National Park Service
U.S. Department of Interior
Tuzigoot National Monument
Clarkdale, AZ

Tavasci Marsh Management and Habitat Enhancement Plan

Environmental Assessment

May 2011

Page intentionally left blank.

Tavasci Marsh Management and Habitat Enhancement Plan
Environmental Assessment

SUMMARY

Tuzigoot National Monument is proposing to manage Tavasci Marsh to enhance wildlife habitat and increase recreational and educational use of the marsh. The National Park Service acquired Tavasci Marsh as part of a 324-acre addition to the monument in December 2005. This plan would address both the long-term ecological and recreational management of Tavasci Marsh.

Tavasci Marsh has undergone extensive changes to its hydrology from its century-long history as a farmland and pasture area for cattle. Previous farming activities such as draining and leveling the marsh have contributed to the current hydrologic system causing abrupt and narrow transition zones to the more upland mesquite bosque, with reduced areas of transitional zones including sedge/rush shorelines, shrubby willow fringe, and native grassland habitats.

An interagency Tavasci Marsh Wildlife Habitat Workshop with over 30 wetland, wildlife, and hydrology experts met in January 2010 to discuss the existing conditions of the marsh, and future potential habitat type acreages to best optimize wildlife habitat at the marsh. This proposed project works toward those habitat targets resulting from the workshop.

The purposes of this project are to enhance the wildlife habitat conditions in the marsh by establishing short- and long-term restoration and management actions in order to maintain sustainability of the enhanced marsh ecosystem; and encourage visitor appreciation of the marsh. This environmental assessment evaluates three alternatives: a No-action alternative and two action alternatives. The No-action alternative describes the current management and condition of the marsh. The first action alternative addresses habitat enhancement for the marsh through long-term cattail management. The second action alternative (the Preferred Alternative) addresses habitat enhancement for the marsh through long-term adaptive hydrologic management through the construction of water control structures and a water conveyance channel designed to allow fluctuation of water levels in the marsh's northern section. Visitor use-related infrastructures and activities are identified for each alternative.

This environmental assessment has been prepared in compliance with the National Environmental Policy Act (NEPA) to provide the decision-making framework that 1) analyzes a reasonable range of alternatives to meet objectives of the proposal, 2) evaluates potential issues and impacts to monument resources and values, and 3) identifies mitigation measures to lessen the degree or extent of these impacts. Resource topics included in this document as resulting impacts may be greater-than-minor include soils, vegetation, water quality, wetlands and floodplains, general fish and wildlife, species of special concern, archeological resources, ethnographic resources, historic structures, public health and safety, visitor use and experience, and park operations. All other resource topics were dismissed because the project would result in negligible or minor effects to those resources.

No major effects are anticipated as a result of this project. No unacceptable impacts or impairment of park resources would occur through implementation of any alternative. Public scoping was

conducted to assist with document development; three comments were received during the official scoping period, although over forty pre-formatted comment forms (see Appendix A) were received during the public scoping meetings conducted twice in 2008.

PUBLIC COMMENT

If you wish to comment on the environmental assessment, you may post comments online at http://parkplanning.nps.gov/tuzi or mail comments to: Superintendent; Montezuma Castle and Tuzigoot National Monuments, P.O. Box 219, Camp Verde, AZ 86322.

This environmental assessment will be on public review for 30 days. Before including your address, phone number, e-mail address, or other personal identifying information in your comment, you should be aware that your entire comment – including your personal identifying information – may be made publicly available at any time. Although you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

CHAPTER 1.0 PURPOSE AND NEED 1

1.1 Introduction 1

1.2 Background 3
1.2.1 History of Tavasci Marsh before NPS acquisition 3
1.2.2 NPS Acquisition and Subsequent Restoration/Management Planning 6
1.2.3 Narrow Transition Zones in the Marsh 7
1.2.4 Documenting Existing Conditions: Wetland Delineation and Condition Assessment 7
1.2.5 Defining Habitat Objectives: Tavasci Marsh Interagency Wildlife Habitat Workshop 8

1.3 Purpose and Need 8

1.4 Relationship to Other Plans and Policies 11

1.5 Appropriate Use 12

1.6 Public Scoping 13

1.7 Impact Topics 14
1.7.1 Impact Topics Retained for Further Analysis 15
1.7.1.1 Soils 15
1.7.1.2 Vegetation 16
1.7.1.3 Water Quality 16
1.7.1.4 Wetlands and Floodplains 16
1.7.1.5 General Fish and Wildlife 17
1.7.1.6 Species of Special Concern 17
1.7.1.7 Archeological Resources 17
1.7.1.8 Ethnographic Resources 17
1.7.1.9 Historic Structures 17
1.7.1.10 Public Health and Safety 18
1.7.1.11 Visitor Use and Experience 18
1.7.1.12 Park Operations 18
1.7.2 Impact Topics Dismissed from Further Analysis 18
1.7.2.1 Air Quality 18
1.7.2.2 Water Quantity 19
1.7.2.3 Paleontological Resources 19
1.7.2.4 Cultural Landscapes 19
1.7.2.5 Museum Collections 20
1.7.2.6 Soundscape Management 20
1.7.2.7 Socioeconomic Environment 20
1.7.2.8 Prime and Unique Farmlands 20
1.7.2.9 Indian Trust Resources 20
1.7.2.10 Environmental Justice 21
1.7.2.11 Wilderness 21

CHAPTER 2.0 ALTERNATIVES CONSIDERED 22

2.1 Actions Common to All Alternatives 22

2.2 Alternatives Carried Forward 23

2.2.1 Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 23
2.2.2 Alternative B: Enhance marsh habitat primarily through cattail management 25
2.2.3 Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 28

2.3 Alternatives Considered and Dismissed 33
2.3.1 Enhance wildlife habitat at Tavasci Marsh habitat by exclusively managing beaver activity and beavers 33
2.3.2 Reuse Arizona Game and Fish Department water control structures to change marsh hydrology 33

2.4 Mitigation Measures 33

2.5 Environmentally Preferred Alternative 36

2.6 Alternatives Summary 37

CHAPTER 3.0 AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES 46

3.1 Cumulative Effects 47

3.2 Soils 49
3.2.1 Affected Environment and Intensity Level Definitions 49
3.2.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 50
3.2.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 51
3.2.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 51

3.3 Vegetation 53
3.3.1 Affected Environment and Intensity Level Definitions 53
3.3.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 55
3.3.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 56
3.3.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 57

3.4 Water Quality 59
3.4.1 Affected Environment and Intensity Level Definitions 59
3.4.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 60
3.4.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 60
3.4.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 61

3.5 Wetlands and Floodplains 62
3.5.1 Affected Environment and Intensity Level Definitions 62
3.5.1.1 Wetlands 62
3.5.1.2 Floodplains 65
3.5.1.3 Wetland and Floodplain Assessment 65
3.5.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 67

3.5.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 67
3.5.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 68

3.6 General Fish and Wildlife 71
3.6.1 Affected Environment and Intensity Level Definitions 71
3.6.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 73
3.6.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 73
3.6.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 75

3.7 Species of Special Concern 77
3.7.1 Affected Environment and Intensity Level Definitions 77
3.7.1.1 Species Protected Under the Endangered Species Act 77
3.7.1.2 Species of Concern 80
3.7.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 82
3.7.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 83
3.7.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 85

3.8 Archeological Resources 87
3.8.1 Affected Environment and Intensity Level Definitions 87
3.8.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 89
3.8.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 89
3.8.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 90

3.9 Ethnographic Resources 91
3.9.1 Affected Environment and Intensity Level Definitions 92
3.9.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 93
3.9.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 93
3.9.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 94

3.10 Historic Structures 95
3.10.1 Affected Environment and Intensity Level Definitions 95
3.10.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 97
3.10.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 97
3.10.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 98

3.11 Public Health and Safety 99
3.11.1 Affected Environment and Intensity Level Definitions 99
3.11.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 100
3.11.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 101

3.11.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 102

3.12 Visitor Use and Experience 102
3.12.1 Affected Environment and Intensity Level Definitions 102
3.12.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 103
3.12.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 104
3.12.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 105

3.13 Park Operations 106
3.13.1 Affected Environment and Intensity Level Definitions 106
3.13.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program 107
3.13.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management 108
3.13.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology 109

CHAPTER 4.0 CONSULTATION AND COORDINATION 112

4.1 Internal Scoping 112

4.2 External Scoping 112

4.3 Scoping Letter Response 113

4.4 Consultation 113
4.4.1 U.S. Fish and Wildlife Service 113
4.4.2 U.S. Army Corps of Engineers 113
4.4.3 Arizona State Historic Preservation Office 113

4.5 Environmental Assessment Review and List of Recipients 113

4.6 List of Preparers 114

CHAPTER 5.0 REFERENCES 115

5.1 REFERENCES FOR EXECUTIVE ORDERS AND DIRECTOR'S ORDERS 116

APPENDIX A—IMPAIRMENT 118

APPENDIX B—PUBLIC SCOPING CHECKBOX LETTER 123

APPENDIX C—WILDLIFE WORKSHOP EXHIBITS 124

APPENDIX D—SPECIES LISTS, INCLUDES SCIENTIFIC NAMES 130

APPENDIX E—FLOODPLAIN STATEMENT OF FINDINGS.....143

APPENDIX F—CONSULTATION LETTERS.....152

LIST OF TABLES

Table 1 Desired Marsh Habitat Table Generated by Jan. 2010 Wildlife Workshop…..… 10

Table 2 Alternatives Summary and Project Objectives—Overview……. 38

Table 3 Alternatives Summary and Project Objectives–Wildlife Habitat Targets and Attainment Percentages …….. 40

Table 4 Environmental Impact Summary by Alternatives…… 41

Table 5 Federally-listed Threatened and Endangered Species ……. 77

Table 6 Potentially Affected Species of Concern ……. 81

LIST OF FIGURES

Figure 1 Location of Tuzigoot National Monument……. 2

Figure 2 Location of Tavasci Marsh at Tuzigoot National Monument……..... 2

Figure 3 Photo from 1987 with Tavasci Marsh Farm Buildings and Irrigation Ditches..... 5

Figure 4 Location of AGFD Water Control Structures in Tavasci Marsh…..…….. 6

Figure 5 Abrupt Transition from Cattail to Mesquite Bosque Habitat……..8

Figure 6 Map from Wetland Delineation and Condition Assessment…….. 9

Figure 7 Alternative A (No-action)—Existing Habitat Type Map……..24

Figure 8 Marsh-related Trails…….. 25

Figure 9 Alternative B—Conceptual Plan of Habitat Type Map Likely to Result from Proposed Actions……..…… 26

Figure 10 Alternative C (Preferred)—Conceptual Plan of Habitat Type Map Likely to Result from Proposed Actions……..……29

Figure 11 Proposed Conveyance Channel Conceptual Cross Section……...30

Figure 12 Proposed Location of Water Control Structures/Berm/Trail……...……. 31

Figure 13 Wetland Delineation Overview for Tavasci Marsh……...……64

Figure 14 100-Year Floodplain Map……. 65

Figure 15 Location of Alternative C Action Compared to Wetland Delineation……..69

Figure 16 Photos of the Cattail Vegetation Overlying the Historic Road……..96

CHAPTER 1.0 PURPOSE AND NEED

1.1 Introduction

Tuzigoot National Monument in Clarkdale, Arizona (see Figure 1) was established by presidential proclamation on July 25, 1939, to protect the prehistoric structures built by the southern Sinagua archeological culture starting in the 11th century. The monument is managed jointly with Montezuma Castle National Monument under a single National Park Service (NPS) administration office.

Tuzigoot National Monument was 58-acres in area until December 2005, when the National Park Service acquired Tavasci Marsh as part of a 324-acre expansion (see Figure 2), expanding the total monument acreage to 382 acres. Tavasci Marsh is a spring-fed freshwater wetland that occupies an abandoned oxbow of the Verde River to the north and east of the Tuzigoot Pueblo. With an area of approximately 96 acres, Tavasci Marsh is the largest freshwater marsh away from the Colorado River in northern Arizona. The southern portion of the marsh area is bounded by the Verde River, and lies between the Verde River Greenway State Natural Area and Dead Horse Ranch State Park, both managed by Arizona State Parks. The marsh is located at T16N, R3E, Sections 15 and 22 of the Gila and Salt River Base and Meridian.

Since historical times, the marsh system has had a varied management history including irrigated agriculture fields; pasture for a dairy operation; soil extraction; flushing through of waters from the adjacent, upstream Peck's Lake for nutrient management; draining of the Shea Springs marsh water for additional pastureland; and hydrological modifications to increase wetland areas for waterfowl and wildlife habitat. This use history has contributed to its current state with a cattail-dominated wetland covering nearly 70 percent of the marsh (Parsons and Ryan 2009).

The primary cause of the dominance of cattails at Tavasci Marsh results from the existing hydrology and micro-topography of the marsh system. The historic conversion to agricultural fields removed natural variations in the topography of the marsh, and stable outlet elevations result in little change in water surfaces throughout the year with relatively stable, constant water depths that favor cattails. Hydrologic conditions also favor cattail growth encroaching upon the remaining open water areas of the marsh, important to many wildlife species including waterfowl. Current hydrologic conditions causing standing water and cattail habitat proliferation have enhanced West Nile Virus vector mosquito breeding habitat. In 2010, Arizona led the nation for the highest number of human deaths caused by West Nile Virus, (Center for Disease Control Website, posted Dec. 7, 2010) and West Nile Virus is a serious public concern.

In addition to the dominance of cattails, abrupt transitions to the dry mesquite bosque with low levels of transitional species occur across much of the marsh. These depressed plant communities have the potential to provide additional valuable habitats for a variety of animals.

The purpose of this environmental assessment is to examine the beneficial and adverse environmental impacts associated with proposed actions to enhance wildlife habitat functions for Tavasci Marsh. Throughout this document, the terms "National Park Service," "NPS," "monument," and "park" will be used interchangeably.

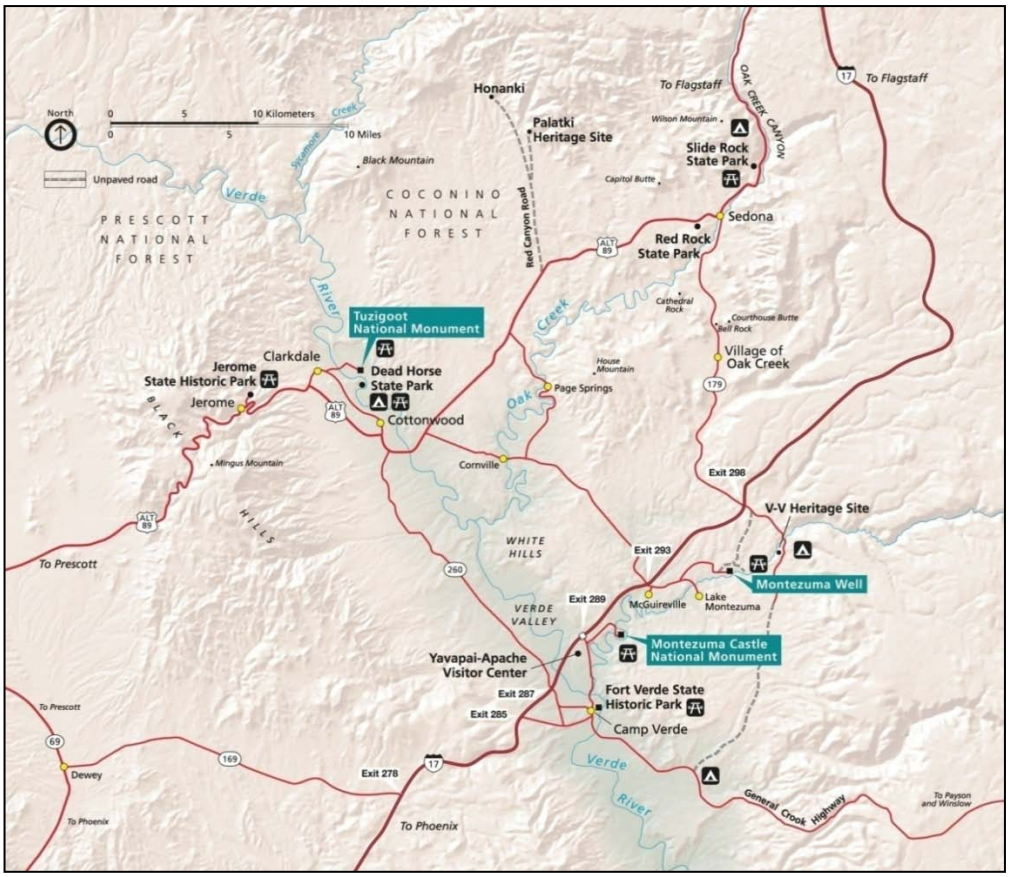

Figure 1. Location of Tuzigoot National Monument.

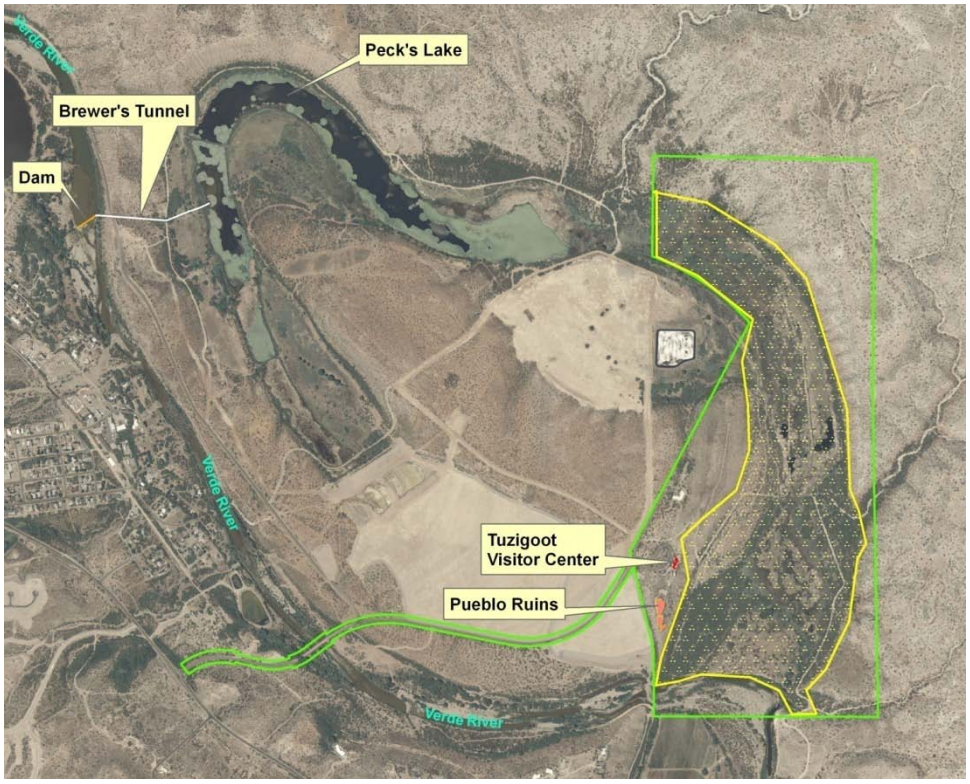

Figure 2. Location of Tavasci Marsh area at Tuzigoot National Monument (yellow stippled area). Green is park boundary. Other structures labeled (dam and tunnel drawn in; approximate location). Photo from 2005.

1.2 Background

1.2.1 History of Tavasci Marsh before NPS acquisition

Tavasci Marsh and Peck's Lake are located on an ancient oxbow of the Verde River (see Figure 2) which was abandoned by the river approximately 10,000 years ago. The marsh is primarily fed by a complex of springs along the base of the cliffs, including Shea Springs. Tavasci Marsh is located adjacent to the Tuzigoot ridge which is estimated to have been inhabited from 1050 to 1400 A.D.

The first known record of private ownership occurs in 1890, when an area including Tavasci Marsh was deeded to Thomas Goodwin who raised beef cattle for Jerome and other local markets (all historical information for Section 1.2.1 from Stoutamire 2010). Early irrigation reports reveal that the Goodwins used a local spring (later known as Shea Springs) to water and cultivate four acres of their property. In 1900, this land was sold to Daniel O'Shea, who built the Shea Home Ranch and began an extensive ditch system to distribute water in the marsh area and additional property west of the marsh. O'Shea, along with other local people including representatives from the United Verde Copper Company, also developed the Brewer Tunnel (see Figure 2), which would divert water from the Verde River through Peck's Lake and into Tavasci Marsh. The Shea Home Ranch raised beef cattle and produced dry goods for Jerome and Cottonwood. It is likely that the marsh may have been drained at least partially during this time in order to develop fertile usable land for agricultural purposes.

In 1911, the United Verde Copper Company purchased the Shea Home Ranch from the O'Sheas, but would continue to lease the lands to the O'Sheas for agricultural uses. In 1928, the Clarkdale Dairy was established on the marsh through start-up funds provided by the United Verde Copper Company. The dairy was a 250-acre farm run by local families including the Tavasci family (all information related to the Clarkdale Dairy from Dallette/NPS interviews with John Tavasci, Sr. and John Tavasci Jr., as well as Stoutamire 2010).

For the operations of the dairy, the pre-existing irrigation system in the marsh was maintained and enlarged. The dairy also expanded this irrigation system on the lands to the south of the wetland to create additional fields for pasture and the growth of crops. Throughout the duration of cattle operations in the area, this regularly maintained irrigation system provided sufficient water for the irrigation of the fields of alfalfa, "Mexican June" corn, and sweet Sudan grass that constituted the herd's regular diet. Buildings from the Shea Home Ranch-era were used with additional residences and dairy-related structures built in the marsh area.

During the first two decades of operation, the dairy was highly productive even through changes in land ownership (in 1935, the United Verde Copper Company was purchased by Phelps Dodge Corporation). By 1946, the dairy had over 200 head of cattle, supported by alfalfa fields and corn grown in the marsh. Pasture yields were also increased by using modern fertilizers, in addition to planting prolific nonnative grass. By 1946, the dairy cooperative was owned and run by a single family, the Tavascis.

In the 1950's, there were significant changes to the milk industry as well as to the local mining communities that contributed to the dairy's demise. These changes forced the Tavascis to switch from a dairy to a beef cattle operation in the marsh. With various expensive upgrades for milk

pasteurization and milk transport required to stay in business, the dairy became less profitable and closed in 1958. The Tavascis sold their 280 head of dairy cattle at this time, but invested in 135 head of beef cattle and raised them in the marsh pasturelands.

Starting in 1951, the Tavascis worked closely with the Bridgeport Soil Conservation District to develop a strategy for a more sustainable and less labor-intensive land management plan. The plan involved leveling 109 acres of otherwise patchy farmland to create permanent pastures that benefitted both dairy and beef cattle. Croplands were also rotated on these pastures to provide better fodder for the cattle. The Tavascis would farm the marsh area through 1990, when Phelps Dodge Corporation cancelled their grazing lease and required them to remove cattle from the marsh. For new lease terms in 1991, Phelps Dodge raised the monthly rent from $75 to $500, effectively removing the Tavascis from the property.

From 1928 through 1991, the Tavasci family would ultimately live on and manage the pasturelands in Tavasci Marsh (see Figure 3). A constant challenge to the dairy farmers was the marsh itself, which threatened to overrun the pastureland. The farmers burned the cattail areas on an annual basis and built additional ditches in the marsh to drain the fields. Three ditches, including historic and nonhistoric alignments, drained Tavasci Marsh and were maintained on an annual basis (see Figure 3). The fields were leveled when necessary with bulldozers and other equipment to maintain and expand the grazing lands. Pasturelands were expanded to the south by dynamiting mesquite trees and hauling the stumps out by mule in order to provide open, level pastures. Native marsh wildlife were also a threat to the farmers, as beavers would constantly dam their ditches and required significant control. Waterfowl were hunted for meat, and the local fish were eaten. Non-native bullfrogs were even introduced to the marsh to sell to local restaurants as a delicacy.

In January 1990, Phelps Dodge Corporation and the Arizona Game and Fish Department began a cooperative project to restore the marsh, which triggered the Tavasci grazing lease cancellation. Starting in 1991, Phelps Dodge Corporation and the Arizona Game and Fish Department began to restore the marsh to native plants and encourage use of the area for recreation and education.

The restoration activities enacted by the Arizona Game and Fish Department during 1991 through 1995 included the installation of two water control structures (see Figure 4) designed to control the water levels within the marsh. Trails and an overlook structure were also created to allow for recreation in the marsh.

In 1993, the road through Tavasci Marsh to access Dead Horse Ranch State Park (see Figure 3) was no longer maintained by state park staff as the state park no longer required this road for access; access to the state park was now ensured at another location through a newly-constructed bridge (S. M. Castillo, Arizona State Parks, pers. comm.). Once the Tavasci Marsh roadway was no longer maintained by state park staff, the road culverts soon became clogged with debris (these culverts had been maintained on a daily basis) (S. M. Castillo, Arizona State Parks, pers. comm.). Beavers then began using the roadway as an anchor for their dams and subsequently raised water levels in the marsh.

By the mid-late 1990's, with limited Arizona Game and Fish Department staff involvement due to budget constraints, the water control structures fell into disrepair. Beavers dammed water

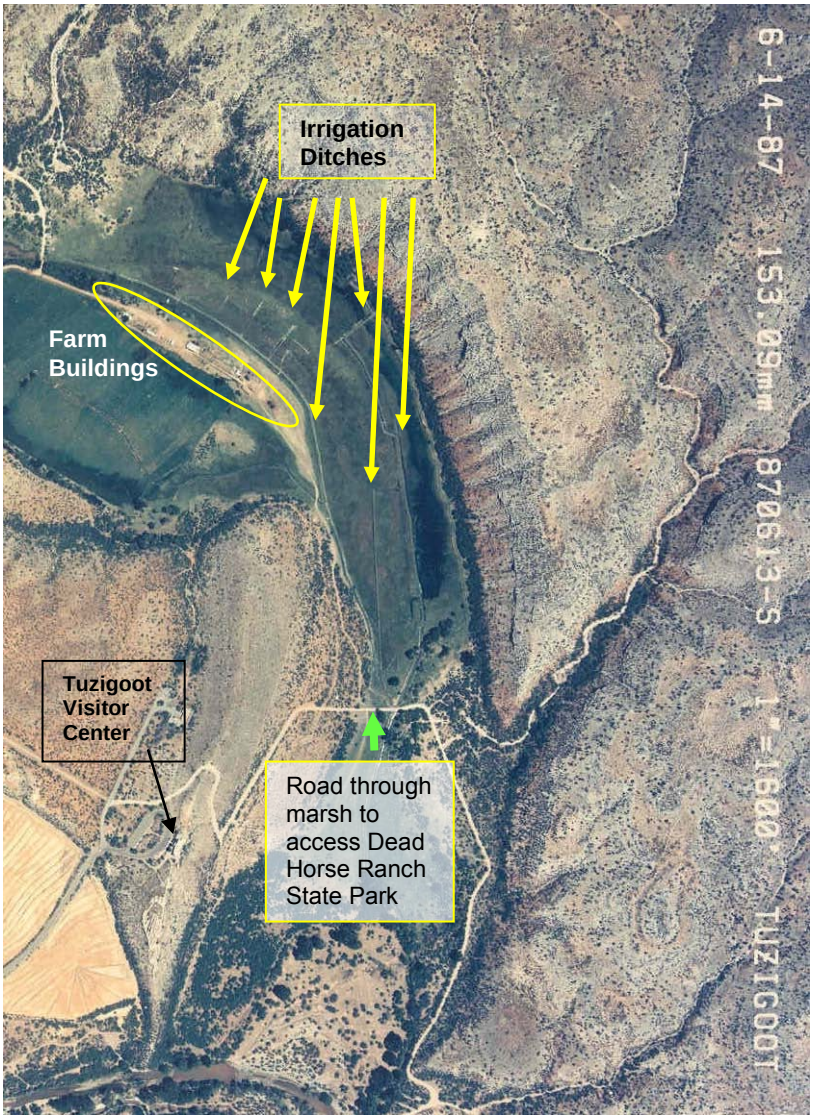

Figure 3. Photo from 1987 showing the Tavasci farm operations with pasturelands and farm buildings. Straight lines within green pasture area indicate the ditch systems and are pointed to with yellow arrows. Note road goes through the middle of the marsh (with green arrow).

downstream of the structures (related to the Tuzigoot-Dead Horse Ranch road no longer being maintained), thereby flooding the water control structures and rendering them inoperative. Additionally at this time, Peck's Lake was undergoing periodic flushing which inundated the marsh with additional waters (Van Gausig, Clarkdale Mayor, pers. comm.). Both of these conditions contributed to a vast acreage of cattails by the mid-1990's (S. M. Castillo, Arizona State Parks, pers. comm.).

Recreation has been allowed in the southern portion of the marsh throughout the decades. Use of this area increased when in 1986, the land close to the Tuzigoot Bridge (just west of the current monument boundaries) was created as part of the Verde River Greenway State Natural Area administered by the Arizona State Parks. Hikers, horseback riders, and bicycles used the area

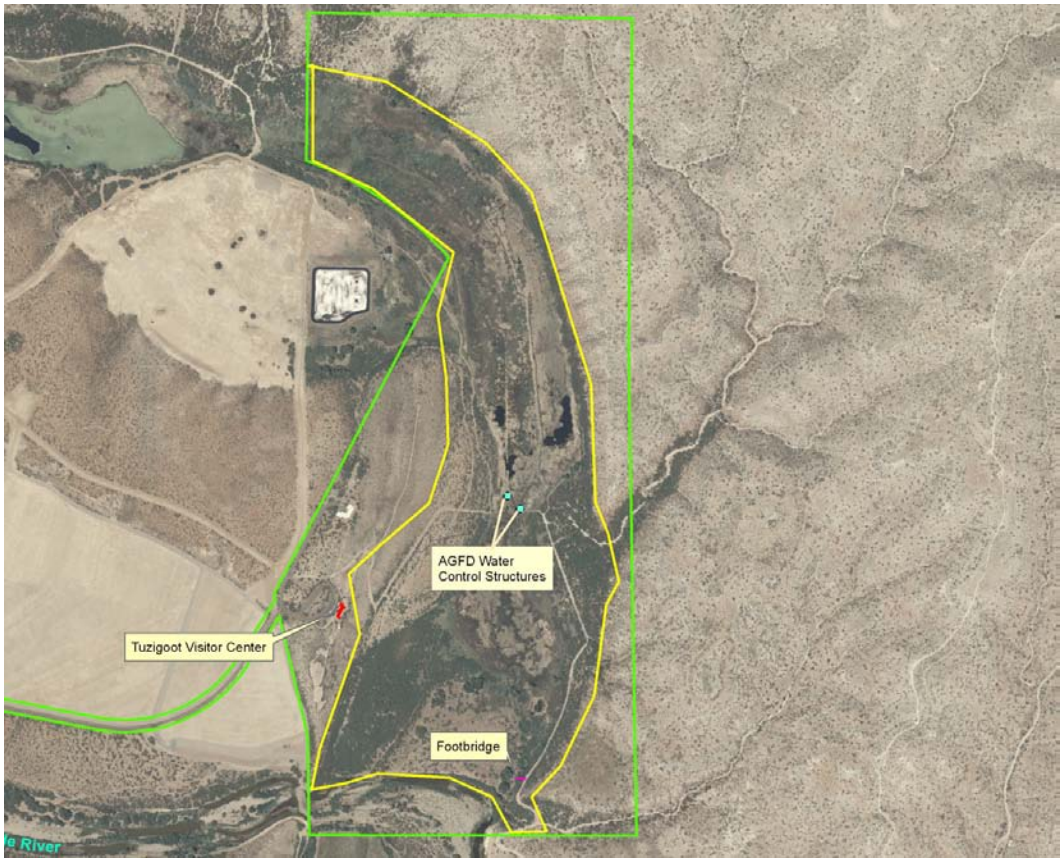

Figure 4. Water control structures (in light blue) constructed in the early 1990's by the Arizona Game and Fish Department to control water levels in the marsh. By the late 1990's, these structures no longer functioned as they were flooded by beaver activity.

just north of the Verde River to connect the trails between Dead Horse State Park and the Verde River Greenway State Natural Area for recreation from the 1986 to the present.

1.2.2 NPS Acquisition and Subsequent Restoration/Management Planning

In December 2005, 324 acres were conveyed from Phelps Dodge to the National Park Service (NPS), including Tavasci Marsh, through a land swap. Numerous inventories and assessments were conducted in the marsh area by NPS even before the property was acquired including vascular plant and vertebrate inventories (Schmidt et al. 2005) and water quality sampling. Starting in 2006, the NPS also began integrated pest management of mosquitoes in the marsh, a major public concern due to West Nile Virus issues. In 2007, a water budget experiment was conducted to determine the discharge of the Shea Springs complex.

In 2007, NPS staff (both local and national levels) also began discussing the potential for restoring and enhancing marsh habitat that had been impacted by decades of agricultural management. In spring 2008, NPS began working with Natural Channel Design to partner on a proposal to the Arizona Water Protection Fund. Beginning in summer 2008, NPS staff began to give presentations about the marsh and solicit public input for future management considerations, including marsh recreation opportunities. The Arizona Water Protection Fund proposal for marsh restoration was funded in October 2008 (Natural Channel Design 2008), and

on-the-ground environmental planning for this project started soon afterwards. In November 2008, a formal public scoping letter was sent to the public.

Baseline data continued to be collected at the marsh to provide specific details for the marsh management and enhancement project. NPS staff (from Point Reyes National Seashore and experienced in wetland projects) conducted a Wetland Delineation and Condition Assessment in May 2009 (Ryan and Parsons 2009; Parsons and Ryan 2009). In fall 2009, Natural Channel Design conducted a survey of the marsh to determine topography and elevation, as well as map the structures in the marsh. To understand groundwater contributions compared to Peck's Lake surface contributions, NPS installed shallow wells to measure groundwater levels in the northern section of the marsh in May 2010.

1.2.3 Narrow Transition Zones in the Marsh

While Tavasci Marsh currently provides valuable habitats, the existing species and structural diversity of marsh vegetation are limited as a result of historic management practices, especially from 60 years of dairy/cattle farming operations. Wetland systems are typically composed of four hydrologic regimes: areas of short inundation, areas of long-term inundation, the drawdown zone, and the permanently flooded areas (Hoag, Melvin, and Tilley 2007). Each regime or zone supports a characteristic plant community providing essential habitats and function to the wetland system.

Tavasci Marsh is dominated with close to 70 percent cover by cattails (Ryan and Parsons 2009) in the permanently flooded zone. With the exception of some cottonwood/willow communities (short inundation zone) located along the eastern marsh edge, the marsh is surrounded by mesquite bosque upland habitats. The change from cattail marsh to mesquite bosque is abrupt with little or no transition (see Figure 5). The artificially narrow or missing transition zones include wetted sedge/rush shoreline (draw down zone), shrubby willow fringe (short-term saturation zone), and native grassland habitats. These plant communities provide additional valuable wildlife habitats. Open water areas are also diminishing due to invasion of cattails, further restricting wildlife habitats.

This lack of plant community diversity at Tavasci Marsh is primarily the result of the existing hydrology and micro-topography of the marsh system. The historic management of agricultural fields removed natural variations in the topography of the marsh. Stable outlet elevations result in little change in water surfaces throughout the year. The combination of flat topography and stable, constant water depths favor cattails and abrupt transitions to dry uplands.

1.2.4 Documenting Existing Conditions: Wetland Delineation and Condition Assessment

As briefly described above, in May 2009, NPS staff from Point Reyes National Seashore conducted a Wetland Delineation following the Cowardin Wetlands Classification (Cowardin et al. 1979), a wetland classification system developed by the U.S. Fish and Wildlife Service and used by the National Wetlands Inventory to describe and classify wetlands. At the same time, a Wetlands Condition Assessment was conducted following the California Rapid Assessment Methods (CRAM) protocol (Collins et al. 2009) to characterize the wetlands. This project provided quantification and mapping of the wetland acreages, and also provided the basis for existing conditions of the wetlands. This project also identified and mapped the major wetland

Figure 5. Abrupt transition from cattails to mesquite. Missing transition zones include willow and sedge/rush zones.

plant communities in the marsh, providing a framework for restoration and habitat enhancement planning.

This project resulted in 96 acres of wetlands being identified at Tavasci Marsh through the delineation (see Figure 6). Of the 96 acres, 69.5 percent was identified as being associated with cattail habitat (see Table 1 for the existing percentages).

1.2.5 Defining Habitat Objectives: Tavasci Marsh Interagency Wildlife Habitat Workshop

In January 2010, after receiving the Wetland Delineation/Condition Assessment and topographic survey products, the National Park Service coordinated a marsh habitat workshop. Over thirty individuals participated from various agencies and groups including NPS, Arizona State Parks, U.S. Fish and Wildlife Service, Natural Channel Design, the Arizona Game and Fish Department, Northern Arizona University, University of Arizona, Nature Conservancy, Town of Clarkdale, and the Audubon Society (see Appendix C for wildlife workshop exhibits).

Through a consensus procedure, this group generated the target plant habitat types and the extent of the habitats that would provide optimum assemblage for the maximum enhancement of fish and wildlife habitats within the marsh. The results from this workshop for the proposed optimum areal extents of hydrologic conditions and plant assemblages (expressed in percentages of the total area of the marsh) are listed below in Table 1 as the objectives for the marsh habitat enhancement project.

1.3 Purpose and Need

Since the late 19th century, Tavasci Marsh has undergone extensive changes to its hydrology due to its century-long history as a farmland and pasture area. Activities such as draining and leveling the marsh have directly contributed to the current hydrologic system. The marsh currently has abrupt and narrow transition zones to the more upland mesquite bosque areas, with depressed plant communities including the sedge/rush shorelines, shrubby willow fringe, and native grassland habitats.

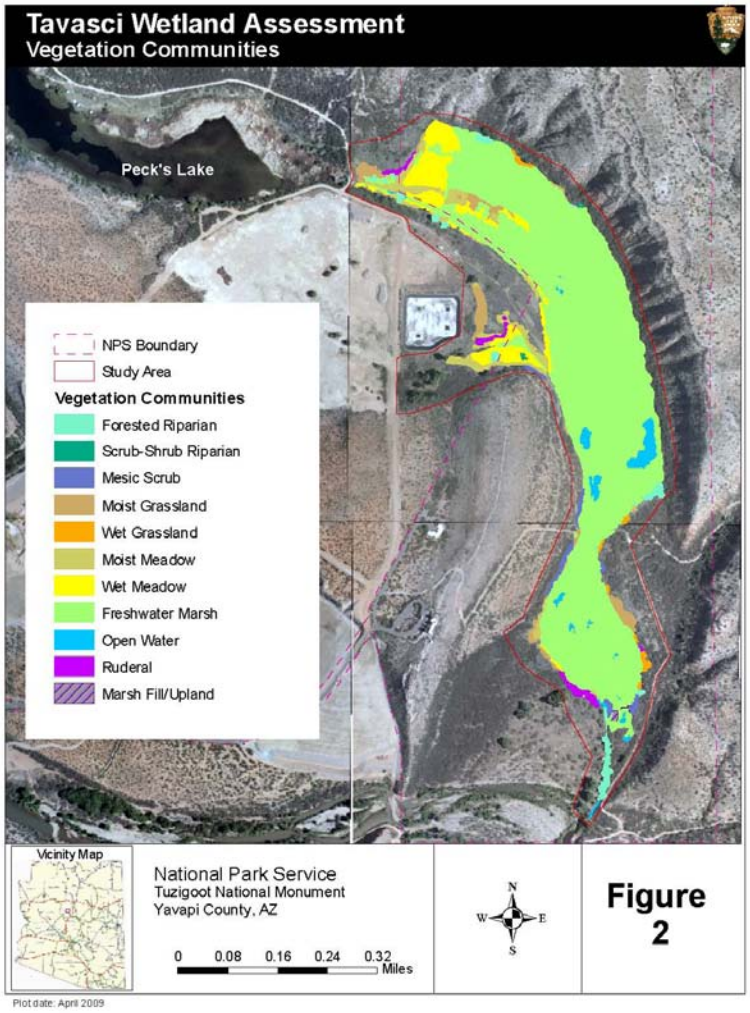

Figure 6. Example of one of many maps from the Wetland Delineation and Condition Assessment conducted by Ryans and Parsons (2009) and Parsons and Ryan (2009). This map referred to broad vegetation community types.

The purposes of this project are to enhance or rehabilitate the wildlife and fish habitat conditions in the marsh ecosystem, and to encourage visitor appreciation of the marsh. This would be accomplished by implementing short- and long-term restoration and management actions designed to maintain sustainability of the enhanced marsh ecosystem; and increasing access to and interpretation of the marsh ecosystem for the visiting public.

The project is needed to achieve the following objectives:

1. Enhance the wildlife and fish habitat in the marsh by working toward the habitat type targets recommended by the Tavasci Marsh Wildlife Habitat Workshop (Table 1).

2. Promote long-term sustainability for both enhancement and management actions.

3. Increase recreational, interpretive, and educational use of the marsh.

Table 1. Target percentages for Objective 1. Range of optimal percentages (across the total area of the marsh) for each habitat type for the various wildlife species as determined by the Tavasci Marsh Habitat Workshop attendees on January 2010. Existing vegetation communities derived from wetland delineation and wetland delineation (Ryan and Parsons 2009).

Vegetation Community	Dominant species (if present)	Current Acres	Current %	Birds	Amphibian	Reptile--Aquatic	Reptile--Terrestrial	Aquatic Inverts	Mammals-Aquatic	Mammals-Terrestrial	Fish	Ideal %
Open Water-Deep and Shallow		2.17	2.3	10	5 SHALLOW	2.3 SHALLOW	2.3		5	2.3	X	5-10
Freshwater Marsh A	Cattails	66.6	69.5	30-40	25	25	15	X	40	11.4		25-40
Freshwater Marsh B	Bulrushes (*Scirpus*)	8.6	9.0	15-20	25	25	15	X	30	15	X SHALLOW	15-25
Wet/Moist Meadow	Short Sedges and rushes	10.65	11.1	11.2	20	20	20.4		4.7	25		11-25
Wet/Moist Grassland	*Leymus triticoides*(wild rye)	3.88	4.0	1.5	13	21	30		4	30		15-30
Scrub-Shrub Riparian	*Baccharis,* arrowweed, scrub willows	0.1	0.1	2	5.7	5	5		10	5		1-10
Forested Riparian	Fremont Cottonwood/Gooding Willow	1.81	1.9	5	5.7	5	5		5	5		5
Mesic Scrub/Upland	Velvet mesquite	0.83	0.9	Upland areas have extensive mesquite, not focusing on this habitat type for enhancement/restoration								
Shea Springs				Related to Page Springsnail: need free-flowing springhead that is not inundated with water. May need vegetation management to allow for sunlight								
Disturbed Lands/Ruderal		1.25	1.3	Focusing on reducing this habitat type as much as possible.								
		95.89	**100%**									**77-145%**

1.4 Relationship to Other Plans and Policies

Current plans and policy that pertain to this proposal include the 2010 General Management Plan/Environmental Assessment for Montezuma Castle and Tuzigoot National Monuments (NPS 2010), the 2006 National Park Service Management Policies (NPS 2006), and the 2007 Invasive Plant Management Plan for Montezuma Castle and Tuzigoot National Monuments (NPS 2007). The following paragraphs are more information on how this proposal meets the goals and objectives of these plans and policies:

- The Tavasci Marsh project is consistent with the 2010 General Management Plan/Environmental Assessment for Montezuma Castle and Tuzigoot National Monuments (NPS 2010), which included as part of the preferred alternative restoring and managing the marsh. The General Management Plan identifies the actions, impacts, and mitigating measures necessary to resolve issues facing the monument. The preferred alternative of the General Management Plan states:

  > Active marsh restoration and management activities would begin at the Tavasci Marsh. A boardwalk would be constructed through the marsh. If assessment determines that there would be no conflict with preservation of significant cultural resources, this would be constructed along an existing old road alignment.

- The Tavasci Marsh project ties in closely with the 2007 Invasive Plant Management Plan. One of the main objectives for the 2007 plan is to "Preserve, protect, and restore natural conditions and ecological processes of MOCA/TUZI [Montezuma Castle and Tuzigoot National Monuments] by eradicating, significantly reducing, or containing infestations of known invasive plants." The Tavasci Marsh project also similarly proposes to improve ecological function and restore the marsh to more natural conditions than those that currently exist.

- The Tavasci Marsh project is consistent with the goals and objectives of the 2006 National Park Service Management Policies (NPS 2006) related to wetlands that state when "natural wetland characteristics or functions have been degraded or lost due to previous or ongoing human actions, the Service will, to the extent practicable, restore them to predisturbance conditions….When practicable, the Service will not simply protect but will seek to enhance natural wetland value by using them for educational, recreational, scientific, and similar purposes that do not disrupt natural wetland functions."

- The 2006 NPS Management Policies clearly only allow for bicycle use on roads or in parking areas. Although the policies state that routes may be designated for bicycle use, "determination may be made to designate routes outside developed areas and special use zones; however, the designation must be made by promulgating a special regulation." Thus, a concurrent rule-making process will be conducted to allow for mountain bike use on a designated trail along the southern part of the marsh to allow connection for mountain bikers between the Dead Horse Ranch State Park and Verde River Greenway

State Natural Area. This use has historically occurred on this land since the Verde River Greenway State Natural Area lands were acquired in 1986.

1.5 Appropriate Use

Sections 1.4 and 1.5 of 2006 National Park Service Management Policies (NPS 2006) direct that the National Park Service must ensure that the park uses that are allowed would not cause impairment of, or unacceptable impacts on, park resources and values. A new form of park use may be allowed within a park only after a determination has been made in the professional judgment of the park manager that it would not result in unacceptable impacts.

Section 8.1.2 of 2006 National Park Service Management Policies, "Process for Determining Appropriate Uses," provides evaluation factors for determining appropriate uses. All proposals for park uses are evaluated for:

- Consistency with applicable laws, executive orders, regulations, and policies;
- Consistency with existing plans for public use and resource management;
- Actual and potential effects on park resources and values;
- Total costs to the service; and
- Whether the public interest will be served.

Park managers must continually monitor all park uses to prevent unanticipated and unacceptable impacts. If unanticipated and unacceptable impacts emerge, the park manager must engage in a thoughtful, deliberate process to further manage or constrain the use, or discontinue it. More information on the definition of unacceptable impacts as cited in Section 1.4.7.1 of 2006 National Park Service Management Policies can be found in Section 4.0, Environmental Consequences, of this document.

Section 8.2 of 2006 National Park Service Management Policies related to "Visitor Use" states that "To provide for enjoyment of the parks, the National Park Service will encourage visitor use activities that:

- Are appropriate to the purpose for which the park was established, and
- Are inspirational, educational, or healthful, and otherwise appropriate to the park environment; and
- Will foster an understanding of and appreciation for park resources and values, or will promote enjoyment through a direct association with, interaction with, or relation to park resources; and
- Can be sustained without causing unacceptable impacts to park resources and values."

Section 9.2.2.4 of the 2006 NPS Management Policies, "Bicycle Trails," clearly only allows for bicycle use on roads or in parking areas. Policies state that routes may be designated for bicycle use and "determination may be made to designate routes outside developed areas and special use zones; however, the designation must be made by promulgating a special regulation."

To address this, a concurrent rule-making process will be conducted to consider allowing for mountain bike use on a designated trail along the southern part of the marsh to foster connection for mountain bikers between the Dead Horse Ranch State Park and Verde River Greenway State Natural Area. This use has historically occurred on this land since the Verde River Greenway State Natural Area lands were acquired in 1986.

