locally. Thinking through and describing more specific components of each of these HWB targets (e.g. Biedenweg et al. 2016) would help identify useful metrics and indicators for each, and would likely suggest additional strategies to sustain or improve these targets. In the meanwhile, we note major domains for each HWB target:

1. Positive sense of place and community: social, psychological;

2. Flood protection: physical, economic;

3. Water security for residents and businesses: economic, governance;

4. Nature based economy: economic, physical, governance;

5. Multi-generational community: social, cultural.

A process of fleshing out metrics for HWB targets could provide additional value if it were incorporated into some of partners' existing programs. Generating additional insights from within the community could, in fact, actively build up cultural, social, and governance elements of these same HWB targets, and could have surprising benefits to conservation targets.

For example, HWB elements could be more explicitly incorporated into curricula for field schools, in-depth workshops, youth programs, and other trainings by working with existing organizations and schools to share the burden and enhance existing frameworks for education and data collection simultaneously.

Carefully designed programs can enable students to contribute to social science knowledge while learning about its methods and contributing to students' own reflections on sense of place and value. Questions such as the following situate learning at the intersection of social and natural sciences: "How are restoration outcomes likely to differ depending on whose perspectives are included and whose aren't? How could broadening the involvement of community members change

what we get, short- and long-term, from our projects? Why is it important to build interview skills, and how do the questions asked influence possible answers?" Coursework could include modules on social science skills more explicitly, and range from basic semi-structured interview skills and snowball sampling among friends and family, to more complex survey instrument creation and focus group facilitation that together inform an infinite, open-ended data set that can literally be passed on inter-generationally.

Many such databases and storymaps exists today with basic frameworks customizable and adaptable to local needs, and even minimal amounts of targeted funding could contribute to the creation of such a set and a first pass at the data that can begin to build it out. In the process, regular community presentations and updates would be provided via social media, public presentations would also function as focus groups, and private presentations would be offered in an attempt to reach those who remain reluctant to participate in the most common, dominant-culture venues that often dissuade minority opinion voices.

Along the way, teachers and students occupy and even trade roles over time, while all benefit from the opportunity to draw out perspectives of the same youth we are imagining as future leaders. At the same time, the area's unique natural settings—as captured in this plan's conservation targets—provides a multiplier effect that has been shown to increase the effectiveness of learning in many tangible ways, from improving attention spans to reducing stress and even fostering self-discipline and teamwork (Kuo et al. 2019). Building on the arts and ecology and similar programming already active in local communities, it is possible to expand and deepen knowledge and appreciation by incorporating storytelling and other creative arts for all ages, further reinforcing the connections between people and nature and empowering folks to engage on their own terms, and in their own time.

Hydrology

There has been much demand for a comprehensive snapshot of status and trends in the area's groundwater and surface water hydrology (see, for example, Town of Patagonia, Flood and Flows Committee meeting minutes). The complexity of this ask, however, is hard to overstate. Data on any one element (say, depth to groundwater) is scattered across people and institutions, varies across space and time, has many sources of error in collecting and reporting, and much uncertainty in interpreting results. Each element is tied to others in complex ways (e.g. depth to groundwater affecting streamflow rate and/or extent) and many are affected by factors that are hard to observe (e.g. sub-surface geology affecting where groundwater surfaces in a channel). Lag times between causes and effects are often unknown (e.g. poor correlation between rainfall and streamflow) and even counterintuitive (e.g. springs may be flowing with water that fell as rain thousands of years in the past, yet still have flow rates affected by recent droughts). In addition, hydrology investigations with strong vested interests can easily produce biased or incomplete results.

In short, it can be hard to ask the right questions, much less get reliable answers. Yet those answers are critically important when trying to protect targets such as perennial streams and town water security from threats, and when evaluating success of strategies designed to, say, increase aquifer recharge or reduce impacts from pumping.

For these reasons, the objective to "stabilize or improve groundwater conditions by 2030" has several strategies and multiple targets. The most comprehensive of these strategies is development of a groundwater model that is both well calibrated and widely embraced. Groundwater models can describe impacts of pumping and other activities from throughout the modeled area, including lag times associated with features such as cones of depression whose impacts will affect the creek but do not yet appear in near-stream measurements. Models can enable a community to compare alternate suites of actions and visualize tradeoffs.

