Environmental Assessment

Funding Assistance for the Town of Superior Queen Creek Riparian Restoration

Prepared for:

U.S. Department of the Interior
Bureau of Reclamation
Phoenix Area Office
Phoenix, Arizona

Prepared by:

Jones & Stokes

November 2002

Environmental Assessment

Funding Assistance for the Town of Superior Queen Creek Riparian Restoration

Prepared for:

U.S. Bureau of Reclamation
P.O. Box 81169
Phoenix, AZ 85021-2801
Contact: John McGlothlen
602/216-3866

Prepared by:

Jones & Stokes
340 East Palm Lane, Suite A275
Phoenix, AZ 85004
Contact: Jeff Connell, AICP
602/256-6662 ext. 111

November 2002

Prepared under subcontract to CH2M Hill

Contents

Tables

Figures

Appendices

Chapter 1

Purpose and Need

1.1 Introduction

The U.S. Bureau of Reclamation (Reclamation) is proposing to provide federal funding assistance to the Town of Superior, Arizona (Figure 1-1) for the purpose of implementing several actions related to riparian restoration along Queen Creek. The funding would be provided under Reclamation's wetland program. Because the issuance of funding is a federal action, Reclamation is required to conduct an environmental impact analysis and prepare documentation for the purpose of complying with the National Environmental Policy Act (NEPA). This environmental assessment (EA) has been prepared in accordance with NEPA, the Council on Environmental Quality regulations (40 CFR 1500–1508), and the Reclamation NEPA Handbook. Reclamation is the lead federal agency pursuant to NEPA.

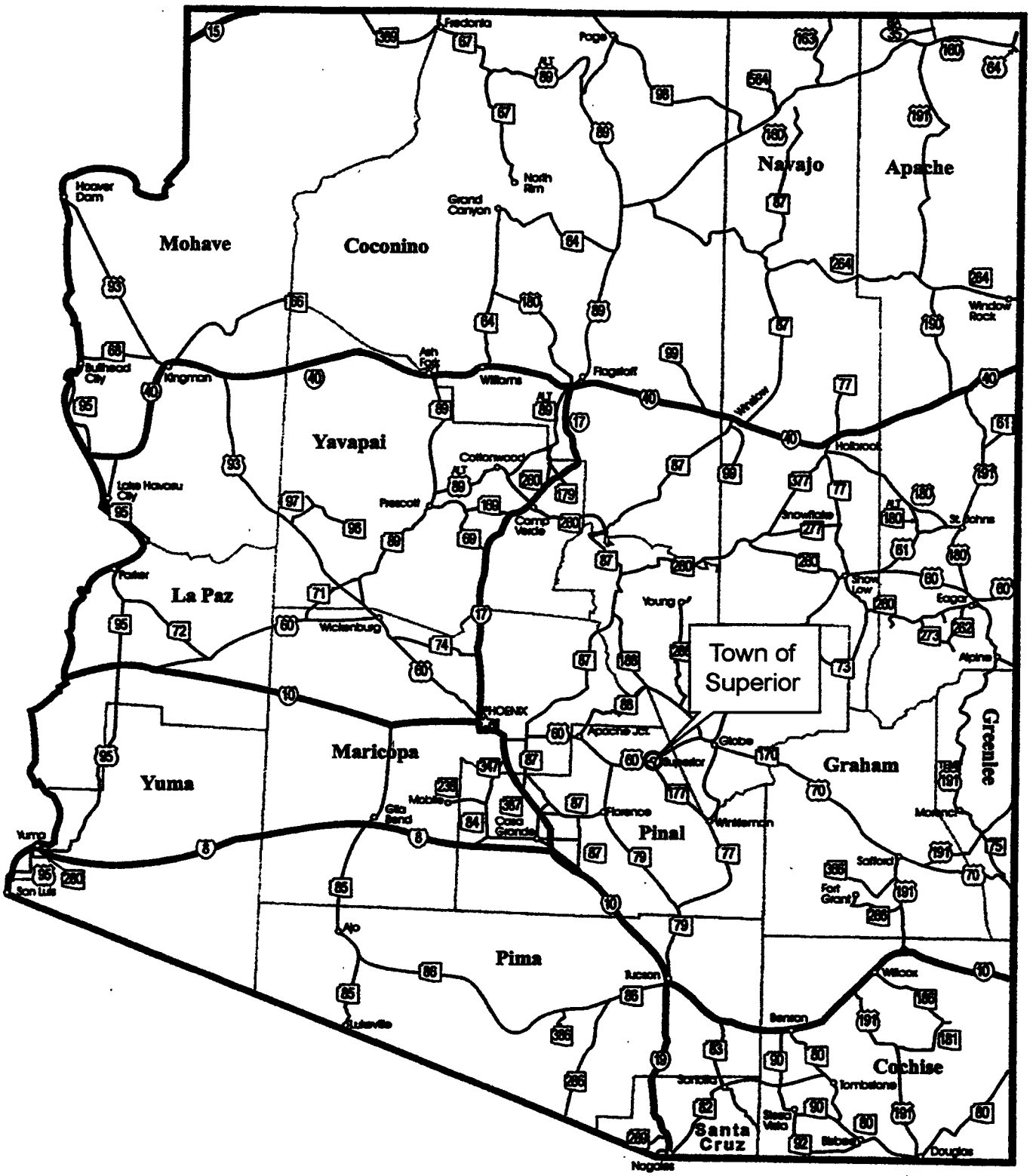
1.2 Purpose and Need for the Project

Queen Creek is a natural watercourse that flows through the Town of Superior. Although the quality of riparian habitat along this reach of the creek is somewhat degraded because of previous mining activities in the area, the citizens of the town have recognized the potential for this stream to be restored or enhanced to become a high-quality natural resource. Thus, the proposed project funding by Reclamation is needed to enhance the riparian functions of Queen Creek.

The overall goal for restoration and management of this reach of Queen Creek is to protect and enhance native riparian vegetation and wildlife habitat. In addition to this goal, primary and secondary objectives have been developed.

1.2.1 Primary Objectives

- Conserve existing riparian habitat along the creek corridor, especially relatively large stands of vegetation.



N

Figure 1-1. Regional Location Map

- Modify land use and water flows along the creek corridor to promote physical processes that lead to the natural regeneration, structure, and function of riparian vegetation along the corridor.

1.2.2 Secondary Objectives

- Maintain or decrease the existing level of flood risk for buildings near the creek channel.
- Provide access to the creek channel and riparian corridor along selected reaches for recreational and educational activities that are compatible with protection of habitat values and that respect private land ownership.
- Enhance the aesthetic qualities of the creek corridor so that it is more attractive to the community and visitors.

1.3 Purpose and Scope of the Environmental Assessment

The purpose of this EA is to assess and disclose the environmental consequences associated with Reclamation's provision of federal funding under Reclamation's wetland program, which would be used to help implement actions associated with potential restoration of a section of Queen Creek. This EA evaluates each of the project components that would be funded by Reclamation.

Chapter 3, "Affected Environment," provides a description of the existing conditions within the project area. Chapter 4, "Environmental Consequences," provides a description of the potential impacts that could occur if the funding is provided and the project implemented. Where appropriate, mitigation measures have been provided for the purpose of reducing, avoiding, or minimizing adverse impacts. A discussion of cumulative impacts is also provided in this section.

Based on information gathered during scoping and considering the nature of this project, Reclamation has focused the environmental analysis on the following resource issues:

- land use,
- water resources,
- biological resources, and
- cultural resources.

Chapter 2

Proposed Action and Alternatives

2.1 Background

In April 2000, the Town of Superior completed the *Restoration and Management Plan for Queen Creek near Superior, Arizona* (Jones & Stokes 2000). This plan, which was funded under a state grant from the Arizona Water Protection Fund, provided a template for restoration and enhancement of the 5-mile section of Queen Creek that extends west of downtown Superior (Figure 2-1). The plan included:

- focused technical studies to identify measures for increasing the vigor, diversity, and distribution of native vegetation along the creek consistent with flood control and recreational needs;
- identification of specific restoration projects for implementation; establishment of priorities, responsibilities, and land and easement acquisition requirements; and
- development of general cost estimates and potential funding sources for each project.

The Town of Superior subsequently applied to Reclamation for funding to implement some of the specific actions that were included in this plan. This EA analyzes the impacts associated with implementation of these actions and alternative actions.

2.2 Proposed Action

The descriptions provided below for the proposed action and alternatives are based upon information in the *Restoration and Management Plan for Queen Creek near Superior, Arizona* (Jones & Stokes 2000). Figure 2-1 shows the locations of the various project components. The locations of reaches 1–5 are shown on Figure 3-1.

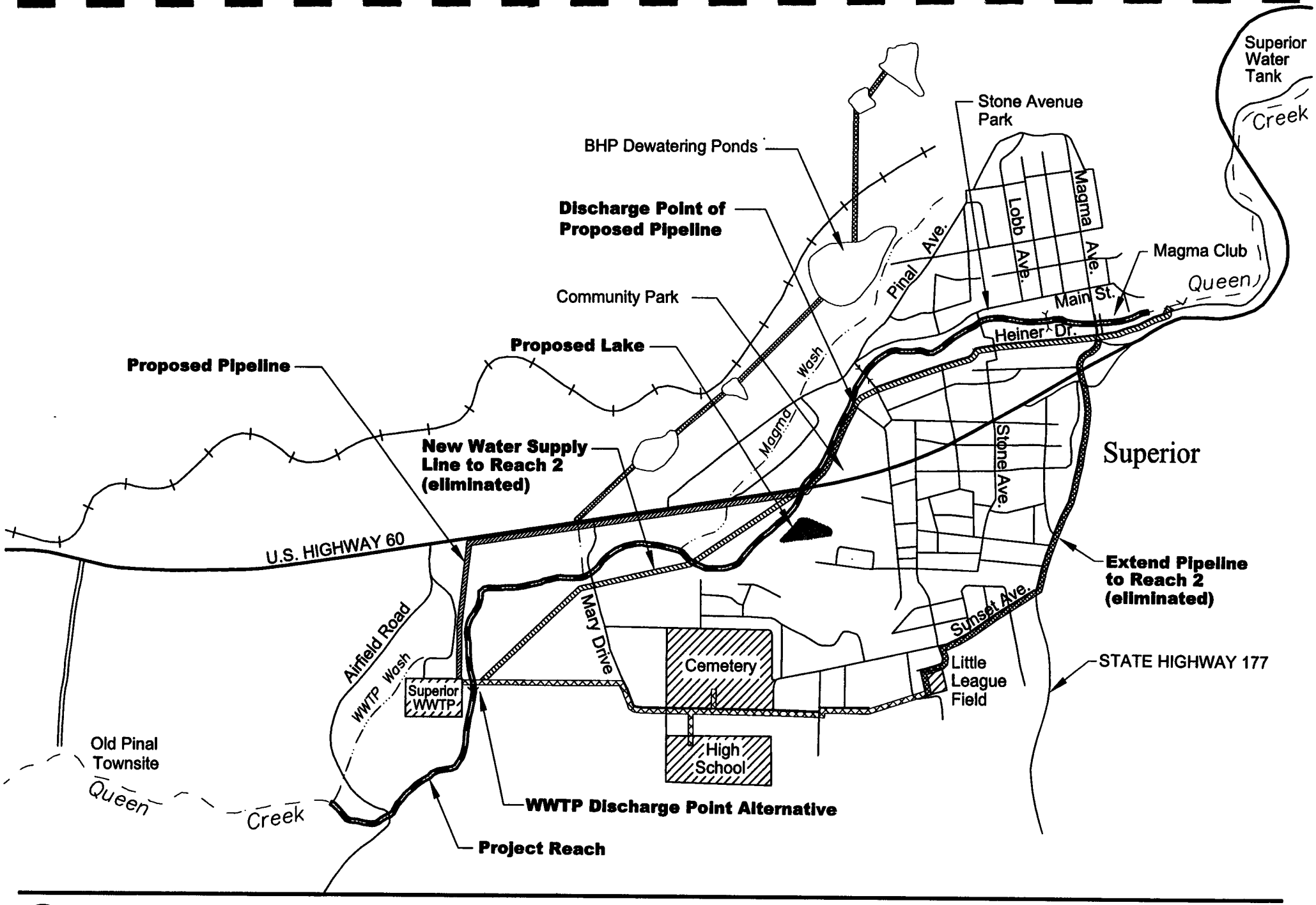


Figure 2-1. Project Area

Town of Superior - Queen Creek
Riparian Restoration Project

The proposed action would focus restoration of riparian vegetation along Reach 3 near Community Park and the Highway 60 crossing of Queen Creek, where the creek and its vegetation would be easily visible to residents and visitors.

Initially, reclaimed water could be discharged at a rate of approximately 34 gallons per minute (gpm), which represents 20% of the current total WWTP discharge rate (Jones & Stokes 2000) plus a maximum of 6 gpm from a new well. The amount and rate of discharge are limited by the need to avoid impacting the growth of riparian vegetation downstream of the WWTP that is largely supported by discharges from the plant, and the fact that some of the water discharged from the WWTP is already committed to turf irrigation at Superior High School and the local cemetery. Production of effluent will be commensurate with community growth, so as Superior grows the amount of water available for use in Queen Creek would also increase, even if the 20% diversion rate remains the same.

2.2.1 Highway 60 Reclaimed Water Supply Line Construction

A reclaimed water pipeline no more than 10 inches in diameter would be constructed to deliver water from the wastewater treatment plant (WWTP) along the main sewer easement that generally follows Queen Creek north to the Highway 60 bridge in Reach 3 (Figure 2-1). The proposed point for releasing water into the creek is located upstream of this bridge at the northern end of Community Park. This option would require approximately 8,000 feet of new pipeline and would primarily benefit the upper part of Reach 3, downstream of the discharge point.

2.2.2 Lake Construction

A lake would be constructed on the left (east) bank of Queen Creek immediately downstream from the Highway 60 bridge by building a berm between the channel and an existing broad floodplain terrace (Figures 2-1 and 3-1) A concrete-and-boulder spillway also would be incorporated into the berm near the southwest corner of the lake. Material for the berm would be excavated from the lakebed area, and clay would be added as needed to achieve proper compaction, cohesiveness, and strength. Except for a narrow area along the shoreline edge, the lakebed would be lined with bentonite or similar clay-like material to minimize water losses resulting from seepage into the creekbed.

The bottom footprint of the lake would occupy approximately 2 acres; assuming 3:1 side slopes on the berm, the total size of the lake would be approximately 2.2 acres. The water depth when the lake is full would be 3–5 feet.

Cottonwood–willow riparian vegetation should be able to establish adjacent to the lining at the edge of the lake, if some areas stay moist through the period of

time in spring when cottonwood seeds sprout and become established. On the berm, the band of vegetation will be narrow, probably no more than the width of a tree canopy (about 30 feet). The shoreline would be expected to advance and retreat substantially on the shallow slopes along the northern and eastern edges of the lake in late spring and through summer. Depending on the final design grades and depths, some of the shallow unlined shoreline areas may support willows or cottonwood. In addition, some shallow-water areas may be colonized by cattails or other emergent vegetation if a sufficient sediment layer is placed on top of the liner to allow rooting. Lake-level fluctuations will not routinely exceed 5 feet during a typical year, and areas deeper than 3 feet will not completely dry out for long periods of time during the growing season. The upper parts of the berm separating the lake from the creek channel would support mesquite. The existing floodplain vegetation consists almost entirely of mesquite. A total of approximately 3 acres of mesquite would be converted to open water, cottonwood-willow vegetation, shallows, and berm slopes.

2.2.3 Well

A well would be constructed either at Community Park or at the proposed lake site to provide water to fill the lake and/or water to supplement the effluent available to discharge into Queen Creek from the WWTP. Because Superior is located within the Phoenix Active Management Area (AMA) for groundwater, a groundwater right is required to pump groundwater, unless the groundwater is withdrawn from an "exempt well" as defined under Arizona Department of Water Resource (ADWR) regulations. The proposed well would be an "exempt well,"i.e., the well would have a maximum pump capacity of 35 gpm and no more than 10 acre-feet [af] per year would be pumped from the well; only one well may be drilled or used to serve the same nonirrigation use at the same location.

Groundwater must be used to fill the lake, since the Town of Superior does not own surface rights to storm flow in Queen Creek and therefore cannot divert water from the creek to fill the lake. If the pump is used only to supply the lake, the well and pump would be installed at the exterior toe of the berm near the southwest corner of the lake to provide the water. A gated, low-level outlet would be installed through the berm at the southwest corner of the lake to allow passage of excess water into Queen Creek if the lake fills and to allow the lake to be drained for maintenance or repairs. If the well is used to increase the amount of water in Queen Creek or is used to supply water to both the creek and the lake, the well and pump would be installed at Community Park, and any water for the lake would be supplied through a pipeline constructed underneath US 60 from the park to the lake. The exact alignment of this pipeline is not yet known; however, the alignment would be selected to minimize the disruption of native riparian vegetation. Supplemental NEPA compliance would be required for the pipeline and well once their locations are more precisely known.

2.3 No-Action Alternative

Under this alternative, Reclamation would not provide funding to the Town of Superior for the project components described above. Restoration activities along this reach of Queen Creek would likely be delayed until an alternative funding source was identified. Until or unless that happened, no new source of water would be supplied to Reach 3 of Queen Creek and no lake would be built. All of the effluent that is currently discharged from the WWTP would continue to flow downstream from its existing discharge point. It is conceivable, depending on the priorities of the various funding entities, that the project would not be funded at all.

2.4 WWTP Water Discharge Point Alternative

Under this alternative, a new discharge point for reclaimed water would be created just east of the WWTP in Reach 4, either by adding a valved turnout to an existing reclaimed-water pipeline that crosses Queen Creek in this area or by constructing a new 10-inch-diameter pipeline from the WWTP to Queen Creek that could be used exclusively for that purpose (Figure 2-1). As with the proposed action, approximately 20% of the water now being discharged into the WWTP would be diverted to the new discharge point and the remaining 80% would continue to be discharged into WWTP Wash. The primary potential restoration benefit would be provided to the portion of Reach 4 that is located between the WWTP and the point at which WWTP Wash enters Queen Creek, a distance of approximately 3,400 feet. Of this total area, approximately 850 feet of the restoration area would be located within the Town of Superior. The remaining area of Reach 4 downstream of the WWTP is outside town limits, bordered by the Tonto National Forest and privately-owned parcels.

2.5 Alternatives Considered but Eliminated from Further Analysis

Four other alternatives for providing suitable water supplies for riparian restoration were evaluated but discarded as infeasible at this time. These alternatives are described below.

2.5.1 Extension of Reclaimed Water Supply Line to Reach 2

This alternative would deliver water from the wastewater treatment plant (WWTP) to a discharge point at the upper end of Reach 2 near the Magma Club (Figure 2-1) by extending an existing 4-inch pipeline from the WWTP that currently ends at the Little League baseball field. The existing pipeline crosses under Queen Creek due east of the WWTP. This action would pump the existing permitted discharge of treated effluent uphill from a location below and east of the downtown area to a location where the water would flow through downtown Superior, where the creek is bordered by commercial buildings on the right bank and private residences on the left bank. One of the advantages of this alternative is that, in addition to enhancing and increasing the amount of riparian habitat available in this reach, a well-developed riparian community in this area would create a greenbelt through downtown Superior, thus providing an important visual amenity for the community.