Restoring and enhancing Tavasci Marsh is consistent with applicable laws, executive orders, regulations, and policies. Washington and regional-level NPS wetland scientists, floodplain experts, and hydrologists have partnered with local NPS staff for this project. Restoration and management activities of Tavasci Marsh were specifically identified in the 2010 Montezuma Castle/Tuzigoot General Management Plan (NPS 2010). Actual and potential effects on park resources and values are expected to be beneficial enhancement for native marsh plant and wildlife communities. Costs for this partner project are shared among the National Park Service, the Arizona Water Protection Fund, and Natural Channel Design, in addition to various other agencies.

Working closely with local habitat experts, Washington Office NPS staff, hydrologists, and civil engineers would ensure that management and habitat improvements for Tavasci Marsh would not cause unacceptable impacts. Ultimately, rehabilitating or enhancing the ecological functions of Tavasci Marsh and managing the marsh for greater recreation, interpretation, and educational opportunities would greatly enhance the public interest for the marsh. Tavasci Marsh is a unique resource, especially in the arid southwest, and has been identified as an Important Bird Area by the Audubon Society due to high bird diversity found at the marsh. The marsh presents a rare opportunity for visitors and residents of the Verde River basin to learn about the current ecological values for an enhanced and restored marsh, as well as emphasizing the close connection with the Tuzigoot Pueblo in the past. Because the ancient oxbow including Peck's Lake and Tavasci Marsh predate Sinaguan occupation of Tuzigoot, the marsh area was likely used by the Sinaguans.

1.6 Public Scoping

Scoping is a process to identify the resources that may be affected by a project proposal, and to explore possible alternative ways of achieving the proposal while minimizing adverse impacts. Scoping is also a way of gauging what the public values in terms of management actions and visitor activities at a specific area. Tuzigoot National Monument conducted both internal scoping with National Park Service staff and external scoping with the public and interested/affected groups and agencies for Tavasci Marsh.

Internal scoping was conducted by an interdisciplinary team of professionals from Tuzigoot and Montezuma Castle National Monuments and National Park Service Washington Office's Water Resources Division. Internal scoping included recreation opportunities and management in addition to habitat enhancement for the marsh. On some occasions, some internal scoping meetings for the habitat enhancement strategies also included U.S. Fish and Wildlife Service, Arizona State Parks, and Natural Channel Design. Interdisciplinary team members met on May 2007, February 2008, October 2008, November 2008, May 2009, August 2010, and September 2010 to discuss the purpose and need for the project; various alternatives; potential

environmental impacts; past, present, and reasonably foreseeable projects that may have cumulative effects; and possible mitigation measures. Over the course of the project discussions, team members have conducted numerous site visits to view and discuss Tavasci Marsh.

External scoping was initiated first at public meetings, followed by a scoping letter. Public meetings were held on August 2008 with over 40 attendees and November 2008 with 25 attendees. At those meetings, public comments were written on a flipchart in addition to passing out a checkbox/comment form. There were 44 people who filled out individual comment forms, 41 flipchart comments in August 2008, and 19 flipchart comments in November 2008.

On November 14, 2008, a public scoping letter was emailed to over 80 different email addresses, as well as announced in local papers. In addition, the scoping letter was mailed to various federal and state agencies, associated Native American tribes, local governments, and local news organizations. Scoping information was also posted on the monument's website. During the 30-day scoping period, three public responses were received expressing support for the restoration and management of Tavasci Marsh. One Native American tribe responded with no objection to the proposed project but did request that NPS continue to solicit their input. More information regarding scoping can be found in Section 4, Consultation and Coordination.

1.7 Impact Topics

In Sections 1.7.1 Impact Topics Retained for Further Analyses and 1.7.2 Impact Topics Dismissed from Further Analyses, the NPS closely considers at all potential impacts by considering the direct, indirect, and cumulative effects of the proposed action on the environment, along with connected and cumulative actions. The NPS defines "measurable" impacts as moderate or greater effects. It equates "no measurable effects" as minor or less effects. "No measurable effect" is used by the NPS in determining if a categorical exclusion applies or if impact topics may be dismissed from further evaluation in an EA or EIS. The use of "no measurable effects" in this EA pertains to whether the NPS dismisses an impact topic from further detailed evaluation in the EA. The reason the NPS uses "no measurable effects" to determine whether impact topics are dismissed from further evaluation is to concentrate on the issues that are truly significant to the action in question, rather than amassing needless detail in accordance with CEQ regulations at 1500.1(b).

In this section of the EA, NPS also provides a limited evaluation and explanation as to why some impact topics are not evaluated in more detail. Impact topics are dismissed from further evaluation in this EA if:

- they do not exist in the project analysis area, or
- they would not be affected by the proposal, or the likelihood of impacts are not reasonably expected, or
- through the application of mitigation measures, there would be minor or less effects (i.e. no measurable effects) from the proposal, and there is little controversy on the subject or reasons to otherwise include the topic.

Due to there being no effect or no measurable effects, there would either be no contribution towards cumulative effects or the contribution would be extremely low. For each issue or topic presented below, if the resource is found in the analysis area or the issue is applicable to the proposal, then a limited analysis of direct and indirect, and cumulative effects is presented.

Impact topics for this project were identified on the basis of federal laws, regulations, and orders; 2006 Management Policies; and National Park Service knowledge of resources at Tuzigoot National Monument. Impact topics carried forward for further analysis in this environmental assessment are:

- Soils
- Vegetation
- Water Quality
- Wetlands and Floodplains
- General Fish and Wildlife
- Species of Special Concern
- Archeological Resources
- Ethnographic Resources
- Historic Structures
- Public Health and Safety
- Visitor Use and Experience
- Park Operations

Impact topics dismissed from further analysis are:

- Air Quality
- Water Quantity
- Paleontological Resources
- Cultural Landscapes
- Museum Collections
- Soundscape Management
- Socioeconomic Environment
- Prime and Unique Farmlands
- Indian Trust Resources
- Environmental Justice
- Wilderness

1.7.1 Impact Topics Retained for Further Analysis

Impact topics that are carried forward for further analysis in this environmental assessment are listed below along with the reasons why the impact topic is further analyzed. For each of these topics, the following text also describes the existing setting or baseline conditions (i.e. affected environment) within the project area. This information would be used to analyze impacts against the current conditions of the project area in Section 3.0, Affected Environment and Environmental Consequences.

1.7.1.1 Soils

According to the 2006 National Park Service Management Policies, the National Park Service will preserve and protect geologic resources and features from adverse effects of human activity, while allowing natural processes to continue (NPS 2006). These policies also state that the National Park Service will strive to understand and preserve the soil resources of park units and to prevent, to the extent possible, the unnatural erosion, physical removal, or contamination of the soil, or its contamination of other resources. Enhancing the marsh's hydrologic function and restoring/rehabilitating native plant communities involves some earth movement, which has the potential to have a measurable impact on soil resources; therefore this topic will be analyzed further.

1.7.1.2 Vegetation

According to the 2006 National Park Service Management Policies, the National Park Service strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of plants (NPS 2006). Enhancing the marsh's hydrologic function and manipulating water levels, restoring/rehabilitating native plant communities, and recreation management all have the potential to have a measurable impact on vegetation; therefore this topic will be analyzed further.

1.7.1.3 Water Quality

NPS policies require protection of water quality consistent with the Clean Water Act (also known as Federal Water Pollution Control Act, 33 U.S.C. 1251-1387). The purpose of the Clean Water Act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." To enact this goal, the U.S. Army Corps of Engineers has been charged with evaluating federal actions that result in potential degradation of waters of the United States and issuing permits for actions consistent with the Clean Water Act. The U.S. Environmental Protection Agency also has responsibility for oversight and review of permits and actions, which affect waters of the United States.

The marsh waters flow to the south to the Verde River (see Figure 2). Changing the hydrologic function of the marsh could impact water quality in the monument and downstream; therefore, the topic of water quality will be analyzed further.

1.7.1.4 Wetlands and Floodplains

For regulatory purposes under the Clean Water Act (also known as Federal Water Pollution Control Act, 33 U.S.C. 1251-1387), the term wetlands means "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." Executive Order 11990 Protection of Wetlands requires federal agencies to avoid, where possible, adversely impacting wetlands. Further, Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to prohibit or regulate, through a permitting process, discharge of dredged or fill material or excavation within waters of the United States. National Park Service policies for wetlands as stated in 2006 National Park Service Management Policies and Director's Order (DO) 77-1 Wetlands Protection, strive to prevent the loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

Executive Order 11988 Floodplain Management requires all federal agencies to avoid construction within the 100-year floodplain unless no other practicable alternative exists. The National Park Service under 2006 National Park Service Management Policies and Director's Order 77-2 Floodplain Management will strive to preserve floodplain values and minimize hazardous floodplain conditions. According to DO 77-2 Floodplain Management, certain construction within a 100-year floodplain requires preparation of a Statement of Findings for floodplains. Tavasci Marsh lies within a floodplain for the Verde River and construction of water structures and visitor access structures may occur in this project. Therefore, the topic of floodplains will be analyzed further and a Statement of Findings for floodplains has been prepared (Appendix E).

1.7.1.5 General Fish and Wildlife

According to 2006 National Park Service Management Policies, the NPS strives to maintain all components and processes of naturally evolving park unit ecosystems, including the natural abundance, diversity, and ecological integrity of animals. Because Tavasci Marsh provides unique habitat for fish and wildlife along the Verde River, habitat enhancement and hydrological changes to the marsh have the potential to affect wildlife. Therefore, the topic of general fish and wildlife will be analyzed further.

1.7.1.6 Species of Special Concern

The Endangered Species Act of 1973 requires examination of impacts on all federally-listed threatened, endangered, and candidate species. Section 7 of the Endangered Species Act requires all federal agencies to consult with the U.S. Fish and Wildlife Service (or designated representative) to ensure that any action authorized, funded, or carried out by the agency does not jeopardize the continued existence of listed species or critical habitats. In addition, the 2006 National Park Service Management Policies and Director's Order 77 Natural Resources Management Guidelines require the National Park Service to examine the impacts on federal candidate species, as well as state-listed threatened, endangered, candidate, rare, declining, and sensitive species (NPS 2006). There are a number of special status species in Tavasci Marsh and this project may affect these species or their habitats; therefore, this topic is carried forward for further analysis.

1.7.1.7 Archeological Resources

Section 106 of the National Historic Preservation Act, as amended in 1992 (16 USC 470 et seq.); the National Park Service's Director's Order 28 Cultural Resource Management Guideline; 2006 National Park Service Management Policies; and the National Park Service's Director's Order 28A Archeology require the consideration of impacts on prehistoric and historic properties that are listed on or eligible to be listed in the National Register of Historic Places. Because the excavation activities for the water conveyance channel, creation of microtopography through excavation of soil materials, and removal of cattails have the potential to impact archeological resources; this topic is carried forward for further analysis.

1.7.1.8 Ethnographic Resources

Per the National Park Service's Director's Order 28 Cultural Resource Management Guideline, ethnographic resources are defined as any site, structure, object, landscape, or natural resource feature assigned traditional, legendary, religious, subsistence, or other significance in the cultural system of a group traditionally associated with it. According to Director's Order 28 and Executive Order 13007 on sacred sites, the National Park Service should try to preserve and protect ethnographic resources. Tavasci Marsh has traditional significance in the cultural systems of several Native American tribes associated with Tuzigoot National Monument. Thus, ethnographic resources have been retained for further analyses.

1.7.1.9 Historic Structures

The term "historic structures" refers to both historic and prehistoric structures, which are defined as constructions that shelter any form of human habitation or activity. The project area contains a historic structure eligible for the National Register of Historic Places. For the purpose of this environmental assessment, only structures containing standing architecture will be discussed in this section while ephemeral prehistoric sites will be addressed above under archeological

resources. Proposed alternatives address actions that may have the potential to affect historic structures; therefore this topic will be analyzed further.

1.7.1.10 Public Health and Safety

The health and safety of visitors and park staff are of the utmost importance to NPS. The 2006 National Park Service Management Policies state that the "Service and its concessioners, contractors, and cooperators will seek to provide a safe and healthful environment for visitors and employees." Tavasci Marsh is known to harbor West Nile Virus mosquitoes, and standing water/cattail marsh areas are known to be excellent breeding grounds for mosquitoes. With the average number of 109,000 annual visitors for the monument compounded by proximity to the state parks, West Nile Virus vector mosquitoes are a serious concern. Proposed alternatives address actions that have the potential to affect mosquito breeding habitat, and thereby have the potential to affect public health and safety; thus this topic will be analyzed further.

1.7.1.11 Visitor Use and Experience

According to 2006 National Park Service Management Policies, the enjoyment of park resources and values by the public is part of the fundamental purpose of all park units (NPS 2006). The National Park Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and will maintain within the parks an atmosphere that is open, inviting, and accessible to every segment of society. Further, the National Park Service will provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks. Tavasci Marsh was an Audubon Society Important Bird Area prior to NPS acquisition, and the marsh is located below the Tuzigoot Pueblo, which is the primary destination for most Tuzigoot visitors. By increasing visitor access into the marsh through additional trails and upgrading bridges, this project will likely affect visitor use and experience. Therefore, this topic will be analyzed further.

1.7.1.12 Park Operations

Currently, the primary focus for Tuzigoot National Monument is the Tuzigoot Pueblo and the Tuzigoot Visitor Center. Expanding and encouraging visitor access to Tavasci Marsh is expected to have a measureable effect on monument staff's opportunities within the marsh to interpret to visitors, as well as staff time and work. Natural Resource management staff will also be closely tied to proposed habitat enhancement alternative actions. Therefore, this topic will be analyzed further.

1.7.2 Impact Topics Dismissed from Further Analysis

Impact topics that are dismissed forward for further analysis in this environmental assessment are listed below along with the reasons for dismissal.

1.7.2.1 Air Quality

The Clean Air Act of 1963 (42 U.S.C. 7401 et seq.) was established to promote the public health and welfare by protecting and enhancing the nation's air quality. The act establishes specific programs that provide special protection for air resources and air quality related values associated with National Park Service units. Section 118 of the Clean Air Act requires a park unit to meet all federal, state, and local air pollution standards. Tuzigoot National Monument is designated as Class II air quality area under the Clean Air Act. A Class II designation indicates the maximum allowable increase in concentrations of pollutants over baseline concentrations of

sulfur dioxide and particulate matter as specified in Section 163 of the Clean Air Act. Furthermore, the Clean Air Act provides that the federal land manager has an affirmative responsibility to protect air quality related values (including visibility, plants, animals, soils, water quality, cultural resources, and visitor health) from adverse pollution impacts.

For the activities to restore hydrologic function, add topography to the edges, and place water control structures; construction equipment could adversely affect air quality by exhaust emissions. Minimizing the extent to which construction equipment idles would help reduce this effect. Indirect air quality impacts associated with routine daily vehicle emissions from field visits by employees on official business would be unchanged. Therefore, local air quality may be temporarily degraded by exhaust and/or dust generated by activities and emissions related to enhancing hydrologic function. This degradation would result in an overall negligible impact to air quality, and would be temporary, lasting only as long as the construction-type activities. Impacts to overall park air quality are not expected. Therefore, air quality was dismissed from further analysis.

1.7.2.2 Water Quantity

According to 2006 National Park Service Management Policies, water for the preservation and management of the national park system will be obtained and used in accordance with legal authorities. This project will not change existing water rights quantities. NPS has, however, applied for an amendment to the State of Arizona to change the water usages for the existing rights for (1) irrigation for wildlife use and wetlands, and (2) recreation, but this will not change the water quantities for the water rights. Because this project is not expected to have any impacts, water quantity is dismissed from further analyses.

1.7.2.3 Paleontological Resources

According to 2006 National Park Service Management Policies, paleontological resources (fossils), including both organic and mineralized remains in body or trace form, will be protected, preserved, and managed for public education, interpretation, and scientific research (NPS 2006). No paleontological resources have been found in or near the project site. Therefore, there are no impacts to paleontological resources as a result of this proposal and they will be dismissed from further assessment.

1.7.2.4 Cultural Landscapes

According to the National Park Service's Director's Order 28 Cultural Resource Management Guideline, a cultural landscape is a reflection of human adaptation and use of natural resources, and is often expressed in the way land is organized and divided, patterns of settlement, land use, systems of circulation, and the types of structures that are built. Under 2006 National Park Service Management Policies it states that the "National Park Service will not reconstruct an obliterated cultural landscape." The historic farmlands have been obliterated by cattails and other plants (compare Figures 3 and 4). While the Tuzigoot Pueblo archeological district is considered to be an eligible Cultural Landscape, the marsh is outside the scope due to long-term farm activities, significant cattail growth, and extensive manipulation of the substrate. While the inhabitants of the Tuzigoot Pueblo likely used the marsh for farming, the changes that have occurred from historic farming activities and centuries of flooding from the Verde River have most likely greatly changed the cultural landscape since their time. Therefore, this topic has been dismissed from further consideration.

1.7.2.5 Museum Collections

According to Director's Order 24 Museum Collections, the National Park Service requires the consideration of impacts on museum collections (historic artifacts, natural specimens, and archival and manuscript material), and provides further policy guidance, standards, and requirements for preserving, protecting, documenting, and providing access to, and use of, National Park Service museum collections. Museum collections would not be impacted by this proposal and the topic of museum collections has been dismissed from further consideration.

1.7.2.6 Soundscape Management

Equipment used to place new water control structures, add topography to the edges, and enhance the hydrology of the marsh would generate some noise in the marsh above ambient conditions. Noise sources include vehicles, equipment, and additional people in the area conducting work. Noise impacts from this project would only last the duration of construction-type work. Minimizing idling of construction vehicles and equipment would help reduce noise impacts. This project is not expected to have considerable effects on soundscape. Similarly, effects of past, present, and foreseeable future actions on soundscape would be short-term and would not considerably affect soundscape. Therefore, soundscape was dismissed from further analysis.

1.7.2.7 Socioeconomic Environment

The proposed action would neither change local and regional land use nor appreciably impact local businesses or other agencies. Implementation of the proposed action could provide a negligible impact to the economy of nearby Clarkdale and Cottonwood, Arizona. There could be minimal increases in employment opportunities and revenue generated from this project. Any increase in workforce and revenue would be temporary and negligible. Because the impacts to the socioeconomic environment would be negligible, this topic has been dismissed.

1.7.2.8 Prime and Unique Farmlands

The Farmland Protection Policy Act of 1981, as amended, requires federal agencies to consider adverse effects to prime and unique farmlands that would result in the conversion of these lands to non-agricultural uses. Prime or unique farmland is classified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), and is defined as soil that particularly produces general crops such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts. There are no prime and unique farmlands designated in Tuzigoot National Monument and this topic has been dismissed.

1.7.2.9 Indian Trust Resources

Secretarial Order 3175 requires that any anticipated impacts to Indian trust resources from a proposed project or action by the Department of Interior agencies be explicitly addressed in environmental documents. The federal Indian trust responsibility is a legally enforceable fiduciary obligation on the part of the United States to protect tribal lands, assets, resources, and treaty rights, and it represents a duty to carry out the mandates of federal law with respect to American Indian and Alaska Native tribes.

There are no Indian trust resources at Tuzigoot National Monument. The lands comprising the monument are not held in trust by the Secretary of the Interior for the benefit of Indians due to

their status as Indians. Because there are no Indian trust resources, this topic is dismissed from further analysis in this document.

1.7.2.10 Environmental Justice

Executive Order 12898 General Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires all federal agencies to incorporate environmental justice into their missions by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs and policies on minorities and low-income populations and communities. Because Tavasci Marsh would be available for use by all park visitors regardless of race or income, the proposed action would not have disproportionate health or environmental effects on minorities or low-income populations or communities. Because there would be no disproportionate effects, this topic is dismissed from further analysis in this document.

1.7.2.11 Wilderness

The 2006 National Park Service Management Policies applies "wilderness" to the categories of eligible, study, proposed, recommended, and designated wilderness. There are no such lands designated under any of those categories at Tuzigoot National Monument, therefore this topic is dismissed from further analysis in this document.

CHAPTER 2.0 ALTERNATIVES CONSIDERED

During meetings on February 2008, May 2009, August 2010, and September 2010, an interdisciplinary NPS team (Montezuma Castle and Tuzigoot National Monuments, Washington Office Water Resources Division, and Southern Arizona Support Office) and Natural Channel Design met to discuss developing project alternatives. A total of five alternatives were considered. Three alternatives were carried forward for analyses and two alternatives were rejected.

2.1 Actions Common to All Alternatives

For all of the alternatives, the following management strategies will apply:

- **There will be no net loss of wetlands resulting from any of the alternatives.** For Tavasci Marsh, we will be following Executive Order 11990, Protection of Wetlands; NPS Director's Order 77-1, Wetland Protection and its accompanying Procedural Manual; and the "no net loss" goal outlined by the White House Office on Environmental Policy in 1993.

- **NPS will manage Tavasci Marsh separately from the Tuzigoot Pueblo for hours of operation, access, and fee collection.** The Tuzigoot Pueblo is only open during park business hours and is closed to access at all other times to protect the archeological resources. Tavasci Marsh, on the other hand, will be open from dawn to dusk hours. Fees will be collected for people visiting the Tuzigoot Pueblo and museum areas, but will not be collected for people visiting Tavasci Marsh. The Tuzigoot Pueblo area will be clearly marked on gates as a "Fee Area."

- **Parking areas for after business-hour parking to access the marsh will be located in two places, both located on state park lands: Tuzigoot Bridge and Dead Horse Ranch State Park.** Parking in these two areas managed by Arizona State Parks must follow state park regulations. The Tuzigoot Pueblo parking area will not be available outside of park business hours.

- **Horses will be allowed on a designated trail in Tavasci Marsh, unlike other areas of Tuzigoot National Monument.** They will only be allowed on a trail providing connection with Arizona State Park lands (Verde River Greenway and Dead Horse State Park). No horses will be allowed on the Tuzigoot ridge trails or in other non-designated trails of the marsh.

- **Access to private lands closed to the public, such as Freeport-McMoRan, Inc.-owned properties, will be discouraged.** Fencing and signage will continue to be maintained to clearly indicate where parklands end. Freeport-McMoRan lands to the north and east of the marsh have been closed to public entry for several years and "No Trespassing" signs have been posted.

2.2 Alternatives Carried Forward

The following sections provide details regarding each of the three proposed management alternatives that were carried forward. Table 2 summarizes the key actions included in each of the alternatives. Tables 2 and 3 summarize the extent to which the three primary objectives are achieved for each alternative. Table 4 summarizes beneficial and adverse impacts anticipated for each of the five impact topics discussed in the previous chapter.

In the following sections that describe the three alternatives carried forward, Tavasci Marsh is frequently divided into the "northern marsh" or "north marsh," and the "southern marsh" or "south marsh." The "northern/north marsh" refers to the part of the marsh located upstream or north of the old road (identified in Figure 7 as the "old road bed inundated by the beaver dam"), and "southern/south marsh" refers to the part of the marsh located downstream or south of the old road. Planning and management of the marsh has been divided in this way in large part as a result of past management actions of prior owners, which led to the water storage rights of the National Park Service being associated with the northern marsh and not with the southern marsh.

2.2.1 Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this alternative, all restoration and habitat enhancement activities would occur in association with on-going invasive plant control/native plant restoration activities. Since 2007 when the Montezuma Castle and Tuzigoot Invasive Plant Management Plan Environmental Assessment was approved (NPS 2007), Tavasci Marsh has been included in the park's routine invasive plant management and native plant restoration program. Park staff would continue to remove tamarisk, tree of heaven, Russian olive, Russian thistle, Mexican fireweed, horehound, and other exotic invasive plants. Seed collection activities for native plants would be conducted throughout the year, and these collected seeds would be used to reseed barren, controlled areas. These vegetation management activities would continue under this alternative and be the primary means for enhancing marsh habitat; current mapped acreages are shown in Figure 7 and approximate existing acreages of each habitat type are in Tables 1 and 3.

Under this alternative, hydrology and water levels in the marsh north of the old road would be controlled mainly by beaver activity and beaver dams, and by water levels in the south marsh. Historically, water levels have risen in the marsh in the past 20 years and would be expected to continue to increase over time.

Recreation for the marsh would occur primarily on the edges along the existing, surrounding trails. Trails would continue to be maintained in their current condition and would not be upgraded. A small footbridge in the southern part of the marsh (see Figure 8) connects the eastern and western trails. This footbridge would be maintained without substantial alterations or increases in load-bearing capacity. The footbridge is the only trail connection between the east and west sides of the marsh.

Bicycle use in the monument including the marsh would not be allowed, as rule-making procedures would not be initiated.

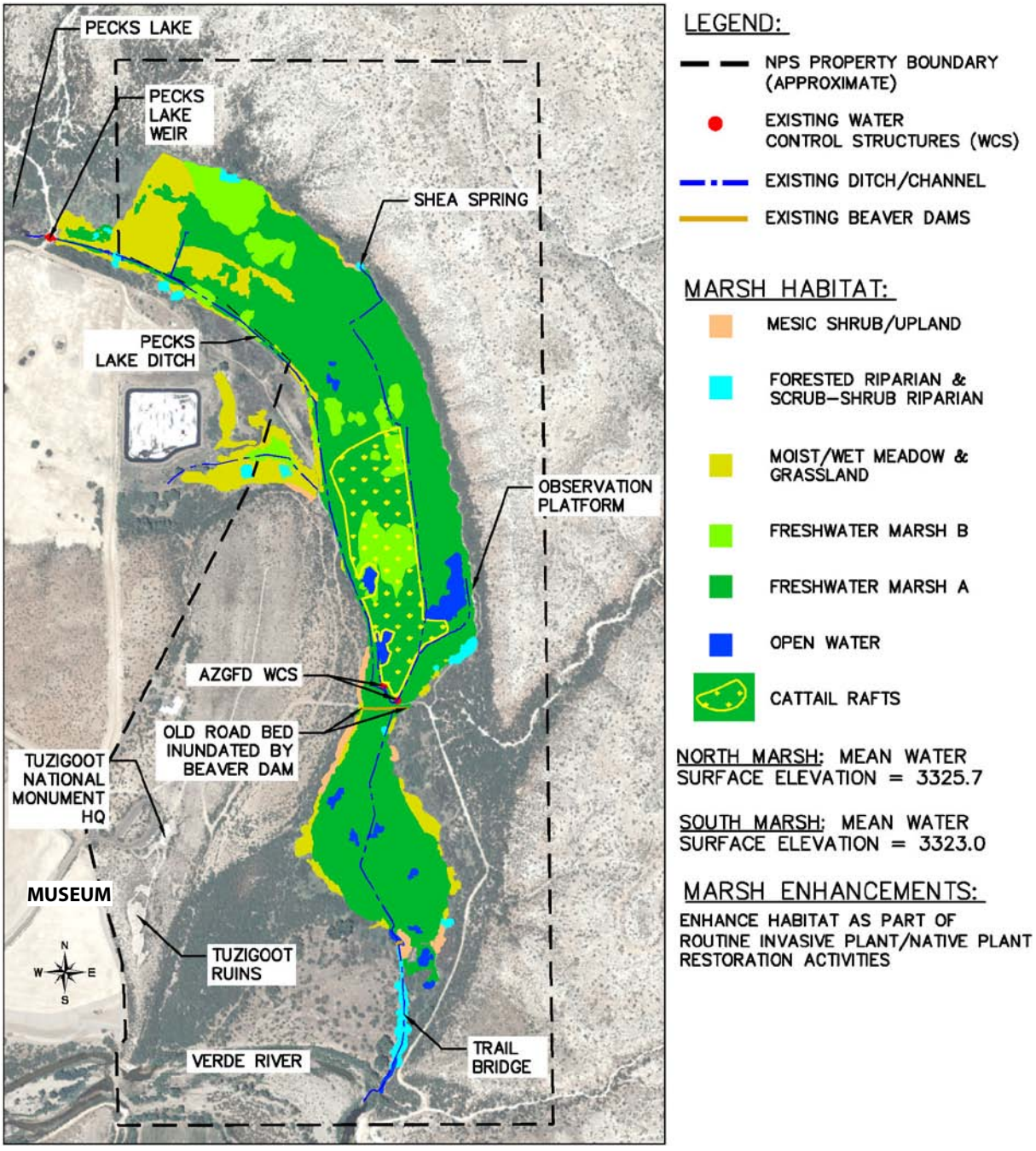

Figure 7. Alternative A (No-action)—Map of existing vegetation and habitat types. Figure courtesy of Natural Channel Design.

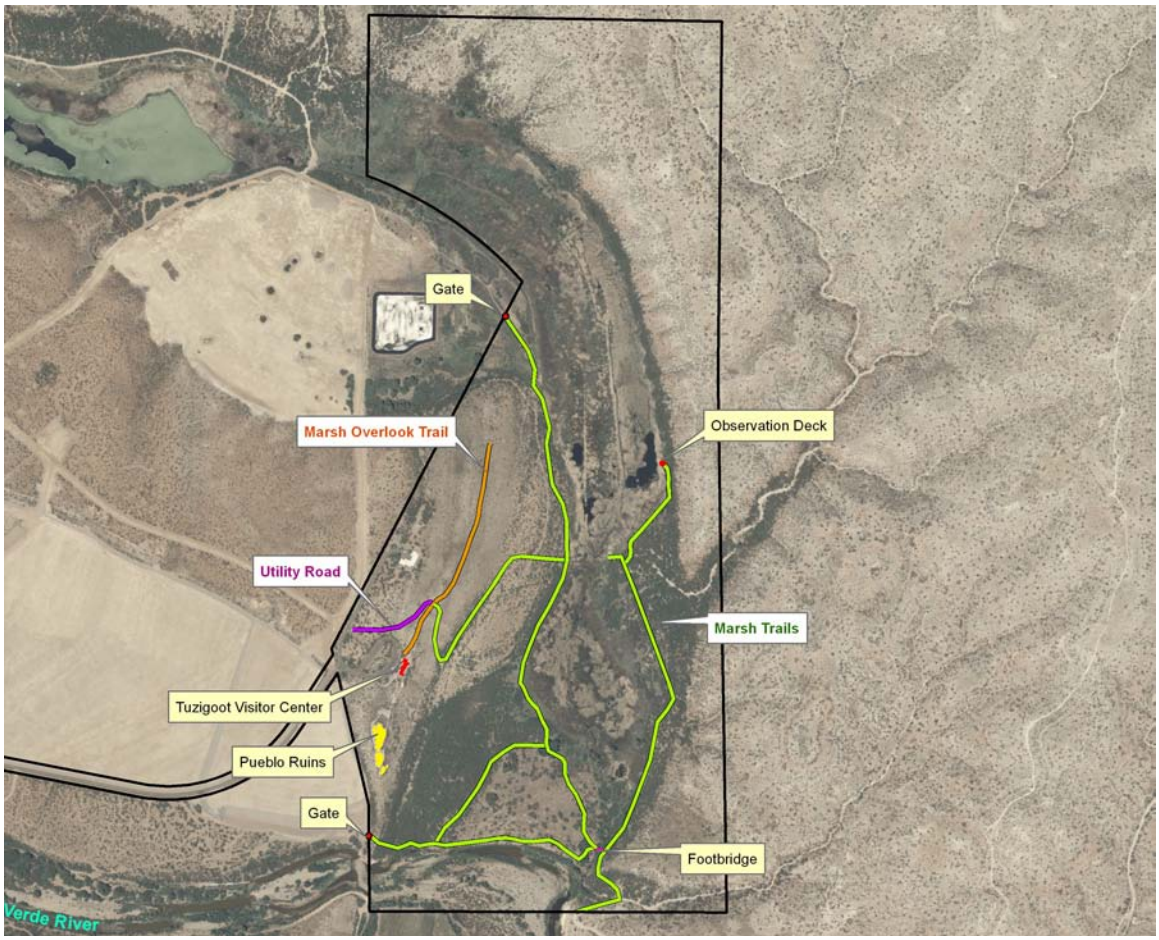

Figure 8. Current trails in the marsh (No-action Alternative). Marsh-related trails shown in color. Light green indicates trails in the marsh. Orange indicates overview trail along Tuzigoot Ridge above marsh area. Purple indicates utility road open the NPS employees only for park business.

2.2.2 Alternative B: Enhance marsh habitat primarily through cattail management

Under this alternative, the park would actively manage cattails in addition to routine invasive plant control/native plant restoration. Some cattail habitat would be removed from the marsh on a regular schedule using mechanical, chemical, and/or fire management methods. (For clarification, "northern marsh" refers to the marsh located above the old road, while "southern marsh area" refers to the marsh located below the old road.)

To create additional open water habitat (approximately 12 acres total, including the currently existing 2 acres), floating "islands" of cattails currently located in the northern marsh would be removed. Given the current condition of approximately 10 acres of floating cattail mat, up to 35,000 cubic yards of material could be removed.

Topographic contouring would be carried out using local soil fill; approximately 18,500 cubic yards, after archeological mitigation methods occur, would be taken from uplands near the western part of the marsh. The borrow area is known as the "Kochia plot" (see Figure 9). If archeological resources are found in the Kochia plot or it is determined that additional fill is

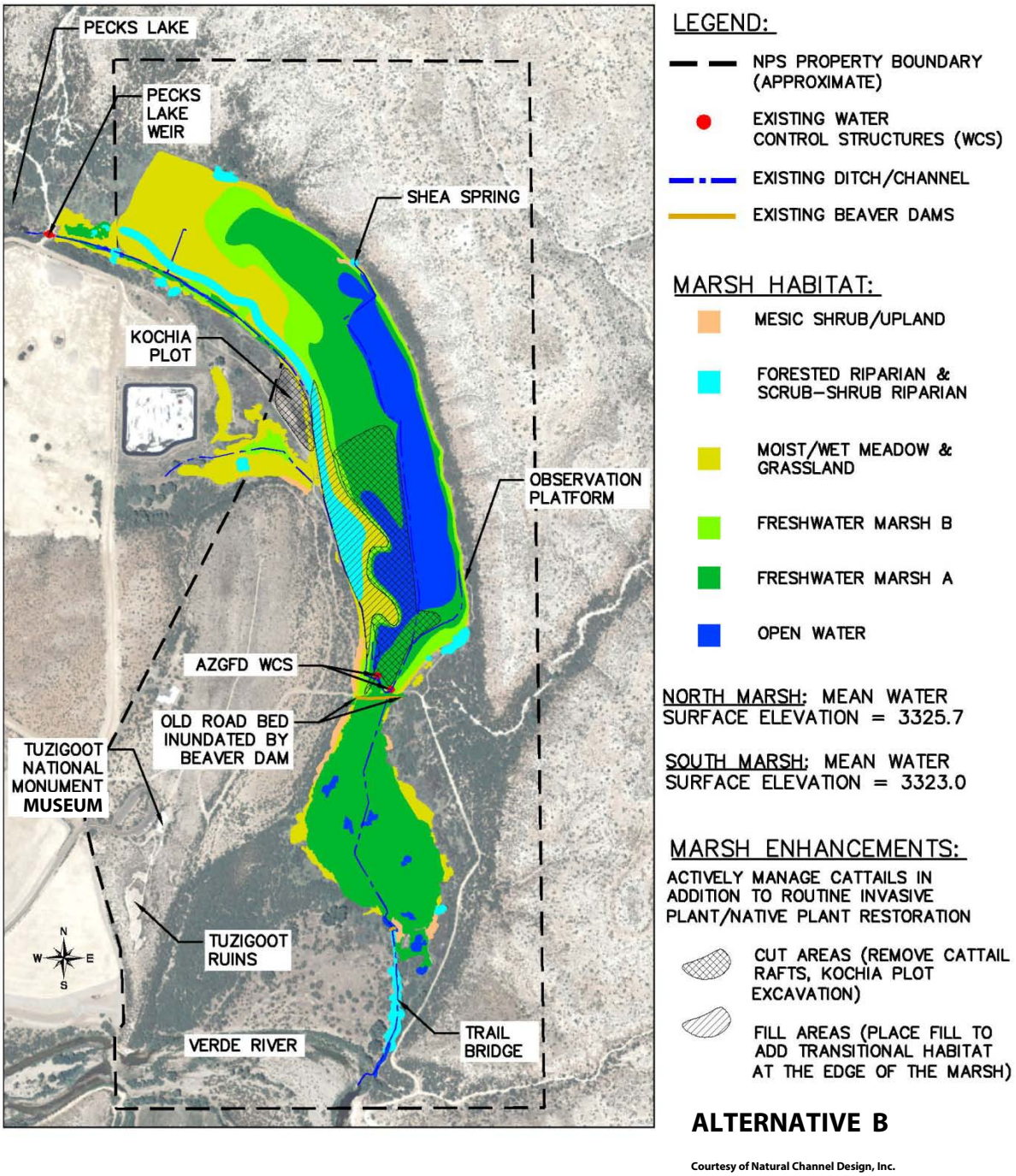

Figure 9. Alternative B—Conceptual plan/map of vegetation and habitat types likely to result from proposed actions. Figure courtesy of Natural Channel Design.

necessary, the fill would be supplemented with weed-free fill from outside the park as necessary. This fill material would be used to create a natural microtopography along the northern marsh edges. The fill material would be sloped at approximately 25:1 (horizontal:vertical ratio) slope to provide a very gradually sloped surface for planting. The excavated areas would be converted to open water and the transitional areas would be planted with marsh vegetation appropriate to the new soil moisture regime.

This would facilitate increasing by over approximately 14 acres the transitional vegetation communities including riparian, wet/moist grassland, wet/moist meadow, and bulrush communities. Cattail removal and creation of marsh microtopography would require temporary breach of the beaver dams and draining of the marsh to allow equipment into the marsh interior to remove cattails. Drainage would require at least a month and would be accomplished to minimize potential impacts to aquatic fauna and breeding birds. Construction efforts would be concluded before the spring nesting and growing season.

After the first phase of this project (expected to last two years), no additional earth movement would occur related to increasing the topographic variation for the marsh edges. This alternative would be designed to create a mosaic of wetland habitat types in this area (see Figure 9); approximate acreages of each habitat type are listed in Table 3.

Future vegetation management beyond the first phase would focus on perpetual cattail management (mechanical, chemical, and/or fire), and activities in the marsh under the routine invasive plant management activities. New open water areas and newly created topography would continue to provide potential habitat for cattail growth or support reinvasion from existing cattail stands, especially if water levels increase. Regrowth and reinvasion of cattail would be managed as the planted target native marsh vegetation becomes established. Annual applications of aquatic formulated herbicide would likely be required in specific areas to prevent cattail domination. Once target native vegetation communities become established, active cattail management may not need to be as frequent. However, infrequent burning or herbicide management may be required to prevent cattail stands from becoming so dense that they break free and float into the open water areas, creating floating cattail mats or islands once again.

Under this alternative, the hydrologic functioning of the marsh would be determined by the condition of beaver dams and water levels in the south marsh. The water surface level and related soil moisture regimes in the surrounding areas would be under the influence of beaver activities at the current beaver dam or other future beaver dam locations. Historically, beaver activities have increased the water levels in the marsh and many of the newly planted areas would potentially be inundated in the future, conditions that favor cattail vegetation. The southern marsh water levels also affect the northern marsh area when the southern waters are high enough to overtop the old historic roadbed.

Under this alternative, recreation at the marsh would occur throughout the edges along the existing**,** surrounding trails. Trails known to be periodically flooded would be rerouted onto drier ground. Trails would be hardened and delineated as needed to prevent visitors from creating their own trails (“social trails”) trying to avoid muddy ground. The footbridge, located in the southern part of the marsh connecting the eastern and western trails (see Figure 8), would

be upgraded to be able to support utility terrain vehicle (UTV) travel (UTV-use would only be for administrative purposes). The upgraded bridge would provide the only structured trail connection for the east and west sides of the marsh.

Under this alternative, bicycle use in the marsh would be allowed on a designated trail for the southern part of the marsh to allow connection between Dead Horse Ranch State Park on the east side of the monument and Verde River Greenway State Natural Area on the west side of the monument. This trail would be clearly signed and would extend from the gate on the east side located at the base of the Tuzigoot Ridge (adjoining the Verde River Greenway) to the upgraded footbridge, and extend south to connect with Dead Horse Ranch State Park. Allowing bikes on the designated trail in the monument would be considered a new use within the park unit and would require special promulgation through rulemaking.

2.2.3 Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

This alternative focuses on changing and controlling the hydrologic regime of the northern part of the marsh by adding water control structures to the marsh to allow seasonal manipulations of marsh water levels. The proposed area for the adaptively flooded/dried areas would be north of the old roadbed (see Figure 10), and the water control structures would tie into the roadbed. (For clarification, "northern marsh" refers to the marsh located above the old road, while "southern marsh area" refers to the marsh located below the old road. The management of the marsh was divided in this way primarily due to the water storage rights of the National Park Service being tied to the northern marsh and not the southern marsh. Due to lack of water storage rights tied to the southern marsh, no water control structures were allowed in the southern marsh.)

The water control structures for the northern marsh would be constructed so that the maximum water surface elevation would be near the current existing water levels (the water volume in storage is related to the park's existing water right). The water level elevation change accommodated by the structures would be approximately 6-feet. This would allow for periodic flooding and drying of the north marsh to maintain the open water and target native vegetation habitats. Maximum water surface elevations, for example, would be manipulated to establish marsh vegetation in the higher marsh elevations.

Under this alternative, a water conveyance channel would also be constructed on the western edge of the southern marsh, to avoid having the water control structures become overtopped (as the AGFD control structures were in the 1990's). This channel would facilitate control of water levels in both the north and south marsh areas. Water levels in the southern marsh are currently two feet lower than the northern marsh and the rate of water movement through the southern marsh is limited (slow). The water conveyance channel would provide a means of enhancing drainage control of both marsh areas as needed and would make it possible to prevent marsh waters south of the road from backing up and overtopping the berm and water control structures, rendering the water control structures inoperable. The water conveyance channel for the south part of the marsh would begin at the northern marsh's newly constructed water control structures, extend along the southwestern edge of the southern part of the marsh, and would terminate north of the planned UTV-rated bridge (see Figure 10). The water in the conveyance channel would discharge water into the existing outflow ditch between the southern marsh and

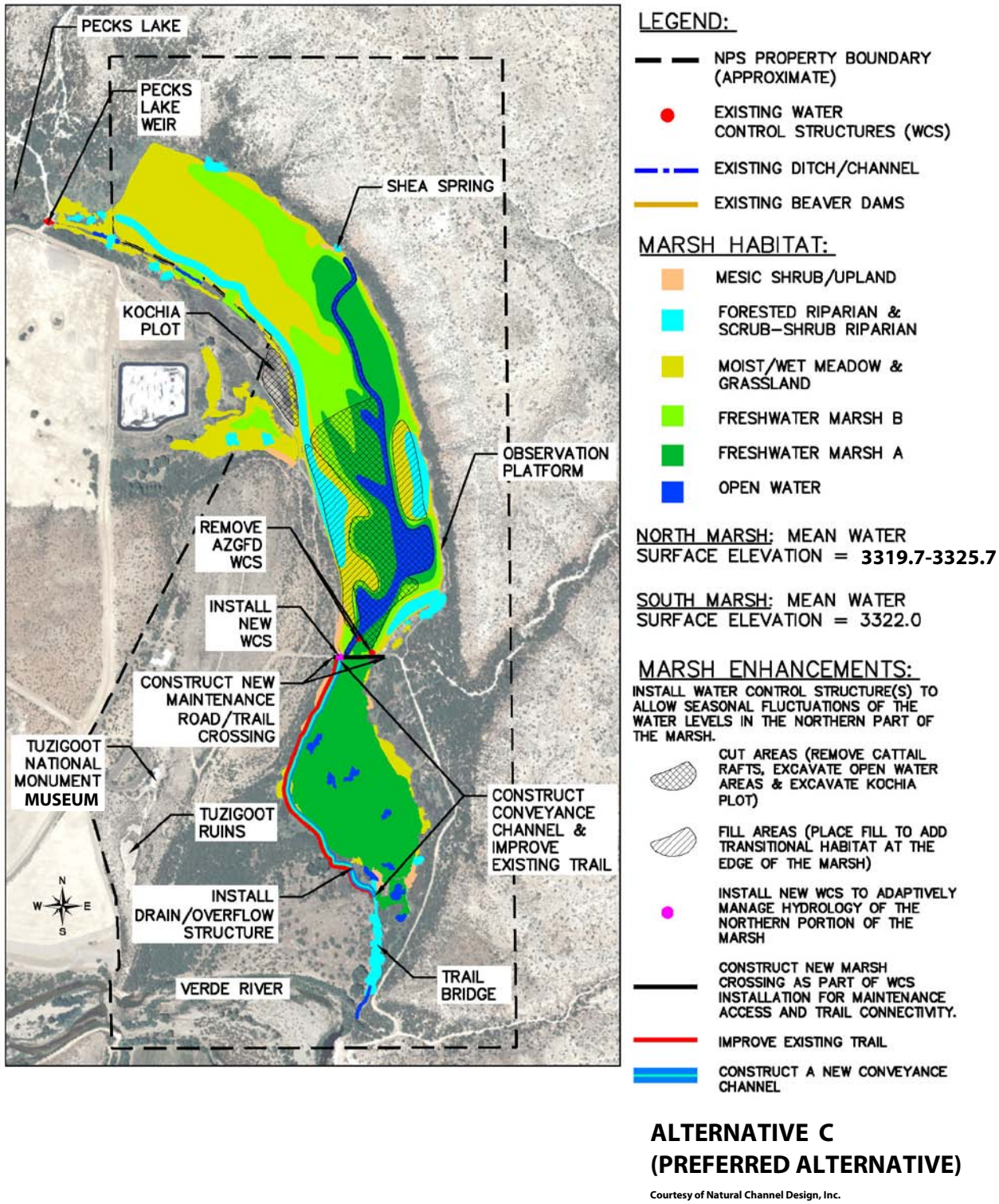

Figure 10. Alternative C (Preferred)—Conceptual plan/map of vegetation and habitat types likely to result from proposed actions. Figure courtesy of Natural Channel Design.