Rainbow over the Patagonia-Sonoita Creek Preserve.

Photo © Luke Reese/TNC

Other strategies are designed to build a strong foundation for the future groundwater model by providing better calibration information (monitoring data collection and analyses by TNC, Flood and Flow Committee) and by fostering the governance skills needed to apply it well (Flood and Flow Committee tackling important questions, convening community discussions around findings about current conditions, etc.). In this light, progress on this strategy should include metrics of governance as well as metrics related to data analyzed.

Because developing good groundwater models takes considerable time, money, and expertise, other strategies in this objective are also designed to provide more timely feedback on items of critical interest. For example, TNC and contractors expect to complete analyses of groundwater and surface flow data from the Patagonia-Sonoita Creek Preserve in 2020. The many years of surface water and groundwater data from the Preserve, and rainfall data from the Paton Center, will be analyzed by a qualified hydrologist for trends and correlations. Rainfall data should be examined for trends in both annual and seasonal totals. This will greatly improve our knowledge of the preserve's current status and threats. This is also a critical step to identifying goals for any future hydrologic monitoring efforts, and will inform the sampling design and protocols for ongoing monitoring.

To improve flood modeling and inform strategies for protecting water quality, a high-resolution Digital Elevation Model for the Sonoita Creek floodplain is needed to develop models of floodplain management impacts and sediment dynamics. Such a model could be used to compare alternatives for floodplain and channel management projects before committing significant resources to the planning and permitting required for such projects, and would help identify risks as well as benefits of such modifications. Additional information on water quality at key locations —sediment load, rainfall-runoff relationships, water chemistry, etc.— would be extremely useful for documenting current conditions as a benchmark to understand future changes, calibrate models, and inform future strategies.

In short, several sets of data are needed to inform strategies for sustaining water security for people and ecosystems. Partners in the Plan can play important roles in helping gather this data, and in fostering conditions that will enable the community and its decisionmakers to make good use of it. To be effective, this process will need to have a combination of thoughtful community input, and input from professional hydrologists (analyses, interpretations, communications) throughout.

Implementation

This plan is intended to be a high-level, strategic framework to guide the work and priorities for all of the planning partners. Partners will meet on a bi-annual basis to discuss status of ongoing strategies and discuss each partner's pertinent contributions, as well as new opportunities that may present themselves where collaboration will be key in achieving positive conservation and human outcomes.

For The Nature Conservancy, these objectives and strategies will inform annual work plans, project management plans, funding proposals, and budgets. We will utilize the formal chapter approval processes outlined in the Arizona chapter strategic framework to define chapter commitments in support of priorities, where higher levels of detail will be developed including costs, timing, and needed resources.

Planning Team

This plan was developed through collaboration between representatives of the four partner organizations:

The Nature Conservancy: Pete Leiterman, Bob Rogers, Gita Bodner, Marty Lawrence, Dale Turner.

Tucson Audubon Society: Howard Buchanan, Jonathon Horst.

Borderlands Restoration Network: David Seibert, Kurt Vaughn.

Circle Z Ranch: Diana Nash.

The plan was prepared by Dale Turner and Gita Bodner, with contributions from the team.