A 4-inch-diameter reclaimed pipeline would be constructed to extend the existing reclaimed-water pipeline from the Little League field east along Sunset Drive to Highway 177 and then north to Queen Creek near the Magma Club. The total length of new pipeline needed to reach the Magma Club would be 6,200 feet. The pipeline route from the Little League ball field along Sunset Drive to Highway 177 would travel through a residential area. The Highway 177 portion of the route is primarily residential on the west side (there is one church); the east side is undeveloped desert that is zoned for residential use. It is assumed that the pipeline could be installed within the town and Arizona Department of Transportation (ADOT) road rights-of-way for Sunset Drive and Highway 177. The precise location of the pump station that would be required is not known, but it is assumed that it would probably need to be in the vicinity of the ball field, where the existing line now ends.

Initially, reclaimed water could be discharged into Queen Creek at a rate of approximately 34 gpm, or 20% of the total WWTP discharge rate (Jones & Stokes 2000).

Reclamation recognizes that restoration of this portion of Queen Creek could provide an important amenity to the downtown area. However, it was concluded that implementation of this alternative would not be feasible with the amount of water that would be available at this time. Although seepage losses in this reach are apparently small, the large boulders and cobbles that constitute most of the creekbed in this area would require much more water to create a flow downstream than the 0.07 cfs that would be available (20% of the current WWTP discharge). For that reason, this alternative was eliminated from further consideration.

2.5.2 Installation of a New Water Supply Line to Reach 2

Under this alternative, the same concept for conveying reclaimed water would be implemented, though the approach would be different. An entirely new 10-inch reclaimed water pipeline would be installed from the WWTP along the main sewer easement that generally follows Queen Creek up to the Highway 60 bridge. From there, the pipe would pass under the bridge and continue past Community Park to a discharge point near the Magma Club at the upper end of Reach 2. This option would require a pump station and about 7,200 feet of pipeline.

As in the previous alternative, the infiltration rates in Reach 2 would be too high to have a sustainable water source because of the cobbly streambed. For that reason, this alternative was eliminated from further consideration.

2.5.3 Return of Freshwater Mine Inflow Directly to Queen Creek

Under this approach, substantial stream base flows that are currently lost because of seepage into underground mine tunnels and shafts would be recovered and conveyed back into Reach 2 of Queen Creek. Because this alternative would likely involve the expense of treatment prior to discharge to the environment, this alternative was not advanced for detailed analysis.

2.5.4 Installation of New Mine Dewatering Treatment System and Discharge Pipeline to Reach 2

This alternative assumes that the local Broken Hills Property (BHP) mine would return to active operation. If this were to occur, the mining company might change its method of treating water from dewatering operations, such that the previous practice of storing treated water would not be required. This unstored water might then be returned to the creek and be available for habitat enhancement.

This alternative has been eliminated from further consideration at this time because of uncertainty about timing and execution by the mining company. It is not certain that the mine will return to operation. Also, the water treatment process that would be used is unknown, which raises unanswered questions regarding the quality of the treated water. Costs associated with implementing this alternative are also unknown.

Chapter 3
Affected Environment

3.1 Introduction

This chapter provides a description of the current condition of environmental resources in the project area, particularly as they relate to land use, water resources, biological resources, and cultural resources in the Town of Superior area. The information presented below primarily focuses on those areas that would be directly affected by the proposed action and other action alternatives.

3.2 Land Use

The project area is located in and around the Town of Superior, Arizona, about 63 miles east of Phoenix. Superior is located near the headwaters of Queen Creek, which drains the western slopes of Fortuna Peak and Kings Crown Peak. The creek flows westward from its headwaters, draining an area midway between the Salt and Gila Rivers. The creek formerly entered the Gila River but now ends at the Roosevelt Water Conservation District Canal near the Town of Queen Creek, about 25 miles southeast of Phoenix. About 10 miles downstream of Superior, Queen Creek is regulated by Whitlow Dam, an earthen flood-control structure.

3.2.1 Land Use Planning

3.2.1.1 Town of Superior

Most of the project area lies within the town limits of Superior and is subject to local zoning and other ordinances. In addition, the project must be considered from the perspective of consistency with the town's general plan.

The *Restoration and Management Plan for Queen Creek near Superior, Arizona* (Jones & Stokes 2000) reviewed the project goals and objectives and compared them to the policies provided in the Town of Superior General Plan (Carter Associates 1987). The current project's goals and objectives are consistent with the general plan. The community's interest in preserving and enhancing natural

vegetation and habitat along Queen Creek for aesthetic, recreational, and economic reasons is expressed in the following statements from the plan:

Land Use (Discussion). "Open space should be reserved to the areas in Queen Creek's floodplain. This land is developable only under stringent restrictions and it is best suited to remain undeveloped or put to use as parks and recreation land."

Land Use Policy 2.b. "Utilize the approval process of the Planning and Zoning Board to encourage developers and individuals to include amenities and features in their site planning that will enhance the desired character of the Town."

Environmental Protection and Management Goals. "To preserve the existing quality of the natural environment." "To provide the residents of Superior with a healthy natural environment."

Environmental Protection and Management Policy 1. "The Town supports the protection and enhancement of major drainageways and existing floodplains." The policy includes the following objectives:

"1.a. Incorporate these areas into the overall plan for parks and recreation development," and

"1.b. Include the flood-prone areas into the zoning-ordinance as areas of open space."

Environmental Protection and Management Policy 2. "The Town encourages the incorporation of open space, parks and recreation facilities, views, hillsides, and natural vegetation in all new residential developments."

Community Revitalization Objective 2. "To create quality physical and economic environments in the downtown area."

Parks and Recreation (Discussion). "The provision of recreation opportunities and park facilities was identified by the citizens of Superior as one of the development requirements with the highest priority."

Parks and Recreation Goal. "To develop passive park facilities and open space and greenbelt areas to increase leisure time opportunities for residents and the attractiveness of the Town."

Parks and Recreation Policy 1. "The Town supports the development of open space plans, natural features, landmarks and passive parks." The policy includes the following objective:

"1.b. Utilize significant natural features and landmarks, including scenic vistas, in an overall open space system. Queen Creek—particularly within the 100-year floodplain—and other drainageways that limit other developments should be considered as opportunities for such use as well as hiking and riding trails."

3.2.1.2 Tonto National Forest

Much of the lower reaches of the project area (Reaches 4 and 5) fall under Tonto National Forest jurisdiction.

3.2.2 Existing Land Uses

In general, the project area consists of low- to moderate-income households, with some areas of manufactured homes. A large portion of the plan area is privately owned, with some commercial properties scattered throughout. Land use south of Reach 2 of Queen Creek, along State Highway 177 and Sunset Drive, is also primarily residential, with the exception of a church that is located to the west of Highway 177 and just north of Sunset Drive. A Little League field is located just south of Sunset Drive.

The Town's WWTP is located on the north side of Queen Creek in Reach 4. Effluent, treated at a tertiary level, flows into a nearby wash, WWTP Wash, before flowing into Queen Creek. The remainder of Reach 4 and Reach 5, including Tonto National Forest lands, consists of open space or otherwise undeveloped land.

3.3 Water Resources

This section describes available streamflow, groundwater, water-use, wastewater-generation, and water-quality data for Queen Creek in the vicinity of the Town of Superior.

3.3.1 Hydrology

Climate data for the Town of Superior area have been recorded since 1948. From 1948 to the present, annual precipitation has averaged 18.6 inches. Most precipitation falls in winter, when large frontal-storm systems originating from the Pacific Ocean create storms of generally moderate intensity that last for several days. Intense but brief and localized thunderstorms occasionally drop significant amounts of rainfall in the summer, derived from moist, monsoonal air masses originating in the Gulf of Mexico. May and June are the months of least precipitation. Average daily maximum air temperatures range from 60°F in January to 99°F in June. Corresponding average daily minimum temperatures are 41°F in January and 77°F in June. The average annual evapotranspiration (ET) rate for the Superior area is about 60 inches.

Queen Creek is a small, intermittent tributary stream within the Middle Gila River basin. Streamflow data for Queen Creek are available only for limited periods of time and only at a few locations. The average annual discharge for the gage at Whitlow Dam, which regulates a large flood-detention basin downstream

of the project area, is approximately 2,970 af (Jones & Stokes 2000). The minimum and maximum annual discharges are 940 af and 10,130 af, respectively. Queen Creek flows have also been monitored at the Boyce Thompson Arboretum since 1994. A small base flow of 1,000–2,000 gpm, or 2–5 cubic feet per second (cfs), is typical for the winter period and is punctuated by brief flow peaks in response to rainfall (1 cfs is equal to 448.8 gpm). The peaks (average flow over 24 hours) are commonly 30,000–40,000 gpm (70–90 cfs). Overall, the estimated normal and wet-year monthly flows indicate that a base flow of 1 cfs or more would normally be present from December through April, decreasing to a negligible amount in June and July. In wet years, significant amounts of base flow can be expected from August through early May. Under dry conditions, average monthly flow could be less than 0.3 cfs in any month and is likely to be less than 0.15 cfs in most months. Within the proposed project reach, prolonged periods of no flow are common during dry conditions.

The mining firm, BHP, operates a gage on Magma Wash next to one of its water-treatment ponds as a requirement of a National Pollution Discharge Elimination System (NPDES) permit. The wash flows along Pinal Avenue and empties into Queen Creek between the U.S. Highway 60 bridge and Mary Drive. Surface flow is present only in response to major storms. The wash drains an area of about 604 square miles on the lower flanks of Apache Leap. The infrequent occurrence of flow in this wash indicates that surface inflow to Queen Creek from most tributaries between Apache Leap and the Boyce Thompson Arboretum is probably minimal.

Anecdotal information gathered previously from long-time residents of Superior (Jones & Stokes 2000) indicates that existing base flow conditions in Queen Creek appear to be less persistent compared to historical conditions. Specifically, pools in the creek a short distance upstream of the Magma Avenue bridge were reported to remain full of water all summer and served as popular swimming holes. However, the drought stress and mortality evident in cottonwood trees along the lower downtown area in Reach 2 suggest that the flow regime has become drier. The most likely cause of the decrease in base flow is seepage into underground mine workings. Large amounts of Queen Creek flow reportedly leak into mine workings along the creek about 0.2 mile upstream of the Magma Club. Another leaky spot is located at the most upstream end of the project area where the creek crosses exposed, steeply dipping limestone beds. In the past, mine workers built a berm isolating one-half of the creek channel to shunt flow away from the leakiest spots. In addition, mine operators attempted to decrease seepage from the creek into the mine at least twice during the mine's 100-year history, once by sealing the creekbed and once by grouting the walls of selected mine tunnels. Neither of these efforts met with much success because the water was able to flow around the seals through other fractures.

There are presently no known direct surface diversions from Queen Creek within the project area. Historical dewatering operations of the BHP mine were effectively equivalent to an indirect diversion of streamflow from Queen Creek, since these operations were known to induce seepage from Queen Creek and intercept groundwater that would otherwise have been discharged to the creek.

These dewatering operations were discontinued in 1998 and it is uncertain whether they will occur in the future. In addition, prior to 1998, the Boyce Thompson Arboretum annually used an average of 40 af for irrigation. The arboretum has since constructed a water supply well near the confluence of Arnett and Queen creeks. The new well provides supplemental water if the existing well runs short and is intended to meet increases in irrigation demand associated with future expansion of the arboretum.

3.3.1.1 Flooding

The Federal Emergency Management Agency (FEMA) completed a flood-insurance study and a flood-boundary and floodway map of the Town of Superior in 1981. The flood-boundary map shows that a number of residences along Heiner Drive would be inundated in a 100-year storm (a 100-year flood is the peak flow that has a 1% probability of occurring in any year.) However, flooding is not perceived as a major problem by local residents because all floods that have occurred in about the last 60–70 years have been contained within the channel and have not inundated buildings along the creek. The flood-hydraulics model developed by FEMA was updated for the *Restoration and Management Plan for Queen Creek near Superior, Arizona* (Jones & Stokes 2000) to provide quantitative estimates of the potential flood impacts of actions proposed in that plan and to identify potential mitigation strategies for any adverse impacts. Table 3-1 shows the estimated flow rates projected for storms of varying recurrence intervals. The simulated 100-year floodplain closely matches the FEMA floodplain. Sediment deposition and vegetation growth have reportedly decreased the channel capacity along the lower end of the downtown reach (Reach 2), so this creek segment would be the most likely to experience overbank flooding.

Table 3-1. Flood Magnitudes in Queen Creek at Mary Drive

Flood Magnitude		Peak Flow (cfs)
Annual Probability (rate)	Recurrence Interval (years)	
0.10	10	4,600
0.02	50	9,800
0.01	100	11,400
0.002	500	14,200

Notes:
cfs = cubic feet per second

3.3.1.2 Wastewater Treatment Plant Discharges

The WWTP is located between U.S. Highway 60 and Queen Creek west of Mary Drive (Figure 2-1). The WWTP was built in 1976 and has a capacity of 750,000 gallons per day (gpd). The effluent discharge rate is essentially equal to the raw wastewater inflow rate because fluctuations in storage at the WWTP are minimal. Tertiary-treated wastewater is discharged to the WWTP wash and flows 2,200 feet south to the confluence with Queen Creek. The dry-weather inflow to the plant in 1997–1998 averaged 230,000 gpd, which provides for a continuous flow that equals 0.36 cfs (1 cfs = 448.8 gpm). Daily WWTP flows fluctuate hourly, with a pronounced period of peak water use between 6:00 a.m. and 8:00 a.m. on weekdays and a smaller peak in the late afternoon and evening. Inflow plummets during the late night hours to only 25% of the typical daytime inflow. On weekends, the morning peak inflow period is later and longer. The WWTP discharge provides a year-round, fairly constant flow from WWTP Wash to the pump house at the Boyce Thompson Arboretum.

Superior High School and the local cemetery presently use effluent for turf irrigation. If these facilities received their maximum historical delivery in one year, the amount of reclaimed water used would be approximately 11% of the amount presently produced at the WWTP.

3.3.1.3 BHP Dewatering Discharge Operations

Discharge from BHP's dewatering water-treatment ponds was fairly large but contributed infrequently to low flows in Queen Creek. When the mine was in operation, dewatering pumps removed water from a central sump at one of the deepest shafts to keep the underground workings dry. The pumps operated continuously at a rate of about 500 gpm (about 1.1 cfs) and discharged into ponds where metals are removed by addition of lime, flocculation, and settling (Jones & Stokes 2000). The ponds have a large surface area, and losses to seepage and evaporation equaled or exceeded the inflow of dewatering water most of the time. When the pond storage capacity was exceeded, excess treated water was discharged into an unnamed ephemeral wash that enters Queen Creek near Mary Drive. Historically, discharges were quite sporadic; monthly dewatering discharge rates were usually about 800–1,000 gpm in months when discharge occurred. Relatively continuous, high rates of discharge occurred in 1989–1990, when dewatering was resumed after a 3-year hiatus.

3.3.1.4 Groundwater and Hydrogeology

The Town of Superior is located at the far eastern end of the East Salt River Valley subbasin of the Phoenix AMA. The Phoenix AMA is one of the four (there are now five) original overdrafted groundwater basins established by the Arizona Groundwater Management Code of 1980, and as such, it is subject to intensive management. The primary management goal of the Phoenix AMA is to achieve safe yield by 2025 (defined as a long-term balance between the annual

amount of groundwater withdrawn in the AMA and the annual amount of natural and artificial recharge).

Groundwater in the vicinity of Superior appears to be divided functionally into shallow and deep-flow systems that share a certain amount of interconnection. Information regarding the deep-flow system comes from observations of groundwater flow and levels in the mine workings, and information regarding the shallow system comes from domestic water wells and flow gains and losses in Queen Creek (Jones & Stokes 2000).

Apache Leap, a local topographic landmark, consists of a highly fractured dacite tuff underlain by Paleozoic carbonate deposits that form conspicuous tilted bedrock strata in the lower part of the Queen Creek canyon immediately upstream of Superior. The fractures in the tuff allow a small amount of rainfall infiltration. Under predevelopment conditions, this rainwater would gradually emerge as base flows in springs and Queen Creek. The extensive network of mining tunnels and shafts now intercept part of this natural groundwater input. West of Apache Leap, the older sediments are overlain by the Gila Formation, a mixture of sedimentary rocks ranging from a hard, uniform sandstone to a conglomerate containing large boulders in a sand matrix. Because domestic wells in Superior are able to produce water from relatively shallow depths (<300 feet), there clearly is a shallow groundwater system associated with the Gila Formation. Because of its variable texture and degree of cementation, the primary permeability of the Gila Formation is probably quite variable but generally low. This level of permeability is consistent with the reportedly low yields of domestic wells that are completed in the formation. Water level records from local wells within Superior suggest that the water table is fairly flat and slopes westward at the same gradient as the Queen Creek creekbed, and that the shallow groundwater system is hydraulically connected with the creek along most of its length.

The local groundwater aquifer underlying the municipal area of Superior is not a major water supply for domestic drinking water or other uses. The Arizona Water Company provides the town's drinking water supplies from a well that is about 20 miles from the town. Private wells are not regulated in any manner and it is unlikely that there are any wells located in a portion of the aquifer that is directly affected by Queen Creek streamflow and associated recharge patterns. The wells that may be present within the agricultural areas are most likely only used for agricultural livestock watering.

3.3.1.5 Estimated Streamflow Loss Rates to Groundwater

Gains and losses of streamflow resulting from the interaction between groundwater and the stream channel were estimated from direct field measurements and existing well water level records (Jones & Stokes 2000). Streamflow loss rates depend on the channel substrate characteristics and location of groundwater levels adjacent to the channel. Groundwater level

records of nearby wells indicate that groundwater adjacent to all reaches of the channel in the project area is probably shallow during most months of the year.

The highest rate of streamflow loss was measured along the lower part of Reach 1, where Queen Creek leaves the bedrock canyon and flows out over its alluvial fan, which extends into the valley. Coarse bed materials and high seepage losses are typical at the upper ends of alluvial fans. In addition, seepage into the underground BHP mine tunnels near the middle of Reach 1 reportedly contribute to high seepage losses in that area. The measured rate of streamflow seepage loss to groundwater along Reach 2 was essentially negligible. Consolidated bedrock of the Gila Formation is exposed at various places along Reach 2 and is probably covered only thinly with stream deposits along most of the reach. The bedrock permeability is relatively low in areas where the Gila Formation is highly consolidated. Reaches 3 through 5 are estimated to be similar based on field measurements and geomorphologic characteristics. The location of these reaches at lower elevations of the valley floor, where the alluvial deposits are more extensive, results in a moderate average loss rate estimated to be 0.17 cfs per mile of channel.

3.3.2 Water Quality

The only available routine measurements of water quality in Queen Creek are weekly measurements of electrical conductivity taken at the Boyce Thompson Arboretum. Conductivity is a general indicator of the total concentration of dissolved minerals in the water, which typically consist primarily of calcium, magnesium, sodium, bicarbonate, and chloride. Data for 1994 indicate that conductivity fluctuated widely and frequently over a range from 550–1,200 microSiemens per centimeter (µS/cm) (Jones & Stokes 2000). This conductivity range corresponds to a total dissolved-solids concentration of 360–780 milligrams per liter (mg/l). For comparison, the maximum recommended dissolved-solids concentration for long-term consumption under federal drinking water standards is 500 mg/l.

