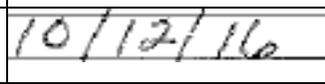


**Arizona Water Protection Fund
Application Cover Page
FY 2017**

Title of Project: Lower Verde River Riparian Restoration Project												
Type of Project: <input type="checkbox"/> Capital or Other <input type="checkbox"/> Water Conservation <input type="checkbox"/> Research	Stream Type: <input type="checkbox"/> Perennial <input type="checkbox"/> Intermittent <input type="checkbox"/> Ephemeral	Your level of commitment to maintenance of project benefits and capital improvements: <input type="checkbox"/> < 5 years <input type="checkbox"/> 5-10 years <input type="checkbox"/> 11-15 years <input type="checkbox"/> 16-20 years										
Applicant Information: Name/Organization: Address 1: Address 2: City: State: ZIP Code: Phone: Fax: Tax ID No.:		Inside an AMA: Yes <input type="checkbox"/> No <input type="checkbox"/> If yes, which AMA: <input type="checkbox"/> Phoenix <input type="checkbox"/> Tucson <input type="checkbox"/> Prescott <input type="checkbox"/> Pinal <input type="checkbox"/> Santa Cruz										
Contact Person: Name: Title: Phone: Fax: e-mail:		Type of Application: <input type="checkbox"/> New <input type="checkbox"/> Continuation Any Previous AWPf Grants: <input type="checkbox"/> Yes <input type="checkbox"/> No If yes, please provide Grant #(s):										
Arizona Water Protection Fund Grant Amount Requested: \$ If the application is funded, will the Grantee intend to request an advance: <input type="checkbox"/> Yes <input type="checkbox"/> No	Matching Funds Obtained and Secured: <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%;"><u>Applicant/Agency/Organization:</u></td> <td style="width: 30%;"><u>Amount (\$):</u></td> </tr> <tr> <td>1. Applicant</td> <td></td> </tr> <tr> <td>2.</td> <td></td> </tr> <tr> <td>3.</td> <td></td> </tr> <tr> <td colspan="2" style="text-align: right;">Total:</td> </tr> </table>		<u>Applicant/Agency/Organization:</u>	<u>Amount (\$):</u>	1. Applicant		2.		3.		Total:	
<u>Applicant/Agency/Organization:</u>	<u>Amount (\$):</u>											
1. Applicant												
2.												
3.												
Total:												
Has your legal counsel or contracting authority reviewed and accepted the Grant Award Contract General Provisions? <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/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.												
Typed Name of Applicant or Applicant's Authorized Representative	Title and Telephone Number											
												
Signature Mark Frank	Date Signed Acting Environmental Manager 480-789-7163											

Fort McDowell Yavapai Nation

Lower Verde River Riparian Restoration Project

AWPF Grant Proposal

October 16, 2016



Executive Summary

In the Fort McDowell Yavapai Nation (FMYN), riparian areas represent just over 5% of the total area of the reservation yet these areas provide habitat and resources for the majority of wildlife species and critical habitat for native plants. The riparian areas along the river support numerous migratory bird species, relic cottonwood and Goodding's willow gallery forests, provide culturally significant places for the Fort McDowell Yavapai people, and provide water to the Nation as well as to the greater Phoenix area. This section of the river is a ribbon of green flowing through a Sonoran Desert landscape.

The riparian areas along this section of the Verde River have been dramatically altered by invasive plant species invasions. Tamarisk, giant reed and tree tobacco are three of the most prevalent and ecosystem-altering species found in abundance along the river corridor. A vegetation map completed by Mariposa Ecological and Botanical Consulting in 2016 reported just over 200 acres of tamarisk-dominated land and an additional 500 acres of dispersed tamarisk infestations. The biggest detriments to the native landscape along this section of the Verde because of tamarisk infestations are a loss of water availability for other plants, wildlife and humans, and the potential consequences upon the arrival of the tamarisk leaf beetle. The beetle was released as a bio-control agent in attempt to limit the spread of tamarisk and to decrease the total area of infestation however; potential consequences of the beetle include a significant loss of habitat and increased wildfire risk.

In the last year and half, FMYN, Mariposa, and Morning Dew Landscaping have partnered to begin treating giant reed and tree tobacco in the riparian areas along the river. These species are both recent invaders to this section of the Verde. Early detection and rapid response has created forward momentum for the establishment of native species and prevention of further infestations both up and downstream of FMYN.

We are proposing the following projects:

1. Retreat giant reed and tree tobacco along the river for two more years
2. Develop a Restoration Manual that identifies invasive species for control, specific sites for restoration, species information for restoration and bioengineering protocols
3. Develop and begin implementing a Restoration Plan at an already identified 30-acre Pilot Project Site
4. Monitor invasive plant treatments and restoration activities.

Restoration of the Lower Verde River will have benefits stretching both up and downstream of the project area. This project will help to prevent the further spread of invasive species, create critical habitat in light of the arrival of the tamarisk beetle, create propagule islands for passive restoration, allow for more water to be infiltrated back into the native riparian system and increase water quality.

Project Overview

Background

The Verde River supplies more than 3 million people with their water needs, irrigates agriculture practices including the Fort McDowell Yavapai Nation (FMYN) and provides habitat for unique and diverse riparian habitats. However, the river has been significantly impacted from the invasion of non-native plant species.

In 2015, FMYN received a grant from the Bureau of Indian Affairs to map and treat giant reed (*Arundo donax*) from along the Verde River. Mariposa Ecological and Botanical Consulting, LLC (Mariposa) was awarded the contract and partnered with Morning Dew Landscaping, Inc. to map and treat giant reed and tree tobacco along the Verde River and at the Fort McDowell Materials Plant (Materials Plant). There were 26 populations of giant reed and 24 populations of tree tobacco located along the river and 5 acres infested at the Materials Plant. Initial treatment was completed in December 2015 and retreated in March 2016 (see Appendix A Photos, Appendix B Report). To date, the success rate for treatment of giant reed is approximately 70% and 95% success rate for tree tobacco. However, tree tobacco can produce up to 1 million seeds per year and seedlings will need to be treated to prevent further infestations. Giant reed retreatment is necessary as there are still populations upstream that could establish at FMYN. However, conversations are underway with the Tonto National Forest to begin the process of treatment from Bartlett Dam down river. Also as part of this initial project, Mariposa also created a vegetation map of the entire reservation (Appendix C). With this data, FMYN is able to know how many acres of various riparian communities they have along the river and this data can be used to inform management actions and restoration plans.

Goals

The overarching goal of this project is to continue restoring the riparian areas along the lower Verde River through the control invasive plant species that threaten the biodiversity and over all health of the riparian areas in FMYN. The specific goals of the project are to:

1. Promote long-term sustainable habitats for all wildlife but especially bald eagles through active restoration of cottonwoods and willows.
2. Promote and establish native riparian habitat in preparation for the eventual arrival of the tamarisk beetle and the subsequent defoliation, loss of habitat and increased wildfire risk.
3. Increase community and youth engagement with the Fort McDowell Yavapai Nation to encourage environmental stewardship and promote the incorporation of traditional ecological knowledge.

Objectives

FMYN will utilize a collaborative approach that will incorporate science-based principles and Traditional Ecological Knowledge to achieve these goals.

1. Continue to implement an invasive plant management plan to retreat giant reed and tree tobacco along the Verde River through FMYN in 2017 & 2018

2. Develop a Restoration Manual that identifies invasive species for control, areas for restoration, species information for restoration and bioengineering protocols
3. Develop and Implement a Restoration Plan at a 30-acre Pilot Project Site to encourage a new cohort of trees, shrubs and marsh/wetlands to be used in the future by bald eagles and other wildlife
4. Monitor invasive plant treatments and restoration efforts to inform future projects and document successes and challenges
5. Incorporate the FMYN Youth and community members in the restoration of the Pilot project site to inform and educate local communities on the value of a healthy river and to encourage active participation in riparian restoration

Statement of Problems, Causes and Related Solutions

The biggest detriments to the native landscape along this section of the Verde are the invasion of several high priority exotic plant species. The habitat loss and degradation as a result of tamarisk infestations have led to a lack of natural recruitment of native plant species and alterations to the channel morphology. The inevitable arrival of the tamarisk beetle may lead to further loss of habitat for endangered bird species and increased wildfire risk to the surrounding communities of Fountain Hills, Rio Verde and Salt River Pima-Maricopa Indian Community

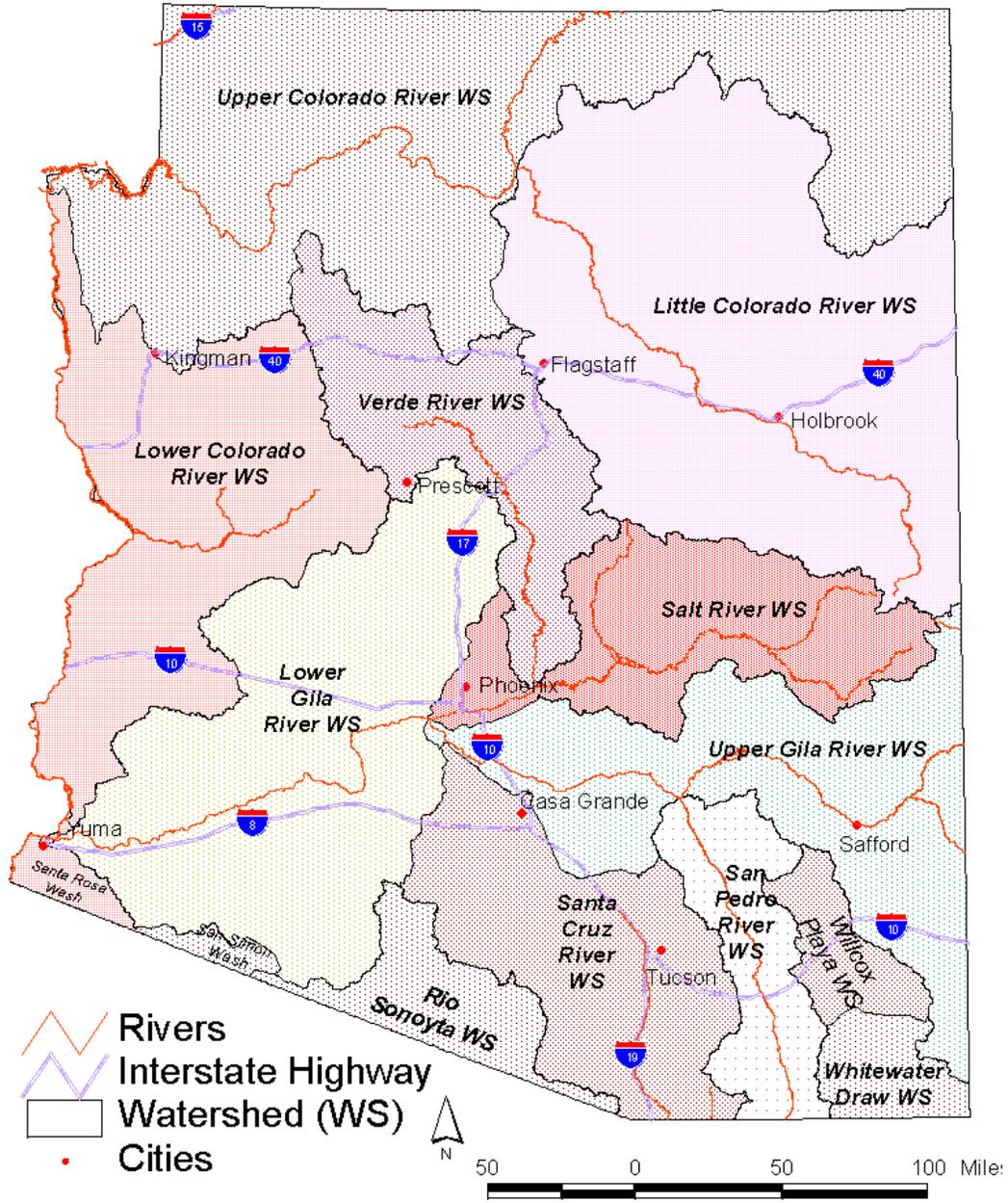
Giant reed and tree tobacco are recent invaders into this section of the Verde. Treating these infestations before the plants create well-established monocultures like those seen in the Upper Verde watershed will decrease the likelihood of infestations both up and downstream and prevent the further degradation of the river system by increasing water filtration, water availability, and native habitat.

The proposed project will mitigate some of these problems through the initiation of tamarisk removal on a pilot project site and the restoration of that site with native trees, shrubs and wetland species. We will increase native habitat prior to the arrival of the tamarisk beetle, using the pilot project area as a native habitat propagule island for nearby areas in need of restoration.

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

FMYN intends to use the data collected in the pilot restoration project to inform future projects. The removal of invasive species will lead to water conservation for native plant species, fewer invasive seed and propagule sources to create infestations up and down river communities, and better water quality. Pro-active restoration of tamarisk-infested areas will decrease the potentially damaging effects of the tamarisk beetle and will bring an increased awareness of invasive plant species to the tribal members of the Fort McDowell Yavapai Nation. Through the use of youth and community members, the project will promote active participation by tribal members in restoration. It is projected that there will be 50+ years of benefit for this project.

Arizona Watershed Map FY 2017



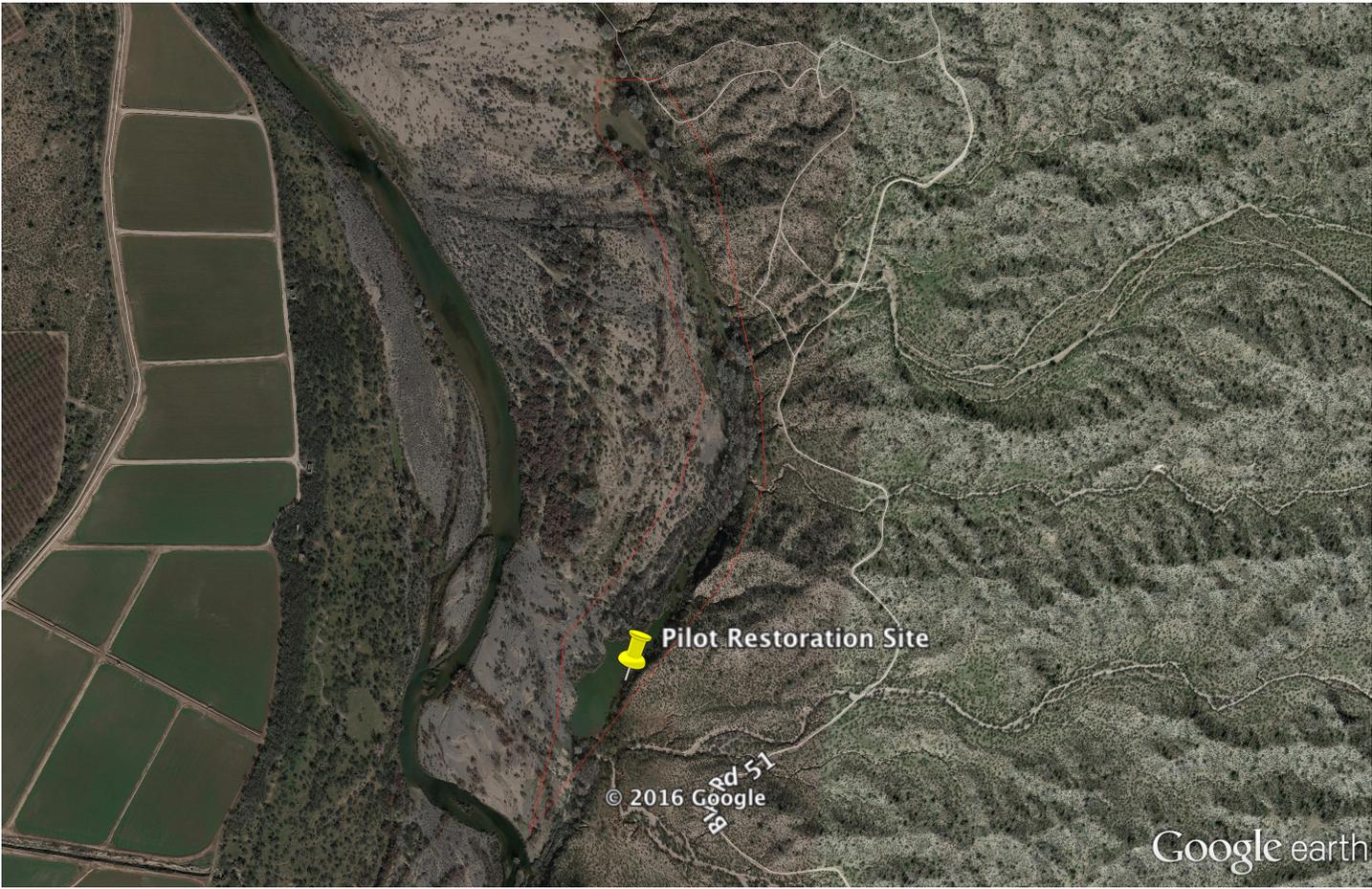
Title of Project: Lower Verde River Riparian Restoration Project

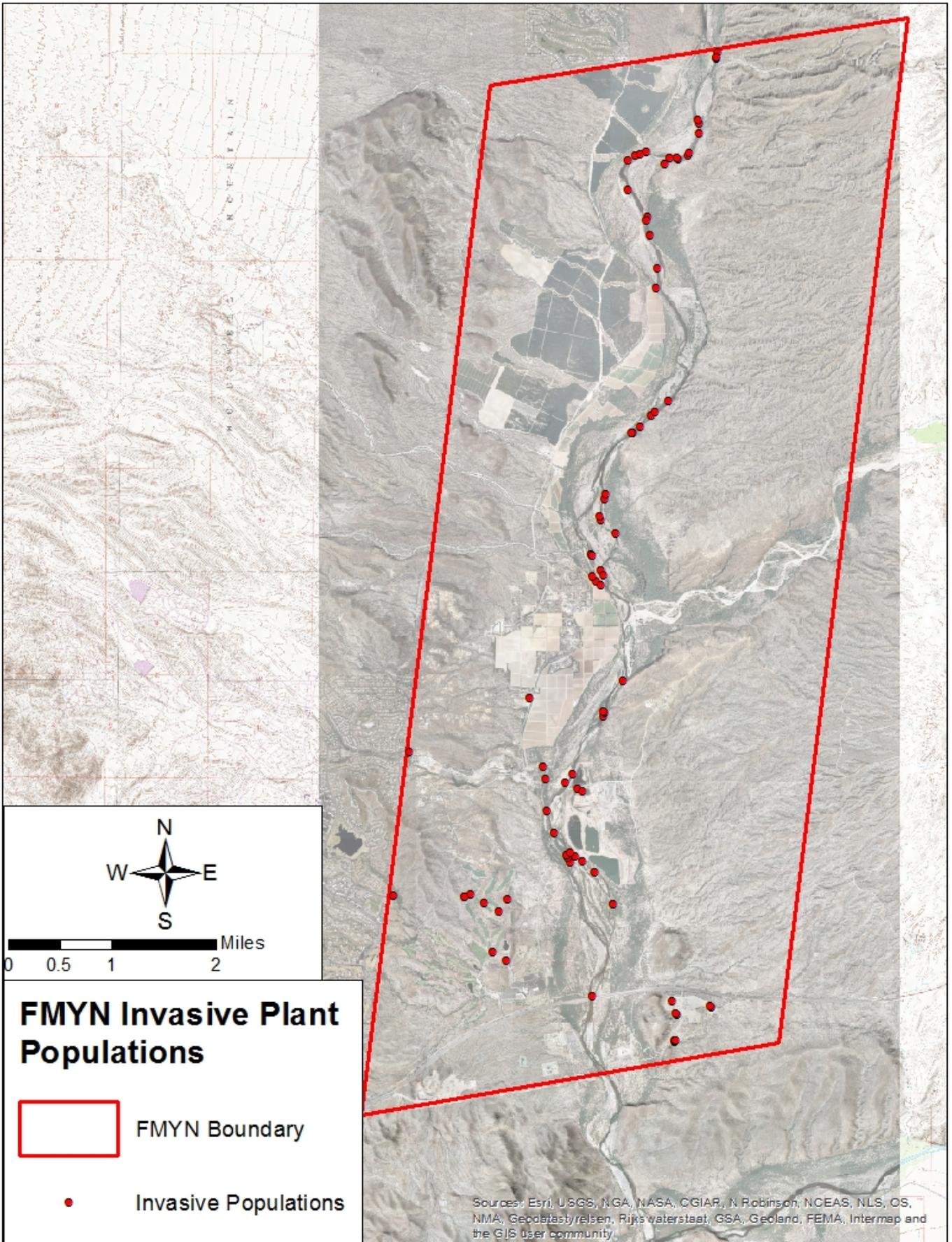
Location: (UTM's and Tnshp./Sect./Range: UTM's 439328E 3725906N S20; T4N; R7E)

Project Location & Environmental Contaminant Information FY 2017

Project Location Information			
1. County: <u>Maricopa</u>	2. Section: <u>S20</u>	3. Township: <u>T4N</u>	4. Range: <u>R7E</u>
<p>5. Watershed: <u>Verde River Watershed</u></p> <p>6. 8 or 10 Digit Hydrologic Unit Code (HUC): <u>15060203</u></p> <p>7. Name of USGS Topographic Map where project area is located: <u>Granite Reef Dam, AZ</u></p> <p>8. State Legislative District: <u>23</u> (Information available at: http://azredistricting.org/districtlocator/)</p> <p>9. Land ownership of project area: <u>Fort McDowell Yavapai Nation</u></p> <p>10. Current land use of project area: <u>some cattle grazing</u></p> <p>11. Size of project area (in acres): <u>30 acres</u> <u>DIRECT</u></p> <p>12. Stream Name: <u>Verde River</u></p> <p>13. Length of stream through project area: <u>965 meters backwater- old channel</u></p> <p>14. Miles of stream benefited: <u>0.6 miles for Pilot Project and 10.3 miles for retreatment</u></p> <p>15. Acres of riparian habitat: <u>30</u> acres will be:</p> <div style="margin-left: 300px;"> <input type="checkbox"/> Enhanced <input type="checkbox"/> Maintained <input type="checkbox"/> Restored <input type="checkbox"/> Created </div>			
<p>16. General description and/or delineation for the area of impact of the project within the watershed. The area directly impacted in along the Verde River through the Fort McDowell Yavapai Nation. The Pilot Project is located in an old channel that has water year round and is now more of a wetland area. The area to be retreated for giant reed and tree tobacco is along the length of the river through the FMYN</p> <p>17. Provide directions to the project site from the nearest city or town. List any special access requirements: From Found Hills, go east on N Beeline Hwy 87, turn left (N) on N Hiawatha Road, continue on this road for 6 ½ miles. The road becomes dirt after the Resort area. You cross over Sycamore Canyon, and continue on road BIA 51. Access to the site is made from a small road near the UTM's 439453E 3725710N. Permission to access must be granted from the FMYN.</p>			
Environmental Contaminant Location Information			
<p>1. Does your project site contain known environmental contaminants? <input type="checkbox"/> YES <input type="checkbox"/> NO If yes, please identify the contaminant(s) and enclose data about the location and levels of contaminants:</p> <p>2. Are there known environmental contaminants in the project vicinity? <input type="checkbox"/> YES <input type="checkbox"/> NO If yes, please identify the contaminant(s) and enclose data about the location and levels of contaminants:</p> <p>3. Are you asking for Arizona Water Protection Fund monies to identify whether or not environmental contaminants are present? <input type="checkbox"/> YES <input type="checkbox"/> NO</p>			







Scope of Work

Task 1. Obtain permits and authorizations

Task Description

The Grantee must obtain and submit all permits, authorizations, clearances and agreements necessary to complete the tasks listed in this Scope of Work including but not limited to cultural resource clearance (SHPO), NEPA compliance, ESA Section 7 consultation, and Clean Water 404 permit.