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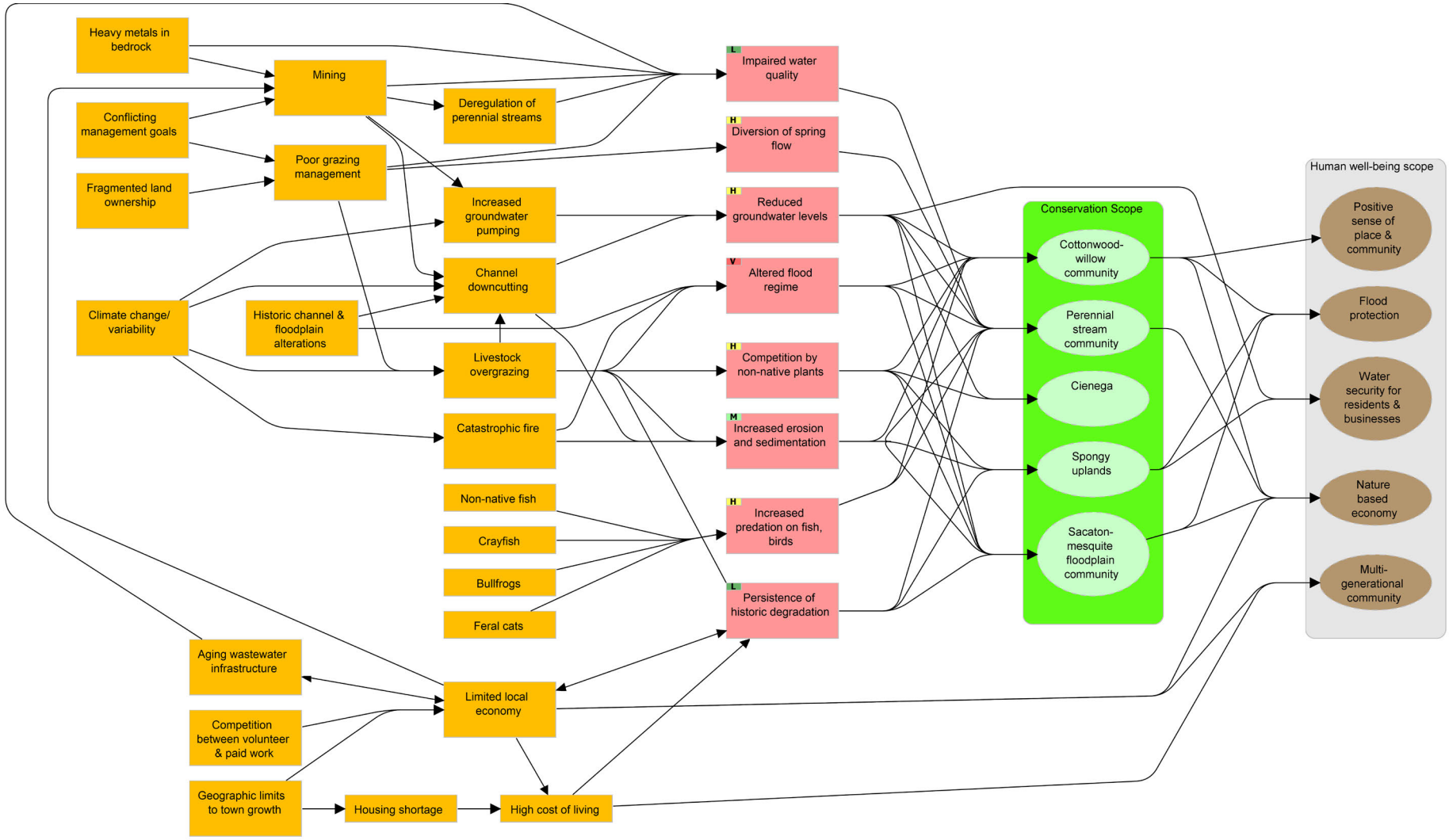
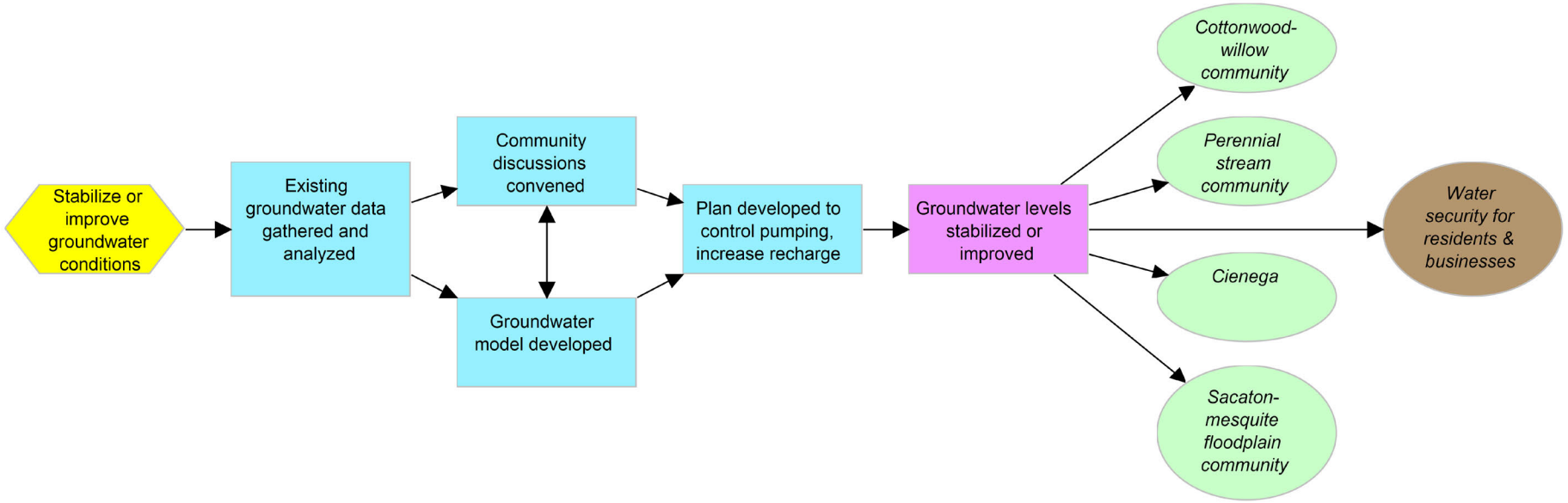
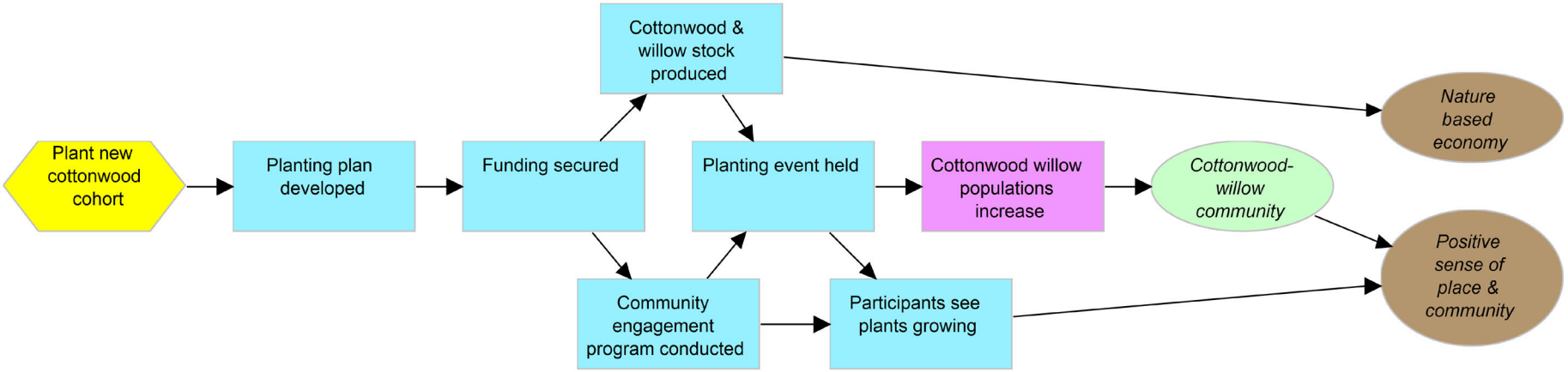
Appendix 1. Situation diagram for Sonoita Creek watershed.