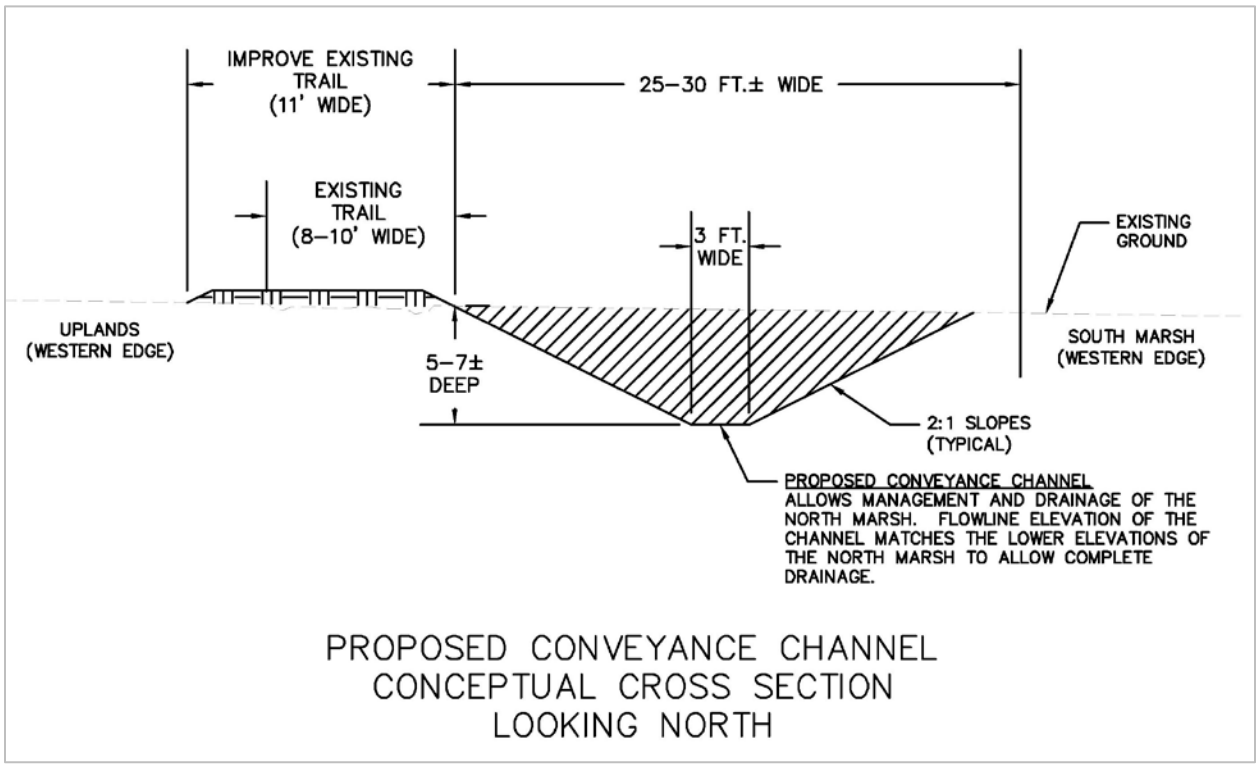

Figure 11. Cross-section of the marsh, trail, and water conveyance channel in the southern part of the marsh for Alternative C (Preferred Alternative). The channel is 25-30 feet wide with a 3-feet wide bottom. The utility road (left flat portion of drawing) would widen the existing trail 2-3 feet and would also create a new trail/road in the middle of the southern marsh (see Figure 10).

the Verde River. The water conveyance channel would be approximately 1915 feet in length.

The actual structure of the channel would be a 5 to 7-feet deep open ditch ranging between 25 and 30 feet wide depending on the topography, with a 3-feet wide bottom (see Figure 11), and extend around 1915 feet in length. The bottom of the channel would intercept the groundwater table, and would continue to function as wetland, although it would be maintained as a ditch with vegetation and sediment removals when necessary. At the southern end of the channel, a drain/overflow structure would be installed to allow for control of the drainage from the southern marsh area. Since they will be hydrologically connected through the adjoining soils, static water levels in the channel would be the same as those in the south marsh when the overflow structure is closed.

A trail/maintenance road would also be created in the upland on the western side of the water conveyance ditch and marsh, initially following the existing marsh trail for approximately 1230 feet (see Figure 12). The existing trail would be upgraded, hardened, and widened an additional one to three feet to support heavy equipment needed to clear out the conveyance channel periodically. This utility road/trail would follow along the existing trail for approximately 1230 feet, and a new segment of the road/trail would extend east into the marsh paralleling the conveyance channel for another 685 feet approximately (totaling 1915 feet). This hardened trail, paralleling the water conveyance channel, would be wide enough to accommodate heavy

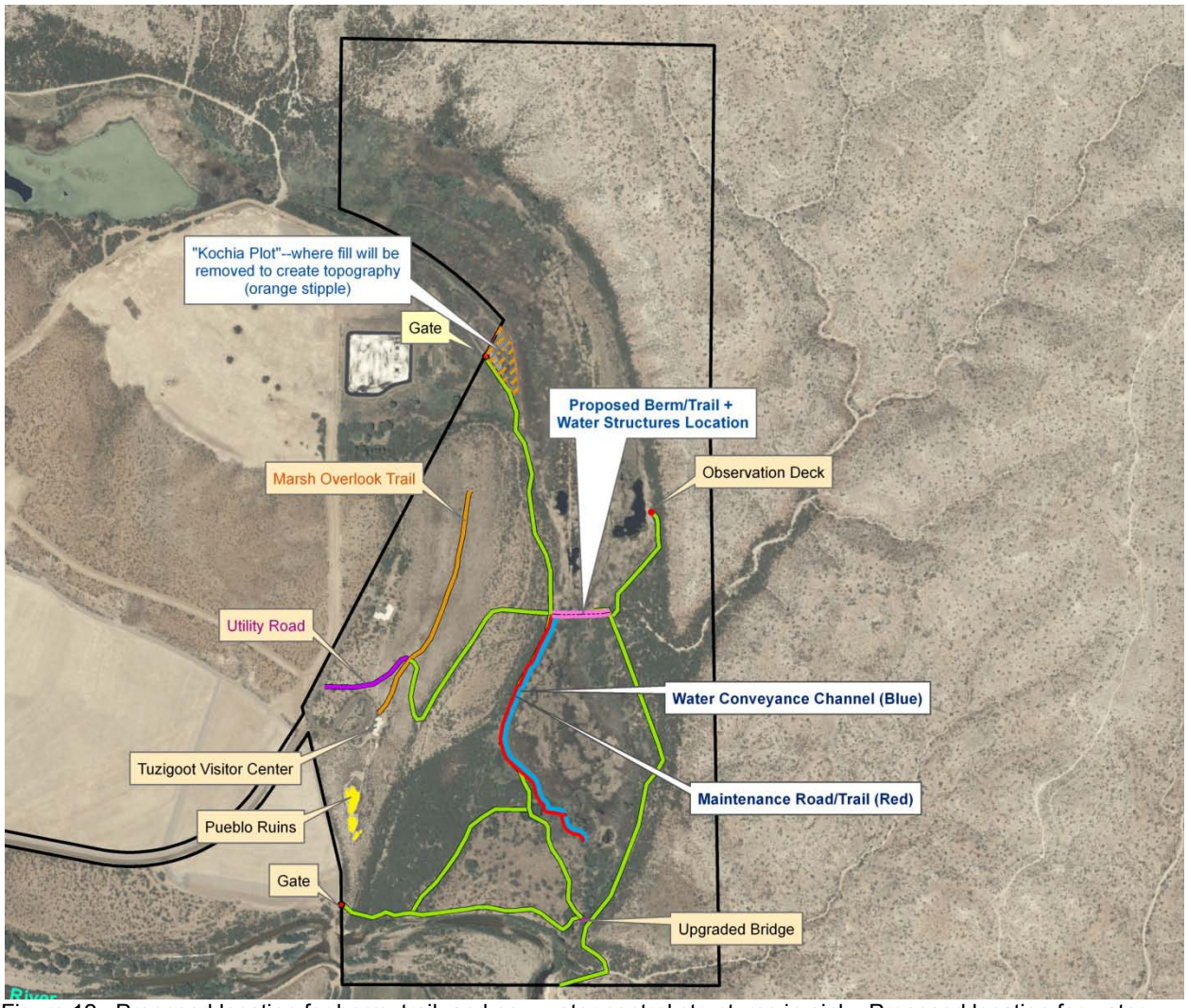

Figure 12. Proposed location for berm, trail, and new water control structures in pink. Proposed location for water conveyance channel in blue, with parallel maintenance access road/trail in red. First ~1230 feet of maintenance road is on existing trail (green trail masked in diagram), and next ~685 feet is newly created road in marsh. The "Kochia plot" (orange stipple) is where fill will be removed to create topography following archeological surveys.

equipment to clear out vegetation and sedimentation from the ditch when necessary (see Figures 10, 11 and 12).

Without a water conveyance channel in the southern marsh, beaver activity could increase southern marsh water levels and limit the effectiveness of the upstream water control structures (mirroring what happened to the overtopped, non-functioning AGFD structures currently in the marsh). This water conveyance channel ditch would need to be maintained every one to three years to ensure that vegetation growth and sediments do not clog the channel.

Floating islands of cattails currently located in the marsh would be removed to create open water habitat (approximately five acres). Topographic contouring would be carried out using local soil fill. Approximately a total of 18,500 cubic yards would be taken from soils excavated from the water conveyance channel in the southern marsh and from uplands near the western part of the northern marsh known as the "Kochia plot" following archeological clearances (see Figures 10

and 12). If archeological resources are found in the Kochia plot or it is determined that additional fill is necessary, weed-free fill from outside of the park would supplement the local fill soils. Habitat islands or peninsulas would also be created by using this fill. These newly elevated areas would be revegetated with native marsh plants to create a mosaic of habitat types in the marsh, focusing on species from riparian, wet/moist grassland, wet/moist meadow, and bulrush communities (see Figure 10). Approximate acreages of each habitat type for the marsh are given in Table 3, and the approximate locations of the water conveyance channel, utility vehicle road/trail and water control structure location are shown in Figures 10 and 12.

Removal of cattail material and construction of the water control structures would require temporary breach of beaver dams and drainage of the marsh so that equipment can access the interior of the northern marsh. Drainage of the marsh would take at least one month, and water from the northern marsh would be drained into the water conveyance channel in the south marsh. Drainage and construction would be timed to minimize impacts to aquatic fauna and breeding birds. All construction activities would be concluded prior to onset of growing and nesting season.

Relatively precise control and timing of water level elevations would provide a long-term tool for vegetation management and reduce the need to rely on more invasive strategies to manage cattails such as herbicides, fire, or excavation. Periodic, adaptive management of water levels in the northern marsh would maintain plant communities of the wet/moist grasslands and the wet/moist meadows through occasional flooding and drying. Seasonally adjusted flows would be managed to discourage establishment of cattail in the deepest portions of the northern marsh and to maintain heterogeneous, hydric soil moisture regimes for the upper elevations of the marsh. Preventing long-term inundation of higher wetland elevations would limit the establishment of cattails and promote growth of a variety of wetland plants.

Recreation for the marsh would occur throughout the edges along the existing, surrounding trails, and would also extend into the marsh proper. A boardwalk and a viewing platform would be built in the marsh to allow visitors to enter into the marsh (see Figure 12). These structures would likely be located on a berm/berms near the water control structures. The water control structures would be tied to the existing road bed (currently flooded).

Trails known to be periodically flooded would be rerouted onto drier ground. Trails would be hardened and delineated as needed to prevent social trails from developing, in addition to the utility vehicle trail paralleling the water conveyance channel in the south marsh. The footbridge, located in the southern part of the marsh connecting the eastern and western trails (see Figure 12), would be upgraded to be able to support UTV travel (UTV-use would only be for administrative purposes). The berm, water control structures, and boardwalk area would also provide a route for vehicles or foot traffic across the marsh to facilitate maintenance and access between Tuzigoot National Monument and neighboring Dead Horse State Park, creating a loop trail system (see Figure 12).

Bicycle use in the marsh would be allowed on a designated trail for the southern part of the marsh to allow connection between Dead Horse Ranch State Park on the east side of the monument and Verde River Greenway State Natural Area on the west side of the monument.

This trail would be clearly signed and extend from the gate on the east side located at the base of the Tuzigoot Ridge (adjoining the Verde River Greenway) to the upgraded footbridge, and extend south to connect with Dead Horse Ranch State Park. Allowing bikes on the designated trail in the monument would be considered a new use within the park unit and would require special promulgation through rulemaking.

2.3 Alternatives Considered and Dismissed

2.3.1 Enhance wildlife habitat at Tavasci Marsh habitat by exclusively managing beaver activity and beavers

The existing beaver dams are designed by beavers according to the location of water flows, areas where vegetation can be stacked to restrict flows, availability of woody species and mud for building materials, and several other factors. Thus, the locations of the dams are somewhat random, the dams vary in their ability to retain and control water flow, and water flow through and over them cannot be controlled. Beaver management would involve the physical modification of the structures as well as removal of beavers. Neither of the beaver management actions can provide the opportunity to accurately control the flow of water in the marsh necessary to meet the objectives of the project. Therefore, this alternative was dismissed.

2.3.2 Reuse Arizona Game and Fish Department water control structures to change marsh hydrology

This alternative was considered at length due to the positive recycling aspect of redesigning and reusing the Arizona Game and Fish Department water control structures placed in the marsh in the 1990's. In the end, however, consultation with civil engineers at Natural Channel Design indicated that this would be a very expensive procedure with limited success due to the inherent limitations of the existing structures. Because these water control structures need to be seasonally manipulated by NPS staff in order to adaptively manage flooding and seeding cycles, having water control structures that are difficult to maneuver would likely lead to future abandonment. Therefore, this alternative was dismissed.

2.4 Mitigation Measures

The following mitigation measures have been developed to minimize the degree and/or severity of adverse effects, and would be implemented during construction for Alternatives B and C, and relate directly to wetland areas. From NPS Procedural Manual #77-1: Wetland Protection and "Best Management Practices and Conditions for Proposed Actions with the Potential to Have Adverse Impacts on Wetlands:"

- **Effects on hydrology:** Action must have only negligible effects on site hydrology, including flow, circulation, velocities, hydroperiods, water level fluctuations, and so on. Care must be taken to avoid any rutting caused by vehicles or equipment.

- **Water quality protection and certification:** Action is conducted so as to avoid degrading water quality to the maximum extent practicable. Measures must be employed to prevent or control spills of fuels, lubricants, or other contaminants from entering the waterway or wetland. Action is consistent with state water quality standards and Clean

Water Act Section 401 certification requirements.

- **Erosion and siltation controls:** Appropriate erosion and siltation controls must be maintained during construction, and all exposed soil or fill material must be permanently stabilized at the earliest practicable date.

- **Effects on fauna:** Action must have only negligible effects on normal movement, migration, reproduction, or health of aquatic or terrestrial fauna, including at low flow conditions.

- **Proper maintenance:** Structure or fill must be properly maintained so as to avoid adverse impacts on aquatic environments or public safety.

- **Heavy equipment use:** Heavy equipment use in wetlands must be avoided if possible. Heavy equipment used in wetlands must be placed on mats, or other measures must be taken to minimize soil and plant root disturbance and to preserve preconstruction elevations.

- **Stockpiling material:** Whenever possible, excavated material must be placed on an upland site. However, when this is not feasible, temporary stockpiling of excavated material in wetlands must be placed on filter cloth, mats, or some other semipermeable surface, or comparable measures must be taken to ensure that underlying wetland habitat is protected. The material must be stabilized with straw bales, filter cloth, or other appropriate means to prevent reentry into the waterway or wetland.

- **Removal of stockpiles and other temporary disturbances during construction:** Temporary stockpiles in wetlands must be removed in their entirety as soon as practicable. Wetland areas temporarily disturbed by stockpiling or other activities during construction must be returned to their pre-existing elevations, and soil, hydrology, and native vegetation communities must be restored as soon as practicable.

- **Topsoil storage and reuse:** Revegetation of disturbed soil areas should be facilitated by salvaging and storing existing topsoil and reusing it in restoration efforts in accordance with NPS policies and guidance. Topsoil storage must be for as short a time as possible to prevent loss of seed and root viability, loss of organic matter, and degradation of the soil microbial community.

- **Native plants:** Where plantings or seeding are required, native plant material must be obtained and used in accordance with NPS policies and guidance. Management techniques must be implemented to foster rapid development of target native plant communities and to eliminate invasion by exotic or other undesirable species.

- **Boardwalk elevations:** Minimizing shade impacts, to the extent practicable, should be a consideration in designing boardwalks and similar structures. (Placing a boardwalk at an elevation above the vegetation surface at least equal to the width of the boardwalk is one way to minimize shading.)

- **Endangered species:** Action must not jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, including degradation of critical habitat.

- **Historic properties:** Action must not have adverse effects on historic properties listed or eligible for listing in the National Register of Historic Places.

Other mitigation efforts outside of wetland considerations would include:

- Because disturbed soils are susceptible to erosion until revegetation takes place, standard erosion control measures such as silt fences and/or sand bags would be used to minimize any potential soil erosion.

- Fugitive dust generated by construction would be controlled by spraying water on the construction site, if necessary.

- To reduce noise and emissions, construction equipment would not be permitted to idle for long periods of time.

- To minimize possible petrochemical leaks from construction equipment, the contractor/cooperator would regularly monitor and check construction equipment to identify and repair any leaks.

- Construction workers and supervisors would be informed about special status species. Contract provisions would require the cessation of construction activities if a species were discovered in the project area, until park staff re-evaluates the project. This would allow modification of the contract for any protection measures determined necessary to protect the discovery.

- All ground disturbance would be monitored by the park archeologist and/or archeological technicians. Should construction unearth previously undiscovered cultural resources, work would be stopped in the area of any discovery and the monument would consult with the Arizona State Historic Preservation Officer (SHPO) and the Advisory Council on Historic Preservation, as necessary, according to §36 CFR 800.13, Post Review Discoveries. In the unlikely event that human remains are discovered during construction, provisions outlined in the Native American Graves Protection and Repatriation Act (1990) would be followed.

- The National Park Service would ensure that all workers, contractors, and subcontractors are informed of the penalties for illegally collecting artifacts or intentionally damaging archeological sites or historic properties. Contractors and subcontractors would also be instructed on procedures to follow in case previously unknown paleontological or archeological resources are uncovered during construction.

- Construction workers and supervisors would be informed about the special sensitivity of monument's values, regulations, and appropriate housekeeping.

- 2006 National Park Service Management Policies emphasize constructing facilities with sustainable designs and systems to minimize potential environmental impacts. Development would not compete with or dominate monument's features, or interfere with natural processes, such as the seasonal migration of wildlife. To the extent possible, the design and management of facilities would emphasize environmental sensitivity in construction, use of nontoxic materials, resource conservation, and recycling. The National Park Service also reduces energy costs, eliminates waste, and conserves energy resources by using energy-efficient and cost-effective technology.

- Construction activities generating high levels of noise would be avoided during the sensitive breeding season from March through September as much as possible.

- Activities generating potential soil runoff events would be avoided during the heavy monsoon periods of July-September.

2.5 Environmentally Preferred Alternative

The environmentally preferred alternative is determined by applying the criteria suggested in the National Environmental Policy Act of 1969 (NEPA), which guides the Council on Environmental Quality (CEQ). The CEQ provides direction that "[t]he environmentally preferable alternative is the alternative that would promote the national environmental policy as expressed in NEPA's §101:

1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;

2. Assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;

3. Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;

4. Preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;

5. Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and

6. Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Through internal scoping, the Environmentally Preferred Alternative is determined to be Alternative C. This alternative best meets the purpose and need for action and best addresses overall NPS objectives and evaluation factors while minimizing impacts to park resources.

Because Alternative C would enhance wildlife and fish habitat to the recommended percentages from the habitat workshop, it would best fulfill the responsibilities of being a trustee for the environment. With the long-term sustainability of Alternative C compared to Alternatives A and B, Alternative C would provide succeeding generations enhanced wildlife and fish habitat in the marsh. Alternative C also decreases mosquito habitat within the marsh, which would assure for all generations a safer and more healthful environment. Furthermore, by having recreation use increase within the marsh proper, Alternative C would achieve the best balance between beneficial uses of the environment without degradation, and resource use that allows sharing of the marsh. Finally, Alternative C would most enhance the quality of the wildlife and fish habitats compared to the other alternatives, and enhance the quality of the renewable resources.

No new information came forward from public scoping or consultation with other agencies to necessitate the development of any new alternatives, other than those described and evaluated in this document. Because it meets the purpose and need for the project, the project objectives, and is the environmentally preferred alternative, Alternative C is also recommended as the National Park Service's Preferred Alternative. For the remainder of the document, Alternative C would thus be referred to as the Preferred Alternative.

2.6 Alternatives Summary

Tables 2 and 3 summarize the major components of Alternatives A, B, and C; and compare the ability of these alternatives to meet the project objectives (the objectives for this project are identified in Section 1.0 Purpose and Need). As shown Tables 2 and 3, Alternative C (the Preferred Alternative) meets each of the objectives identified for this project, while Alternative A and Alternative B do not address all of the objectives. Table 4 gives a summary of the environmental analyses by resource topic.

Table 2. Alternatives Summary and Project Objectives

	Alternative A (No-Action Alternative): Enhance marsh habitat as part of the routine native plant restoration program	**Alternative B:** Enhance marsh habitat primarily through cattail management	**Alternative C (Preferred Alternative):** Enhance marsh habitat by adaptively managing hydrology
SUMMARY OF KEY ACTIONS	Habitat enhancement via •routine invasive plant management •native plant restoration activities. Marsh trails continue to be located in current area and conditions. Bike riding would not be allowed anywhere on the monument trails.	Habitat enhancement via •removal of floating cattail "islands" •create topography on edges with fill dirt from upland area •revegetation of habitat mosaics on newly-created topography in marsh Harden or reroute of marsh trails to avoid muddy areas. Upgrade footbridge to UTV-rated bridge (administrative traffic). Allow bike riding along one designated marsh trail to provide a connection between two state park lands allowing bikes.	Habitat enhancement via •removal of floating cattail "islands" •create topography on edges with fill dirt from upland area •revegetation of habitat mosaics on newly-created topography in marsh •control hydrology of the northern marsh area with water control structures to adaptively flood and dry habitat mosaics to maintain target habitat percentages Construct water control structures tied into old roadbed. Construct a water conveyance channel and parallel hardened utility trail/road for equipment access in the southern marsh—ensures south marsh waters do not overtop and render inoperable water control structures in the northern marsh. Harden or reroute of marsh trails to avoid muddy areas. Upgrade footbridge to UTV-rated bridge (administrative traffic) Allow bike riding along one designated marsh trail to provide a connection between two state park lands allowing bikes. Create a loop trail system by using the water control structure berms. Construct a marsh boardwalk and viewing platform in middle of marsh on the water control structure berms.
OBJECTIVE 1: **Habitat Enhancement Targets**	See Table 3.	See Table 3.	See Table 3.

	Alternative A (No-Action Alternative): Enhance marsh habitat as part of the routine native plant restoration program	**Alternative B:** Enhance marsh habitat primarily through cattail management	**Alternative C (Preferred Alternative):** Enhance marsh habitat by adaptively managing hydrology
OBJECTIVE 2: **Long-term Sustainability for Restoration & Management Actions**	Sustainable long-term, although it is expected that cattails would continue to proliferate and increase in number in the marsh. No control over water levels in marsh; future flooding or drying may occur without warning.	Unknown long-term sustainability due to reliance of the northern marsh hydrology on beaver dams and activities. Future increase of beaver dams/activities could lead to higher water elevations and flooding of habitat enhancement and restoration sites. Alternatively, future failure of beaver dams would lead to loss of marsh water levels in northern marsh area.	Sustainable long-term due to the NPS control of water levels in northern area of the marsh where much of the habitat enhancement and restoration sites would occur. Prevention of water control structures being overtopped by south marsh waters through construction of water conveyance channel in south marsh.
OBJECTIVE 3: **Increase Recreational, Interpretive, & Educational Use of the Marsh**	Marsh trails would not be hardened. Marsh viewing platforms would be the Marsh Overlook (located on the Tuzigoot Ridge above the marsh) and the eastern Marsh Observation Deck. Interpretive walks would be limited to Tavasci Marsh Overlook due to lack of visitor infrastructure on west side of marsh, closest to Museum/Pueblo area. Bike riding would not be allowed anywhere on the monument trails.	Marsh trails in muddy areas would be hardened or rerouted as needed. Marsh viewing platforms would be the Marsh Overlook (located on the Tuzigoot Ridge above the marsh) and the eastern Marsh Observation Deck. Interpretive walks would be limited to Tavasci Marsh Overlook due to lack of visitor infrastructure on west side of marsh, closest to Tuzigoot Pueblo. Bike riding along one designated trail would be allowed to provide a connection between two state park lands surrounding the monument.	Marsh trails in muddy areas would be hardened or rerouted as needed. The utility vehicle trail paralleling the conveyance channel in the south marsh would be entirely hardened. Marsh viewing platforms would be the Marsh Overlook (located on the Tuzigoot Ridge above the marsh), the eastern Marsh Observation Deck, a new marsh boardwalk, and marsh viewing platform (located on the berms tied to the water control structures). A loop trail system would exist in the marsh with east-west marsh crossings along the water control structure berms/boardwalk trail and the upgraded bridge. Interpretive walks would be expanded into Tavasci Marsh proper, likely extending to the marsh viewing platform. Bike riding would be allowed along one designated trail to provide a connection between two state park lands surrounding the monument.

Table 3. Alternatives Summary and Project Objectives: Wildlife Habitat Targets and Attainment Percentages (courtesy of Natural Channel Design).

		HABITAT TARGETS (MINIMUM)		HABITAT TARGETS (MAXIMUM)		**ALTERNATIVE A (No Action Alternative):** Enhance marsh habitat via routine native plant restoration program.		**ALTERNATIVE B:** Enhance marsh habitat primarily through cattail management		**ALTERNATIVE C (Preferred Alternative):** Enhance marsh habitat by adaptively managing hydrology	
Vegetation Community	**Dominant species**	Vegetation Community (Acres)	Target - Minimum %	Vegetation Community (Acres)	Target - Maximum %	Vegetation Community (Acres)	Alt. A %	Vegetation Community (Acres)	Alt. B %	Vegetation Community (Acres)	Alt C %
Mesic Scrub/Upland	Velvet mesquite	0.8	0.0%	0.8	0.0%	0.8	0.9%	0.8	0.9%	0.8	0.8%
Forested Riparian	Fremont cottonwood/ Gooding willow	5.7	6.0%	14.2	15.0%	1.9	2.0%	5.9	6.2%	7.5	7.9%
Scrub-Shrub Riparian	Coyote willow, arrowweed, scrub willows *(Baccharis)*										
Moist/Wet Grassland	Wild rye (*Leymus triticoides)* and other marsh grasses	24.6	26.0%	52.1	55.0%	14.5	15.4%	25.4	26.8%	34.3	36.2%
Wet/Moist Meadow	Short sedges & rushes										
Freshwater Marsh B	Tall sedges & bulrushes *(Scirpus)*	14.2	15.0%	23.7	25.0%	8.6	9.1%	8.9	9.4%	14.5	15.3%
Freshwater Marsh A	Cattail --deep H20	23.7	25.0%	37.9	40.0%	66.6	70.4%	39.1	41.3%	32.2	34.0%
Freshwater Marsh A	Cattail--shallow										
Freshwater Marsh A	Cattail--floating										
Open Water		4.7	5.0%	9.5	10.0%	2.2	2.3%	14.6	15.4%	5.4	5.7%
					TOTALS	**94.6**	**100.0%**	**94.6**	**100.0%**	**94.6**	**100.0%**

Table 4. Environmental Impact Summary by Alternatives.

(1 of 5)	**Alternative A (No-Action Alternative):** Enhance marsh habitat as part of the routine native plant restoration program	**Alternative B:** Enhance marsh habitat primarily through cattail management	**Alternative C (Preferred Alternative):** Enhance marsh habitat by adaptively managing hydrology
Soils	Short-term minor, adverse impacts from invasive plant management activities including chemical treatments. Long-term impacts are minor and beneficial as areas revegetate and stabilize soil.	Minor, direct, and long-term effects: some beneficial, mostly adverse. Beneficial: Restoring marsh soil topography on edges of northern marsh area. Hardening trails in soft sediment to prevent proliferation of social trails. Adverse: Localized upland area ("Kochia plot") where 18,500 cubic yards of fill dirt would be removed to build topography on northern edge of marsh (following archeological clearances).	Moderate, direct, and long-term effects: some beneficial, mostly adverse. Beneficial: Restoring marsh soil topography on edges of northern marsh area. Hardening trails in soft sediment to prevent proliferation of social trails. Adverse: Localized upland area ("Kochia plot") where 18,500 cubic yards of fill dirt would be removed to build topography on northern edge of marsh (following archeological clearances). Close to 1.5 acres of soils would be disturbed in the southern marsh to create the water conveyance channel and maintenance road. Old roadbed soils for water control structures/boardwalk are already disturbed.
Vegetation	Long-term, minor, adverse impacts, especially related to native plant community diversity as the cattail vegetation type would continue to expand at the loss of other native plant communities.	Short-term, minor, direct, beneficial effects to increase native vegetation diversity and create mosaic of various native marsh vegetation communities. Long-term effects uncertain for newly created habitat mosaics due to the reliance of water levels on beaver dams, beaver activity, and south marsh water levels.	Long-term, moderate, direct beneficial impacts to increase native vegetation diversity and create mosaic of various native vegetation communities.

(2 of 5)	**Alternative A (No-Action Alternative):** Enhance marsh habitat as part of the routine native plant restoration program	**Alternative B:** Enhance marsh habitat primarily through cattail management	**Alternative C (Preferred Alternative):** Enhance marsh habitat by adaptively managing hydrology
Water Quality	Short-term, minor, indirect, adverse impacts in the park and downstream from routine invasive plant management activities including chemical treatments. Long-term, minor, indirect, beneficial impacts as invasive plant treatments and native plant replantings would be selected to prevent sedimentation.	Short-term, minor, indirect, adverse impacts in the park and downstream due to potential sediment loads from excavation activities. Long-term effects are not expected.	Short-term, minor, indirect, adverse impacts in the park and downstream due to potential sediment loads from excavation activities. Impacts likely higher than Alternative B due to increase in excavation activities from construction of water control structures and water conveyance structures. Long-term effects are not expected.
Wetlands and Floodplains	Short and long-term minor beneficial effects due to removal of exotic, invasive plants from wetlands and floodplains.	Direct, short-term, moderate beneficial effects for wetlands to bring the marsh back to conditions prior to the farming activities. Increasing native marsh vegetation diversity would also increase natural function by enhancing marsh wildlife habitat. Long-term effects uncertain due to reliance of hydrology on beaver activity.	Direct short- and long-term, moderate, beneficial effects for wetlands to bring the marsh back to conditions prior to the farmland activities of bulldozing and flattening the marsh for pasturelands. Increasing native marsh vegetation diversity would also increase natural wetland function by enhancing marsh wildlife habitat.
General Fish and Wildlife	Long-term, minor, adverse impacts with continued trend of wildlife habitat diversity loss	Short-term, moderate, beneficial effects with increase in marsh wildlife habitat diversity and associated species. Long-term effects uncertain for newly created habitat mosaics due to the reliance of water levels on beaver dams, beaver activity, and water levels in the south marsh.	Long-term, moderate, beneficial effects with increase in marsh wildlife habitat diversity and associated species.

(3 of 5)	**Alternative A (No-Action Alternative):** Enhance marsh habitat as part of the routine native plant restoration program	**Alternative B:** Enhance marsh habitat primarily through cattail management	**Alternative C (Preferred Alternative):** Enhance marsh habitat by adaptively managing hydrology
Species of Special Concern	Long-term, minor, adverse effects to sensitive species as the diversity of wildlife habitats such as riparian forests and bulrush and sedges diminished in response to expanding cattail habitat .	Short-term, beneficial: Moderate, direct effects for increased marsh wildlife habitat diversity and use by associated sensitive species. Short-term, Adverse: Direct and indirect, negligible, effects for sensitive species due to increased sedimentation or reliance on reduced cattail habitat Long-term: Effects uncertain for newly created habitat mosaics due to the reliance of water levels on beaver dams, beaver activity, and south marsh levels	Short-term: Direct and indirect, negligible, adverse effects for sensitive species due to increased sedimentation or reliance on reduced cattail habitat Long-term: Direct, moderate, beneficial effects due to the increases in marsh wildlife habitat diversity supporting the majority of potential species of concern
Archeological Resources	Negligible effects for archeological sites. Includes archeological monitoring and avoidance of surface sites.	Long-term, minor, adverse effects from potential impacts resulting from excavation of the northwest upland area for fill to create topography in the northern marsh in addition to excavation and removal of floating cattails.	Long-term, minor, adverse effects from potential impacts resulting from excavation of the northwest upland area for fill to create topography in the northern marsh in addition to excavation and removal of floating cattails. Construction of the conveyance channel in the south marsh could also potentially affect archeological resources.

(4 of 5)	**Alternative A (No-Action Alternative):** Enhance marsh habitat as part of the routine native plant restoration program	**Alternative B:** Enhance marsh habitat primarily through cattail management	**Alternative C (Preferred Alternative):** Enhance marsh habitat by adaptively managing hydrology
Ethnographic Resources	Negligible effects.	Short-term, minor, adverse impacts for cattails that could be mitigated to negligible by working with the associated tribes. Long-term (greater than one year), minor, beneficial effects for other marsh plant ethnographic resources by working closely with the tribes to plant ethnographically important species in restoration efforts.	Same as Alternative B.
Historic Structures	No effect.	Long-term, negligible effects on historic ditches because of the extremely poor condition of these ditches unmaintained for twenty years, overgrown with cattails, and loaded with sediments.	Long-term, negligible effects on historic ditches from removal of cattails and excavation of water control structures; and on the historic roadbed from construction of water control structures, berms, boardwalks, and a viewing platform. The ditches and road have lost their historic integrity following years of repeated flooding and sedimentation.
Public Health and Safety	Long-term, negligible, adverse effect as following historic trends, mosquito habitat would continue to expand in the marsh.	Short-term, moderate, beneficial effect as 12 acres of prime mosquito breeding habitat would be removed from the marsh and converted into open water areas, not ideal for mosquito breeding Long-term effects uncertain due to reliance of hydrology on beaver activity.	Short- and long-term, moderate, beneficial effect as 34 acres of prime mosquito breeding habitat would be removed from the marsh, and control of the hydrology of the northern area of the marsh would allow park staff to maintain close to the initially restored acreage for the vegetation communities.

(5 of 5)	**Alternative A (No-Action Alternative):** Enhance marsh habitat as part of the routine native plant restoration program	**Alternative B:** Enhance marsh habitat primarily through cattail management	**Alternative C (Preferred Alternative):** Enhance marsh habitat by adaptively managing hydrology
Visitor Use and Experience	Long-term, negligible effect to continue existing operations. Bike riding would not be considered as a possible recreational activity in the park.	Long-term, minor, beneficial effect for visitor use and enjoyment because the marsh trails would be rerouted or hardened to be readily accessible following rains. Bike riding would be considered along a designated trail in the southern marsh to allow connection between two state parklands.	Long-term, moderate, beneficial effect because visitors could access the interior of the marsh from a new trail crossing the marsh and a newly constructed boardwalk. A loop trail would also be created in the marsh. Marsh trails rerouted or hardened to be readily accessible following rains. Bike riding would be considered along a designated trail in the southern marsh to allow connection between two state parklands.
Park Operations	Long-term, negligible effect to continue existing operations.	Long-term, moderate, adverse effect for park operations because of the increase in annual cattail management activities for resource management staff.	Long-term, moderate Beneficial: Interpretation rangers would need less time to access to marsh visitor use structures, and have increased interpretive opportunities. Adverse: Increase in workload for maintenance and resource staff to maintain water control structures, monitor wetland response to water levels to adaptively manage water levels, and maintain the water conveyance ditch. Increased infrastructure such as the boardwalk and bridge would also increase maintenance cost.

CHAPTER 3.0 AFFECTED ENVIRONMENT/ENVIRONMENTAL CONSEQUENCES

This chapter analyzes the potential environmental consequences, or impacts, that would occur as a result of implementing the proposed project. Direct, indirect, and cumulative effects, as well as impairment are analyzed for each resource topic carried forward. Potential impacts are described in terms of type, context, duration, and intensity. General definitions are defined as follows, while more specific impact thresholds are given for each resource at the beginning of each resource section. The impact topics analyzed:

- Soils
- Vegetation
- Water Quality
- Wetlands and Floodplains
- General Fish and Wildlife
- Species of Special Concern
- Archeological Resources
- Ethnographic Resources
- Historic Structures
- Public Health and Safety
- Visitor Use and Experience
- Park Operations

The environmental effects, or changes from present baseline condition, described in this chapter reflect these impact topics and include intensity and duration of the action. Direct, indirect, and cumulative effects, as well as impairment are analyzed for each of the resource topic carried forward (listed above). Potential impacts are described in terms of type, context, duration, and intensity. General definitions are defined as follows, while more specific impact thresholds are given for each resource at the beginning of each resource section.

- **TYPE:** Describes the classification of the impact as either beneficial or adverse, direct or indirect:
  - ***Beneficial***: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
  - ***Adverse:*** A change that moves the resource away from a desired condition or detracts from its appearance or condition.
  - ***Direct:*** An effect that is caused by an action and occurs in the same time and place.
  - ***Indirect:*** An effect that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.
- **INTENSITY:** Describes the degree, level, or strength of an impact. For this analysis, intensity has been categorized into negligible, minor, moderate, and major. Because definitions of intensity vary by resource topic, intensity definitions are provided separately for each impact topic analyzed in this environmental assessment.
- **CONTEXT:** Describes the area or location in which the impact will occur. Are the effects site-specific, local, regional, or even broader?
- **DURATION:** Describes the length of time an effect will occur, either short-term or long-term, and is specific to each resource. In general, however:

- Short-term impacts generally last only during construction, and the resources resume their pre-construction conditions following construction.
- Long-term impacts last beyond the construction period, and the resources may not resume their pre-construction conditions for a longer period of time following construction.

3.1 Cumulative Effects

The Council on Environmental Quality (CEQ) regulations, which implement the National Environmental Policy Act of 1969 (42 USC 4321 et seq.), requires assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts are considered for all action alternatives.

Cumulative impacts were determined by combining the impacts of the preferred alternative with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects at Tuzigoot National Monument and, if applicable, the surrounding region. The geographic scope for this analysis includes elements mostly within the monument's boundaries, while the temporal scope includes projects within a range of approximately ten years. Given this, the following projects were identified for the purpose of conducting the cumulative effects analysis, listed from past to future:

Fire Management Plan for Montezuma Castle and Tuzigoot National Monuments, 2004
In 2004, Montezuma Castle and Tuzigoot National Monument finalized the first fire management plan which identified the fire management activities for the monuments. This plan emphasized fire suppression of the monuments. Hazardous fuel reduction was considered through mechanical treatment and pile burning, although no prescribed fire was considered for management action.

Invasive Plant Management Plan for Montezuma Castle and Tuzigoot National Monuments, 2007-present
Since 2007, Montezuma Castle and Tuzigoot National Monuments have had an active invasive exotic plant management program. In fiscal year 2010, 27.8 acres of invasive plants in the three monument areas were treated. This program is continuing to expand with additional staff and volunteer efforts at both monuments.

Invasive Tree Pile Burning at Tuzigoot National Monument, 2009
Tamarisk and tree of heaven piles resulting from 2006 to 2009 invasive plant mechanical removals were burned by the Saguaro National Park fire crews in 2009 over one day. Most piles were located in the southern portion of the marsh, between the old historic east-west road bisecting the marsh and the Verde River.

Road Improvements to Tuzigoot National Monument's Parking Lot and Entrance and Administrative Roads, 2009

Asphalt was applied at Tuzigoot National Monument to the parking lot, entrance road, and the administrative road (entrance road to the residences/offices) areas through Federal Highways Funds to improve existing roads.

Tuzigoot Fencing Project, 2010
A fence was erected from May to June 2010 on the northern boundary of Tuzigoot ridge to prevent trespass cattle from entering the marsh area, and also prevent visitors from inadvertently entering private lands owned by Freeport-McMoran. Fence posts and a wildlife-friendly design for the wire were installed by park staff and volunteers.

Painting and Repairing Tuzigoot Residences/Resource Management Office Exteriors, 2010
The residences and Resources office at Tuzigoot National Monument were repaired and painted on their exteriors by a contractor. Some gutter work and roof patching were part of this project.

Tuzigoot Museum Renovation, 2010-2011
The Tuzigoot Musuem/Visitor Center began extensive renovation to its interiors, exteriors, and exhibits in November 2010. Installing fire prevention systems and burying datalines extending from the Museum/Visitor Center and the Resources Offices were also part of this project. Renovation finished in April 2011, with exhibits being installed in May 2011. The grand opening of the visitor center is planned in June 2011.

Tuzigoot Hillside Trail Repair, 2011
The trail extending down into the marsh from the Overlook Trail (see Figure 6) has continued to erode since the NPS acquired the marsh. Use from NPS service vehicles has also increased the water damage and deteriorated this trail/access road. In spring 2011, a trail repair crew assisted the monument to rehabilitate the trail, create water bars, and upgrade the trail to prevent further erosion.

Verde River Cooperative Invasive Plant Management Plan, 2011
The Verde River Cooperative Invasive Plant Management Plan is an interagency plan that looks at invasive plant issues across the Verde River watershed, and includes addressing invasive plant treatments along private and state lands. These potential treatment areas would be located both up and downstream along the Verde River.

Fire Management Plan/Environmental Assessment for Montezuma Castle and Tuzigoot National Monuments, 2011
Public scoping for the Fire Management Plan/Environmental Assessment occurred in March-April 2011 for both Montezuma Castle and Tuzigoot National Monuments. Currently there are two proposed alternatives. The proposed action alternative would allow for implementation of a full range of fire management activities. Wildland fire management actions could include suppression and the use of prescribed fire for resource benefit. The main focus of these activities and treatments is centered on public and firefighter safety, communities identified as at risk from wildland fires (Wildland Urban Interface), historic fire regimes, current condition class, and collaboration with other agencies and stakeholders. While the no action alternative would continue to manage wildland fires consistent with the existing Fire Management Plan and Categorical Exclusion. Fire management activities would be in response to emergencies and to

protect people and park resources. The environmental assessment is expected to be released for public review in fall 2011.

Tuzigoot Waterline Replacement, 2011
The existing waterline piping connects the well to the Tuzigoot Visitor Center and to the residences/Resources office area. This original asbestos waterline was installed in 1964, and is expected to have a 30-year life cycle by industry standards. This waterline has clearly exceeded that timeframe and NPS policies/practices require cyclic replacement. In order to address old, potentially failing asbestos pipe issues, the monument plans to install a new waterline system located 10 to 15 feet away from the existing water line, still within the disturbed footprint. Equipment such as a bobcat will likely be used to excavate the new waterline three feet deep and is expected to occur over a one-month period.

Integrated Pest Management Plan/Environmental Assessment for Montezuma Castle and Tuzigoot (2011-future)
The primary focus for this Integrated Pest Management (IPM) plan and environmental assessment will be the management of vertebrate and invertebrate pest species at Montezuma Castle and Tuzigoot National Monuments. The objectives of this plan and environmental assessment will be to help preserve stored artifacts, museum resources and prehistoric structures, as well as assist with the protection of the health and safety of staff and visitors in developed areas, public and administrative buildings, and park housing.

Upgrade Tuzigoot Museum/Visitor Center Bathrooms (future)
A future project would provide better ADA accessibility and renovate the Tuzigoot Museum/Visitor Center's bathrooms.

3.2 Soils

3.2.1 Affected Environment and Intensity Level Definitions

Tavasci Marsh, along with Peck's Lake, are on recent Verde River terrace deposits that are underlain by lake deposits of the Verde Formation, forming a steep limestone cliff immediately east of the marsh (Smith and Bender 1973). The Verde Formation is a relatively young soil formed from the deposits of a prehistoric lake which occupied the Verde Valley during the late Miocene, 5 million years ago, and local soils combine limestone, clastic, and evaporitic (or mudstone) facies (Lindsay 2000). Localized conglomerates composed of alluvial cobble and gravel are visible in several areas around the marsh (Ryan and Parsons 2009). The soils in the area of Calciorthidic and Lithic ustochrepts and are shallow, cobbly, and have rock fragments (Lindsay 2000). These soils were heavily impacted by human manipulation of the marsh during the century of farming from 1890's through 1990's.

Negligible Soils would not be affected or the effects to soils would be below or at the lower levels of detection. Any effects to soils would be slight and erosion would not be noticeable.

Minor The effects to soils would be detectable. Effects to soil area, including soil disturbance and erosion, would be small and localized. Minimal soil loss would

occur. Mitigation may be needed to offset adverse effects and would be relatively simple to implement and likely be successful.

Moderate The effect on soils would be readily apparent and result in a change to the soil character over a relatively wide area, soil disturbance over a wide area, or erosion that extends beyond the project site and/or results in some soil loss. Mitigation measures would be necessary to offset adverse effects and likely be successful.

Major The effect on soils would be readily apparent and substantially change the character of soils over a large area, and substantial erosion would occur resulting in a large soil loss. Mitigation measures to offset adverse effects would be needed, would be extensive, and their success could not be guaranteed.

Duration Short-term—recovers in less than 3 years
Long-term—requires more than 3 years to recover

Context Within Tavasci Marsh and immediately surrounding uplands

3.2.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the wildlife habitat at Tavasci Marsh. Impacts to soil resources would result primarily from invasive plant treatments, seed collection, and replanting of native plants. Marsh trails would likely have greater numbers of social trails associated with them as visitors reroute trails during wetter time periods to avoid mud. The No-action alternative due to plant management activities, chemical treatments, and proliferation of social trails would result in short-term, minor, adverse impacts to the soils resources at Tuzigoot National Monument. Long-term effects would be minor and beneficial as areas revegetate and stabilize the soil resource.

Cumulative Effects: Any monument activities that require excavation or ground disturbance have the potential to affect soils resources. Invasive plant management, native plant restoration, and fire management activities are usually conducted off-trail and can disturb soils. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying have occurred in already-disturbed soils. The waterline replacement may increase the footprint for the disturbed soils, but would be close to the buried utility lines on the hillside between the Tuzigoot Museum and the Resources office/residences. The future planned projects such as the Integrated Pest Management Plan EA and upgrading the Tuzigoot bathrooms would focus on existing buildings and would not cause any additional soil disturbance. Because this No-action alternative would continue invasive plant treatments and restoration activities, this project would have long-term, negligible effects on soils resources when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: The habitat enhancement activities from the routine invasive plant management and restoration program and proliferation of social trails to avoid muddy substrates would result in short-term, minor, adverse impacts to soil resource. Long-term impacts would be minor and beneficial as areas revegetate and stabilize the soil resource. This alternative would contribute

only long-term negligibly to any cumulative disturbance of soils resources, when considered with other past, present, and reasonably foreseeable future actions.

3.2.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Within the first phase of the project (expected to take two years), floating islands of cattails would be removed from the marsh. Also within the first phase of the project, topography would be created along the marsh edges by removing and using fill dirt from western upland areas, following archeological clearances, to create areas of transitional marsh vegetation above the existing water levels of the marsh. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh.

Soils from upland areas (from the "Kochia plot", see Figure 9) following archeological clearances would be used to create topography along the marsh edges during the first phase for the project, resulting in direct, minor, adverse, and long-term impacts to upland soils. Alternative B would restore microtopography to the marsh soils, which were artificially flattened from historic management of pasturelands in the marsh, resulting in direct, minor, beneficial, and long-term impacts to marsh soils.

Marsh trails would be hardened to prevent proliferation of social trails, which would be a minor beneficial effect for soils near the trails.

Cumulative Effects: Any monument activities that require excavation or ground disturbance have the potential to affect soils resources. Invasive plant management, native plant restoration, and fire management activities are usually conducted off-trail and can disturb soils. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying would occur in already-disturbed soils. The waterline replacement may increase the footprint for the disturbed soils, but would be close to the buried utility lines on the hillside between the Tuzigoot Museum and the Resources Office/Residences. The future planned projects such as the Integrated Pest Management Plan EA and upgrading the Tuzigoot bathrooms would focus on existing buildings and would not cause any additional soil disturbance. Because this alternative would increase disturbance to localized uplands areas and change some of the soils on the marsh edges, this project would have minor effects on soils resources when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: Under Alternative B, the impacts on soil resources would be long-term, minor, and both beneficial and adverse on marsh edges and localized upland areas respectively. Under Alternative B, the park would actively manage cattails and restore marsh microtopography in addition to routine invasive plant control/native plant restoration. Some cattail habitat would be removed from the marsh on a regular schedule mechanically, chemically, and with fire.

3.2.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be constructed near the abandoned old east-west road bisecting the marsh and used to adaptively manage the water levels of the marsh

north of the old road. Sediments on top of the road bed and most likely already disturbed due to farming activities, ditches, culverts, and the old Arizona Game and Fish Department water control structures would be excavated and/or used for the construction of the structures.