Selected water-quality constituents are measured in the effluent from the WWTP. The WWTP effluent meets applicable Arizona Department of Environmental Quality (ADEQ) water quality standards for surface waters and the most restrictive reclaimed water quality classification (i.e., Class A+ reclaimed water) that are applicable to the existing designated beneficial uses in Queen Creek. The constituents include 11 metals, total suspended solids, and several nitrogen compounds. In samples collected on July 6, 1998, the metal concentrations were all below the detection limits, the concentration of total suspended solids was 180 mg/l, and the concentration of nitrate was 10 mg/l (as nitrogen) (Jones & Stokes 2000). Electrical conductivity of the effluent is not routinely measured.

3.4 Biological Resources

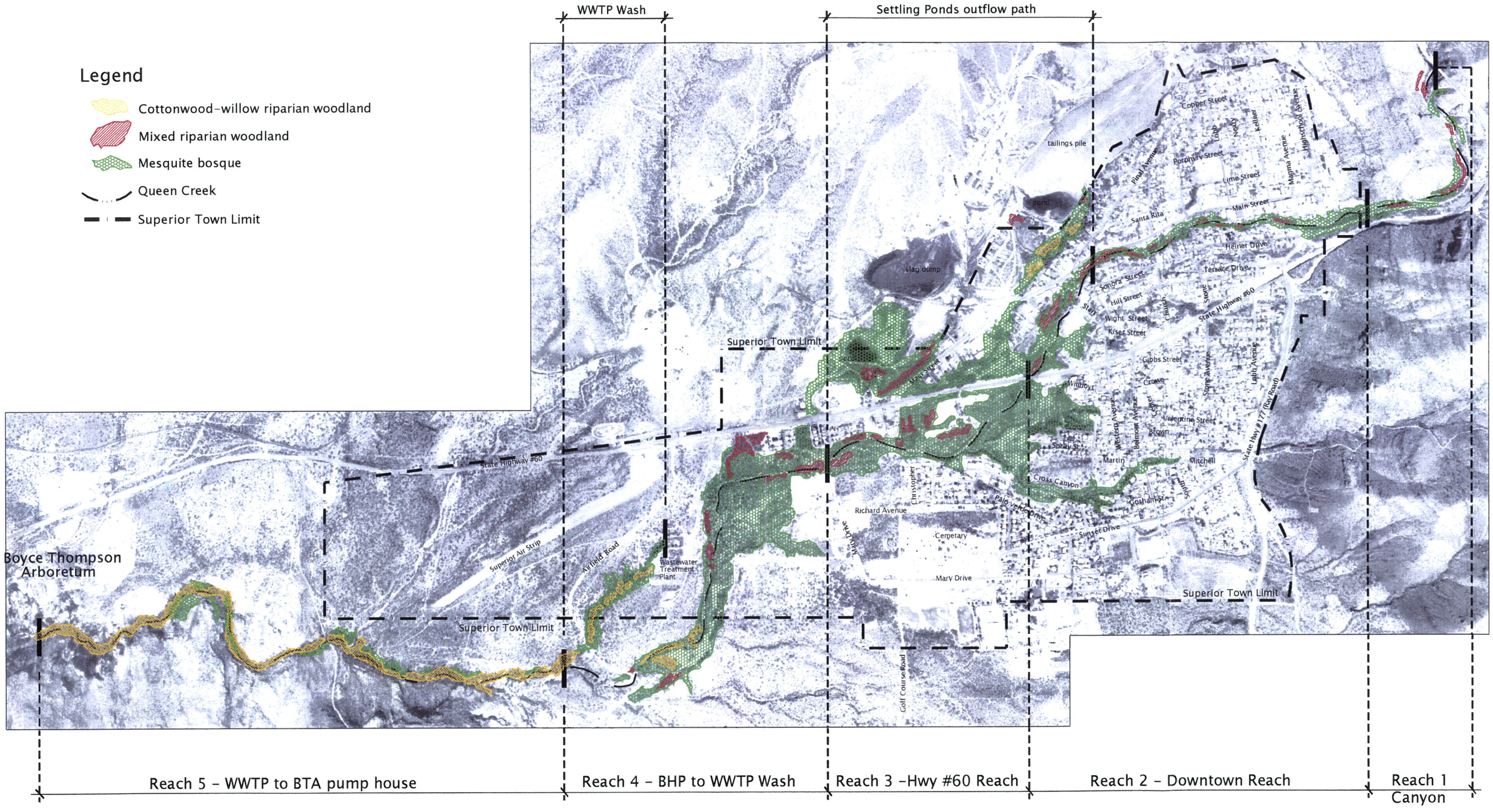
3.4.1 Introduction

This section was prepared using documentation of conditions contained in the *Restoration and Management Plan for Queen Creek near Superior, Arizona* (Jones & Stokes 2000) and field visits conducted in June 2002. The project area encompasses a number of distinct biological communities that provide substantial value for wildlife, potentially including threatened or endangered species or other species of concern that may occur in the project area. Riparian plant associations described by Brown (1982), Szaro (1989), and Myers (1993) were reviewed to classify the riparian communities in the project area. Szaro's (1989) classifications were the most comprehensive and provided a basis from which to describe communities within the project area; however, the specific riparian communities occurring along Queen Creek reflect minor differences from those observed in classifications described by Szaro.

The general condition of riparian vegetation along five reaches of Queen Creek was observed during field reconnaissance in March and May 1998, June and September 1999, and June 2002. Vegetation communities were mapped onto an aerial photograph as shown in Figure 3-1. In addition, locations of non-native, invasive species populations (e.g., saltcedar (*Tamarix* sp.); tree of heaven (*Ailanthus altissima*), and giant reed (*Arundo donax*) that could potentially compete with native riparian species within the project area were noted. Appendix A contains listings of plant and animal species that were observed during field surveys or are mentioned in the text of this EA.

The value of riparian vegetation communities to wildlife was assessed by conducting breeding bird point-count surveys in May 1998 and September 1999. Because riparian habitats in the desert Southwest are known to provide high-value habitat to a variety of migratory and resident birds, breeding birds were chosen as an indicator of habitat value. Specifically, vegetation associations with greater species diversity or larger populations were used as an indication of potentially higher habitat value. Because the point-count survey was a limited, one-time survey, the results are an indicator of wildlife-habitat associations but are not a statistically robust evaluation of populations or habitat associations of individual species. The results of the survey are presented in detail in Appendix B; the following sections summarize the results for each vegetation community. Habitat attributes that may account for the higher habitat value are also described.

While breeding birds were chosen as an indicator of habitat value, riparian communities are of course important to many species (Appendix A).



Town of Superior - Queen Creek
Riparian Restoration Project

0 500 1000

Source: Jones & Stokes 2000

Figure 3-1
Riparian Vegetation Communities

Jones & Stokes

3.4.2 Vegetation Communities

3.4.2.1 Cottonwood-Willow Riparian Woodland

Plants

Cottonwood-willow riparian woodland occupies a significant portion of the project area in the low floodplain of Queen Creek. In particular, cottonwood-willow is the dominant riparian community in the lower portion of Reach 4 and in Reach 5, where water is available year-round. Fremont cottonwood (*Populus fremontii*) and Goodding's willow (*Salix gooddingii* var. *varibilis*) dominate the canopy. While no measurements were made of tree height, both willows and cottonwoods in the cottonwood-willow riparian community along Queen Creek tend to be mature and appear approximately 50–70 feet tall. Velvet ash (*Fraxinus velutina*) is also present but less common. The understory includes young willows, ash, and seepwillow (*Baccharis salicifolia*), and the lush herbaceous layer contains a variety of grasses and forbs, including Bermuda grass (*Cynodon dactylon*), rabbitsfoot grass (*Polypogon monspeliensis*), deer grass (*Muhlenbergia rigens*), spikerush (*Eleocharis* sp.), and wild rhubarb (*Rumex hymenosepalus*).

The cottonwood-willow riparian community is among the richest habitats in the desert Southwest for bird diversity and abundance (Rosenberg et al. 1991). One important feature that separates mature cottonwood-willow habitats from other riparian vegetation is their structural complexity (Rosenberg et al. 1991). Cottonwoods and willows typically grow to be the tallest trees in creek or river valleys, forming a strip of green vegetation within an extremely dry landscape. Mature stands, with trees often over 70 feet tall, provide both vertical and horizontal foliage layers that are absent in most of the other valley habitats (Rosenberg et al. 1991), and birds that breed or winter in the Arizona desert riparian habitats prefer tall willows and cottonwoods over shorter, shrubby, or open vegetation patches. Areas with perennial water flow are particularly valuable habitat within this arid landscape because they provide a drinking-water source, provide shade and cover, and support numerous insects and other invertebrates, which are prey for wildlife. The vegetation community in Reach 5 reflects the continuous presence of streamflow that is largely supported by the WWTP effluent discharges (refer to Section 3.3.1, "Hydrology"). While wetlands were not mapped separately from other types of riparian communities for this document, the presence of such strongly hydrophytic species as spikerush (*Eleocharis* sp.), flat sedge (*Cyperus acuminatus*), horsetail (*Equisetum* sp.) and cattail (*Typha domingensis*) (Table A-2) suggests that there are wetland areas along Queen Creek. Because of the presence of a perennial source of water, any wetlands are probably found exclusively below the discharge point into WWTP Wash.

Wildlife

Breeding bird point-count surveys conducted in May 1998 at Queen Creek indicate that cottonwood-willow riparian habitat supported slightly greater species diversity than mixed riparian and velvet mesquite communities (Appendix B). Birds occurring in cottonwood-willow riparian habitat during the surveys included summer resident, riparian-associated species, as well as migrants. Yellow-breasted chats, Bell's vireos, and Lucy's and yellow warblers were common in this riparian habitat. Song sparrow, summer tanager, vermilion flycatcher, and northern oriole also were present but in lower numbers. These occurrences are consistent with the general bird-habitat relationships reported by Rosenberg et al. (1991) for the Colorado River Valley.

The vertical structure of riparian vegetation formed by cottonwoods and willows appears to be important for canopy-nesting wildlife, such as yellow warbler, summer tanager, and northern oriole. These species are largely restricted to areas with tall cottonwoods and willows. Yellow warblers also were observed in small or structurally uncomplex riparian patches, as long as a tall cottonwood or willow was present. Signs of raccoon, striped skunk, and gray fox were observed in this habitat, and a number of other mammals, snakes, and lizards are also expected to occur here. Local residents have also reported common sightings of javelina (Chavez pers. comm.).

3.4.2.2 Mixed-Riparian Woodland

Plants

Mixed-riparian woodland is found in much of Reach 2 and occurs scattered through portions of Reaches 3 and 4. The canopy of the mixed riparian community is typically a sparse mixture of Fremont cottonwood, Goodding's willow, velvet ash, and/or velvet mesquite. The understory includes young seepwillow, catclaw acacia (*Acacia greggii*), velvet mesquite, and desert broom (*Baccharis sarothroides*) and the herbaceous layer is absent or sparse. Mesquite, netleaf hackberry (*Celtis laevigata*), and blue palo verde (*Cercidium floridum*) occur on the high floodplain and adjacent terrace areas. This community appears to occupy areas where lack of water limits the development of dense stands of obligate riparian species and herbaceous layer characteristic of the cottonwood-willow community. As a result, obligate riparian species such as willows and cottonwoods occur only sporadically in areas such as the creek bottom and lower floodplain, where more sediment and soil moisture is available and germination and growth of these species can be supported. The lower vegetation density in Reaches 2 through 4 compared to Reach 5 (downstream of the WWTP discharge) apparently reflects the lack of continuous streamflow in the creek channel for most of the year. The measured rate of streamflow seepage loss to groundwater along Reach 2 of the channel is estimated to be low (refer to Section 3.3.1, "Hydrology"). Reaches 3 through 5 exhibit moderate streamflow loss rates, and groundwater levels adjacent to the channel throughout the project area are

shallow. Consequently, the data indicate that the lack of continuous water source may be a major factor limiting vegetation density.

Wildlife

During the breeding bird point-count surveys conducted in May 1998, commonly observed mixed-riparian associated species were Lucy's and yellow warbler, yellow-breasted chat, and Bell's vireo. White-winged doves, house sparrows, and northern cardinal also were common. A variety of mammals, including desert cottontail, occur in this habitat along with an assortment of lizards and snakes.

3.4.2.3 Mesquite Bosque

Plants

Mesquite bosques along Queen Creek are open woodlands dominated by velvet mesquite, and often contain a scrub understory of saltbush (*Atriplex polycarpa*), hackberry, and other species. Mesquite bosques are found through the project area, but are widest in Reaches 3 and 4 and the lower portion of Reach 2. Most of the areas mapped as mesquite bosque in Reach 2 are small and narrow in width, and confined to the area immediately adjacent to the creek. This community occurs in areas that have more water available than in more upland areas, but where the water table is still too deep or streamflow is too intermittent to support the more hydrophytic cottonwood-willow or mixed-riparian communities. Mesquite is a facultative phreatophyte, meaning it is able to take advantage of high groundwater levels for regeneration and establishment in the project area. The height and density of mesquite shrubs is inversely correlated with depth to the water table. In areas mapped as mesquite bosque, mesquites are distinctly larger and have a denser canopy than in surrounding upland areas. In several groves along Reach 5, the mesquites are large enough to be considered trees because they have single trunks and canopies that reach heights of about 30 feet.

Wildlife

Next to cottonwood-willow and mixed-riparian habitat, mesquite bosque habitats in Arizona have been found to be the most important habitat for abundance and variety of birds (Rosenberg et al. 1991). Mesquite bosques generally dominate the upper floodplains and adjacent terraces. These areas often support resident populations of curve-billed thrashers, cactus wrens, verdins, and black-tailed gnatcatchers. High densities of Lucy's warbler can be found in mesquite-bosque habitat during the breeding season (Rosenberg et al. 1991). In winter, mistletoe, which parasitizes mesquite, produces an abundance of berries that attracts large numbers of phainopeplas, cedar waxwings, American robins, western and mountain bluebirds, and northern mockingbirds. The presence of saltbush and

other seed-producing shrubs that occur in association with mesquite provide foraging habitat and cover for a number of wintering sparrows, resident quail, and towhees.

During the breeding bird point-count surveys conducted in May 1998, mesquite-bosque habitats were found to support high densities of certain summer-resident, riparian-associated species, including migratory yellow-breasted chat and Lucy's warbler. Mesquite-bosque habitats also supported a high density of resident phainopeplas and resident populations of white-winged and mourning doves, curve-billed thrashers, cactus wrens, verdins, northern cardinals, and house sparrows. Desert cottontails, black-tailed jackrabbits, whiptails, and fence lizards were observed in the mesquite-bosque habitat. A variety of other mammals, lizards, and snakes also commonly inhabit mesquite bosque.

3.4.2.4 Sonoran Desert Scrub

Plants

Except for the riparian vegetation along Queen Creek, the vegetation of the Queen Creek watershed is Sonoran desert scrub vegetation typical of high desert areas in central Arizona. This plant community is characterized by open-desert scrub on sloped landforms dotted with occasional cacti. Shallow-to-steep slopes rising from the creek are too high above the water table to support riparian plants, which cannot survive on rainfall alone. The plants most commonly found in this community include catclaw acacia (*Acacia greggii*), banana yucca (*Yucca baccata*), creosote (*Larrea tridentata*), ocotillo (*Fouquieria splendens)*, and foothill palo verde (*Cercidium microphyllum*). Some of the cacti interspersed among these plants are several types of cholla (e.g., jumping cholla [*Opuntia fulgida*]), barrel cactus (*Ferocactus wislezenii*), and saguaro (*Carnegiea gigantea*).

Wildlife

Wildlife associated with Sonoran desert scrub is dominated by reptiles, small mammals, and a number of bird species. Wildlife species typically occurring in desert scrub habitats include the Sonoran desert tortoise, ground squirrels, a variety of snakes and lizards, verdins, black-tailed gnatcatcher, kit fox, coyote, javelina, desert mule deer, and numerous pocket mice and kangaroo rats.

3.4.3 Non-Native/Invasive Plant Issues in the Project Area

Invasive exotic plant species were noted in several areas of the creek corridor during field reconnaissance observations. These species include saltcedar, tree of heaven, Mexican palo verde (*Parkinsonia aculeata*) and giant reed. A few

domestic landscaping plants, such as oleander, were also observed, but did not appear invasive.

Saltcedar appears in the creek corridor mixed with mesquite-bosque habitat and the mixed-riparian communities in Reaches 2–5. Saltcedar seedlings are moderately common along the lower part of Reach 2. A large, dense stand of saltcedar is present in Magma Wash 1 near the upper dewatering water-storage ponds. Conditions along the channel in the upper part of Reach 3 appear to be too xeric to support saltcedar, but it begins to reappear 0.2 mile above Mary Drive. It is abundant from the Mary Drive location to the lower end of Reach 4 and clearly is competing with cottonwood-willow habitat. The shade created by the existing tree canopy along most of Reach 5 and the presence of nearly perennial streamflow favors cottonwood-willow vegetation over saltcedar, but saltcedar is still present in scattered locations in Reach 5.

Tree of heaven and Mexican palo verde are common in Reach 2. They are also present at lower densities in Reaches 3–5. Giant reed appears in only two downtown locations. Oleander is an ornamental plant that has begun establishing itself in the creek channel along Reach 2. Although it is not as common as saltcedar or tree of heaven, its population appears to be increasing.

3.4.4 Special-Status Species

Special-status species are plants and animals that are:

- listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (ESA) (US Department of Interior, Fish and Wildlife Service, http://arizonaes.fws.gov);
- federal candidates for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under the ESA (Notice of Review 1999);
- federal species of concern to the U.S. Fish and Wildlife Service (USFWS) (former C2 species whose conservation status may be of concern to USFWS (Arizona Game and Fish Department, Heritage Data Management System, http://www.gf.state.az.us);
- U.S. Forest Service sensitive (taxa occurring on National Forests in Arizona which are considered sensitive by the Regional Forester) (U.S. Department of Agriculture, Forest Service, Region 3, http://www.fs.fed.us/r3/);
- Wildlife Species of Concern in Arizona (species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines) (Arizona Game and Fish Department, http://www.azgfd.com); and

- plants protected under the Arizona Native Plant Law (1993) (http://agriculture.state.az.us/PSD/nativeplants.htm).

Table 3-2 contains a list of these species and summarizes their status, habitat requirements, potential for occurrence in the project area, and potential effects to these species as a result of riparian restoration. This list was prepared using input from USFWS, Arizona Game & Fish Department, and Tonto National Forest.

3.4.4.1 Wildlife

Based on information contained in *Wildlife of Special Concern in Arizona* (Arizona Game & Fish Department in prep.) regarding the range-wide distributions of these species and the habitat suitability of the project area for these animal species, Jones & Stokes determined that there is potential for 9 of the 10 species to occur in the project area. There is no suitable habitat for the pocketed free-tailed bat, which uses caves and rock crevices for roosts (Burt and Grossenheider 1980).