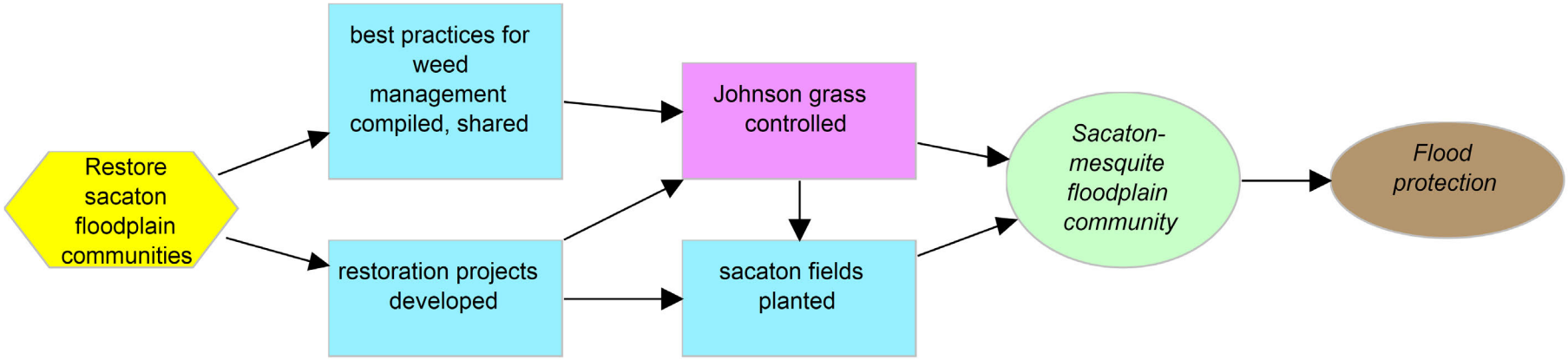
Appendix 2. Results chain for groundwater strategies.