Constructing the approximately 1915-feet length, 25 to 30-feet width, 5 to 7-feet deep water conveyance channel to prevent overflow of the southern marsh waters onto the water control structures in the north marsh would also disturb a maximum of 1.3 acres of wetland soils. Fill from the water conveyance channel would be used to harden the parallel access trail located just west of the channel.

In the northern marsh, the "Kochia area" (see Figures 10 and 12) in the uplands of the northern marsh following archeological clearances would contribute 18,500 cubic yards of fill to create microtopography in areas for marsh transitional species such as baccharis and willow on the outskirts of the marsh. Floating mats of cattails within the marsh would be removed to increase open water areas.

Causing disturbance to the soils in the southern marsh area for the water conveyance channel in addition to removing soils from upland areas in the northern marsh area to create topography along the marsh edges would result in direct, moderate, adverse, and long-term impacts to upland soils. The Preferred Alternative would restore microtopography to the marsh soils, which were flattened from historic management of pasturelands in the marsh, resulting in direct, minor, beneficial, and long-term impacts to marsh soils. Marsh trails would be hardened to discourage proliferation of social trails, which would be a minor beneficial effect for soils near the trails.

Cumulative Effects: Any monument activities that require excavation or ground disturbance have the potential to affect soils resources. Invasive plant management, native plant restoration, and fire management activities are usually conducted off-trail and can disturb soils. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying have occurred in already-disturbed soils. The waterline replacement may increase the footprint for the disturbed soils, but would be close to the buried utility lines on the hillside between the Tuzigoot Museum and the Resources Office/Residences. The future planned projects such as the Integrated Pest Management Plan EA and upgrading the Tuzigoot bathrooms would focus on existing buildings and would not cause any additional soil disturbance. Because this alternative would increase disturbance to localized uplands areas and change some of the soils on the north marsh edges, along the abandoned roadbed, and on the eastern side of the southern marsh, this project would have moderate, long-term effects on soils for cumulative effects.

Conclusion: The Preferred Alternative would result in moderate, direct, and long-term impacts to soils: beneficial along the marsh edges and trails; and adverse for localized upland areas and for the water conveyance channel area. Old roadbed soils where water control structures and berms would be placed are likely already disturbed. Because this alternative would increase disturbance to localized uplands areas and change some of the soils on the north marsh edges, along the abandoned roadbed, and along the western side of the south marsh with excavation for the water conveyance channel, this project would have long-term, moderate, direct, mostly adverse effects on soils resources when considered with other past, present, and reasonably foreseeable future actions.

3.3 Vegetation

3.3.1 Affected Environment and Intensity Level Definitions

Vegetation in the marsh would be described into two broad groups: plants found outside of the designated wetland area for the marsh and located in upland as well as riparian areas along the Verde River; and plants found within the designated wetland area.

In the upland areas of the marsh, vegetation characteristic of the Upper Sonoran life zone such as yucca, velvet mesquite, and saltbush is prevalent. The upland areas of the marsh include the following plant communities (adapted from The Nature Conservancy 1996): deciduous woodland containing Fremont cottonwood/Gooding's willow woodland and Fremont cottonwood/velvet mesquite woodland; evergreen shrubland containing creosote bush/purple three-awn shrubland and four-wing saltbush/bush muhly shrubland; deciduous shrubland containing desert willow shrubland, velvet mesquite/netleaf hackberry shrubland, and velvet mesquite/broom snakeweed shrubland; perennial forb vegetation; and annual graminoids or forbs.

A number of exotic invasive plant species also flourish just outside of the designated wetland areas. Mexican fireweed, Russian thistle, Russian knapweed, and bull thistle are prevalent and targeted for control along the marsh while tamarisk, Russian olive, and tree of heaven, have been controlled in the riparian areas.

For the designated wetland area of Tavasci Marsh, nine vegetation communities were identified by Ryan and Parsons (2009) for the Tavasci Marsh Wetland Delineation and Condition Assessment: (1) forested riparian, (2) scrub-shrub riparian, (3) freshwater marsh, (4) mesic scrub, (5) wet grassland, (6) moist grassland, (7) wet meadow, (8) moist meadow, and (9) open water-related vegetation. The descriptions and the associated species that follow are directly from the Ryan and Parsons 2009 report (species list is located in Appendix D).

The "forested riparian" and "scrub-shrub riparian" vegetation communities (covering less than 2 percent of the wetland delineation area) are dominated by Fremont's cottonwood and Gooding's willow. Other tree species present in this community include Arizona ash and box elder. Understory plants are very diverse, depending on the moisture regime beneath the overstory. In moister areas the understory is composed of rushes and sedges (specifically *Carex praegracilis, Juncus balticus*, and *Eleocharis parishii*). In mesic areas, native and non-native grasses (specifically *Leymus triticoides*, *Hordeum murinum* and *Bromus madritensis* ssp. *rubens*) as well as shrubs such as golden currant and the non-native Mexican fireweed make up the understory.

"Freshwater marsh" is characterized as areas dominated by more than 70 percent of persistent sedges, rushes, and other non-clover herbs that are inundated or saturated nearly year-round. This is by far the most common community at Tavasci Marsh, comprising nearly 80 percent of the total area of the marsh. Most of the freshwater marsh is dominated by one of two species of cattail (*Typha domingensis* and *Typha latifolia*), which together comprised 67 acres or 69 percent of the total mapped area. The other species which occupies a significant percentage of the freshwater marsh vegetation type is American three-square, covering just over 8 acres or 9 percent of the mapped area. Dotted smartweed and soft stem-bulrush also dominate small areas; however these

together account for only 0.1 acres of marsh. Other plant species that occur in the freshwater marsh community included rushes and sedges, scratchgrass, stinging nettle, and curly dock.

"Mesic scrub" represents a wetland-upland transition zone community and is dominated by velvet mesquite. (While within the designated wetland area that Ryan and Parsons surveyed, this community covers less than 1 percent of the marsh, this is the primary community located in the uplands areas above the marsh and has a much higher percentage when upland areas are included for the Tavasci Marsh project area.) Velvet mesquite bosque (woodland) covers two alluvial fans from washes which adjoin Tavasci Marsh and much of the marsh perimeter. In mesic scrub areas, velvet mesquite is associated with two other species: the native grass beardless wildrye and the invasive Mexican fireweed. Other species in this community include golden currant, stinging nettle, mulefat, red barberry, and non-native species brome and London rocket.

"Wet grassland" is a community dominated (greater than 50 percent) by grasses and herbs that are predominantly facultative or obligate hydrophytes or wetland species. The vegetation community is composed of one association: beardless wildrye, which comprises 0.49 acres (0.5 percent) of the total mapped wetland area, approximately one-third of the total cover for the beardless wildrye association.

"Moist grassland" is defined as areas ecotonal to wet marsh or grassland that are dominated by more moderately to weakly hydrophytic wetland plant species, particularly grasses such as bermudagrass, tall fescue, and scratchgrass. In some areas, sedges and rushes co-occurred with these grasses, but they typically represent less than 30 percent cover. "Moist grassland" is distinguished from "wet grassland" by a drier moisture regime rather than by changes in plant community composition alone. In addition to the beardless wildrye association (0.87 acres), one swale (0.72 acres) is dominated by big sacaton. Non-native grasses such as tall fescue and bermudagrass cover an additional 1.2 acres of the mapped wetland area.

"Moist meadow" represents somewhat of an intermediate between some of the wetter and drier vegetation communities, supporting at least 30 percent cover of sedges and rushes. The hydroperiod is shorter than for "wet meadow" and may involve nonpersistent inundation or saturation of soils following seasonal flooding. This community only covers 3.7 acres, or less than 4 percent of the mapped wetland area in the marsh.

"Wet meadow" supports at least 30 percent cover of sedges, rushes, or other nonclover herbs, as well as grasses. The hydroperiod for this community is drier than for the "freshwater marsh," but saturation often extends year round. This community covers approximately 7 acres or 7 percent of the mapped wetland area.

"Open water" was mapped as a part of the vegetation mapping effort (covering less than 2 percent of the mapped wetland area), even though there is no vegetation necessarily associated with this habitat type. However, in areas that were accessible, often a significant cover of aquatic vegetation was observed. The species observed growing in open water habitat in the accessible areas are parrot's feather and curly pondweed. Neither of these species is native to Arizona.

Finally, there has been a loss of vegetation diversity in the past two decades as the hydrologic regimes in the marsh have led to flooded, continuous standing water areas conducive to cattail communities that have outcompeted other hydrophytic emergent species (M. Girard, NPS Southern Arizona Office Ecologist, pers. comm.). Dead, standing cottonwoods in the marsh exemplify the hydrologic changes that have taken places.

Negligible No native vegetation would be affected or some individual native plants could be affected as a result of the alternative, but there would be no effect on native plant species' populations. The effects would be on a small scale.

Minor The alternative would affect some individual plants and would also affect a relatively limited portion of that species' population. Mitigation to offset adverse effects could be required and would be effective.

Moderate The alternative would affect some individual native plants and would also affect a sizeable segment of the species' population over a relatively large area within the park. Mitigation to offset adverse effects would be required and would likely be successful.

Major The alternative would have a considerable effect on individual native plants and affect a sizeable segment of the species' populations over a relatively large area in and out of the park. Mitigation measures to offset the adverse effects would be required, extensive, and success of the mitigation measures would not be guaranteed.

Duration Short-term—recovers in less than 3 years
Long-term—requires more than 3 years to recover

Context Within Tavasci Marsh and surrounding uplands

3.3.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the wildlife habitat around the perimeter of Tavasci Marsh. Impacts to vegetation would result primarily from invasive plant treatments, native seed collection and sowing, and replanting of native plants. Invasive, non-native plants would continue to be controlled and are expected to decrease in number around the marsh. As native plants are replanted in areas cleared of non-native plants, it is expected that native plant populations would increase in these peripheral areas, causing a negligible beneficial impact on native vegetation on the marsh perimeter.

Under the No-action alternative most native plant restoration would occur around the perimeter of the marsh. Large scale restoration of habitat diversity within the wetland would not be feasible due to the lack of topographic diversity and hydrologic control, and would lead to the maintenance of the current vegetation conditions on the perimeter of the marsh. However, the overall trend for the native plant community diversity within the marsh would decrease as cattails would continue to expand, causing a minor adverse impact on native marsh plant community diversity.

Trails in the marsh would not be hardened, and would likely have greater numbers of associated social trails as visitors reroute trails during wetter time periods to avoid mud, affecting plants on or near the social trails; these impacts are expected to be direct, adverse, and negligible.

Cumulative Effects: Any monument activities that require ground disturbance and/or vegetation management have the potential to affect vegetation resources. Invasive plant management, native plant restoration, and fire management activities could directly impact marsh vegetation. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying, Integrated Pest Management Plan EA implementation, and upgrading the Tuzigoot bathrooms focus on existing buildings and already disturbed areas, and would not affect marsh vegetation. Because this No-action alternative would continue to decrease the native plant community diversity even with invasive plant and native plant restoration efforts, this project would have long-term, minor, adverse effects on vegetation resources when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: The No-action alternative would result in long-term, minor, adverse impacts to vegetation resources especially related to native plant community diversity as the cattail vegetation type would continue to expand at the loss of other native plant communities. The current areas for vegetation communities (see Figure 7 and Table 3) would likely increase for cattails at the expense of other native plant communities. Continued use of the marsh trails without hardening the trail surface would likely result in direct negligible negative impacts to localized plants due to proliferation of social trails. This alternative would contribute only minor, adverse impacts to any cumulative disturbance of vegetation resources, when considered with other past, present, and reasonably foreseeable future actions.

3.3.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant control/native plant restoration. Some cattail habitat would be removed from the marsh on a regular schedule mechanically, chemically, and with fire.

Within the first phase of the project (expected to take two years), floating islands of cattails would be removed from the marsh. Also within the first phase of the project, microtopography would be created along the marsh edges by using fill dirt removed from western upland areas, following archeological clearances, to create areas of transitional marsh vegetation above the existing water levels of the marsh. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh.

Initially, following the removal over 25 acres of cattail islands and increasing topography on the northern marsh edges coupled with intensive native plant restoration efforts, the short-term effects on the marsh edge communities would be minor beneficial (see Figure 9 and Table 3) to the following plant communities, primarily in the northern area of the marsh. Approximately 4 acres of riparian forested/scrub shrub habitat would be created. An additional 10 acres of wet/moist grassland and meadows would also be created under this alternative. The acreage of tall sedges

and rushes would not likely change under this alternative. Over 12 acres of open water areas would be created under this alternative, partially as a response to removing the cattail islands.

While this alternative has the potential to create substantial amounts of diverse wildlife habitats, the long-term effects under this alternative are unknown because future water surface elevations and fluctuations are unknown. As can be seen from Figures 3 and 7, cattails can greatly proliferate in 20 years and would require extensive long-term management through chemical, mechanical, or fire methods for control. Furthermore, the water surface and related soil moisture regimes in the northern marsh would be under the influence of beaver activities at the current beaver dam or other future dam locations, as well as water levels in the southern marsh. The historic trend for beaver-controlled water surface elevations at the marsh (south and north) has been upward and all plantings on higher topography constructed areas would potentially be inundated in the future; increased water surface elevations would create even greater areas for cattail marsh invasion and establishment despite the extensive earthwork during the first phase of the project. In contrast, loss of the beaver colony or failure of beaver dams could lead to drastically lower water levels and loss of wetland plant habitat and saturated soils. Either change in the beaver-controlled water levels would lead to loss of native plants replanted during the first phase of marsh restoration, expected to last two years.

Marsh trails would be hardened to prevent proliferation of social trails, which would be a minor beneficial effect for vegetation near the trails.

Cumulative Effects: Any monument activities that require ground disturbance and/or vegetation management have the potential to affect vegetation resources. Invasive plant management, native plant restoration, and fire management activities could directly impact marsh vegetation. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying, Integrated Pest Management Plan EA implementation, and upgrading the Tuzigoot bathrooms focus on existing buildings and already disturbed areas, and would not affect marsh vegetation. Under this alternative, extensive cattail management and increased topography along the northern edges of the marsh would increase specific plant communities: forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes. The cumulative effects for native vegetation resulting from this project and other projects would be overall short-term minor beneficial, although long-term effects unclear and depend on beaver activity.

Conclusion: Alternative B would result primarily in short-term, minor, direct, beneficial impacts to native vegetation communities, especially increasing the diversity of the native plant communities. Long-term effects are less clear, due to the dependence of marsh hydrology levels on beaver number and beaver activities. Cumulatively, this project would have a short-term minor beneficial impact to vegetation communities when considered with other past, present, and reasonably foreseeable future actions.

3.3.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the abandoned old east-west road bisecting the marsh and would be used to adaptively manage the hydrology of the marsh north of the old road. A water conveyance structure would be constructed in the southern marsh to prevent overflow of the southern marsh waters onto the water control structures in the

north marsh as well as be able to drain the north marsh. Floating islands of cattails would be removed from the northern marsh. Topography would be created along the marsh edges by removing and using fill dirt from western upland areas, following archeological clearances. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh. Marsh water levels would be seasonally adaptively adjusted through the water control structures to maintain these acres of native plant communities.

Constructing the approximately 1915-feet length, 25 to 30-feet width, 5 to 7-feet deep water conveyance channel to prevent overflow of the southern marsh waters onto the water control structures in the north marsh would also disturb a maximum of 1.3 acres of wetland soils and primarily cattail vegetation. Fill from the water conveyance channel would be used to harden the parallel access trail located just west of the channel. In the northern marsh, the "Kochia area" (see Figures 10 and 12) from the uplands of the northern marsh following archeological clearances would contribute 18,500 cubic yards of fill to create microtopography in areas for marsh transitional species such as baccharis and willow on the outskirts of the marsh. Floating mats of cattails within the marsh would be removed to increase open water areas.

Under this alternative, over 30 acres of cattail islands would be removed, microtopography on the marsh edges would be coupled with intensive native plant restoration efforts, and the water conveyance channel in the upland eastern area of the southern marsh, would be constructed. The long-term effects on the marsh edge communities would be moderate beneficial (see Figure 10 and Table 3) to the following plant communities, primarily in the northern area of the marsh. Approximately 5 acres of riparian forested/scrub shrub habitat would be created. An additional 20 acres of wet/moist grassland and meadows would also be created. Approximately 6 acres of tall sedges and rushes would be created. Over 3 acres of open water areas would be created and maintained long-term.

Water surface manipulation would enhance and protect long-term project investments in replanting native plants and changing microtopography. Seasonally adjusted water levels for the northern marsh area above the old road would be managed to prevent establishment of cattail in lower marsh elevations and maintain heterogeneous soil moisture regimes for upper marsh elevations. Preventing long-term inundation of higher wetland elevations would limit the establishment of cattails and promote the growth of a variety of wetland plants. Adaptively management of water surface elevations provides a viable longterm strategy for maintenance and establishment of the recently planted native plants from the revegetated forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes areas. Relatively precise control of water level elevations and timing of water fluctuations would provide a valuable tool for vegetation management.

Marsh trails would be hardened to prevent proliferation of social trails, which would be a minor beneficial effect for vegetation near the trails.

Cumulative Effects: Any monument activities that require ground disturbance and/or vegetation management have the potential to affect vegetation resources. Invasive plant management, native plant restoration, and fire management activities could directly impact marsh vegetation. Much of

the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying, Integrated Pest Management Plan EA implementation, and upgrading the Tuzigoot bathrooms focus on existing buildings and already disturbed areas, and would not affect marsh vegetation. Under the Preferred Alternative, water control structures would be constructed to control the hydrology of the northern area of the marsh and a water conveyance channel would be created in the southern area of the marsh. Extensive cattail management and increased topography along the northern edges of the marsh would increase specific plant communities: forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes. These newly-planted native vegetation communities would be maintained long-term through periodic flooding and drying from adaptively managing water levels across the northern part of the marsh. The cumulative effects for native vegetation resulting from this project and other projects would be overall long-term moderate beneficial.

Conclusion: The Preferred Alternative would result primarily in long-term, moderate, direct beneficial impacts to native vegetation communities, especially increasing the diversity of the native plant communities. Adaptively managed water levels would ensure the target percentages of wetland plant communities created. Cumulatively, this project would have a long-term moderate beneficial impact to native vegetation communities when considered with other past, present, and reasonably foreseeable future actions.

3.4 Water Quality

3.4.1 Affected Environment and Intensity Level Definitions

Tavasci Marsh's natural sources are a series of seeps and springs (referred to collectively as the "Shea Springs Complex") located on the north edge of the marsh emerging through the Verde Formation, in addition to an alluvial aquifer under Tavasci Marsh as well as Peck's Lake (Ward 2008). The alluvial aquifer is partially saturated due to the relatively stable Peck's Lake level and ponding within Tavasci Marsh. Groundwater piezometers at Tavasci Marsh were installed in April 2010 to monitor groundwater levels.

Peck's Lake outflow has been an inconsistent source of surface water for Tavasci Marsh. Historically, when Peck's Lake levels are high, the artificial lake's outflow has provided water to the marsh. From May 2009 through the present, there has been no inflow into the marsh from Peck's Lake (Dennis Casper, NPS biologist, pers. comm.), and the Tavasci Marsh piezometers have been measuring groundwater levels without Peck's Lake surface water inputs. Peck's Lake waters originate from water diverted from the Verde River by Brewer's Tunnel, but also includes natural springs from the same Verde Formation as those that feed into Tavasci Marsh.

The southern portion of the marsh (see Figure 2) is bounded by the Verde River which can provide input for the southern part of the marsh during extreme flooding events. Occasional strong storm events can also cause the canyon east of the marsh to flood the marsh with water and sediments; this apparently dislodged the footbridge in summer 2010 after a large monsoon event. Ultimately, marsh waters drain into the Verde River through an outflow ditch located in the southern marsh. The water levels in the outflow ditch typically range from 0 to 30 cfs.

Negligible There would be no observable or measurable impacts to water quality. Impacts would be well within natural fluctuations.

Minor Impacts would be detectable and/or localized, but they would not be expected to be outside the natural range of variability. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate The impact to water quality would be readily apparent and result in a change over a relatively wide area. Mitigation measures would be necessary to offset adverse effects and likely be successful.

Major The impact to water quality would be readily apparent and substantially change over a wide area. Mitigation measures to offset adverse effects would be necessary, extensive, and their success could not be guaranteed.

Duration Short-term—would occur within the first year following treatment
Long-term—would occur more than the first year following treatment

Context Within park boundary and downstream drainages

3.4.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the wildlife habitat at Tavasci Marsh. Impacts to water quality would result only from potential invasive plant treatments (mechanical and chemical in particular) and replanting of native plants. The No-action alternative would result in short-term minor, adverse, indirect impacts from sedimentation from soil erosion from mechanical treatments and potential of chemical drift into surface or ground waters. Long-term impacts would be minor and beneficial in treated areas as revegetated areas would reduce sediment load.

Cumulative Effects: Any monument activities that require excavation or ground disturbance have the potential to loosen soils, leading to an increase in sediment loads for downstream waters, and affecting water quality. Invasive plant management, native plant restoration, and fire management activities can disturb soils and lead to short-term water quality effects. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying would occur in already-disturbed soils, but could still lead to increased sediment load. Because this No-action alternative would continue invasive plant treatments and restoration activities, this project would have long-term, minor, beneficial effects on water quality when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: The No-action alternative would result in short-term, minor, indirect, adverse impacts to water quality from the routine invasive plant management and restoration program, the exclusive source of wildlife habitat enhancement for the marsh. Because this alternative focuses on treatments that would prevent sedimentation and chemical drift, actions would likely benefit water quality in the long-term at a minor level, when considered with other past, present, and reasonably foreseeable future actions.

3.4.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant/native plant restoration. Some cattail habitat would be removed from the marsh on a regular schedule mechanically, chemically, and with fire. Within the first phase of the project (expected to take two years), floating islands of cattails would be removed from the marsh. Also within the first phase, microtopography would be created along the marsh from fill dirt from western upland areas, following archeological clearances, (the "Kochia plot", see Figure 9) to create areas of transitional marsh vegetation above the existing water levels of the marsh. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh.

Activities related to removing cattail islands and creating topography along the northern marsh areas could result in increased sediment loads. These sediment loads would likely occur during construction, and after the first several major rain storms, resulting in a short-term effect. Because the marsh is located below two canyons that also funnel debris into the marsh, the sediment loads related to the marsh restoration activities under this alternative are not expected to change the water quality levels outside of the range of variability, resulting in a minor impact level. Thus, under this alternative, the impacts to water quality are expected to be indirect (due to sediment load), adverse, short-term minor effects.

Cumulative Effects: Any monument activities that require excavation or ground disturbance have the potential to loosen soils, leading to an increase in sediment loads for downstream waters, and affecting water quality. Invasive plant management, native plant restoration, and fire management activities can disturb soils and lead to short-term water quality effects. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying would occur in already-disturbed soils, but could still lead to increased sediment load. Because this alternative would increase disturbance to localized uplands areas and change some of the soils on the marsh edges, this project could have short-term minor effects on soils and likely on increased sediment levels. However, because the effects on water quality under this alternative are only for the short-term, it is not expected to measurably result in cumulative impacts to water quality when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: Alternative B would result in minor, indirect, adverse impacts for the short-term to water quality in the park and downstream. Effects on water quality under this alternative are only for the short-term, it is not expected to measurably result in cumulative impacts to water quality when considered with other past, present, and reasonably foreseeable future actions.

3.4.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the abandoned old east-west road bisecting the marsh and would be used to adaptively manage the hydrology of the marsh north of the old road. A water conveyance channel would be constructed in the southern marsh to prevent overflow of the southern marsh waters onto the water control structures in the north marsh as well as be able to drain the north marsh. Floating islands of cattails would be removed from the northern marsh. Topography would be created along the marsh edges by removing and using fill dirt from western upland areas, following archeological clearances. These areas of increased topography would be revegetated with native plants to create a mosaic of

vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh.

Activities related to installing the water control structures, removing cattail islands, creating topography along the northern marsh areas, and creating a water conveyance channel could result in increased sediment loads. These sediment loads would likely occur during construction, and after the first several major rain storms, resulting in a short-term effect. The sediment load would likely be higher than in Alternative B due to the additional construction of the water control structures and the water conveyance channel. However, because the marsh is located below two canyon areas that also funnel debris into the marsh, the sediment loads related to the marsh restoration activities under this Preferred Alternative are not expected to change the water quality levels outside of the range of variability, resulting in a minor impact level. Thus, under this alternative, the impacts to water quality are expected to be indirect (due to sediment load), adverse, short-term minor effects.

Cumulative Effects: Any monument activities that require excavation or ground disturbance have the potential to loosen soils, leading to an increase in sediment loads for downstream waters, and affecting water quality. Invasive plant management, native plant restoration, and fire management activities can disturb soils and lead to short-term water quality effects. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying would occur in already-disturbed soils, but could still lead to increased sediment load. Because the Preferred Alternative would increase disturbance to soils from construction of water control structures near the historic road, removal of soil from localized uplands areas, and creation of the water conveyance channel; this project would have minor effects on soils and likely on increased sediment levels. However, because the effects on water quality under this alternative are only for the short-term, it is not expected to measurably result in cumulative impacts to water quality when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: The construction activities of the Preferred Alternative would result in indirect, adverse, minor impacts for the short-term to water quality from increased suspended solids in the marsh and downstream. The removal of a significant amount of organic matter (cattail rafts) would result in a short-term, moderate, positive impact to water quality by removing nutrients and sequestered carbon locked up in the organic matter. The effects on water quality under this alternative are only for the short-term, it is not expected to measurably result in cumulative impacts to water quality when considered with other past, present, and reasonably foreseeable future actions.

3.5 Wetlands and Floodplains

3.5.1 Affected Environment and Intensity Level Definitions

3.5.1.1 Wetlands

Wetlands are lands that are transitional between terrestrial and aquatic systems, where the water table is usually at or near the surface, or the land is covered by shallow water. The protection of wetlands within NPS units is facilitated through the following laws and mandates. Executive Order 11990 requires that agencies work to minimize the destruction, loss, or degradation of

wetlands. Director's Order 77-1 and Procedural Manual 77-1 provide specific procedures for implementing Executive Order 11990. Section 404 of the Clean Water Act authorizes the U.S. Army Corps of Engineers to grant permits for construction and disposal of dredged material in waters of the United States, which includes wetlands. The 2006 NPS Management Policies addresses the restoration of wetlands on NPS lands Section 4.6.5, "When natural wetland characteristics or functions [of wetlands] have been degraded or lost due to previous or on-going human actions, the Service would, to the extent practicable, restore them to predisturbance conditions" (NPS 2006).

Tavasci Marsh is a freshwater wetland with natural inputs from the Shea Springs Complex emerging from the Verde Formation, and artificial inputs from Peck's Lake overflow. The following information is nearly exclusively taken from one of two sources: "Delineation of Potential Jurisdictional Wetlands and 'Other Waters': Tavasci Marsh" (Parsons and Ryan 2009) and Wetland Delineation and Condition Assessment Report (Ryan and Parsons 2009). Delineation site visits were conducted by Amelia Ryan and Lorraine Parsons (National Park Service) on April 6-10, 2009. These delineation points were supplemented with additional field visits in May 2011, at the request of the Army Corps of Engineers.

Wetland extent (see Figure 13) was determined using the methodology outlined in the Corps of Engineers Wetland Delineation Manual (1987), incorporating the updates outlined in the "Arid West Interim Regional Supplement." Consultation with the U.S. Army Corps of Engineers (hereafter Corps) to confirm the extent of these delineations and subsequent Corps jurisdiction was initiated on November 15, 2010 and is currently being finalized by the Corps. The Traditional Navigational Water is the Verde River, bounding the marsh to the south. An overview of the wetland delineation is found in Figure 13.

Potential Section 404 Jurisdictional Wetlands and Waters of the United States
Within the marsh complex, there are currently:

- 92.76 acres of Non-Tidal Wetlands (Relatively Permanent Waters to Traditional Navigational Waters)
- 2.17 acres of Non-Tidal Waters (Relatively Permanent Waters to Traditional Navigational Waters)

Wetland vegetation within Tavasci Marsh is primary dominated by tall emergents such as cattails (specifically *Typha latifolia* and *Typha dominengsis)* and American threesquare bulrush within the 75-acre freshwater marsh component, with floating emergents present in areas with less dense cover or open water. Within wet meadows, several associations predominated based on the degree and duration of inundation/saturation, with spikerush (specifically *Eleocharis parishii)* and rush *(*specifically *Juncus balticus)* dominant in the wettest areas; sedge (specifically *Carex praegracilis),* rush, and scratchgrass, beardless wildrye dominant in moderately wet meadows; and bermudagrass dominant in the drier meadows.

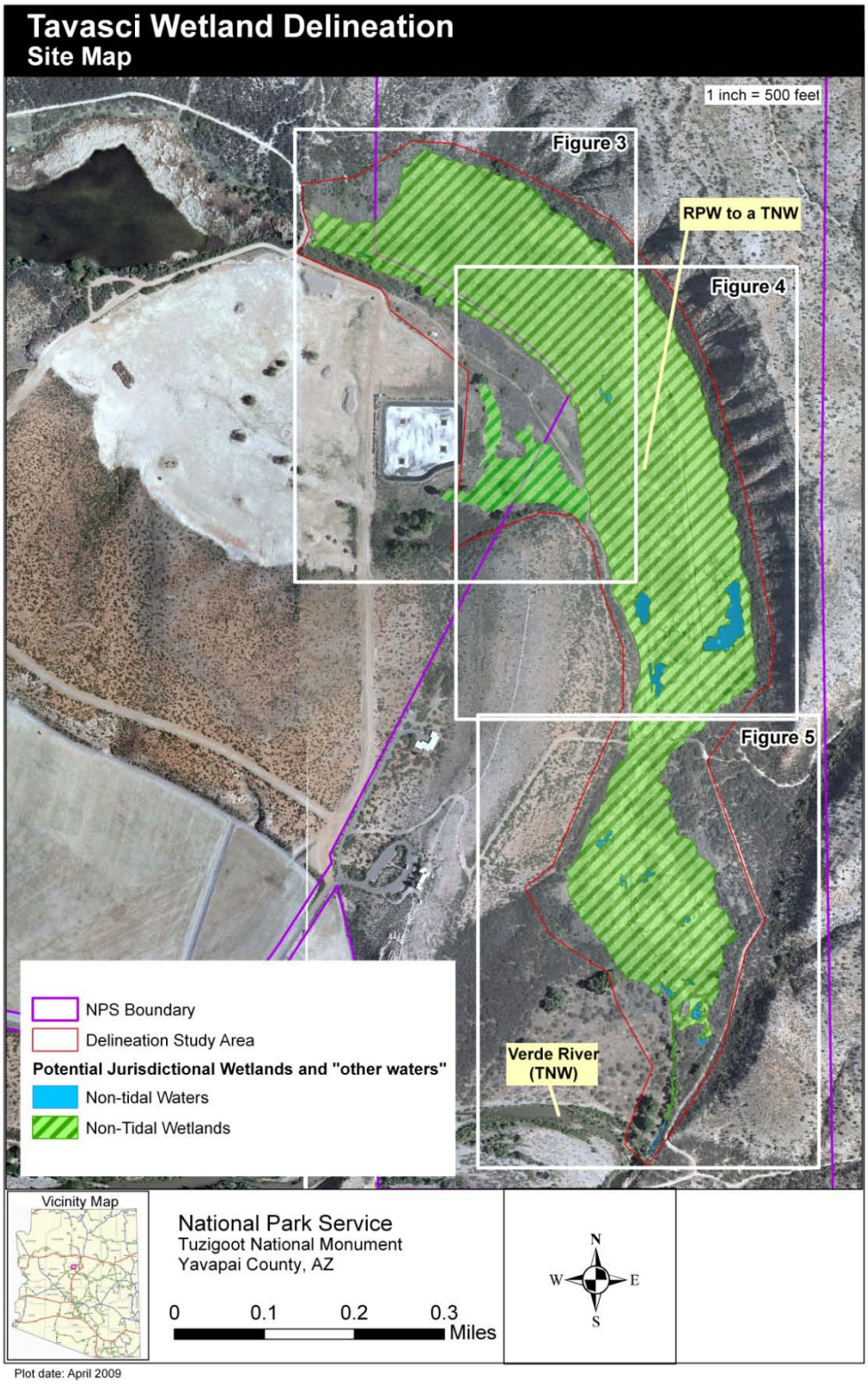

Figure 13. Overview of wetland delineation conducted by Parson and Ryans 2009. "RPW" refers to "Relatively Permanent Waters" and "TNW" refers to "Traditionally Navigational Waters."

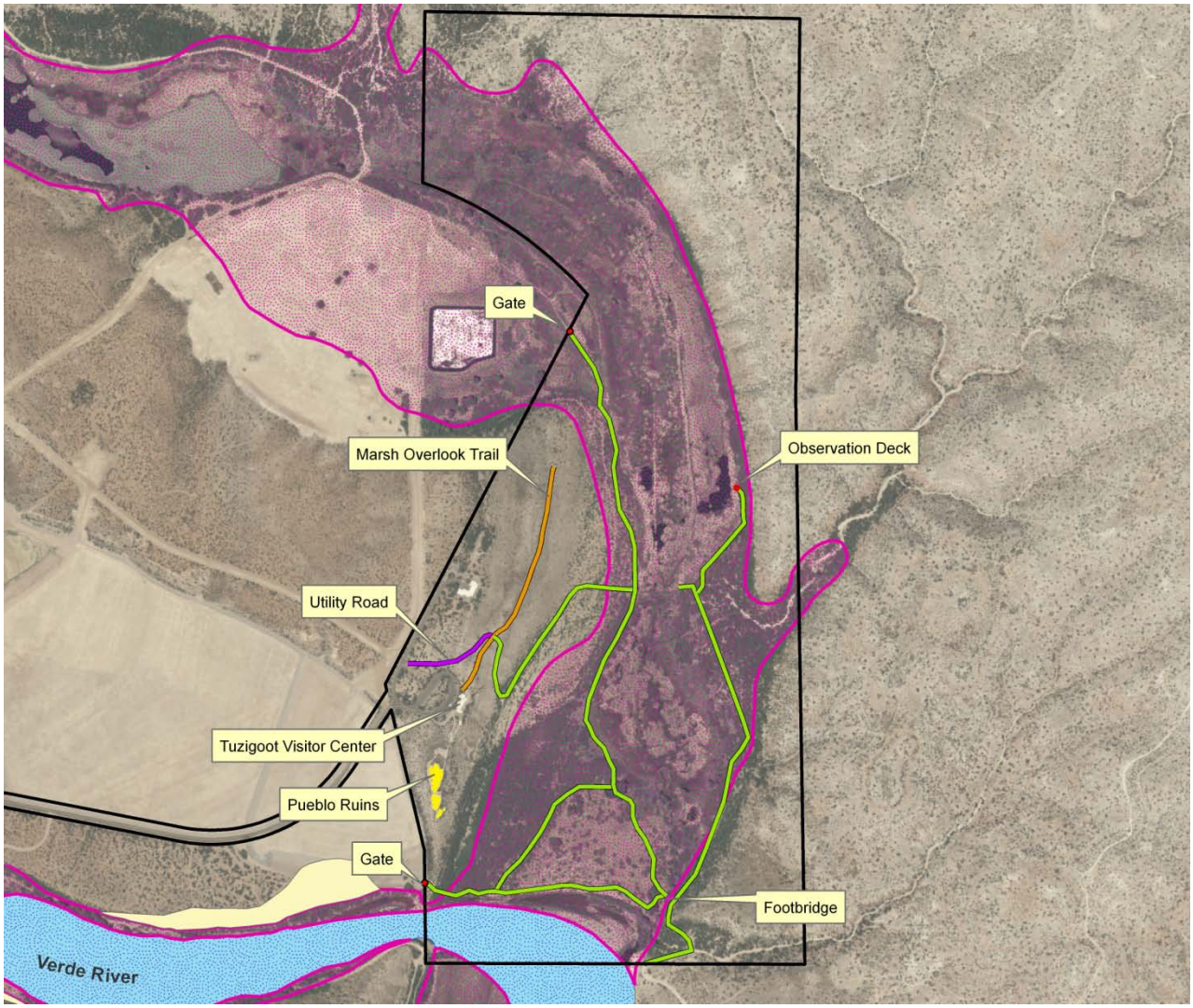

Figure 14. 100-year floodplain map for Tavasci Marsh. Data courtesy of Yavapai County. Floodplain is stippled pink.

3.5.1.2 Floodplains

The southern portion of Tavasci Marsh is affected by flooding from the Verde River and is considered to be in the 100-year flood event regime (Yavapai County Flood Control District data, Figure 14).

3.5.1.3 Wetland and Floodplain Assessment

For this environmental assessment, wetlands that could be subject to impacts were identified using the U.S. Fish and Wildlife Service Cowardin Method (Cowardin et. al. 1979) surveyed in the field (Parsons and Ryan 2009; Ryan and Parsons 2009). Federal policy requires proposed actions to result in no net loss of wetlands, and NPS Management Policies push parks to strive for a net gain in wetland acreage. For this reason, impact thresholds reflect this mandate by establishing more stringent thresholds for adverse impacts. Adverse impact thresholds draw upon federal, state, and local policies. The Park Service requires a statement of finding and mitigation for any projects that may impact > 0.25 acres of "natural" wetlands except for those related to recreational facilities

(e.g., overlooks, bike/foot trails, and signs) and minor stream crossings that completely span channel and wetlands (i.e., no pilings, fill, or other support structures). Beneficial impacts to wetlands through "net gain" in wetland acreage are evaluated using a broader range of criteria, because the high losses of wetlands that have occurred historically requires a higher percentage gain to be considered significant.

Negligible

Beneficial: No observable or measurable changes promoting natural processes necessary for wetland hydrology to develop, or natural processes associated with natural floodplain development

Adverse: No observable or measurable changes altering hydrologic features/factors that are required to maintain the wetland and floodplain; or altering soil properties that are required to maintain the wetland and floodplain

Minor

Beneficial: Changes promoting natural processes necessary for wetland hydrology to develop, or natural processes associated with natural floodplain development would be detectable and/or localized, but they would not be expected to be outside the natural range of variability.

Adverse: Changes altering hydrologic features/factors that are required to maintain the wetland and floodplain; or altering soil properties that are required to maintain the wetland and floodplain; would be detectable and/or localized, but they would not be expected to be outside the natural range of variability. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate

Beneficial: Changes promoting natural processes necessary for wetland hydrology to develop, or natural processes associated with natural floodplain development would be readily apparent, resulting in change over relatively wide area.

Adverse: Changes altering hydrologic features/factors that are required to maintain the wetland and floodplain; or altering soil properties that are required to maintain the wetland and floodplain; would be readily apparent and result in a change over a relatively wide area. Mitigation measures would be necessary to offset adverse effects and likely be successful.

Major

Beneficial: Changes promoting natural processes necessary for wetland hydrology to develop, or natural processes associated with natural floodplain development would be readily apparent and substantially change over a wide area.

Adverse: Changes altering hydrologic features/factors that are required to maintain the wetland and floodplain; or altering soil properties that are required to maintain the wetland and floodplain; would be readily apparent and substantially change over a wide area. Mitigation measures to offset adverse effects would be necessary, extensive, and their success could not be guaranteed.

Duration

Short-term—effects on wetlands and floodplains would persist for two years or less

Long-term—effects on wetlands and floodplains would persist for two years or more beyond the construction period

Context Within Tavasci Marsh

3.5.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the wildlife habitat at Tavasci Marsh. Under the No-action alternative, there would be short and long-term minor beneficial impacts due to removal of invasive species from these areas favoring native species enhancing the function and condition for wetlands and floodplains.

Cumulative Effects: The only other project occurring in the wetland and floodplain areas are invasive plant treatments and restoration activities, which is the same as the previous impacts.

Conclusion: The No-action alternative would have a short and long-term, minor, beneficial impact by removing non-native, invasive plants from wetland and floodplain resources. When considered with all reasonably past, current, and future actions, this alternative will have long-term minor, beneficial impacts for both wetland and floodplain resources.

3.5.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant/native plant restoration. Some cattail habitat would be removed from the marsh on a regular schedule mechanically, chemically, and with fire. Within the first phase of the project (expected to take two years), floating islands of cattails would be removed from the marsh. Also within the first phase of the project, topography would be created along the marsh edges by using fill dirt from western upland areas, following archeological clearances, to create areas of transitional marsh vegetation above the existing water levels of the marsh. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh.

Alternative B would attempt to restore the topography of the wetland and floodplain areas to what likely was present prior to farming activities such as bulldozing and flattening the wetland for pasture, potentially causing a short-term moderate beneficial effect. Also, this alternative would increase the diversity of marsh plants within the wetland, promoting natural processes.

Long-term effects under this alternative are not as predictable, due to the reliance on the marsh hydrology on beaver activity and dams. For example, if the beaver dams failed, it is likely that the wetlands could shrink under this alternative.

Under Alternative B, trails would be hardened or rerouted to avoid having muddy trails. An upgraded bridge to support UTV traffic for administrative use would be constructed in the

floodplain. The upgraded bridge would be structurally built to withstand flooding. Neither of these types of structures would affect floodplain function.

Cumulative Effects: The only other project occurring in the wetland and floodplain areas are invasive plant treatments and restoration activities, which would not cause changes to the wetland area. Cumulative effects under this alternative when considered with all reasonably past, current, and future actions continue to be short-term moderate beneficial effect.

Conclusion: Alternative B would result in direct, short-term, moderate, beneficial effects for wetlands because the actions under the alternative would attempt to bring the marsh back to conditions prior to the farmland activities of bulldozing and flattening the marsh for pasturelands. Increasing native marsh vegetation diversity would also increase natural function by enhancing marsh wildlife habitat. Long-term benefits are not as clear due to marsh hydrology being directly dependent to beaver dams and activities. When considered with all reasonably past, current, and future actions, cumulative effects under this alternative continue to be short-term moderate beneficial effect.

3.5.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the abandoned old east-west road bisecting the marsh and would be used to adaptively manage the hydrology of the marsh north of the old road. A water conveyance channel would be constructed within the western wetland edge in the southern marsh to prevent overflow of the southern marsh waters onto the water control structures in the north marsh as well as be able to drain the north marsh. Floating islands of cattails would be removed from the northern marsh. Topography would be created along the marsh edges by removing and using fill dirt from western upland areas, following archeological clearances. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh.

Although the approximately 1915-feet length, 25 to 30-feet width, 5 to 7-feet deep water conveyance channel to prevent overflow of the southern marsh waters onto the water control structures in the north marsh would be constructed in the wetlands, it would still continue to function as part of the wetland (per K. Noon, Wetland Scientist, NPS Washington Water Resources Division, pers. comm.). Fill from the water conveyance channel would be used to harden the parallel maintenance access trail which would be routed as much as possible outside of the wetland area (see Figure 15). The maintenance access trail expanded to 11-feet wide would initially follow around 1230 feet of existing trail with a current width of 8-10 feet wide. A new length of close to 685 feet of maintenance access trail would be constructed in the wetland to ensure the ability to clean out the conveyance channel of excess debris and vegetation through time. The combination of the area of the newly created maintenance access road/trail and the expansion of the existing trail would result in a combined impact of less than 0.1 acres of wetland.

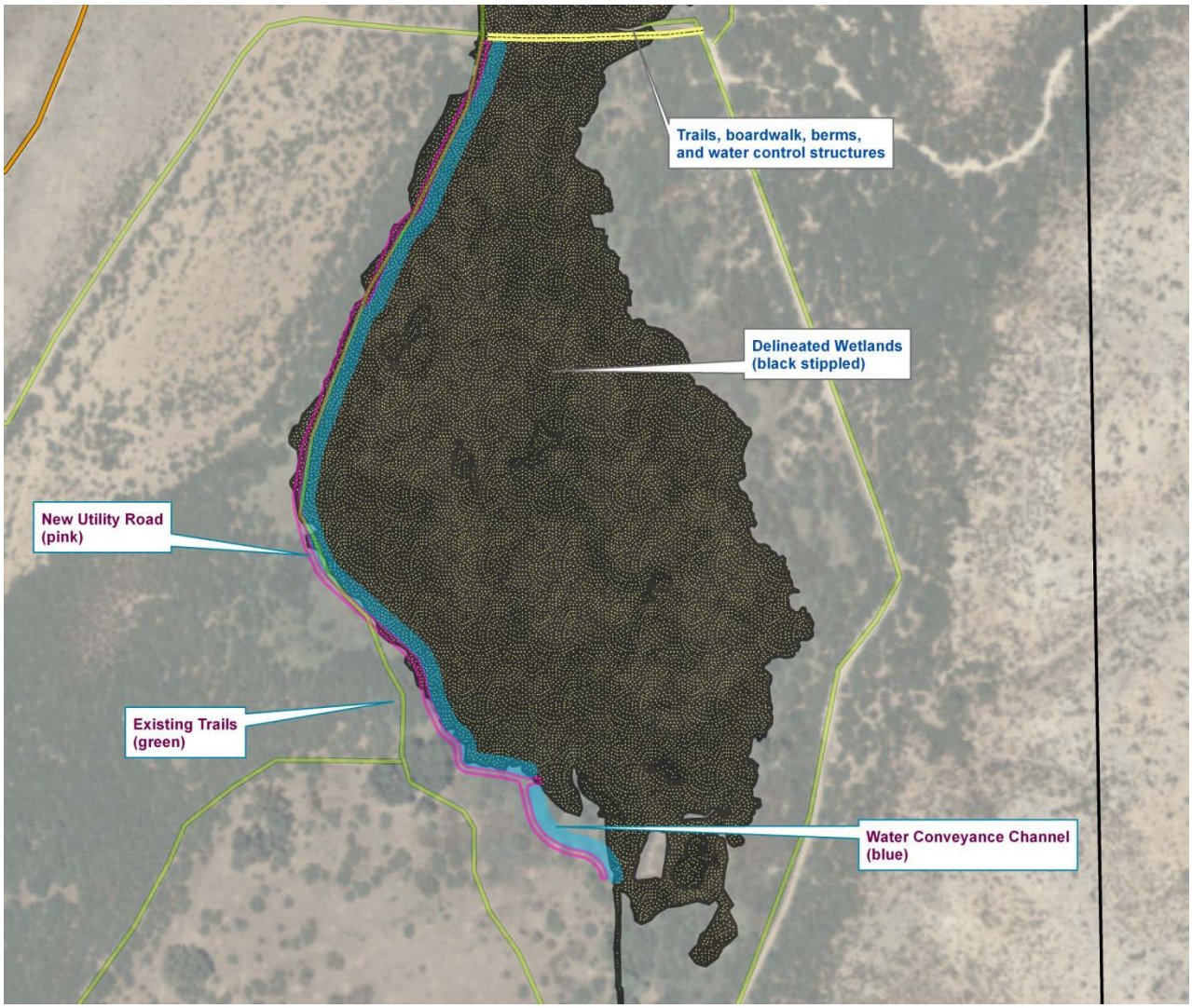

Figure 15. For Alternative C (Preferred Alternative), a comparison of where the existing trails (green), future utility road (outlined in pink), and water conveyance channel (blue) would be located compared to the delineated wetland (black stipple). Future utility road was located on existing trails and routed outside of wetland area whenever possible.

The "Kochia plot" (Figures 10 and 12), an upland area outside of the wetlands, would provide 18,500-cubic yards of fill following archeological clearances to create microtopography in areas for marsh transitional species such as baccharis and willow on the outskirts of the marsh. Floating mats of cattails within the marsh would be removed to increase open water areas.