The aquatic habitat in the project area from the WWTP Wash to the Boyce Thompson Arboretum may provide habitat for the desert pupfish, longfin dace, and Gila topminnow, but because the habitat conditions (i.e., ponded water, presence of predators) are not ideal for these species, the potential for occurrence is considered limited. According to the Arizona Game and Fish Department (Davidson pers. comm.), there is a population of Gila topminnow in the ponds at the arboretum. This is the only known population in the vicinity of the project area and it is not a naturally occurring population. AGFD also has records of a refugia population of pupfish at the arboretum, but the last record is from 1991. AGFD is planning to survey the arboretum area for pupfish and topminnow in late August 2002. Naturally occurring populations of pupfish were extirpated from the state in the 1950s.

The aquatic habitat from the WWTP Wash to the arboretum may also provide habitat for the lowland leopard frog and the Mexican garter snake. Lowland leopard frogs are habitat generalists and breed in a variety of natural and manmade aquatic systems. The Mexican garter snake is usually found in or near water where it feeds on frogs such as the lowland leopard frog (Stebbins 1966).

Because the Sonoran desert tortoise occurs in upland habitats, the potential for this species to occur in the riparian corridor of Queen Creek within the project area is also low. The only potential habitat is along a portion of the pipeline corridor on the east side of Highway 177, where it is unlikely to occur because of the highly disturbed habitat immediately adjacent to the road.

Habitat requirements of the Maricopa leafnose snake are similar to those of the Sonoran desert tortoise. The species occurs in upland desert habitat such as mesquite, saltbush, creosote bush, and paloverde. It burrows in relatively coarse, rocky soils and sand, and is known from the Superior area (Stebbins

Table 3-2. Special-Status Species with Potential to Occur near Queen Creek

Species	Status* ESA/FS/AZ	Habitat Requirements	Potential for Occurrence under Existing Conditions	Potential Effects of Riparian Habitat Restoration
FAUNA				
Desert pupfish (*Cyprinodon macularius*)	LE/-/-	Historically inhabited marshes, springs, backwaters, and slow flowing rivers and streams, of the Gila River Basin below 5,000 feet, before being extirpated from Arizona. Has been reintroduced in a number of sites in Arizona.	Low; although Queen Creek between the WWTP drainage and the arboretum supports perennial stream conditions that could support the fish, the presence of non-native predatory sunfishes would hinder establishment of a pupfish population.	Activities that would result in the reduction of flows in the currently perennial reach of the creek could adversely affect this species, if present. However, creation of new areas of perennial or near-perennial stream and additional riparian vegetation could provide improved habitat.
Gila topminnow (*Poeciliopsis occidentalis*)	LE/-/WC	Historically, was the most abundant native fish in the Gila River Basin. Currently occurs in 11 natural localities in southern Arizona, in warm water with moderate current in portions of the stream containing dense aquatic vegetation and algal mats.	Low; although Queen Creek between the WWTP drainage and the arboretum supports perennial stream conditions with dense algal mats, the lack of current and the presence of non-native predatory sunfishes and mosquitofish would hinder establishment of a topminnow population.	Activities that would result in the reduction of flows in the currently perennial reach of the creek could adversely affect this species, if present. However, creation of new areas of perennial or near-perennial stream and additional riparian vegetation could provide improved habitat.
Longfin dace (*Agosia chrysogaster*)	SC/-/-	Native to the Gila, Bill Williams, Magdalena, Yaqui, and Sonoyta River drainages. It has been introduced to the Virgin River basin. Occurs in a range of habitats, from low elevations intermittent desert streams to cool, higher elevation streams.	Low; although Queen Creek between the WWTP drainage and the arboretum supports perennial stream conditions with some cover, the lack of flowing water with pools and runs would hinder establishment of a longfin dace population.	Activities that would result in the reduction of flows in the currently perennial reach of the creek could adversely affect this species, if present. However, creation of new areas of perennial or near-perennial stream and additional riparian vegetation could provide improved habitat.
Lowland leopard frog (*Rana yavapaiensis*)	SC/S/WC	Generally restricted to permanent waters, apparently preferring streams over ponds or other aquatic habitats within 0.25 mile of water.	Moderate to high; suitable aquatic habitat appears to be present in Queen Creek from the WWTP drainage to the arboretum. Non-native predaceous fishes and bullfrogs (if present) could negatively affect the frog.	Creation of new areas of perennial or near-perennial stream and additional riparian vegetation could provide improved habitat, including movement and dispersal corridor as well as potentially improved foraging and breeding opportunities.
Sonoran desert tortoise (*Gopherus agassizii*)	SC/-/WC	Occurs across much of southwestern Arizona's Sonoran Desert, principally in rocky foothills, and less often on lower bajadas and in semidesert grassland.	Low; because suitable habitat for this species only occurs adjacent to Highway 177, the potential for occurrence of this species is low.	None.

Table 3-2. Continued

Species	Status* ESA/FS/AZ	Habitat Requirements	Potential for Occurrence under Existing Conditions	Potential Effects of Riparian Habitat Restoration
Cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*)	LE/-/WC	Occurs below 4,000 feet in riparian forests, mesquite-cottonwood woodlands, and desert scrub habitats in the southern and central portions of Arizona.	Low to moderate; because suitable habitat occurs in Reaches 3 and 4 on the south side of Highway 60.	Creation of the lake will eliminate 4 acres of mesquite bosque. Some loss would occur during lake construction and the remaining loss would be a habitat conversion overtime as the site is flooded and mesquite bosque habitat converts to cottonwood riparian.
Common black-hawk (*Buteogallus anthracinus*)	-/S/WC	Requires riparian habitat with mature trees for nesting and foraging. Nests in the drainages of the Gila, Salt, Verde, Bill Williams, and San Pedro rivers.	Low; because suitable nesting habitat does not occur within the riparian corridor of Queen Creek, the potential for occurrence of this species is low.	None.
Maricopa leaf-nosed snake (*Phyllorhynchus browni lucidus*)	-/S/-	Occurs from 1,000–3,000 feet in elevation in desert habitats dominated by mesquite, creosote, paloverde, or saguaro cactus.	Low; suitable habitat for this species only occurs adjacent to Highway 177.	None.
Mexican garter snake (*Thamnophis eques megalops*)	SC/S/WC	A strongly aquatic snake that primarily occurs in permanent marshes and streams in central, south-central, and southeastern Arizona.	Moderate; suitable aquatic habitat appears to be present in Queen Creek from the WWTP drainage to the arboretum.	Creation of new areas of perennial or near-perennial stream and additional riparian vegetation could provide improved habitat, including movement and dispersal corridor as well as potentially improved foraging and breeding opportunities.
FLORA				
Arizona hedgehog cactus (*Echinocereus triglochidiatus arizonicus*)	LE/S/HS	Occurs on open slopes, in narrow cracks between boulders, and in the understory of shrubs in the ecotone between Madrean evergreen woodland and interior chaparral, generally between 3,700–5,200 feet.	Low; suitable habitat for this species does not occur within the riparian corridor of Queen Creek. Also, the project area elevation, which ranges between about 2,350–3,000 feet, is slightly below the margin of the species' range.	None.

Table 3-2. Continued

Species	Status* ESA/FS/AZ	Habitat Requirements	Potential for Occurrence under Existing Conditions	Potential Effects of Riparian Habitat Restoration
Hohokam agave (*Agave murpheyi*)	SC/S/HS	Found in Sonoran desert scrub in central Arizona south to Sonora, between 1,300–2,400 feet, usually associated with prehistoric and historic human habitation.	Low; suitable habitat for this species does not occur within the riparian corridor of Queen Creek. However, species could occur in the vicinity of the historic Old Pinal townsite adjacent to the plan area, because of the presence of historic and prehistoric habitations.	None.
Acuña cactus (*Echinomastus erectocentrus acunensis*)	C/-/-	Occurs between 1,200-2,600 ft. on slopes of broad, dissected hills of granite or andesite. Habitat range is Puerto Blanco Mountains, Little Ajo Mountains and Sauceda Mountains, hills between Florence and Kearney, north and south of the Gila River, and in the Sonoita Hills of Sonora Mexico. Restricted to well-drained knolls and ridges between major washes.	Low; little potentially suitable habitat exists for this species. Elevation of the project area ranges from 2,350–5,541. Therefore, the species potential is greater downstream of the project area than within the project area.	None. Since this is a desert species, reduced water supply downstream of the project area would not adversely affect its survival.
Nichol's Turk's head cactus (*Echinocactus horizonthalonius* var. *nicholii*)	LE/-/-	Found in southwestern Pinal and north-central Pima Counties. Occurs at elevations of 2,000–3,600 ft. The preferred habitat consists of open vegetation with few trees and scattered low shrubs.	Low; the only potential habitat for this species would be the portion of the pipeline corridor on the east side of Highway 177. Because this area is highly disturbed habitat adjacent to the road, it is unlikely to occur here.	None.
Varied fishhook cactus (*Mammillaria viridiflora*)	-/-/SR	Found in several different habitats from Upper Sonoran zone in association with *Quercus*, *Arctostaphylos*, and *Juniperus* to the Lower Sonoran zone in association with *Carnegiea*, *Fouquieria*, and *Larrea*. Typically grows on granite outcrops where terrain is very rugged and associated vegetation is very dense	Low, because suitable habitat for this species does not occur within the riparian corridor of Queen Creek. This species has been found in Superior area; however, it is likely to occur on the steep slopes adjacent to the riparian corridor where the terrain is rugged but the incline supports dense vegetation. This type of habitat does not occur within the project area.	None.

Table 3-2. Continued

---

*Status explanations

ESA = Endangered Species Act (US Department ofinterior, Fish and Wildlife Service (http://arizona.fws.gov)

LE = Listed Endangered. Species identifed by the U.S. Fish and Wildlife Service under the Endangered Species Act as being in imminent jeopardyof extinction.
C = Candidate. Species for which USFWS has sufficient information on biological vulnerability (Notice of Review 1999).
SC = Species of Concern, The term should be considered as a term-ofart that describes the entire realm oftaxa whose conservation status maybe of concern to USFWS (currently all former C2 species, Notice ofReview 1999).

FS = US Forest Service (1999 Animals, 1999 Plants) (US Department ofAgriculture, Forest Service, Region 3, http://www.fs.fed.us/r3/).

S = Species classifed as "sensitive" by the Regional Forester when occurring on lands managed bythe U.S. Forest Service.

AZ = Arizona State

WC = Wildlife of Special Concern in Arizona. Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines. (Arizona Game and Fish Department http://azgfd.com)

HS = Highly safeguarded. Those Arizona native plants whose prospects for survival in this state are in jeopardyor that are in danger of extinction, or are likely to become so in the foreseeable future, as described by the Arizona Native Plant Law (1993) (Arizona Department of Agriculture, http://agriculture.state.azus/PSD/nativeplants.htm)

SR = Salvage restricted. Those Arizona native plants not included in the HighlySafeguarded category, but have a high potential for theft or vandalism, as described bythe Arizona Native Plant Law (1993) (Arizona Department of Agriculture, http://agriculture.state.azus/PSD/nativeplants.htm)

1966). If present, it would be expected to occur along the pipeline route in the same area as the Sonoran desert tortoise.

The pygmy-owl was formerly fairly common in mesquite bosques throughout south-central and southern Arizona, including in the Superior area (Arizona Game and Fish Department, Heritage Data Management System 2002). Before 1950, pygmy-owls were fairly common in low elevation riparian mesquite woodlands ranging north to Phoenix, northwest to the Salt-Gila River confluence, west to Cabeza Prieta Tanks, and east to at least Superior (probably to upper Gila River near Safford) (Arizona Game and Fish Department Heritage Data Management System 2002).

Historically, pygmy-owls in Arizona were recorded in mature riparian systems characterized by cottonwood-willow galleries or mesquite bosques. Recent owl observations have been restricted to Sonoran desert scrub habitats characterized by braided wash systems and dense vegetation, including ironwood, palo verde, and mesquite. Historically, pygmy-owl nests were documented in cavities of cottonwoods, willows, or mesquites, although recent nest sites have been located in saguaro, ash, and eucalyptus cavities (Arizona Game and Fish Department 2002). The survey protocol goes on to define suitable habitat for the owl as areas below 4,000 ft in elevation containing one or more of the following vegetation communities:

- riparian vegetation: riparian gallery forests of cottonwoods, willows, mesquites, ash, or other tree species growing along watercourses;
- Sonoran desert scrub: braided wash systems and vegetation that is dense and well-structured. Key species include mesquite, foothill and blue palo verde, ironwood, saguaro, organ pipe cactus, and various other shrubs and cacti;
- semidesert grasslands: grasslands containing wooded drainages with mesquite, hackberry, ash, and a limited number of saguaros.

Superior is within USFWS survey Zone 3 (Hartwig pers. comm.). Areas within Zone 3 are within the historic range of the species and contain suitable pygmy-owl habitat but no recent observations of owls. As described above, the project site includes suitable habitat, including the mesquite bosque in Reaches 3 and 4 and some of the larger trees with trunk diameters of 6 inches or greater measured at 4.5 feet above the ground and lower-level cover.

The two separate most recent documented reports of pygmy-owls in the vicinity of Superior date from before 1910 and occurred approximately 25 miles southeast of Superior along the Gila River and about 25 miles southwest of Superior. There are some more recent (early 1990s) reports of pygmy-owls being present on the Florence Military Reservation, but these reports were not confirmed. No comprehensive surveys for this species have been done in the Superior area (Hartwig pers. comm.).

The common black-hawk occurs along streams and nests in riparian habitats in southern Arizona. The riparian habitat in Queen Creek is considered marginal because it does not provide a robust stand of suitable nest trees. However, there

exists a low potential for the common black-hawk to occur in the project area and possibly nest onsite.

3.4.4.2 Plants

Based on known site requirements and elevational distributions of these species, there is at least some potential for the five species listed in Table 3-2 to occur within the project area. Because none of the species is riparian and most of the project area is in a riparian area, the potential habitat area for these species is relatively small in area and is generally limited to the upper reaches of the project area.

Discussions with the Tonto Forest riparian ecologist (Johnson pers. comm.) and the arboretum horticultural specialist (Petrie pers. comm.) have confirmed that Arizona hedgehog cactus (*Echinocereus triglochidiatus arizonicus*) and Hohokam agave (*Agave murpheyi*) could occur in the general vicinity of the plan area, but that they would occupy upland Sonoran desert, not riparian habitats. In addition, the Arizona hedgehog cactus is more commonly found at higher elevations and the Hohokam agave at lower elevations than are found in the project area. Acuña cactus, another non-riparian desert species, also tends to be found at lower elevations (1,300–2,000 feet) than the project area. In addition, acuña cactus typically is found on granite, limestone hills and flats, or andesite, within the palo verde-saguaro association of the Arizona Subdivision of the Sonoran desert scrub, and is restricted to well-drained higher areas and gravel ridges between large washes (Arizona Game and Fish Department 1994). Nichol's Turk's head cactus generally occurs at elevations of 2,000–3,600 feet and is found in Sonoran desert scrub with limestone-derived alluvium (Arizona Rare Plant Committee 2002). The only potential habitat for any of these four plant species would be the portion of the pipeline corridor on the east side of Highway 177 that was identified as potential habitat for Sonoran desert tortoise. Because the area adjacent to the road is highly disturbed habitat, they are unlikely to occur here.

The only likely potential habitat for the varied fishhook cactus would be in Reach 1, upstream of the project area, where the terrain is much steeper than the general project area. The creek bank in the upper end of Reach 2, north of the Magma Avenue bridge, is steep, but the vegetation is not dense and is also somewhat disturbed by past construction activities. Therefore its presence, although possible, is unlikely.

3.5 Cultural Resources

3.5.1 Introduction

The identification of significant cultural resources was accomplished through a Class III cultural resources survey, records search, and literature review of

approximately 162 acres (66 hectares) along the Queen Creek riparian corridor as it passes through the town of Superior, Arizona (Appendices C and D). The Arizona State Museum, the State Historic Preservation Office, the Bureau of Land Management, and Tonto National Forest were consulted during the records search. The pedestrian survey and associated records search resulted in the identification of six archaeological sites and 26 isolated occurrences. Numerous historical structures are located along the riparian corridor in the Town of Superior. However, these structures were not recorded because they are located outside of the project boundary (the 100-year floodplain).

Previously recorded sites were briefly inspected to determine if additional work would be necessary. One of the previously recorded sites is not considered eligible to the National Register of Historic Places (NRHP). The remaining sites are all considered NRHP-eligible under Criterion D for their potential to yield additional information pertaining to the historical growth and development of the Town of Superior. The following section (Section 3.5.2, "Cultural and Historic Setting") was largely adapted from the technical reports prepared as a result of these surveys, which are provided in Appendices C and D. Rather than providing an exhaustive account of the cultural history of the area, the setting concentrates on those themes and contexts that relate to the known cultural resources in the project area.

3.5.2 Cultural and Historic Setting

The project area is located in Sections 3, 4, 9, T2S, R12E, and Sections 35, T1S, R12E, Pinal County, Arizona. The elevation of the project area ranges from 2,580 feet (786 meters) to 2,950 (1,027 meters) above mean sea level. The project area passes through the Town of Superior and is located within the Basin and Range Physiographic Province of central Arizona (Hendricks 1985:17–26; Plate 2). Vegetation in the project area is characteristic of the Arizona Upland Subdivision of the Sonoran Desert Scrub Biotic Community (Turner and Brown 1994:180–200). Such vegetation includes bursage, palo verde, yucca, ocotillo, buckhorn cholla, prickly pear, saguaro, and barrel cacti, as well as several varieties of grasses and bushes. Riparian flora along the creek include cottonwood, willow, sycamore, ash, catclaw, mesquite, and numerous grasses and weeds.

Paleoindian Period (10,000 to 7,500 B.C.)

The earliest known occupation in North America is the Paleoindian period. No evidence of cultural remains from this time period has been found in the vicinity of Superior. The relatively recent development of the upper bajada around Superior makes it unlikely that Paleoindian sites or artifacts would be found on the surface in this area.

Archaic Period (7,500 B.C. to A.D. 200)

Early Archaic (7,500 to 4,800 B.C.) sites are rare in Arizona. Following the amelioration of Pleistocene climate and the extinction of Pleistocene megafauna, humans in southeastern Arizona began to adapt to a warmer, drier climate and the widespread availability of small game animals. A substantial reliance upon collected plant material is assumed to have occurred because of numerous grinding implements that have been found at Early Archaic sites (Huckell 1996). Presumably, a similar transition would have occurred along Queen Creek if the area was occupied at that time.

Prehistoric occupation along Queen Creek near Superior has been verified by the Middle Archaic (4,800 to 1,500 B.C.). As part of their regional exploitation, small mobile groups exploited the seasonally ripe plant resources and available small game in the area. The mobile lifestyle resulted in the reuse of some locations over multiple generations, often for a small number of specialized activities such as collecting or processing food resources.

The Late Archaic (1,500 B.C. to A.D. 100) represents a time of increasing population size and experimentation with different subsistence systems. Collected resources continue to be an important part of the diet, but evidence of agriculture begins to appear at some sites. As agricultural resources play an increasing role in Late Archaic subsistence, corresponding changes included activity scheduling, task unit size, and increasing sedentism.