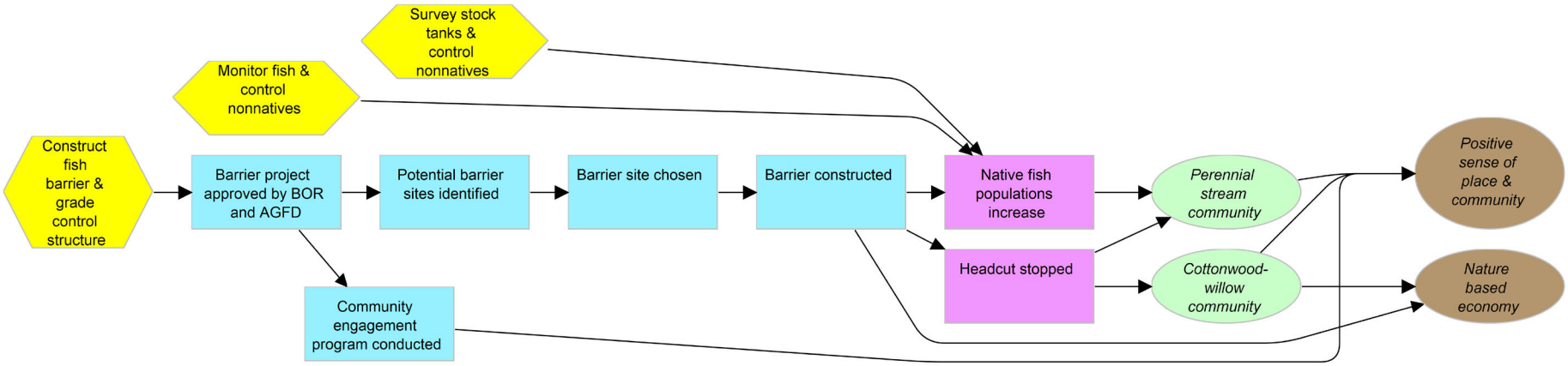
Appendix 3. Results chain for cottonwood restoration strategies.



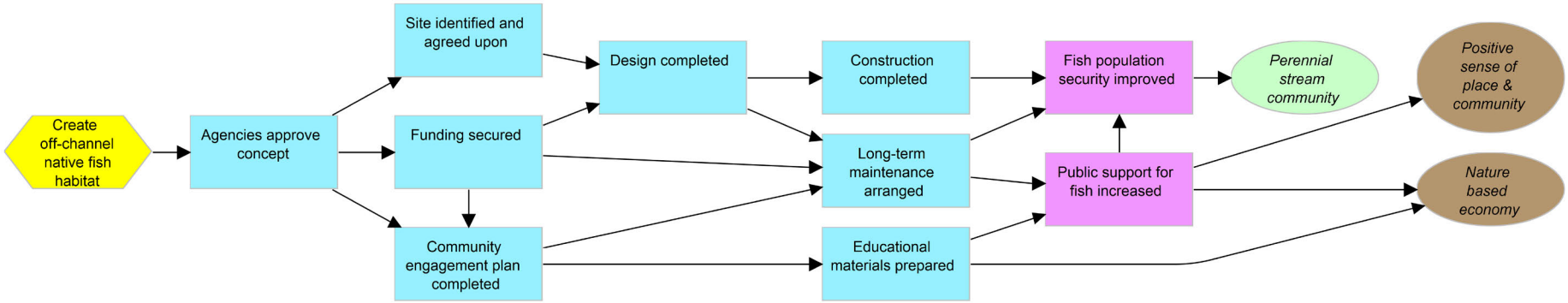
Appendix 4. Results chain for sacaton restoration strategies.