Under the Preferred Alternative, actions would attempt to restore the topography of the wetland and floodplain areas to what likely was present prior to farming activities such as bulldozing and flattening the wetland for pasture, potentially causing a moderate beneficial effect. Also, this alternative would increase the diversity of marsh plants within the wetland, promoting natural processes. Using the water control structures to adaptively control the hydrology of the northern marsh area would also ensure the long-term viability of these actions.

All of the actions under the Preferred Alternative that occur within the designated wetland area fall under excepted actions under the NPS Procedural Manual #77-1:Wetland Protection for Director's Order 77-1 (2008) as cited as follows:

The proposed Tavasci Marsh trails and boardwalks located within the wetlands are under the exception for:

> Scenic overlooks and foot/bike trails or boardwalks, including signs, where primary purposes include public education, interpretation, or enjoyment of wetland resources and where total wetland impacts from fill placement are 0.1 acre or less.

The berms and water control structures would be placed in already disturbed lands along the old roadbed. The water conveyance channel placed within the western edge of the wetland delineation within the southern marsh would still continue to function as wetland, although it would be managed as a ditch. Because constructing the water conveyance channel does not decrease wetland area, it is not considered a loss of wetlands (per K. Noon, Wetland Scientist, NPS Washington Water Resources Division, pers. comm.).

Constructing the maintenance access road paralleling the water conveyance channel will total less than 0.1 acres of wetlands, even after the areas from expansion of the existing trail and the newly created trail/road are combined. These actions fall under the exception for:

> Actions causing a cumulative total of up to 0.25 acres of new long-term adverse impacts on natural wetlands may be allowed under this exception if they are directly associated with and necessary for the restoration (e.g., small structures or berms).

The excavation activities related to the removing the floating islands of cattails fall under the exception for:

> Actions designed specifically for the purpose of restoring degraded (or completely lost) natural wetland, stream, riparian, or other aquatic habitats or ecological processes. For purposes of this exception, "restoration" refers to reestablishing environments in which natural ecological processes can, to the extent practicable, function at the site as they did prior to disturbance.

Thus, after discussion with NPS Water Resources Division, Washington Office, it was determined that a Statement of Findings for Wetlands was not needed for this project.

Under the Preferred Alternative, trails would be hardened or rerouted to avoid having muddy trails. An upgraded bridge to support UTV traffic for administrative use would be constructed in the floodplain. The upgraded bridge would be structurally built to withstand flooding. Neither of these types of structures would affect floodplain function. The water control structures, the water conveyance channel, and the utility road paralleling the water conveyance channel would also be constructed within the 100-year floodplain, but would not affect floodplain function. A Statement of Findings for Floodplain was written for this project, and is attached in Appendix E.

Cumulative Effects: The only other monument project occurring in the wetland and floodplain areas are invasive plant treatments and restoration activities, which would not cause changes to the

wetland area. Because wetlands are rare in desert environments, restoring a marsh to more natural processes and enhancing wetland habitat cumulatively increases the quality of wetland habitat across the region. Cumulative effects under this alternative when considered with all reasonably past, current, and future actions continue to be long-term minor beneficial effect.

Conclusion: The Preferred Alternative would result in direct, short- and long-term, moderate beneficial effects for wetlands because the actions under the alternative would attempt to bring the marsh back to conditions prior to the farmland activities of bulldozing and flattening the marsh for pasturelands. Increasing native marsh vegetation diversity would also increase natural function of the wetland by enhancing marsh wildlife habitat. Floodplain value and function are not affected by this alternative (see Statement of Findings for Floodplain, Appendix E). Cumulative effects under this alternative when considered with all reasonably past, current, and future actions continue to be long-term minor beneficial effect.

3.6 General Fish and Wildlife

3.6.1 Affected Environment and Intensity Level Definitions

Because of the diversity of vegetation communities represented in the marsh and the additional riparian habitat from the Verde River on the marsh's southern boundary, the marsh and river provide valuable habitat for various wildlife species for reproduction, feeding, wintering, hibernation, and connectivity for various species.

In Tuzigoot National Monument, 15 fish, 248 bird, 28 amphibian and reptile species, and 42 mammal species were documented in a three-year vertebrate inventory conducted by the U.S. Geological Survey and University of Arizona for a total of 333 vertebrate species (Schmidt et al. 2005; see Appendix D for species lists).

While native fish were once present, only non-native fish are currently found at Tuzigoot National Monument (Schmidt et al. 2005). These non-native fish include common carp, red shiners, catfish *(*specifically *Ictalurus punctatus* and *Pylodictis olivaris)* and bass *(*specifically *Micropterus salmoides* and *Micropterus dolomieu)*. Mosquitofish and blue gill are commonly found the marsh.

In contrast to the high number of non-native fish, only one non-native herpetological species, the bullfrog, is found out of the 28 amphibian and reptile species that occur in the monument; the rest are native species (Schmidt et al 2005). The most common amphibian found at the marsh was the non-native bullfrog, but Woodhouse's toad was also found. Common reptiles found at the monument were western whiptails, desert grassland whiptails, desert spiny lizards, and western diamond-backed rattlesnakes. Young of amphibians and some reptiles require shallow water for nurseries (Dr. Nowak, NAU herpetologist, pers. comm.).

Tavasci Marsh, in conjunction with Peck's Lake, has been designated an Important Bird Area by the Audubon Society, and bird species are the largest group of vertebrates represented at the marsh. The bird community at the monument had the highest species richness of any national park unit in central and southern Arizona (Schmidt et al. 2005). The bird habitats can be broadly grouped as marsh, riparian, open water, and upland. Common marsh birds include green heron, sora, red-winged blackbirds, Virginia rail, and marsh wren. Common riparian birds include

common yellowthroat, yellow-breasted chat, Bullock's oriole, Cassin's kingbird, western kingbird, and Bewick's wren. Common open water birds include American widgeon, ring-necked duck, mallard, common moorhen, and American coot. Common upland birds include Gambel's quail, northern cardinal, mourning dove, northern flicker, Gila woodpecker, phainopepla, and Abert's towhee. (See Appendix D for the exhaustive bird species list.)

For mammals, the largest species category was for bats with sixteen species of bats documented at the monument with seven myotis bat species (Schmidt et al. 2005). Eleven rodent species were documented, including four species of *Peromyscus,* Ord's kangaroo rat, and beaver. Both mule deer and white deer are present in the monument, and the collared peccary are fairly common. The monument also provides habitat for various carnivores: raccoon, river otter, striped skunk, gray fox, coyote, bobcat, mountain lion, and even occasional black bear.

As plant community diversity has been lost in the past two decades with the hydrologic regimes favoring the expansion of cattails, wildlife dependent on those diverse plant communities have likely decreased in their use of the marsh. For example, the loss of cottonwood and willow habitats, typically supporting a greater number of wildlife species common to Arizona wetland and riparian corridors than cattail habitat, is evidenced from standing dead trees surrounded by cattails. However, the increase of the permanent cattail marsh (which is unique to northern Arizona) may be supporting greater numbers of soras, Virginia rails, green herons, and marsh wrens; these species would likely otherwise migrate through if this marsh were comprised only of willow and riparian habitat.

Negligible There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be of short duration and well within natural fluctuations.

Minor Impacts would be detectable, but they would not be expected to be outside the natural range of variability and would not be expected to have any long-term effects on native species, their habitats, or the natural processes sustaining them. Occasional responses to disturbance by some individuals could be expected, but without interference to feeding, reproduction, or other factors affecting population levels. Sufficient habitat would remain functional to maintain viability of all species. Impacts would be outside critical reproduction periods for sensitive native species.

Moderate Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they could be outside the natural range of variability for short periods of time. Frequent responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, or other factors affecting short-term population levels. Population numbers, population structure, and other demographic factors for species might have short-term changes, but would be expected to rebound to pre-impact numbers and to remain stable and viable in the long term. Sufficient habitat would remain functional to maintain viability of all native species. Some impacts might occur during critical periods of reproduction or in key habitat for sensitive native species.

Major Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, and they would be expected to be outside the natural range of variability for long periods of time or be permanent. Population numbers, population structure, and other demographic factors for species might have large, short-term declines, with long-term population numbers significantly depressed. Frequent responses to disturbance by some individuals would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a long-term decrease in population levels. Breeding colonies of native species might relocate to other portions of the park. Loss of habitat might affect the viability of at least some native species.

Duration Short-term— recovers in less than two years
Long-term— requires more than two years to recover

Context Within park boundary

3.6.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the wildlife habitat at Tavasci Marsh. The No-action alternative would likely result in long-term minor effects to native wildlife habitat diversity as the cattail vegetation type would continue to expand coupled with the loss of other native plant communities. The current areas for vegetation communities (see Figure 7 and Table 3) would likely increase for cattails at the expense of other native plant communities. Under this No-action alternative, there would be minor, likely adverse, long-term effects on general fish and wildlife as native wildlife habitat diversity would decrease due to the continued expansion of cattails from current hydrologic conditions.

Cumulative Effects: Invasive plant management, native plant restoration, and fire management activities could directly and indirectly impact marsh wildlife habitat, but would not likely rise above the negligible effect level. This No-action alternative would result in continued loss of wildlife habitat diversity, although removals of invasive plant species would likely improve native wildlife habitat in a small degree. When considered with other past, present, and reasonably foreseeable future actions, there would be minor, adverse, and long-term effects.

Conclusion: The No-action alternative would result in long-term, minor, adverse impacts to general fish and wildlife resources because the routine invasive plant management and restoration program would be the primary habitat enhancement activities. The cattail habitat type would likely increase as it has historically at the expense of other diverse wildlife habitats. Because this No-action alternative would result in continued loss of wildlife habitat diversity, when considered with other past, present, and reasonably foreseeable future actions, there would be minor, adverse, and long-term effects.

3.6.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant control/native plant restoration. Some cattail habitat would be removed from the marsh on a regular schedule mechanically, chemically, and with fire. Within the first phase of the project (expected to take two years), floating islands of cattails would be removed from the marsh. Also within the first phase of the project, topography would be created along the marsh edges by removing some fill dirt from western upland areas, following archeological clearances, to create areas of transitional marsh vegetation above the existing water levels of the marsh. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh. Construction activities under this alternative would be limited to outside of the March-September breeding season; activities generating substantial noise would be limited to the October-February time period.

Under Alternative B, the changes to the wildlife habitat types would be as follows: over 25 acres of cattail islands would be removed, approximately 4 acres of riparian forested/scrub shrub habitat would be created, and 10 acres of wet/moist grassland and meadows would also be created. The acreage of the mesquite bosque and tall sedges and rushes would not likely change under this alternative. Over 12 acres of open water areas would be created under this alternative, partially as a response to removing the cattail islands.

In the short-term, Alternative B would create a larger acreage of diverse wildlife habitat than currently exists. The increase in riparian forested scrub/shrub habitat would support species dependent on riparian habitat such as bats, flycatchers, raccoons, and specific warbler bird species. Forested riparian areas also provide habitat for roosting birds that hunt in the marsh and also provide connectivity to riparian habitat as a travel corridor for mammals, birds, and reptiles. The additional 10 acres of wet/moist grasslands and meadows which include short sedges and rushes would provide habitat for neonate gartersnakes, ibis, herons, rails, waders, teals, black hawk, harrier, invertebrates, amphibians, small mammals (voles, etc.), terrestrial mammals, and reptiles; and moist grassland specifically is also associated with the previous species as well as rodent-hunting raptors, grassland bird species, and nesting killdeer. The over 12 acres of open water areas would provide habitat for benthic feeders (including waterfowl), flycatchers, native invertebrates, otter, beaver, muskrats, swallows, bats, bald eagle, osprey, belted kingfisher, grebes, gartersnakes, fish, shorebirds, tadpoles, and turtles. Open water would also provide access to water for wildlife.

Under Alternative B, the increases to riparian scrub/shrub, wet/moist grasslands and meadows, and open water areas would provide short-term, moderate, beneficial effects for those groups of wildlife listed above. Although cattail habitat would be decreased in the marsh, there would still be close to 40 acres of cattails to support muskrat, beaver, otter, shore birds such as rails, marsh birds such as red-winged blackbirds, otter, invertebrates, and amphibians; and the project would likely have a short-term minor adverse effect on those species temporarily.

While this alternative has the potential to create substantial amounts of diverse wildlife habitats, the longer term effects under this alternative are unknown because future water surface elevations and fluctuations are unknown and are dependent on beaver activity and dams. Future increases in beaver activities/dams could increase the water levels and flood the newly planted areas, while

future beaver dam failures could result in a breach of marsh waters leading to a drying of wetland areas; either change would result in effects on the newly created wildlife habitats.

Cumulative Effects: Invasive plant management, native plant restoration, and fire management activities could directly and indirectly impact marsh wildlife habitat, but would not likely rise above the negligible effect level. Because Alternative B would increase the mosaic and diversity of wildlife habitat in the marsh, it is expected that this project would have short-term moderate beneficial effects for on general fish and wildlife resources when considered with other past, present, and reasonably foreseeable future actions, although long-term effects are still difficult to predict due to the structural reliance of this alternative on beaver dams.

Conclusion: Alternative B would result primarily in short-term, moderate, beneficial effects for species associated with the increases to riparian scrub/shrub, wet/moist grasslands and meadows, and open water areas, greatly expanding the native wildlife habitat diversity for the marsh. Longer term effects on general wildlife are less clear, due to the dependence of marsh hydrology levels on beaver activities and dam conditions. Cumulative effects for Alternative B would have short-term moderate beneficial effects for on general fish and wildlife resources by increasing the mosaic and diversity of wildlife habitat in the marsh when considered with other past, present, and reasonably foreseeable future actions, although long-term effects are still difficult to predict due to the structural reliance of this alternative on beaver dams.

3.6.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the abandoned old east-west road bisecting the marsh and would be used to adaptively manage the hydrology of the marsh north of the old road. A water conveyance channel and parallel utility road would be constructed in the southern marsh to prevent overflow of the southern marsh waters onto the water control structures in the north marsh as well as be able to drain the north marsh. Floating islands of cattails would be removed from the northern marsh. Topography would be created along the marsh edges by removing and using fill dirt from western upland areas, following archeological clearances. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh.

Construction activities under this alternative would be limited to outside of the March-September breeding season; activities generating substantial noise would be limited to the October-February time period. Life cycle conditions of the resident herpetofauna and naturally occurring annual drought cycles would also be used to determine the optimum time for water drawdown and excavation of the cattail rafts.

Under the Preferred Alternative, the changes to the wildlife habitat types would be as follows: over 30 acres of cattail islands would be removed, approximately 5 acres of riparian forested/scrub shrub habitat would be created, an additional 20 acres of wet/moist grassland and meadows would also be created, and around 6 acres of tall sedges and rushes would be created. The acreage of the mesquite bosque would not likely change under this alternative. Around 3 acres of open water

areas would be created under this alternative, primarily as a response to removing the cattail islands.

The Preferred Alternative would create for the long term a larger acreage of diverse wildlife habitat than currently exists. The increase in riparian forested scrub/shrub habitat would support species dependent on riparian habitat such as bats, flycatchers, raccoons, and specific warbler bird species. Forested riparian areas also provide habitat for roosting birds that hunt in the marsh and also provide connectivity to riparian habitat as a travel corridor for mammals, birds, and reptiles.

The additional 20 acres of wet/moist grasslands and meadows which include short sedges and rushes would provide habitat for neonate gartersnakes, ibis, herons, rails, waders, teals, black hawk, harrier, invertebrates, amphibians, small mammals (voles, etc.), terrestrial mammals, and reptiles; and moist grassland specifically is also associated with the previous species as well as rodent-hunting raptors, grassland bird species, and nesting killdeer. The 6 additional acres of bulrush would provide habitat for gartersnakes, diving ducks, beaver, muskrat, invertebrates, fish, least bittern, lowland leopard frogs. The over 3 acres of open water areas would provide habitat for benthic feeders (including diving and dabbling ducks), flycatchers, native invertebrates, otter, beaver, muskrats, swallows, bats, bald eagle, osprey, belted kingfisher, grebes, gartersnakes, fish, shorebirds, tadpoles, and turtles. Open water would also provide greater marsh edge access for waterfowl and other wildlife.

Under the Preferred Alternative, the increases to riparian scrub/shrub, wet/moist grasslands and meadows, and open water areas would provide long-term, moderate, beneficial effects for those groups of wildlife listed above. Although cattail habitat would be decreased in the marsh, there would still be close to 32 acres of cattails to support Virginia rails, green herons, marsh wrens, red-winged blackbirds, other marsh birds, muskrat, beaver, otter, invertebrates, and amphibians; and the project would likely have a short-term minor adverse effect on those species temporarily.

The Preferred Alternative would create substantial amounts of diverse wildlife habitats for the longer term because the monument would have control over the water levels in the northern part of the marsh where most of the vegetation changes would take place (see Figure 10). Flooding and drying of the vegetation communities would occur adaptively when necessary to ensure the perpetuity of the optimal acreages for the various marsh wildlife habitats.

Cumulative Effects: Invasive plant management, native plant restoration, and fire management activities could directly and indirectly impact marsh wildlife habitat, but would not likely rise above the negligible effect level. Within the Sonoran Desert region, wetland areas are rare wildlife habitat. Because of this, Tavasci Marsh provides habitat for a variety of birds, especially those that migrate. Because the Preferred Alternative would increase the mosaic and diversity of wildlife habitat in the marsh, it is expected that this project would have moderate beneficial effects for on general fish and wildlife resources when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: The Preferred Alternative would result primarily in long-term, moderate, beneficial effects for species associated with the increases to riparian scrub/shrub, wet/moist grasslands and meadows, and open water areas, greatly expanding the native wildlife habitat diversity in the long-

term for the marsh. Cumulative effects for the Preferred Alternative would have moderate beneficial effects for on general fish and wildlife resources by increasing the mosaic and diversity of wildlife habitat in the marsh when considered with other past, present, and reasonably foreseeable future actions.

3.7 Species of Special Concern

3.7.1 Affected Environment and Intensity Level Definitions

3.7.1.1 Species Protected Under the Endangered Species Act

On December 16, 2010, the U.S. Fish and Wildlife Service (USFWS) responded to the NPS request for federally-listed, proposed, and candidate species and critical habitat in the Tavasci Marsh project area (see Appendix F). The federally-listed Threatened, Endangered, and Candidate species and species with critical habitat identified by the UFSWS to be evaluated for this project are shown in the Table 5 below. A biological assessment is in progress and will be sent to the U.S. Fish and Wildlife Service for informal consultation for Section 7 Consultation under the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended. All of the listed species information below is from the U.S. Fish and Wildlife Arizona Ecological Services website, except where noted.

Table 5. Federally-listed Threatened and Endangered Species for Tavasci Marsh.

Species	Status	Critical Habitat	Potentially at TUZI
Razorback Sucker *(Xyrauchen texanus)*	Endangered	X	X
Loach Minnow *(Tiaroga cobitis)*	Threatened	X	
Spikedace *(Meda fulgida)*	Threatened	X	X
Colorado Pikeminnow *(Ptychocheilus lucius)*	Endangered*		X
Roundtail Chub *(Gila robusta)*	Candidate		X
Southwestern Willow Flycatcher *(Empidonax traillii extimus)*	Endangered		X
Yuma Clapper Rail *(Rallus longirostris yumanensis)*	Endangered		X
Yellow-billed Cuckoo *(Coccyzus americanus)*	Candidate		X
Northern Mexican Gartersnake *(Thamnophis eques megalops)*	Candidate		X
Page Springsnail *(Pyrgulopsis morrisoni)*	Candidate		X

*Experimental nonessential population in the Verde River.

Razorback sucker

The razorback sucker is federally-listed as endangered (56 FR 54957, October 23, 1991) with critical habitat (59 FR 13379, March 21, 1994). The razorback sucker is found in backwaters, flooded bottomlands, pools, side channels, and other slower moving habitats under 6,000 feet

elevation. Historically it was found in areas near strong currents, and the Verde River is critical habitat for the sucker. The Arizona Game and Fish Department and U.S. Fish and Wildlife Service have stocked razorback suckers in the Verde River for many years.

Loach minnow

The loach minnow is federally-listed as threatened (51 FR 39468, October 28, 1986) with critical habitat (72 FR 13356, March 21, 2007). Critical habitat was vacated by court ruling in May 2009 but remains in place until a new designation is completed which is expected to be finalized in 2011. The loach minnow is a bottom dweller of small to large perennial creeks and rivers, typically in shallow turbulent riffles with cobble substrate, swift currents, and filamentous algae. The minnow is found below 8,000 feet elevation and recurrent flooding is instrumental in maintenance of quality habitat. Although the loach minnow was once common in the Verde River, habitat destruction due to damming, channel alteration, riparian zone destruction, channel down-cutting, water diversion and groundwater pumping; and the introduction and spread of exotic predatory and competitive fish species have greatly diminished its numbers.

Spikedace

The spikedace is federally-listed as a threatened species (51 FR 23769, July 1, 1986) with designated critical habitat (65 FR 24328, April 25, 2000). Spikedace are found in moderate to large perennial streams, where they inhabit shallow riffles with sand, gravel, and rubble substrates, and moderate to swift currents and swift pools over sand or gravel substrates. Habitat destruction or alteration and interactions with non-native aquatic species have acted both independently and in concert to extirpate or deplete spikedace and loach minnow populations. Habitat destruction and alteration has occurred due to numerous human uses of the stream, floodplain, and watershed, such as livestock grazing, agriculture, timber harvest, mining, roads, urban and suburban development, irrigation, water diversion, impoundment, flood control and repair, channelization, vegetation manipulation, groundwater pumping, gravel mining, fuelwood harvest, and recreation. Erosion, sedimentation, channel downcutting, changes in channel morphology, channel instability, and loss of surface water commonly resulted from human activities causing further loss and alteration of spikedace and loach minnow habitat.

Colorado pikeminnow

The Colorado pikeminnow is federally-listed as endangered (32 FR 4001, March 11, 1967) with critical habitat (59 FR 13374, March 21, 1994), although no critical habitat has been designated within Arizona. Experimental nonessential populations have been introduced in the Verde River (50 FR 30194; July 24, 1985). The pikeminnow, the largest American minnow growing up to six feet long and 80 pounds is found in rivers with high silt content, warm water, turbulence, and variable flow by season under 4,000 feet in elevation. Adults are migratory and inhabit pools and eddies just outside of the main current, while young are found in backwater areas. Their decline is a consequence of alteration of river conditions and loss of habitat caused by dam construction, irrigation dewatering, and channelization; and the introduction of exotic competitive and predatory fish species.

Roundtail chub

The roundtail chub was listed as a candidate species by USFWS in 2009 (50 CFR 17). This chub is characterized by a robust body and tail trunk. It is an olive gray color with silvery sides and a

white belly. The roundtail chub matures at about three years of age with an unknown life expectancy. Breeding males develop red or orange coloration on the lower half of the cheek and the bases of paired fins. Individuals may reach 19 inches but usually average 10 to 12 inches. Spawning occurs in the late spring; females broadcast about 2,000 tiny sticky eggs over gravel/cobble bottom. The roundtail chub occurs in cool to warm water, mid-elevation rivers and streams throughout the Colorado River basin, often occupying open areas of the deepest pools and eddies of middle-sized to larger streams. They occasionally concentrate in relatively swift, turbulent waters below rapids, moving into less turbulent chutes in small groups. Roundtail chubs are often associated with cover in the form of boulders, overhanging cliffs, undercut banks, or vegetation. Roundtail chubs are known to inhabit the Verde River.

Southwestern willow flycatcher

The southwestern willow flycatcher was listed as endangered in 1995 (60 FR 10694) with critical habitat designated in 2005 (50 CFR 60886). The southwestern willow flycatcher occurs in dense riparian habitats along streams, rivers and other wetlands where cottonwood, willow, boxelder, tamarisk, Russian olive, buttonbush and arrowweed are present. Nests are found in thickets of trees and shrubs primarily 13 to 23 feet in height, among dense homogenous foliage. Habitat occurs below 8500 feet. Southwestern willow flycatchers arrive on breeding grounds from late April to early June, and nesting activities occur from mid-May to mid-August (USFWS 2002). The riparian corridor of the Verde River within Tuzigoot National Monument is not designated critical habitat. No flycatchers have been known to nest within the monument boundaries, although Sogge (1995) did find southwestern willow flycatchers breeding near the Tuzigoot Bridge, although most of the flycatcher habitat was on private property and the flycatcher numbers declined through the study. The riparian corridor along the Verde River may be used by flycatchers for migration and feeding.

Yuma clapper rail

The Yuma clapper rail is federally-listed as endangered (32 FR 4001, March 11, 1967) without critical habitat. The Yuma clapper rail requires a wet substrate, such as a mudflat, sandbar, or slough bottom that supports cattail and bulrush stands of moderate to high density adjacent to shorelines. The rail is found in freshwater or brackish stream-sides and marshlands under 4,500 ft elevation and associated with dense riparian and marsh vegetation. Although it is found on the Gila and Salt rivers upstream to the area of the Verde confluence (Maricopa and Pinal counties, Arizona), it may be expanding into other suitable marsh habitats in western and central Arizona. The rail likely has declined due to habitat destruction from stream channelization and elimination of marsh habitat.

Yellow-billed cuckoo

The yellow-billed cuckoo was listed as a candidate species by USFWS in 2001 (66 CFR 38611). The yellow-billed cuckoo is found in large blocks of riparian gallery forests dominated by large cottonwood and willows, and feeds exclusively on insects. Cuckoos migrate north in late June and early July, and breeding commences in early July and continues through August. Holmes et al. (2008) detected yellow-billed cuckoos at Tuzigoot National Monument in 2004, although no breeding pairs were confirmed.

Northern Mexican gartersnake

The northern Mexican gartersnake was listed as a candidate species by USFWS (73 FR 71788, November 25, 2008). The northern Mexican gartersnake occurs at elevations from 3000 to 8500 feet and is considered a riparian obligate outside of dispersal behavior. The gartersnake is specifically found in source-area wetlands called cienegas, large-river riparian woodlands and forests, streamside gallery forests with well-developed broadleaf deciduous riparian forests with limited, if any, herbaceous ground cover or dense grass. The northern Mexican gartersnake has likely declined due to the destruction, modification or curtailment of its habitat; predation; and the inadequacy of existing regulatory mechanisms.

In summer 2010, NPS and Dr. Nowak from Northern Arizona University conducted surveys for the northern Mexican gartersnake in Tavasci Marsh. Sampling was initiated in April, with the placement of coverboards intended as shelter sites for the snakes (a method proven to be effective for this species elsewhere in the Verde Valley). Coverboard checking occurred at least once a month, concluding in September. Surveys were also conducted a total of six weeks using Gee-minnow traps between May 11 through August 13. Only one juvenile northern Mexican gartersnake was caught, and two other snakes that were likely this species (based on superficial appearance and behavior) were seen but could not be captured. This low sighting rate potentially indicates that while northern Mexican gartersnakes are present in the marsh, their numbers are likely low. All of the confirmed and potential sightings occurred within 100 m of the Tavasci Marsh Observation Deck, in dry/wet meadow and cattail marsh edge habitats.

Page Springsnail *(Pyrgulopsis morrisoni)*

The Page springsnail was listed as a candidate species by USFWS in 1996 (61 FR 7595).
The Page springsnail is an aquatic springsnail of the family Hydrobiidae and is small sized (shell length is 0.07 to 0.11 inch). They occur in springs, seeps, marshes, spring pools, outflows, and diverse lotic waters, with the most common habitat being a spring, emerging from the ground as a free-flowing stream. Page springsnail habitats are isolated, mid-elevational (approximately 3,500 ft), permanently saturated, spring-fed aquatic climax communities commonly described as cienegas. Springsnails require firm substrate such as cobble, gravel, woody debris, and aquatic vegetation for egg-laying and grazing. Their populations have declined from historical loss of natural spring habitat conditions have been due to the following (many of which have occurred at Tavasci Marsh): construction of impoundments, outflow restrictions; modification of upland vegetation and aquatic environment by livestock; use of toxic chemicals to eliminate undesirable aquatic organisms; elevated levels of heavy metals; and introductions of non-native predators and competitors such as fish, crayfish, clams, snails, and waterfowl. Historically, a population of the Page springsnail was found at Tavasci Marsh just east of Clarkdale, Yavapai County, although that population is now believed to be extirpated. The species is locally endemic to the Upper Verde River drainage of central Arizona and all extant populations exist within a complex of springs located within an approximately one mile area along the west side of Oak Creek around the community of Page Springs, Yavapai County.

3.7.1.2 Species of Concern

According Section 4.4.2.3 in 2006 National Park Service Management Policies, the NPS will inventory other species that are of special management concern to parks (such as rare, declining, sensitive, or unique species and their habitats) and will manage them to maintain their natural distribution and abundance. The State of Arizona does not maintain any official state-listed

species. Species of Concern were defined by the Arizona Game and Fish Department's Species of Concern list through the Arizona Heritage Data Management System (HDMS) (Arizona Game and Fish Department 2010) and inventories done for vascular plant and vertebrates by U.S. Geological Survey (2006) were compared for the project site. Species of Concern that had potential to be affected by the project are listed below in Table 6; Species of Concern were not listed in the table if they were already listed in Table 5 as a federally-listed species.

The list below was generated comparing the inventories done at Tuzigoot National Monument to the Yavapai County list, and in general is more inclusive of species than the list sent to the monument by Arizona Game and Fish Department dated January 11, 2011 (letter was sent on December 28, 2010). Five species on the officially AGFD-sanctioned list were not found in the monument during those inventories and are not expected to be in the project area: lowland leopard frog, narrow-headed gartersnake, Ripley wild-buckwheat, Tonto Basin agave, and Verde Valley sage.

Table 6. Potentially Affected Arizona Game and Fish Department Species of Concern for Tavasci Marsh in Tuzigoot National Monument (from Schmidt et al. 2005 compared to HDMS Yavapai County list).

Taxa	**Species**	**Habitat Type(s)**
Fish	Sonora sucker *(Catostomus insignis)*	Rivers/streams (near Tuzigoot in Verde River)
Fish	Desert sucker *(Catostomus clarkii)*	Rivers/streams (near Tuzigoot in Verde River)
Fish	Longfin dace *(Agosia chrysogaster)*	Rivers/streams (in Verde River)
Fish	Speckled dace *(Rhinichthys osculus)*	Rivers/streams (in Verde River)
Bird	American bittern *(Botaurus lentiginosus)*	Marsh with tall emergent vegetation and meadows
Bird	Least bittern *(Ixobrychus exilis)*	Marsh with tall emergent vegetation
Bird	Great egret *(Ardea alba)*	Marsh and riparian shrub/forests
Bird	Snowy egret *(Egretta thula)*	Marsh with emergent vegetation, grasslands, and riparian shrub/forests
Bird	White-faced ibis *(Plegadis chihi)*	Marsh with shallow depths and wet meadows
Bird	Osprey *(Pandion haliaetus)*	By waterbodies, including rivers and marshes
Bird	Bald eagle *(Haliaeetus leucocephalus)*	By waterbodies, including rivers and marshes
Bird	Common black-hawk *(Buteogallus anthracinus)*	Riparian gallery forests
Bird	Ferruginous hawk *(Buteo regalis)*	Grasslands
Bird	Peregrine falcon *(Falco peregrines)*	Various habitats
Bird	Belted kingfisher *(Ceryle alcyon)*	Streams and rivers; riparian areas
Bird	Olive-sided flycatcher *(Contopus cooperi)*	Various habitats including riparian forests
Bird	Loggerhead shrike *(Lanius ludovicianus)*	Various habitats
Mammal	Western red bat *(Lasiurus blossevillii)*	Riparian forests, especially cottonwoods
Mammal	Western small-footed myotis *(Myotis ciliolabrum)*	Unknown; uses caves for breeding
Mammal	Arizona myotis *(Myotis occultus)*	Forages near water

Taxa	Species	Habitat Type(s)
Mammal	Fringed myotis *(Myotis thysanodes)*	Unknown; uses caves for breeding
Mammal	Cave myotis *(Myotis velifer)*	Various habitats; uses caves for breeding.
Mammal	Yuma myotis *(Myotis yumanensis)*	Riparian forests by water
Mammal	Townsend's big-eared Bat *(Corynorhinus townsendii)*	Various habitats; typically near caves
Mammal	Pocketed free-tailed bat *(Nyctinomops femorosaccus)*	Desert areas; uses cliff crevices for breeding
Mammal	Big Free-tailed bat *(Nyctinomops macrotis)*	Desert and grassland areas; uses cliff crevices for breeding
Mammal	Northern river otter *(Lontra canadensis)*	Marsh and riparian areas
Plant	Golden columbine *(Aquilegia chrysantha)*	Moist areas
Plant	Velvet mesquite *(Prosopis velutina)*	Upland, floodplain

Negligible No special-status species would be affected or some individuals could be affected as a result of the alternative, but there would be no effect on special-status species' populations. Impacts would be well within natural fluctuations.

Minor The alternative would affect some special-status individuals and would also affect a limited portion of that species' population. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate The alternative would affect some special-status individuals and would also affect a sizeable segment of the species' population over a relatively large area within the park. Mitigation measures, if needed to offset adverse effects, would be extensive and likely successful.

Major The alternative would have a considerable effect on special-status individuals and affect a sizeable segment of the species' population over a relatively large area in and out of the park. Extensive mitigation measures would be needed to offset any adverse effects and their success would not be guaranteed.

Duration Short-term— recovers in less than one year
Long-term— requires more than one year to recover

Context Within park boundary and downstream

3.7.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the wildlife habitat at Tavasci Marsh. The No-action alternative would likely result in long-term minor effects to native wildlife habitat diversity as the cattail vegetation type would continue to expand coupled with the loss of other native plant communities. The current areas for vegetation communities (see Figure 7 and Table 3) would likely increase for cattails at the expense of other native plant communities. Under this No-action alternative, there would be minor, likely adverse,

long-term effects on species of concern as native wildlife habitat diversity would decrease due to the continued expansion of cattails from current hydrologic conditions.

Cumulative Effects: Invasive plant management, native plant restoration, and fire management activities could directly and indirectly impact marsh wildlife habitat, but would not likely rise above the negligible effect level. Because this No-action alternative would continue invasive plant treatments and restoration activities, this project would likely have minor, adverse, long-term effects on sensitive species resources when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: The No-action alternative would result in long-term, minor, adverse effects to sensitive species as the diversity of wildlife habitats such as riparian forests and bulrush and sedges diminished in response to expanding cattail habitat. This could particularly affect threatened and endangered species such as willow flycatchers, yellow-billed cuckoos, and northern Mexican gartersnakes, and other sensitive species dependent on habitats other than cattails. For cumulative effects, this project would likely have minor, adverse, long-term effects on sensitive species resources when considered with other past, present, and reasonably foreseeable future actions.

3.7.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant/native plant restoration. Some cattail habitat would be removed from the marsh on a regular schedule mechanically, chemically, and with fire. Within the first phase of the project (expected to take two years), floating islands of cattails would be removed from the marsh and topography would be created along the marsh edges by fill dirt from western upland areas, following archeological clearances, to create areas of transitional marsh vegetation above the existing water levels of the marsh. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities.

Earth-moving and temporary marsh draining activities under this alternative would be limited to outside of the March-September breeding season—activities generating substantial noise would be limited to the October-February time period. Activities related to removing cattail islands and creating topography along the northern marsh areas could result in increased sediment loads and affect water quality downstream. These sediment loads would likely occur during construction, and after the first several major rain storms, resulting in a short-term effect. Because the marsh is located below two canyon areas that also funnel debris into the marsh, the sediment loads related to the marsh restoration activities under this alternative are not expected to change the water quality levels outside of the range of variability. Native fish species furthermore are adapted to a range of natural sediment loads within their aquatic habitats (they are typically impacted greater from loss of water resources). Thus, under this alternative, the downstream impacts to fish species of concern; including the endangered razorback sucker and its critical habitat, threatened loach minnow with critical habitat, threatened spikedace with designated critical habitat, endangered Colorado pikeminnow, the candidate species roundtail chub, Sonora sucker, desert sucker, longfin dace, roundtail chub, and speckled dace; would be a short-term, negligible, indirect (due to sediment load), adverse effects.

Under Alternative B, the changes to the wildlife habitat types would be as follows: over 25 acres of cattail islands would be removed, approximately 4 additional acres of riparian forested/scrub shrub habitat would be created, and 10 additional acres of wet/moist grassland and meadows would also be created. The acreage of the mesquite bosque and tall sedges and rushes would not likely change under this alternative. Over 12 additional acres of open water areas would be created under this alternative, partially as a response to removing the cattail islands.

In the short-term, Alternative B would create a larger acreage of diverse wildlife habitat than currently exists. The increase in riparian forested scrub/shrub habitat would support species of concern dependent on those habitats, including the endangered southwestern willow flycatcher, candidate yellow-billed cuckoo, great egret, snowy egret, common blackhawk, belted kingfisher, olive-sided flycatcher, Western red bat, and Yuma myotis. Habitat for the candidate northern Mexican gartersnake would also be enhanced under this alternative as they require large-river riparian woodlands and forests, streamside gallery forests with well-developed broadleaf deciduous riparian forests with limited, if any, herbaceous ground cover or dense grass.

The additional 10 acres of wet/moist grasslands and meadows which include short sedges and rushes would provide habitat for species of concern including neonate candidate northern Mexican gartersnakes, Yuma clapper rails, ferruginous hawks, snowy egrets, white-faced ibis, loggerhead shrike, big free-tailed bat and golden columbine.

The over 12 acres of open water areas would provide habitat for candidate northern Mexican gartersnake, bald eagle, osprey, belted kingfisher, Arizona myotis, and northern river otter. Open water would also provide access to water for wildlife species of concern.

Under the Alternative B, the increases to riparian scrub/shrub, wet/moist grasslands and meadows, and open water areas would provide short-term, moderate, beneficial effects for those groups listed above. Although cattail habitat would be decreased in the marsh, there would still be close to 40 acres of cattails to support the endangered Yuma clapper rail, American bittern, least bittern, great egret, snowy egret, white-faced ibis, and northern river otter; and the project would likely have a short-term minor adverse effect on those species temporarily. By removing the mats of cattail islands, there would also be increased edge for cattail habitat, which for many of these species would be a beneficial effect.

While this alternative has the potential to create substantial amounts of diverse wildlife habitats, the longer term effects under this alternative are unknown because future water surface elevations and fluctuations are dependent on beaver activity and dams. Future increases in beaver activities/dams could increase the water levels and flood the newly planted areas, while future beaver dam failures could result in a breach of marsh waters leading to a drying of wetland areas; either change would result in effects on the newly created wildlife habitats.

Cumulative Effects: Invasive plant management, native plant restoration, and fire management activities could directly and indirectly impact marsh wildlife habitat, but would not likely rise above the negligible effect level. From the excavation activities to remove cattails, there would be short-term, negligible, adverse effects for species of concern when considered with other past, present, and reasonably foreseeable future actions, but these activities would be mitigated to fall

out of the typical breeding season for many species—March through September. Long-term effects when considered with other past, present, and reasonably foreseeable future actions are not clear due to the dependence of the marsh hydrology to beaver activities.

Conclusion: Under Alternative B, there would be short-term (mostly related to excavation activities or rain events following these activities), direct and indirect, negligible, adverse effects on species of concern. The native federally-listed fish species and Yuma clapper rail would likely be the most affected by these effects. Other species of concern are expected to have beneficial effects under this alternative due to the increases in their habitat preferences at the marsh, although the longer term effects are difficult to predict due to the dependence of marsh hydrology levels on beaver activities and dam conditions. Following mitigation to avoid excavation activities to remove cattails from March through September, there would be short-term, moderate, beneficial effects for species of concern in the increased areas of marsh habitat diversity when considered with other past, present, and reasonably foreseeable future actions. Long-term effects are less clear due to the dependence of the marsh hydrology and wildlife habitats on beaver dams and beaver activities.

3.7.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the abandoned old east-west road bisecting the marsh and would be used to adaptively manage the hydrology of the marsh north of the old road. A water conveyance structure would be constructed in the southern marsh to prevent overflow of the southern marsh waters onto the water control structures in the north marsh as well as be able to drain the north marsh. A maintenance utility road would be constructed parallel to the conveyance structure to allow for period channel cleaning. Floating islands of cattails would be removed from the northern marsh. Topography would be created along the marsh edges by removing and using fill dirt from western upland areas, following archeological clearances. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh.

Under the Preferred Alternative, the park would actively marsh hydrology with the water control structures to reach target native vegetation community percentages for the northern marsh. Floating islands of cattails would be removed from the marsh and microtopography would be created along the marsh edges by using fill dirt from western upland areas, following archeological clearances, and excavated soils from the water conveyance channel to create areas of transitional marsh vegetation above the existing water levels of the marsh. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities. A water conveyance channel would be constructed to drain waters from the northern marsh and prevent the southern marsh waters from overtopping the water control structures.

Earth-moving and temporary marsh draining activities under this alternative would be limited to outside of the March-September breeding season—activities generating substantial noise would be limited to the October-February time period. Activities related to removing cattail islands and creating topography along the northern marsh areas could result in increased sediment loads and

affect water quality downstream. These sediment loads would likely occur during construction, and after the first several major rain storms, resulting in a short-term effect. Because the marsh is located below two canyon areas that also funnel debris into the marsh, the sediment loads related to the marsh restoration activities under this alternative are not expected to change the water quality levels outside of the range of variability. Native fish species furthermore are adapted to a range of natural sediment loads within their aquatic habitats (they are typically impacted greater from loss of water resources). Thus, under this preferred alternative, the downstream impacts to fish species of concern; including the endangered razorback sucker and its critical habitat, threatened loach minnow with critical habitat, threatened spikedace with designated critical habitat, endangered Colorado pikeminnow, the candidate species roundtail chub, Sonora sucker, desert sucker, longfin dace, roundtail chub, and speckled dace; would be a short-term, negligible, indirect (due to sediment load), adverse effects.

Under the Preferred Alternative, the changes to the wildlife habitat types would be as follows: over 30 acres of cattail islands would be removed, approximately 5 additional acres of riparian forested/scrub shrub habitat would be created, an additional 20 acres of wet/moist grassland and meadows would also be created, and around 6 additional acres of tall sedges and rushes would be created. The acreage of the mesquite bosque would not likely change under this alternative. Around 3 acres of open water areas would be created under this alternative, partially as a response to removing the cattail islands.

The Preferred Alternative would create for the longer term a larger acreage of diverse wildlife habitat than currently exists. The increase in riparian forested scrub/shrub habitat would support species of concern dependent on those habitats, including the endangered southwestern willow flycatcher, candidate yellow-billed cuckoo, great egret, snowy egret, common blackhawk, belted kingfisher, olive-sided flycatcher, Western red bat, and Yuma myotis. Habitat for the candidate northern Mexican gartersnake would also be enhanced under this alternative as they require large-river riparian woodlands and forests, streamside gallery forests with well-developed broadleaf deciduous riparian forests with limited, if any, herbaceous ground cover or dense grass.

The additional 20 acres of wet/moist grasslands and meadows which include short sedges and rushes would provide habitat for species of concern including neonate candidate northern Mexican gartersnakes, Yuma clapper rails, ferruginous hawks, snowy egrets, white-faced ibis, loggerhead shrike, big free-tailed bat, and Golden columbine. The 6 additional acres of tall sedges and bulrushes would provide habitat for the candidate northern Mexican gartersnake, American bittern, least bittern, great egret, snowy egret, and white-faced ibis. The over 3 additional acres of open water areas would provide habitat for candidate northern Mexican gartersnake, bald eagle, osprey, belted kingfisher, Arizona myotis, and northern river otter. Open water would also provide access to water for wildlife species of concern.

Under the Preferred Alternative, the increases to riparian scrub/shrub, wet/moist grasslands and meadows, and open water areas would provide long-term, moderate, beneficial effects for those groups of wildlife listed above. Although cattail habitat would be decreased in the marsh, there would still be close to 32 acres of cattails to support the endangered Yuma clapper rail, American bittern, least bittern, great egret, snowy egret, white-faced ibis, and northern river otter; and the project would likely have a short-term minor adverse effect on those species temporarily. By

removing the floating mats of cattail islands, there would also be increased edge for cattail habitat, which for many of these species would be a beneficial effect.

The Preferred Alternative would create substantial amounts of diverse wildlife habitats for the longer term because the monument would have control over the water levels in the northern part of the marsh where most of the vegetation changes would take place (see Figure 10). Flooding and drying of the vegetation communities would occur adaptively on a seasonal basis to ensure the perpetuity of the optimal acreages for the various marsh wildlife habitats.

Cumulative Effects: Invasive plant management, native plant restoration, and fire management activities could directly and indirectly impact marsh wildlife habitat, but would not likely rise above the negligible effect level. From the excavation activities to remove cattails, there would be short-term, moderate, adverse effects for species of concern when considered with other past, present, and reasonably foreseeable future actions. These activities would be mitigated to fall out of the typical breeding season for many species—March through September.

Conclusion: Under the Preferred Alternative, the short-term effects related to excavation activities or rain events following these activities, would be direct and indirect, negligible, adverse effects on species of concern. The federally-listed and species of concern native fish species, and the bird species dependent on cattail habitat (the candidate Yuma clapper rail, American bittern, least bittern, great egret, snowy egret, and white-faced ibis) would likely be the most affected by the reduction in cattail habitat and associated hydric conditions. Because marsh water levels would be controlled through adaptive management, long-term effects are expected to be moderate, beneficial effects under this alternative due to the increases in wildlife habitat diversity supporting the majority of species of concern at the marsh. Following mitigation to avoid heavy equipment activities from March through September, there would be short-term, negligible, adverse effects for species of concern, but would likely be outweighed in the long-term by moderate, beneficial effects when considered with other past, present, and reasonably foreseeable future actions.

3.8 Archeological Resources

3.8.1 Affected Environment and Intensity Level Definitions

Tuzigoot National Monument was established by President Franklin D. Roosevelt on July 25, 1939, via Presidential Proclamation No. 2344. Established to preserve “historic and prehistoric structures and other objects of historic or scientific interest,” Tuzigoot Pueblo is the principal prehistoric structure within the national monument and the type site for the Tuzigoot Phase (A.D. 1300-1400) of the Southern Sinagua archeological culture.

Identified archeological sites surrounding the project area include several structures representing the Honanki and Tuzigoot Phases (A.D. 1125-1400). Although these sites exist on the hillsides above Tavasci Marsh, none are within the project area. Similarly, a small number of isolated prehistoric artifacts have been located immediately outside the project area. The lack of surface archeological sites and artifacts within the immediate project area may result from a pure absence of these resources or from geologic processes such as erosion and deposition as well as extreme disturbance caused by historic cultivation and land management.

Negligible Impact is at the lowest levels of detection with neither adverse nor beneficial consequences. For purposes of Section 106, the determination of effect would be no adverse effect.

Minor **Adverse:** Disturbance of the site(s) results in little, if any, loss of integrity. For purposes of Section 106, the determination of effect would be *no adverse effect*. Impacts would be slight and noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor relationship between resource and associated group's body of beliefs and practices.

Beneficial: Maintenance and preservation of a site(s). For purposes of Section 106, the determination of effect would be *no adverse effect*. Impacts allow access to and/or accommodate a group's traditional practices or beliefs

Moderate **Adverse:** Disturbance of the site(s) results in loss of integrity and the detection of depletion or displacement of artifacts (based on baseline information) and effects to elements having research potential or increased instability of site landscape. For purposes of Section 106, the determination of effect would be *adverse effect*. A memorandum of agreement is executed among National Park Service and applicable state or tribal historic preservation officer and, if necessary, the Advisory Council on Historic Preservation in accordance with 36 CFR 800.6(b). Measures are identified in the MOA to minimize or mitigate adverse impacts.