Task Purpose/Objective

To comply with all tribal, local, state and federal permit requirements.

Responsible personnel

FMYN Environmental Department, Mariposa

Deliverable Description

Since all work to be completed will occur on FMYN tribal lands, compliance will be completed within tribal regulations and outside consultations will be informal and likely resulting in an MOU between entities. We will complete a Biological Assessment for the Pilot Project site.

Deliverable Due Date

Prior to any ground disturbing activities. (August 2017)

Task Cost (rounded to the nearest dollar)

\$4,070

Task 2: Retreat giant reed and tree tobacco along the Verde River through FMYN and at the Fort McDowell Materials Plant

Task Description

We propose follow-up treatments at known populations of giant reed and tree tobacco along the river and at the Materials Plant to be completed during the fall of 2017 and 2018. Mariposa developed an invasive plant management plan for removing and treating giant reed and tree tobacco at the FMYN in 2016 (Appendix B). Treatment began in the fall of 2015 with a follow-up treatment in the spring of 2016 and there is one more retreat trip scheduled for the fall of 2016. This will provide a total of 4 years of treatment.

Protocols for treating and monitoring these two species have been established and will be employed for this project. The cut biomass of both species will be moved to above the high water mark and the stumps will then be treated with an aquatic approved herbicide.

Task Purpose/Objective

To clear giant reed and tree tobacco from the river and to remove the seed source from the Materials Plant to inhibit the spread of either species up or downstream; To allow for passive restoration of native plants by removing invasives; To allow for better water filtration.

Responsible personnel

Morning Dew Landscaping, Mariposa

Deliverable Description

Annual Report: Data will be collected during the removal and will be compiled into a report. The report will include a summary of work completed, data summaries from all years and photo-documentation of the work.

Final Report: Results from the retreatment will be included in the Final Report

Deliverable Due Date

Annual Report: January 2018 & 2019

Final Report: August 2019

Task Cost (rounded to the nearest dollar)

\$17,001

Task 3. Depth to water and soil salinity analysis

Task Description

This task will be completed in the 30-acre Pilot Project site (Appendix A). This task includes analyzing the soil salinity and depth to the water table at approximately 4 transects on the site. Soils and depth to ground water will be analyzed at approximately 5 points along each transect. Soil samples will be taken at the ground surface and then again at the water table. Results from this analysis will be used to determine the most ecologically appropriate species to plant in different planting zones throughout the site.

Task Purpose/Objective

To gather detailed information on the site conditions regarding soil and water depth in order to develop planting and monitoring plans for the site. This data will identify zones within the site that appropriate for planting both xeric and hydro-riparian species (cottonwoods, willows, and potentially mesquite)

Responsible personnel

Mariposa, Morning Dew Landscaping, FMYN

Deliverable Description

Report: Data will be organized and compiled into a report that will include a summary of results of depth to water and soil salinity for the pilot site. The report will also include maps of soil salinity and depth to water and a table summary of the data collected.

Deliverable Due Date

August 2017

Task Cost (rounded to the nearest dollar)

\$5,790

Task 4. Develop a Restoration Manual for invasive plant management and riparian restoration for the lower Verde River

Task Description

Mariposa and Morning Dew Landscaping will develop a Restoration Manual that can be applied at the Pilot Project site and numerous other areas along the river to control invasive plants, actively restore areas with native trees, shrubs and wetland or marsh species, and monitor success and challenges. This task will also include the selection of 5-10 high priority sites for restoration efforts in the future. These sites will be chosen based on geomorphology, topology, access, potential to provide habitat in light of the arrival of the tamarisk beetle, and potential to provide habitat for bald eagles.

The ultimate goal of this manual is to incorporate all of the best management practices for control of high priority invasive species including removal, treatment and biomass management. The manual will also include best management practices for restoration with cottonwoods, Goodding's willow, coyote willow and marsh/wetland species. We will not include any plans that involve channel modifications but will instead rely on the knowledge that there are ample sites along this stretch of river that are suitable for restoration without channel modifications.

Included in the Restoration Manual will be:

1. Invasive Plant Removal

The Invasive Plant Removal Plan will document and describe all activities related to the removal and treatment of invasive species in the riparian areas of FMYN.

At a minimum, the plan will include the following components:

- Best management practices and protocols for treatments for individual species
- Biomass removal procedures
- Descriptions of herbicide treatments based on species
- Equipment list

2. Restoration

This plan will include best management practices for riparian restoration. The plan will include best practices for planting the most common species for the Verde River including: cottonwood, Goodding's willow, coyote willow, and marsh and wetland species to be determined upon site visits.

At a minimum, the plan will include the following components:

- Plant species, spacing and planting methods

- Plant propagation and grow-out recommendations
- Watering schedule and site maintenance schedule
- Options for irrigation or hand watering
- Secondary weed invasion treatments
- Input from tribal members on suggested plants and Traditional Ecological Knowledge

3. High Priority Site Selection

This plan will identify 5-10 high priority sites for tamarisk removal and native plant restoration along the river in recognition of the eventual arrival of the tamarisk beetle and subsequent defoliation and mortality of tamarisk.

At a minimum, the plan will include the following components:

- Maps of the high priority sites
- Justification of each site chosen
- Descriptions of each site including plant community composition, site conditions, and suggestions for treatment and restoration

4. Monitoring

This plan will be designed to assess the site prior to restoration, during the process and after completion of all restoration activities. The plan will be designed to assess the success of the invasive species removal, restoration and survival of plants installed. Components of the plan will include documentation of resprouts of treated invasives, height and health of planted species, changes in plant community composition, and photo-documentation.

At a minimum, the plan will include the following components:

- Description of variables to be measured and procedures for measurement
- Description and rationale for locations of monitoring transects
- Description of how data will be summarized and analyzed
- Sample datasheets and photo-documentation

Task Purpose/Objective

To create integrative and comprehensive Restoration Manual for removing invasive species, restoring riparian areas, monitoring the success of these projects and selecting sites for restoration in the future.

Responsible personnel

Mariposa, Morning Dew Landscaping, FMYN

Deliverable Description

Restoration Manual including:

1. Invasive Plant Removal Techniques
2. Restoration Techniques
3. High Priority Site Selection Report
4. Monitoring Plan

Deliverable Due Date

A draft of the Restoration Manual will be completed in October 2017
An update of the Restoration Manual will be completed by May 2018
Final Restoration Manual will be completed in May 2019

Task Cost (rounded to the nearest dollar)

\$17,590

Task 5: Develop Invasive Plant Removal and Restoration Plan for the Pilot Project Site***Task Description***

Mariposa and Morning Dew Landscaping will develop an invasive plant removal and restoration plan for the Pilot Project Site using the plan components developed in Task #4. The pilot project site is an old river channel that has standing water year round on approximately 30 acres (Appendix A). This area was the historic river channel until about 1993 when it appears to have changed to the current river channel. There is a limited infestation of tamarisk trees that can easily be removed and replaced with native trees and shrubs and there is a good bank-line for creating marsh and wetland habitats.

The Invasive Plant Removal and Restoration Plan for the site will include the following components:

Invasive Plant Removal Plan for the Pilot Project Site

The Invasive Plant Removal Plan will document and describe all activities related to the removal and treatment of invasive species at the Pilot Project Site.

At a minimum, the plan will include the following components:

- A map with areas to be treated in the project site
- Protocols for treatments for individual species
- Biomass removal procedures
- Descriptions of herbicide treatments based on species
- Secondary weed invasion treatments
- Equipment list

Restoration Plan for the Pilot Project Site

This plan will include a detailed planting design for the restoration of the pilot site. The design will be based on the results from the soil and depth to water analysis in Task 3 and pre-work monitoring (Task 8). The Restoration Plan will be divided into two phases. Phase 1 will involve planting pole cuttings of cottonwoods, Goodding's willow and coyote willow. Phase 2 will involve out-planting of potted plants included cottonwoods, Goodding's willow and select marsh and wetland species.

At a minimum, the plan will include the following components:

- Plant species, planting locations, numbers of each species, spacing and planting methods
- Plant propagation and grow-out recommendations
- Watering schedule and site maintenance schedule

- Options for irrigation if necessary
- Input from tribal members on suggested plants and Traditional Ecological Knowledge

Task Purpose/Objective

To create integrative and comprehensive plan for the Pilot Project Site based on data collected during the site analysis, pre-work monitoring and the Restoration Manual.

Responsible personnel

Mariposa, Morning Dew Landscaping, FMYN

Deliverable Description

1. Invasive Plant Removal Plan
2. Restoration Plan

Deliverable Due Date

A draft of all plans will be submitted by October 2017
 Updates will be made to the plan if needed in May 2018
 The final version of the plan will be submitted in May 2019

Task Cost (rounded to the nearest dollar)

\$6,468

Task 6: Implement the Invasive Plant Removal Plan at the Pilot Project Site

Task Description

All invasive plant species will be removed from the pilot project site. Initial site assessments revealed that tamarisk was the dominant invasive species on the site but if other species, especially giant reed and/or tree tobacco are found, they will also be treated. Tamarisk will be cut down and the stumps will be treated with an aquatic approved herbicide. The biomass from the tamarisk will be either be piled and burned, mulched or dealt with in some other way. The details of the invasive species removal and biomass management will be included in the Plan.

Task Purpose/Objective

To remove invasive plant species from the site in preparation for restoration.

Responsible personnel

Mariposa, Morning Dew

Deliverable Description

An annual report on the removal implementation will be provided along with photo documentation and a map of the site. The report will include all data collected during the implementation and will include but not be limited to the area of tamarisk removed, amount and type of herbicide used, and a summary of activities.

Deliverable Due Date

Annual report in January 2018 and 2019

Task Cost (rounded to the nearest dollar)

\$29,673

Task 7: Implement Phase 1 of the Restoration Plan for the Pilot Project Site

Task Description

Phase 1 of restoration activities will involve planting pole cuttings of at least eight cottonwoods, eight Goodding's willow, and 16 bundles of coyote willow. Specific locations for different species will be determined from the results of the depth to water and soil analysis (Task #3). Poles will be planted using a variety of bioengineering techniques and will be planted into the water table. Plant material will be collected from nearby sources. Pole planting will be done by the FMYN Youth Corp. The Youth Corp and FMYN will be responsible for maintenance of these trees. The results and successes of the Phase 1 planting will help determine the Phase 2 planting plan.

Task Purpose/Objective

To begin the process of restoring 30 acres of riparian habitat along the Verde River.

Responsible personnel

Mariposa, Morning Dew Landscaping, FMYN, FMYN Youth Corps

Deliverable Description

An annual report documenting restoration activities, number and species of native plants installed, and all data collected will be provided. Also included in the report will be a site map and photo documentation. A final report with a culmination and synthesis of all data will also be provided.

Deliverable Due Date

Annual reports in May 2018 and 2019

Final Report in August 2019

Task Cost (rounded to the nearest dollar)

\$12,716

Task 8: Monitoring Plan

Task Description

The Monitoring Plan will incorporate all work done at the Pilot project site in addition to retreatment efforts on giant reed and tree tobacco. The goal of the monitoring plan is to provide a framework for tracking the changes, success and challenges associated with this project. The monitoring data will provide insight into the success of the project both in terms of invasive species removal and

treatment and native plant establishment. It will also be used to inform future restoration projects along the Verde and in other similar ecosystems.

The Monitoring Plan will be comprised of the following components:

Monitoring Plan for retreating giant reed and tree tobacco

Monitoring for retreatment of giant reed and tree tobacco will follow protocols established during initial treatment and will include percent cover of regrowth and photo documentation (Appendix XX).

Monitoring Plan for the Pilot Project Site

This plan will be designed to assess any site prior to restoration, during the process and after completion of all restoration activities. The plan will be designed to assess the success of the invasive species removal, restoration and survival of plants installed. Components of the plan will include documentation of resprouts of treated invasives, height and health of planted species, changes in plant community composition, and photo-documentation.

At a minimum, the plan will include the following components:

- Pre- and post-work monitoring protocols
- Description of variables to be measured and procedures for measurement
- Description and rationale for locations of monitoring transects
- Description of how data will be summarized and analyzed
- Sample datasheets and photo-documentation

Variables to be collected for planted trees or shrubs will include the following: percent vegetative cover, height, health, mortality. Variables to be collected invasive plant treatment will include the following: regrowth observed, percent cover. Plant community composition will also be recorded at specific locations in the site.

Task Purpose/Objective

To determine the successes and failures of the restoration project and to better inform future projects.

Responsible personnel

Mariposa, FMYN

Deliverable Description

An annual and final report with descriptions of monitoring activities (including pre- and post-work data), results, data summaries, discussions and photo documentation will be provided. A final report on monitoring activities will be completed as well.

Deliverable Due Date

Annual report for Monitoring Plan for giant reed and tree tobacco treatment due in January 2018 & 2019

Annual report for Monitoring Plan for the invasive removal and restoration at Pilot Project site due in June 2018, 2019

Final Monitoring Report due August 2019

Task Cost (rounded to the nearest dollar)
\$14,099

Task 9: Final Report and Oral Presentation

Task Description

The Grantee shall prepare and present a final report in accordance with the guidelines and policies provided by the Arizona Water Protection Fund. The report will include a summary of all activities, all invasive plant removal data, and all restoration data, the methodologies employed for each plan, a discussion of success and challenges, a discussion and suggestions of lessons learned for moving forward, and an evaluation of the success of the project. The Grantee shall also provide all data and photos unless otherwise specified.

The Grantee shall also prepare and give an oral presentation in accordance with the guidelines and policies provided by the Arizona Water Protection Fund

Task Purpose/Objective

To provide a comprehensive final report that will be available to the public and can be used to better inform future restoration activities and demonstrate the value of these projects for State of Arizona.

To provide an oral presentation.

Responsible personnel

Mariposa, Morning Dew Landscaping, FMYN

Deliverable Description

A final report and an oral presentation to the Committee.

Deliverable Due Date

August 2019

Task Cost (rounded to the nearest dollar)

\$6,489

TOTAL AMOUNT REQUESTED: \$113,896

Project Timeline

2017	
March 2017	Task 1: Consultation with Tribal Council, USFWS, and ACOE
June 2017	Task 3: Conduct site analysis at pilot site including depth to water table and soil analysis
June 2017	Task 8: Conduct pre-work monitoring at Pilot Project Site
June-July 2017	Task 4: Develop Restoration Manual for the Lower Verde River.
August 2017	Task 1: Biological Assessment for Pilot Project Site complete Task 3: Report on the Soil and Depth to Water Table Analysis completed
August-September 2017	Task 5: Using the Restoration Manual, and results from water table and soil analysis, develop Pilot Project Site Plan
September 2017	Task 4: Strategically choose 5-10 sites that could be selected for restoration in the future.
October 2017	Tasks 4 & 5: Restoration Manual and Pilot Project Plan Completed
November/December 2017	Task 2: Retreat giant reed and tree tobacco along the river and at the FM Materials Plant
November/December 2017	Task 6: Implement Invasive plant removal plan at the Pilot Project Site
2018	
January/February 2018	Task 7: Implement Phase 1 the Restoration Plan at the Pilot Project Site (pole plantings)
January 2018	Task 2: Annual Report for Retreatment of giant reed and tree tobacco completed Task 6: Annual Report for Invasive Plant Removal Plan
April 2018	Task 8: Implement the monitoring plan- conduct post-removal and restoration monitoring
May 2018	Task 7: Annual Report for Restoration Plan
May 2018	Task 4 & 5: Update Restoration Manual and Pilot Project Plan
June 2018	Task 8: Annual report for Monitoring Plan for Pilot Project Completed
November/December 2018	Task 2: Retreat giant reed and tree tobacco along the river and at the Material Plant
November/December 2018	Task 6: Retreat invasive plants at the Pilot Project Site
2019	
January/February 2019	Task 7: Replace pole plantings as needed
January 2019	Task 2: Annual Report for Retreatment of giant reed and tree tobacco completed Task 6: Annual Report for Invasive Plant Removal Plan
March 2019	Task 8: Conduct post-restoration monitoring
May 2018	Task 7: Annual Report for Restoration Plan
May 2018	Task 4& 5: Final Restoration Manual and Pilot Project Plan Completed
June 2019	Task 8: Annual Monitoring Report for Pilot Project Completed
August 2019	Task 8: Final Monitoring Report Completed
August 2019	Task 9: Final Report Competed; Oral Presentation to Committee

DETAILED BUDGET BREAKDOWN
Fort McDowell Yavapai Nation
Lower Verde River Restoration Project

Item	AWPF Funding Request				
	Item/Hours	Unit	Rate	Matching	Total
Task #1 Permits, Authorizations, Clearances and Agreements					
Wetland Delineation					
Environmental Coordinator FMYN	40	Hours	\$ 105.00	\$ 4,200.00	
Assist Environmental Dept. with Consultation with USFWS, AZGF, and ACOE					
Principal Biologist and Certified Delineator	8	Hours	\$105.00		\$ 840.00
Biological Assessment for Pilot Project Site					
Principal Biologist, MS	24	Hours	\$105.00		\$ 2,520.00
Other direct costs:					
Per Diem	2	Days	\$150.00		\$ 300.00
Mileage	400	Miles	\$0.54		\$ 216.00
Printing	1	Lump	\$75.00	\$ 75.00	
Subtotal					\$ 3,876.00
Administration: (5%)					\$ 193.80
Total for Task #1				\$ 4,275.00	\$ 4,069.80

Item	AWPF Funding Request				
	Item/Hours	Unit	Rate	Matching	Total
Task #2: Retreat giant reed & tree tobacco along the Verde River and at the Fort McDowell Materials Plant (2017 & 2018)					
Licensed Herbicide Applicator	92	Hours	\$ 50.00		\$ 4,600.00
Laborer	92	Hours	\$ 45.00		\$ 4,140.00
Landscape Architect, RLA	8	Hours	\$ 85.00		\$ 680.00
Data Summaries and Report (2018, 2019)					
Biologist, MS	32	Hours	\$ 85.00		\$ 2,720.00
Other Direct Costs					
Inflatable Kayak (2)	10	days	\$ 36.00		\$ 360.00
Herbicide (Imazapyr)	1	Lump	\$ 313.78		\$ 313.78
Per Diem	20	Days	\$ 150.00		\$ 3,000.00
Mileage	700	Miles	\$ 0.54		\$ 378.00
Printing	1	Lump	\$ 50.00	\$ 50.00	
Subtotal					\$ 16,191.78
Administration: (5%)					\$ 809.59
Total for Task #2				\$ 50.00	\$ 17,001.37

Item	AWPF Funding Request				
	Item/Hours	Unit	Rate	Matching	Total
Task #3: Depth to Water and Soil Salinity Analysis (Matching Funds)					
Hydrologist, FMYN	12	Hours	\$ 105.00	\$ 1,260.00	
Principal Biologist, MS	24	Hours	\$ 105.00		\$ 2,520.00
Laborer	24	Hours	\$ 45.00		\$ 1,080.00
Autocadd/GIS Operator	3	Hours	\$ 65.00		\$ 195.00
Report on Analysis, Ecologist, MS	8	Hours	\$ 85.00		\$ 680.00
Other Direct Costs					
Per Diem	2	Days	\$ 150.00		\$ 300.00
Mileage	350	miles	\$ 0.54		\$ 189.00
Printing	1	Lump	\$ 50.00	\$ 50.00	
Soil Samples	1	Lump	\$ 550.00		\$ 550.00
Subtotal					\$ 5,514.00
Administration: (5%)					\$ 275.70
Total for Task #3				\$ 1,310.00	\$ 5,789.70

Item	AWPF Funding Request				
	Item/Hours	Unit	Rate	Matching	Total
Task #4 Develop a Restoration Manual for invasive plant management and riparian restoration plan for the lower Verde River					
Invasive plant treatment					
Principal Biologist, MS	24	Hours	\$ 105.00		\$ 2,520.00
Landscape Architect, RLA	4	Hours	\$ 85.00		\$ 340.00
Restoration techniques					
Principal Biologist, MS	16	Hours	\$ 105.00		\$ 1,680.00
Landscape Architect, RLA	16	Hours	\$ 85.00		\$ 1,360.00
Monitoring plan					
Principal Biologist, MS	16	Hours	\$ 105.00		\$ 1,680.00
Landscape Architect, RLA	2	Hours	\$ 85.00		\$ 170.00
Autocadd/Arcview Operator	4	Hours	\$ 65.00		\$ 260.00
High priority site selection					
Environmental Director, FMYN	8	Hours	\$ 105.00	\$ 840.00	
Hydrologist, FMYN	8	Hours	\$ 90.00	\$ 720.00	
Principal Biologist, MS	32	Hours	\$ 105.00		\$ 3,360.00
Landscape Architect, RLA	32	Hours	\$ 85.00		\$ 2,720.00
GIS Specialist	8	Hours	\$ 85.00		
Updates to Restoration Manual (2018 & 2019)					
Principal Biologist, MS	8	Hours	\$ 105.00		\$ 840.00
Landscape Architect, RLA	8	Hours	\$ 85.00		\$ 680.00
Other Direct Costs					
Ground Truth Potential Project Sites Travel Estimated	6	Days	\$ 150.00		\$ 900.00