Ceramic Period (A.D. 200 to 1450)

The Hohokam culture represents the most widespread archaeological culture identified in southern Arizona. The Hohokam lifestyle developed out of the preceding Late Archaic and represents an elaboration of previous patterns. There is considerable variation for the 15 centuries that the Hohokam occupied the Salt River Valley and its margins, but a general cultural history of the region is outlined in the following paragraphs.

The first settled villages known in the Salt River Valley mark the Red Mountain phase (A.D. 100 to 400). Evidence of subsistence practices from Red Mountain phase sites indicates reliance upon collected resources, but with a growing dependence upon agricultural products. The Pioneer period (A.D. 400 to 700) is associated with the first appearance of irrigation agriculture and decorated ceramics identified in the Gila and Salt River Valleys. The Colonial period (A.D. 750 to 950) was an era of expansion and elaboration for the Hohokam. Areas that were distant from the Gila and Salt Rivers were occupied as the number and size of Hohokam sites increased. Colonial period sites have been found as far north as Prescott, south into Mexico, west of the Gila Bend area, and east near the New Mexico border. The Sedentary Period (A.D. 950 to 1150) was a time of decline for the formerly flourishing Hohokam. Sedentary period subsistence continues to show an increased reliance upon domesticated crops, along with intensification in procurement of selected wild resources. The Hohokam Classic

period (A.D. 1150 to 1450) exhibits an increased reliance upon irrigation agriculture and domesticated products.

Archaeological remains associated with the Salado culture are prevalent in the areas surrounding Superior by the Classic period. The Salado are identified by adobe, or masonry, compound architecture and polychrome pottery. The intrusion of Salado materials into areas occupied by the Hohokam likely represents the migration of peoples and ideas to the margins of the Salt and Gila River valleys from regions to the north and east. The heart of the Salado culture is in the Tonto Basin, north of Globe, Arizona.

Protohistoric (A.D. 1450 to 1700)

Population in and around the Salt River Valley declined precipitously after the Hohokam Classic period. Significant habitation of the area was absent until the nineteenth century, though at least two aboriginal cultures continued to procure resources in the area. Small groups of Yavapai exploited the uplands, while Pima farms and villages were established south of the Salt River. Fishing, hunting, and wild plant collection have been documented for areas near the Salt River in the early nineteenth century.

Historic Period (A.D. 1521 to 1950)

Although Coronado explored this region of Arizona in 1542, little other Spanish exploration took place thereafter. Spanish travelers into the region were mainly Jesuit priests whose mission it was to convert the indigenous population to Catholicism. Spanish settlements were eventually established in the larger region in which the Apache raided. Spanish attempts to combat the Apache raiding were not successful, and hostilities became intensified. In the late 1700s a peace agreement was reached with the Apaches, and a food ration system was established which decreased raiding activities. This situation deteriorated after Mexico won independence from Spain in 1821, and by 1831 Apache raiding had recommenced with intensity. This was met with a Mexican policy of extermination; and, as a result, from 1831 to 1853, the Apache population of Sonora drastically declined.

After Arizona came under the control of the United States in 1853, Euroamericans began immigrating to the area, many intent on making their fortune in mining. Hostilities ensued between the new immigrants and the Apaches that resulted in warfare that lasted for almost 40 years. In 1870, the Western Apache were removed to the San Carlos Reservation. Today, the first and preferred language of many Apache is their native language, and while many have converted quite devoutly to Christianity, native ceremonies are still conducted by shamans, and many of the native spiritual beliefs are still maintained and passed on.

The Silver King and the Pioneer Mining District were established after the discovery of silver in the 1870s. In 1878, the mill town of Pinal (originally known as Picket Post) was established and quickly began processing the ore of the Silver King mine. Pinal soon became a town with a population of over 2,000 (Bernard Deutsch Associates 1988). Another mining camp that developed around Silver Queen became known as Queen. The economic depression of the 1890s and the discontinuation of silver coinage in 1893, led to the decline of silver mining and the cessation of production by the Silver Queen. In 1902, the Lake Superior and Arizona Mining Company was established, which purchased the Golden Eagle mine and laid out the townsite of Hastings at the Queen mining camp. The town was eventually renamed Superior, and prospered with the growth of mining companies with a peak population of more than 5,000.(Bernard Deutsch Associates 1988).

In 1910, William Boyce Thompson purchased the Silver Queen mine and constructed a mill and smelter and the Magma Arizona Railroad to transport the ore. Over the following years, many structures were built to serve the needs of the company employees. In 1924, Thompson built an arboretum west of Superior, along Queen Creek in 1924. Today, the arboretum is both a National Historic District and an Arizona State Park.

3.5.3 Known Resources

A total of nine archaeological investigations have been conducted in the vicinity of the project area. A total of 18 archaeological sites have been located within an approximate 1-mile radius of the project area as a result of previous investigations. The nature of the previously recorded sites is varied, with a diversity of prehistoric and historical site types represented. For example, prehistoric sites consist of Hohokam habitation sites and artifact scatters, as well as a Salado village and artifact scatter. The historical remains are primarily associated with mines and mining related activities such as claims, prospects, adits, shafts, tailings, access roads, and associated machinery. Historical trash dumps, which may or may not be associated with mining, are also common.

3.5.3.1 Previously Identified Sites

Only two of the previously recorded sites, AZ V:2:101(ASM) and AZ U:12:105(ASM), are located on or adjacent to the current project boundary.

AZ V:2:101(ASM) consists of the historical period road that connected Florence to Superior to Miami and Globe. The construction of U.S. Highway 60 usurped the majority of the historical period alignment. However, certain roadway related features, such as bridges remain intact. Very little remains of the original roadway, besides its orientation and alignment, in the vicinity of the project area. However, a portion of the original road still exists on the eastern side of Superior as it leaves town, paralleling Queen Creek on its south side as it heads up the canyon. This portion of the site intersects the project area. The original site card

and report were not found, but the site is listed as eligible to the NRHP. The site is eligible under Criterion D for its potential to yield information pertaining to historical era communication and transportation.

AZ U:12:105 consists of a small historical period trash scatter. The site is located on an "island" of land created by the U.S. 60 and SR 177 interchange on the east side of Superior. The site is originally described as a two-track road alignment and historic trash dump consisting of glass, ceramics, metal, and a clay doll observed (DeMaagd 2000). The site is listed as not eligible to the NRHP. The site was inspected in the field as part of the current project area. It should be noted that the project corridor will not impact any cultural remains associated with this site. The site does not appear NRHP-eligible due to the lack of information potential associated with the site.

3.5.3.2 Newly Identified Sites

Four sites and 26 isolated occurrences were identified and recorded during the pedestrian survey of the project area.

AZ U:12:152(ASM) consists of a historical period trash dump, or artifact scatter. There appears to be some depth to the site based on the presence of artifacts eroding out of the hillside. The only feature identified consisted of a wellhead located on the west side of the site on the uppermost terrace. It was not possible to determine if the artifacts were the result of a single dumping episode or repeated refuse disposal. The artifacts primarily consisted of glass bottles, including numerous bases, lips, and necks. Ceramics were also abundant. Other artifacts consisted of various pieces of metal. Numerous glassmaker's marks were observed. Maker's marks indicate the site may have been formed as early as the period 1920–1929. The site is in decent condition despite natural processes such as erosion. Modern debris and refuse are also interspersed with the historical artifacts. However, the site appears eligible for inclusion in the NRHP under Criterion D for its potential to yield information. The site is located outside of the town of Superior and may provide information pertaining to domestic life associated with homesteading and mining in the region.

AZ U:12:153(ASM) consists of several historical artifact concentrations and various car parts. Site depth is unknown. Numerous Model T cars parts were scattered across the site, representing between two and four disassembled autos. The only other feature at the site consists of a small push pile of small cobbles and historical debris such as glass and ceramics. There were five concentrations of artifacts and/or car parts identified across the site. The density of artifacts within the concentrations ranged from 3 to 30 artifacts per square meter. Artifacts primarily consisted of glass and ceramics. Metal objects were also common. Maker's marks identified on several bottle bases suggest the site may have been formed in the 1920s at the earliest. It is not possible to determine if the site is the result of multiple dumping episodes, or the result of a single event. The site is located within the area identified as "Bellamy Pasture" on the 1912 GLO plat map. However, the relationship of the site to the pasture is unknown. The site is in good condition. The site appears eligible for inclusion in the NRHP

under Criterion D for its potential to yield information. The site is located outside of Superior proper and may provide information on nearby homesteading and mining. It may also be possible to determine the relationship, if any, to Bellamy Pasture.

AZ U:12:154(ASM) consists of a historical period trash dump, or artifact scatter, eroding out of the bank of a wash. The refuse is likely associated with the historic concrete foundation located above it. A trailer is now located on the foundation. There appears to be considerable depth to the sediments based on the numerous artifacts eroding out of the edge of the creek. There were no features associated with the site. The artifacts consisted primarily of glass, as well as historical ceramic and metal. It is likely that the site is the result of repeated trash disposal "out the back door" from the former structure located above the wash. The average artifact density was approximately 30 artifacts per square meter. Based on the observed maker's marks, it is likely that the site was formed in the late 1930s and 1940s and continued to grow as more refuse was added over the following decades. The site is in decent condition despite natural processes such as erosion. Modern debris and refuse is also interspersed with the historical artifacts. However the site appears eligible for inclusion in the NRHP under Criterion D for its potential to yield information. The site is likely to provide information on domestic or commercial activities in the town of Superior during the first half of the twentieth century.

AZ U:12:155(ASM) consists of a historical period trash dump, or artifact scatter, eroding out of the bank of a wash. The refuse is likely associated with several houses to the south. There appears to be depth to the sediments based on the numerous artifacts eroding out of the edge of the creek. There were no features associated with the site. The artifacts consisted primarily of glass, as well as historical ceramic and metal. It is likely that the site is the result of repeated trash disposal "out the back door" from the former structure located above the wash. The average artifact density was approximately 20 artifacts per square meter. Based on the observed maker's marks, it is likely that the site was formed in the late 1930s and 1940s and continued to grow as more refuse was added over the following decades. The site is in decent condition despite natural processes such as erosion. Modern debris and refuse is also interspersed with the historical artifacts. However the site appears eligible for inclusion in the NRHP under Criterion D for its potential to yield information. The site is likely to provide information on domestic activities in the town Superior during the first half of the twentieth century.

A total of 26 isolated occurrences were recorded as a result of the pedestrian survey. The majority of isolated occurrences consist of linear rock alignments. The rock alignments are likely prehistoric agricultural features related to floodwater farming along Queen Creek. Some of the alignments are parallel rows of rocks with a cleared space between them, whereas others are a single row of rocks with a cleared space behind them, or "upslope." Numerous rock alignments were scattered across portions of the 100-year floodplain where it is broad and relatively flat. It is likely that more of these features exist than were identified by the current project. The identification of these features is difficult due to natural processes of flooding and erosion, as well as the density of

vegetation in these low-lying areas. Several possible field houses were also identified in the low-lying area. They were identified as "possible" field houses due to their ephemeral nature and lack of associated artifacts. Archaeological testing, or excavation, would be necessary to determine if cultural sediments or artifacts occur in association with these features. Cars or parts of cars were also common throughout the project area. Only the locations of vehicles that were clearly historical in age were recorded. The majority of automobiles were modern in age. A variety of modern trash and debris was also common throughout the project area, while prehistoric and historical artifacts were quite rare. The paucity of archaeological artifacts is likely the result of period flooding which removes some items downstream, while burying others.

Chapter 4

Environmental Consequences

4.1 Introduction

This chapter evaluates the environmental effects that may occur if the proposed action or alternatives are implemented. As required under NEPA, this analysis addresses both direct and indirect effects and any cumulative effects resulting from the proposed action or alternatives. For adverse effects, mitigation measures have been developed to minimize, reduce, or avoid the adverse effect.

4.2 Land Use

This section focuses on the potential impacts associated with implementation of the proposed action and alternatives that may be inconsistent with land use plans or conflict with existing land uses.

4.2.1 Proposed Action

The proposed action involves the construction and operation of a reclaimed waterline, well, and lake. The focus of the restoration benefit would be for the Town of Superior and may be linked to future implementation of recreational components that would be closely associated with the riparian corridor.

As discussed in Section 3.2, "Land Use," the proposed restoration of Queen Creek would be consistent with the goals and policies of the town's general plan. There would be no impacts involving conflicts with this plan.

Impact LU-1: Short-Term Land Use Conflicts

Because the project would involve construction activities along the pipeline route and at the lake, there is the potential for these activities to conflict with local land uses during construction. Noise and dust may be viewed as a nuisance by those with businesses or residences adjacent to the construction site. Implementation of Mitigation Measure LU-1 would minimize this impact.

Mitigation Measure LU-1: Limit Construction Activities to Normal Working Hours

To minimize disruption to nearby businesses and residences, construction activities will be limited to normal working hours. No construction will be allowed on weekends or holidays.

To minimize nuisance impacts from construction site dust, the contractor will be required to comply with the requirements of Article 3 of the Pinal County Air Quality Control District Regulations, which pertain to construction site dust. No other mitigation measures would be required.

Impact LU-2: Potential Long-Term Land Use Impact

A pump station would need to be installed along the pipeline alignment to move the water upgradient to the new discharge point in Community Park. In addition, a well and pump station would be installed either at the lake or at Community Park. The precise locations of these facilities are not currently known. Depending on the size of the pump, noise from pump motors may be disruptive to existing or future noise-sensitive land uses along the route, such as residences. Mitigation is required to minimize this potential effect.

Mitigation Measure LU-2: Assess and Mitigate Noise Issues Prior to Siting and Operation of Pumps

During the design phase of the project, the Town of Superior will conduct an assessment of potential noise impacts associated with the installation of the pump system for the project. The Town will consider siting of the pump and noise emissions of the system to be installed to ensure that potential noise impacts are minimized or avoided.

4.2.2 No-Action Alternative

Under the No-Action Alternative, the plan would not receive necessary funding and the restoration of water flow, native vegetation, and wildlife along Queen Creek would not occur until an alternative funding source was identified. The adverse impacts described for the proposed action would not occur. In addition, the beneficial effects of the project on local land uses would not be realized.

4.2.3 WWTP Water Discharge Point Alternative

This alternative point would be located in Reach 4 and would entail the addition of a new discharge point for reclaimed water to Queen Creek just east of the WWTP. This would be done either by adding a valved turnout to the existing reclaimed water pipeline that crosses the creek or by installing a new pipeline from the WWTP to the new discharge point. Construction activities would be

minimal under this alternative since the distance to the creek is short and construction would occur in a relatively undeveloped area. For these reasons, no adverse impacts to existing land uses would occur. However, this alternative would reduce the amount of riparian restoration that would occur within the town limits and would not have a beneficial impact in the downtown area. Reach 4 downstream of the WWTP is undeveloped land and implementation of this alternative would not affect that land use.

Impact LU-1: Short-Term Land Use Conflicts

Because the project would involve construction activities along the pipeline route, there is the potential for these activities to conflict with local land uses during construction, particularly traffic to and from the WWTP. Noise and dust may be viewed as a nuisance by the WWTP or by nearby residents. Implementation of Mitigation Measure LU-1 would minimize this impact.

Mitigation Measure LU-3: Coordinate Activities with WWTP

To minimize disruption to WWTP activities, the town will coordinate construction with the WWTP to ensure that disruption of normal work activities is minimized.

To minimize nuisance impacts from construction site dust, the contractor will be required to comply with the requirements of Article 3 of the Pinal County Air Quality Control District Regulations, which pertain to construction site dust. No other mitigation measures would be required.

Impact LU-2: Potential Long-Term Land Use Impact

If a new pipeline is installed from the WWTP to Queen Creek, no pump will be required. Installation of a valved turnout of the existing pipeline, however, would require installation of a new low-rate, low-pressure pump near the new turnout. The exact location of this pump is not currently known, but is assumed that the pump will be located adjacent to the existing pipeline. Depending on the size of the pump, noise from pump motors may be disruptive to existing or future noise-sensitive land uses along the route, such as residences. Mitigation is required to minimize this potential effect.

Mitigation Measure LU-4: Assess and Mitigate Noise Issues prior to Siting and Operation of Pumps

If a valved turnout is used, and a pump is therefore required, during the design phase of the project the Town of Superior will conduct an assessment of potential noise impacts associated with installation of a pump system along the pipeline route. The Town shall consider siting of the pump and noise emissions of the system to be installed to ensure that potential noise impacts are minimized or avoided.

4.3 Water Resources

4.3.1 Methods

A water-balance model of Queen Creek and its associated vegetation was developed to facilitate restoration planning by providing a quantitative analysis tool that related water availability to vegetation (Jones & Stokes 2000). The spreadsheet model calculated gains and losses of water along each of five reaches of Queen Creek (Figure 3-1). The model also accounted for flows in washes that conveyed discharges of BHP dewatering water and treated municipal WWTP effluent. Water-budget items included in the model were natural runoff from rainfall, snowmelt, and groundwater discharge in the upper Queen Creek watershed; discharges from BHP and the WWTP; diversion at the arboretum pump house; seepage losses in the upper watershed area induced by mine dewatering; seepage gains and losses along the lower reaches of the creek where the water table is naturally higher or lower than the creekbed; direct evaporation from the creek surface; and net evapotranspiration (ET) by phreatophytic vegetation along the riparian corridor.

The flood-hydraulics model developed by FEMA was updated during the original project planning phase to provide quantitative estimates of the potential project-related impacts to flooding from various vegetation-restoration alternatives (Jones & Stokes 2000). The simulations were performed with the U.S. Army Corps of Engineers' HEC-RAS software. Information and input data from FEMA for hydraulic parameters such as roughness coefficients and expansion and contraction coefficients were duplicated to the extent possible.

4.3.2 Proposed Action

Impact WR-1: Temporary Construction-Related Water Quality Impacts

Project-related construction activities for the pipeline, well, and lake could cause temporary water quality impacts because disturbed and eroded soil, petroleum products, and miscellaneous construction wastes may be discharged to receiving surface waters and groundwater. Soil and associated contaminants that enter stream channels can increase turbidity, stimulate the growth of algae, increase sedimentation of aquatic habitat, and introduce compounds that are toxic to aquatic organisms. Construction materials such as fuels, oils, paints, and concrete are potentially harmful to fish and other aquatic life if released into the environment. The extent of potential environmental effects depends on the erodibility of soil types encountered, the type of construction practice, the extent of the disturbed area and the duration of the disturbance, the timing of precipitation, and the proximity to drainage channels. The size of the project-related land disturbances would most likely exceed 1 acre but be less than 5 acres. If construction occurs after March 10, 2003, the NPDES stormwater

permit system for general construction activity would apply to the action. Implementation of the following mitigation would avoid and minimize construction impacts to water quality.

Mitigation Measure WR-1: Implement Construction Site Practices and Secure NPDES Permit

To minimize exposure of disturbed construction sites to rainfall and stormwater runoff, construction activities should be conducted in the dry weather season to the extent possible. The general contractor for the project will prepare and implement standard grading and erosion control measures to minimize contaminated runoff. If construction occurs after March 10, 2003, the contractor will contact either the Environmental Protection Agency (EPA) or ADEQ, as appropriate (Section 5.1.1), to obtain authorization under the NPDES stormwater permit for general construction activity. Standard erosion control measures (e.g., management, structural, and vegetative controls) will be implemented for all construction activities that expose soil to stormwater runoff. Best management practices (BMPs) must be implemented before predicted rain events. In addition, the construction contractor will implement standard hazardous materials management practices to reduce the possibility of chemical spills or releases of contaminants in runoff.