Appendix 5. Results chain for fish barrier strategies.



Appendix 6. Results chain for off-channel fish population strategies.



Appendix 7. Sonoita Creek Watershed Plan, Shared Conservation Agenda, and The Nature Conservancy's Arizona Chapter Strategic Framework

The current path that our planet is on is unsustainable. Without significant changes, we will experience devastating impacts to people and nature by 2050. The Nature Conservancy's science has established that there is another way: it is possible to have a world where both people and nature thrive, yet it will require significant changes from the current "business-as-usual" path (Tallis et al. 2018).

To put the world on the path to sustainability, we need to make significant progress in the next 10 years. TNC has developed a plan* for how we can help to make that happen. Called the Shared Conservation Agenda (SCA), this plan includes strategies that focus on two core themes:

- TACKLE CLIMATE CHANGE: Implement and increase emphasis on readily available, cost-effective natural climate solutions, such as reforestation, and drive policy changes to accelerate our transition to a clean energy future

- PROTECT OCEANS, LAND, AND WATER: Complete large protection deals using innovative finance, share smart infrastructure siting principles to encourage sustainable development and partner with indigenous people to strengthen their rights as environmental stewards

The Arizona chapter of The Nature Conservancy has developed a Strategic Framework to guide our work across the state. It includes three strategic imperatives to guide our work and investment decisions through fiscal year 2023. Specifically, those form a commitment to strategies and solutions that allow the Arizona Chapter to make our optimal contribution to the SCA, are financially sustainable, and are scalable.

This Sonoita Creek Watershed Conservation Plan contributes to achieving the Shared Conservation Agenda and Arizona Strategic Framework in the following ways.

The strategy "Conserving Resilient Lands and Waters" under the Protect Oceans, Land, & Water theme of the SCA and the AZ Strategic Framework, focuses on legal protection of new lands within a representative network of resilient, connected lands and waters that will allow nature to adapt to climate change. It also includes effective management and restoration within that network, both in protected and unprotected areas. This does not mean TNC will take the lead on every action, but should engage and support the work of like-minded partners. The Sonoita Creek floodplain is shown as part of a resilient and connected network of lands on the preliminary map for the Rocky Mountains and Southwest Deserts, bringing confirmed diversity and climate resilience. That includes multiple cross-valley corridors, such as Monkey Canyon on the east side connecting with canyons and foothills of the Santa Rita Mountains to the west. It also includes a continuous corridor from the Patagonia-Sonoita Creek Preserve to Patagonia Lake, with cross-valley connections to Forest Service lands on both sides. To safeguard and expand conservation of these lands into the future, partners in this plan bring a diverse history of innovative finance for land protection, and ongoing emphasis on sustainable development.

Objectives 1, 2, 3, 4, 5, 6, and 11. will directly support Conserving Resilient Lands and Waters in and along Sonoita Creek through effective management and restoration activities. Objective 11 will secure legal protection for an important wildlife connection between blocks of federal land. The strong engagement of partners in developing and achieving these objectives should help provide financial sustainability. In particular, partners will likely be key to funding land protection projects under Objective 11. The groundwater strategies under Objective 1 were directly shaped by our

* This description is current as of April 2020.

experiences in the San Pedro River, and represent the next step in scaling up those strategies.

Objectives 9 and 10 will contribute to the strategy "Inspiring People for Nature" under the Protect Oceans, Land, & Water priority by helping people recognize ways that healthy natural areas can support the local economy. Plan partners' emphasis on fostering a Restoration Economy also showcases a new model for "providing food and water sustainably." These are scalable approaches that can be applied in other rural settings across Arizona. With their focus on economic viability of the local community, they should also allow access to non-traditional funding sources and thus have financial sustainability.

The Nature Conservancy
Arizona

8/17/2023

Dear Arizona Water Protection Fund Commissioners,

The Nature Conservancy-Arizona is pleased to express our enthusiastic support for the project, "Restoring Riparian Health of Sonoita Creek and Patagonia Lake." Completing perimeter fencing, invasive plant control, and riparian restoration are integral to safeguarding the intact functioning of the Sonoita Creek and all its stakeholders.