	Ground Truth Mileage	450	Miles	\$ 0.54		\$ 243.00
Subtotal						\$ 16,753.00
Administration: (5%)						\$ 837.65
Total for Task #4					\$ 1,560.00	\$ 17,590.65
AWPF Funding Request						
Item		Item/Hours	Unit	Rate	Matching	Total
Task #5 Develop Invasive Plant Removal and Restoration Plan for the Pilot Project Site						
Invasive Plant Removal Plan for the Pilot Project Site						
	Principal Biologist, MS	8	Hours	\$ 105.00		\$ 840.00
	Landscape Architect, RLA	8	Hours	\$ 85.00		\$ 680.00
	Autocadd/GIS Operator	4	Hours	\$ 65.00		\$ 260.00
Restoration Plan for the Pilot Project Site						
	Hydrologist, FMYN	4	Hours	\$ 105.00	\$ 420.00	
	Principal Biologist, MS	8	Hours	\$ 105.00		\$ 840.00
	Landscape Architect, RLA	18	Hours	\$ 85.00		\$ 1,530.00
	Autocadd/Arcview Operator	6	Hours	\$ 65.00		\$ 390.00
Updates to Pilot Project Plan (2018 & 2019)						
	Principal Biologist, MS	8	Hours	\$ 105.00		\$ 840.00
	Landscape Architect, RLA	8	Hours	\$ 85.00		\$ 680.00
Other Direct Costs						
	Printing	1	Lump	\$ 100.00		\$ 100.00
Subtotal						\$ 6,160.00
Administration: (5%)						\$ 308.00
Total for Task #5					\$ 420.00	\$ 6,468.00
AWPF Funding Request						
Item		Item/Hours	Unit	Rate	Matching	Total
Task #6: Implement the Invasive Plant Removal Plan at the Pilot Project Site						
Plant Removal						
	Landscape Architect, RLA	16	Hours	\$ 85.00		\$ 1,360.00
	Crew Leader	138	Hours	\$ 55.00		\$ 7,590.00
	Labor	258	Hours	\$ 45.00		\$ 11,610.00
	Equipment	1	Lump	\$ 500.00		\$ 500.00
	Licensed Herbicide Applicator	138	Hours	\$ 50.00		\$ 6,900.00
Other Direct Costs						
	Herbicide (imazapyr)	1	Lump	\$ 300.00		\$ 300.00
	Per Diem	60	Days	\$ 150.00		\$ 9,000.00
	Mileage	1050	miles	\$ 0.54		\$ 567.00
Retreat						
	Landscape Architect, RLA	14	Hours	\$ 85.00		\$ 1,190.00
	Crew Leader	46	Hours	\$ 55.00		\$ 2,530.00
	Labor	46	Hours	\$ 45.00		\$ 2,070.00
	Equipment	1	Lump	\$ 350.00		\$ 350.00
	Licensed Herbicide Applicator	46	Hours	\$ 50.00		\$ 2,300.00
Other Direct Costs						
	Herbicide (imazapyr)	1	Lump	\$ 175.00		\$ 175.00
	Per Diem	15	Days	\$ 150.00		\$ 2,250.00
	Mileage	450	miles	\$ 0.54		\$ 243.00
Subtotal						\$ 28,260.00
Administration: (5%)						\$ 1,413.00
Total for Task #6						\$ 29,673.00
AWPF Funding Request						
Item		Item/Hours	Unit	Rate	Matching	Total
Task #7: Implement Phase 1 of the Restoration Plan for the Pilot Project Site						
Harvesting Plant Material						
	Principal Biologist, MS	16	Hours	\$ 105.00		\$ 1,680.00
	Laborer	16	Hours	\$ 45.00		\$ 720.00
Other Direct Costs:						
	Per Diem	4	Days	\$ 150.00		\$ 600.00
	Mileage	350	Miles	\$ 0.54		\$ 189.00
Planting Labor						
	Landscape Architect	30	hours	\$ 85.00		\$ 2,550.00
	Crew Leader	30	hours	\$ 55.00		\$ 1,650.00
	FMYN Youth Corps	96	hours	\$ 55.00	\$ 5,280.00	
Annual Report on Phase 1 restoration implementation (2018 & 2019)						
	Ecologist, MS	18	Hours	\$ 85.00		\$ 1,530.00
Other Direct Costs:						
	Travel Mileage	400	Miles	\$ 0.54		\$ 216.00
	Per Diem	6	Days	\$ 150.00		\$ 900.00
	Bobcat with Auger	1	Days	\$ 550.00		\$ 550.00
	Water Auger and Water Pump	2	Days	\$ 250.00		\$ 500.00
	Fencing supplies	1	Lump	\$ 800.00		\$ 800.00
	Tools	1	Lump	\$ 225.00		\$ 225.00
Subtotal						\$ 12,110.00
Administration: (5%)						\$ 605.50
Total for Task #7					\$ 5,280.00	\$ 12,715.50
AWPF Funding Request						
Item		Item/Hours	Unit	Rate	Matching	Total
Task #8: Monitoring Plan						
Pre-work Monitoring at Pilot Project Site (June 2017)						
	Hydrologist	8	Hours	\$ 105.00	\$ 840.00	
	Ecologist, MS	24	Hours	\$ 85.00		\$ 2,040.00

Laborer	24	Hours	\$ 45.00		\$ 1,080.00
Plant Monitoring Report,; Ecologist, MS	16	Hours	\$ 85.00		\$ 1,360.00
Other Direct Costs:					
Travel Mileage	400	Miles	\$ 0.54		\$ 216.00
Per Diem	6	Days	\$ 150.00		\$ 900.00
Post-work Monitoring at Pilot Project Site (April 2017)					
Hydrologist	8	Hours	\$ 105.00	\$ 840.00	
Ecologist, MS	16	Hours	\$ 85.00		\$ 1,360.00
Laborer	16	Hours	\$ 45.00		\$ 720.00
Plant Monitoring Report,; Ecologist, MS	16	Hours	\$ 85.00		\$ 1,360.00
Other Direct Costs:					
Travel Mileage	400	Miles	\$ 0.54		\$ 216.00
Per Diem	4	Days	\$ 150.00		\$ 600.00
Post-work Monitoring at Pilot Project Site (April 2018)					
Hydrologist	8	Hours	\$ 105.00	\$ 840.00	
Ecologist, MS	16	Hours	\$ 85.00		\$ 1,360.00
Laborer	16	Hours	\$ 45.00		\$ 720.00
Plant Monitoring Report,; Ecologist, MS	8	Hours	\$ 85.00		\$ 680.00
Other Direct Costs:					
Travel Mileage	400	Miles	\$ 0.54		\$ 216.00
Per Diem	4	Days	\$ 150.00		\$ 600.00
Printing (reports and photodocumentation)	1	Lump	\$ 500.00	\$ 800.00	
Subtotal					\$ 13,428.00
Administration: (5%)					\$ 671.40
Total for Task #8				\$ 3,320.00	\$ 14,099.40
AWPF Funding Request					
Item	Item/Hours	Unit	Rate	Matching	Total
Task #9 Final Report and Oral Presentation					
Environmental Director, FMYN	8	Hours	\$ 105.00	\$ 840.00	
Principal Biologist, MS	32	Hours	\$ 105.00		\$ 3,360.00
Landscape Architect, RLA	16	Hours	\$ 85.00		\$ 1,360.00
Autocadd/GIS Operator	4	Hours	\$ 65.00		\$ 260.00
Editor	24	Hours	\$ 50.00		\$ 1,200.00
Other Direct Costs:					
Printing	1	Lump	\$ 650.00	\$ 650.00	
Subtotal					\$ 6,180.00
Administration: (5%)					\$ 309.00
Total for Task #9				\$ 1,490.00	\$ 6,489.00
Total Grant Request and Matching Funds				\$17,705.00	\$ 113,896

Community Support

October 12, 2016

Arizona Water Protection Fund

3550 North Central Avenue

Phoenix, Arizona 85012

RE: FY 2017 Grant Application

Dear Grant Review Committee,

I am writing to express the Tamarisk Coalition's support of the Fort McDowell Yavapai Nation's application for the Lower Verde River Riparian Restoration project. There has been a significant amount of momentum for riparian restoration on the Upper Verde River (above Bartlett Dam) in the last four years, and it is exciting to see the Fort McDowell Yavapai Nation taking the initiative to conduct riparian restoration on the Lower Verde River.

The goal of the proposed project is to retreat giant reed and tree tobacco along a 10-mile stretch of river and to implement a phased plan to remove tamarisk and replant with native trees, shrubs and wetland species on a 30-acre pilot site. This section of the Verde River provides valuable habitat for many wildlife species, and especially for four nesting pairs of bald eagles. Creating and enhancing riparian habitat on these 30 acres as well as continued treatment of giant reed and tree tobacco along the Lower Verde is an important addition the work being done in the Upper Verde watershed.

This project will hopefully be the first of many to come along the Lower Verde River. The Tamarisk Coalition has been consulting with the Tonto National Forest to discuss opportunities to implement restoration activities on the approximately 30 miles of river between Bartlett Dam and the boundary with Fort McDowell Yavapai Nation. Integrating the Lower Verde working groups into active riparian restoration will lead to a more diverse and healthy ecosystem throughout the entire Verde watershed.

Sincerely,



Stacy K. Beagh

Executive Director



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 AWWPF 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: **Fort McDowell Yavapai Nation – Lower Verde River Riparian Restoration Project**
3. Applicant Name and Address: **Fort McDowell Yavapai Nation
17721 E. Yavapai Road, Fort McDowell, Az.
85269**
4. Current Land Owner/Manager(s): **Fort McDowell Yavapai Nation – Indian Tribe**
5. Project Location, including Township, Range, Section: **T4N, R7E, Section 20**
6. Total Project Area in Acres (or total miles if trail): **30 acres**
7. Does the proposed project have the potential to disturb the surface and/or subsurface of the ground? YES NO
8. Please provide a brief description of the proposed project and specifically identify any surface or subsurface impacts that are expected: **Invasive plant species (tamarisk) removed - Native wetland, hydro-riparian and xeric-riparian species planted, including cottonwood trees for bald eagle nesting.**

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: **The ground surface of the proposed project area is in a natural undisturbed condition.**

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

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

- An Archaeological Survey of the Orme Reservoir (1975)
- Boundary Delineation and Limited Testing of Several Sites on the Fort McDowell Indian Reservation (April 26, 1994). Attached

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 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 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.

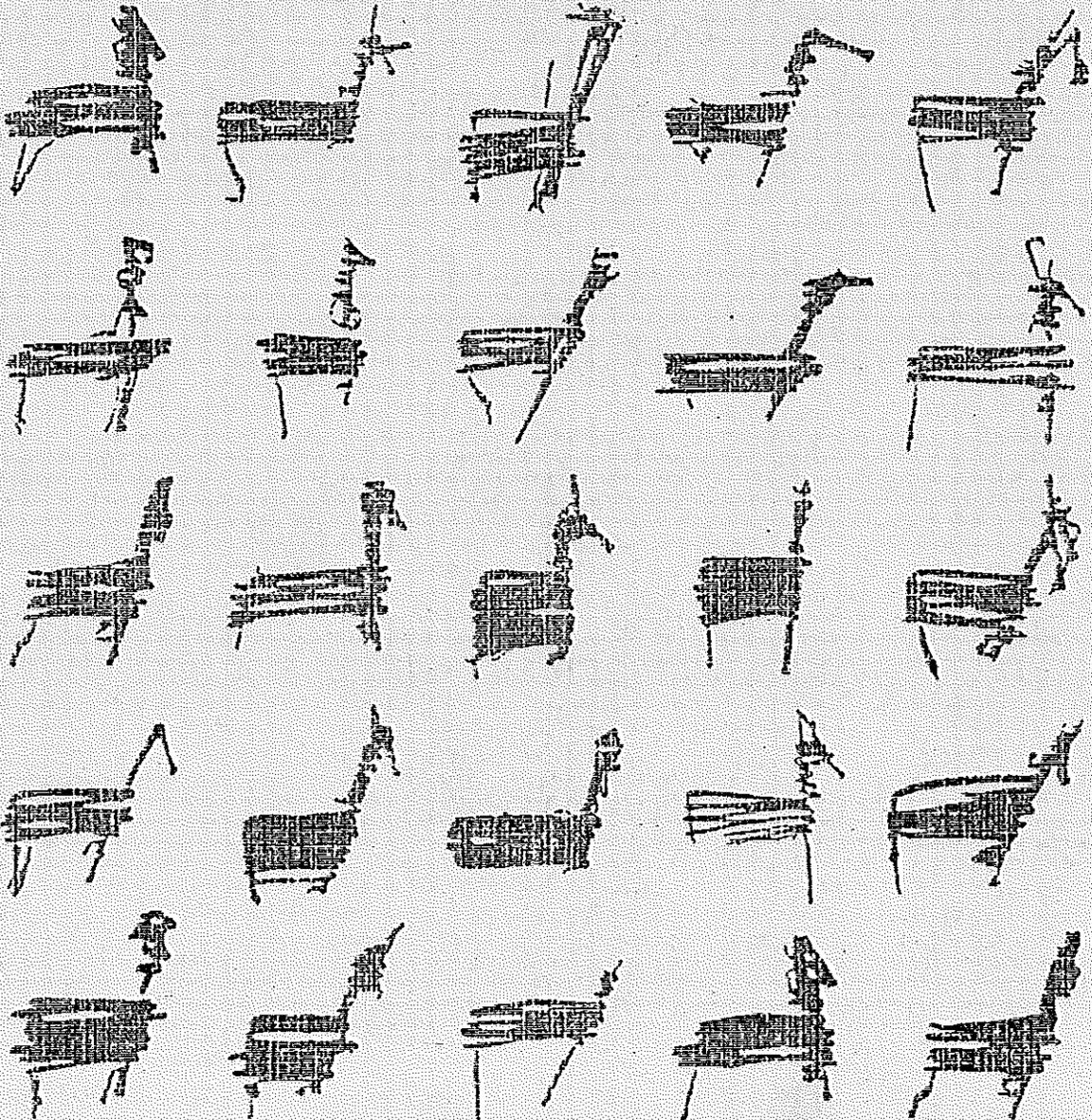
Mark Frank 10/11/16
Applicant Signature /Date

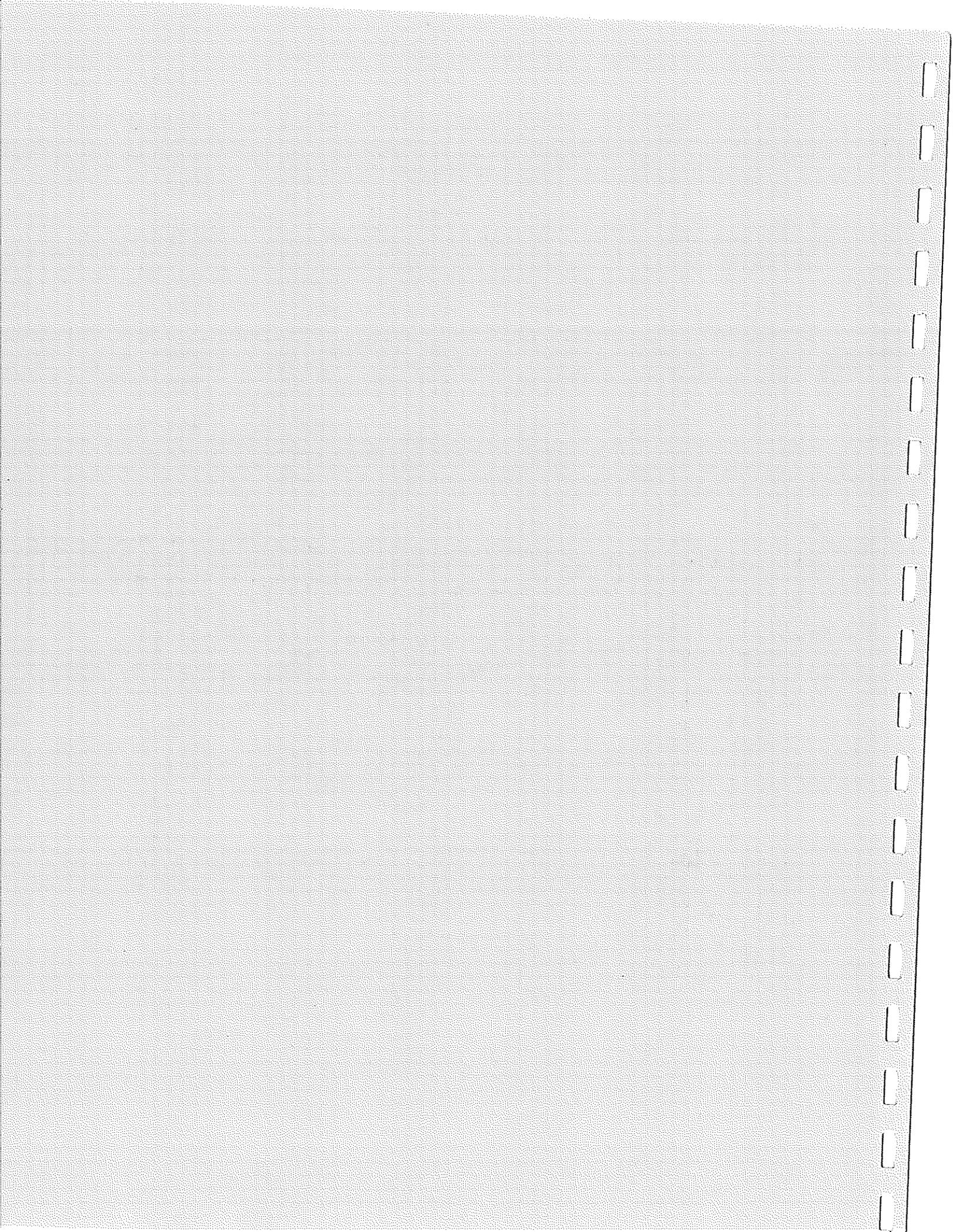
MARK FRANK
Applicant Printed Name

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

Boundary Delineation and Limited Testing of Several Sites
on the Fort McDowell Indian Reservation, Maricopa County, Arizona

Archaeological Consulting Services Ltd.





SHPO STANDARDIZED REPORT ABSTRACT

AGENCY: U.S. Bureau of Reclamation, Ft. McDowell Indian Reservation

PROJECT TITLE: Ft. McDowell Survey

DATE OF REPORT: April 26, 1994

AGENCY PROJECT NUMBER:

ACS PROJECT NUMBER: 93-316

PROJECT DESCRIPTION: Clearance for proposed agricultural development

LOCATION: Sections 7, 8, 19, 20, 24, 25, and 30 of Township 4 North, Range 6 East.
USGS 7.5' Ft. McDowell, Arizona topographic quadrangle
on the Ft. McDowell Indian Reservation, Maricopa County

NUMBER OF SURVEYED ACRES: 200 acres

METHODOLOGY: The work was performed to define the boundaries of archaeological sites to be avoided by agricultural development. Eight sites were slated for preservation; however, only seven sites were relocated and flagged, and two new sites were defined. In most cases the sizes of the sites increased. The survey was conducted with parallel pedestrian transects spaced 20 m apart.

NUMBER OF SITES: nine

NUMBER OF ELIGIBLE SITES: nine

LIST OF ELIGIBLE SITES: AZ U:6:3, 81, 87, 239, 248, 249, 250, 251, 252(ASM)

COMMENTS: Mapping of the Agricultural Sites

A large prehistoric agricultural site, AZ U:6:239(ASM), was found during the 200-acre survey associated with this study. The site consists of numerous, widely dispersed rockpiles. In a separate report (Adams 1993), recommendations were made regarding data recovery measures since the site would not be avoided by the proposed agricultural development. The recommendations have been reviewed and approved by Reclamation and SHPO. Similar prehistoric agricultural features were discovered surrounding the habitation core of AZ U:6:81(ASM), and since they will not be avoided by development, this component of the site will need to undergo data recovery.

The same measures recommended for AZ U:6:239(ASM) are proposed for the agricultural component of AZ U:6:81(ASM). These recommendations include detailed mapping of the location of the agricultural features with particular emphasis upon their relationship to the landscape. As argued previously, analysis beyond mapping would result in the recovery of very little additional information and is not recommended. Botanical analyses from similar rockpile fields in the lower Verde Valley (Jon Czaplicki, personal communication 1993) and in the Santan

Mountains (Hutira 1989) have not been significantly informative.

Further Survey to Define the Boundaries of the Agricultural Sites

It became obvious during the current project that agricultural fields were not often recognized during the earlier ASM survey in the vicinity of the project area (Canouts 1975). Survey of areas beyond the agricultural fields identified around sites AZ U:6:81 and U:6:239(ASM) is suggested. Archaeological assessment of any surrounding lands that will be impacted by development and have not been cleared of vegetation also is recommended. Specifically, systematic archaeological survey should be undertaken in the northwest quarter of Section 30 and the southwestern and southeastern quarters of Section 19.

Documentary Investigation of a Possible Historic Site

A possible historic site was found north of the agricultural portion of AZ U:6:81(ASM). The age of this site is not known, but it is suspected that it is older than 50 years and therefore qualifies as a historic resource. Documentary investigation to determine this site's age and National Register eligibility status is recommended.

Avoidance of the Project Sites by Fencing

The testing conducted during the current project was very limited in scope and was intended only to define boundaries and confirm the presence of subsurface features. Fencing is recommended for sites AZ U:6:3, U:6:87, U:6:248, U:6:249, U:6:250, U:6:252 and the core of site U:6:81(ASM). Site AZ U:6:251(ASM) is located within AZ U:6:3(ASM) and, therefore, does not need to be fenced separately. The fencing will protect the sites from future impacts from the proposed development. If avoidance is not possible then Phase I data recovery is recommended for every site that will be adversely affected. Phase I data recovery involves the determination of the nature and number of cultural deposits present and provides a means to finalize a full mitigation plan. A data recovery plan must be prepared and then approved by the SHPO before any data recovery efforts can be undertaken.

**Boundary Delineation and Limited Testing of Several Sites
on the Fort McDowell Indian Reservation
Maricopa County, Arizona**

Kim Adams
Archaeological Consulting Services, Ltd.
April 26, 1994

Introduction

Archaeological Consulting Services, Ltd. (ACS) conducted survey of 200 acres and limited testing of cultural resources on Fort McDowell Mohave-Apache Indian Community (FMIC) land at the request of Mr. Jon Czaplicki of the Bureau of Reclamation (Reclamation). The work was performed to define the boundaries of archaeological sites to be avoided by agricultural development. Eight sites were slated for preservation; however, only seven sites were relocated and flagged, and two new sites were defined. In most cases the sizes of the sites increased.

Project Area

The project area is on FMIC land in portions of Sections 7, 8, 19, 20, 24, 25, and 30 of Township 4 North, Range 6 East (Gila and Salt River Baseline and Meridian) (Figures 1 and 2). This area is along the alluvial terrace west of the Verde River in the Basin and Range physiographic province at elevations ranging from approximately 1460 to 1640 ft. The vegetation in the undisturbed desert is dominated by creosotebush-bursage, although abundant palo verde, cholla, saguaro, barrel cactus, and mesquite are also present. Recent clearing of vegetation by the FMIC had impacted four of the sites.

Previous Research

In conjunction with the environmental assessment for the FMIC agricultural development, ACS prepared a cultural resource overview that identified previously recorded sites located in the vicinity of the proposed project area (Stone 1991). Following is a brief summary of the information provided in that document.

In 1975, as part of the Orme Reservoir study, Arizona State Museum (ASM) conducted an extensive survey of FMIC land, including most of the current study parcel (Canouts 1975). This survey identified 110 prehistoric and historic cultural resources ranging from large Hohokam village sites and dry farming systems to small resource procurement loci. A later study conducted by Archaeological Research Services, Inc. (ARS) inventoried 80 historic sites, three of which are in the current study area (Stone and Ayres 1984). The proposed reservoir was never built, so no further study of these sites occurred in conjunction with that project.