Impact WR-2: Long-Term Surface and Groundwater Water Quality Impacts

Moving the discharge location for the WWTP effluent upstream would expose a new section of the river to potential conventional inorganic and organic contaminants that are typically present in domestic wastewater effluent. The WWTP effluent meets the highest applicable ADEQ water quality standards for A+ water and, therefore, the project would be consistent with the designated uses of Queen Creek. However, the WWTP can still contain variable concentrations of dissolved solids, organic matter and oxygen-demanding substances, nutrients (nitrogen and phosphorus), bacteria and other potential pathogens, and trace metal and organic compounds, depending on the source of raw wastewater inflows. Dissolved solids and nitrates can percolate through the stream channel to the groundwater aquifers. Nutrients in the channel can stimulate increased aquatic algae or aquatic plant growth, available dissolved oxygen can be reduced, pathogens can reduce recreational opportunities, and other contaminants can potentially impair aquatic organisms.

While the location of impacts would change by relocating the WWTP discharge point, the potential impacts would be similar to the current situation because the receiving water (Queen Creek) would not change. The water quality would be suitable to support existing ADEQ-designated recreational, aquatic and wildlife habitat, and agricultural uses that occur along the channel. ADEQ currently does not identify drinking water or full-body contact recreation as a beneficial use in Queen Creek; therefore, the use of the WWTP discharges is consistent with applicable water quality regulations. The Town of Superior would have to revise

its NPDES permit for the WWTP; modifications to the water quality monitoring and reporting program for the permit would presumably be required to address specific discharge issues. The potential percolation of effluent to the groundwater aquifer would not have any adverse impacts because the aquifer area is not used for municipal supplies in Superior and the quantity of discharge would be small compared to the size of the groundwater basin potentially affected.

No mitigation is required because the project is consistent with applicable regulations. However, public knowledge, perception, and opinions regarding the use of reclaimed wastewater can vary. Because a new discharge location for WWTP effluent will be created, the town should consider including an educational component for the project (e.g., written brochures, advertisements, information signs along the channel) that describe applicable regulations, precautions, and proper uses near the channel.

Impact WR-3: Potential Changes in Flood Conveyance or Floodplain Storage

The project-related increase in Queen Creek streamflow should stimulate growth of phreatophytic vegetation within the channel. The project would use approximately 20% of the volume of annual WWTP effluent to maintain approximately 1,100 feet of wetted channel downstream of the discharge point until approximately May 1 of each year and to meet the ET rate produced by the increased vegetation (Jones & Stokes 2000). The WWTP effluent and the nutrients (nitrogen and phosphorus) it contains will stimulate riparian vegetation growth. The net increase in riparian vegetation density in the floodway and floodplain has the potential to reduce floodflow conveyance capacity by increasing the hydraulic roughness. Vegetation may also increase the rate and patterns of sedimentation that could reduce floodflow storage capacity within the floodplain. However, simulations of the stream channel showing the project area being fully vegetated with shrubs and trees resulted in a floodplain that was only slightly larger than the existing floodplain in certain areas (Jones & Stokes 2000). The model also confirmed that the floodplain terrace on the south bank of Queen Creek downstream of the Highway 60 bridge, which is the proposed location for the lake, is an area of ineffective flow under flood conditions. The potential impacts to flood conveyance and floodplain storage can be minimized through implementation of the following mitigation.

Mitigation Measure WR-2: Implement Vegetation Management Plan

The town will prepare and implement a vegetation management plan for the riparian vegetation community. In general, the management plan will ensure that vegetation densities and growth patterns are maintained at levels that do not adversely impair the course and currents of floodflows. At a minimum, the management plan will address the following actions:

- allowing enough trees to reach maturity to form a closed canopy that suppresses the growth of shrubby vegetation by shading the creek channel;
- planting or selecting trees whose trunks form a line parallel to the direction of flow, thereby decreasing their individual hydraulic resistances by up to 40%;
- pruning tree branches that are below the 100-year flood level;
- removing shrubby vegetation from areas below the 100-year flood level; and
- removing piles of woody debris that accumulate during floods and that obstruct flood flows.

4.3.3 No-Action Alternative

Under the No-Action Alternative, the project would not be implemented. Therefore, no water quality or hydrologic impacts would occur.

4.3.4 WWTP Water Discharge Point

The WWTP discharge would be located approximately at the mid-point of Reach 4 and its impacts to water resources would be very similar to those of the proposed action. Therefore, impacts WR-1, WR-2, and WR-3 would apply for this alternative and implementation of Mitigation Measures WR-1 and WR-2 would be required to mitigate these impacts.

4.4 Biological Resources

Impacts to biological resources were assessed by determining the nature of temporary and permanent changes to vegetation communities in the project area resulting from implementation of the proposed action and alternatives. In addition, potential impacts to special-status plant and animal species occurring in the project area were also assessed.

4.4.1 Proposed Action

Impact BIO-1: Conversion of Mesquite Habitat in Reach 3 to Other Riparian Communities

As indicated under the discussion for Impact WR-3, it is anticipated that water from the new pipeline will improve the vigor and enhance the growth of the existing riparian vegetation along approximately 1,100 feet of Reach 3. Based upon the model developed by Jones and Stokes (Jones and Stokes 2000) and as shown below in Table 4-1, under the proposed action approximately 16 acres of

existing vegetation downstream of the discharge point would gradually convert to approximately 15 acres of mesquite bosque and about 1 acre mixed-riparian woodland. Since the majority of the woody community in this portion of Reach 3 is already mesquite bosque, "conversion" is somewhat of a misnomer. The more accurate statement would be that, because of the availability of a greater water supply, the vigor and growth rate of approximately 15 acres of mesquite bosque would be increased and 1 acre of mesquite would be converted to mixed-riparian forest. Enhancement of the growth of existing trees would eventually create a more dense canopy along the creek than presently exists. The result should be an increase in the quantity and quality of riparian vegetation in the project area. Because this impact is considered beneficial, no mitigation is required.

Table 4-1 shows the estimated changes in riparian plant communities that would result from installation of the pipeline at the upper end of Community Park.

Table 4-1. Estimated Net Change in Habitat – Proposed Action

Vegetation Type	Change in Vegetation Area (acres)	Restored Canopy Density (%)
Mesquite	-1	40
Mixed-riparian forest	+1	50

The changes in vegetation were calculated based on the water-balance model presented in the original restoration and management plan. The new discharge of reclaimed water is assumed to enhance or convert existing vegetation along the creek banks, so that the total vegetation coverage remains the same. In addition to changing the acreages of riparian communities to a small degree, the discharge causes increases in the canopy coverage within each of the communities, as presented in the table.

Construction of the lake will result in the permanent loss of approximately 3 acres of mesquite bosque through its conversion to open water, emergent, vegetated shallows, and/or cottonwood-willow habitat. A portion of the mesquite that is lost as a result of construction of the lake should be replaced over time by mesquite establishing on the berm of the lake. The size of the area on the berm that will be available for colonization by mesquite will depend on the design of the berm, but is presumed to be small enough that the net loss of mesquite due to lake construction will remain approximately 3 acres. Because of the relative abundance of mesquite in the project area and the enhancement of mesquite habitat that should occur just upstream because of the pipeline, no additional mitigation for the loss of mesquite is anticipated.

Impact BIO-2: Increase in Invasive Plant Species

Providing a new source of water, particularly in amounts that are expected to fluctuate over the year, has the potential for increasing both the quantity and vigor of invasive plant species in the project area. The species of greatest concern is saltcedar, since it already has a substantial presence in the area and

adapts well to habitats with fluctuating moisture levels. The potential for saltcedar expansion is probably greatest along the unlined edges of the lake because the shoreline here will fluctuate during the year.

Mitigation BIO-1: Implement Invasive Species Management Program

The Town will prepare and implement a management plan to control invasive species within the project area. This work will be done in the fall to avoid disturbance of breeding birds and potential contamination of stream flows. Hand equipment will generally be used to minimize damage to surrounding areas. For large trees, including tamarisk, work crews will cut down exotic plants to approximately ground level and paint the stumps with a pesticide registered for use near aquatic areas. Tamarisk can be burned; however, if particular circumstances preclude burning, cutting and other methods should be employed to ensure the plants are thoroughly removed from the project area and ensure destruction of their seed source.

Impact BIO-3: Potential Impacts to Cactus Ferruginous Pygmy-Owl

As described under Impact BIO-1, the proposed project would result in the loss of approximately 4 acres of mesquite habitat (3 acres from lake construction and 1 acre from conversion to mixed-riparian woodland). According to USFWS (Hartwig pers. comm.), the Superior area is considered suitable habitat for the cactus ferruginous pygmy-owl. If pygmy-owls are present, effects would include disturbance from noise or other construction activities while owls are present.

Mitigation Measure BIO-2: Cactus Ferruginous Pygmy-Owl Surveys

To ensure that the project will not affect the pygmy-owl, USFWS protocol-level surveys will be conducted for 2 years prior to construction to determine if pygmy-owls are present. The surveys would be done in the area of the proposed lake site and any other areas containing suitable habitat that could be adversely affected by the project.

Impact BIO-4: Temporary Construction-Related Loss of Vegetation in Reach 3

Construction of the pipeline and lake would result in removal and damage to vegetation in the construction corridor because of the activities necessary to install the pipeline and build the lake (i.e., vegetation crushed or excavated by construction equipment). Much of the damage and loss, particularly from pipeline construction, would occur in areas that are already disturbed, but mixed-riparian and mesquite bosque communities would also be affected. Once the pipeline and berm have been installed and the area of the pipeline restored to

preconstruction grades, the berm and pipeline route should recolonize with plants. Because non-native vegetation is known to occur in the area, both native and non-native plants will probably colonize.

Mitigation Measure BIO-3: Mark Construction Limits and Re-Seed with Native Plants in Reach 3

To minimize the extent of temporary impacts to vegetation, construction limits will be clearly marked in the field so that construction personnel will know the limits of allowable impacts. The size of the construction area will be limited to the amount necessary to perform the work safely with appropriate equipment.

To minimize the colonization success of non-native plants in disturbed areas, disturbed areas will be seeded with an appropriate native seed mixture when construction activities have been completed.

Impact BIO-5: Impacts to Vegetation Communities Downstream of the WWTP Wash

The proposed action would increase the total consumptive use of wastewater upstream of the WWTP, thereby reducing the amount of water released into the WWTP Wash, thereby decreasing the amount of water available to support the riparian community downstream of the project area and potentially also decreasing the annual yield of the Canyon Well at the Boyce Thompson Arboretum. A decrease in the amount of downstream release could, over time, result in a more open riparian community downstream of the WWTP since there would be less water available to support understory annual and perennial herbaceous plants.

Diverting 20% of the WWTP discharge to Reach 3 is not expected to decrease the Canyon Well yield substantially because the arboretum's well pumping is a relatively small percentage of the WWTP discharge and because natural streamflow also partly recharges the groundwater. Furthermore, the arboretum now has a second well that can provide a backup supply to offset any decrease in yield at the Canyon Well. Finally, discharge from the WWTP is expected to gradually increase as the population and local economy increase.

Mitigation Measure BIO-4: Long-Term Monitoring of Downstream Impacts

The Town of Superior will coordinate with the Tonto National Forest and the Boyce Thompson Arboretum to determine the need and scope for a downstream vegetation monitoring program.

4.4.2 No-Action Alternative

Under the No-Action Alternative, there would be no immediate funding for restoration activities along this section of Queen Creek. There would be no disturbances from construction activities. However, there would also be no net improvement in riparian habitat quality.

4.4.3 WWTP Water Discharge Point Alternative

Impact BIO-6: Conversion of Mesquite Habitat in Reach 4 to Other Riparian Communities

Water discharged from the WWTP will have the potential to wet approximately 1,100 feet of channel downstream from the discharge point. The extent of wetted channel is the same distance (1,100 feet) that would be wetted under the proposed action because seepage loss rates in Reach 3 and Reach 4 are assumed to be similar (Jones & Stokes 2000). Based on the model developed by Jones and Stokes (Jones and Stokes 2000) and as shown below in Table 4-2, under this alternative, approximately 17 acres of existing vegetation downstream of the discharge point would gradually convert to approximately 16 acres of mesquite bosque and about 1 acre of mixed-riparian woodland. Since most of the woody community in this portion of Reach 4 (as under the area affected by the proposed action) is already mesquite bosque, most of the "conversion" would actually consist of enhancement of the existing mesquite vegetation. Because of the availability of a greater water supply, the vigor and growth rate of approximately 17 acres of mesquite bosque would be increased and 1 acre of mesquite would be converted to mixed-riparian forest. Enhancement of the growth of existing trees would eventually create a denser canopy along the creek than presently exists. The result should be an increase in the quantity and quality of riparian vegetation in the project area. Because this impact is considered beneficial, no mitigation is required.

Table 4-2. Estimated Net Change in Habitat – WWTP Water Discharge Point

Vegetation Type	Change in Vegetation Area (acres)	Restored Canopy Density (%)
Mesquite	-1	40
Mixed-riparian forest	+1	50

The result of these changes should be an increase in the quantity and quality of riparian vegetation in the project area. Because this impact is considered beneficial, no mitigation is required.

Impact BIO-7: Temporary Construction-Related Loss of Vegetation in Reach 4

Construction of the pipeline would result in removal and damage to vegetation in the construction corridor because of the activities necessary to install the pipeline (i.e., vegetation crushed or excavated by construction equipment). Much of this damage and loss would occur in areas that are already disturbed, but mixed-riparian and mesquite bosque communities would also be affected. Once the pipeline and berm have been installed and the area of the pipeline restored to preconstruction grades, these disturbed areas should recolonize with plants. Because non-native vegetation is known to occur in the area, both native and non-native plants will probably colonize.

Mitigation Measure BIO-5: Mark Construction Limits and Re-Seed with Native Plants in Reach 4

To minimize the extent of temporary impacts to vegetation, construction limits will be clearly marked in the field so that construction personnel will know the limits of allowable impacts. The size of the construction area will be limited to the amount necessary to perform the work safely with appropriate equipment.

To minimize the colonization success of non-native plants in disturbed areas, disturbed areas will be seeded with an appropriate native seed mixture when construction activities have been completed.

Impact BIO-5: Impacts to Vegetation Communities Downstream of the WWTP Wash

The proposed action would increase the total consumptive use of wastewater upstream of the WWTP, thereby reducing the amount of water released into the WWTP Wash. This increased consumption would reduce the amount of water available to support the riparian community downstream of the project area and could also decrease the annual yield of the Canyon Well at the Boyce Thompson Arboretum. A decrease in the amount of downstream release is expected, over time, to result in a more open riparian community downstream of the WWTP since there would be less water available to support understory annual and perennial plants.

Diverting 20% of the WWTP discharge to Reach 4 is not expected to decrease the Canyon Well yield substantially because the arboretum's well pumping is a relatively small percentage of the WWTP discharge and because natural streamflow also partly recharges the groundwater. Furthermore, the arboretum now has a second well that can provide a backup supply to offset any decrease in yield at the Canyon Well. Finally, discharge from the WWTP is expected to gradually increase as the population and local economy grow in the future.

Mitigation Measure BIO-4: Long-Term Monitoring of Downstream Impacts

The Town of Superior will coordinate with the Tonto National Forest and the Boyce Thompson Arboretum to determine the need and scope for a downstream vegetation monitoring program.

4.5 Cultural Resources

4.5.1 Methods

NEPA recommends that compliance with Section 106 of the NHPA be coordinated with the NEPA review, and that efforts be made to integrate the processes. Although Section 106 compliance for the proposed action is being conducted and documented separately by the Bureau, the two processes use the same criteria for determining impacts, and mitigation measures are typically developed during the Section 106 consultation process.

Under federal regulations, a project has an effect on a historic property when the undertaking could alter the characteristics of the property that may qualify the property for inclusion in the NRHP, including alteration of location, setting, or use. An undertaking may be considered to have an adverse effect on a historic property when the effect may diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects on historic properties include, but are not limited to,

- physical destruction or alteration of all or part of the property;
- isolation of the property from or alteration of the property's setting when that character contributes to the property's qualifications for listing in the NRHP;
- introduction of visual, audible, or atmospheric elements that are out of character with the property or that alter its setting;
- neglect of a property resulting in its deterioration or destruction; or
- transfer, lease, or sale of the property. (36 CFR 800.9)

4.5.2 Proposed Action

Impact CR-1: Impacts to Archeological Resources Due to Ground-Disturbing Activities during Construction of the Pipeline and the Lake.

Under the alternative action, construction activities may occur within 200 feet of known archeological isolates. The proposed action includes plans for subsurface excavation to a depth of no more than 4 feet along the pipeline and no more than

5 feet for the lake. Research indicates that there is a moderate potential for the presence of previously unidentified, buried archaeological resources in the project area. For example, it appears that isolates 18, 19, 20, and 21 may be in the location of the lake and isolates 20, 21, 22, and 23 may be in the path of the pipeline. Although disturbance of the isolates may not constitute a significant effect, several of the isolates indicate sensitivity for prehistoric sites. As a result, the proposed construction has the potential to damage or destroy archaeological resources, cultural deposits, or human remains. This impact is considered significant. Implementation of Mitigation Measure CR-1 would reduce this impact to an insignificant level.

Mitigation Measure CR 1: Ensure Archaeological Monitoring for All Ground-Disturbing Activities

Because of the sensitive nature of the project area, an archaeological monitor will be onsite whenever ground-disturbing activities are taking place. A monitoring plan for specific procedures and recommendations for monitoring and discovery situations of human remains will be completed before construction begins. Reclamation and the State Historic Preservation Officer (SHPO) will approve the monitoring and discovery plan. Consultation with Native Americans during the Section 106 compliance process for Traditional Cultural Properties is required.

An archaeological monitor can identify archaeological and human remains during construction and stop work to allow for a close inspection of the artifacts to determine if they might be significant. In the event of a discovery, the appropriate tribes would be consulted to determine how the human remains would be handled.

If an archaeological monitor is not present and archaeological remains or suspected archaeological remains are discovered, the contractor will immediately cease earthmoving activity within a 100-foot radius of the discovery. The contractor will notify the lead agency and implement the measures identified in the monitoring and discovery plan.

4.5.3 No-Action Alternative

There would be no impact to cultural resources under the no-action alternative.

4.5.4 WWTP Water Discharge Point

Impact CR-2: Impacts to Known Cultural Resources Due to Ground-Disturbing Activities during Construction of the Pipeline and the Lake

Under the alternative action, construction activities may occur within 200 feet of a known archeological site, AZ U:12:152(ASM). If the project cannot be redesigned to locate all construction activities more than 200 feet from the boundaries of the site, the impact to the site would be significant. Implementation of Mitigation Measure CR-2 would reduce this impact to an insignificant level.