Beneficial: Stabilization of a site(s). For purposes of Section 106, the determination of effect would be *no adverse effect*.

Major **Adverse:** Disturbance of a site(s) results in loss of overall integrity and changes to character-defining, cultural or structural elements to the extent that the property would no longer be eligible for inclusion in the National Register. For purposes of Section 106, the determination of effect would be *adverse effect*. Measures to minimize or mitigate adverse impacts cannot be agreed upon and the National Park Service and applicable state or tribal historic preservation officer and/or the Advisory Council are unable to negotiate or execute a memorandum of agreement in accordance with 36 CFR 800.6(b).

Beneficial: Active intervention is undertaken to preserve the site. For purposes of Section 106, the determination of effect would be *no adverse effect*.

Duration Short-term— any effect from treatments of archeological resources would be considered long-term (see below).
Long-term— because archeological resources are non-renewable, any effects on archeological resources would be long-term.

Context Within Tavasci Marsh

3.8.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing routine invasive plant management and native plant restoration programs to enhance the wildlife habitat at Tavasci Marsh. Archeological resources would be affected negligibly, as invasive plant and native restoration activities could disturb previously unidentified surface archeological sites and isolated artifacts. No archeological sites have been documented within the marsh proper. Additionally, the park Archeologist would monitor all activities to ensure plant management and restoration activities would not impact surface sites. As no excavation would occur under this No-action alternative, no subsurface archeological resources would be affected.

Cumulative Effects: With the rehabilitation of the trail accessing the marsh from the Marsh Overlook Trail, more visitors may enter into the marsh area. Invasive plant management, native plant restoration, and fire management activities would continue and directly impact resource management staff. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying, Integrated Pest Management Plan EA implementation, and upgrading the Tuzigoot bathrooms would continue and possibly increase maintenance staff presence at Tuzigoot. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this No-action alternative to archeological resources in Tavasci Marsh would be negligible.

Conclusion: The No-action alternative would result in negligible effects for archeological sites. The No-action alternative includes archeological monitoring as well as avoidance of surface sites. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this No-action alternative to archeological resources in Tavasci Marsh would be negligible effects.

3.8.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant management and native plant restoration. Some cattail habitat would be removed mechanically, chemically, and with fire from the marsh. Within the first phase of the project (expected to take two years), floating islands of cattails would be removed from the marsh.

Topography would be created along the marsh edges by using fill dirt from the “Kochia plot” (a western upland area, see Figure 9) to create topography along the marsh edges and areas of transitional marsh vegetation above the existing water levels of the marsh. Approximately 18,500 cubic yards of material would be removed from the “Kochia plot” for fill following archeological clearances, but would be supplemented with outside, weed-free fill if necessary.

The “Kochia plot” would be surveyed by park archeology staff to locate surface archeological sites and artifacts. Previous surveys have failed to locate surface sites, although a small number of isolated prehistoric artifacts are present. Subsurface archeological testing would occur prior to any ground disturbance in these areas. Subsurface testing would locate buried archeological sites and artifact deposits, if present. Decisions regarding appropriate mitigation strategies employing the

recordation and avoidance of subsurface archeological sites would be made. If archeological resources were discovered at the "Kochia plot," outside fill dirt would be brought in for use in the construction of berms and the utility road.

Additionally, extreme disturbance caused by natural and cultural processes has likely destroyed any site integrity within the marsh. Excavation and removal of floating islands of cattails could have an effect on subsurface archeological resources. These archeological resources, if present, were impacted by geologic processes such as erosion, deposition and flooding as well as extreme historic disturbance caused by cultivation and past land management. It is likely that these resources have been covered or destroyed by past processes or disturbances.

Cumulative Effects: With the rehabilitation of the marsh access trail from the Marsh Overlook Trail, more visitors may enter into the marsh area. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under Alternative B would be long-term, minor effects to any archeological resources present.

Conclusion: Actions under Alternative B could result in a long-term, minor, adverse effect for archeological resources. Subsurface testing in upland areas would occur in areas of proposed ground disturbance. If archeological sites or deposits are located, ground disturbance would cease and further impact to the site would be avoided. Additionally, extreme disturbance caused by natural and cultural processes has likely destroyed site integrity within the marsh proper. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under Alternative B to archeological resources for Tuzigoot National Monument would be long-term, minor effects.

3.8.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the old road and would be used to adaptively manage the hydrologic levels of the marsh north of the old road. A boardwalk and a viewing platform would be built on newly-created berms near the new water control structures, likely tied to the existing historic roadbed (currently flooded). The berms and water control structures would also provide a route for vehicles or foot traffic across the marsh to facilitate maintenance and access between Tuzigoot National Monument and neighboring Dead Horse State Park creating a loop trail system within Tavasci Marsh (see Figure 8). A water conveyance channel would be constructed on the western edge of the southern marsh's wetland to drain waters from the northern marsh; this will prevent the southern marsh waters from overtopping the water control structures. A hardened utility road will be created in the upland area directly west of the water conveyance channel to allow access to the channel for maintenance.

Topography would be created along the marsh edges by using fill dirt from the "Kochia plot" (a western upland area, see Figure 9) following archeological clearances to create topography along the marsh edges and areas of transitional marsh vegetation above the existing water levels of the marsh. Approximately 18,500 cubic yards of material would be removed from the "Kochia plot" for fill, but would be supplemented with outside, weed-free fill if necessary.

The "Kochia plot" would be surveyed by park archeology staff to locate surface archeological sites and artifacts. Previous surveys have failed to locate surface sites, although a small number of isolated prehistoric artifacts are present. Subsurface archeological testing would occur prior to any ground disturbance in these areas. Subsurface testing would locate buried archeological sites and artifact deposits, if present. Decisions regarding appropriate mitigation strategies employing the recordation and avoidance of subsurface archeological sites would be made. If archeological resources were discovered at the "Kochia plot," outside fill dirt would be brought in for the construction of berms and a utility road.

Additionally, extreme disturbance caused by natural and cultural processes has likely destroyed any site integrity within the marsh. Excavation and removal of floating islands of cattails could have an effect on subsurface archeological resources. These archeological resources, if present, were impacted by geologic processes such as erosion, deposition and flooding as well as extreme historic disturbance caused by cultivation and past land management.

Similarly, any archeological resources that may be located in the path of the proposed water conveyance channel would have likely been heavily impacted by geologic processes as well as disturbance caused by historic cultivation and land management processes. Discovering previously unidentified archeological sites in this area is unlikely. If possible (due to the ground water levels), the park Archeologist will monitor ground disturbance associated with the construction of the conveyance channel. In the unlikely event that a site is identified, all work will cease and a mitigation procedure that includes recordation and avoidance will follow.

A utility vehicle trail/road would be located immediately above (west of) the conveyance channel. Where the utility vehicle trail/road is located directly above the existing trail, the trail would also be widened. The roadway would be hardened with mineral soil extracted from excavation of the channel. No subsurface disturbance would occur within the proposed alignment of the roadway.

Cumulative Effects: With the rehabilitation of the marsh access trail from the Marsh Overlook Trail, more visitors may enter into the marsh area. The larger springs located at the north end of the marsh would not be accessible to visitors. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under the Preferred Alternative to archeological resources for Tuzigoot National Monument would be long-term, minor effects to any archeological resources present.

Conclusion: Actions under Preferred Alternative could result in a long-term, minor, adverse effect for archeological resources. Subsurface testing in the upland areas would occur in areas of proposed ground disturbance. If archeological sites or deposits are located, ground disturbance would cease and further impact to the site would be avoided. Additionally, extreme disturbance caused by natural and cultural processes has likely destroyed any site integrity within the marsh. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under the Preferred Alternative to archeological resources for Tuzigoot National Monument would be long-term, minor effects.

3.9 Ethnographic Resources

3.9.1 Affected Environment and Intensity Level Definitions

"Ethnographic Resources" are described by 2006 NPS Management Policies as cultural and natural features of a park that are of traditional significance to traditionally associated peoples who differ from other park visitors in that traditionally associated peoples have these places closely linked with their own sense of purpose, existence as a community, and development as ethnically distinctive peoples.

Tavasci Marsh is considered an ethnographic resource by at least three associated tribes (S. Kim, Tuzigoot Chief of Natural Resources, pers. observ.). In particular, the cattail species are used to support ceremonial activities as well as serving as native food sources. Additionally, the large marsh area is unique along the Verde River and can provide a source for wetland-associated plants traditionally used by associated tribes.

Negligible Impacts at lowest levels of detection; barely perceptible and alter neither resource condition, such as traditional access, nor relationship between resource and associated group's body of practices and beliefs

Minor **Adverse:** Impacts would be slight and noticeable and would neither appreciably alter resource conditions, such as traditional access or site preservation, nor relationship between resource and associated group's body of beliefs and practices

Beneficial: Impacts allow access to and/or accommodate a group's traditional practices or beliefs

Moderate **Adverse:** Impacts would be apparent and alter resource conditions or interfere with traditional access or relationship between resource and associated group's practice and beliefs, even though the group's practices and beliefs would survive

Beneficial: Impacts facilitate traditional access and/or accommodate a group's practices or beliefs

Major **Adverse:** Impacts alter resource conditions. Proposed actions would block or greatly affect traditional access or relationship between resource and associated group's body of beliefs and practices, to the extent that survival of a group's beliefs and/or practices jeopardized. Impacts result in significant changes or destabilization to defining elements and resource condition and an increase in exposure or vulnerability to natural elements

Beneficial: Impacts encourage traditional practices and/or accommodate a group's beliefs or practices.

Duration Short-term— recovers in less than one year
Long-term— requires more than one year to recover

Context Within park boundary

3.9.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the wildlife habitat at Tavasci Marsh. Invasive plant treatments, native seed collection and sowing, and replanting of native plants are the primary activities under this alternative. Although native plants are replanted in areas cleared of non-native plants, the plant species are primarily upland species, not marsh species. Because of the intensive annual maintenance requirement, cattails are not managed under the routine invasive plant management and native plant restoration programs.

For the No-action alternative, the impact for ethnographic resources is negligible, as the park's activities under this No-action alternative do not alter resource condition, such as traditional access, nor relationship between resource and associated group's body of practices and beliefs.

Cumulative Effects: Invasive plant management, native plant restoration, and fire management activities have negligible effects on ethnographic resources. The development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying do not affect ethnographic resources. Because this No-action alternative would continue invasive plant treatments and restoration activities, this project may have negligible effects on ethnographic resources when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: The No-action alternative would result in negligible impacts to ethnographic resources from the routine invasive plant management and restoration program, the exclusive source of wildlife habitat enhancement for the marsh. Therefore, this alternative would contribute only negligibly to any cumulative disturbance of ethnographic resources, when considered with other past, present, and reasonably foreseeable future actions.

3.9.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant/native plant restoration. Some cattail habitat would be removed from the marsh on a regular schedule mechanically, chemically, and with fire. Within the first phase of the project (expected to take two years), floating islands of cattails would be removed from the marsh. Topography would be created along the marsh edges by using fill dirt from western upland areas, following archeological clearances, to create areas of transitional marsh vegetation above the existing water levels of the marsh. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh.

Activities related to removing cattail islands and decreasing the area of cattail in the marsh could adversely affect ethnographic resources. However, under this alternative, over 39 acres of cattails are expected to continue to flourish in the marsh (see Table 3). Management activities such as burning or herbicide treatments for cattails under this alternative could affect cattails in the short-term. To mitigate tribal concerns, the park would work directly with Native American tribes interested in the cattail ethnographic resources.

Revegetation of the newly created topography would include marsh plant species ethnographically important to the associated tribes. Park biologists would work with tribal liaisons to generate a list of native marsh plant species that would be used when selecting plants for revegetation.

Under this alternative, the effects to the cattail ethnographic resource would likely initially be a minor, adverse, short-term effect (less than a year). Working with associated tribes interesting in accessing the cattails during particular times of the year could mitigate this effect to a negligible level. Working with native tribes to determine a mutually satisfactory list of native wetland species for forested riparian, wet/moist grassland, and wet/moist meadow plant communities for revegetation efforts would be a minor beneficial long-term effect (greater than a year). (NPS has begun conversations with two of the tribes and they are interested in partnering with the monument for this project.)

Cumulative Effects: Invasive plant management, native plant restoration, and fire management activities have negligible effects on ethnographic resources. The development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying do not affect ethnographic resources. This alternative would have minor adverse to negligible effects on cattail ethnographic resources, and a minor beneficial effect for other marsh plant ethnographic resources when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: Alternative B would result in both adverse, minor impacts for the short-term that could be mitigated to negligible for cattail ethnographic resources. The alternative would also result in minor beneficial long-term (greater than one year) effects for other marsh plant ethnographic resources by working closely with the tribes to plant ethnographically important species in restoration efforts. For cumulative effects, this alternative would have minor adverse to negligible effects on cattail ethnographic resources, and a minor beneficial effect for other marsh plant ethnographic resources when considered with other past, present, and reasonably foreseeable future actions.

3.9.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the abandoned old east-west road bisecting the marsh and would be used to adaptively manage the hydrology of the marsh north of the old road. A water conveyance channel would be constructed in the southern marsh to prevent overflow of the southern marsh waters onto the water control structures in the north marsh as well as be able to drain the north marsh. A parallel maintenance road/trail would be constructed for maintaining the conveyance channel free of vegetation and sediment. Floating islands of cattails would be removed from the northern marsh. Topography would be created along the marsh edges by using fill dirt removed from western upland areas, following archeological clearances. These areas of increased topography would be revegetated with native plants to create a mosaic of vegetation communities such as forested/scrub-shrub riparian, moist/wet grasslands and meadows, and tall sedges and rushes above the existing water levels of the marsh.

Activities related to removing cattail islands, decreasing the area of cattail in the marsh, and creating a water conveyance channel could adversely affect ethnographic resources. However, under this alternative, over 32 acres of cattails are expected to continue to flourish in the marsh (see Table 3). Management activities such as burning or herbicide treatments for cattails under this alternative could affect cattails in the short-term. To mitigate tribal concerns, the park would work directly with native tribes interested in the cattail ethnographic resources.

Revegetation of the newly created topography would include marsh plant species ethnographically important to associated tribes. Park biologists would work with tribal liaisons to generate a list of native marsh plant species that would be used when selecting plants for revegetation.

Under the Preferred Alternative, the effects to the cattail ethnographic resource would likely initially be a minor adverse short-term effect (less than a year). Working with associated tribes interesting in accessing the cattails during particular times of the year could mitigate this effect to a negligible level. Working with native tribes to determine a mutually satisfactory list of native wetland species for forested riparian, wet/moist grassland, and wet/moist meadow plant communities for revegetation efforts would be a minor beneficial long-term effect (greater than a year). (NPS has begun conversations with two of the tribes and they are interested in partnering with the monument for this project.)

Cumulative Effects: Invasive plant management, native plant restoration, and fire management activities have negligible effects on ethnographic resources. The development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying do not affect ethnographic resources. The Preferred Alternative would have minor adverse to negligible effects on cattail ethnographic resources, and a minor beneficial effect for other marsh plant ethnographic resources when considered with other past, present, and reasonably foreseeable future actions.

Conclusion: The Preferred Alternative would result in both adverse, minor impacts for the short-term that could be mitigated to negligible for cattail ethnographic resources. This alternative would also result in minor beneficial long-term (greater than one year) effects for other marsh plant ethnographic resources by working closely with the tribes to plant ethnographically important species in restoration efforts. For cumulative effects, the Preferred Alternative would have minor adverse to negligible effects on cattail ethnographic resources, and a minor beneficial effect for other marsh plant ethnographic resources when considered with other past, present, and reasonably foreseeable future actions.

3.10 Historic Structures

3.10.1 Affected Environment and Intensity Level Definitions

Tavasci Marsh has three historic structures in various conditions associated with the historic dairy and cattle operations from the 1920's to 1990's: a stone impoundment around a spring, ditches channeling marsh waters, and an old roadbed. One of the larger springs is surrounded by a small historic stone impoundment, ponding the spring. This stone impoundment is in good condition and continues to pond water. Various ditches run through the marsh, but are primarily overgrown with cattails (see Figure 3 for locations) and most are difficult to find or have been destroyed by flooding.

Figure 16. Location of abandoned historic road that connected the two sides of the marsh, currently covered by cattails and other vegetation. Right photo was taken where road should go through marsh (where arrow is in left photo).

The old historic road originally connected the road from Tuzigoot Bridge into Dead Horse Ranch State Park (see Figure 3). This road had been maintained by Arizona State Park rangers on a daily basis to access Dead Horse Ranch State Park. In 1993, the state park staff stopped maintaining the road through Tavasci Marsh to access Dead Horse Ranch State Park. Instead, access to the state park was now ensured at another location (outside of the marsh) through a newly-constructed bridge (S. M. Castillo, Arizona State Parks, pers. comm.). Once the road was no longer maintained by state park staff, the road culverts soon became clogged with debris (these culverts had been maintained on a daily basis) (S. M. Castillo, Arizona State Parks, pers. comm.). Beavers then began using the roadway as an anchor for their dams, raising marsh water levels. The road is currently flooded, completely covered with cattails (Figure 16), and not visible.

Of the three structures mentioned, the stone impoundment of the spring is likely the only structure eligible for the National Register of Historic Places due to its historic integrity. The historic ditches and the historic roadbed have extensive cattail overgrowth, sediment accumulation, and erosion caused by flooding.

Negligible Any effects would be below or at the lower levels of detection. Any detectable effects would be slight.

Minor **Adverse:** The impact is measurable and perceptible, but is slight and affects a limited area of a structure or group of structures. The impact does not affect the character defining features of a National Register of Historic Places eligible or listed structure and would not have a permanent effect on the integrity of the structure.

Beneficial: Stabilization/preservation of features is in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (1992).

Moderate **Adverse:** The effects would be detectable and readily apparent. The impact changes one or more character defining feature(s) of a historic structure, but does not diminish the integrity of the resource to the extent that its National Register eligibility is jeopardized. The effect could be site-specific or monument-wide.

Beneficial: Rehabilitation of a structure is in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (1992).

Major **Adverse:** The impact is substantial, noticeable and permanent. For National Register eligible or listed historic structures, the impact changes one or more character defining features(s) of the historic resource, diminishing the integrity of the resource to the extent that it is no longer eligible for listing on the National Register.

Beneficial: The impact is of exceptional benefit and the restoration of a structure is in accordance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (1992).

Duration Short-term— Any effect from treatments of historic resources would be considered long-term (see below).
Long-term— Because most historic resources are non-renewable, any effects on historic resources would be long-term.

Context Within Tavasci Marsh

3.10.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the wildlife habitat at Tavasci Marsh. No historic properties would be affected by this No-action alternative as there would be no actions affecting the spring impoundments, the ditches, or the road bed.

Cumulative Effects: With the rehabilitation of the trail accessing the marsh from the Marsh Overlook Trail, more visitors may enter into the marsh area. Invasive plant management, native plant restoration, and fire management activities would continue and directly impact resource management staff. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying, Integrated Pest Management Plan EA implementation, and upgrading the Tuzigoot bathrooms would continue and possibly increase maintenance staff presence at Tuzigoot. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this No-action alternative to historic properties in Tavasci Marsh would be no effects.

Conclusion: The No-action alternative would result in no effects for historic properties as no actions involve historic marsh properties. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this No-action alternative to historic properties in Tavasci Marsh would be no effects.

3.10.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant/native plant restoration. Some cattail habitat would be removed

from the marsh on a regular schedule mechanically, chemically, and with fire. Within the first phase of the project (expected to take two years), floating islands of cattails would be removed from the marsh. Topography would be created along the marsh edges by using fill dirt from western upland areas, following archeological clearances, to create areas of transitional marsh vegetation above the existing water levels of the marsh.

Removal of floating islands of cattails could have an effect on the historic ditches, as many of the ditches would be difficult to avoid during ground-disturbing activities. However, these historic ditches have been impacted by flooding, are currently filled with cattails and sediment, and likely lack historic integrity. Because of the extremely poor condition of these ditches unmaintained for twenty years, overgrown with cattails, and loaded with sediments, the effect on the historic ditches is expected to be long-term negligible.

Neither the spring impoundment nor the roadbed would be affected by this alternative.

Cumulative Effects: With the rehabilitation of the marsh access trail from the Marsh Overlook Trail, more visitors may enter into the marsh area. The larger springs in the marsh would not be accessible to the public to protect their integrity. Restricted access would also protect the historic spring impoundment. Much of the historic building projects such as the Tuzigoot Museum renovation, Integrated Pest Management Plan EA implementation, and upgrading the Tuzigoot bathrooms would be beneficial for historic buildings in the park boundary. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under Alternative B to historic structures for Tuzigoot National Monument would be long-term, negligible effects.

Conclusion: Actions under Alternative B would likely result in a long-term, negligible, adverse effect for historic structures due to the likelihood of intersecting with a historic ditch during cattail island removal activities. Because the cattails have grown into the ditches following sedimentation and flooding, the historic integrity of the ditches is in question. The other historic structures of the spring impoundment and the road bed would not be affected under this alternative. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under Alternative B to historic structures for Tuzigoot National Monument would be long-term, negligible effects.

3.10.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the old road and would be used to adaptively manage the hydrologic levels of the marsh north of the old road. A boardwalk and a viewing platform would be built on newly-created berms near the new water control structures, likely tied to the existing historic roadbed (currently flooded). The berms and water control structures would also provide a route for vehicles or foot traffic across the marsh to facilitate maintenance and access between Tuzigoot National Monument and neighboring Dead Horse State Park creating a loop trail system within Tavasci Marsh (see Figure 8). A water conveyance channel would be constructed to drain waters from the northern marsh and prevent the southern marsh waters from overtopping the water control structures.

Under the Preferred Alternative, floating islands of cattails would be removed from the marsh and a water conveyance channel would be excavated. Removal of floating islands of cattails and excavation of the water conveyance channel could have an effect on the historic ditches, as many of the ditches would be difficult to avoid during ground-disturbing activities. However, these historic ditches are currently filled with cattails and sediment, impacted by flooding, and likely lack historic integrity. Because of the extremely poor condition of these ditches unmaintained for twenty years, overgrown with cattails, and loaded with sedimentation, the effect on the historic ditches is expected to be long-term negligible.

Similarly, the historic roadbed is no longer visible, has been flooded by beaver activity, is filled with sediment, and is overgrown with cattails. Although the water control structures would be tying into the historic roadbed area, they are expected to do negligible damage due to the existing eroding of the road surface from the cattail roots and level of sedimentation within a marsh system. Because of this lack of historic integrity, impacts from constructing water control structures, berms, boardwalk, and viewing platform on the existing historic roadbed location are expected to be long-term, negligible.

Cumulative Effects: With the rehabilitation of the marsh access trail from the Marsh Overlook Trail, more visitors may enter into the marsh area. The larger springs in the marsh would not be accessible to the public to protect their integrity, and would also protect the historic spring impoundment. Much of the historic building projects such as the Tuzigoot Museum renovation, Integrated Pest Management Plan EA implementation, and upgrading the Tuzigoot bathrooms would be beneficial for the historic buildings. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under Preferred Alternative to historic structures for Tuzigoot National Monument would be long-term, negligible effects.

Conclusion: Actions under the Preferred Alternative would likely result in a long-term, negligible effect for historic structures due to the likelihood of intersecting with historic ditches during cattail island removal and water conveyance channel excavation activities; and with the construction of water control structures, berms, boardwalks, and a viewing platform on the location of a historic road. Because the cattails have grown into the ditches and road following repeated sedimentation and flooding, the ditches and road have lost their historic integrity. The other historic structure of the spring impoundment, which is in good condition and likely eligible for the National Register of Historic Places, would not be affected under this alternative. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under Preferred Alternative to historic structures for Tuzigoot National Monument would be long-term, negligible effects.

3.11 Public Health and Safety

3.11.1 Affected Environment and Intensity Level Definitions

In 2008 and 2010, West Nile Virus was documented for mosquitoes in the Tavasci Marsh/Peck's Lake area by Yavapai County Community Health Services. West Nile Virus, known to be transmitted to people and animals through bites from infected mosquitoes, is a potentially lethal disease which can range from mild symptoms such as fever and aches, to severe symptoms affecting the entire central nervous system such as meningitis and encephalitis, and to death. In 2010, Arizona led the nation with the highest number of human deaths (ten fatalities) caused by

West Nile Virus, increasing the level of public concern for the disease (Center for Disease Control Website, posted Dec. 7, 2010).

People over 50 are known to be at higher risk to West Nile Virus, a serious concern in local communities with higher retiree numbers such as the Verde Valley where Tuzigoot National Monument is located. Furthermore, Tavasci Marsh is adjacent to Dead Horse Ranch State Park, which adjoins a series of community parks including a playground, dog park, skateboard park, and six softball fields. During the mosquito season from April through November with the high daytime temperatures, many locals use the community parks in the cool of the evening when the mosquitoes are the most active.

Mosquito breeding habitat is found in stagnant waters, and emergent marsh vegetation such as cattails and bulrush as well as cattail roots (Walton et al. 1990). Mosquito breeding habitat is not found in open waters (Yadav 2009; Center for Disease Control and Prevention 2003). Thus Tavasci Marsh, with its current hydrologic regime, is excellent habitat for breeding mosquitoes.

In 2006, NPS began an Integrated Pest Management approach to managing the mosquitoes by placing "Mosquito Magnets" that emit carbon dioxide and octenol on the edges of the marsh to capture escaping mosquitoes. Only female mosquitoes (the only mosquitoes looking for blood meals) are caught and since the inception of the program, an annual average of over 739,000 mosquitoes have been caught. Since August 2006, since the park began its female mosquito capture program, an estimated over 3.2 million mosquitoes have been captured (Dennis Casper, Park Biologist, pers. comm.) from eight Mosquito Magnets traps located strategically at the edges of the marsh. It is unknown how what percentage of those mosquitoes were West Nile Virus-positive.

Because the mosquitoes are known to be potential West Nile Virus vectors at Tavasci Marsh, this analysis would focus changes to mosquito habitat in the marsh as an index of how public health and safety would be affected.

Negligible A change in public health and safety not measurable or perceptible

Minor A change in public health and safety readily apparent with few measurable consequences

Moderate A change to public health and safety readily apparent with measurable consequences

Major A severely adverse or exceptionally beneficial change to public health and safety

Duration Short-term— occurs in less than three years
Long-term— occurs over more than three years

Context Within park boundary and surrounding community

3.11.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the wildlife habitat at Tavasci Marsh. Under this alternative, NPS would continue to control mosquitoes as they have since NPS acquisition in December 2005. The park has controlled mosquitoes through Integrated Pest Management techniques using "Mosquito Magnets" with carbon dioxide and octenol attractants. These were determined at the Washington, regional, and local level to be the best control method. The magnets attract female mosquitoes and provide a repository area where the mosquitoes are dispatched. At Tavasci Marsh, park staff have positioned the Mosquito Magnet traps to target female mosquitoes leaving the marsh in search of blood meals to produce eggs. Under the No-action alternative, there would be a negligible effect on public health and safety, primarily due to the existing mosquito control methods.

Cumulative Effects: With the rehabilitation of the trail entering the marsh, more visitors may enter into the marsh area. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this alternative to public health and safety in Tuzigoot National Monument may be negligible adverse effects as a higher number of people may enter into the marsh with mosquito breeding habitat.

Conclusion: The No-action alternative would likely result in a long-term, negligible, adverse effect for public health and safety because the hydrologic marsh conditions favor mosquito breeding habitat and an increase for mosquito breeding habitat would be expected as the cattails continue to proliferate and extend into the current open water areas. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects would likely result in long-term, negligible adverse effects as visitation is expected to increase in the marsh area.

3.11.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant/native plant restoration. Some cattail habitat would be removed from the marsh on a regular schedule mechanically, chemically, and with fire.

Within the first phase of the project (expected to take two years), floating islands of cattails would be removed from the marsh. Open water areas, unsuitable areas for mosquito breeding, would also be created in areas where some cattail islands floated, increasing from around 2 acres to over 14 acres in the marsh. However, an additional 20 acres of wet/moist grassland and meadows would be created which is less suitable habitat for mosquito breeding compared to cattails. Thus, in the short-term (less than three years), there would be a moderate beneficial effect. However, the long-term effects of cattail removal and management would be less certain due to the dependence of this alternative on beaver activity and beaver dams controlling the water levels in the marsh.

Cumulative Effects: With the rehabilitation of the trail entering the marsh, more visitors may enter into the marsh area. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this alternative to public health and safety in Tuzigoot National Monument may be moderate beneficial effects as a higher number of people would enter the marsh with a decreased level of mosquito breeding habitat, which should eventually lead to a decreased number of mosquitoes.

Conclusion: Actions under Alternative B would likely result in a short-term, moderate, beneficial effect for public health and safety because 12 acres of prime mosquito breeding habitat would be removed from the marsh and converted into open water areas, not ideal for mosquito breeding (Yadav 2009). Cumulative effects would likely result in short-term (less than three years), moderate beneficial effects as visitation is expected to increase in the marsh area. Overall, there would be a short-term moderate beneficial effect for public health and safety, especially considering cumulative effects. Long-term effects under this alternative are less clear due to the dependence of this alternative on beaver activity and dams, out of the control of NPS.

3.11.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the abandoned old east-west road bisecting the marsh and would be used to adaptively manage the hydrologic levels of the marsh north of the old road. As part of this alternative, floating islands of cattails would be removed from the marsh. Open water would only increase by 3 acres under this alternative, although 34 acres of cattails would be removed. However, an additional 20 acres of wet/moist grassland and meadows would be created which is less suitable habitat for mosquito breeding compared to cattails. These areas would be maintained through periodic flooding and drying through the use of the newly-constructed water control structures. The overall enhancement of habitat conditions should also result in an increase in diversity and numbers of mosquito predator species within the marsh, thus reducing the mosquito population numbers below current levels.

Cumulative Effects: With the rehabilitation of the trail entering the marsh, more visitors may enter into the marsh area. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under the Preferred Alternative to public health and safety in Tuzigoot National Monument may be moderate beneficial effects as a higher number of people would enter the marsh with a decreased level of mosquito breeding habitat, which should eventually lead to a decreased number of mosquitoes.

Conclusion: The Preferred Alternative would likely result in a short- and long-term, moderate, beneficial effect for public health and safety because this alternative focuses on decreasing the cattail vegetation type, which favor mosquito breeding habitat, and control of the hydrology of the northern area of the marsh would allow park staff to maintain close to the target acreage for the vegetation communities. Ultimately, the mosquito population in the marsh would likely be lowered with the decrease in breeding areas and with the increase in prey species. Cumulative effects would likely result in long-term (greater than three years), moderate beneficial effects as visitation is expected to increase in the marsh area. Overall, there would be a short- and long-term moderate beneficial effect for public health and safety, especially considering cumulative effects.

3.12 Visitor Use and Experience

3.12.1 Affected Environment and Intensity Level Definitions

In 2009, Tuzigoot National Monument received 106,490 visitors. It is unclear how many of these visitors recreated in the marsh, as the primary visitor destination for the monument has been the Tuzigoot Museum and Pueblo site (see Figure 2). Because Tavasci Marsh was not acquired until December 2005, many visitors are not familiar with the marsh as part of the monument. Furthermore, the utility road/trail leading down to the marsh from the overlook trail (the primary

access route to the marsh for visitors viewing the Tuzigoot Museum and Pueblo) until spring 2011 was fairly eroded, requiring visitors to be sure-footed to access the marsh.

There are two observation decks for Tavasci Marsh, one of which is within the marsh proper along the eastern side and the other is the western observation deck located along the Tuzigoot Museum/Visitor Center ridge above the marsh (see Figure 8). The eastern observation deck is located in the marsh at the northern end of the eastern marsh trail that extends from Dead Horse State Park (see Figure 8). The western observation deck is at the north end of the Marsh Overlook Trail.

Within Tavasci Marsh, the current visitor use and experience is by default restricted toward the outer marsh edges along trails. The historic road is no longer passable (see Figure 16), and the east and west sides of the marsh are connected through a foot bridge (see Figure 8), or by following the Verde River (see Figure 2). The trails can be occasionally become water-logged, soggy, and muddy during the rains.

In order to connect the Verde River Greenway State Park Lands and Dead Horse Ranch State Park, the marsh is open to horses on a designated trail along the Verde River in the southern portion of the marsh. Horseback riders are not allowed currently on the bridge due to safety concerns. Bicycles are not currently legally allowed in the marsh as bicycling is considered a new park use.

Negligible Visitors would not likely be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources.

Minor Visitors would likely be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources; however the changes in visitor use and experience would be slight and likely short term.

Moderate Visitors would be aware of the effects associated with changes proposed for visitor use and enjoyment of park resources. Changes in visitor use and experience would be readily apparent and likely long term.

Major Visitors would be highly aware of the effects associated with changes proposed for visitor use and enjoyment of park resources. Changes in visitor use and experience would be readily apparent and long term. The change in visitor use and experience proposed in the alternative would preclude future generations of some visitors from enjoying park resources and values.

Duration Short-term— occurs during project activities and within one year of these activities
Long-term— occurs during project activities and after one year of these activities

Context Within park boundary

3.12.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the

wildlife habitat at Tavasci Marsh. Recreation for the marsh would occur primarily on the edges along the existing, surrounding trails. Trails would continue to be maintained in their current condition and would not be upgraded. While horseback riding is allowed in the marsh, bicycling which is considered a new park use would not be allowed, and rule-making procedures would not be initiated for bicycle use.

Visitor use of the trails would be to walk into and out of the marsh by the same trails, unless the marsh trails were used to access the state park lands. Visitors would also continue to deal with muddy trails during the rains. Under the No-action alternative, there would be a negligible long-term effect on visitor use and experience as existing conditions would continue.

Cumulative Effects: With the rehabilitation of the trail accessing the marsh from the Marsh Overlook Trail, more visitors may enter into the marsh area. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this No-action alternative to visitor use and experience for Tuzigoot National Monument would be negligible effects.

Conclusion: The No-action alternative would likely result in a long-term, negligible effect for visitor use and enjoyment because the marsh trails would remain on the exterior of the marsh and would continue to be muddy during rainy periods. Visitors would be limited to walking in and out on the same trails, without a trail loop system. Cumulative effects under this No-action alternative to visitor use and experience for Tuzigoot National Monument would be negligible effects when considered with other past, present, and reasonably foreseeable future actions.

3.12.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant/native plant restoration. Recreation for the marsh would occur throughout the edges along the existing**,** surrounding trails. Trails known to be periodically flooded would be rerouted onto drier ground. Trails would be hardened and delineated to prevent social trails. The footbridge, located in the southern part of the marsh connecting the eastern and western trails (see Figure 8), would be upgraded to be able to support UTV travel (UTV-use would only be for administrative purposes).

Visitor use of the trails would be to walk into and out of the marsh by the same trails, unless the marsh trails were used to access the state park lands. Visitors would be able to access hardened trails during the rains. Under the Alternative B, there would be a minor, long-term, beneficial effect on visitor use and experience as trails would be in relatively good condition in various weather.

Bicycle use in the marsh would be allowed on a designated trail for the southern part of the marsh to allow connection between Dead Horse Ranch State Park on the east side of the monument and Verde River Greenway State Natural Area on the west side of the monument. This trail would be clearly signed and extend from the gate on the east side located at the base of the Tuzigoot Ridge (adjoining the Verde River Greenway) to the upgraded footbridge, and extend south to connect with Dead Horse Ranch State Park. Allowing bikes on the designated trail in the monument would

be considered a new use within the park unit and would require special promulgation through rulemaking.

Cumulative Effects: With the rehabilitation of the trail accessing the marsh from the Marsh Overlook Trail, more visitors may enter into the marsh area. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this No-action alternative to visitor use and experience for Tuzigoot National Monument would be minor effects.

Conclusion: Actions under Alternative B would likely result in a long-term, minor, beneficial effect for visitor use and enjoyment because the marsh trails would be rerouted or hardened to be readily accessible following rains. Visitors would be limited to walking in and out on the same trails, without a trail loop system. Allowing bikes through a rulemaking process would occur to allow bike use on a designated trail connecting the two state parklands in the southern part of the marsh. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this No-action alternative to visitor use and experience for Tuzigoot National Monument would be long-term minor, beneficial effects.

3.12.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the abandoned old east-west road bisecting the marsh and would be used to adaptively manage the hydrologic levels of the marsh north of the old road. Recreation for the marsh would occur throughout the edges along the existing, surrounding trails, and would also extend into the marsh proper. A boardwalk and a viewing platform would be built in the marsh to allow visitors to enter into the marsh. These structures would likely be located on a berm/berms near the water control structures. The water control structures would likely be tied to the existing road bed (currently flooded).

An approximately 1915-feet water conveyance channel would be constructed in the southern marsh to drain waters from the northern marsh and prevent the southern marsh waters from overtopping the water control structures. This conveyance channel would also have a parallel trail/utility road used by heavy equipment occasionally to maintain and clear vegetation and sediment build-up from channel.

The berm and water control structures located along the old historic roadway would also provide a route for vehicles or foot traffic across the marsh to facilitate maintenance and access between Tuzigoot National Monument and neighboring Dead Horse State Park. This route would create a loop trail system within Tavasci Marsh (see Figure 12).

Trails known to be periodically flooded would be rerouted onto drier ground. Trails would be hardened and delineated to prevent proliferation of social trails. The footbridge, damaged in July 2010 and located in the southern part of the marsh connecting the eastern and western trails (see Figure 6), would be upgraded to be able to support UTV travel (UTV-use would only be for administrative purposes).

Because visitors would be able to use a loop trail system in the marsh as well as being able to access the interior of the marsh on the boardwalk, the effects of the Preferred Alternative on visitor

use and enjoyment would be a moderate, beneficial, long-term effect. Furthermore, the habitat enhancement is meant to increase the diversity and numbers of wetland plant and animal species in the marsh, visitors should have more opportunities of viewing diverse marsh wildlife than allowed by the current habitat conditions.

Bicycle use in the marsh would be allowed on a designated trail for the southern part of the marsh to allow connection between Dead Horse Ranch State Park on the east side of the monument and Verde River Greenway State Natural Area on the west side of the monument. This trail would be clearly signed and extend from the gate on the east side located at the base of the Tuzigoot Ridge (adjoining the Verde River Greenway) to the upgraded footbridge, and extend south to connect with Dead Horse Ranch State Park. Allowing bikes on the designated trail in the monument would be considered a new use within the park unit and would require special promulgation through rulemaking.

Cumulative Effects: With the rehabilitation of the trail accessing the marsh from the Marsh Overlook Trail, more visitors may enter into the marsh area. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this Preferred Alternative to visitor use and experience for Tuzigoot National Monument would be moderate beneficial effects, especially as more visitors would be able to have the opportunity to recreate in the marsh in addition to the Pueblo area as the trails would be hardened and easier to hike on.

Conclusion: Actions under Preferred Alternative even considering cumulative effects would likely result in a long-term, moderate, beneficial effect for visitor use and enjoyment because visitors could access and enjoy the interior of the marsh with enhanced habitat conditions from a new trail across the marsh and a newly constructed boardwalk. Visitors to the marsh would also be able to take a loop trail within the marsh, instead of having to enter and leave on the same trails. With the marsh trails rerouted or hardened to be readily accessible following rains, the marsh would be accessible to more visitors. Allowing bikes through a rulemaking process would occur to allow bike use on a designated trail connecting the two state parklands in the southern part of the marsh. Cumulative effects under this Preferred Alternative to visitor use and experience for Tuzigoot National Monument would be moderate beneficial effects when considered with other past, present, and reasonably foreseeable future actions, especially as more visitors would be able to have the opportunity to recreate in the marsh.

3.13 Park Operations

3.13.1 Affected Environment and Intensity Level Definitions

Park operations refer to adequacy of staffing levels and quality and effectiveness of park infrastructure in protecting and preserving vital resources and providing for effective visitor experience. Infrastructure facilities include roads providing access to and in the park, trails for visitor and employee access, visitor orientation facilities, administrative buildings, management support facilities, and utilities such as phones, sewer, water, and electric. Visitor services are included under this topic including interpretive, youth outreach, and law enforcement programs. Resource management activities are also included in this topic. There are five divisions at Montezuma Castle and Tuzigoot National Monuments: Maintenance, Visitor Services (Interpretation and Law Enforcement), Administration, Cultural Resources, and Natural Resources.

The park superintendent is ultimately responsible for the monument's operations management. In 2009, the park employed 25 full-time equivalent staff to manage operations including visitor services, resource management and preservation, planning and environmental compliance, law enforcement, facilities management and maintenance, and administrative duties.

Negligible A localized change in operations, barely perceptible or measurable. No measurable difference in operating costs from existing levels and no change in financial balance between revenue sources and operating costs. Park operations not affected or effect at or below lower levels of detection; no appreciable effect on park operations

Minor A slight and localized change in operations with few measurable consequences to existing park facilities. Slight additions or reductions in operating costs from existing levels. Slight change in current staffing arrangements or operations required to reach a balance with funding

Moderate An apparent change with measurable consequences to in-park facilities. Requires additions or reductions in operating costs from existing levels. Changes required in park operations or result in a financial imbalance between available funding and annual operating costs

Major A readily apparent change with measurable consequences in and outside the park. Substantial additions or reductions in operating costs from existing levels. Changes require new administrative structures and/or result in a significant financial imbalance between available funding and annual operating costs

Duration Short-term— occurs during project activities and within one year of these activities
Long-term— occurs during project activities and within one year of these activities

Context Within park boundary

3.13.2 Impacts of Alternative A (No-action Alternative): Enhance marsh habitat as part of the routine native plant restoration program

Under this No-action alternative, the National Park Service would primarily focus on continuing the routine invasive plant management and native plant restoration programs to enhance the wildlife habitat at Tavasci Marsh. Recreation for the marsh would occur primarily on the edges along the existing, surrounding trails. Trails would continue to be maintained in their current condition. A small footbridge in the southern part of the marsh (see Figure 4) connects the eastern and western trails, but cannot support administrative UTV travel.

Park management activities of the marsh under the No-action alternative would primarily focus on routine invasive plant management activities and native restoration. Interpretation of the marsh would be limited to occasional talks on the Marsh Overview Trail (overlooking the marsh from along the Tuzigoot ridge). Because the only overlook within the marsh is located on the eastern side of the marsh and is accessible only after a 30- to 45-minute walk, there are little opportunities for interpretive talks within the marsh. Trails are frequently muddy, further restricting access for many visitors. Access to the eastern side of the marsh is limited to the footbridge. Any

administrative use for vehicles in the marsh is limited to the western side, unless the vehicle is driven through Cottonwood and Dead Horse Ranch State Park to access the eastern side through the state park's gate.

Cumulative Effects: With the rehabilitation of the trail accessing the marsh from the Marsh Overlook Trail, more visitors may enter into the marsh area. Invasive plant management, native plant restoration, and fire management activities would continue and directly impact resource management staff. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying, Integrated Pest Management Plan EA implementation, and upgrading the Tuzigoot bathrooms would continue and possibly increase maintenance staff presence at Tuzigoot. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this No-action alternative to park operations for Tuzigoot National Monument would be negligible effects.

Conclusion: The No-action alternative would likely result in a long-term, negligible effect for park operations because the park is currently staffed for routine invasive plant treatments and restoration efforts and visitor services at the Tuzigoot Museum and Pueblo area. Although visitation may increase due to the upgrade of the access trail from the Marsh Overlook Trail, visitor services within the marsh would not be expected to increase given current staffing levels at the monument. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under this No-action alternative to park operations for Tuzigoot National Monument would be negligible effects.

3.13.3 Impacts of Alternative B: Enhance marsh habitat primarily through cattail management

Under Alternative B, the park would actively manage cattails and change marsh topography in addition to routine invasive plant/native plant restoration. Recreation for the marsh would occur throughout the edges along the existing**,** surrounding trails. Trails known to be periodically flooded would be rerouted onto drier ground. Trails would be hardened and delineated to prevent social trails. The footbridge, located in the southern part of the marsh connecting the eastern and western trails (see Figure 8), would be upgraded to be able to support UTV travel (UTV-use would only be for administrative purposes).

Actively managing cattails annually to prevent cattail encroachment would become a focus for the Natural Resource Management (NRM) staff. Because the topography favors cattails and because the beaver activity and dams are setting the water levels, the NRM staff would need to use extensive mechanical, chemical, and/or fire methods to control the cattails from expanding from their initial post-restoration areas. This would require these activities above and beyond current routine invasive plant and restoration activities, likely requiring additional NRM staff for the long-term. Some long-term monitoring would also need to occur to ensure that the vegetation communities planted for initially for habitat enhancement would be continuing to exist within the prescribed levels.

Access for UTV-use for administrative purposes on the eastern side of Tavasci Marsh would be facilitated by the upgrading of the marsh footbridge to a UTV-rated bridge. Instead of having to

trailer the UTV through Cottonwood and Dead Horse Ranch State Park, and then driving it to the eastern section of the marsh, park staff could cross the upgraded UTV-rated bridge.

Visitor services would likely continue to be on the Tuzigoot Ridge area with the Marsh Overlook Trail instead inside the marsh. Because the trails in the marsh are currently on the edges of the marsh without any viewpoint or boardwalk within 15-20 minutes walking distance, interpretive walks about the marsh are typically given from the Marsh Overlook area.

Thus, under Alternative B, while the Visitor Services staff would likely not be impacted, Natural Resource staff would be greatly impacted would likely need to expand their staffing levels to accommodate the annual cattail management for the short- and long-term. The annual cattail management would likely involve heavy machinery in order to mechanically cut the cattails extending over eight feet high and would involve fire staff. Herbicide application would need to be carefully considered for the large area of cattails involved. Because of this increase in cattail management activities through perpetuity, this alternative would result in a long-term, moderate, adverse effect for park staff.

Cumulative Effects: With the rehabilitation of the trail accessing the marsh from the Marsh Overlook Trail, more visitors may enter into the marsh area. Invasive plant management, native plant restoration, and fire management activities would continue and directly impact resource management staff. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying, Integrated Pest Management Plan EA implementation, and upgrading the Tuzigoot bathrooms would continue and possibly increase maintenance staff presence at Tuzigoot. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under Alternative B to park operations for Tuzigoot National Monument would be long-term, moderate, adverse effects.

Conclusion: Actions under Alternative B would likely result in long-term, moderate, adverse effects for park operations because of the increase in cattail management activities. Cattail management activities would include mechanical cutting and thinning, requiring floating equipment; wide-spread herbicide application; and controlled burn treatments. Including cumulative effects from past, present, and future projects also maintains the long-term, moderate, adverse effects for park operations.

3.13.4 Impacts of Alternative C (Preferred Alternative): Enhance marsh habitat by adaptively managing hydrology

Under the Preferred Alternative, water control structures would be added near the abandoned old east-west road bisecting the marsh and would be used to adaptively manage the hydrologic levels of the marsh north of the old road. A boardwalk and a viewing platform would be built on on berms near the water control structures, likely tied to the existing road bed (currently flooded). The berms and water control structures would also provide a route for vehicles or foot traffic across the marsh to facilitate maintenance and access between Tuzigoot National Monument and neighboring Dead Horse State Park creating a loop trail system within Tavasci Marsh (see Figure 11).

Trails known to be periodically flooded would be rerouted onto drier ground. Trails would be

hardened and delineated to prevent social trails. The footbridge, located in the southern part of the marsh connecting the eastern and western trails (see Figures 8 and 11), would be upgraded to be able to support UTV travel (UTV-use would only be for administrative purposes).