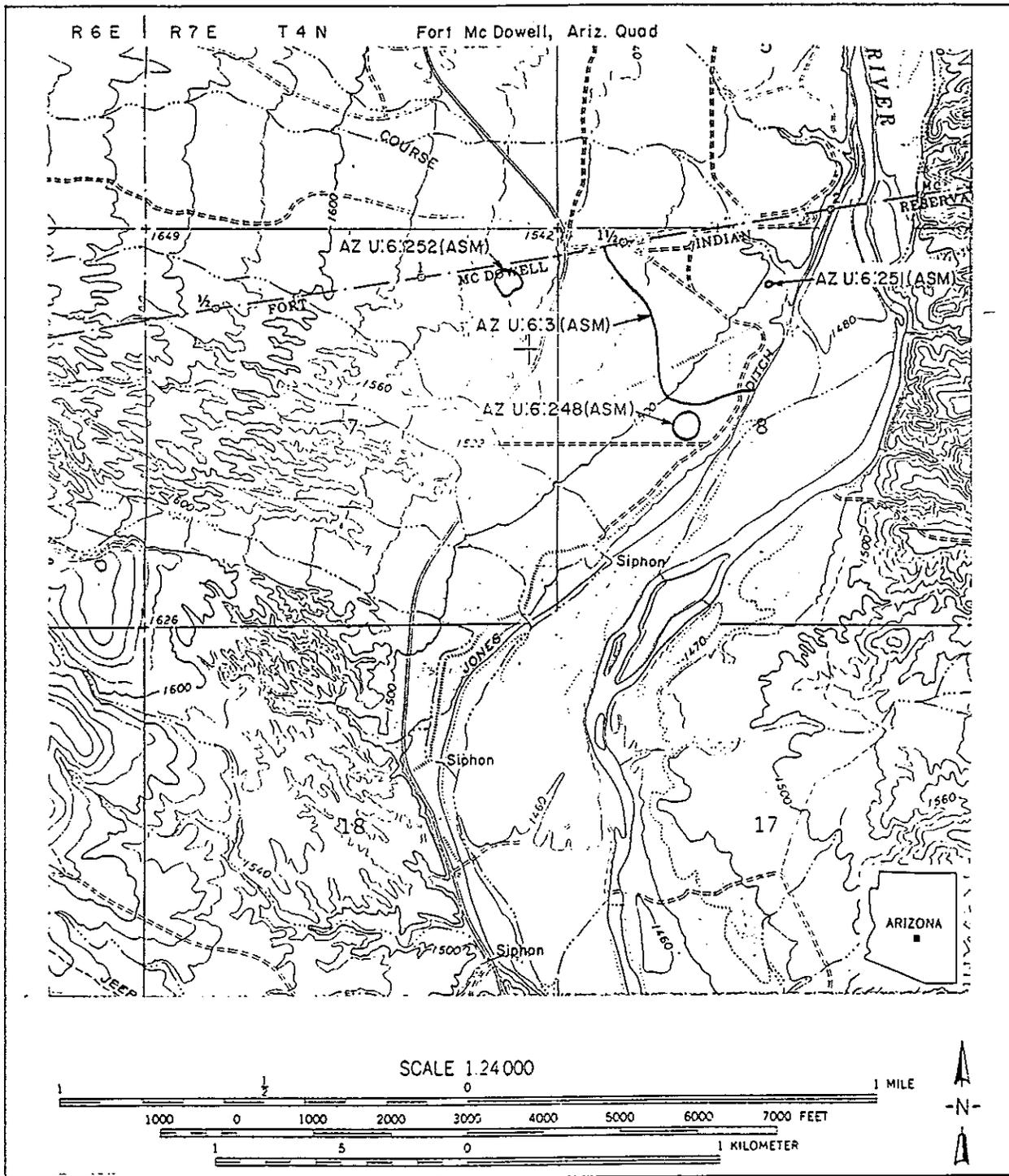


Figure 1. Portion of the USGS 7.5' Fort McDowell, Arizona (photorevised 1974) topographic quadrangle showing the sites in the northern half of the project area.

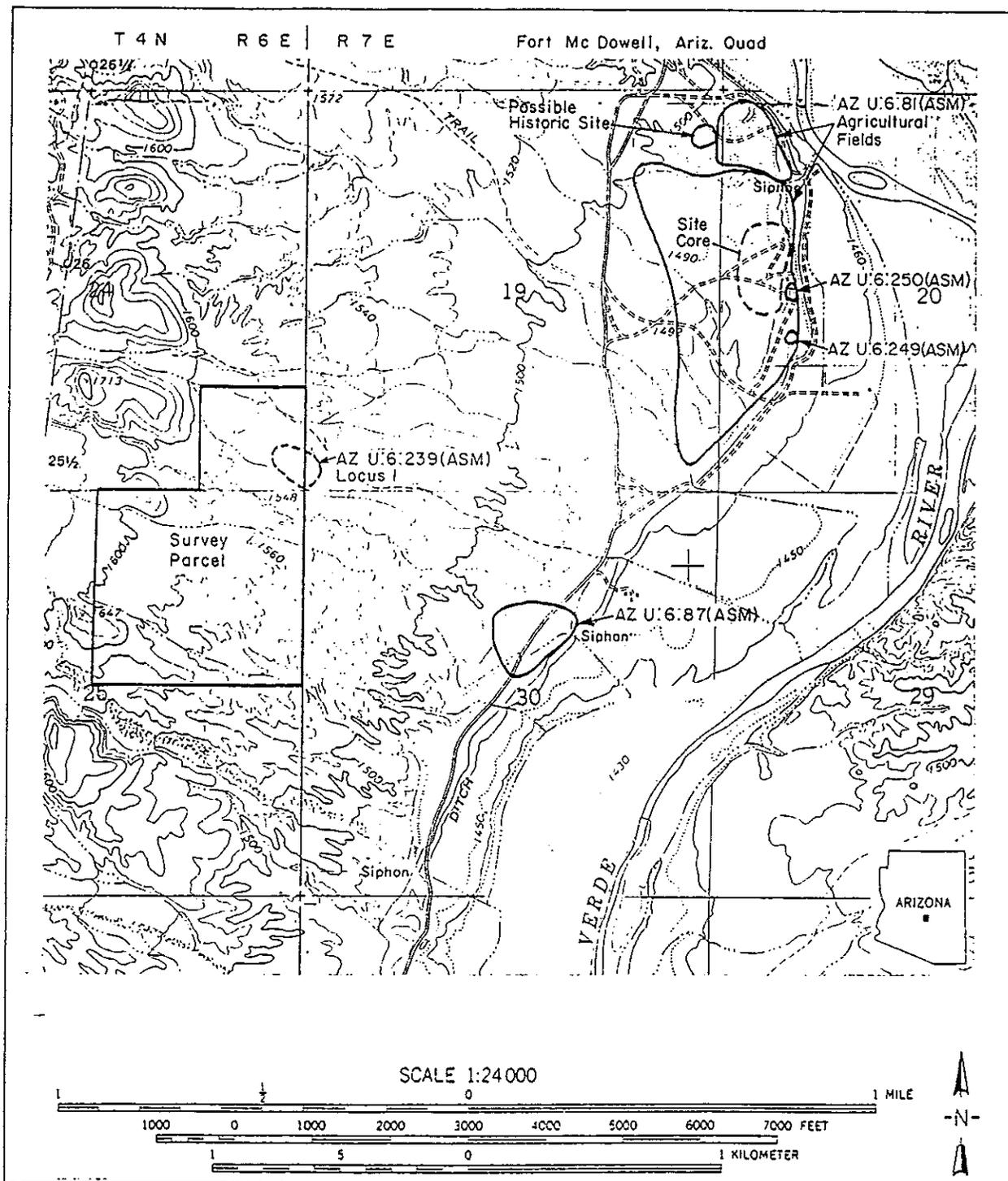


Figure 2. Portion of the USGS 7.5' Fort McDowell, Arizona (photorevised 1974) topographic quadrangle showing the sites in the southern half of the project area.

Cultural resource studies associated with proposed agricultural development on FMIC land began in the mid-1980s. ACS provided a resource overview in 1983 that re-evaluated previously identified sites and concluded that many were potentially eligible for inclusion on the National Register of Historic Places under criterion D (Efland 1983). ARS carried out data recovery at nine historic sites that would be impacted by Phase I of the Fort McDowell Irrigation Betterment Project (Stein 1984). These sites were east and south of the current project area. As part of the planning process ARS also surveyed a 29-acre parcel along the northern boundary of FMIC land and identified a prehistoric artifact scatter (AZ U:6:55(ARS)) (Stone 1985). ARS recommended avoidance of the site.

Sites Included in Testing and Boundary Delineation

On the basis of the previous work conducted by ASM and ARS, eight archaeological sites were included in this study (Table 1). One site found by ASM, AZ U:6:79(ASM), a historic adobe manufacturing site with two corrals, was not relocated. During the search for this site however, a new prehistoric artifact scatter, AZ U:6:248(ASM), was identified. The site was mapped, a site form was filed with ASM, and it was investigated in a manner consistent with the work done at the other sites previously located. Also, a large dry farming site, (AZ U:6:239(ASM)), was identified during the 200-acre survey.

Table 1. Archaeological Sites Included in the Boundary Definition Study.

ASM Site #	Other Site #	Site Type
AZ U:6:3		Prehistoric Hohokam village complex
AZ U:6:79		Historic adobe manufacturing site with corrals
AZ U:6:81		Prehistoric Hohokam habitation
AZ U:6:87		Prehistoric Hohokam habitation and agricultural fields
AZ U:6:239		Prehistoric Hohokam agricultural fields
AZ U:6:248		Prehistoric Hohokam artifact scatter
AZ U:6:249	U:6:11(ARS)	Historic artifact scatter
AZ U:6:250	U:6:12(ARS)	Historic homestead
AZ U:6:251	U:6:31(ARS)	Historic artifact scatter
AZ U:6:252	U:6:55(ARS)	Prehistoric Hohokam artifact scatter

Fieldwork

Fieldwork was conducted between October 4 and December 13, 1993, with Kim Adams serving as Field Director and Andrew Dutt as Assistant Crew Chief. The crew was composed of Eloise Vincent, Norman Vincent, Thomas Jones, and Mac McDonnell. In all, 122 person-days were

expended. Fieldwork proceeded under a letter of authorization issued by the FMIC tribal council. Verbal authorization was received from C. Randall Morrison, Area Archaeologist for the Phoenix Area Office of the Bureau of Indian Affairs. He decided that an Archaeological Resources Protection Act permit was not necessary for the limited testing project since the work was being performed for another federal agency.

Methodology

Investigation was consistent with the proposed plan of work, approved by Reclamation and the Arizona State Historic Preservation Office (SHPO) in which three tasks were specified (ACS 1993). These tasks were:

1. survey of a 200-acre parcel of land proposed for agricultural development;
2. mapping and boundary delineation of eight sites; and
3. limited testing for site integrity and subsurface boundary delineation at two of the sites.

The 200-acre parcel of previously uninspected land was surveyed via systematic parallel pedestrian transects, and a report was prepared under separate cover (Adams 1993). The two other tasks, mapping and testing, are reported herein. Results and specific variations to the general methodology are presented below in appropriate site discussions.

Mapping was aided by aerial photographs provided by Reclamation. Prior to the start of fieldwork, all visible natural and cultural features were produced on digitized maps. These maps were then field checked. Cultural materials and all features were mapped by transit, and these data were inputted to a computer to produce the final site maps. Individual artifacts were mapped at smaller sites, and concentrations of artifacts were plotted for the larger sites. Maps were not produced to the fine level of all of the data collected, but the transit data will serve as a record of each site and as a baseline by which to determine any impacts to the sites.

Boundaries for each site were determined by decreased densities of artifacts and the lack of cultural features on the ground surface. Density level of artifacts for the site definition was set by at 1 artifact per 6 m², per the contract specifications with Reclamation (ACS 1993). Site boundaries were then mapped and marked with blue and white flagging tape. These boundaries are to be fenced by the FMIC to protect the sites.

Two sites, AZ U:6:3 and U:6:81(ASM), underwent limited subsurface testing as per the plan of work. Two additional sites, AZ U:6:87 and U:6:248(ASM), were tested with judgmentally placed trenches placed along the boundaries at the request of Mr. Czaplicki (Contracting Officer's Technical Representative for Reclamation). The trenching, limited to the edges of sites, was carried out to determine the limits of buried resources. Series of 5-m long trenches were placed 50 m apart along the boundaries as defined by surface artifacts and features. Each series, or locus of trenches, consisted of a number of 5-m-long trenches dug 1.5 m deep and spaced at 5 m intervals. Prior to excavation, all artifacts on the surface of each trench were collected. Following excavation, each trench wall was faced (scraped flat by shovel and trowel) and inspected. If cultural material was found in the trench walls, another trench was excavated beyond the surface boundaries of the site. This pattern of skip trenches was continued at each locus until

no cultural material was identified. The outermost trench in the series was then extended to 20 m long to ensure that the edge of the site had been found. If, in excavating trenches along the surface boundary of the site no material was identified in the first two trenches of a series, then additional skip trenches were excavated towards the center of the site until material was identified or a total of eight trenches had been dug. The judgmental trenching at AZ U:6:87 and U:6:248(ASM) consisted of one or two trenches at each locus, proceeding away from the site surface boundary until no subsurface cultural material was identified.

All cultural deposits found by trenching were photographed, profiled, and mapped. No botanical or chronological samples were collected. All trenches were backfilled after mapping was completed. An analysis of collected materials was conducted at the ACS lab. Information pertaining to the analysis of the material collected is presented in Appendix A.

Also, ASM site numbers were obtained for those cultural resources with only ARS site numbers. The ASM numbers will be used in the report. Table 1 above shows the concordance between the two numbers.

Finally, the site boundary definition phase of the project was completed in two stages. The sites located in the southern half of the project area (Figure 2) were investigated first. After the work was completed at these sites (AZ U:6:81, U:6:87, U:6:249, and U:6:250(ASM)), a meeting was held with Reclamation and FMIC farm office staff. Another meeting was held after work at the northern sites (U:6:3, U:6:248, U:6:251, and U:6:252(ASM)) (Figure 1) was completed. At both meetings our findings were discussed and questions put forth by the FMIC representatives and their consultants were answered.

Results of the Site Boundary Definition Fieldwork

Following is the description of the eight sites investigated during the site boundary definition phase of the project. As mentioned above, AZ U:6:79(ASM) was not relocated despite repeated attempts to find it, and AZ U:6:248(ASM) was found during one of these attempts. The sites will be discussed in numeric order.

AZ U:6:3(ASM)

<i>Site Location:</i>	Township 4N, Range 7E, Section 8 (on FMIC land only)
<i>Elevation:</i>	1500 ft
<i>Landform:</i>	Western terrace of the Verde River
<i>Vegetation:</i>	Creosotebush, bursage, palo verde, mesquite, saguaro, cholla, barrel cactus
<i>Soils:</i>	Gravelly silt and
<i>Site Area:</i>	455,000 m ² (650 x 700 m) on FMIC land only
<i>Cultural/Temporal Affiliation:</i>	Colonial period Hohokam

Description: This is a large Hohokam village site known as Azatlan. Only the extreme southern portion of the site is situated within the current project area. The majority of the site extends north onto Tonto National Forest land. Within the project area, the site was visible on the surface

as a dense scatter of artifacts, including ceramics, chipped stone, and ground stone. Surface features included five rockpiles and 10 trash mounds (Table 2). A small historic site, AZ U:6:251(ASM), is located within the site (Figure 3).

Site Condition: A large modern borrow pit has completely destroyed a large portion of the site on FMIC land. Only the area located north of the dirt road that borders the north edge of the borrow pit and in the mesquite bosque at the south end of the site remains relatively intact. Most of the site not destroyed by the borrow pit was recently cleared of vegetation with heavy machinery. Surface features in this area were almost completely obliterated, however artifactual materials were identified on the surface in sufficient densities to allow a definition of the site boundaries despite the severe impacts. The clearing has effectively obscured the view of surface artifacts in places while churning up artifacts in others. Other disturbances to the site include dirt roads, a canal, an erosion control berm, and a powerline. Artifacts are eroding from several small drainages.

Discussion of Fieldwork: Only one trash mound (Feature 2) could be identified in the cleared area. Fourteen features were found in the undisturbed portions of the site (Figure 3). The large site size, amount of vegetation in uncleared areas, and the amount of disturbance in cleared areas precluded detailed artifactual mapping. For AZ U:6:3(ASM), surface collection was conducted along the entire locus transect and all materials received the locus provenience.

In total, 84 5-m trenches in 12 loci were excavated along 650 m of site perimeter. No subsurface remains were located. Examination of the walls of the borrow pit revealed buried cultural material, but no features. On FMIC land, the boundary of the site encompasses approximately 112 acres. The original site boundaries defined by ASM include roughly 123 acres of FMIC land.

The sediments at the site appear to be unconsolidated alluvium with no caliche development evident. They are moderately well-sorted silty sand with some bedding of clay, silt, and gravel interspersed. Several root burns are present subsurface. Trenches in Loci 1-6 and 12 were spaced to adjust around slash piles, saguaros, and washes, but attempts were made to maintain the original 5-m spacing pattern as closely as possible.

Trenching in the mesquite bosque, Loci 7-11, proved somewhat difficult and trenches by necessity were placed at various angles and spacing to maneuver the backhoe around the mesquite without causing excessive damage to the trees. Surface collection in the bosque was done in the same manner as at the other sites, with collections made from each trench location. The sediments in the bosque were moderately well-sorted alluvium, which exhibited significantly greater evidence of bioturbation from burrowing animals and tree roots than other portions of the site.

Table 2. Surface Features Found at AZ U:6:3(ASM).

Feature	Feature Type
1	Rockpile
2	Trash mound
3	Trash mound
4	Trash mound
5	Trash mound
6	Trash mound
7	Rockpile
8	Trash mound
9	Rockpile
10	Trash mound
11	Trash mound
12	Trash mound
13	Trash mound
14	Rockpile
15	Rockpile

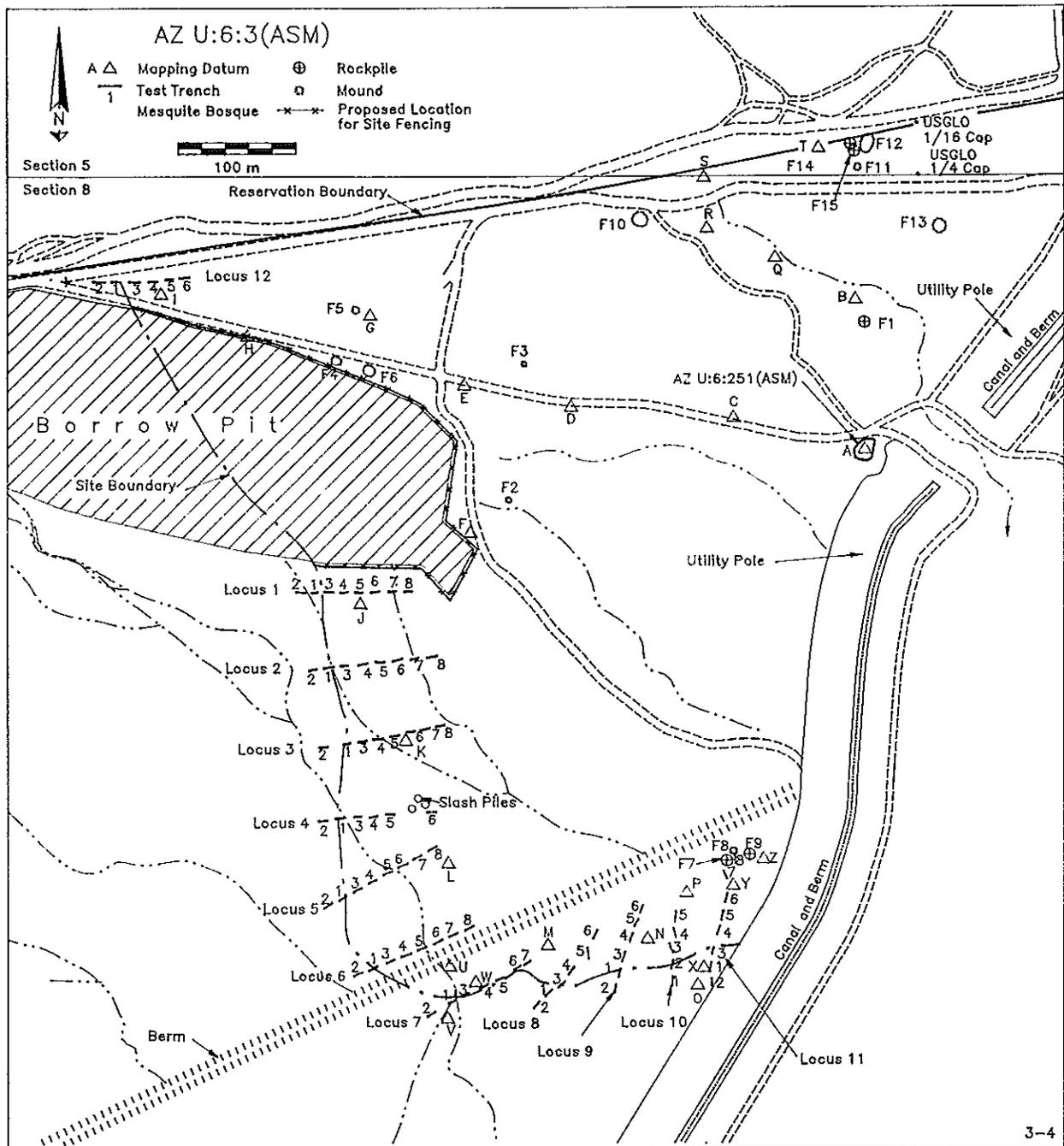


Figure 3. Site map of AZ U:6:3(ASM) showing surface artifacts and test trenches.

AZ U:6:81(ASM)

<i>Site Location:</i>	Township 4N, Range 7E, Sections 19 and 20
<i>Elevation:</i>	1480 ft
<i>Vegetation:</i>	Creosotebush, bursage, palo verde, mesquite, saguaro, cholla, barrel cactus
<i>Landform:</i>	Western terrace of the Verde River
<i>Soils:</i>	Gravelly silt and sand loam
<i>Site Area:</i>	103,000 m ² (450 x 230 m) approximately 810,000 m ² including surrounding agricultural fields
<i>Cultural/Temporal Affiliation:</i>	Late Pioneer/Early Colonial period Hohokam

Description: This is a large Hohokam habitation site surrounded by agricultural fields with rock-pile features and low-density artifact scatters (Figure 4). The habitation area is identified by a very high frequency and diversity of artifacts, including mano and metate fragments, shell fragments, chipped stone of various materials, and plain ware and red-on-buff sherds. Surface features in this core area include trash mounds, rockpiles, and fire-cracked rock concentrations that could be hornos or roasting pits. Subsurface features found in backhoe trenches include pithouses, trash concentrations, and thermal and non-thermal pits. This site is overlain by historic sites AZ U:6:249 and U:6:250(ASM).

Site condition: The site is well preserved. Several two-track roads run through the site, and a number of small drainages are present. Some concrete debris and dirt have been dumped next to a road in the southern portion of the site

Discussion of Fieldwork: Examination of this site revealed extensive agricultural fields surrounding the site as originally defined by ASM (Canouts 1975). The primary boundary definition task entailed the discrimination of the agricultural fields from the occupation area of the site, referred to as the core area. The boundary separating the two areas was determined on the basis of the criteria listed in Table 3.

Since the site turned out to be much larger than defined by the task order, mapping was done in detail in only three portions of the site core. The surrounding agricultural fields were cursorily examined and approximate boundaries were marked with pink and white flagging; blue and white flagging was used to mark the boundaries of the core area (Figure 4). All features, both surface and subsurface, were mapped by transit.

In total, 104 5-m trenches in 20 loci were excavated along 1100 m of site core perimeter (Figure 5). Two additional testing loci would have effected AZ U:6:250(ASM), a historic site not slated for testing and, therefore, were not excavated. Thirteen features were identified during the test trenching (Table 4). As defined by ASM, the site encompassed 25 acres; this area is roughly equivalent to the core area defined by ACS. The overall site, which includes two areas of large agricultural fields separated by a large wash, includes 200 acres. Furthermore, the site may continue across a wash at the south end of the site into the southwest quarter of Section 19.