Mitigation Measure CR-2: Coordinate Mitigation of Direct Impacts to Known Sites with the Section 106 Process

As part of the Section 106 process, direct impacts to known sites will be analyzed in a finding of effect document. Based on the findings of this document and consultation with the SHPO and consulting parties, a memorandum of agreement will be prepared that itemizes steps for mitigating adverse effects to the sites.

4.6 Environmental Justice

In 1994, the president of the United States issued Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations." The objectives of the order include developing federal agency implementation strategies, identifying minority and low-income populations where proposed federal actions could have disproportionately high and adverse human health and environmental effects, and encouraging the participation of minority and low-income populations in the NEPA process.

The proposed action involves temporary construction impacts associated with constructing a lake and a reclaimed water pipeline. As documented in this EA, no significant impacts would result from these activities. Because no high and adverse impacts would result from this project, there would be no disproportionate impacts on any specific population groups in the project area.

4.7 Cumulative Impacts

Cumulative effects result from the proposed action's incremental impacts when these impacts are added to the impacts of other past, present, and reasonably foreseeable future actions, regardless of the agency or person who undertakes them. For the proposed action, Reclamation considered the implementation of a number of other components contained in the Town of Superior's *Restoration*

and Management Plan for Queen Creek near Superior, Arizona (Jones & Stokes 2000). These components include the following:

- installing wells for riparian irrigation and supplemental streamflow,
- adopting a creek protection ordinance,
- implementing a creek cleanup and anti-dumping program,
- implementing a program to remove exotic vegetation,
- implementing a program to minimize grazing impacts,
- establishing a floodway vegetation management program,
- completing construction of the Community Park,
- constructing access and park facilities around the lake,
- constructing a campground and trail at the Old Pinal Townsite, and
- extending the Old Town Trail to the high school.

The following sections describe cumulative effect issues for each resource topic analyzed in this EA.

4.7.1 Land Use

The cumulative effects associated with this project would generally be considered beneficial. The proposed action is being implemented to support the revitalization of the Town of Superior through enhancement of the environmental amenities associated with the western Queen Creek riparian corridor. Short-term impacts may occur as the above projects are implemented, but the overall cumulative effect that would result after implementation would be beneficial.

4.7.2 Water Resources

The enhancement of the riparian corridor along with implementation of the above projects would have cumulative effects associated with surface water quality and hydrology. Enhancement of riparian communities may contribute to an increase in overall water quality in the stream from a fully functioning wetland system. This would be a beneficial cumulative effect on surface water quality.

As noted in this EA, the enhancement of riparian communities has the potential to reduce the floodway carrying capacity of Queen Creek. However, a vegetation management plan has been proposed as a means of maintaining the carrying capacity of the floodway. No adverse cumulative effects to water resources would result.

4.7.3 Biological Resources

The enhancement of riparian resources along Queen Creek would increase the habitat values for the affected reaches. Implementation of the other projects above would contribute to this enhancement, while increasing public access to the enhanced stream corridor. Cumulative effects involving biological resources would be beneficial in nature.

4.7.4 Cultural Resources—Cumulative Impacts

The proposed action will not adversely affect known cultural resources, and thus would not contribute to a cumulative loss of cultural resources. Although the ground-disturbing activities associated with the project have the potential to disturb previously undiscovered cultural deposits, a mitigation monitoring plan has been proposed as a means of avoiding or reducing effects to buried cultural resources. No adverse cumulative effects to cultural resources would result.

Chapter 5

Consultation and Coordination

5.1 Relevant Laws, Rules, Regulations, and Executive Orders

Certain laws, rules, regulations, and executive orders would have applicability to the proposed action and are summarized below.

5.1.1 Clean Water Act

The Clean Water Act (CWA) strives to "restore and maintain chemical, physical, and biological integrity of the Nation's water." Section 404 of the CWA regulates the placement of dredged or fill materials into waters of the United States; a permit, issued by the U.S. Army Corps of Engineers, and water quality certification, obtained through ADEQ, would be required before undertaking such an action. Section 404 authorization would be required for construction work within the Queen Creek channel below the ordinary high water mark. Section 402 imposes limitations on pollutant discharges through the NPDES program. Under the NPDES program, any person responsible for the discharge of a pollutant or pollutants into any waters of the United States from any point source must apply for and obtain a permit.

An NPDES permit will likely be required for construction activities associated with this project. In Arizona, NPDES permits are currently issued by EPA. However, ADEQ is seeking authorization from EPA to operate the NPDES permit program at the state level and anticipates receiving program approval in October or November of 2002.

5.1.2 Endangered Species Act

The ESA provides protection for animal and plant species in danger of extinction (endangered) and those that may become so in the foreseeable future (threatened). Section 7 of the ESA requires federal agencies to ensure that federal activities in the United States do not have adverse impacts on the continued existence of threatened or endangered species or on designated areas

that are important in conserving those species. Lead agencies must consult with USFWS to determine the potential impacts that a project may have on listed species. This EA discloses those impacts and no adverse effects related to the proposed action are anticipated.

5.1.3 National Historic Preservation Act

The National Historic Preservation Act (NHPA) establishes as federal policy the protection of historic sites and values in cooperation with other nations, states, and local governments. The act designates the State Historic Preservation Officer (SHPO) as the individual responsible for administering programs in the states. Federal agencies are required to consider the effects of their undertakings on historic resources and to give the SHPO a reasonable opportunity to comment on those undertakings. For this project, Reclamation has conducted a Class I records review and a Class III pedestrian survey for cultural resources in the project area and will consult with SHPO.

5.1.4 Executive Order 11988—Floodplain Management

This executive order requires an agency to "avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" within the 100-year floodplain. Impacts associated with the 100-year floodplain have been assessed and mitigation proposed in this EA.

5.1.5 Executive Order 11990—Wetlands

This executive order requires the lead agency to "avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative." The proposed action may result in short-term impacts to riparian plant communities. However, the overall long-term goal of this project is enhancement and restoration of riparian communities.

5.1.6 Executive Order 12898—Environmental Justice

This executive order requires federal agencies to identify and address disproportionately high and adverse human health and environmental effects of

federal programs, policies, and activities on minority and low-income communities. No such communities would be adversely affected by implementation of the proposed action.

5.1.7 Executive Order 13175—Consultation and Coordination with Indian Tribal Governments

This executive order requires that actions reviewed under NEPA consider potential effects on Indian trust assets, which are defined as "legal interests in property held in trust by the federal government for the benefit of Indian tribes or individuals." Examples of such assets include lands, mineral rights, hunting and fishing rights, and water rights. Reclamation policy requires activities to be carried out in a manner that protects Indian trust assets and avoids adverse impacts when possible. No Indian trust assets occur within the project area.

5.1.8 Arizona Burial Protection Law

This state law (A.R.S. 41-865) protects human remains and associated funerary objects on private lands. It requires landowners or their agents to notify the Arizona State Museum when materials that might be human remains are found. The Museum then has up to 10 days, or more if permitted by the landowner, to consult with any groups that might be culturally related to the remains and then implement the decision about what to do with the materials. Groups to be consulted include Native American Indian tribes and any other organized cultural group that can reasonably represent the group to which the deceased belonged. This law also makes it a crime to profit financially from the sale of human remains or items buried with human remains, as covered under the law.

5.1.9 Farmland Protection Policy Act

The Natural Resources Conservation Service is responsible for administering this act. The intent of the act is to minimize the impact Federal programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. The proposed action would not affect the use of land as farmland. No prime or unique farmlands would be affected by this project.

5.2 Summary of Agency and Public Involvement Activities

On June 20, 2002 scoping letters were mailed by Reclamation to interested parties requesting input on this EA. The letter requested that any input be received within a 30-day scoping period. Because of the relatively small scale of

this project and the lack of potentially controversial issues, no agency or public scoping meetings were conducted.

Responses to the scoping letter were received from the Town of Superior Chamber of Commerce and the Arizona Game and Fish Department (AGFD). No significant environmental issues were raised. The AGFD expressed its support for restoring riparian habitat along Queen Creek.

Chapter 6
References

6.1 Printed References

Arizona Game and Fish Department. 1994. *Plant abstracts*. Compiled and Maintained by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. Available: <http://www.gf.state.az.us/frames/fishwild/hdms_site/Abstracts/Plants/abstracts%20-%20plants.htm>.

_____. 1996. *Wildlife of special concern in Arizona*. Nongame and Endangered Wildlife Program, Arizona Game and Fish Department, Phoenix, AZ.

Arizona Rare Plant Committee. 2002. *Arizona rare plant field guide*. Washington, DC: U.S. Government Printing Office.

Brown, D. E. (ed.). 1982. *Desert plants: Biotic communities of the American Southwest—United States and Mexico*. Volume 4, Numbers 1–4. Tucson: University of Arizona Press.

Burt, W. H., and R. P. Grossenheider. 1980. *A field guide to the mammals of North America north of Mexico*. Peterson Field Guide Series. Sponsored by the National Audubon Society, the National Wildlife Federation, and the Roger Tory Peterson Institute.

Cable, J. S., and D. E. Doyel. 1984. The implications of field houses for modeling Hohokam agricultural systems. Pp. 259–279 in *City of Phoenix, Archaeology of the Original Townsite: The Murphy's Addition*. J. S. Cable, S. L. Henry, and D. E. Doyel (eds.). Soil Systems Publications in Archaeology No. 3. Soil Systems, Inc., Phoenix, AZ.

Carter Associates, Inc. 1987. *1987 Superior general plan*. Final draft. July 1. Phoenix, AZ. Prepared for the Town of Superior, AZ.

DeMaagd, H. 2000. *Cultural resources survey along State Route 177 between mileposts 167.4 and 164.6, Superior, Pinal County, Arizona*. Archaeological Consulting Services, Ltd., Tempe, AZ.

Doyel, D. E. 1985. The New River-Palo Verde system. Pp. 681–699 in *Hohokam Settlement and Economic Systems in the Central New River Drainage, Arizona*. D. E. Doyel and M. D. Elson (eds.). Soil Systems Publications in Archaeology, No. 4, Volumes I and II. Soil Systems, Inc., Phoenix, AZ.

Epple, A. 1997. *A field guide to the plants of Arizona*. Helena, MT: Falcon Publishing.

Huckell, B. 1996. The archaic prehistory of the North American Southwest. *Journal of World Prehistory* 10(3):305–373.

Jones & Stokes. 2000. *Restoration and management plan for Queen Creek near Superior, Arizona*. April. (JSA 98-034.) Prepared for the Town of Superior, AZ. Phoenix, AZ.

Mabry, J. B. (ed.). 1999. *Paleoindian and archaic sites in Arizona*. Arizona State Historic Preservation Office, Arizona State Parks Board, Phoenix.

Myers, L. H. 1993. *Queen Creek riparian analysis, Superior allotment, Tonto National Forest*. Phoenix, AZ.

Reid, J., and S. Whittlesey. 1992. New evidence for dating Gila polychrome. Pp. 233–239 in *Proceedings of the Second Salado Conference, Globe, AZ, 1992*. R. C. Lange and S. Germick (eds.). Occasional Paper. Arizona Archaeological Society, Phoenix. Salt Lake City: University of Utah Press.

Rosenberg, K. V., R. D. Omart, W. C. Hunter, and B. W. Anderson. 1991. *Birds of the lower Colorado River Valley*. Tucson: University of Arizona Press.

R.S. Means Company. 1999. *CostWorks'99: Construction cost database and software*. CD-ROM. Kingston, MA.

Stebbins, R. C. 1966. *A field guide to western reptiles and amphibians*. Boston: Houghton Mifflin.

Szaro, R. C. 1989. Riparian forest and scrubland community types of Arizona and New Mexico. *Desert Plants* 9(3-4):70–138.

U.S. Fish and Wildlife Service. 1992. *Handbook of Arizona's endangered, threatened, and candidate plants*. Arizona Ecological Services Field Office, Phoenix, AZ.

Van Gerven, D. P., and S. G. Sheridan (eds.). 1994. *The Pueblo Grande project, volume 6: The bioethnography of a classic period Hohokam population*. Soil Systems Publications in Archaeology No. 20. Soil Systems, Inc., Phoenix, AZ.

6.2 Personal Communications

Chavez, Roy. Town Manager, Town of Superior, AZ. September 28, 1999—telephone conversation with Randy Wilson of Jones & Stokes.

Davidson, Rebecca. Gila Topminnow and Desert Pupfish Project Coordinator, Arizona Game and Fish Department. August 23, 2002—telephone conversation with Charles Coyle of Jones & Stokes.

Hartwig, Kim. Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Tucson, AZ. August 2002—telephone conversations with Stephanie Myers and Michele Waltz of Jones & Stokes.

Johnson, Janet. Riparian Ecologist, U.S. Forest Service, Tonto National Forest, Globe, AZ. June 1998—telephone conversation with Ruthanne Henry of Jones & Stokes.

Petrie, Pete. Assistant Manager, Boyce Thompson Arboretum, Superior, AZ. June 1998—telephone conversation with Ruthanne Henry of Jones & Stokes. August 11, 1999—statement at Queen Creek public meeting. September 10, 1999—telephone conversaton with Randy Wilson of Jones & Stokes.

Chapter 7

List of Preparers

7.1 U.S. Bureau of Reclamation

John McGlothlen	Biologist
Darlene Tuel	Project Manager
William Doyle	Civil Engineer

7.2 Jones & Stokes

Jeff Connell, AICP	Principal-in-Charge, Project Manager
Michele Waltz	Biological Resources, Project Coordinator
Michael Langley	NEPA Specialist
Stephanie Myers	Biological Resources
Kim Bidle	Land Use
Jeff Lafer	Water Resources
Susan Lassell	Cultural Resources
Charles Coyle	Technical Editor

7.3 Northland Research

David Hart	Cultural Resources

Appendices

Appendix A

Plant and Wildlife Species Lists

Table A-1. Wildlife Species Observed near Queen Creek during Field Reconnaissance Surveys, or Mentioned in the Inventory and Assessment of Historical Conditions

Common Name	Scientific Name
Fish	
Desert pupfish[a,b]	*Cyprinodon macularius macularius*
Gila topminnow[a,b]	*Poeciliopsis occidentalis occidentalis*
Reptiles	
Fence lizard	*Sceloporus* sp.
Long-nosed leopard lizard[a,b]	*Gambelia wiselezenii*
Lowland leopard frog[a,b]	*Rana yavapaiensis*
Sonoran desert tortoise[a,b]	*Gopherus agassizii*
Whiptail lizard	*Cnemidorphorus* sp.
Birds	
Turkey vulture	*Cathartes aura*
Red-tailed hawk	*Buteo jamaicensis*
Gambel's quail	*Callipepla gambelii*
Killdeer	*Charadrius vociferus*
Rock dove	*Columba livia*
White-winged dove	*Zenaida asiatica*
Mourning dove	*Zenaida macroura*
Inca dove	*Columbina inca*
Greater roadrunner	*Geococcyx californianus*
Great horned owl	*Bubo virginianus*
Vaux's swift	*Chaetura vauxi*
White-throated swift	*Aeronautes saxatalis*
Black-chinned hummingbird	*Archilochus alexandri*
Anna's hummingbird	*Calypte anna*
Costa's hummingbird	*Calypte costae*
Gila woodpecker	*Melanerpes uropygialis*
Ladder-backed woodpecker	*Picoides scalaris*
Black phoebe	*Sayornis nigricans*
Say's phoebe	*Sayornis saya*
Vermillion flycatcher	*Pyrocephalus rubinus*
Ash-throated flycatcher	*Myiarchus cinerascens*
Western kingbird	*Tyrannus verticalis*
Violet-green swallow	*Tachycineta thalassina*
Northern Rough-winged swallow	*Stelgidopteryx serripennis*

Table A-1. Continued

Common Name	Scientific Name
Birds (continued)	
Verdin	*Auriparus flaviceps*
Cactus wren	*Campylorhynchus brunneicapillus*
Rock wren	*Salpinctes obsoletus*
Canyon wren	*Catherpes mexicanus*
Bewick's wren	*thryomanes bewickii*
House wren	*Troglopdytes aedon*
Ruby-crowned kinglet	*Regulus calendula*
Black-tailed gnatcatcher	*Polioptila melanura*
Northern mockingbird	*Mimus polyglottos*
Curve-billed thrasher	*Toxostoma curvirostre*
Phainopepla	*Phainopepla nitens*
European starling	*Sturnus vulgaris*
Bell's vireo	*Vireo bellii*
Lucy's warbler	*Vermivora luciae*
Yellow warbler	*Dendroica petechia*
Yellow-rumped warbler	*Dendroica coronata*
Black-throated gray warbler	*Dendroica nigrescens*
Yellow-breasted chat	*Icteria virens*
Summer tanager	*Piranga rubra*
Northern cardinal	*Cardinalis cardinalis*
Pyrrhuloxia	*Cardinalis sinuatus*
Blue grosbeak	*Guiraca caerulea*
Abert's towhee	*Pipilo aberti*
Spotted towhee	*Pipilo erythrophthalmus*
Canyon towhee	*Pipilo fuscus*
Song sparrow	*Melospiza melodia*
Lincoln's sparrow	*Melospiza lincolnii*
White-crowned sparrow	*Zonotrichia leucophyrs*
Dark-eyed junco	*Junco hyemalis*
Great-tailed grackle	*Quiscalus mexicanus*
Bronzed cowbird	*Molothrus aeneus*
Brown-headed cowbird	*Molothrus ater*
Northern oriole	*Icterus galbula*
Hooded oriole	*Icetrus cucullatus*
House finch	*Carpodacus mexicanus*
Lesser goldfinch	*Carduelis psaltria*
House sparrow	*Passer domesticus*

Table A-1. Continued

Common Name	Scientific Name
Mammals	
Desert cottontail	*Sylvilagus audubonii*
Black-tailed jackrabbit	*Lepus californicus*
Raccoon	*Procyon lotor*
Gray fox	*Urocyon cineroargenteus*
Striped skunk	*Mephitis mephitis*
Javelina	*Tayassu tajaca sonoriensis*

[a] Special-status species (see Table 3-2).
[b] Not observed.