The northern part of the marsh would need to be adaptively managed for the optimal hydrologic levels during the year. Some monitoring would need to occur to ensure that the vegetation communities planted for initially for habitat enhancement would be continuing to exist within the prescribed levels. The water control structures would need to be maintained to keep them functioning. This could lead to increased resource management staffing levels potentially, although to a lesser degree than Alternative B (two water control structures compared to acres of cattail). Some long-term monitoring would also need to occur to ensure that the vegetation communities planted for initially for habitat enhancement would be continuing to exist within the prescribed levels. Thus, both staffing the water controls to adaptively manage the marsh water levels and monitoring the plant communities would be a long-term, minor, adverse effect.

The water conveyance channel in the southern marsh to drain northern marsh waters and prevent southern marsh waters from overtopping water control structures would also require occasional maintenance every one to three years. Vegetation clearing would be required every several years in order to ensure water passage. Heavy equipment accessing the parallel trail/utility road would be used to maintain the channel.

Visitor services would likely increase in the marsh as reaching the viewing platform and boardwalk area would take 15 to 20 minutes, being located near at the base of the marsh access trail extending from the Marsh Overlook Trail (see Figure 8). The viewing platform and boardwalk area would be an excellent area to discuss marsh ecology, including wetland obligate species, providing ample opportunities for interpretive walks. Because the viewing platform would provide another opportunity for rangers to give interpretive talks to visitors, this would be a minor, beneficial effect.

Access for UTV-use for administrative purposes on the eastern side of Tavasci Marsh would be facilitated by the loop trail as well as the upgrading of the marsh footbridge to a UTV-rated bridge. Instead of having to trailer the UTV through Dead Horse Ranch State Park and then driving it to the eastern section of the marsh, park staff could cross the old road/water control structure/berm area or the upgraded UTV-rated bridge.

Cumulative Effects: With the rehabilitation of the trail accessing the marsh from the Marsh Overlook Trail, more visitors may enter into the marsh area. Invasive plant management, native plant restoration, and fire management activities would continue and directly impact resource management staff. Much of the development-related renovations such as the road improvements, Tuzigoot Museum renovation and dataline burying, Integrated Pest Management Plan EA implementation, and upgrading the Tuzigoot bathrooms would continue and possibly increase maintenance staff presence at Tuzigoot. When considered with other past, present, and reasonably foreseeable future actions, cumulative effects under the Preferred Alternative to park operations for Tuzigoot National Monument would be long-term, moderate effects—adverse for natural resource staff and maintenance staff, and beneficial for interpretive rangers.

Conclusion: Actions under the Preferred Alternative would likely result in a long-term, moderate effect for park operations because of the increase in maintenance of water control structures and water conveyance channel, adaptively managing marsh hydrology, increased interpretive opportunities, and increased infrastructure for maintenance. Including cumulative effects from past, present, and future projects also maintains the long-term, moderate effects for park operations—adverse for natural resource and maintenance staff and beneficial for interpretive rangers.

CHAPTER 4.0 CONSULTATION AND COORDINATION

4.1 Internal Scoping

Internal scoping was conducted by an interdisciplinary team of NPS professionals from Montezuma Castle/Tuzigoot National Monuments, the Washington Office Water Resources Division, and Flagstaff National Monuments. Some internal scoping was attended by Arizona State Parks, U.S. Fish and Wildlife Service, and Natural Channel Design (partner in the Arizona Water Protection Fund grant received in October 2008). Internal scoping meetings were held on various dates including May 2007, February 2008, November 2008, May 2009, and September 2010.

4.2 External Scoping

External (public) scoping was conducted to inform various agencies and the public about the proposal to "develop a comprehensive management plan for Tavasci Marsh to restore and enhance native wetland plant communities to create quality wildlife habitat, while providing adequate visitor use infrastructure to allow the public to enjoy the resource;" and to generate input on the preparation of this environmental assessment. There were two open house public meetings held on August 13, 2008 with over 40 attendees, and November 19, 2008 with 25 attendees. At those meetings, public comments were written on a flipchart in addition to passing out a checkbox/comment form (see Appendix A). From those two meetings, there were 44 people who filled out individual comment forms. There were also 41 flipchart comments recorded in August 2008, and 19 flipchart comments recorded in November 2008.

On November 14, 2008, a public scoping letter was emailed to over 80 different email addresses, as well as announced in local papers. In addition, the scoping letter was mailed to various federal and state agencies, associated Native American tribes, local governments, and local news organizations. Scoping information was also posted on the monument's website.

In addition to the aforementioned public entities, the following agencies and Native American tribes were sent scoping information and were contacted for information regarding the project:

Federal Agencies
U.S. Department of the Interior – Fish and Wildlife Service
U.S. Army Corps of Engineers
U.S. Forest Service

State Agencies
Office of the State Historic Preservation Officer
Arizona State Parks

Affiliated Native American Groups
Ak-Chin Indian Community
Gila River Pima-Maricopa Indian Community
Hopi Tribe
Salt River Pima-Maricopa Indian Community
Tohono O'odham Nation
Zuni Tribe
Yavapai-Apache Nation
Yavapai-Prescott Indian Tribe

4.3 Scoping Letter Response

During the 30-day scoping period, three public responses were received in support of restoring the marsh to enhance the quality of wildlife habitat. One Native American Nation, the Hopi Tribe, had no objection to the proposed project and requested that the NPS continue to solicit their input for the project. Following the letter, they conducted a site visit to Tavasci Marsh in January 2009 and discussed the project with NPS staff.

4.4 Consultation

4.4.1 U.S. Fish and Wildlife Service

Under Section 7(c) of the Endangered Species Act, the park reviewed the proposed activities and determined whether any federally listed species may be affected. Consultation with U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act was initiated under a letter requesting a species list for the project area dated November 15, 2010. A biological assessment is currently being written and will be sent to the U.S. Fish and Wildlife Service during the public comment period for this environmental assessment.

4.4.2 U.S. Army Corps of Engineers

A Cowardin Wetlands Delineation and a Wetlands Condition Assessment was completed during 2009 by the NPS staff from Point Reyes National Seashore. This Wetland Delineation Report and Forms, in addition to the Wetlands Condition Assessment Report was sent to the Army Corps on November 15, 2010. A Clean Water Act Section 404 Wetlands Permit will be obtained through the Army Corps following completion of the NEPA process.

4.4.3 Arizona State Historic Preservation Office

The State Historic Preservation Office (SHPO) was contacted regarding the potential effects on the historic road and historic structures related to the dairy farming activities in the project area. A letter providing information and seeking concurrence with the park's determination of effect on properties eligible for the National Register of Historic Places will be sent during the public comment period for this environmental assessment. The SHPO personnel also did a site visit on February 16, 2011.

4.5 Environmental Assessment Review and List of Recipients

This environmental assessment has been released for public review in May 2011. To inform the public of EA availability, the NPS will publish and distribute a press release to various agencies, tribes, and members of the public on the park's mailing list. Copies of the environmental assessment will be provided to interested individuals upon request. Copies of the document will also be available on the internet at http://parkplanning.nps.gov/tuzi.

This EA is subject to a 30-day public comment period. During this time, the public is encouraged to submit their written comments to the National Park Service address provided at the beginning of this document. Following the close of the comment period, all public comments will be reviewed and analyzed, prior to the release of a decision document. The National Park Service will issue responses to substantive comments received during the public comment period, and will make appropriate changes to the environmental assessment as needed.

4.6 List of Preparers

Preparer (developed EA content)

-Sharon Kim, Chief of Natural Resources, North Central Arizona Monuments (Montezuma Castle, Tuzigoot, Sunset Crater Volcano, Walnut Canyon, and Wupatki National Monuments)

NPS Consultants (provided information)

-Dennis Casper, Ecologist, Montezuma Castle and Tuzigoot National Monuments
-Paul Christensen, Hydrologist, Adjudications and Information Management, Washington Office, Water Resources Division, NPS
-Ed Cummins, Chief Ranger, Montezuma Castle and Tuzigoot National Monuments
-Kathy M. Davis, Superintendent, Montezuma Castle and Tuzigoot National Monuments
-Colleen Filippone, Hydrologist, Intermountain Region, NPS
-Michele Girard, Ecologist, Southern Arizona Office, NPS
-Matt Guebard, Archeologist, Montezuma Castle and Tuzigoot National Monuments
-Bill Hansen, Program Leader, Adjudications and Information Management, Washington Office, Water Resources Division, NPS
-Lisa Leap, Chief of Cultural Resources, North Central Arizona Monuments
-Mike Martin, Hydrologist, Washington Office, Water Resources Division, NPS
-Kevin Noon, Wetland Scientist, Washington Office, Water Resources Division, NPS
-Bill Osterhaus, Chief of Maintenance, Montezuma Castle and Tuzigoot National Monuments
-John Reid, Park Ranger, Tuzigoot National Monument
-Joel Wagner, Hydrologist, Washington Office, Water Resources Division, NPS
-Penny Wagner, Lead Visitor Use Assistant, Montezuma Castle and Tuzigoot National Monuments

Non-NPS Consultants (provided information)

-George Cathey, Civil Engineer, Natural Channel Design, Inc.
-Allen Haden, Aquatic Ecologist, Natural Channel Design, Inc.
-Stephanie Yard, Civil Engineer, Natural Channel Design, Inc.

CHAPTER 5.0 REFERENCES

Centers for Disease Control and Prevention. 2003. Epidemic/Epizooteic West Nile Virus in the United States: Guidelines for Surveillance, Prevention and Control. 3rd Revision.

Collins, J.N., E.D. Stein, M. Sutula, R. Clark, A.E. Fetscher, L. Grenier, C. Grosso, and A. Wiskind. 2008. California Rapid Assessment Method (CRAM) for Wetlands, v. 5.0.2. 157 pp.

Corps of Engineers Wetland Delineation Manual. 1987. Technical Report. Y-87-1.

Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. Office of Biological Services, Fish and Wildlife Service, U.S. Dept. of the Interior, Washington, D.C.

Hoag, J. Chris, Norman Melvin, and Derek J. Tilley 2007. Wetland Plants: Their Function, Adaptation and Relationship to Water Levels. Riparian/Wetland Project Information Series No.21, Natural Resources Conservation Service, Plant Material Center, Aberdeen ID.

Lindsay, B. A. 2000. Soil survey of Tuzigoot National Monument, Arizona. Technical Report No. 67. USGS Sonoran Desert Field Station, University of Arizona, Tucson, AZ.

National Park Service. 2006. Management Policies. U.S. Department of Interior.

National Park Service. 2007. Invasive Plant Management Plan and Environmental Assessment for Montezuma Castle and Tuzigoot National Monuments. Finding of No Significant Impact (FONSI) signed in October 2007.

National Park Service. 2008. National Park Service Procedural Manual #77-1: Wetland Protection.

National Park Service. 2010. General Management Plan/Environmental Assessment for Montezuma Castle National Monument and Tuzigoot National Monument. Finding of No Significant Impact (FONSI) signed in December 2010.

Natural Channel Design, Inc. 2008. Tavasci Marsh - Wetland Restoration Project. Arizona Water Protection Fund Application Package.

Parsons and Ryan. 2009. Delineation of Potential Jurisdictional Wetlands and "Other Waters:" Tavasci Marsh. U.S. Department of Interior, National Park Service.

Ryan and Parsons. 2009. Tavasci Marsh Wetland Assessment: Wetland Vegetation Communities, Condition, and Functions. U.S. Department of Interior, National Park Service.

Schmidt, C.A., Powell, B.F., and Halvorson, W.L. 2005. Vascular Plant and Vertebrate Inventory of Tuzigoot National Monument. USGS Open-File Report 2005-1347. U.S.

Geological Survey, Southwest Biological Science Center, Sonoran Desert Research Station, University of Arizona, Tucson, AZ.

Smith, E. L. and Bender, G.L. 1973. Proposed Natural Areas: Tavasci Marsh, Report No. 1. Prepared by the Arizona Academy of Science for the Planning Division, Department of Economic Planning and Development, Office of the Governor, State of Arizona.

Sogge, M. 1995. Southwestern Willow Flycatcher *(Empidonax traillii extimus)* Monitoring at Tuzigoot National Monument. 1995 progress report to the National Park Service. National Biological Service Colorado Plateau Research Station/Northern Arizona University Report. 20 pp.

Stoutamire, W. 2010. Water in the Desert: A History of Arizona's Tavasci Marsh, 1865 – 2005. University of Arizona at Tucson.

The Nature Conservancy (TNC). 1996. USGS – NPS Vegetation Mapping Program, Vegetation mapping of Tuzigoot National Monument. Arlington, VA. Accessed 24 June 2005: http://biology.usgs.gov/npsveg/Tuzigoot N MON/methods.html.

Walton, W.E., Schreiber, E.T., and Mulla, M.S. 1990. Distribution of *Culex* tarsalis larvae in a freshwater marsh in Orange County, California. Journal of the American Mosquito Control Association. Vol. 6, No. 3.

Ward, J. J. 2008. Water Resources Assessment, Tuzigoot National Monument, Arizona. Prepared for U.S. Department of Interior.

Yadav, P. 2009. Factors affecting mosquito populations in created wetlands. Master's Thesis. Ohio State University.

5.1 REFERENCES FOR EXECUTIVE ORDERS AND DIRECTOR'S ORDERS

Executive Order No. 11988 (Floodplain Management). May 24, 1977, 42 FR 26951, as amended by Executive Order 12148, July 20, 1979, 44 FR 43239 [42 USC 4321].

Executive Order No. 11990 (Protection of Wetlands). May 24, 1977, 42 FR 26951, as amended by Executive Order 12608, September 9, 1987, 52 FR 34617 [42 USC 4321].

Executive Order No. 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations). February 11, 1994, 59 FR 7629, as amended by

Executive Order 12948, January 30, 1995, 60 FR 6381 [42 USC 4321].

Executive Order No. 13007 (Indian Sacred Sites). May 24, 1996, 61 FR 26771 [42 USC 1996].

Director's Order 12. Conservation Planning, Environmental Impact Analysis, and Decision-Making. Approved January 8, 2001.

Director's Order 28. Cultural Resources Management. Sunset on June 11, 2002 (currently being updated).

Director's Order 28A. Archeology. Approved October 12, 2004.

Director's Order 77-1. Wetland Protection. Reissued on October 30, 2002.

Director's Order 77-2. Floodplain Management. Approved September 8, 2003

APPENDIX A—IMPAIRMENT

National Park Service's 2006 Management Policies require analysis of potential effects to determine whether or not actions would impair park resources. The fundamental purpose of the national park system, established by the Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. National Park Service managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adversely impacting park resources and values.

However, the laws do give the National Park Service the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the National Park Service the management discretion to allow certain impacts within park, that discretion is limited by the statutory requirement that the National Park Service must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. The prohibited impairment is an impact that, in the professional judgment of the responsible National Park Service manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of these resources or values. An impact to any park resource or value may, but does not necessarily, constitute an impairment, but an impact would be more likely to constitute an impairment when there is a major or severe adverse effect upon a resource or value whose conservation is:

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- key to the natural or cultural integrity of the park; or
- identified as a goal in the park's general management plan or other relevant NPS planning documents.

An impact would be less likely to constitute an impairment if it is an unavoidable result of an action necessary to pursue or restore the integrity of park resources or values and it cannot be further mitigated.

The park resources and values that are subject to the no-impairment standard include:

- the park's scenery, natural and historic objects, and wildlife, and the processes and conditions that sustain them, including, to the extent present in the park: the ecological, biological, and physical processes that created the park and continue to act upon it; scenic features; natural visibility, both in daytime and at night; natural landscapes; natural soundscapes and smells; water and air resources; soils; geological resources; paleontological resources; archeological resources; cultural landscapes; ethnographic resources; historic and prehistoric sites, structures, and objects; museum collections; and native plants and animals;
- appropriate opportunities to experience enjoyment of the above resources, to the extent that can be done without impairing them;
- the park's role in contributing to the national dignity, the high public value and integrity, and the superlative environmental quality of the national park system, and the benefit and inspiration provided to the American people by the national park system; and

- any additional attributes encompassed by the specific values and purposes for which the park was established.

Impairment may result from National Park Service activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park. The NPS's threshold for considering whether there could be an impairment is based on whether an action would have major (or significant) effects.

Impairment findings are not necessary for visitor use and experience, socioeconomics, public health and safety, environmental justice, land use, and park operations, because impairment findings relates back to park resources and values, and these impact areas are not generally considered park resources or values according to the Organic Act, and cannot be impaired in the same way that an action can impair park resources and values. After dismissing the above topics, topics remaining to be evaluated for impairment include soils, vegetation, water quality, wetlands and floodplains, general fish and wildlife, species of special concern, ethnographic resources, archeological resources, and historic structures.

Fundamental resources and values for Tuzigoot National Monument are identified in the 2010 General Management Plan (NPS 2010). According to that document, of the impact topics carried forward in this environmental assessment; soils, vegetation, water resources, wetlands and floodplains, fish and wildlife (including species of special concern), archeological resources, ethnographic resources, and historic structures are considered necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; are key to the natural or cultural integrity of the park; and/or are identified as a goal in the park's General Management Plan or other relevant NPS planning document.

Soils/Geology—In the 2010 General Management Plan, natural resources that support "ecological processes and conditions related to the integration of desert and riparian landscapes" and "the unique hydrology and geology of the monuments," are identified as fundamental resources and values. This project involves excavation work to remove cattail islands from the marsh, install water control structures along an old abandoned and flooded road, recontour the northwest side of the marsh to reestablish topographic gradients that were removed during last century's farming activities, and excavate a maximum of 2.5 acres of soils to create the water conveyance channel. These activities would result in moderate and long-term impacts to soils: beneficial along the marsh edges and trails; and adverse for water conveyance channel excavation and localized upland areas where soil to create the topography would be removed. Although soil resources are a fundamental resource at the park, the preferred alternative would result in only moderate for the long-term beneficial and adverse site-specific impacts to soil resources; therefore, there would be no impairment to soil resources.

Vegetation— Vegetation also falls within the natural resources that support "ecological processes and conditions related to the integration of desert and riparian landscapes" as described by the 2010 General Management Plan as fundamental resources and values. The objectives of this project include enhancing current marsh habitat. Although vegetation is a part of the monument's fundamental resources, the

Preferred Alternative would result primarily in long-term moderate direct mostly beneficial impacts to native vegetation communities, especially increasing the diversity of the native plant communities, and would cause no impairment to vegetation resources.

Water resources— In the 2010 General Management Plan, natural resources that support "ecological processes and conditions related to the integration of desert and riparian landscapes" and "the unique hydrology and geology of the monuments… including the spring-fed Tavasci Marsh draining onto the fields below," are identified as fundamental resources and values. The importance of the Verde River on the southern part of Tuzigoot National Monument ties in directly with the cultural significance and location of the Tuzigoot Pueblo. This project involves excavation of soil and cattail islands that could potentially affect water quality. Although water resources are a fundamental resource and value for the park, the Preferred Alternative would result in short-term, minor, indirect, adverse, minor impacts to water quality in the park and downstream; therefore, there would be no impairment to water quality and water resources.

Wetlands and floodplains—Wetland and floodplain resources are included in the "ecological processes and conditions related to the integration of desert and riparian landscapes" and "the unique hydrology and geology of the monuments…including the spring-fed Tavasci Marsh draining onto the fields below," and are considered fundamental resources in the 2010 General Management Plan. This project takes place in Tavasci Marsh which is a wetland and floodplain area and these resources would directly be affected. Although wetland and floodplain resources are fundamental resources for the monument, the Preferred Alternative would result in direct short- and long-term moderate beneficial effects for wetlands because the actions under the alternative would enhance and rehabilitate the marsh by increasing the physical and biological functions of the existing conditions. Floodplain function is not affected by the Preferred Alternative. Although wetlands and floodplains are fundamental resources for the monument, there would be no impairment to wetland and floodplain resources.

Fish and wildlife (including species of special concern)—Fish and wildlife are included in the "ecological processes and conditions related to the integration of desert and riparian landscapes" identified in the 2010 General Management Plan. The objectives of this project include enhancing current marsh habitat to diversify wildlife habitat. Although fish and wildlife are fundamental resources for the monument, the Preferred Alternative would result primarily in long-term, moderate, beneficial effects for species associated with the increases to riparian scrub/shrub, wet/moist grasslands and meadows, and open water areas, greatly expanding the native wildlife habitat diversity in the long-term for the marsh. For species of concern, there would be short-term, negligible, adverse effects for species of concern, but would likely be outweighed in the long-term by moderate, beneficial effects when considered with other past, present, and reasonably foreseeable future actions. Thus, through the

implementation of this project, there would be no impairment to fish and wildlife resources.

Archeological resources—The 2010 General Management Plan identifies "cultural connectivity" as "the connection of structures within the monuments boundaries that reveal patterns in prehistoric land use and the related opportunity to contrast the similarities and differences in land use to man's relationship with the environment from prehistoric to modern times." Archeological structures provide evidence for prehistoric land use and are irreplaceable. Archeological sites are fundamental resources for the park, and the actions under the Preferred Alternative could result in long-term, minor, adverse effects for subsurface or previously unidentified archeological resources within the project area.

To date, no archeological sites have been located in the project area. Extensive excavation of the "Kochia plot", removal of cattails, the conveyance channel ditch, and the parallel utility road for maintenance activities could impact previously unidentified subsurface archeological resources. Test excavation within the "Kochia plot" will be conducted in an effort to identify possible subsurface resources before ground disturbance begins. Additionally, ground disturbance within the "Kochia plot" area and conveyance channel will be closely monitored to identify archeological resources. If any resources are located within the project area, work will stop and ground disturbance within the project area will be re-evaluated. Thus, due to monitoring and mitigation plans, there is no impairment to archeological resources from this project.

Ethnographic resources – In the 2010 General Management Plan, "cultural connectivity" which includes ethnographic resources tying past and present traditional use of the monument's resources. This project involves enhancing wildlife habitat diversity by removing floating islands of cattails, a species known to be used by associated tribes. Although ethnographic resources are considered to be a fundamental resource and value for the monument, the Preferred Alternative would result in both adverse, minor impacts for the short-term that could be mitigated to negligible for cattail ethnographic resources. This alternative would also result in minor beneficial long-term (greater than one year) effects for other marsh plant ethnographic resources by working closely with the tribes to plant ethnographically important species in restoration efforts. Because of this, there would be no impairment to ethnographic resources from this project.

Historic structures—The 2010 General Management Plan identifies "cultural connectivity" with one aspect being "the connection of structures within the monuments boundaries that reveal patterns in prehistoric land use and the related opportunity to contrast the similarities and differences in land use to man's relationship with the environment from prehistoric to modern times." Although historic structures are fundamental resources for the park, actions under the Preferred Alternative would likely result in a long-term, negligible effect for historic structures due to the likelihood of intersecting with a historic ditch during cattail island removal activities, and with the construction of water control structures, berms, boardwalks, and a viewing platform on the location of a historic road. Because the cattails have

grown into the ditches and road following repeated sedimentation and flooding, the ditches and road have lost their historic integrity. The other historic structure of the spring impoundment, which is in good condition and likely eligible for the National Register of Historic Places, would not be affected under this alternative. Thus, there would be no impairment to historic structures from this project.

Additionally, mitigation measures for these resources would further lessen the degree of impact to and help promote the protection of these resources. Excavation activities within the marsh would be limited between October and February (avoiding the heavy monsoon period between July through September, as well as avoiding critical wildlife breeding periods between March through September). This would lessen the impacts on soil/geology, water resources, and fish and wildlife. By working closely with the associated tribes, impacts to ethnographic resources could be mitigated. This project will actually increase wetland and native vegetation diversity, and working closely with wetland scientists and ecologists will assist in ensuring the beneficial effects.

In conclusion, as guided by this analysis, good science and scholarship, advice from subject matter experts and others who have relevant knowledge and experience, and the results of public involvement activities, it is the Superintendent's professional judgment that there would be no impairment of park resources and values from implementation of the preferred alternative.

APPENDIX B—PUBLIC SCOPING CHECKBOX LETTER

Please Help Us Improve Tavasci Marsh

- What visitor services improvements would you like? (Check all that apply)
  ☐ Observation platforms
  ☐ Trails
  ☐ Interpretation Signage and programs
  ☐ Other (Please Specify): _____

- Would you support restoration to more diverse habitats at Tavasci Marsh?
  ☐ Yes, see below ☐ No, I prefer the existing conditions

- Please rank these enhancements in order of importance (1 being the highest)
  ☐ Wildlife and bird habitat enhancement
  ☐ A mix of diverse wetland plant communities including cottonwood and willow forest and open water features
  ☐ Improved access and hiking trails
  Other Enhancements (Please Specify):
  _____

- Would you approve of the following uses around the Marsh area? (Check all that apply)
  ☐ Equestrian ☐ Mountain bike ☐ ATV

- How often do you currently visit the Marsh? (Check One)
  ☐ Once a year
  ☐ Every few months
  ☐ Once a month
  ☐ Once a week
  ☐ More than once a week

- If visitor services infrastructure were improved would you visit more often?
  ☐ Yes ☐ No

- Would you be interested in becoming a volunteer at Tavasci Marsh?
  ☐ Yes ☐ No

  If yes, what type of work would you like to do?
  ☐ Lead interpretive programs
  ☐ Assist with facility maintenance
  ☐ Assist with resource management work
  ☐ Other (Please Specify): _____

  If yes, how can we contact you?

APPENDIX C—WILDLIFE WORKSHOP EXHIBITS

The following pages are a table and summarized notes that resulted from the January 2010 interagency Tavasci Marsh Wildlife Habitat Workshop with over 30 wetland, wildlife, and hydrology experts in attendance. Because this workshop developed into the habitat target objectives for this project (Table 1), this information is included in this appendix.

Tavasci Marsh Meeting List--Jan. 20-21, 2010

NAME	AFFILIATION
Allen Haden	Natural Channel Design, Inc., Aquatic Ecologist
Andy Hubbard	NPS SODN Coordinator
Bill Halvorson	USGS ecologist/UA adjunct professor
Bill Hansen	WASO Water rights, Water Resources Division
Bob Sejkora	State Park Water Program Manager
Chris Hoag	Wetland Expert
Colleen Fillippone	Regional Hydrologist
Dan Campbell	Nature Conservancy manager/biologist
Dennis Casper	MOCA/TUZI Biologist
Doug VanGausig	Town of Clarkdale--biologist/mayor
Erika Nowak	NAU herpetologist (formerly with USGS)
George Cathey	Natural Channel Design, Inc., Civil Engineer
Joel Wagner	WASO Wetland Program Leader
John Reid	Park Ranger
Kathy Davis	MOCA/TUZI Superintendent
Kevin Noon	WASO Wetland Scientist, Water Resources Div.
Justin Swiger	Dead Horse Ranch State Park
Lorraine Parsons	PORE Vegetation Program Manager
Max Castillo	Dead Horse Ranch State Park
Michele Girard	SOAR Ecologist
Mike Martin	WASO Hydrologist
Patty Denison	Asst. Park Manager, Red Rock State Park
Paul Whitefield	FLAG Resource Management Specialist
Roger Radd	Audubon Society--N. AZ chapter
Sharon Kim	MOCA/FLAG Chief of Nat. Res. (Acting)
Mike Martinez	US Fish and Wildlife Service Biologist
Stephanie Yard	Natural Channel Design, Inc., Civil Engineer
Steve Buckley	NPS--SODN Network plant ecologist
Tice Supplee	Audubon Society--IBA
Tom Bagley	AGFD wildlife biologist
Trevor Buhr	AGFD Habitat Program Manager

Desired Acreage Percent Per Species Assemblage

Vegetation Community	Dominant species (if present)	Current Acres	Current %	Birds	Amphibian	Reptile--Aquatic	Reptile--Terrestrial	Aquatic Inverts	Mammals-Aquatic	Mammals-Terrestrial (esp. bats)	Fish	Overall %
Open Water-Deep & Shallow	(N/A)	2.17	2.3	10?	5 SHALLOW	2.3 SHALLOW	2.3		5	2.3	X	5-10
Freshwater Marsh A	Cattails	66.6	69.5	30-40	25	25	15	X	40	11.4		25-40
Freshwater Marsh B	Bulrushes (Scirpus)	8.6	9.0	15-20	25	25	15	X	30	15	X SHALLOW	15-25
Wet/Moist Meadow	Short Sedges & rushes	10.65	11.1	11.2	20	20--import. For juv.	20.4		4.7	25		11-25
Wet/Moist Grassland	*Leymus triticoides* (wild rye)	3.88	4.0	1.5	13	21	30		4	30		15-30
Scrub-Shrub Riparian	Willow/juv. Cottonwood?	0.1	0.1	2	same as below	same as below	same as below		10	same as below		1-10
Forested Riparian	Fremont Cottonwood/Gooding Willow	1.81	1.9	5	5.7	5	5		5	5		5
Shea Springs	(related to Page Springsnail)			Need free-flowing springhead that is not inundated with water. May need veg management to allow for sunlight								
		1.81	**100%**									**77-145%**

HABITAT TABLE INFO: HABITAT DESCRIPTION, CHANGES AND ASSOCIATED SPECIES
Tavasci Marsh Workshop, Jan. 20-21, 2010

- **OPEN WATER—5-10% for all open water**

DEEP OPEN WATER

CHANGE NEEDED:

-Increase
-Multiple patches
-Depth is important
-Encourage native submerged aquatics (such as *Potamogeton* and *Stuckenia* spp.*)*

ASSOCIATED SPECIES: benthic feeders (inc. waterfowl), flycatcher, native fish, native invertebrates, otter, beaver, muskrats, swallows & bats, bald eagle, osprey, belted kingfisher grebes, submerged native aquatic plants,
provides access to water

SHALLOW OPEN WATER (% included under "Open Water")

CHANGE NEEDED

-Increase
-Tadpoles prefer 60% open in any given patch
-May be hard to maintain

ASSOCIATED SPECIES: Northern Mexican garter snake (candidate species), fish, shorebirds, tadpoles, turtles

- **FRESHWATER MARSH A: CATTAILS—25-40% for all cattails**

CATTAILS—DEEP WATER AND FLOATING

CHANGE NEEDED

-Increased edge
-Lower *Typhus domingensis* density (denser, thicker cattail species)
-Increase bulrush component
-Remove some cattails
-Decrease areal extent
-Rearrange the matrix
-Have patches with open water channels
-Appropriate patch size for rails
-Gartersnakes would prefer something like 25%

ASSOCIATED PEOPLE/SPECIES: Native Americans, muskrat, beaver, rails, unique birds (however, no listed species are tied to cattails at Tavasci), water quality, thermal management, aquatic mammals

SHALLOW CATTAILS

CHANGE NEEDED

(No notes)

ASSOCIATED SPECIES: Northern Mexican garter snake (candidate species), fish, birds, invertebrates, amphibians, rails—listed Yuma Clapper?,

- **FRESHWATER MARSH B: BULRUSHES (SCIRPUS)—15-25%**

  CHANGE NEEDED

  -increase amounts

  ASSOCIATED SPECIES: Northern Mexican garter snake (candidate species), diving ducks, beaver, muskrat, invertebrates, fish, least bittern, lowland leopard frogs

- **WET/MOIST MEADOWS (inc. Short Sedges/Rushes)—11-25%**

  CHANGE NEEDED

  -Increase amount

  -25-30 acres have been lost in the last 10-15 years

  -Improve access

  ASSOCIATED SPECIES: neonate Northern Mexican garter snake (candidate species), ibis, herons, rails, waders, teals, black hawk, harrier, invertebrates, amphibians, small mammals (voles, etc.), terrestrial mammals & reptiles

- **WET/MOIST GRASSLAND (Short sedges/rushes)—15-30%**

  CHANGE NEEDED

  -Need more inventory data from this habitat

  -Decrease invasives

  -In moist grasslands, decrease Bermuda grass

  ASSOCIATED SPECIES: (see "Wet/Moist Meadow" for same associated species)

  -PLUS, for moist grasslands: raptors hunting rodents, grassland bird species, killdeer nesting

- **SCRUB/SHRUB RIPARIAN (Willow and juvenile cottonwood)—1-10%**

  CHANGE NEEDED

  -Expand willow/cottonwood gallery on South end (patches)

  -Otherwise, there may be enough outside the marsh in the Verde River?

  -Increase transitory ash

  ASSOCIATED SPECIES: willow flycatchers & Yellow-billed cuckoo(listed species), Bell's Vireo provides buffer for wildlife leading from
  river to wetter marsh areas

- **FORESTED RIPARIAN—5%**

  CHANGE NEEDED

  -Replace what has been lost, esp. on South end

  ASSOCIATED SPECIES: Roosting birds that hunt in the marsh, Connectivity to river habitat for travel corridor for mammals, birds, and reptiles, Yellow-billed cuckoo

- **SHEA SPRING**

  CHANGE NEEDED

  -Free-flowing springhead, not inundated by backwater

  -Allow for sunlight

  -Water couple inches deep

  -Remove exotic fish

ASSOCIATED SPECIES: Page Springsnail (maybe)--Page Springsnail is FWS spotlight species*

*Email clarification from USFWS: One of the changes needed that is identified in the notes is the need to allow for sunlight. I want to be careful that we aren't promoting the idea of clearing trees and other native plants around Shea Springs to benefit the Page springsnail. In other parts of the species range, notably Page Springs, the Page springsnail thrives in free-flowing springheads with significant natural shading provided by native trees and shrubs. I just want NPS to be aware that allowing for sunlight probably doesn't need to mean clearing overhanging trees and shrubs at the springhead.

- **OTHER HABITATS REMOVED FROM ORIGINAL TABLE**

UPLAND MESQUITE

CHANGE NEEDED

-No change; OK as is

-Did not look for a percentage because there is extensive mesquite adjoining the marsh

ASSOCIATED SPECIES: (none listed)

(Van Gausig comment following the workshop: The mesquite gallery supplies tremendous services to other adjacent habitats. Insects that inhabit the mesquite supply food for species that forage and breed in the marsh – like Marsh Wrens, Common Yellowthroat, Song Sparrow. Species that forage in the marsh often breed in the mesquite (YBCU, BEVI, etc., etc.) The mesquite expands and contracts with the local water table, so maintaining a desirable mesquite gallery means maintaining a desirable water table in that area.)

APPENDIX D—SPECIES LISTS, INCLUDES SCIENTIFIC NAMES

Tavasci Marsh Plant Species List – Tuzigoot National Monument

Family	PLANT Code	Species	Common Name	Life form	Wetland Indicator Status	Non-native?
Aceraceae	ACNE2	*Acer negundo var. interius*	box elder	t	FACW-	n
Apiaceae	HYVE2	*Hydrocotyle verticillata*	whorled marsh pennywort	h	OBL	y
Asteraceae	ACRE3	*Acroptilon repens*	Russian knapweed	h	NI	y
	CIVU	*Cirsium vulgare*	bull thistle	h	FACU	y
	BASA4	*Baccharis salicifolia*	Mule Fat	s	FACW	n
	HEAN3	*Helianthus annuus*	annual sunflower	h	FAC-	n
	SOAS	*Sonchus asper*	spiny sowthistle	h	FACW	y
	XAST	*Xanthium strumarium*	Rouch cocklebur	h	NI	n
Berberidaceae	BEHA	*Berberis haematocarpa*	Red barberry	s	NI	n
Brassicaceae	DESO2	*Descurainia sophia*	herb sophia	h	NA	y
	RONA2	*Rorippa nasturtium-aquaticum*	watercress	h	OBL	n
	SIIR	*Sisymbrium irio*	London rocket	h	NI	y
Chenopodiaceae	KOSC	*Kochia scoparia*	Mexican fireweed	s	FAC	y
Cupressaceae	JUOS	*Juniperus osteosperma*	Utah juniper	t	NA	n
Cyperaceae	CAPR5	*Carex praegracilis*	clustered field sedge	h	FACW+	n
	ELPA4	*Eleocharis parishii*	Parish's spikerush	h	FACW	n
	SCAM6	*Schoenoplectus americanus*	American threesquare	h	OBL	n
	SCTA2	*Schoenoplectus tabernaemontani*	softstem bullrush	h	OBL	n
Equisetaceae	EQLA	*Equisetum laevigatum*	Smooth horsetail	H	FACW	n
Fabaceae	MEAL2	*Melilotus alba*	white sweetclover	h	FACU+	y
	MEIN2	*Melilotus indica*	annual yellow sweetclover	h	FACU+	y
	PRVE	*Prosopis velutina*	velvet ash	s	NI	n
Grossulariaceae	RIAU	*Ribes aureum*	golgen current	s	FACW	n
Haloragaceae	MYAQ2	*Myriophyllum aquaticum*	parrot feather watermilfoil	h	OBL	y
Juncaceae	JUBA	*Juncus balticus*	Baltic rush	h	OBL	n
Lamiaceae	MAVU	*Marrubium vulgare*	horehound	h	FAC+	y
Lemnaceae	LEMI2	*Lemna minima*	common duckweed	h	OBL	n
Moraceae	MOAL	*Morus alba*	White mulberry	T	NO	y
Oleacece	FRVE2	*Fraxinus velutina*	Arizona ash	t	FAC+	n

Family	PLANT Code	Species	Common Name	Life form	Wetland Indicator Status	Non-native?
Onagraceae	EPCIC	*Epilobium ciliatum ssp. ciliatum*	fringed willowherb	h	FACW	n
Plantaginaceae	PLLA	*Plantago lanceolata*	English plantain	H	FAC	y
Poaceae	AGST2	*Agrostis stolonifera*	creeping bent	h	NI	y
	BRDI3	*Bromus diandrus*	ripgut brome	h	NI	y
	BRMAR	*Bromus madritensis ssp. rubens*	red brome	h	NI	y
	CYDA	*Cynodon dactylon*	Bermudagrass	h	FACU	y
	DISP	*Distichlis spicata*	inland saltgrass	h	FACW	n
	FEAR3	*Festuca arundinacea*	tall fescue	h	NA	y
	HOJU	*Hordeum jubatum*	foxtail barley	h	FACW-	y
	HOMU	*Hordeum murinum*	mouse barley	h	NI	y
	LETR5	*Leymus triticoides*	beardless wildrye	h	FACU	n
	POMO5	*Polypogon monspeliensis*	annual rabbitsfoot grass	h	FACW+	y
	MUAS	*Muhlenbergia asperifolia*	scratchgrass	h	FACW	n
	SPWR2	*Sporobolus wrightii*	big sacaton	h	NI	n
Polygonaceae	POPU5	*Polygonum punctatum*	dotted smartweed	h	OBL	n
	RUCR	*Rumex crispus*	curly dock	h	FACW	y
Potamogetonaceae	POCR3	*Potamogeton crispus*	curly pondweed	h	OBL	y
Salicaeae	SAGO	*Salix gooddingii*	Goodding's willow	t	OBL	n
	POFR2	*Populus fremontii*	Fremont Cottonwood	t	FACW	n
Schrophulariaceae	VEAM2	*Veronica americana*	American speedwell	h	OBL	n
Solonaceae	SOEL	*Solanum elaeagnifolium*	white horsenettle	h	NI	n
Typhaceae	TYDO	*Typha domingensis*	southern cattail	h	OBL	n
	TYLA	*Typha latifolia*	broadleaf cattail	h	OBL	n
Urticaceae	URDI	*Urtica dioica*	stinging nettle	h	NI	n

Appendix B. Fish species recorded by University of Arizona (UA) inventory personnel at Tuzigoot NM or that may occur at the monument based on other studies: Bonar et al. (2004), Bryan et al. (Bry; 2000), Rinne et al. (Rin; 1998), and Minkley (Min; 1973) near the monument or in the Verde River. Species in bold-faced type are non-native. See Appendix M for additional information on voucher specimens collected.

				Bonar et al. (2004)		Throughout the Verde River			
Order Family	Common name	Scientific name	UA	near Tuzigoot	Other locations of the Verde River	BRY	RIN	MIN	Conservation Designation[a]
Clupeiformes									
Clupeidae	threadfin shad	*Dorosoma petenense*			X				
Cypriniformes									
Catostomidae	Sonora sucker	*Catostomus insignis*		X					SC
	desert sucker	*Catostomus clarkii*		X					SC
	razorback sucker	*Xyrauchen texanus*			X				LE
Cyprinidae	Colorado pikeminnow	*Ptychocheilus lucius*		X					LE, XN
	common carp	*Cyprinus carpio*	X	X					
	fathead minnow	*Pimephales promelas*				X			
	loach minnow	*Tiaroga cobitis*					X		LT
	longfin dace	*Agosia chrysogaster*			X				SC
	red shiner	*Cyprinella lutrensis*	X	X					
	roundtail chub	*Gila robusta*		X					SC
	speckled dace	*Rhinichthys osculus*					X		SC
	spikedace	*Meda fulgida*					X		LT
Cyprinodontiformes									
Ictaluridae	channel catfish	*Ictalurus punctatus*	X	X					
	flathead catfish	*Pylodictis olivaris*	X	X					
Poeciliidae	Gila topminnow	*Poeciliopsis occidentalis*						X	LE
	sailfin molly	*Poecilia latipinna*				X			
	shortfin molly	*Poecilia mexicana*				X			
	western mosquitofish	*Gambusia affinis*	X	X					
Perciformes									
Centrarchidae	black crappie	*Pomoxis nigromaculatus*				X			
Cichlidae	tilapia	*Tilapia* spp.			X				
	bluegill	*Lepomis macrochirus*	X	X					
	green sunfish	*Lepomis cyanellus*	X	X					
	largemouth bass	*Micropterus salmoides*	X	X					
	smallmouth bass	*Micropterus dolomieu*	X	X					
Moronidae	yellow bass	*Morone mississippiensis*			X	X			
Salmoniformes									
Salmonidae	rainbow trout	*Oncorhynchus mykiss*	X	X					
Siluriformes									
Ictaluridae	yellow bullhead	*Ameiurus natalis*	X	X					

[a] Endangered Species Act Designations: LE = Listed Endangered, LT = Listed Threatened, XN = Experimental Nonessential Population, SC = Species of Concern (HDMS 2004).

Appendix C. List of amphibians and reptiles observed or documented at Tuzigoot NM by University of Arizona inventory personnel, by survey type, 2002–2004. Species in bold-faced type are non-native. Numbers indicate observations by that survey type and are not meant to indicate abundance.

				Active survey type						Trapping type			Voucher type	
Order	Family	Scientific name	Common name	TACS	Line transect	Extensive	Road	Amphibian calls	Incidental	Pitfall	Cover-board	Minnow	Photo	Specimen
Anura	Bufonidae	*Bufo woodhousii*	Woodhouse's toad			3	12	12		1			2	
	Ranidae	*Rana catesbeiana*	American bullfrog	1	14	41	1	13	1	4		77	2	
Testudines	Kinosternidae	*Kinosternon sonoriense*	Sonoran mud turtle			2								
Squamata	Gekkonidae	*Coleonyx variegatus*	western banded gecko			11			1				1	
	Crotaphytidae	*Crotaphytus collaris*	eastern collared lizard	4		1			2				1	
	Phrynosomatidae	*Cophosaurus texanus*	greater earless lizard	9		7							1	
		Sceloporus magister	desert spiny lizard	12	4	11	3		2	76			1	
		Sceloporus clarkii	Clark's spiny lizard	4	1	6				22			2	
		Sceloporus undulatus	eastern fence lizard	4	2	7	1			22	2		1	
		Uta stansburiana	common side-blotched lizard	76	25	44			2	2			1	
		Urosaurus ornatus	ornate tree lizard	2		15				8			1	
	Teiidae	*Cnemidophorus uniparens*	desert grassland whiptail	35	52	11			1	4			1	1
		Cnemidophorus flagellicaudus	Gila spotted whiptail	11	2	3				3			1	
		Cnemidophorus tigris	western whiptail	76	25	48				32			1	
	Leptotyphlopidae	*Leptotyphlops humilis*	western blind snake			1			1				1	1
	Colubridae	*Diadophis punctatus*	ring-necked snake						2					
		Masticophis flagellum	coachwhip	1	1	1			7				1	
		Masticophis taeniatus	striped whipsnake			1			7				4	
		Masticophis bilineatus	Sonoran whipsnake						1	1			1	
		Salvadora hexalepis	western patch-nosed snake	1										1
		Pituophis catenifer	gopher snake			1	1		6	1			3	
		Lampropeltis getula	common kingsnake				2		2				2	
		Thamnophis eques	Mexican garter snake[a]						2				3	
		Sonora semiannulata	western ground snake						1					
		Tantilla hobartsmithi	southwestern black-headed snake							1				1
		Trimorphodon biscutatus	western lyre snake						1					
	Viperidae	*Crotalus atrox*	western diamond-backed rattlesnake	1		6	6		31				1	
		Crotalus molossus	black-tailed rattlesnake						2					

[a] ESA "Species of concern", U.S.F.S. "Sensitive species", and State of Arizona "Wildlife Species of Concern (HDMS 2005).

Appendix D. Number of observations of bird species by University of Arizona (UA) inventory personnel, by survey type, Tuzigoot NM, 2002–2004. Numbers of individuals recorded are not scaled by search effort and should not be used for comparison among species. List also includes species reported on three species lists for the area: Zarki and Zarki (Z&Z; 1981), Johnson and Sogge (J&S; 1995), Von Gausig and Radd (VG&R; 2001). Underlined species are neotropical migrants (Rappole 1995). Species in bold-faced type are non-native.