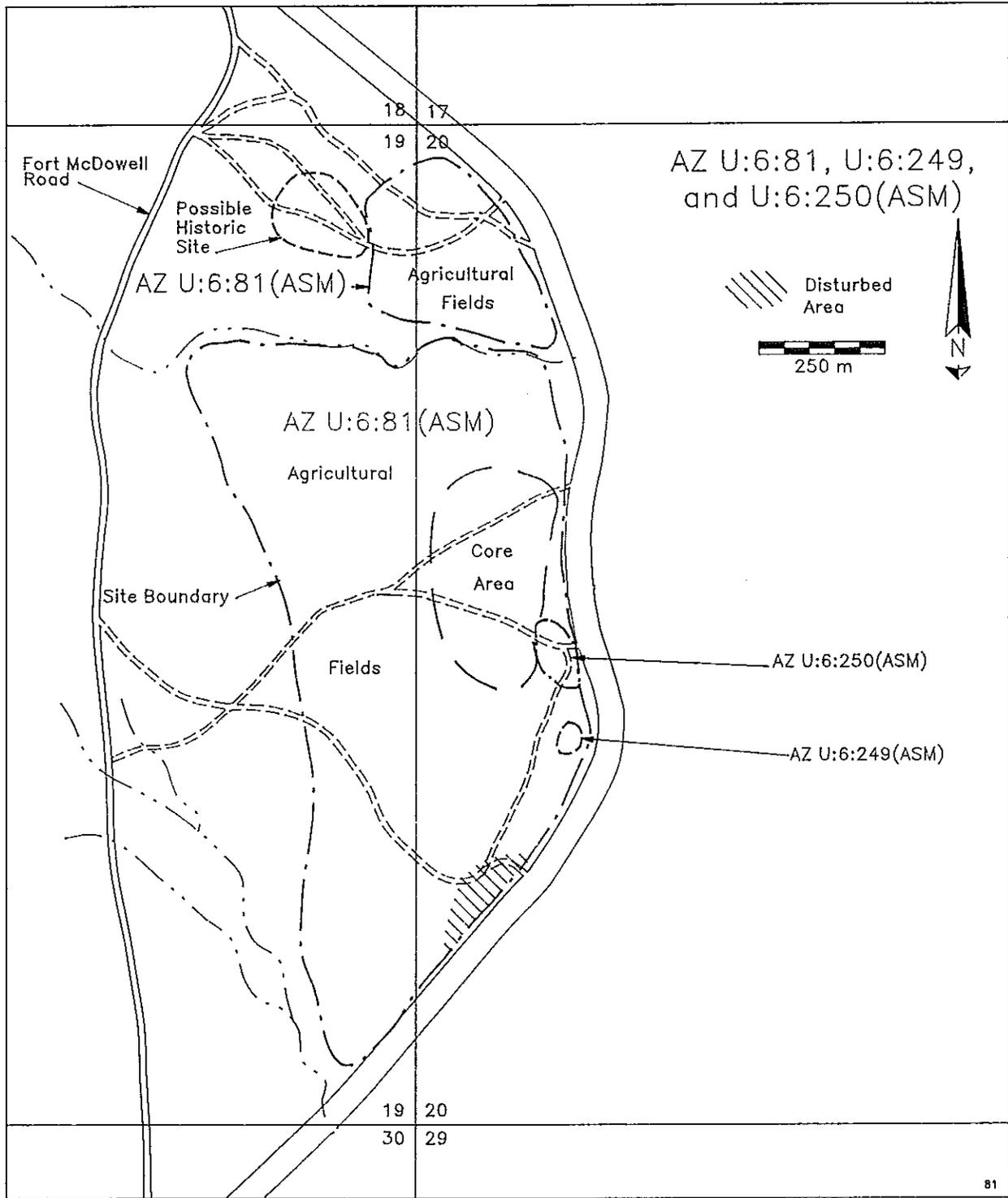


Figure 4. Area map showing AZ U:6:81, U:6:249, and U:6:250(ASM).

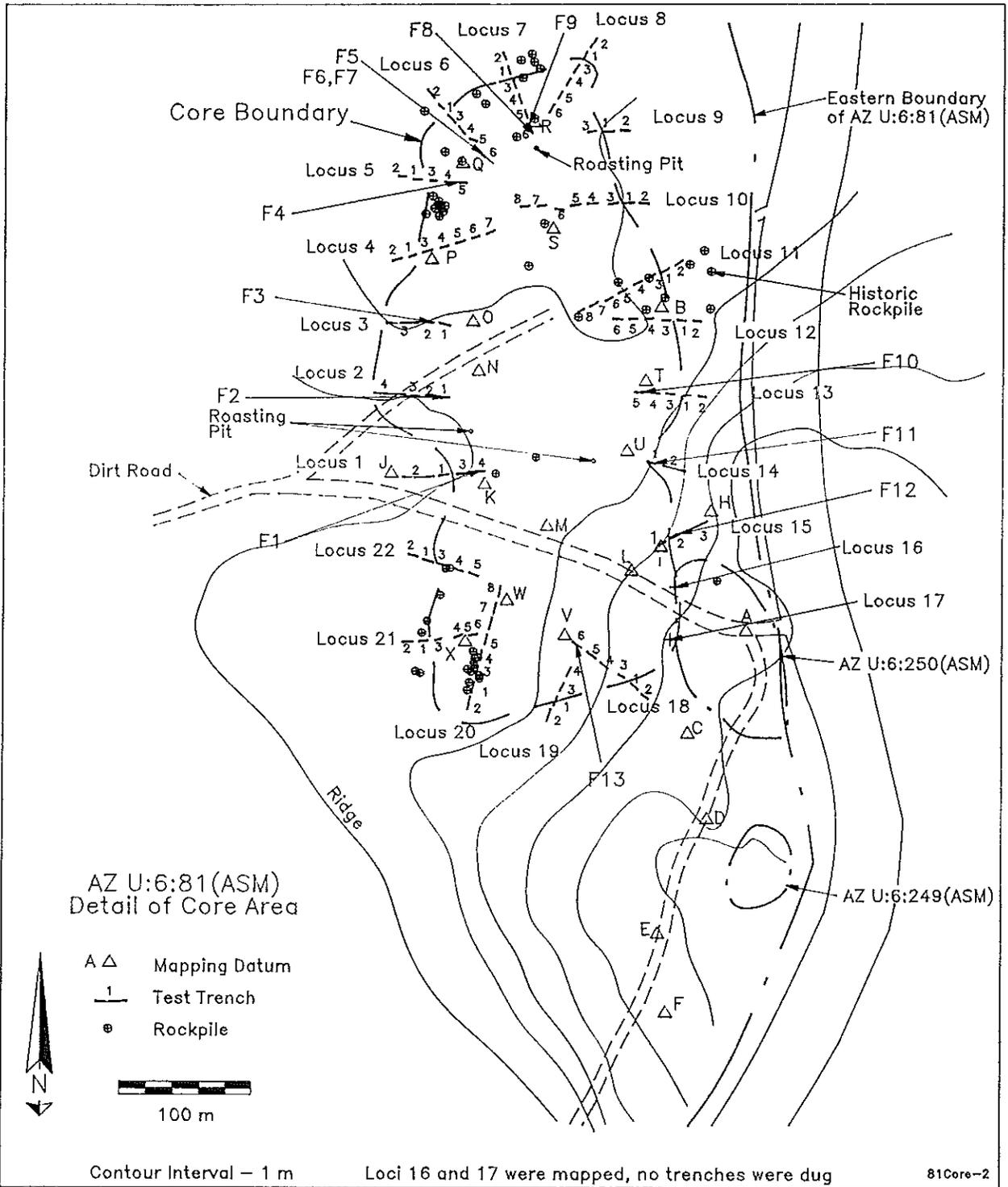


Figure 5. Detail map of AZ U:6:81(ASM) core area showing surface features and test trenches.

**Table 3. Criteria Used to Define Agricultural and Habitation Areas
at AZ U:6:81(ASM).**

Agricultural	Habitation
Discontinuous artifact distribution	Continuous artifact distribution
Isolated chipping stations	Greater artifact diversity
Dispersed features	Presence of a wide variety of feature types including houses
Rockpiles as major feature type	High artifact density
Low artifact density	Higher ratio of ceramics to lithics
Artifacts primarily chipped stone, scrapers and tabular knives	Presence of decorated wares
Expedient tool types	Presence of more formal tool types
Ground stone found almost exclusively in association with rockpiles	Ground stone found throughout

A possible historic homestead was identified immediately northwest of AZ U:6:81(ASM). The site is composed of three concrete slab foundations and household trash. The site was not previously recorded and was not examined in detail during the current project. The age of this site is not known. Reclamation was notified about its presence, and additional work will take place to determine the age of the site and its eligibility for inclusion on the National Register of Historic Places.

**Table 4. Subsurface Features Identified
During Testing at AZ U:6:81(ASM).**

Feature #	Locus	Trench	Feature Type
1	1	4	Pit
2	2	1	Pit
3	3	2	Pit (roasting)
4	5	5	Pithouse
5	6	6	Pit
6	6	6	Pit
7	6	6	Pit
8	7	6	Pithouse
9	7	6	Pithouse
10	13	5	Pit (roasting)
11	14	1	Pit (trash-filled)
12	15	2	Midden
13	18	6	Midden

AZ U:6:87(ASM)

Site Location: Township 4 North, Range 7 East, Section 30
Elevation: 1470 ft
Vegetation: Creosotebush, bursage, palo verde, mesquite, saguaro, cholla
Landform: Western alluvial terrace of the Verde River
Soils: Gravelly silt and sandy loam
Site Area: 87,500 m² (350 x 250 m)
Cultural/Temporal Affiliation: Prehistoric Hohokam

Description: The site consists of a dense scatter of prehistoric artifacts. These artifacts include high numbers of ceramics, chipped stone of various types, and low counts of ground stone fragments. One concentration of fire-cracked rock, a possible horno or roasting pit, was visible on the surface. Two burned pithouses and an ash pit were discovered in backhoe trenches in the southwestern portion of the site (Table 5). A buff ware jar was found on the floor of one house.

Site Condition: The full extent of AZ U:6:87(ASM) is unknown. Modern agricultural fields located east of the site may have removed a large section of it. Prior to working at AZ U:6:87(ASM), the northern edge of the site was impacted by recent clearing of vegetation by heavy machinery. Only one feature, a fire-cracked rock concentration (Feature 4), was identified in this area. Ft. McDowell Road cuts through the eastern half of what remains of this site, as do several two-track roads and a historic irrigation ditch.

Subsurface features found in the trenches were in good condition, and it is believed that, in general, the subsurface portion of the site is in good condition.

It is important to note that the subsurface features were located in the southwestern portion of the site, where little surface artifactual material was found. The historic double-bermed irrigation ditch and a wash bound this area to the south and the east. It is suspected that sediments trapped by the berms resulted in the burial of the cultural remains in this portion of the site.

Discussion of Fieldwork: Since the eastern edge of the site abutted the terrace edge and is currently in agricultural use, subsurface testing was not necessary in this area to determine the location of the site boundary. Nine testing loci were excavated along the northern and western site boundary; no subsurface remains were identified.

Table 5. Features Identified at AZ U:6:87(ASM).

Feature #	Locus	Trench	Feature Type
1	7	1	Pithouse
2	12	2	Pithouse
3	12	1	Ashpit
4	surface		Fire-cracked rock concentration

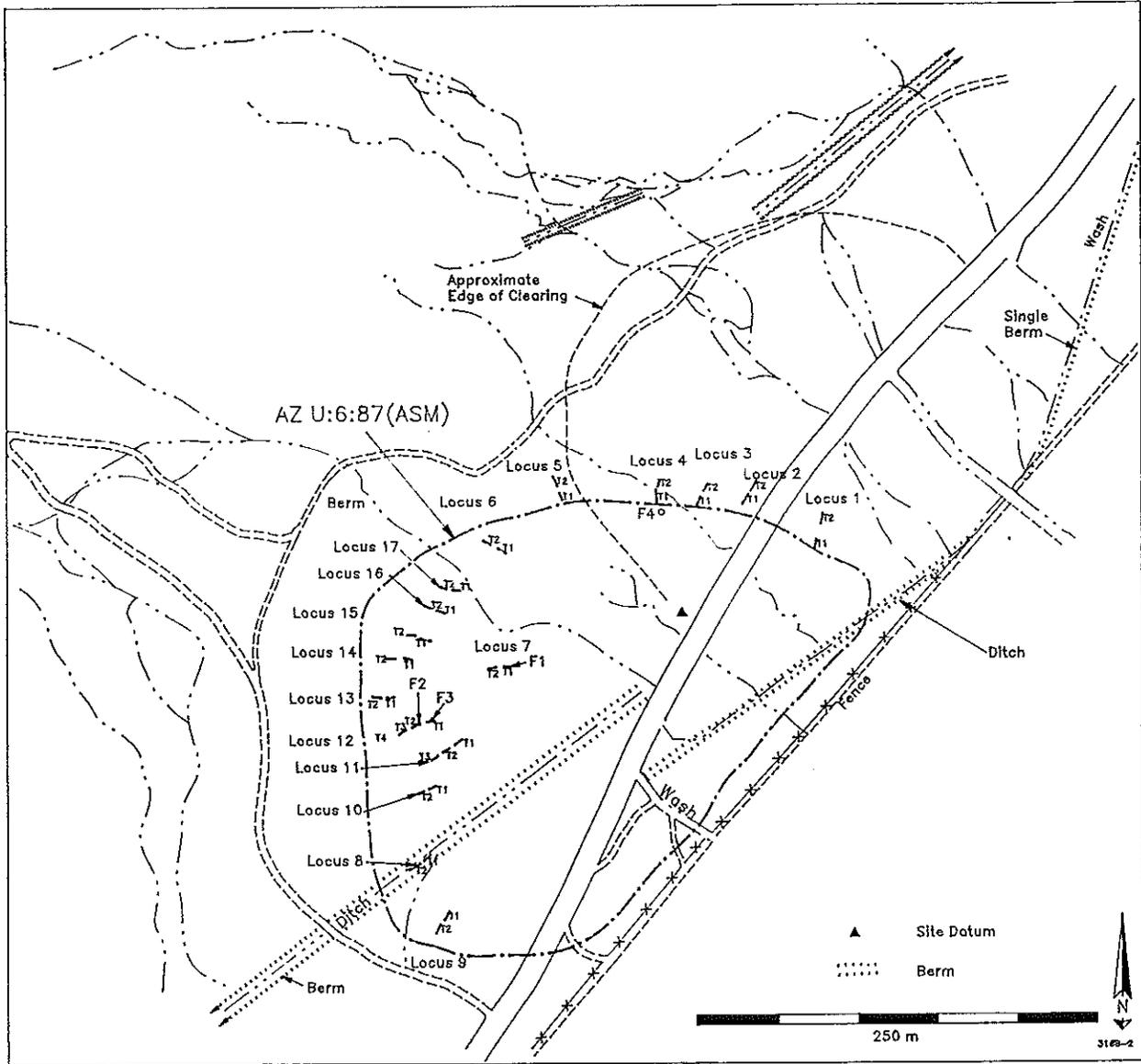


Figure 6. Area map of AZ U:6:87(ASM).

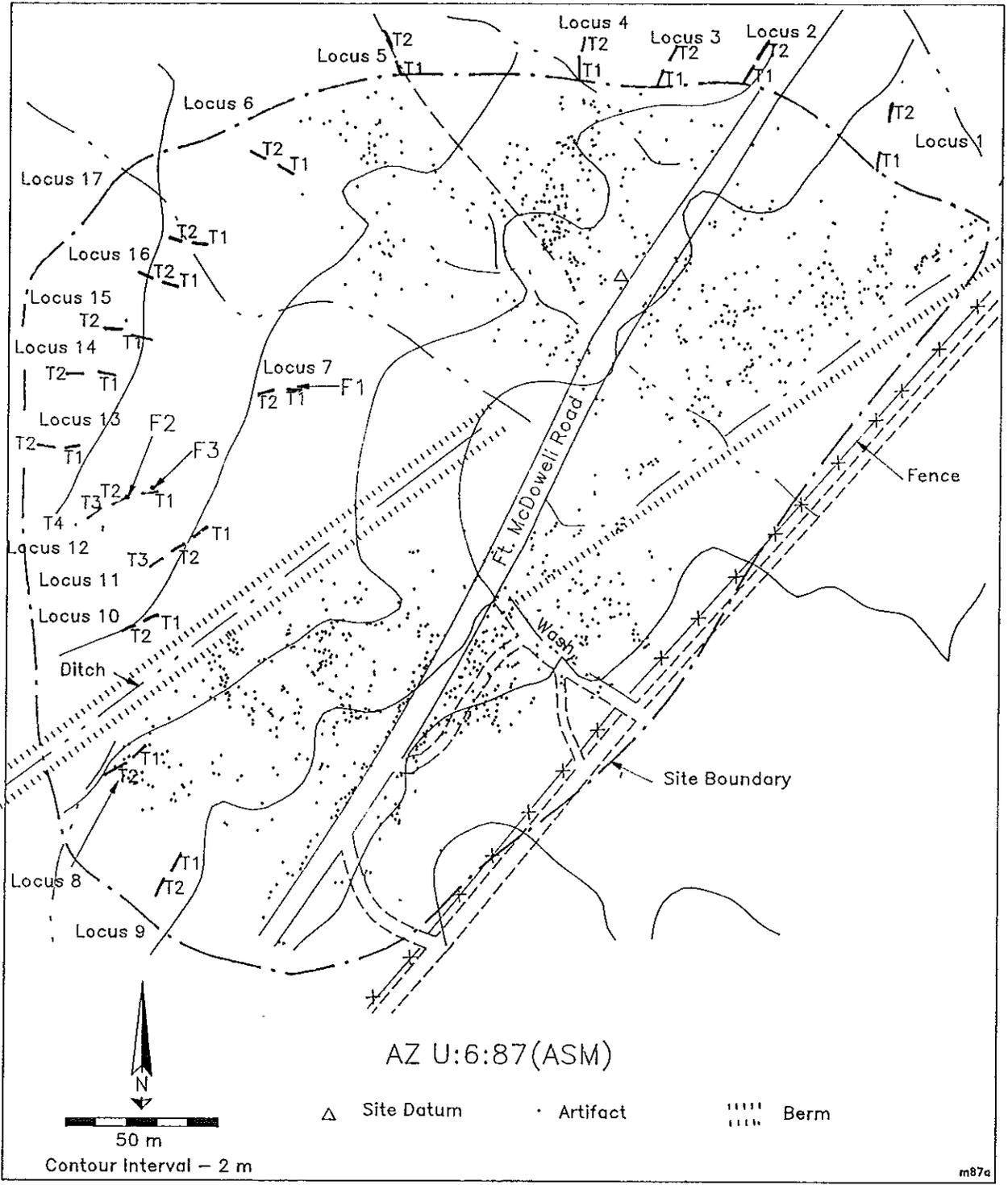


Figure 7. Site map of AZ U:6:87(ASM) showing test trenches and features.

Based on surface evidence, the site exhibited a rather odd L-shape that seemed to correlate with a wash and a double-bermed ditch. Only a few isolated artifacts, far below the site-defining density level, were found on the ground beyond the ditch. To be sure that site did not continue beyond the ditch a locus of trenches was excavated (Locus 7). A Hohokam pithouse was identified in the first 5-m trench. The pithouse, was slightly burned and contained a buff ware jar at floor contact. No chronological indicators were found. This finding resulted in additional trenching, and two more subsurface features, another pithouse and an ashpit, were identified in Locus 12. In total, 38 5-m trenches in 17 loci were excavated along 590 m of site perimeter. The site was found to encompass 21.6 acres, considerably larger than the 2.3-acre size recorded by ASM.

AZ U:6:248(ASM)

<i>Site Location:</i>	Township 4 North, Range 7 East Section 8
<i>Elevation:</i>	1500 ft
<i>Vegetation:</i>	Creosotebush, bursage, saguaro, mesquite, cholla
<i>Landform:</i>	West terrace of the Verde River
<i>Soils:</i>	Sandy loam
<i>Site Area:</i>	10,000 m ² (100 x 100 m)
<i>Cultural/Temporal Affiliation:</i>	Gila Butte phase of Colonial period Hohokam

Description: The site is a dense scatter of artifacts at the surface, exposed by machinery during the vegetation clearing. The wide range of artifacts, which include plain and red-on-buff ceramics, chipped stone of several local material types, mano and metate fragments, and a few pieces of shell, suggest that it is an habitation site. Artifacts are eroding out of a small drainage and in places where the machinery has turned up the ground, suggesting subsurface remains.

Site Condition: The surface of this site has been greatly disturbed by heavy machinery used in the clearing of vegetation. However, this disturbance does not appear to have been deep enough to destroy subsurface integrity. A small drainage cuts through the northern boundary of the site.

Discussion: Because the site had not been previously recorded it was not addressed by the Reclamation task order. At their request, mapping, boundary definition, and limited testing were conducted. The boundary was defined on the basis of the surface evidence, and 5-m-long backhoe trenches were excavated at approximately 25 m intervals along the 390 m-perimeter (Figure 8). The trenches were dug to a depth of 5 ft, then faced and inspected for cultural remains. When subsurface artifacts or features were identified, a second trench was dug 5 to 10 m farther from the center of the site, continuing until no cultural remains were found. Eleven trenches were excavated at nine loci. Artifacts were identified in two trenches, but no features were found.

Subsequently, three trenches were excavated in the area of densest artifact distribution. This trenching revealed three features, two midden deposits and a pit (Figure 8; Table 6). These features were photographed, profiled, and located on the site map. Since the site was first recorded during this testing project, it has not been evaluated for National Register eligibility.

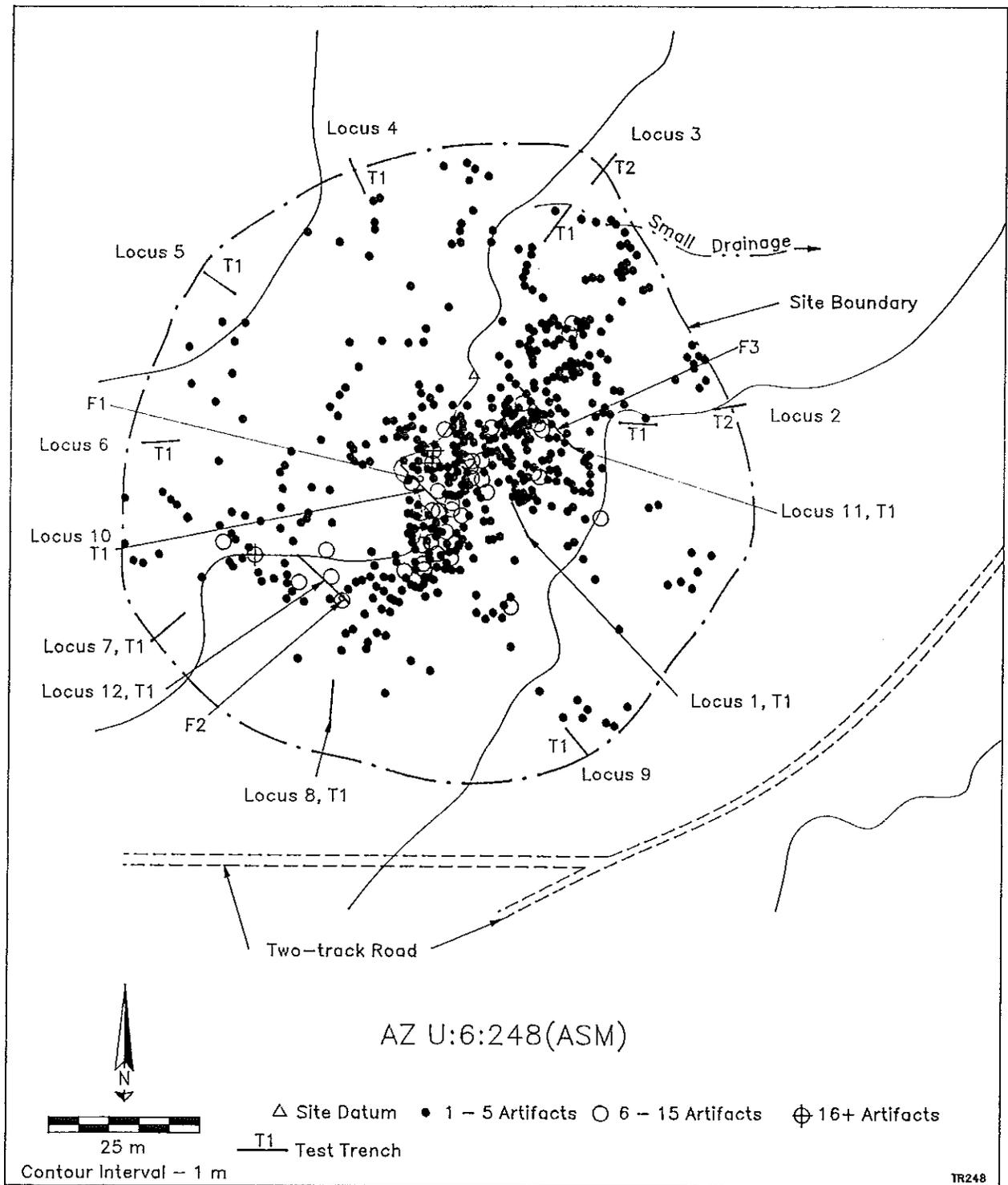


Figure 8. Site map of AZ U:6:248(ASM) showing surface artifacts and test trenches.