Sonoita Creek is an important water resource for a wide range of stakeholders - from recreational visitors to Patagonia Lake State Park, to ecotourists in Patagonia, to ranchers upstream and down, and to Patagonia and Rio Rico. We support building a wildlife-friendly fence around Patagonia Lake to protect the site's water resources from illegal trespass cattle and their unfortunate conflicts with site users. Addressing the proliferation of invasive species within the park is also a critical endeavor to maintain water quality and quantity flowing into the lake and to the state and private lands further downstream. These invasive plants impact both the wildlife and site visitors and increase the risk of wildfires that could spread onto adjacent state, federal, and private lands thereby significantly damaging water quality/quantity and leading to increased sedimentation, erosion, and flooding.

TNC, with additional local partners, has written the Sonoita Creek Watershed Management Plan for the upper watershed. The plan identifies several objectives and priorities for TNC in the watershed which can be positively impacted through this proposal. Fencing the park and addressing hydrological issues in the creek within PLSP as critical priority activities for ensuring long-term health of the watershed and all its varied stakeholders.

The Nature Conservancy has a long history of investment in the Sonoita Creek Watershed and has identified the watershed as a priority area in the latest Apache Highlands Strategic Planning process which will continue to focus resources on the watershed.

Sincerely,

Pete Leiterman

SE Arizona Program Director
Arizona Chapter of The Nature Conservancy

Friends of Sonoita Creek
keep it flowing!

Robert Proctor, President
Friends of Sonoita Creek
P. O. Box 161
Patagonia, Arizona 85624
sonoitacreek@gmail.com
(520) 559-1221

August 21, 2023

Arizona Water Protection Fund Commissioners:

Friends of Sonoita Creek wish to express support for Restoring Riparian Health of Sonoita Creek and Patagonia Lake. Repairing and completing perimeter fencing, removal and control of invasive species and riparian restoration is essential to the proper health and function of Sonoita Creek.

Sonoita Creek is an essential resource to the stakeholders of the watershed, including agriculture, ecotourism, state and federal agencies, as well as the communities of Patagonia and Rio Rico.

The repair and completion of a wildlife friendly fence around Patagonia Lake is essential to protect plant and water resources from illegal trespass cattle and their conflict with people. Removal of invasive species within the site and restoration of the riparian area is essential to the heath of the watershed.

The Friends of Sonoita Creek mission is the restoration and protection of the Sonoita Creek Watershed. FoSC has a long history with the Park. For about 20 years FoSC has sponsored and collaborated in educational and interpretive programs, trail building and maintenance, riparian health and water quality monitoring.

FoSC will continue to provide volunteer and community science in support of this important restoration project to protect the unique ecosystem of Patagonia Lake State Park.

Robert Proctor,
Friends of Sonoita Creek president

Restoring Riparian Health of Sonoita Creek and Patagonia Lake
Letters from those pledging matching funds

Tucson Audubon has a designated temporary restricted account that is intended for use along Sonoita Creek especially focused on the restoration of the creek and its habitats within the bounds of Patagonia Lake State Park. Tucson Audubon also maintains an active volunteer base to contribute time to this project.

FoSC and PLSP have had volunteers working on components of this project for many years. Their commitments are not explicitly stated in their Letters of Support (ASPT/PLSP letter to come during comment period); Tucson Audubon will be tracking volunteer time for each organization toward match and PLSP has indicated by email:

From: **Colt Alford** <colt.alford@azstateparks.gov>
Date: Wed, Aug 23, 2023 at 12:56 PM
Subject: Re: Cocklebur
To: Howard Buchanan <hbuchanan@tucsonaudubon.org>

Howard
We will spend as many as 128 man hours a year removing cocklebur. The attached picture of us burning piles, are just a fraction of what we removed last season and the oher pictures are new growth this year. I will send in two different emails

Colt Alford
AZ State Parks & Trails
Park Manager
Patagonia Lake State Park
Sonoita Creek State Natural Area
SanRafael State Natural Area
400 Patagonia Lake Rd.
Nogales, AZ 85621
(520) 287-6965 wk.
(480) 848-8823 cell
colt.alford@azstateparks.gov

Restoring Riparian Health of Sonoita Creek and Patagonia Lake

Evidence of Control and Tenure of Land including legal access

NA

Evidence of Physical and Legal Availability of Water is not applicable to this application.