				UA survey type			Species list			Conservation designation				
Order	Family	Scientific name	Common name	Inci-dental	VCP	Line transect	Z&Z	J&S	VG&R	ESA[a]	USFS[b]	WSCA[c]	APF[d]	USFWS[e]
Anseriformes	Anatidae	*Anser albifrons*	greater white-fronted goose				X	X	X					
		Chen caerulescens	snow goose					X	X					
		Branta canadensis	Canada goose			7	X	X	X					
		Cygnus columbianus	tundra swan				X	X						
		Aix sponsa	wood duck				X	X	X					
		Anas strepera	gadwall				X	X	X					
		Anas americana	American wigeon			16	X	X	X					
		Anas platyrhynchos	mallard	4	12	2	X	X	X					
		Anas discors	blue-winged teal				X	X						
		Anas cyanoptera	cinnamon teal		1	6	X	X	X					
		Anas clypeata	northern shoveler				X	X	X					
		Anas acuta	northern pintail				X	X	X					
		Anas crecca	green-winged teal			4	X	X	X					
		Aythya valisineria	canvasback				X	X	X					
		Aythya americana	redhead				X	X	X					
		Aythya collaris	ring-necked duck			1	X	X	X					
		Aythya affinis	lesser scaup				X	X						
		Bucephala albeola	bufflehead				X	X	X					
		Bucephala clangula	common goldeneye				X	X						
		Lophodytes cucullatus	hooded merganser					X						
		Mergus merganser	common merganser			3	X	X	X					
		Oxyura jamaicensis	ruddy duck				X	X	X					
Galliformes	Odontophoridae	*Callipepla gambelii*	Gambel's quail	50	360	6	X	X	X					
Gaviiformes	Gaviidae	*Gavia immer*	common loon					X						
Podicipediformes	Podicipedidae	*Podilymbus podiceps podiceps*	pied-billed grebe		4	1	X	X	X					
		Podiceps nigricollis	eared grebe				X	X	X					
		Aechmophorus occidentalis	western grebe				X	X	X					
Pelecaniformes	Pelecanidae	*Pelecanus erythrorhynchos*	American white pelican				X	X						
	Phalacrocoracidae	*Phalacrocorax auritus*	double-crested cormorant				X	X	X					
Ciconiiformes	Ardeidae	*Botaurus lentiginosus*	American bittern				X	X				X		
		Ixobrychus exilis	least bittern				X	X	X			X		
		Ardea herodias	great blue heron	1	19	1	X	X	X					
		Ardea alba	great egret	1			X	X	X			X		

				UA survey type			Species list			Conservation designation				
Order	Family	Scientific name	Common name	Inci-dental	VCP	Line transect	Z&Z	J&S	VG&R	ESA[a]	USFS[b]	WSCA[c]	APF[d]	USFWS[e]
Ciconiiformes	Ardeidae	*Egretta thula*	snowy egret				X	X	X			X		
		Egretta caerulea	little blue heron					X						
		Bubulcus ibis	cattle egret						X					
		Butorides virescens	green heron		9		X	X	X					
		Nycticorax nycticorax	black-crowned night-heron	2	5		X	X	X					
	Threskiornithidae	*Plegadis chihi*	white-faced Ibis	16	1		X	X	X	SC	S			
	Cathartidae	*Cathartes aura*	turkey vulture	1	8		X	X	X					
Falconiformes	Accipitridae	*Pandion haliaetus*	osprey	1			X	X	X			X		
		Haliaeetus leucocephalus	bald eagle	1	1	1	X	X	X	LT	S	X		
		Circus cyaneus	northern harrier	2	1		X	X	X					
		Accipiter striatus	sharp-shinned hawk	1		1	X	X	X		S			
		Accipiter cooperii	Cooper's hawk	1	19	1	X	X	X					
		Buteogallus anthracinus	common black-hawk				X	X	X		S	X	X	
		Parabuteo unicinctus	Harris's hawk					X						
		Buteo swainsoni	Swainson's hawk				X	X						
		Buteo albonotatus	zone-tailed hawk	1			X	X	X					
		Buteo jamaicensis	red-tailed hawk	3	8	1	X	X	X					
		Buteo regalis	ferruginous hawk				X	X	X	SC		X		
		Buteo lagopus	rough-legged hawk				X	X						
		Aquila chrysaetos	golden eagle		1		X	X	X					
	Falconidae	*Caracara cheriway*	crested caracara [f]											
		Falco sparverius	American kestrel	1	7	2	X	X	X					
		Falco columbarius	merlin			1	X	X	X					
		Falco peregrinus	peregrine falcon		1			X	X	SC		X		X
		Falco mexicanus	prairie falcon				X	X						
Gruiformes	Rallidae	*Rallus longirostris yumanensis*	Yuma clapper rail						X	LE		X		
		Rallus limicola limicola	Virginia rail		27	2	X	X	X					
		Porzana carolina	sora	1	26	1	X	X	X					
		Gallinula chloropus	common moorhen		20	2	X	X	X					
		Fulica americana	American coot		11	1	X	X	X					
Charadriiformes	Charadriidae	*Charadrius vociferus*	killdeer	1	2		X	X	X					
	Recurvirostridae	*Himantopus mexicanus*	black-necked stilt				X	X	X					
		Recurvirostra americana	American avocet				X	X	X					
	Scolopacidae	*Tringa melanoleuca*	greater yellowlegs				X	X						
		Tringa flavipes	lesser yellowlegs				X	X						
		Tringa solitaria	solitary sandpiper				X	X						
		Catoptrophorus semipalmatus	willet				X	X						
Charadriiformes	Scolopacidae	*Actitis macularia*	spotted sandpiper	1			X	X	X					

				UA survey type			Species list			Conservation designation				
Order	Family	Scientific name	Common name	Inci-dental	VCP	Line transect	Z&Z	J&S	VG&R	ESA[a]	USFS[b]	WSCA[c]	APF[d]	USFWS[e]
		Numenius americanus	long-billed curlew					X						
		Limosa fedoa	marbled godwit					X						
		Calidris mauri	western sandpiper				X	X						
		Calidris minutilla	least sandpiper				X	X						
		Limnodromus scolopaceus	long-billed dowitcher				X	X						
		Gallinago gallinago	common snipe					X	X					
		Phalaropus tricolor	Wilson's phalarope				X	X						
		Phalaropus lobatus	red-necked phalarope					X						
	Laridae	*Larus pipixcan*	Franklin's gull					X						
		Larus philadelphia	Bonaparte's gull					X						
		Larus delawarensis	ring-billed gull				X	X	X					
		Larus californicus	California gull					X						
		Xema sabini	Sabine's gull					X						
		Sterna forsteri	Forster's tern				X	X						
		Chlidonias niger	black tern				X	X						
Columbiformes	Columbidae	*Columba livia*	rock pigeon				X	X	X					
		Zenaida asiatica	white-winged dove		4		X	X	X					
		Steptopelia decaocto	Eurasian collared-dove [f]											
		Zenaida macroura	mourning dove	1	300	2	X	X	X					
		Columbina inca	Inca dove						X					
Cuculiformes	Cuculidae	*Coccyzus americanus occidentalis*	yellow-billed cuckoo	1			X	X	X	C	X	X	X	X
		Geococcyx californianus	greater roadrunner	1			X	X	X					
Strigiformes	Tytonidae	*Tyto alba*	barn owl	1					X					
	Strigidae	*Megascops kennicottii*	western screech-owl	1			X	X						
		Bubo virginianus	great horned owl	1	1		X	X	X					
		Micrathene whitneyi	elf owl				X	X						X
		Asio otus	long-eared owl				X	X						
		Aegolius acadicus	northern saw-whet owl				X	X						
Caprimulgiformes	Caprimulgidae	*Chordeiles acutipennis*	lesser nighthawk		4		X	X	X					
		Chordeiles minor	common nighthawk	1			X	X						
		Phalaenoptilus nuttallii	common poorwill				X	X	X					
Apodiformes	Apodidae	*Chaetura vauxi*	Vaux's swift				X	X						
		Aeronautes saxatalis	white-throated swift				X	X	X					
	Trochilidae	*Archilochus alexandri*	black-chinned hummingbird	2	24		X	X	X					
		Calypte anna	Anna's hummingbird		1	1		X	X					
		Calypte costae	Costa's hummingbird		1			X					X	
Apodiformes	Trochilidae	*Stellula calliope*	calliope hummingbird				X	X						
		Selasphorus platycercus	broad-tailed hummingbird				X	X	X					

				UA survey type			Species list			Conservation designation				
Order	Family	Scientific name	Common name	Inci-dental	VCP	Line transect	Z&Z	J&S	VG&R	ESA[a]	USFS[b]	WSCA[c]	APF[d]	USFWS[e]
		Selasphorus rufus	rufous hummingbird				X	X	X					
Coraciiformes	Alcedinidae	*Ceryle alcyon*	belted kingfisher		7	1	X	X	X			X		
Piciformes	Picidae	*Melanerpes lewis*	Lewis's woodpecker				X	X						
		Melanerpes formicivorus	acorn woodpecker				X	X						
		Melanerpes uropygialis	Gila woodpecker	2	107	1	X	X	X					X
		Sphyrapicus varius	yellow-bellied sapsucker				X							
		Sphyrapicus nuchalis	red-naped sapsucker					X	X					
		Picoides scalaris	ladder-backed woodpecker	1	24	1	X	X	X					
		Picoides villosus	hairy woodpecker				X	X						
		Colaptes auratus	northern flicker		19	1	X	X	X					
Passeriformes	Tyrannidae	*Contopus cooperi*	olive-sided flycatcher					X		SC				
		Contopus sordidulus	western wood-pewee		3		X	X	X					
		Empidonax traillii	willow flycatcher [g]		1		X	X	X			X		
		Empidonax hammondii	Hammond's flycatcher				X	X	X					
		Empidonax wrightii	gray flycatcher		1		X	X	X					
		Empidonax oberholseri	dusky flycatcher					X	X					
		Empidonax difficilis	pacific-slope flycatcher					X						
		Empidonax occidentalis	cordilleran flycatcher					X	X					
		Sayornis nigricans	black phoebe		11	1	X	X	X					
		Sayornis saya	Say's phoebe	1	24	1	X	X	X					
		Pyrocephalus rubinus	vermilion flycatcher				X	X	X					
		Myiarchus tuberculifer	dusky-capped flycatcher		1									
		Myiarchus cinerascens	ash-throated flycatcher		53		X	X	X					
		Myiarchus tyrannulus	brown-crested flycatcher		33		X	X	X					
		Tyrannus vociferans	Cassin's kingbird		52		X	X	X					
		Tyrannus verticalis	western kingbird	1	67		X	X	X					
	Laniidae	*Lanius ludovicianus*	loggerhead shrike			1	X	X	X	SC	X			
	Vireonidae	*Vireo bellii*	Bell's vireo	2	24		X	X	X		X			X
		Vireo vicinior	gray vireo				X	X						
		Vireo plumbeus	plumbeous vireo						X					
		Vireo gilvus	warbling vireo	1			X	X						
	Corvidae	*Cyanocitta stelleri*	Steller's jay				X	X						
		Aphelocoma californica	western scrub-jay		5	1			X					
		Aphelocoma ultramarina	Mexican jay				X	X						
		Gymnorhinus cyanocephalus	pinyon jay				X	X	X					
Passeriformes	Corvidae	*Corvus brachyrhynchos*	American crow		1		X	X						
		Corvus corax	common raven		35	1	X	X	X					
	Hirundinidae	*Progne subis*	purple martin	2			X	X	X				X	

				UA survey type			Species list			Conservation designation				
Order	Family	Scientific name	Common name	Inci-dental	VCP	Line transect	Z&Z	J&S	VG&R	ESA[a]	USFS[b]	WSCA[c]	APF[d]	USFWS[e]
		Tachycineta bicolor	tree swallow		3		X	X	X					
		Tachycineta thalassina	violet-green swallow		50		X	X	X					
		Stelgidopteryx serripennis	northern rough-winged swallow		177	3	X	X	X					
		Riparia riparia	bank swallow				X	X	X					
		Petrochelidon pyrrhonota	cliff swallow		22		X	X	X					
		Hirundo rustica	barn swallow		2		X	X	X					
	Paridae	*Baeolophus wollweberi*	bridled titmouse				X	X	X					
		Baeolphus ridgwayi	juniper titmouse				X	X						
	Remizidae	*Auriparus flaviceps*	verdin		18	2	X	X	X					
	Aegithalidae	*Psaltriparus minimus*	bushtit		21		X	X	X					
	Sittidae	*Sitta carolinensis*	white-breasted nuthatch				X	X	X					
	Certhiidae	*Certhia americana*	brown creeper			1	X	X						
	Troglodytidae	*Campylorhynchus brunneicapillus*	cactus wren			1								
		Salpinctes obsoletus	rock wren		12	1	X	X	X					
		Catherpes mexicanus	canyon wren		4		X	X	X					
		Thryomanes bewickii	Bewick's wren		89	2	X	X	X					
		Troglodytes aedon	house wren				X	X	X					
		Troglodytes troglodytes	winter wren						X					
		Cistothorus palustris	marsh wren	1	4	1	X	X	X					
	Regulidae	*Regulus calendula*	ruby-crowned kinglet			1	X	X	X					
		Polioptila caerulea	blue-gray gnatcatcher		5		X	X	X					
		Polioptila melanura	black-tailed gnatcatcher		1			X						
	Turdidae	*Sialia mexicana*	western bluebird			8	X	X	X					
		Sialia currucoides	mountain bluebird			4	X	X	X					
		Myadestes townsendi	Townsend's solitaire			1	X	X	X					
		Catharus ustulatus	Swainson's thrush					X						
		Catharus guttatus	hermit thrush				X	X	X					
		Turdus migratorius	American robin			1	X	X	X					
	Mimidae	*Mimus polyglottos*	northern mockingbird		48		X	X	X					
		Oreoscoptes montanus	sage thrasher				X	X	X					
		Toxostoma bendirei	Bendire's thrasher				X	X						
		Toxostoma crissale	crissal thrasher	1	8	1	X	X	X					X
		Toxostoma lecontei	Le Conte's thrasher				X							
	Sturnidae	*Sturnus vulgaris*	European starling		1		X	X	X					
Passeriformes	Motacillidae	*Anthus rubescens*	American pipit				X	X	X					
	Bombycillidae	*Bombycilla cedrorum*	cedar waxwing				X	X	X					
	Ptilogonatidae	*Phainopepla nitens*	phainopepla		341		X	X	X					
	Parulidae	*Vermivora celata*	orange-crowned warbler		1		X	X	X					

				UA survey type			Species list			Conservation designation				
Order	Family	Scientific name	Common name	Inci-dental	VCP	Line transect	Z&Z	J&S	VG&R	ESA[a]	USFS[b]	WSCA[c]	APF[d]	USFWS[e]
		Vermivora ruficapilla	Nashville warbler				X	X						
		Vermivora virginiae	Virginia's warbler		1		X	X	X					
		Vermivora luciae	Lucy's warbler		53		X	X	X				X	
		Dendroica petechia	yellow warbler		14		X	X	X					
		Dendroica caerulescens	black-throated blue warbler				X	X						
		Dendroica coronata	yellow-rumped warbler			1	X	X	X					
		Dendroica nigrescens	black-throated gray warbler				X	X						
		Dendroica townsendi	Townsend's warbler				X	X	X					
		Dendroica occidentalis	hermit warbler				X	X						
		Seiurus noveboracensis	northern waterthrush				X	X						
		Oporornis tolmiei	MacGillivray's warbler	1			X	X	X					
		Geothlypis trichas	common yellowthroat	1	152		X	X	X					
		Wilsonia pusilla	Wilson's warbler	1	4		X	X	X					
		Cardellina rubrifrons	red-faced warbler				X	X						
		Myioborus pictus	painted redstart				X	X						
		Icteria virens	yellow-breasted chat		87		X	X	X					
	Thraupidae	*Piranga rubra*	summer tanager		44		X	X	X					
		Piranga ludoviciana	western tanager		3		X	X	X					
	Emberizidae	*Pipilo chlorurus*	green-tailed towhee	1			X	X	X					
		Pipilo maculatus	spotted towhee		1	1	X	X	X					
		Pipilo fuscus	canyon towhee	1	1		X	X	X					
		Pipilo aberti	Abert's towhee	2	93	1	X	X	X					
		Aimophila ruficeps	rufous-crowned sparrow				X	X	X					
		Spizella passerina	chipping sparrow				X	X	X					
		Spizella breweri	Brewer's sparrow		1		X	X	X					
		Passerculus sandwichensis	savannah sparrow				X	X	X					
		Pooecetes gramineus	vesper sparrow				X	X	X					
		Melospiza lincolnii	Lincoln's sparrow		1	3	X	X	X					
		Chondestes grammacus	lark sparrow		1		X	X	X					
		Amphispiza bilineata	black-throated sparrow		10		X	X	X					
		Amphispiza belli	sage sparrow				X	X						
		Calamospiza melanocorys	lark bunting				X	X						
		Melospiza melodia	song sparrow	1	104	12	X	X	X					
Passeriformes	Emberizidae	*Zonotrichia albicollis*	white-throated sparrow				X	X						
		Zonotrichia leucophrys	white-crowned sparrow		6	7	X	X	X					
		Junco hyemalis	dark-eyed junco			20	X	X	X					
	Cardinalidae	*Cardinalis cardinalis*	northern cardinal		57	1	X	X	X					
		Pheucticus melanocephalus	black-headed grosbeak		2		X	X	X					

				UA survey type			Species list			Conservation designation				
Order	Family	Scientific name	Common name	Inci-dental	VCP	Line transect	Z&Z	J&S	VG&R	ESA[a]	USFS[b]	WSCA[c]	APF[d]	USFWS[e]
		Passerina caerulea	blue grosbeak		50		X	X	X					
		Passerina amoena	lazuli bunting		6		X	X	X					
		Passerina cyanea	indigo bunting				X	X	X					
	Icteridae	*Agelaius phoeniceus*	red-winged blackbird		491	10	X	X	X					
		Sturnella magna lilianae	eastern meadowlark						X					
		Sturnella neglecta	western meadowlark			1	X	X	X					
		Xanthocephalus xanthocephalus	yellow-headed blackbird		1		X	X	X					
		Euphagus cyanocephalus	Brewer's blackbird		1	300	X	X	X					
		Quiscalus quiscula	common grackle		1									
		Quiscalus mexicanus	great-tailed grackle		73	1	X	X	X					
		Molothrus aeneus	bronzed cowbird					X						
		Molothrus ater	brown-headed cowbird		147		X	X	X					
		Icterus cucullatus	hooded oriole		12		X	X	X					
		Icterus bullockii	Bullock's oriole	1	83		X	X	X					
		Icterus parisorum	Scott's oriole		1		X	X	X					
	Fringillidae	*Carpodacus purpureus*	purple finch				X							
		Carpodacus cassinii	Cassin's finch					X	X					
		Carpodacus mexicanus	house finch	2	163	1	X	X	X					
		Loxia curvirostra	red crossbill						X					
		Carduelis pinus	pine siskin				X	X	X					
		Carduelis psaltria	lesser goldfinch		41	1	X	X	X					
		Carduelis lawrencei	Lawrence's goldfinch					X						
		Carduelis tristis	American goldfinch				X	X	X					
		Coccothraustes vespertinus	evening grosbeak				X	X						
	Passeridae	*Passer domesticus*	house sparrow				X	X	X					

[a] Endangered Species Act designations: "LE" = Endangered; "LT" = Threatened; "SC" = "Species of Concern"; "C" = Candidate for listing. U.S. Fish and Wildlife Service (HDMS 2004).
[b] "Sensitive species"; U.S.D.A. Forest Service (HDMS 2004).
[c] "Wildlife of Special Concern"; Arizona Game and Fish Department (HDMS 2004).
[d] "Priority species"; Arizona Partners in Flight (Latta et al. 1999).
[e] "Bird of conservation concern"; U.S. Fish and Wildlife Service (USFWS 2002).
[f] Doug Von Gausig, *pers. comm.* Seen in May (crested caracara) and September (Eurasian collared dove) 2005. Eurasian collared dove has been seen around Clarkdale for about three years.
[g] Southwestern subspecies (*E. t. traillii*) has been recorded as nesting near the monument. See text for more information.

Appendix E. Number of observations of mammals by University of Arizona (UA) inventory personnel, by survey type, Tuzigoot NM, 2002–2004. List also includes species documented during trapping and acoustic surveys by Bucci and Petryszyn (B&P; 2004) and a specimen located at the Western Archeological Conservation Center (WACC). Underlined species indicate that we obtained voucher specimen(s) and/or photograph(s)[a]. Species in bold-faced type are non-native.

				UA Survey Type				
Order	Family	Scientific name	Common name	Small mammal trapping	Trail-master	Incid-ental	B&P	WACC
Insectivora	Soricidae	*Notiosorex crawfordi*	Crawford's desert shrew			3[b]		
Chiroptera	Vespertilionidae	*Myotis occultus*	Arizona myotis				X	
		Myotis yumanensis	Yuma myotis				X	
		Myotis auriculus	southwestern myotis				X	
		Myotis velifer	cave myotis				X	
		Myotis thysanodes	fringed myotis				X	
		Myotis californicus	California myotis				X	
		Myotis ciliolabrum	western small-footed myotis				X	
		Pipistrellus hesperus	western pipistrelle				X	
		Eptesicus fuscus	big brown bat				X	
		Lasiurus blossevillii	western red bat				X	
		Lasiurus cinereus	hoary bat				X	
		Corynorhinus townsendii	Townsend's big-eared bat				X	
		Antrozous pallidus	pallid bat				X	
	Molossidae	*Tadarida brasiliensis*	Brazilian free-tailed bat				X	
		Nyctinomops femorosaccus	pocketed free-tailed bat				X	
		Nyctinomops macrotis	big free-tailed bat				X	
Carnivora	Ursidae	*Ursus americanus*	American black bear			1		
	Procyonidae	*Procyon lotor*	northern raccoon			1		
	Mustelidae	*Lontra canadensis*	river otter			2		
	Mephitidae	*Mephitis mephitis*	striped skunk		7	2		
		Canis latrans	coyote		1			
		Urocyon cinereoargenteus	common gray fox		4			
	Felidae	*Puma concolor*	mountain lion			2		
		Lynx rufus	bobcat		1			
Rodentia	Sciuridae	*Spermophilus variegatus*	rock squirrel		2	1		
		Ammospermophilus harrisii	Harris' antelope squirrel			1		
	Geomyidae	*Thomomys bottae*	Botta's pocket gopher			5		
	Heteromyidae	*Dipodomys ordii*	Ord's kangaroo rat	5		3		
	Castoridae	*Castor canadensis*	American beaver			2		
	Muridae	*Reithrodontomys megalotis*	western harvest mouse	3		7[b]		
		Peromyscus eremicus	cactus mouse	15		1[b]		
		Peromyscus maniculatus	deer mouse	37		10[b]		
		Peromyscus leucopus	white-footed mouse	2				
		Peromyscus boylii	brush mouse	1				
		Neotoma albigula	western white-throated	1				
Lagomorpha	Leporidae	*Lepus californicus*	black-tailed jackrabbit			1		
		Sylvilagus species	unknown cottontail[c]			5		
Artiodactyla	Bovidae	*Bos taurus*	domestic cattle		2	1		
	Tayassuidae	*Pecari tajacu*	collared peccary		7	1		
	Cervidae	*Odocoileus hemionus*	mule deer					X
		Odocoileus virginianus	white-tailed deer			3		
Number of species				7	8	19		

[a] See Appendix H for additional information.

[b] Caught in pitfall trap for reptiles and amphibians.

[c] Either a desert or eastern cottontail.

APPENDIX E—FLOODPLAIN STATEMENT OF FINDINGS

National Park Service
Department of Interior
Tuzigoot National Monument
Clarkdale, Yavapai County, AZ

STATEMENT OF FINDINGS
EXECUTIVE ORDER 11988: Floodplain Management
Tavasci Marsh Management and Habitat Enhancement Plan

Recommended:

_____ _____
Superintendent, Montezuma Castle and Tuzigoot National Monuments — Date

Certified for Technical Adequacy and Servicewide Consistency:

_____ _____
Chief, WASO Water Resources Division — Date

Approved:

_____ _____
Director, Intermountain Region — Date

INTRODUCTION

Executive Order 11988, Floodplain Management, requires the NPS and other federal agencies to evaluate the likely impacts of actions in the floodplains. NPS Director's Order #77-2 Floodplain Management and Procedural Manual #77-2 provide NPS policies and procedures for complying with Executive Order 11988. This Statement of Findings (SOF) documents compliance with these NPS floodplain management procedures.

SITE DESCRIPTION

Tavasci Marsh and Peck's Lake are located on an ancient oxbow of the Verde River which was abandoned by the river approximately 10,000 years ago. The marsh is primarily fed by a complex of springs along the base of the cliffs, including Shea Springs. When Peck's Lake receives water from the Verde River through a temporary dam structure, water can flow through the Peck's Lake outlet into Tavasci Marsh in the north.

Federal Emergency Management Agency (FEMA) Flood Insurance Rate maps show that the water control structures, boardwalk, trails, and UTV-rated bridge are within the Zone A or AE 100-year floodplain (see Figure 1). The floodplain is located in the marsh area, and is subject to low grade velocities from the Verde River (slack water). The southern part of the floodplain is also prone to flooding from the eastern canyon near the center of the marsh (see Figure 1). Flooding from this canyon likely caused the existing footbridge to shift in summer 2010 and become unsafe for passage.

PROPOSED ACTIONS

The Preferred Alternative (Alternative C) in the Tavasci Marsh Management and Habitat Enhancement Plan/Environmental Assessment focuses on changing the hydrologic regime of the northern part of the marsh by adding water control structures to the marsh to allow manipulations of marsh water levels seasonally. The proposed area for the adaptively flooded/dried areas would be north of the old roadbed (see Figure 2), and the water control structures would tie into the roadbed. (For clarification, "northern marsh" refers to the marsh located above the old road, while "southern marsh area" refers to the marsh located below the old road. The management of the marsh was divided in this way primarily due to the water storage rights of the National Park Service being tied to the northern marsh and not the southern marsh. Due to lack of water storage rights tied to the southern marsh, no water control structures were allowed in the southern marsh.)

The water control structures for the northern marsh would be constructed so that maximum water surface would be similar to the current existing water levels (the stored amount of water is related to the park's existing water rights). The water elevation change allowed by the structures would be approximately a 6-feet elevation change. This would allow periodic flooding and drying of the marsh to maintain the open water and target native vegetation habitats. Maximum water surface elevations, for example, would be manipulated to establish marsh vegetation in the higher marsh elevations.

To avoid having the water control structures become overtopped (as Arizona Game and Fish Department control structures were in the 1990's), a water conveyance channel would also be constructed on the western edge of the southern marsh. The southern marsh is currently two feet

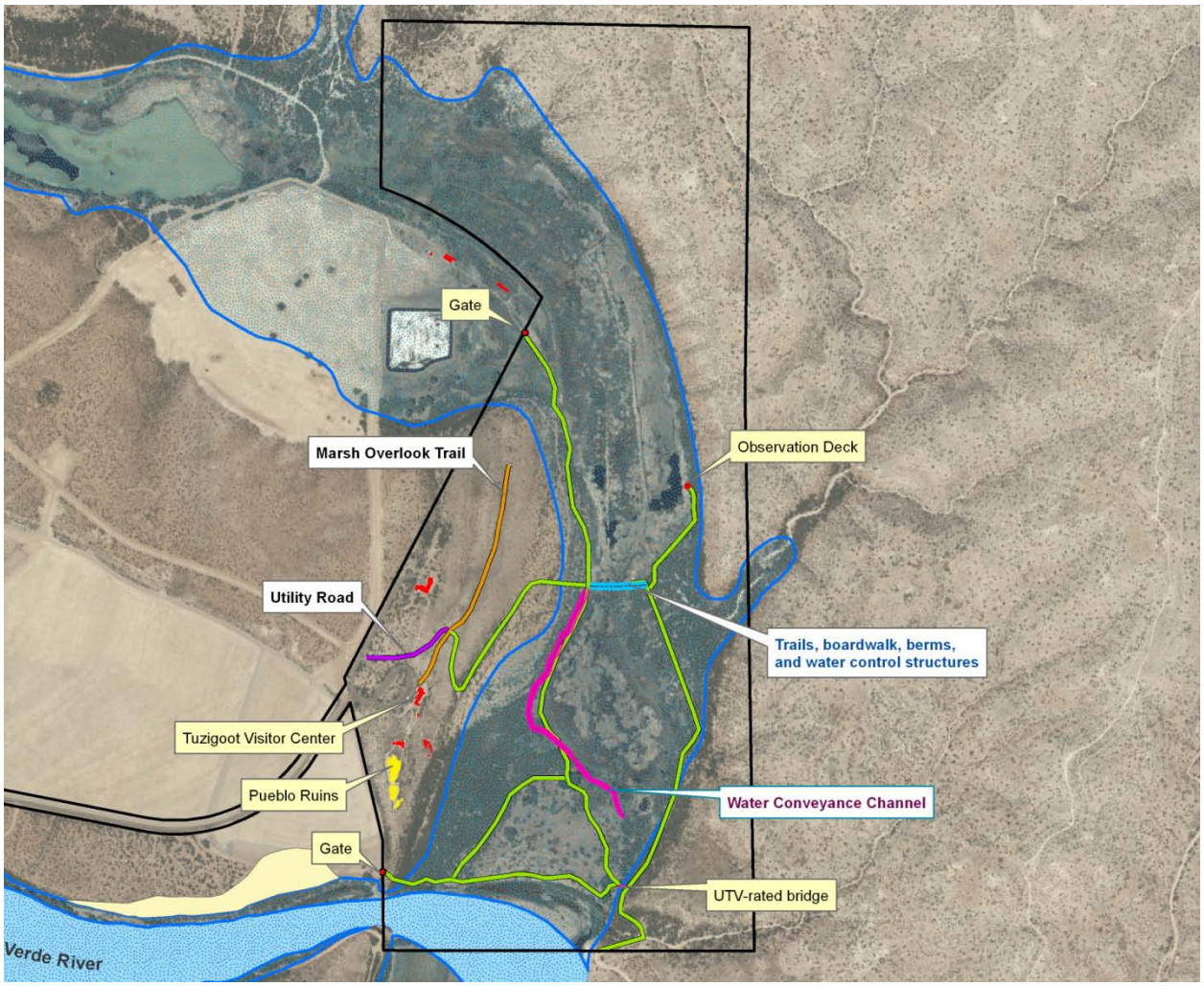

Figure 1. Location Zone A, the 100-year-flood floodplain is outlined in blue stipple, with a clear background showing the vegetation underneath. The proposed water controls structures, trails, boardwalk, water conveyance channel, and bridge are all located within the 100-year-flood floodplain. The water conveyance also has a parallel trail.

lower than the northern marsh and slowly conveys water. This water conveyance channel would provide a way to drain the northern marsh when necessary and prevent marsh waters south of the road from backing up and overtopping the berm and water control structures, as overtopping would render the water control structures inoperable. The water conveyance channel for the south part of the marsh would begin at the northern marsh's water control structures, extend along western edge of the southern part of the marsh, and end north of the future UTV-rated bridge, approximately 1915 feet in length (see Figure 1).

The actual structure of the channel would be a 5 to 7-feet deep open ditch ranging between 25 and 30 feet wide depending on the topography, with a 3-feet wide bottom, and around 1915 feet in length (see Figure 3). The bottom of the channel would intercept groundwater, and still essentially be wetland, although it would be maintained as a ditch. At the southern end of the channel would be a drain/overflow structure to prevent entirely draining the southern marsh. A trail/maintenance road would also be created in the upland on the western side of the water

Figure 2. Location of old road (see red arrow) through the marsh where future water control structures, berms, trails, and boardwalk will be placed. Photo from 1987.

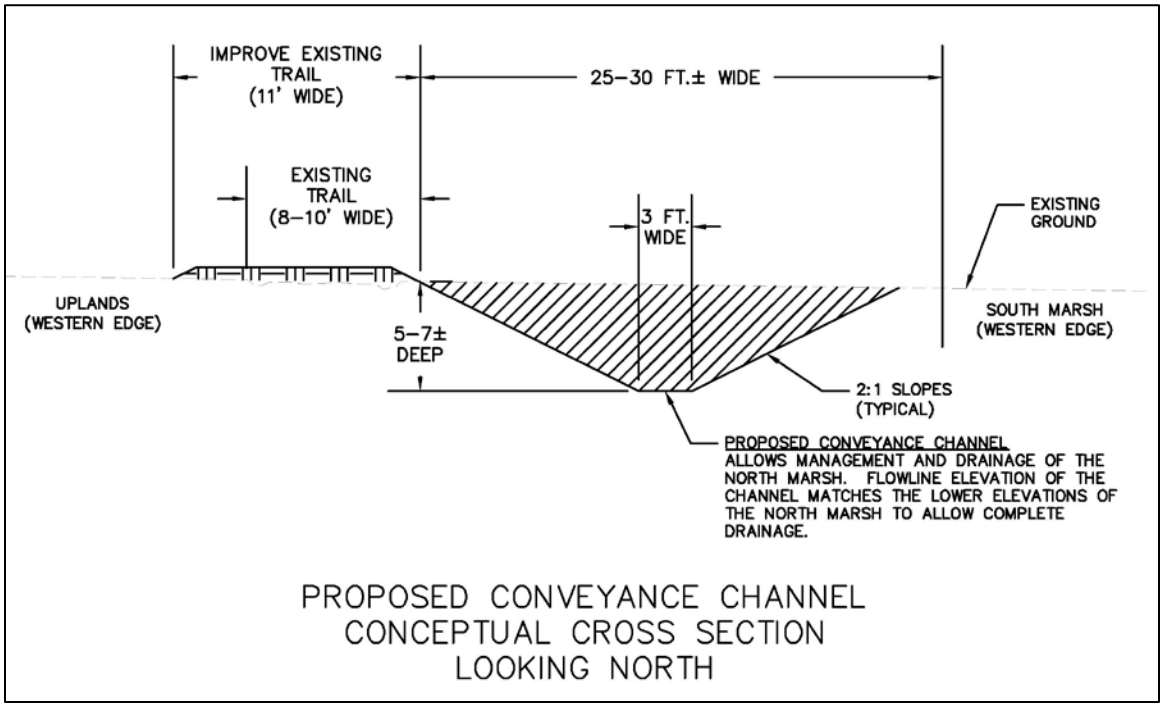

Figure 3. Schematic drawing of the proposed conveyance channel in the south part of the marsh.

conveyance ditch and marsh, initially following the existing marsh trail for approximately 1230 feet (see Figure 1). The existing trail would be upgraded, hardened, and widened an additional one to three feet to support heavy equipment needed to clear out the conveyance channel periodically. This utility road/trail would follow along the existing trail for approximately 1230 feet, and a new segment of the road/trail would extend east into the marsh paralleling the conveyance channel for another 685 feet approximately (totaling 1915 feet). This hardened trail, paralleling the water conveyance channel, would be wide enough to accommodate heavy equipment to clear out vegetation and sedimentation from the ditch when necessary (see Figures 1 and 3).

Without a water conveyance channel in the southern marsh, beaver activity could increase southern marsh water levels and limit the effectiveness of the upstream water control structures (mirroring what happened to the overtopped, non-functioning AGFD structures currently in the marsh). This water conveyance channel ditch would need to be maintained every one to three years to ensure that vegetation growth and sediments do not clog the channel.

Floating islands of cattails currently located in the marsh would be removed to create open water habitat (approximately five acres). Fill for creating microtopography along the edges of the marsh (approximately 18,500 cubic yards) would be taken from upland western areas as well as from soils excavated from the water conveyance channel in the southern marsh area. Soil for fill dirt would potentially supplemented with outside, weed-free fill if necessary. Habitat islands or peninsulas would also be created. These newly elevated areas would be revegetated with native marsh plants to create a mosaic of habitat types in the marsh, focusing on species from riparian, wet/moist grassland, wet/moist meadow, and bulrush communities.

Removal of cattail material and construction of the water control structures would require temporary breach of beaver dams and drainage of the marsh so that equipment can access the interior of the northern marsh. Drainage of the marsh would take at least one month, and water from the northern marsh would be drained from the south marsh into the water conveyance channel. Drainage and construction would be timed to minimize impacts to aquatic fauna and breeding birds. All construction activities would be concluded prior to onset of growing and nesting season.

Relatively precise control of water level elevations and timing of changes to elevation would provide a long-term tool for vegetation management and reduce the need to rely on more invasive strategies such as herbicides, fire, or excavation. Periodic, adaptive management of water levels in the northern marsh would maintain plant communities of the wet/moist grasslands and the wet/moist meadows through occasional flooding and drying. Seasonally adjusted flows would be managed to discourage establishment of cattail in the deepest portions of the northern marsh and to maintain heterogeneous, hydric soil moisture regimes for the upper elevations of the marsh. Preventing long-term inundation of higher wetland elevations would limit the establishment of cattails and promote the growth of a variety of wetland plants.

Recreation for the marsh would occur throughout the edges along the existing, surrounding trails, and would also extend into the marsh proper. A boardwalk and a viewing platform would be built in the marsh to allow visitors to enter into the marsh. These structures would likely be

located on a berm/berms near the water control structures. The water control structures would be tied to the existing road bed (currently flooded).

Trails known to be periodically flooded would be rerouted onto drier ground. Trails would be hardened and delineated as needed to prevent social trails from developing, in addition to the utility vehicle trail paralleling the water conveyance channel in the south marsh. The footbridge, located in the southern part of the marsh connecting the eastern and western trails (see Figure 1), would be upgraded to be able to support UTV travel (UTV-use would only be for administrative purposes). The berm, water control structures, and boardwalk area would also provide a route for vehicles or foot traffic across the marsh to facilitate maintenance and access between Tuzigoot National Monument and neighboring Dead Horse State Park, creating a loop trail system (see Figure 1).

Bicycle use in the marsh would be allowed on a designated trail for the southern part of the marsh to allow connection between Dead Horse Ranch State Park on the east side of the monument and Verde River Greenway State Natural Area on the west side of the monument. This trail would be clearly signed and extend from the gate on the east side located at the base of the Tuzigoot Ridge (adjoining the Verde River Greenway) to the upgraded footbridge, and extend south to connect with Dead Horse Ranch State Park. Allowing bikes on the designated trail in the monument would be considered a new use within the park unit and would require special promulgation through rulemaking.

JUSTIFICATION FOR USE IN THE FLOODPLAIN

The project proposes to place water control structures, trails, and a boardwalk along an existing abandoned roadway. The water control structures are necessary within the floodplain to control the hydrology in the northern marsh. Trails and boardwalks would be built within the floodplain to allow visitors to enjoy viewing marsh wildlife and experience the marsh.

In the southern part of the marsh; a water conveyance channel, utility road/trail paralleling the water conveyance channel, and a bridge sturdy enough to support a utility vehicle are proposed to be built within the floodplain. The water conveyance channel also must be built in the floodplain in order to provide the function for draining the northern marsh, as well as preventing the southern marsh waters from rising and overtopping the water control structures. The utility road/trail must be constructed parallel to the water conveyance channel because heavy equipment would be necessary on a two to three year basis to clean out the channel for vegetation and siltation. The UTV-rated bridge would cross the Tavasci Marsh outlet ditch in the floodplain to provides connection between the east and west trails of the marsh.

Alternative sites are not available for these structures—the marsh hydrology cannot be controlled outside of the marsh, and structures such as the trails and boardwalks must be built within the marsh to have visitors be able to access the marsh. The water conveyance channel (and corresponding utility road/trail) is necessary within the floodplain because it is directly linked to draining the northern and southern parts of the marsh, and cannot be built outside of the floodplain. The UTV-rated bridge is necessary to cross over the ditch, and cannot be built outside of the floodplain area.

DESCRIPTION OF SITE-SPECIFIC FLOOD RISK

Flooding occurs regularly within the floodplain. It has been observed that the eastern canyon delivers water and sediments into the marsh at least once or twice during the monsoon season. The Verde River has risen above its banks around every five years, reaching up to the old road in the middle of the marsh approximately every decade.

There is adequate warning time in the event of flooding, because high levels of precipitation typically cause the flooding in the canyon, and extensive days of precipitation trigger the Verde River flooding north into the marsh. Furthermore, high water levels for the Verde River can easily be observed upstream and can be followed through the on-line USGS stream gage station just north of Clarkdale (USGS Gage 09504000). Should evacuation of the site be necessary in the event of flooding, visitors and park staff would be able to use the marsh access road on the western side, or the Dead Horse Ranch State Park marsh access road on the eastern/southern side.

For the Verde River, flood flows begin to spill over the sandy riverbanks around a five-year event and spread toward the existing trails. For the eastern canyon, the sediment and waters from the canyon typically diffuse at the canyon mouth, although water can run down to the Tavasci Marsh outlet ditch with significant velocity, enough to dislodge a footbridge. Flooding from this canyon likely caused the existing footbridge to shift in summer 2010 and become unsafe for passage.

FLOODPLAIN MITIGATION

Protection of Human Life—Tavasci Marsh only has visitor use from dawn to dusk, and overnight use is prohibited. Were flooding to occur on the Verde River, rangers would be able to warn visitors with ample time to avoid the flood due to the on-line nature of Verde River gage north of Clarkdale registering high flood levels. Flooding occurrance within the canyon has not affected current visitor use on the trail leading to the existing observation deck on the eastern side, and is not expected to affect visitor use in the proposed project.

Protection of Capital Investment—The water control structures would be anchored into the existing roadbed and unlikely to be affected by flood events. The boardwalk, water conveyance channel, and trails may be subject to flooding, but would be replaced as needed. The UTV-rated bridge would likely be the most expensive single structure in the floodplain area. The previous footbridge that was dislodged during the flood event from the eastern canyon was 14 feet in length. The new bridge is proposed to be 40 feet in length with concrete abutments to secure the bridge better during flood events.

Protection of Floodplain Resource Values—The structures tied to the existing road bed—the water control structures, the trail across the berm(s), and the boardwalk are not expected to impact floodplain resource values. The water channel conveyance in the south marsh is also not expected to have substantial, detrimental effects on floodplain values. The bridge would be above-ground, stabilized by concrete abutments, not piers, and should not affect floodplain resources and values. Care will be exercised in the design and placement of the water conveyance channel so as not to affect groundwater conditions.

CONCLUSION

The National Park Service concludes that there are no practical alternatives for placing the water control structures, trails, water conveyance channel, conveyance channel maintenance road/trail, and the UTV-rated bridge outside of the floodplain. The preferred alternative would increase wetland function and enhance wildlife habitat in the northern marsh by adaptively managing the hydrology in the north part of the marsh, which must place water control structures and a water conveyance channel in the floodplain. The visitor-use trails, boardwalk, and bridges are to expand recreational opportunities of the marsh and by definition must be located within the marsh and floodplain. Mitigation and compliance with regulations and policies to prevent impacts to water quality, floodplain values, and loss of property or human life would be strictly adhered to during and after the construction. Individual permits with other federal and cooperating state and local agencies would be obtained prior to construction activities. No long-term adverse impacts to floodplain resources would occur from the Preferred Alternative. Therefore, the National Park Service finds the Preferred Alternative to be acceptable under Executive Order 11988 for the protection of floodplains.

APPENDIX F—CONSULTATION LETTERS

United States Department of the Interior

U.S. Fish and Wildlife Service
Arizona Ecological Services Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 Fax: (602) 242-2513

In reply refer to:

AESO/SE
22410-2011-TA-0028

December 16, 2010

Memorandum

To: Superintendent, Montezuma Castle and Tuzigoot Monuments, Camp Verde, Arizona

From: Field Supervisor

Subject: Tavasci Marsh Management and Habitat Enhancement Plan

Thank you for your November 15, 2010, letter regarding your intent to prepare an environmental assessment and a comprehensive management plan for Tavasci Marsh, Tuzigoot National Monument, Yavapai County, Arizona. Specifically, you requested a current list of federally-listed, proposed, and candidate species; designated and proposed critical habitat; and other species of concern that may inhabit the project area. We received your request for a species list on November 19, 2010.

Based on the description of the project area, the following listed and proposed species and designated or proposed critical habitat may occur in the area: the experimental non-essential population (treated as a proposed threatened species) of Colorado pikeminnow (*Ptychocheilus lucius*), the endangered razorback sucker (*Xyrauchen texanus*) and its critical habitat, the endangered southwestern willow flycatcher (*Empidonax traillii extimus*), the threatened spikedace (*Meda fulgida*) and its proposed critical habitat, proposed critical habitat for the threatened loach minnow (*Tiaroga cobitis*), the candidate northern Mexican gartersnake (*Thamnophis eques megalops*), the candidate Page springsnail (*Pyrgulopsis morrisoni*), the candidate roundtail chub (*Gila robusta*), the candidate yellow-billed cuckoo (*Coccyzus americanus*), and the endangered Yuma clapper rail (*Rallus longirostris yumanensis*).

The State of Arizona and some Native American tribes protect some plant and animal species not protected by Federal law. We recommend you contact the Arizona Game and Fish Department and the Arizona Department of Agriculture for State-listed or sensitive species, or contact the appropriate Native American tribe to determine if sensitive species are protected by tribal governments in your project area. We further recommend that you invite the Arizona Game and Fish Department and any Native American tribes in or near your project area to participate in the informal or formal section 7 consultation process.

For additional communications regarding this project, please refer to consultation number 22410-2010-TA-0028. We look forward to assisting you with the development and implementation of this project. If you have any questions in regard to this project, please contact Shaula Hedwall at (928) 226-0614 (x103) or Brenda Smith (x101) of our Flagstaff Suboffice.

Brenda H. Smith

for Steven L. Spangle

cc: (electronic)
Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Regional Supervisor, Arizona Game and Fish Department, Flagstaff, AZ
Chief of Natural Resources Management, National Park Service, Camp Verde, AZ

W:\Brenda Smith\Tavasci Marsh Mgmt & Habitat Enhancement Plan Spp Letter.docx: jkey

THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
5000 W. CAREFREE HIGHWAY
PHOENIX, AZ 85086-5000
(602) 942-3000 • WWW.AZGFD.GOV

December 28, 2010

Kathy Davis
National Park Service
Montezuma Castle and Tuzigoot National Monuments
5727 S. Main St.
PO box 219
Camp Verde, AZ 86322

Re: TUZI-L7615
Tavasci Marsh Management and Habitat Enhancement Plan/Environmental Assessment

Dear Ms Davis:

The Arizona Game and Fish Department (Department) has reviewed your Request for List of State Species of Concern dated December 6, 2010. A review of our HDMS Data Base identified Multiple Listed Threatened or Endangered species and Designated Critical Habitrat within 3 miles of your project site (see attached list). **We recommend you contact the U.S. Fish and Wildlife Service regarding the potential impacts of your project on these species and habitats.**

The Department's HDMS data are not intended to include potential distribution of special status species. Arizona is large and diverse with plants, animals, and environmental conditions that are ever changing. Consequently, many areas may contain species that biologists do not know about or species previously noted in a particular area may no longer occur there. Not all of Arizona has been surveyed for special status species, and surveys that have been conducted have varied greatly in scope and intensity.

The Department appreciates the opportunity to provide comments early in the planning and design stages of the proposed project. We would like to continue this coordinated effort and offer additional site-specific guidance that will help conserve wildlife and their habitats, including sensitive, threatened, non-game and game species. If you have any questions regarding this letter, please contact me at 623 236-7513.

Sincerely,

Daniel E. Nelson
Project Evaluation Specialist
Cc: Trevor Buhr, AGFD; Debra Bills USFWS
M10-12091751

Special Status Species 3 mile buffer
Tavasci March

COMMON NAME	NAME	FWS	USFS	BLM	STATE
10J area for Colorado pikeminnow	Ptychocheilus lucius				
Arizona Myotis	Myotis occultus	SC			
Bald Eagle - Sonoran Desert area Population	Haliaeetus leucocephalus pop. 3	LT,DPS, BGA	S	S	WSC
Bald Eagle - Winter Population	Haliaeetus leucocephalus (wintering pop.)	SAT, BGA	S	S	WSC
Big Free-tailed Bat	Nyctinomops macrotis	SC			
Camp Verde Indian Reservation	Camp Verde Indian Reservation				
Common Black-Hawk	Buteogallus anthracinus		S	S	WSC
Desert Sucker	Catostomus clarkii	SC	S	S	
Designated Critical Habitat for razorback sucker	CH for Xyrauchen texanus				
Designated Critical Habitat for spikedace	CH for Meda fulgida				
Gila Longfin Dace	Agosia chrysogaster chrysogaster	SC	S	S	
Lowland Leopard Frog	Rana yavapaiensis	SC	S	S	WSC
Maricopa Tiger Beetle	Cicindela oregona maricopa	SC			
Narrow-headed Gartersnake	Thamnophis rufipunctatus	SC	S	S	WSC
Northern Mexican Gartersnake	Thamnophis eques megalops	C	S		WSC
Pale Townsend's Big-eared Bat	Corynorhinus townsendii pallescens	SC	S	S	
Razorback Sucker	Xyrauchen texanus	LE			WSC
Ripley Wild-buckwheat	Eriogonum ripleyi	SC	S		SR
Roundtail Chub	Gila robusta	C	S	S	WSC
Sonora Sucker	Catostomus insignis	SC	S	S	
Southwestern Willow Flycatcher	Empidonax traillii extimus	LE			WSC
Tonto Basin Agave	Agave delamateri	SC	S		HS
Verde Valley Sage	Salvia dorrii ssp. mearnsii	SC	S		SR
Western Red Bat	Lasiurus blossevillii		S	S	WSC
Western Small-footed Myotis	Myotis ciliolabrum	SC			
Wildlife Corridor	Munds Mountain - Black Hills Linkage Design				
Yellow-billed Cuckoo (Western U.S. DPS)	Coccyzus americanus	C	S		WSC
	Bat Colony				