Based on the limited testing, the site appears to have depth. The full extent and nature of the site is not known, but it is likely a habitation area on the basis of the artifact diversity and density.

Table 6. Features Identified at AZ U:6:248(ASM).

Feature #	Locus	Trench	Feature Type
1	10	1	Midden
2	12	1	Pit
3	11	1	Midden

AZ U:6:249(ASM)

Site Location: Township 4 North, Range 7 East, Section 20
Elevation: 1480 ft
Vegetation: Creosotebush, bursage, mesquite, saguaro, palo verde, barrel cactus, cholla
Landform: West terrace of the Verde River
Soils: Gravelly silt and sandy loam
Site Area: 14,000 m² (140 x 100 m)
Cultural/Temporal Affiliation: Historic period Yavapai-Apache

Description: The site consists of a moderately dense scatter of historic household goods and trash dating to ca. 1900-1910 (Figure 9). Artifacts included metal hole-in-top cans, mule shoes, a tea kettle, an iron bed frame, and pieces of cast iron. Sun-colored amethyst and aqua glass, and some 1 x 2-in pieces of lumber are also present. No evidence of structures was found. However, the ARS survey site description indicates a building once existed as noted on the 1906 USGS map (Stone and Ayres 1984). This site is situated within the boundaries of AZ U:6:81(ASM). The site area is slightly smaller than that originally recorded by ARS, but comparable in the number and type of artifacts identified.

Site Condition: With the exception of minor erosion, site is intact.

Discussion of Fieldwork: All artifactual materials were mapped by transit. No trenching was done.

AZ U:6:250(ASM)

Site Location: Township 4N, Range 7E, Section 20
Elevation: 1480 ft
Vegetation: Creosotebush, bursage, palo verde, mesquite, saguaro, cholla
Landform: West terrace of the Verde River
Soils: Gravelly silt and sandy loam
Site Area: 12,000 m² (150 x 80 m)
Cultural/Temporal Affiliation: Historic period Yavapai-Apache

Description: This site, a homestead dating to the early to mid-twentieth century, consists of a wooden frame residential structure with a dirt floor and several outlying features. These features include an outhouse, chicken coop, collapsed ramada, concrete pad, wellhead, and three trash dumps. The trash dumps are located at the northern end of the site approximately 40-60 m from the structure. The outhouse is located in the southwestern portion of the site approximately 70 m from the structure. The ramada, wellhead, and platform are all near the dirt roads that pass through the site. Aside from the structures, the site has a dense scatter of historic household artifacts including glass, metal, boots, structural debris, and furniture. The artifactual material and site size are consistent with the original ARS site record. The site overlies a prehistoric site, AZ U:6:81(ASM) (Figure 10).

Site Condition: There is a fair amount of modern trash (glass bottles and aluminum cans) on the site. Two dirt roads of unknown age run through the site. The buildings are slumped due to age and disrepair, and the ramada has collapsed completely.

Discussion: All artifactual material and features were mapped by transit. No trenching was done.

AZ U:6:251(ASM)

<i>Site Location:</i>	Township 4N, Range 7E, Section 8
<i>Elevation:</i>	1500 ft
<i>Vegetation:</i>	Creosotebush, bursage, palo verde, mesquite
<i>Soils:</i>	Gravelly silt and sandy loam
<i>Site Area:</i>	3740 m ² (68 x 55 m)
<i>Cultural/Temporal Affiliation:</i>	Historic period Yavapai-Apache?

Description: The site is a dense scatter of historic trash (Figure 11) that includes pieces of china and porcelain, hole-in-top cans, sun-colored amethyst and aqua glass, cast iron stove parts, and one octagonal-head nail. No structures or other features were discovered at the site, which is within the boundaries of AZ U:6:3(ASM) (Figure 3). AZ U:6:251(ASM) was found to be approximately 310 m² smaller than was originally recorded.

Site condition: There are no signs of major disturbance to the site, other than the presence of a well-used dirt road, which runs along the northern boundary.

Discussion: All artifactual materials were mapped by transit. No trenching was done.

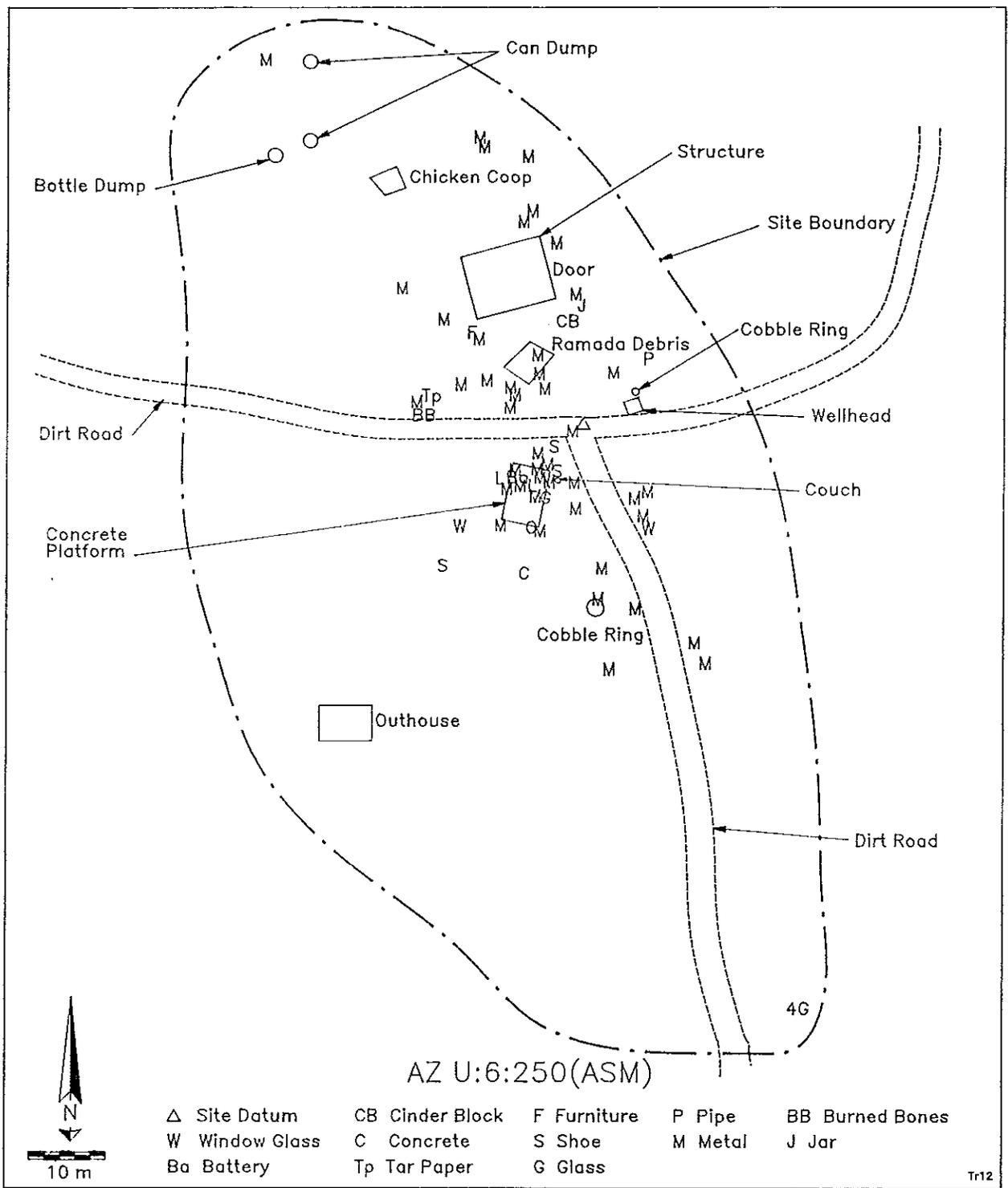


Figure 10. Site map of AZ U:5:250(ASM).



Figure 11. Site map of AZ U:6:251(ASM).

AZ U:6:252(ASM)

Site Location: Township 4N, Range 7E, Section 7
Elevation: 1550 ft
Vegetation: Creosotebush, bursage, palo verde, mesquite, saguaro, cholla, hedgehog cactus
Landform: Alluvial terrace west of the Verde River
Soils: Gravelly silt and sandy loam
Site Area: 10,000 m² (100 x 100 m)
Cultural/Temporal Affiliation: Prehistoric Hohokam

Description: The site is a dense scatter of prehistoric artifacts, including ceramic sherds, chipped stone debitage, and a few fragments of ground stone (Figure 12). Artifacts are present in the small drainages that run through the site, suggesting the possibility of buried resources. The site was found to be larger than the originally recorded size of 2800 m². No features were identified on the ground surface.

Site Condition: There are several small drainages that cut through the site. The site is otherwise intact.

Discussion: All artifactual material was mapped by transit. No trenching was done.

Recommendations

Four recommendations related to the mitigation of potential impacts as a result of the proposed agricultural development are presented below.

Mapping of the Agricultural Sites

As mentioned above, a large prehistoric agricultural site, AZ U:6:239(ASM), was found during the 200-acre survey associated with this study. The site consists of numerous, widely dispersed rockpiles. In a separate report (Adams 1993), recommendations were made regarding data recovery measures since the site would not be avoided by the proposed agricultural development. The recommendations have been reviewed and approved by Reclamation and SHPO. Similar prehistoric agricultural features were discovered surrounding the habitation core of AZ U:6:81(ASM), and since they will not be avoided by development, this component of the site will need to undergo data recovery.

The same measures recommended for AZ U:6:239(ASM) are proposed for the agricultural component of AZ U:6:81(ASM). These recommendations include detailed mapping of the location of the agricultural features with particular emphasis upon their relationship to the landscape. As argued previously, analysis beyond mapping would result in the recovery of very little additional information and is not recommended. Botanical analyses from similar rockpile fields in the lower Verde Valley (Jon Czaplicki, personal communication 1993) and in the Santan Mountains (Hutira 1989) have not been significantly informative.

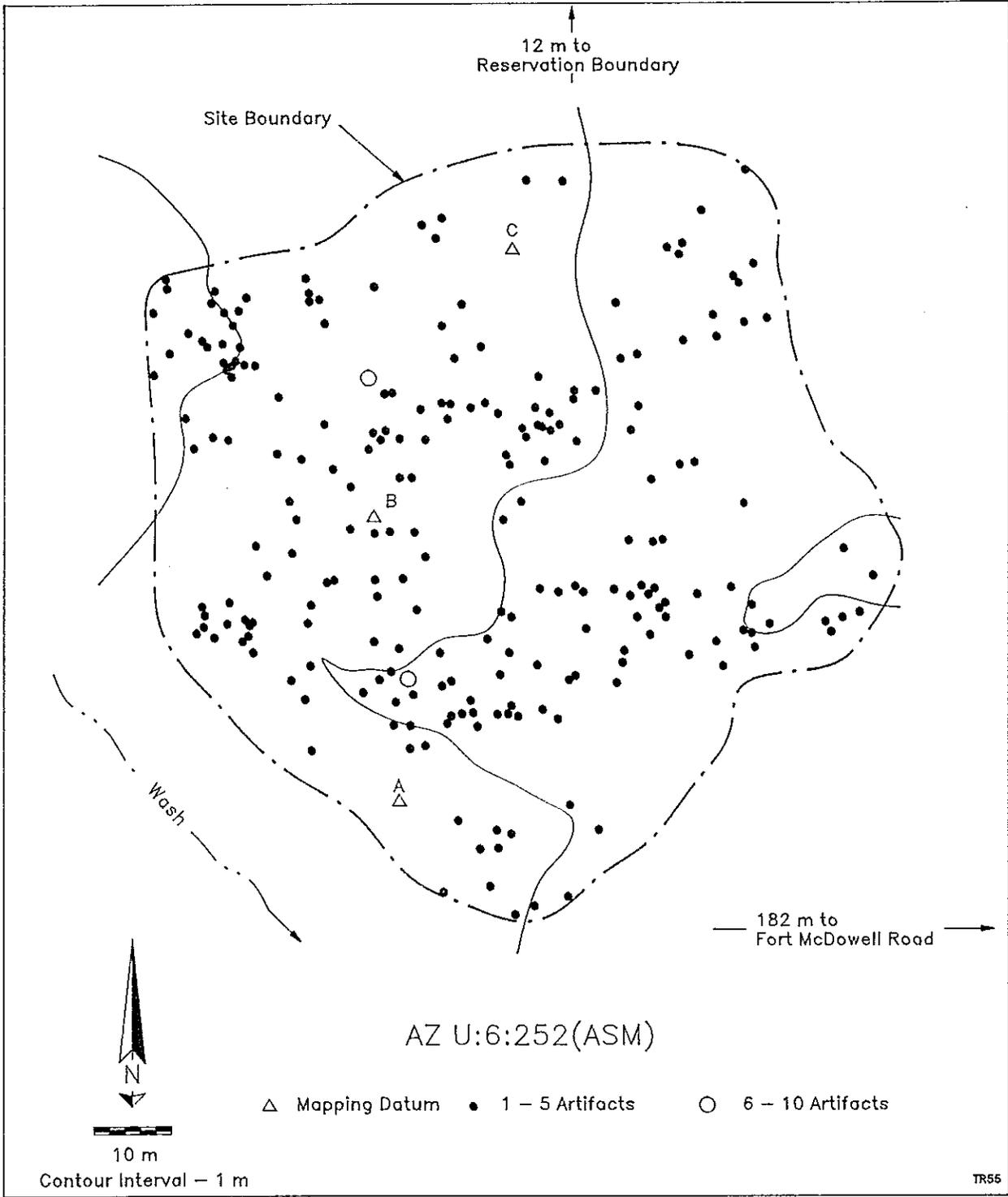


Figure 12. Site map of AZ U:6:252(ASM).

Further Survey to Define the Boundaries of the Agricultural Sites

It became obvious during the current project that agricultural fields were not often recognized during the earlier ASM survey in the vicinity of the project area (Canouts 1975). Survey of areas beyond the agricultural fields identified around sites AZ U:6:81 and U:6:239(ASM) is suggested. Archaeological assessment of any surrounding lands that will be impacted by development and have not been cleared of vegetation also is recommended. Specifically, systematic archaeological survey should be undertaken in the northwest quarter of Section 30 and the southwestern and southeastern quarters of Section 19.

Documentary Investigation of a Possible Historic Site

A possible historic site was found north of the agricultural portion of AZ U:6:81(ASM) (Figures 2 and 4). The age of this site is not known, but it is suspected that it is older than 50 years and therefore qualifies as a historic resource. Documentary investigation to determine this site's age and National Register eligibility status is recommended.

Avoidance of the Project Sites by Fencing

The testing conducted during the current project was very limited in scope and was intended only to define boundaries and confirm the presence of subsurface features. Fencing is recommended for sites AZ U:6:3, U:6:87, U:6:248, U:6:249, U:6:250, U:6:252 and the core of site U:6:81(ASM). Site AZ U:6:251(ASM) is located within AZ U:6:3(ASM) and, therefore, does not need to be fenced separately. Also, the fence at AZ U:6:3(ASM) will go around the existing borrow area even though the site once continued through this area. The fencing, which will follow the site boundaries are presented in the text and as marked in the field with blue and white flagging tape, will protect the sites from future impacts from the proposed development.

If avoidance is not possible then Phase I data recovery is recommended for every site that will be adversely affected. Phase I data recovery involves the determination of the nature and number of cultural deposits present and provides a means to finalize a full mitigation plan. A data recovery plan must be prepared and then approved by the SHPO before any data recovery efforts can be undertaken.

National Register Eligibility

Finally, a component of this investigation has been to provide a recommendation of the eligibility of the sites for inclusion in the State and National Registers of Historic Places. It is recommended that all of the sites are potentially eligible under criterion D.

References

ACS

- 1993 Revised Proposal for Class III (Intensive) Cultural Resources Survey and Site Boundary Delineation Through Surface Mapping and Limited Testing of the Fort McDowell Indian Community. Ms. on file, Archaeological Consulting Services, Ltd., Tempe.

Adams, Kim

- 1993 Archaeological Assessment of a Parcel Proposed for Agricultural Development on the Fort McDowell Indian Reservation, Maricopa County, Arizona. Ms. on file, Archaeological Consulting Services, Tempe.

Canouts, Valetta

- 1975 *An Archaeological Survey of the Orme Reservoir*. Archaeological Series No. 92. Arizona State Museum, Tucson.

Effland, Richard W., Jr.

- 1983 An Assessment of Cultural Resources for the Fort McDowell Irrigation Development Project. Ms. on file, Archaeological Consulting Services, Ltd., Tempe.

Hutira, Johna

- 1989 Appendix I. Results of Flotation Analysis. In *Final Report for the Santan Mountain-Julian Berry Land Exchange Fieldwork*, by Kim Adams, Ann Valdo Howard and Barbara S. Macnider, pp. 75-79. Cultural Resource Report No. 61a. Archaeological Consulting Services, Ltd., Tempe.

Stein, Pat H.

- 1984 Data Recovery for Phase I of the Fort McDowell Irrigation Betterment Project: Historical Archaeological at the Fort McDowell Indian Reservation, Maricopa County, Arizona. Ms. on file, Archaeological Research Services, Inc., Tempe.

Stone, Connie L.

- 1991 An Overview of Cultural Resources of Agricultural Development Parcels, Fort McDowell Mohave-Apache Indian Community, Maricopa County, Arizona. Ms. on file, Archaeological Consulting Services, Ltd., Tempe.

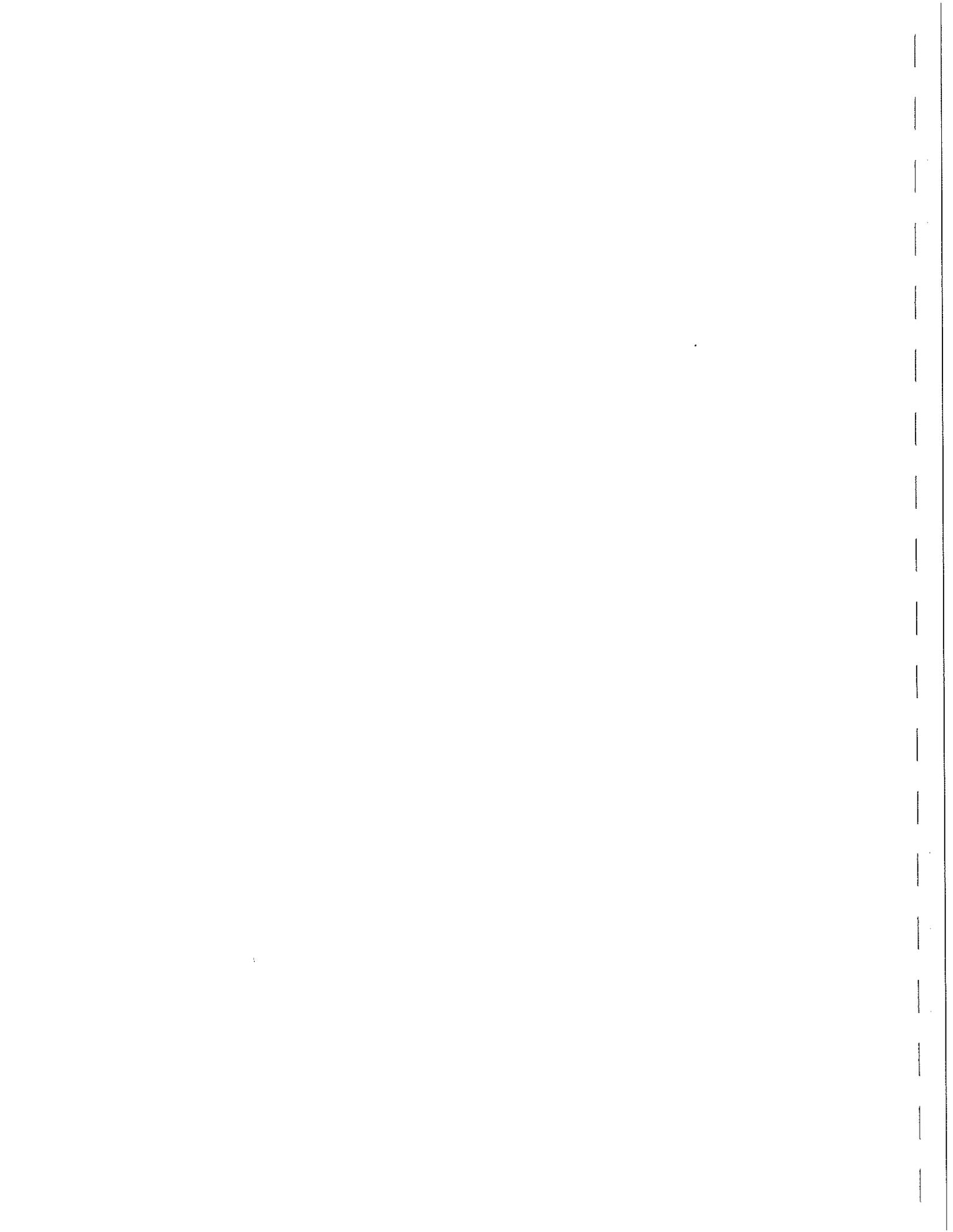
Stone, Lyle

- 1985 A Cultural Resource Evaluation of a 29 Acre Parcel on the Fort McDowell Indian Reservation. Ms. on file, Archaeological Research Services, Inc., Tempe.

Stone, Lyle, and James E. Ayres

- 1984 *An Evaluation of Historic Cultural Resources in Relation to the Central Arizona Water Control Study*. Archaeological Research Services, Inc., Tempe.

APPENDIX A:
ARTIFACT ANALYSES



Lithic Analysis

by Ruth Rubenstein

In total, 1,368 lithic artifacts were recovered from four sites, AZ U:6:3, U:6:81, U:6:87, and U:6:248(ASM). The artifacts were divided into two classes for analysis based on production type: ground stone and chipped stone. Ground stone artifacts were analyzed for raw material, form, and texture. Texture has been considered a good indicator of function (Greenwald 1990; Halbirt 1985), so these artifacts were divided into two texture categories: fine-grained and coarse-grained. Fine-grained materials have less than a 2 mm grain or vesicle size. Fine-grained materials were primarily used for processing small seeds or crushing already-processed corn kernels to a finer texture, whereas coarse-grained materials were used for processing larger seeds, such as corn, to a coarse-textured meal (Greenwald 1990; Halbirt 1985). Chipped stone artifacts were first divided by raw material and then placed into eight functional categories: debitage, flake tools, cores, core-tools, hammerstones, tabular tools, bifaces, and other formal tools. The debitage category consists of unutilized flakes, shatter, and broken flakes.

The raw materials were identified based on standard material classification (Schumann 1993) with the exception of the metavolcanic category. Metavolcanic rocks are divided into two types based on texture, fine and coarse. These materials contain a high degree of silica and appear almost glassy in texture. They usually contain phenocrysts and are often identified as vitrified basalt, fine-grained and porphyritic basalt, and meta-volcanic.

AZ U:6:3(ASM)

Lithic artifacts recovered from this site include four pieces of ground stone and 47 chipped stone artifacts. The ground stone was manufactured exclusively from vesicular basalt and includes two indeterminate ground stone fragments, one mano fragment, and one metate fragment. The forms of the mano and metate could not be determined as they were too fragmentary. The texture of the ground stone artifacts was predominately coarse-grained. This indicates that at least some degree of reliance on cultigens took place.

The chipped stone artifacts include 40 pieces of debitage, two flake tools, one core, one core-tool, two hammerstones, and one tabular tool. The artifacts were primarily manufactured from basalt (Table A-1).

AZ U:6:81(ASM)

Thirty-four ground stone and 1,268 chipped stone artifacts were recovered from this site. The ground stone artifacts consist of 22 metate fragments (seven trough metates and 15 metate fragments of indeterminate form), seven manos, and five indeterminate ground stone fragments (Table A-2). The majority of the ground stone artifacts were manufactured from vesicular basalt. The metates were all manufactured from vesicular basalt, whereas the manos were made from andesite, rhyolite, and vesicular basalt. The texture of the ground stone artifacts was predominately coarse-grained. The ground stone assemblage suggests a grinding of corn, as coarse-grained artifacts are associated with cultigens.

The chipped stone artifacts include 1,150 pieces of debitage, 39 flake tools, 52 cores, 11 core tools, 16 hammerstones, and 2 tabular tools (Table A-3). The presence of tabular tools on this site may indicate a subsistence strategy that involved agave horticulture. The collected lithics were predominately manufactured from basalt.

AZ U:6:87(ASM)

Only four lithic artifacts were recovered from this site, including two flakes, one core, and one core-tool (Table A-4). Two materials were utilized, basalt and quartzite.

AZ U:6:248(ASM)

Four ground stone artifacts (manos) were recovered from this site. They were all manufactured from coarse-grained vesicular basalt. One mano was whole and was identified as a one-hand rectangular mano measuring 16.5 cm long, 9.5 cm wide, and 4.0 cm thick.

Sixty chipped stone artifacts were recovered from this site (Table A-5). The chipped stone assemblage consisted of 46 pieces of debitage, one flake tool, eight cores, two core tools, and three hammerstones. The artifacts were predominately manufactured from basalt.

Table A-1. Chipped Stone Artifacts from AZ U:6:3(ASM).

Raw Material	Debitage	Flake Tools	Cores	Core Tools	Hammerstones	Tabular Tools	Total
Andesite	2	1	0	0	0	1	4
Basalt	19	1	0	0	0	0	20
Chalcedony	2	0	0	0	0	0	2
Conglomerate	1	0	1	0	0	0	2
Greenstone	7	0	0	0	0	0	7
Metavolcanic (fine-grained)	8	0	0	0	0	0	8
Quartzite	1	0	0	1	2	0	4
Total	40	2	1	1	2	1	47

Table A-2. Ground Stone Artifacts from AZ U:6:81(ASM).

Raw Material	Indeterminate Form	Indeterminate Mano	Indeterminate Metate	Trough Metate	Total
Andesite	0	1	0	0	1
Rhyolite	0	1	0	0	1
Vesicular basalt	5	5	15	7	32
Total	5	7	15	7	34

Table A-3. Chipped Stone Artifacts from AZ U:6:81(ASM).

Raw Material	Debitage	Flake Tools	Cores	Core Tools	Hammerstones	Tabular Tools	Total
Andesite	39	0	0	0	0	0	39
Basalt	545	18	12	1	5	0	580
Chalcedony	27	0	2	0	0	0	29
Chert	25	3	4	1	0	0	33
Conglomerate	19	1	3	2	3	0	28
Diabase	2	1	1	1	1	0	6
Granite	1	0	0	0	0	0	1
Graywacke	28	4	2	1	3	0	38
Greenstone	76	0	2	2	1	0	81
Jasper	11	1	2	0	0	0	14
Metavolcanic (fine-grained)	246	6	15	3	0	0	269
Metavolcanic (coarse-grained)	3	0	0	0	0	0	3
Quartz	13	0	0	0	0	0	13
Quartzite	84	3	9	0	1	2	99
Rhyolite	23	0	0	0	0	0	23
Sandstone	3	2	0	0	1	0	6
Schist	1	0	0	0	1	0	2
Siltstone	3	0	0	0	0	0	3
Unknown	1	0	0	0	0	0	1
Total	1,150	39	52	11	16	2	1,268

Table A-4. Chipped Stone Artifacts from AZ U:6:87(ASM).

Raw Material	Debitage	Flake Tools	Cores	Core Tools	Total
Basalt	0	1	0	0	1
Quartzite	0	1	1	1	3
Total	0	2	1	1	4

Table A-5. Chipped Stone Artifacts from AZ U:6:248(ASM).

Raw Material	Debitage	Flake Tools	Cores	Core Tools	Hammer-stones	Tabular Tools	Total
Andesite	5	0	0	1	0	0	6
Basalt	23	1	3	1	0	0	28
Chalcedony	1	0	0	0	0	0	1
Diabase	2	0	0	0	2	0	4
Greenstone	4	0	2	0	0	0	6
Metavolcanic (fine-grained)	6	0	0	0	0	0	6
Quartzite	4	0	3	0	1	0	8
Rhyolite	1	0	0	0	0	0	1
Total	46	1	8	2	3	0	60

Ceramic Analysis

by Mac McDonnell

AZ U:6:3(ASM)

Eighteen plain ware sherds and two decorated buff ware sherds were recovered (Tables A-6 and A-7). Five of the plain ware sherds had Wingfield temper, five had unidentified schist temper, and eight had unidentified sand temper. The two decorated buff ware sherds were too small to identify, making chronological placement impossible.

AZ U:6:81(ASM)

More ceramics were recovered from this site than from the other three combined. In total, 503 sherds were analyzed, of which 448 were plain ware, 38 were decorated ware, and 17 were non-decorated buff ware sherds. The plain ware sherds were sorted into three temper categories: Wingfield, unidentified schist-tempered, and unidentified sand-tempered (Table A-7).

The 38 decorated sherds were identified as Gila Butte Red-on-buff, Gila Butte Red-on-pseudo-buff, Gila Butte/Snaketown Red-on-Buff transitional, and Snaketown Red-on-buff. The remaining 11 red-on-buff ware sherds were too small to identify further. The category of pseudo-buff ware was created to describe a ceramic with a paste almost identical in texture to the buff ware paste of the Gila/Salt Basin but with a non-Gila Butte schist temper. The pseudo-buff ware paste also differs from the plain ware paste at this site, which is finer in texture than the typical plain ware paste of the Gila/Salt Basin. All plain ware ceramics collected for this project were similar in past and temper.

The identification of 35 of the decorated sherds was based on the presence and spacing of incised lines; only three had enough design left to aid in identification. Most of the sherds were too small for surface treatment analysis. All of the sherds were from ceramic vessels manufactured by the paddle and anvil technique. The majority of the vessels had been hand-smoothed; only a few sherds showed evidence of polishing.

The recovery of a few Snaketown phase sherds and the lack of any Santa Cruz phase sherds suggests that this site was probably occupied between A.D. 500 and 700.

AZ U:6:87(ASM)

Two unidentified sand-tempered sherds and one decorated pseudo-buff ware sherd were recovered. The pseudo-buff ware sherd was too small to identify, making chronological placement impossible.

AZ U:6:248(ASM)

Fifty plain ware sherds, three decorated buff ware sherds, and five non-decorated buff ware sherds were recovered from this site. Twenty-five of the plain ware sherds were tempered with Wingfield temper, whereas the remaining plain ware sherds have either unidentified schist temper or unidentified sand temper. Four of the 13 unidentified sand-tempered sherds may be pseudo-buff ware.

One of the decorated buff ware sherds is a possible Santa Cruz/Sacaton Red-on-buff. The remaining two decorated sherds were too small to identify. Based on the single identified sherd, this site was probably occupied during the late Santa Cruz or early Sacaton phase, approximately A.D. 900.

Table A-6. Ceramic Types Collected from the Project Area.

ASM Site #	Santa Cruz-Sacaton R/B	Gila Butte R/B	Gila Butte Red-on-Pseudo-Buff	Snaketown-GB Red-on-Pseudo-Buff	Snaketown Red-on-Pseudo Buff	Indet. R/B	Non-decorated R/B	Plain	Total
AZ U:6:3	0	0	0	0	0	2	0	18	20
AZ U:6:81	0	7	11	6	3	11	17	448	503
AZ U:6:87	0	0	0	0	0	1	0	2	3
AZ U:6:248	1	0	0	0	0	2	5	50	58
Total	1	7	11	6	3	16	22	518	584

Table A-7. Plain Ware Sherds by Temper Type.

ASM	Wingfield	Unidentified	Unidentified	
AZ U:6:3	5	5	8	18
AZ:U:6:81	2	218	228	448
AZ U:6:87	0	0	2	2
AZ:U:6:248	25	13	12	50
Total	32	236	250	518

References

Greenwald, Dawn M.

1990 *A Functional Evaluation of Hohokam Grinding Systems*. Unpublished Master's thesis, Department of Anthropology, Northern Arizona State University, Flagstaff.

Halbirt, Carl Dale

1985 *Pollen Analysis of Metate Wash Samples: Evaluating Techniques for Determining Metate Function*. Unpublished Master's thesis, Department of Anthropology, University of New Mexico, Albuquerque.

Schumann, Walter

1993 *Handbook of Rocks Minerals and Gemstones*. Houghton-Mifflin Company, Boston.

All lands within the exterior boundaries of the Fort McDowell Yavapai Nation are held in trust by the Federal Government for the Fort McDowell Yavapai Nation. All activities taking place within the exterior boundaries of the FMYN are under the direction and authority of the tribal government. This proposal is being submitted by the Environmental Director of the Fort McDowell Yavapai Nation.

The rights to water are based on the Fort McDowell Indian Water Settlement Act of 1990. Under this Settlement, the FMYN received 36,350 acre feet of water annually. This includes 18,117 acre feet of Verde River water.

Appendix A

Pilot Project Site



Pilot Project Site



Giant Reed Sites



Giant Reed Treatment



Appendix B

FORT MCDOWELL YAVAPAI NATION
Initial Treatment of Invasive Plant Species Along
the Verde River and at the Fort McDowell
Yavapai Materials Plant

November 30- December 4, 2015

&

December 7-11, 2015

Prepared by:

Melissa McMaster

Mariposa Ecological and Botanical Consulting, LLC

February 20, 2016



Table of Contents

EXECUTIVE SUMMARY..... 3

INTRODUCTION 3

TRIP OBJECTIVES 4

LOGISTICS AND PERSONNEL..... 4

METHODS..... 5

 VERDE RIVER 5

Giant reed5

Tree tobacco.....5

 FMY MATERIALS PLANT..... 5

Tree tobacco.....5

RESULTS 6

 VERDE RIVER 6

 FMY MATERIALS PLANT..... 6

CONCLUSIONS AND RECOMMENDATIONS..... 10

 VERDE RIVER 10

 FMY MATERIALS PLANT..... 10

 RETREATMENT PROPOSED SCHEDULE, SPRING 2016..... 10

Executive Summary

Mariposa Ecological and Botanical Consulting and Morning Dew Landscaping implemented the invasive plant removal plan along the Verde River and at the Fort McDowell Yavapai Materials plant. During a two-week period, we treated a total of 22,540 square feet of invasive plant species along the river. There were 26 populations of giant reed totaling 18,482 square feet (~0.5 acre) and 23 populations of tree tobacco totaling 4,058 square feet along the river. The entire infestation (~10 acres) of tree tobacco at the materials plant was also treated. All of these plants were cut down, the biomass removed and the stumps then sprayed with an aquatic approved herbicide. We expect the initial removal and treatment with herbicide to be highly effective, however, some retreatment will be necessary. We have been monitoring several populations of giant reed for regrowth since mid-January and will continue to visit the sites every two weeks until regrowth is observed. Once we observe regrowth, we will coordinate with the FMYN Environmental Department to initiate the second phase of treatment. The same process will occur for regrowth of the tree tobacco both along the river and at the Fort McDowell Yavapai Materials plant. It is anticipated the second phase of treatment will occur in March.

Introduction

During the spring and summer of 2015, Mariposa Ecological and Botanical Consulting, LLC (Mariposa) conducted surveys along the Verde River to identify populations of invasive plant species to be treated during the fall/winter of 2015. Mariposa identified 19 populations of giant reed and 20 populations of tree tobacco along the river. An additional trip was done in November 2015 to survey channels that we had not surveyed in the initial trips and we found 4 more populations of giant reed.

Mariposa sub-contracted with Morning Dew Landscaping to implement the treatment of invasive plant species. The timing of treatment was based on two main factors: the best timing for the most effective treatment (i.e. greatest absorption of herbicide) and the river level. Late fall and early winter is the best time to treat giant reed as the plants are going dormant, taking all energy reserves into their roots thus making herbicide treatments more effective. Ideal water flows for treatment are between 200 and 400 cubic feet per second (CFS) on this section of the Verde River. We needed enough water to be able to float in our boats, but if the water level was above 500 CFS, it would be too swift and the plants could be partially underwater. To effectively treat the plants, we need to be able to access the base of the majority of each plant and if the water is high, that becomes difficult. Giant reed reproduces vegetatively meaning that if there are any pieces of the plant that remain in the water that piece of plant will develop roots and establish as a new plant. Because of this, all of the biomass of the giant reed had to be placed above the high water mark on the bank of the river so it would dry out and decay.

Fort McDowell Yavapai Nation: Initial Treatment of Invasive Plant Species Along the

Mariposa discovered a large infestation of tree tobacco at the Fort McDowell Yavapai Materials plant in October 2015. It is unclear how and when the plants or seeds were introduced to the area, but there were several large infestations along the dyke that separates the plant from the river and along the ponds and mud flats. Coordination and cooperation with the plant manager enabled the work to be done quickly and efficiently.

Trip Objectives

1. Control giant reed (*Arundo donax*) populations along the river
2. Control tree tobacco (*Nicotiana glauca*) populations along the river
3. Collect data (location and area of infestation) for each population treated
4. Survey for additional populations of invasive plant species; including but not limited to giant reed and tree tobacco
5. Survey the tree tobacco populations at the Fort McDowell Yavapai Materials Plant for treatment
6. Control tree tobacco populations at the Fort McDowell Yavapai Materials Plant
7. Install vegetation mapping plots along the river to add to database for vegetation map
8. Photo documentation of invasive plant populations along the river

Logistics and Personnel

Mariposa subcontracted with Morning Dew Landscaping to conduct two trips to the Fort McDowell Yavapai Nation to conduct invasive plant removal along the Verde River and at the Fort McDowell Yavapai Materials Plant. The first trip took place November 30-December 4, 2015 to remove giant reed and tree tobacco along the Verde River. The crew consisted of 5 employees from Morning Dew: the company owner, a landscape architect, two herbicide specialists, and 1 laborer. Melissa McMaster (principal plant biologist) from Mariposa worked with the crew on most days but spent some time collecting data for the vegetation map. The crew spent five days working along the river and completed removal from river mile 1 to river mile 5. We set up a base camp near the Adventure Resort to save time packing and unpacking camp each day.

Morning Dew Landscaping conducted the removal of tree tobacco at the FMY Materials Plant December 7-11, 2015. The crew consisted of two herbicide specialists and a laborer. Because crews were not able to treat the entire Verde River section during the first trip, an additional crew worked along the river December 8-11. Working onsite were the landscape architect, one crew leader and two laborers. Ms. McMaster was available for assistance with logistics if necessary, but spent most of the time collecting data for the vegetation map.

Methods

Verde River

Giant reed

We accessed the majority of the sites via the river as all of the populations were growing along the banks of the river. Because we had already mapped the majority of the populations, we were able to float the river and scan for additional plants we may have initially missed and had detailed maps of each population to make it easier to find them.

At each site, we began by removing the biomass of the reeds. These plants can reproduce vegetatively so it was imperative to get all biomass out of the river. Access to some of the populations was challenging due to steep banks and dense vegetation. At times, we had to remove some native vegetation to access the plants we were treating. Our intention was to bundle the reeds to assist in carrying them up the banks, but we found it easier and more efficient to make smaller bundles and pass them up the bank. We cut the reeds down using loppers, hand pruners, and weed whackers with metal blades. The biomass was then moved to above the high water mark on the bank so it would be out of the water and dry out and decay. After the biomass was removed, the giant reed stumps were sprayed with herbicide (Table 1).

Table 1. Herbicides and concentrations used to treat giant reed and tree tobacco.

Trade Name	Active ingredient	Active Ingredient Concentration	Mixed Concentration
Polaris	Isopropylamine salt of Imazapyr	27.70%	1.25%
Round Up Custom	Glyphosate	53.80%	1.00%

Tree tobacco

Like the giant reed, tree tobacco also grows directly on the banks of the river. We cut the trees using handsaws, loppers, or a small chainsaw and placed the biomass above the high water mark. A stump of about 6 inches was left and then sprayed with herbicide. The same herbicide was used to treat both species (Table 1).

FMY Materials Plant

Tree tobacco

We coordinated with the FMY Materials Plant to conduct the removal of tree tobacco. The same cut-stump method was used on these plants. Crews used chainsaws, loppers and handsaws to cut the trees, leaving stumps between 2-6 inches. Those stumps were then sprayed with the same herbicides used along the river (Table 1). There was one small population of trees that were only cut and not sprayed with herbicide. Those trees

were growing in the mud flats and will be retreated with herbicide at a later date if necessary.

Results

Verde River

We treated a grand total of 22,540 square feet of invasive plant species along the river. Of that, giant reed comprised 18,482 square feet and tree tobacco 4,058 square feet. There were 26 populations of giant reed and 23 populations of tree tobacco (Table 2). Some of the populations of giant reed had several large plants within close proximity and therefore were considered one population. The tree tobacco often grew in small clumps and some of the populations consisted of several trees. Crews used 22 gallons of mixed herbicide to treat the giant reed and tree tobacco along the river. The herbicide was mixed at a rate of 1.25% or 1% of active ingredient with water.

Photo documentation was implemented at most giant reed sites. Crews attempted to take photos both before and after treatment. All photos will be given to the FMYN at the completion of the project and an example of the pre- and post-work photos can be seen in Figure 1. In addition, Mariposa will supply FMYN with a link to a Dropbox account to access all photos to date. Mariposa will also supply FMYN with a map of the populations along the river. The final map will be provided as both a hard copy and in GIS, but a preview of the plants treated in December 2015 will be provided in a Google Earth document.

FMY Materials Plant

Crews treated the entire area of infestation at the materials plant. The areas of greatest infestation were the steep banks of the dyke along the ponds and separating the plant from the river. There were also infestations in the mud flats and along the bank of the smaller pond on the north end of the plant. Crews used eight gallons of mixed herbicide to treat the tree tobacco. The herbicide was mixed at 1 or 1.25% with water. Almost all of these plants were in seed meaning there is still a significant seed source at the plant. These trees will need to be monitored and treated several times a year for the next few years to prevent another infestation.

Table 2. Populations of giant reed and tree tobacco treated in December 2015 along the Verde River. The population name consists of the four-letter species code (ARDO for giant reed and NIGL for tree tobacco), the river mile (to the tenth of a mile) and river side (right or left).

Species	Population name	Infestation in square feet
Giant reed	ARDO0.04L	2691
<i>Arundo donax</i>	ARDO0.09L	5382
	ARDO0.79R	54
	ARDO0.91L	538
	ARDO1.11L	2691
	ARDO1.23L	323
	ARDO1.31L	215
	ARDO1.60R	538
	ARDO1.64R	54
	ARDO1.73R	108
	ARDO2.34L	269
	ARDO3.06R	0
	ARDO4.51L	517
	ARDO4.56L	108
	ARDO4.81L	215
	ARDO5.76R	215
	ARDO5.80R	108
	ARDO6.34L	65
	ARDO6.35L	86
	ARDO6.42R	215
	ARDO6.44R	108
	ARDO6.46R	215
	ARDO6.56R	323
	ARDO7.98L	54
	ARDO9.61R	161
	ARDO9.63L	3229
Tree tobacco	NIGL0.08L	22
<i>Nicotiana glauca</i>	NIGL0.82L	22
	NIGL1.13L	215
	NIGL1.25L	215
	NIGL2.37L	22
	NIGL2.52L	1076
	NIGL4.72L	108
	NIGL4.80L	22
	NIGL5.53L	915
	NIGL5.59L	108
	NIGL6.01L	54

Fort McDowell Yavapai Nation: Initial Treatment of Invasive Plant Species Along the

NIGL6.49R	108
NIGL7.98R	54
NIGL8.02L	54
NIGL9.13L	11
NIGL9.36L	54
NIGL9.59L	54
NIGL9.65L	538
NIGL9.68L	269
NIGL9.73L	54
NIGL9.88R	11
NIGL10.23L	22
NIGL11.16L	54



Figure 1. Photo of ARDO 0.09L prior to removal.



Figure 2. Photo of ARDO 0.09L after removal. Note the visible stumps along the edge of the bank on the left side of the photo and the stacks of giant reed on the bank above.

Conclusions and Recommendations

Verde River

Implementation of the invasive plant treatment plan was very successful. The mapping efforts made it easy to find the known populations and locate any new ones. The initial treatment of the giant reed will be the most labor-intensive phase of the project. The removal and placement of the biomass on the banks can be time consuming, especially along steep banks. We anticipate that the initial herbicide treatment will be highly effective but we acknowledge that some regrowth will occur, as these plants were large and well established. We will be retreating the plants on the regrowth (new leaves and stems) as opposed to the cut stems. We have been monitoring several of the populations for regrowth every two weeks since mid-January, and once the plants have grown to 1-3 feet tall, we will begin phase two of treatment.

FMY Materials Plant

As with the treatment along the river, the initial treatment will be the most labor intensive. However, because of the large area of infestation, the materials plant will need to be monitored for several years for regrowth. There should be a conversation with the Materials plant at some point to discuss the possibility of them taking over the treatment.

Retreatment proposed schedule, spring 2016

Verde River

March 2016, 5 days, 5 people. Crews will be in two boats with one herbicide specialist and one laborer per boat. We will have maps and points on a GPS to direct us to each population of giant reed and tree tobacco. We will survey each population for possible regrowth and retreat as necessary. A few of the sites are in two small side channels and those sites will be accessed via foot.

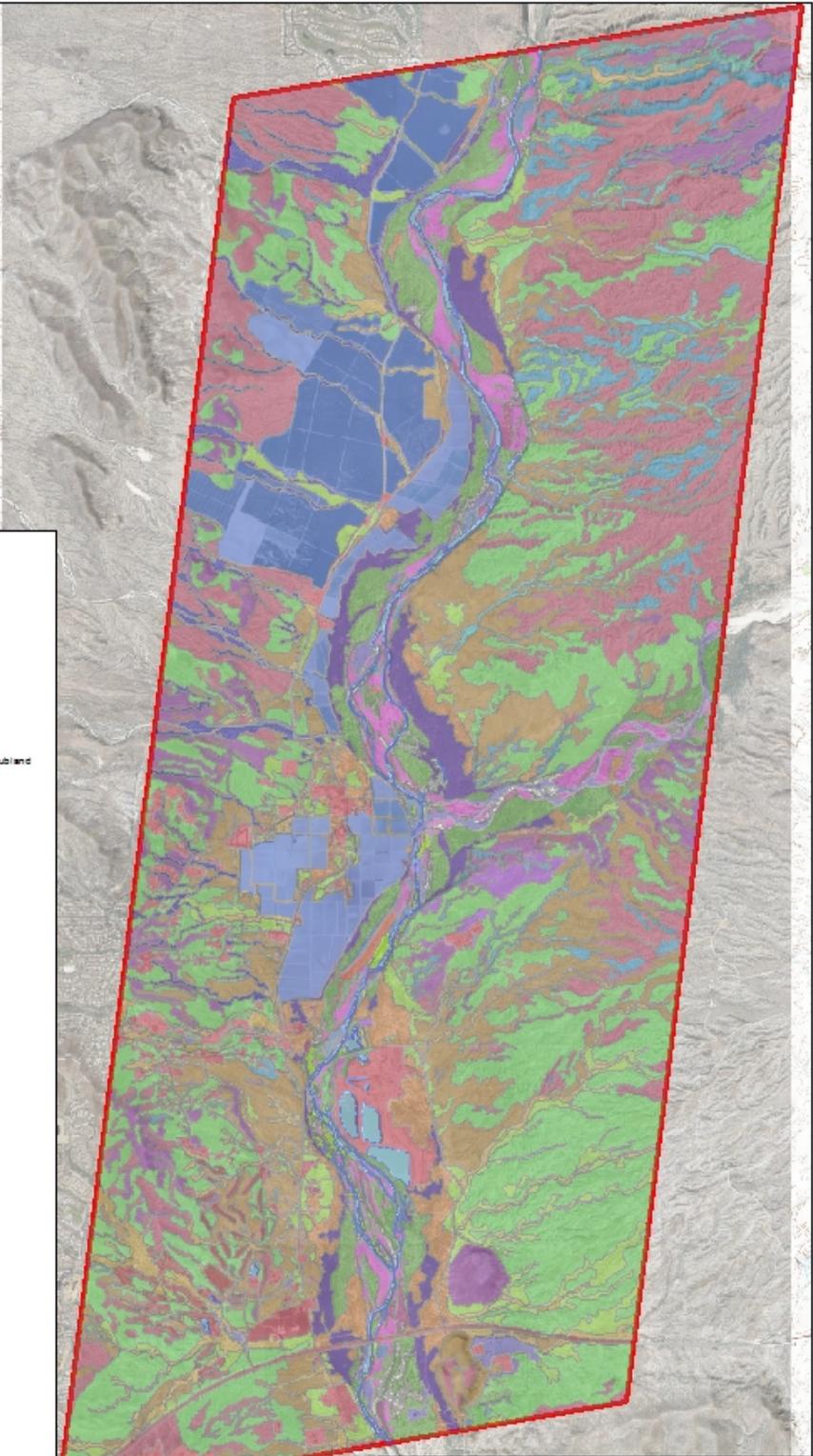
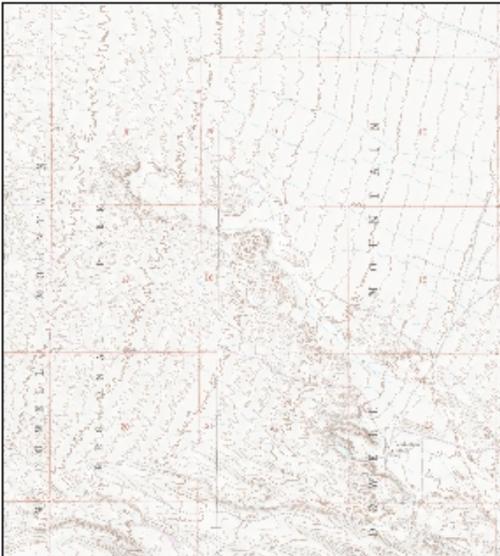
April/May, 2016, 5 days, 5 people. Another round of retreatment will be necessary along the river. We are anticipating the treatment to be done in late spring, but we will employ adaptive management and possibly do the third phase of treatment during the fall of 2016. The estimated cost for the two retreatments along the river is \$15,000 each.

FMY Materials Plant

March 2016, 3 days, 2 people. Crews will coordinate the FMY Materials plant to retreat the tree tobacco.

April/May, 2016, 3 days, 2 people. A third round of treatment will be necessary at the Materials plant. We will employ adaptive management strategies and determine the most appropriate timing after the first retreatment in the spring. The estimated cost for the two retreatments at the materials plant is \$6,500 each.

Appendix C

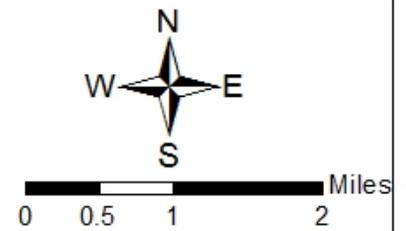


Final Vegetation Map Fort McDowell Yavapai Nation

Map Class Label

- Acacia constricta* Wash Shrubland
- Agriculture
- Ambrosia deltoidea* Shrubland
- Ambrosia deltoidea*/ *Larrea tridentata*/ *Parkinsonia microphylla*- *Cineya laevis* Shrubland
- Baccharis salicifolia* Shrubland
- Baccharis sarothroides* Shrubland
- Sesuvium juncea* Shrubland
- Cylindropuntia bigelovii* Shrubland
- Developed
- Shrubs laniflora* Shrubland
- Sarcocolla laniflora* Shrubland
- Golf Course
- Hymenoclea monogyra* Shrubland
- Larrea tridentata*/ *Munroa* Shrubland
- Larrea tridentata*/ *Ambrosia deltoidea* Shrubland
- Larrea tridentata*/ *Ambrosia deltoidea*- *Krameria grayi* Shrubland
- Larrea tridentata*/ *Prosopis* spp. Floodplain
- Cineya laevis*/ *Parkinsonia florida*/ *Acacia greggii*/ *Lycium* spp. Wash Shrubland
- Parkinsonia microphylla* Shrubland
- Populus tremuloides*- *Salix gooddingii* Forest
- Prosopis glandulosa*/ *velutina* Mixed Scrub
- Prosopis glandulosa*/ *velutina* Woodland
- Prosopis* spp. Bosque
- Prosopis velutina*/ *Parkinsonia florida*/ *Acacia greggii*/ *Lycium* Wash
- Salix gooddingii* Forest
- Sparsely Vegetated
- Tamarix aphylla* Forest
- Tamarix ramosissima* Shrubland
- Unclassified
- Unvegetated
- Water

Sources: Esri, USGS, NGA, NMA, Geodestrylsen, P, the GIS user community



Key Personnel

Mark R Frank

Primary Business Address
17721 E. Yavapai Road
Fort McDowell, Arizona
85264

Phone: 480-789-7163
Fax: 480-789-7132
E-mail: mfrank@ftmcdowell.org

Objective

To make a positive and measurable contribution to the community or organization I serve.

Work History

2007 to present, Acting Environmental Manager, Fort McDowell Yavapai Nation.
Responsible for a wide range of environmental programs, including water quality monitoring, air quality monitoring, West Nile Virus monitoring, community education and outreach, ordinance development, and water sustainability studies.

1992 to 2007, Director of the Phoenix Active Management Area Office-Arizona Department of Water Resources.

Responsible for all programs within the Phoenix AMA, including water rights permitting, planning and special studies, compliance and enforcement activities, and conservation and augmentation assistance grants. Provided direction and support to a professional staff of eighteen. Instrumental in the development of water management policy and program development. Frequently interacted with various members of the water community, including elected officials, city managers, community associations, attorneys, consultants, company presidents and general managers. Frequently interacted with state legislators and legislative staff on water management issues and/or pending legislation. Interacted with federal officials regarding federal/state water interest and programs. Have secured and managed federal grants pertaining to regional aquifer management and conservation assistance to water users in the agricultural, municipal, and industrial sectors.

1984 to 1992, Deputy Director of the Phoenix AMA Office.

1981 to 1984, Manager of Operations and Field Services, Phoenix AMA

1977 to 1981, Co-Program Manager of the Maricopa Association of Governments-Water Quality Management Program (MAG 208 Program)

Responsible for preparation and implementation of MAG 208 Program. Administered multiple consultant contracts. Responsible for public participation element of the 208 Program.

Education

1973, Bachelor of Science Degree-Carroll College, Waukesha, Wisconsin

1975-1977, Graduate work at University of Wisconsin (Urban Planning)

References

Furnished upon request.

Melissa Anne McMaster

melissa.mcmaster@gmail.com

PO Box 1603

Flagstaff, AZ 86002

928.814.6373

OBJECTIVE

A position as a biologist and conservationist developing and implementing scientifically sound restoration projects and conservation strategies that are meaningful, functional, further preservation efforts on a grand scale and that promote a sense of stewardship.

EDUCATION

Master of Science in Forestry, Northern Arizona University, Flagstaff, AZ, 2010; GPA 3.88

Bachelor of Science in Biology and Secondary Education, Utah State University, Logan, Utah, 2001; GPA 3.4

PROFESSIONAL EXPERIENCE

Principal/Plant Biologist, Mariposa Ecological and Botanical Consulting LLC, July 2014-current

- Fort McDowell Yavapai Nation, Fountain Hills, AZ. March 2015-current.
 - Creating a vegetation map for the entire reservation using NVCS classification systems
 - Survey and inventory plants throughout the entire reservation
 - Developing and implementing an Invasive Plant Management Plan for a variety of species
 - Developing and implementing a Restoration Plan for disturbed areas along the Verde River
- Hualapai Tribal Nation, Peach Springs, AZ. May 2015-current.
 - Consultant for riparian restoration/rehabilitation on Hualapai Tribal Lands adjacent to and in conjunction with federal lands in Grand Canyon National Park. Consultation included site identification and selection and work plan development.
- The Nature Conservancy, Escalante, UT. July 2014-December 2014 & July 2015-current.
 - Implemented a pilot project to map and inventory legacy riparian trees along the Escalante River
 - Conducted field work to collect data, install photopoints and refine protocols
 - Synthesized data, created maps and spatially represented tree data
 - Compiled a final report with updated protocols for data collection, results of the pilot project, and a proposal for completing data collection for the entire Escalante River watershed.
- Greater Grand Canyon Landscape Assessment, Flagstaff, AZ. August 2015-current
 - Co-author on the chapter "Riparian Assessment" from a Management Plan for Grand Canyon NP
- Grand Canyon Field Institute, Grand Canyon National Park, AZ. April 2015, April 2016
 - Instructor and river guide on an 18 day river trip through Grand Canyon

Restoration Coordinator Tamarisk Coalition, Flagstaff, AZ, April 2016- current

- Coordinate riparian restoration activities in Arizona and specifically with the Gila Watershed Partnership and Verde Watershed Restoration Coalition
- Facilitate meetings and workshops with Arizona residents on the tamarisk beetle

- Assist with identifying funding sources for riparian restoration

Plant Biologist (GS-9), Grand Canyon National Park, Flagstaff, AZ, August 2011- July 2014

- Directed and managed the daily operations of all activities related to vegetation management in remote backcountry areas in Grand Canyon including the following:
 - Riparian restoration/rehabilitation and habitat assessments along the Colorado River
 - Invasive plant mapping, monitoring and removal along the river, in side canyons and in all other backcountry areas of the park
 - Rare plant surveys, monitoring, mapping and collection
 - Vegetation monitoring and data analysis for several large projects
 - Served as a park expert in vegetation management providing technical guidance and vision to park wide projects
 - Managed all herbicide use proposals and reports
 - Supervised two full time employees and two interns as well as many volunteers
- Project manager of the first large-scale riparian restoration stewardship project
 - Developed a restoration plan including invasive plant removal and native plant replacement
 - Developed and implemented a scientifically rigorous pre- and post-work vegetation monitoring protocol
 - Implemented and refined restoration procedures including collecting seeds and live cuttings, nursery propagation and outplanting
- Project manager for the vegetation monitoring component of the Colorado River Mgmt. Plan
 - Developed and implemented statistically valid data collection protocols to monitor vegetation in camps and at attraction sites along the river corridor and in side canyons
 - Collected vegetation and soils data on 18 day river trips
- Project manager for all invasive plant monitoring and management
 - Developed and implemented bi-annual work plans to control a variety of invasive plant species along the Colorado River and in the side canyons
 - Controlled plants using mechanical, chemical and cultural practices
 - Used GIS to map plants and statistically analyzed success rates of treatments
- Additional accomplishments
 - Developed and implemented work plans every two fiscal years
 - Refined and developed annual progress reports
 - Government and Performance Result Acts reporting at the end of each fiscal year
 - Plant collections and herbarium specimens reported into SeiNet (a plants database)
 - Maintained herbicide proposals and completed reports per federal requirements.
 - Assisted with grants and proposals for additional program funding
 - Used ArcGIS to create maps and plot data spatially

SKILLS AND ACCOMPLISHMENTS

- Highly skilled in managing numerous multi-faceted projects with several different stakeholders
 - Excellent communication skills
 - Extensive experience working cooperatively with federal land agencies and stakeholders on land management issues
 - Solid knowledge and understanding of experimental design and implementation of scientific methods
 - Demonstrated enthusiasm for stewardship, citizen science and community engagement with conservation issues
-

David Blanchard, RLA

808 North Humphreys Street
Flagstaff, AZ 86001
(225) 936 – 4781
dblanc6@gmail.com

Landscape Architect

Environmentally focused Landscape Architect with 8+ years of conservation and habitat restoration project building experience. Proven ability to take a project from the round table to construction through strategic planning, creating exceptional restoration designs, and successful implementation that will lead to continued community engagement and successful fundraising opportunities, which is essential for the support of future projects. **Areas of expertise are:**

- | | | |
|---------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|
| <input type="checkbox"/> Restoration Project Planning | <input type="checkbox"/> Habitat Design | <input type="checkbox"/> Project Management |
| <input type="checkbox"/> Construction Supervision | <input type="checkbox"/> Site Selection and Analysis | <input type="checkbox"/> Planting and Irrigation |
| <input type="checkbox"/> Volunteer Coordination | <input type="checkbox"/> Stakeholder Relations | <input type="checkbox"/> Subcontractor Coordination |
| <input type="checkbox"/> Public Speaking, Presentations | <input type="checkbox"/> Staff Management | <input type="checkbox"/> Manage Complex Budgets |
| <input type="checkbox"/> Certified Wetland Delineator | <input type="checkbox"/> Experience in Southwest AZ | <input type="checkbox"/> Construction Implementation |
-

Professional Experience

Morning Dew Landscaping, Flagstaff, AZ **Landscape Architect**

2013 - Present

Manage the design/build department of a residential and commercial landscaping company. Coordinate with homeowners, property managers, and government officials to design, budget, and implement various scales and types of irrigation and landscaping projects. Continually work to increase environmental practices of the company, steer landscape projects to be regionally specific, and bring in more ecologically focused work. Supervise over 5 landscape construction crews consisting of 3-4 members and 2-3 office personnel. Successfully manage multiple projects through all stages of construction with an attention to detail to maintain a high quality of craftsmanship.

Key Contributions:

- Registered Landscape Architect in the state of Arizona
- Work with clients to produce landscape designs with native drought, tolerant plants requiring minimal irrigation.
- Design projects to fit within a specific budget as well as maintaining the budget throughout project implementation.
- Developed relationships with the Arizona Game and Fish Department and environmental consulting companies to provide invasive plant species removal and habitat design on restoration projects throughout the state.
- Produce hand sketches and computer graphics to help clients visualize landscape designs and ideas.

Fred Phillips Consulting, LLC., Flagstaff, AZ **Landscape Architect / Restoration Program Manager**

2008-2013

Recruited to operate as the Restoration Program Manager to provide project management and design of riparian and wetland restoration projects. Worked on all aspects of riparian and wetland restoration projects from initial site selection and analysis to successful construction by creating restoration site assessments, wetland delineations, invasive species removal plans, habitat designs, fundraising, stakeholder and subcontractor coordination, and permitting. Managed 2-3 office personnel, 5-6 restoration laborers, and worked closely with biologists to create designs based on monitoring the successes and failures of past projects. Coordinated volunteer events to alleviate tight construction budgets and to encourage stewardship. Organized restoration workshops, presented on various restoration topics, and lead workshop participants on projects to implement the latest bioengineering practices. Projects involved collaboration with Local, State, and Federal agencies, as well as Native American Communities, and various non-profit organizations.

David Blanchard, RLA

Key Contributions:

- Registered Landscape Architect in the states of Arizona and Texas
- Project Management & Design – Completed restoration, revegetation, and invasive species removal designs for rivers and wetlands across the Southwest including the Lower Colorado River and Colorado River Delta, confluence of the Gila and Salt Rivers, confluence of the Gila and Colorado Rivers, Las Vegas Wash and its tributaries within the Las Vegas Valley, the Muddy River in the Upper and Lower Moapa Valleys, Aqua Fria River, Verde River, and the Colorado River through Grand Canyon National Park. Managed contracts and budgets for both design and install projects.
- Yuma Wetlands – Project planning and design of over 1,400 acres on the Lower Colorado River. This project also included daily management of 350 acres of restored riparian and wetland restoration that served as an amenity to the community and created significant habitat for wildlife. Successfully obtained grants for continued funding and completed grant reports.
- Laguna Division Conservation Area – Project planning and design of over 1,200 acres on the Lower Colorado River. This project involved working closely with engineers, The Bureau of Reclamation, MSCP Stakeholders, and Army Corps of Engineers. Completed wetland delineations, initial site analysis and soil sampling, and habitat design to incorporate a mosaic of open water, marsh, riparian and upland habitat taking advantage of several historic river meanders all based on various water elevations created by water control structures.
- Grand Canyon National Park– Worked as a consultant on the Granite Camp Riparian Restoration project for the National Park service to help plan and design the removal of invasive species and plant native plants with minimal irrigation in a remote backcountry setting.
- Construction Supervision/Management – Managed and coordinated the construction of wetland, riparian, upland, and stream restoration projects, construction of parks, invasive species removal projects, and installation and maintenance of drip and flood irrigation systems.
- Environmental permitting, certified wetlands delineator with training in the Arid Southwest.

Houston Cuozzo Group, Inc., Stuart, FL
Landscape Designer

2006-2008

Hired as an entry-level landscape designer to produce landscape drawings, details, and graphics for a wide variety of projects. Increased office awareness of environmental issues regarding sustainable development practices by using native plants requiring minimal irrigation, introducing green drainage practices with bioswales and rain gardens, and worked to reduce the foot print of development.

Key Contributions:

- Team Management & Project Design – Project designer working with other office personal and a range of consultants to create wide variety of projects including: the master planning of community developments ranging in scale from 2 acres to 6,000 acres; several small-scale commercial, mixed-use and urban infill projects; water-wise streetscape designs; environmental projects helping to recreate and preserve habitats, including wetlands, uplands and drainage corridors
- Team leader in numerous community design charrettes to collect ideas and visions from residents
- Presented design ideas to help communicate a project's design and intentions
- Created sketches and project visuals via hand and computer graphics

Education and Technical Proficiencies

Louisiana State University, Baton Rouge, LA
College of Art and Design
Bachelor of Landscape Architecture

Graduated, May 2006

Edinburgh College of Art, Edinburgh, Scotland
Design Studio with emphasis on Brownfield Reclamation

Fall Semester 2005

Technical Skills

AutoCAD, Microsoft Office, Photoshop, SketchUp, ArcGIS, GPS equipment, ability to operate 4WD vehicles and heavy equipment

Dan DeVere, Vegetation Management Supervisor

Morning Dew Landscape Inc.

Company Responsibilities

- Supervisor Vegetation Management Division
- Responsible for the weed control for Morning Dew customers emphasizing careful and responsible herbicide applications with low impact on the surrounding community
- Directs the application of all pesticides for the company utilizing organic and natural remedies when possible
- Designs turf management systems for our clients turf grass areas using advanced cultural and organic practices.

Personal Qualifications

- Certified Golf Course Superintendent with 30 years' experience building and maintaining golf courses in Northern Arizona.
- Bachelor of Science Degree in Agriculture from the University of Arizona
- Qualifying Party and Licensed Pesticide Applicator with the State of Arizona since 1991
- Past Commissioner on the Structural Pest Control Commission
- Arizona Master Gardener

Landscape Maintenance Experience

- Golf Course Superintendent for Aspen Valley Golf Club, and Continental Country Club 1994-2000
- Project manager for the construction and maintenance of Flagstaff Ranch Golf Club 2001 - 2008
- Vegetation Management Supervisor for Morning Dew Landscaping since 2012

Patrick T. Phillips

Education	2000 - 2003	Northern Arizona University	GPA: 4.0
	Master of Liberal Studies		
	<ul style="list-style-type: none">▪ Program emphasis: Riparian Ecology▪ Thesis: "Human Settlement Impacts on Wet Beaver and Beaver Creek"		
	1988 – 1993	Arizona State University	GPA: 3.96
	Bachelor of Arts, Political Science		
	<ul style="list-style-type: none">▪ Coursework focus Southeast Asian and Environmental Science studies		
Professional experience		River Restoration Technician	2004 – 2016
	<ul style="list-style-type: none">▪ Worked for Natural Channel Design in Flagstaff to assist engineering consulting in diverse river restoration projects in the 4 corners area.▪ Crew leader of riparian re-vegetation projects in the Southwestern U.S. supervising up to 20 people for multiple weeks including National Park Service projects in Grand Canyon, and private stakeholders		
		Whitewater River Guide/Outfitter	1992 - 2016
	<ul style="list-style-type: none">▪ Professional commercial guide trip-leading multi-week raft and kayak expeditions in Grand Canyon and internationally▪ Extensive knowledge of desert riparian ecology and hydrology▪ Founder, Guide, and Manager of Mongolian River Adventures		
Additional professional activities	Three years active military service in U.S.Army as logistical specialist Awarded Soldier of the Year for U.S. Army Japan/IX Corps 1986 Honorably discharged at the rank of E-5/Sergeant.		
	Agricultural and herdsman knowledge acquired as a farmer and rancher		
	Wide ranging riparian vegetation survey experience		
Special skills	Working knowledge of Rosgen's stream classification system		
	Extensive backcountry driving, hiking, and living skills		
	Mechanically competent and proficient operating heavy machinery		
	Spanish language ability		
References	Available upon request		