Table A-2. Plant Species Observed near the Queen Creek Plan Area during Field Reconnaissance Surveys or Mentioned in the Inventory and Assessment of Historical Conditions

Common Name	Scientific Name
Riparian Species	
Arizona black walnut	*Juglans major*
Arizona rosewood	*Vauquelinia californica*
Arizona sycamore	*Platanus wrightii*
Bermuda grass[a]	*Cynodon dactylon*
Blue palo verde	*Cercidium floridum*
Canyon grape	*Vitis arizonica*
Canyon ragweed	*Ambrosia ambrosioides*
Cattail	*Typha domingensis*
Coyote willow	*Salix exigua*
Creeping barberry	*Berberis repens*
Deer grass	*Muhlenbergia rigens*
Desert broom	*Baccharis sarothroides*
Desert hackberry	*Celtis spinosa* var. *pallida*
Desert honeysuckle	*Anisacanthus thurberi*
Desert mock-orange	*Crossosoma bigelovvii*
Wild rhubarb	*Rumex hymenosepalus*
Fremont cottonwood	*Populus fremontii*
Goodding's willow	*Salix gooddingii* var. *varabilis*
Horsetail	*Equisetum* sp.
Netleaf hackberry	*Celtis laevigata*
Oleander[a]	*Nerium oleander*
Rabbitfoot grass[a]	*Polypogon monspeliensis*
Salt cedar[a]	*Tamarix* sp.
Flat sedge	*Cyperus acuminatus*
Seepwillow	*Baccharis salicifolia*

Table A-2. Continued

Common Name	Scientific Name
Spikerush	*Eleocharis* sp.
Tree of heaven[a]	*Ailanthus altissima*
Velvet ash	*Fraxinus velutina*
Velvet mesquite	*Prosopis velutina*
Sonoran Desert Species	
Arizona hedgehog cactus[b, c]	*Echinocereus triglochidiatus* var. *arizonicus*
Barrel cactus	*Ferocactus wislizenii*
Brittlebush	*Encelia farinosa*
Broom snakeweed	*Gutierrezia sarothrae*
Catclaw acacia	*Acacia greggii*
Cocklebur[a]	*Xanthium strumarium*
Creosote	*Larrea tridentata*
Cudweed sagewort	*Artemisia ludoviciana*
Desert agave	*Agave deserti*
Desert broom	*Baccharis sarothroides*
Engelmann prickly pear	*Opuntia engelmannii*
Fairy duster	*Calliandra eriophylla*
Foothill palo verde	*Cercidium microphyllum*
Globe mallow	*Sphaeralcea* sp.
Hohokum agave[b, c]	*Agave murpheyi*
Jojoba	*Simmondsia chinensis*
Jumping cholla	*Opuntia fulgida*
Mexican palo verde	*Parkinsonia aculeata*
Ocotillo	*Fouquieria splendens*
Russian thistle[a]	*Salsola iberica*
Saguaro	*Carnegiea gigantea*

Table A-2. Continued

Common Name	Scientific Name
Saltbush	*Atriplex polycarpa*
Thistle[a]	*Cirsium* sp.
Triangleleaf bursage	*Ambrosia deltoidea*
Banana yucca	*Yucca baccata*
Varied fishhook cactus[b, c]	*Mammillaria viridiflora*

[a] Introduced species.
[b] Special-status species.
[c] Not observed.

Appendix B

Breeding Bird Point-Count Survey Results

Appendix B. Breeding Bird Point-Count Survey Results

INTRODUCTION AND METHODS

The value of various riparian-vegetation associations to wildlife was assessed during field reconnaissance of the Queen Creek plan area. Because riparian habitats in the desert southwest are known to provide high-value habitat to a variety of migratory and resident birds, breeding birds were chosen as an indicator of habitat value. Vegetation associations with greater species diversity or populations can be used as an indication that the habitat has potentially higher value.

A point-count survey was conducted on May 27, 1998, beginning at 5:50 a.m. and ending at noon. Eighteen points were surveyed during this period. The areas spanning immediately upstream of Superior to just below the WWTP were surveyed in the early morning. The well-developed cottonwood-willow riparian habitat downstream of the Old Pinal Townsite was surveyed later in the morning. Drainages below the BHP settling ponds and the WWTP, where unnatural water flows have resulted in the establishment of some riparian vegetation, were also included in the survey to determine their habitat value to riparian-associated birds. A census of each point count was conducted over a 5-minute period and all birds seen and heard from the point were counted. At each point count, vegetation descriptions noting the dominant species were made so that comparison between bird-species richness or abundance and vegetation conditions could be made. These data are summarized in Table B-1 and discussed in the following section.

RESULTS

For the surveyed area, three generalized riparian-vegetation associations were identified by dominant vegetation features: cottonwood-willow riparian, mixed-riparian (i.e., cottonwood, willow, ash, and mesquite), and mesquite bosque. Census results for each are discussed below. Table B-1 shows all species observed, frequency of occurrence, and abundance within each vegetation association. The following sections focus on the riparian-associated bird species, which are those species that prefer or depend on riparian habitats during the breeding season for food, shelter, and nesting sites. Other species that are not riparian dependent but were common in these habitats are also discussed.

Cottonwood-Willow Riparian

Of the 18 point counts for which a census was conducted, 9 occurred in this vegetation association, including 3 points in artificially created riparian habitat. Riparian-associated species most commonly detected in this vegetation association include yellow warbler, Bell's vireo, Lucy's warbler, and yellow-breasted chat. Other riparian-associated species observed included summer tanager, song sparrow, vermilion flycatcher, and northern oriole. Birds with wider habitat affinities that were commonly observed included white-winged dove and mourning dove. Numerically, yellow warbler was the most abundant species, followed by Bell's vireo, yellow-breasted chat, mourning dove, and white-winged dove.

Table B-1. Bird Species Census

Bird Species	Riparian Vegetation Type: Cottonwood-Willow [1] Frequency	(Total Observed)	Mixed [2] Frequency	(Total Observed)	Mesquite [3] Frequency	(Total Observed)	Total [4] Frequency	(Total Observed)
Gambel's quail	0.22	(2)	-	(0)	-	(0)	0.11	(2)
White-winged dove	0.67	(10)	0.50	(5)	0.60	(4)	0.61	(19)
Mourning dove	0.56	(11)	-	(0)	0.40	(2)	0.39	(13)
Inca dove	-	(0)	-	(0)	0.20	(1)	0.06	(1)
Black-chinned hummingbird	-	(0)	-	(0)	-	(0)	0.00	(0)
Costa's hummingbird	-	(0)	0.25	(2)	-	(0)	0.06	(2)
Gila woodpecker	0.11	(1)	-	(0)	-	(0)	0.06	(1)
Ladder-backed woodpecker	-	(0)	-	(0)	0.20	(1)	0.06	(1)
Black phoebe *	0.11	(1)	-	(0)	-	(0)	0.06	(1)
Say's phoebe	-	(0)	-	(0)	0.20	(1)	0.06	(1)
Vermillion flycatcher*	0.11	(2)	-	(0)	-	(0)	0.06	(2)
Ash-throated flycatcher*	-	(0)	0.25	(1)	0.20	(1)	0.11	(2)
Western kingbird	-	(0)	0.25	(2)	-	(0)	0.06	(2)
Northern rough-winged swallow	-	(0)	-	(0)	0.40	(2)	0.11	(2)
Verdin	0.44	(4)	-	(0)	-	(0)	0.22	(4)
Cactus wren	0.22	(2)	-	(0)	0.40	(3)	0.22	(5)
Canyon wren	-	(0)	-	(0)	-	(0)	0.00	(0)
Bewick's wren	0.33	(3)	0.25	(1)	-	(0)	0.22	(4)
Black-tailed gnatcatcher	-	(0)	-	(0)	0.20	(1)	0.06	(1)
Northern mockingbird	0.11	(1)	-	(0)	0.40	(3)	0.17	(4)
Curve-billed thrasher	0.22	(2)	0.25	(1)	0.20	(1)	0.22	(4)
Phainopepla	0.22	(3)	0.50	(4)	0.80	(19)	0.44	(26)
European starling	-	(0)	0.25	(2)	-	(0)	0.06	(2)
Bell's vireo*	0.78	(13)	0.50	(2)	0.80	(5)	0.72	(20)
Lucy's warbler*	0.78	(8)	1.00	(5)	0.80	(9)	0.83	(22)
Yellow warbler*	1.00	(19)	1.00	(6)	-	(0)	0.72	(25)
Yellow-breasted chat*	0.78	(12)	0.75	(3)	0.40	(3)	0.67	(18)
Summer tanager*	0:22	(2)	0.25	(1)	-	(0)	0.17	(3)
Northern cardinal	0.22	(3)	0.75	(4)	0.40	(4)	0.39	(11)
Blue grosbeak*	0.11	(1)	-	(0)	-	(0)	0.06	(1)
Abert's towhee*	-	(0)	0.25	(1)	0.20	(1)	0.11	(2)
Song sparrow*	0.56	(7)	0.25	(1)	-	(0)	0.33	(8)
Great-tailed grackle	0.11	(2)	-	(0)	0.40	(3)	0.17	(5)
Bronzed cowbird	-	(0)	-	(0)	0.20	(1)	0.06	(1)
Brown-headed cowbird*	0.11	(2)	0.25	(1)	-	(0)	0.11	(3)
Northern oriole*	0.11	(1)	-	(0)	-	(0)	0.06	(1)
House finch	0.33	(4)	-	(0)	0.40	(4)	0.28	(8)
Lesser goldfinch	0.44	(6)	-	(0)	0.20	(1)	0.33	(7)
House sparrow	0.33	(5)	0.75	(6)	0.40	(7)	0.44	(18)
Total riparian species		(67)		(21)		(19)		(107)
Total all species		(127)		(48)		(77)		(252)

Notes:

(1) Nine points surveyed
(2) Four points surveyed
(3) Five points surveyed
(4) Total of 18 points surveyed
* Riparian-associated species

Mixed Riparian

Four census points occurred in this vegetation association. Commonly observed riparian-associated species were yellow warbler, Bell's vireo, and yellow-breasted chat. Other nonriparian species commonly observed included house sparrows and northern cardinals. Numerically, yellow warblers and house sparrows were the most abundant, followed by Lucy's warblers and white-winged doves.

Mesquite Bosque

A census was conducted for five points in this vegetation association. Commonly observed riparian-associated species were Bell's vireo and Lucy's warbler. Yellow-breasted chats were also observed. Notably, no yellow warblers were observed in this vegetation association. Commonly observed nonriparian species included phainopeplas and white-winged doves. Numerically, phainopeplas were the most abundant, followed by Lucy's warblers and house sparrows.

Artificial Cottonwood-Willow Riparian

The overall cottonwood-willow riparian-habitat census included counts for all points located in this type of habitat, regardless of whether the habitat is supported by a natural or artificial water source. Of the nine points included in the census, however, three were located in drainages that support riparian vegetation and provide habitat value to wildlife because of an artificial water source. These three points were segregated from those occurring in naturally occurring cottonwood-willow riparian to determine whether the artificial habitat was used by riparian-associated species that were observed in natural habitats. Riparian-associated species, including Bell's vireo, yellow warbler, and yellow-breasted chat, were observed at all three points; song sparrows, Lucy's warblers, and a summer tanager were also observed. Numerically, yellow-breasted chat was the most common species, followed by Bell's vireos, yellow warblers, song sparrows, and Lucy's warblers.

DISCUSSION

The most frequently observed riparian-associated species was the Lucy's warbler, followed by Bell's vireo and yellow-breasted chats. These observations were made across the three riparian-vegetation associations (Table B-1). Yellow warblers were abundant but restricted to cottonwood-willow riparian and mixed-riparian habitats. Song sparrows were observed primarily in cottonwood-willow riparian habitat. Summer tanagers were observed both in cottonwood-willow riparian habitat and in dense, well-developed, mixed-riparian habitat. Vermilion flycatcher and Bullock's oriole were observed only once in cottonwood-willow habitat.

Although more cottonwood-willow riparian habitat was surveyed than mixed-riparian or mesquite-bosque habitat, survey results indicated that cottonwood-willow riparian habitat

supported a slightly greater species diversity than mixed-riparian and velvet-mesquite communities. At the nine cottonwood-willow census points, 10 riparian-associated species were observed; these represented 53% (67/127) of the total birds observed in this habitat. In the combination of the four mixed-riparian and five mesquite-bosque census points, nine riparian-associated species were observed, which represented a combined 32% (40/125) of the total birds detected in these two habitats.

As previously noted, riparian-associated birds were more common, both in species diversity and abundance, in well-developed, structurally diverse cottonwood-willow riparian habitat than in mixed-riparian and mesquite-bosque habitats. The major habitat differences that may account for this appear to be the vertical structure and well-developed herbaceous and subcanopy layers of the cottonwood-willow riparian habitat. Vertical structure is important for canopy-nesting wildlife, such as yellow warbler, summer tanager, and northern oriole. These species are largely restricted to areas with tall cottonwoods and willows. Even in small or structurally uncomplex riparian patches, as long as a tall cottonwood or willow was present, yellow warblers were observed; in mesquite-bosque vegetation lacking tall cottonwoods or willows, however, these three canopy-nesting species were absent. A well-developed herbaceous and lower canopy was needed to support song sparrows.

Artificial riparian habitats below the WWTP and BHP mine-dewatering ponds possess habitat structure similar to native cottonwood-willow riparian habitats. As long as these drainages continue to receive artificial irrigation, they should continue to attract the riparian-associated bird species. Removal of water from these washes would cause an eventual vegetation shift back to mesquite-dominated habitats. If cottonwoods and willows are rooted into groundwater, they could persist and likely provide continued habitat for canopy-nesting species.

These general observations can be used as guides for restoring or creating riparian habitats to support a specific bird community. For example, intermittent drainages occurring on alluvial soils that support mesquite bosque could be converted to mixed riparian or cottonwood-willow riparian by supplying an augmented streamflow. This conversion would facilitate the development of woody riparian and herbaceous vegetation that was observed to support high avian species diversity and abundance.

Appendix C

Addendum to Cultural Resources Survey of the Queen Creek Riparian Corridor, Superior, Arizona, August 2002

Addendum to Cultural Resources Survey of the Queen Creek Riparian Corridor Superior, Arizona — Proposed Alternate Waterline Route North of US 60

Prepared for:

U.S. Bureau of Reclamation
P.O. Box 81169
Phoenix, AZ 85021-2801
Contact: John McGlothlen
602/216-3866

Prepared by:

David Hart
Northland Research, Inc.
2510 S. Rural Road, Suite 102
Tempe, AZ 85282
(480) 894-0020

August 2002

Addendum to Cultural Resources Survey of the Queen Creek Riparian Corridor, Superior, Arizona – Proposed Alternate Waterline Route North of US 60

INTRODUCTION

As a result of a modification to the original contract, an alternate waterline route was proposed. Under the alternate plan, a pipeline would be located north of US 60 within the existing ADOT right-of-way. This area was not included in the previous cultural resources assessment and therefore required additional investigation. Results from the survey of the alternate waterline are presented below.

ALTERNATE PIPELINE ROUTE

The previously unsurveyed portion of the proposed alternate waterline alignment north of US 60 begins just west of Queen Creek. The alignment continues west, within the ADOT right-of-way, for approximately 3000 feet (914 meters), where it crosses to the south side of US 60, north of the wastewater treatment plant (Figure 1). This segment of the waterline is located within Sections 3 and 4 of Township 2 South, Range 12 East. David Hart of Northland Research conducted the survey on August 6, 2002, under Arizona State Museum (ASM) permit No. 2002-7bl.

A full coverage[1] (100%) cultural resources survey was conducted of the approximately 3000 feet (914 meter) long, 100 feet (30 meter) wide right-of-way north of US 60. The south side of the US 60 right-of-way was heavily modified as a result of grading and paving. Much of the ground surface was obscured by gravel associated with driveways and parking areas. No cultural remains were identified immediately south of US 60 as a result of either the records search or the adjacent survey.

The pedestrian survey of the right-of-way consisted of an archaeologist walking transects parallel to US 60 and spaced approximately 50 feet (15 meters) apart. The area along and between transects was inspected for cultural remains. Ground visibility ranged from extremely good (ca. 95%) to extremely poor (ca. 5%). The average ground visibility was approximately 70% due to the absence of vegetation in much of the right-of-way. David Hart identified one previously recorded site, AZ U:12:56(ASM), as a result of the prior records search (see original report, Appendix D) and the current pedestrian survey.

[1] A few areas in the northern extreme of the ADOT right-of-way were cursorily inspected due to extremely dense stands of mesquite and catclaw. However, these areas were very thin and typically occurred in and along small drainages, which are unlikely to yield cultural remains.

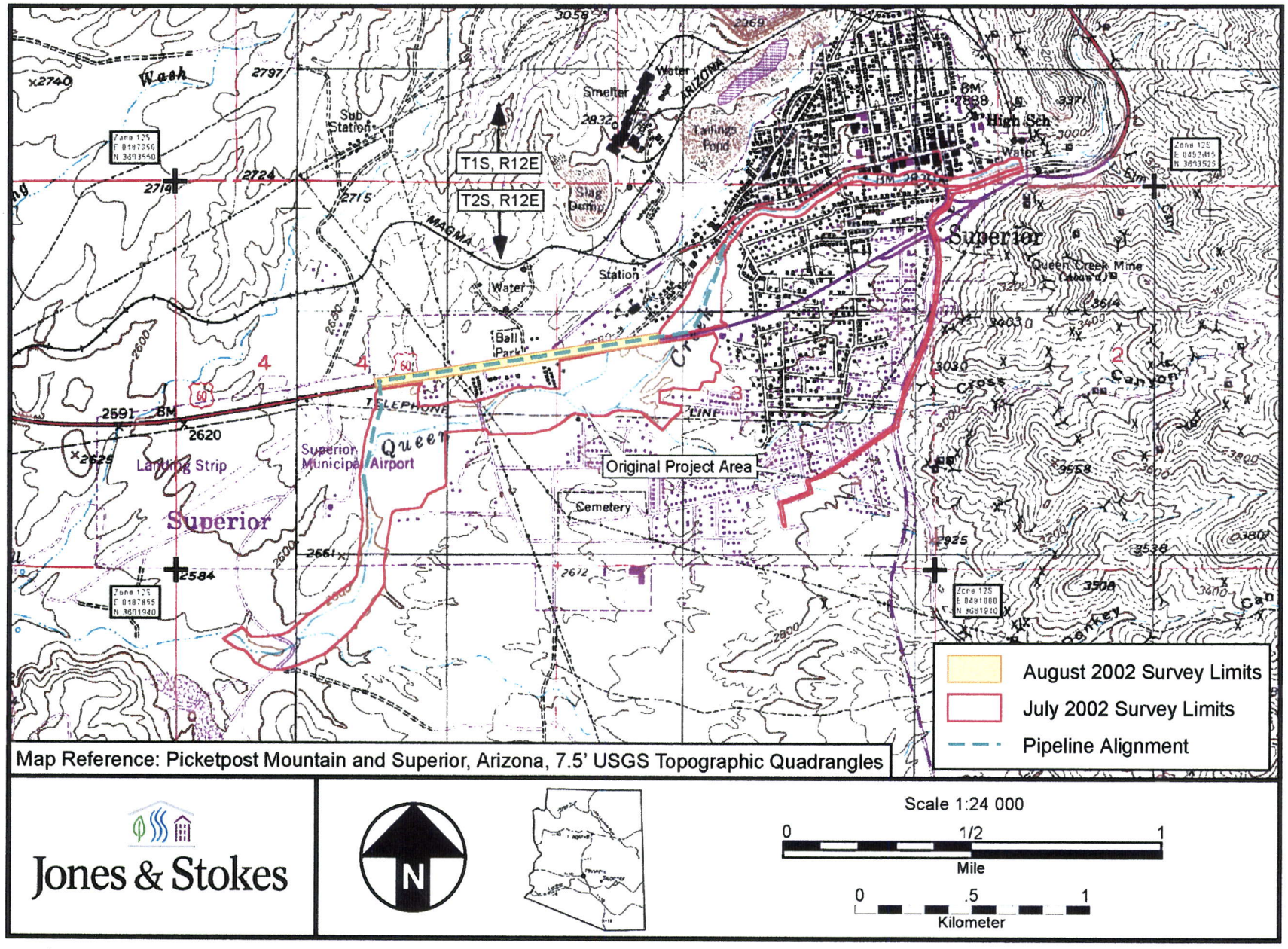


Figure 1. August 2002 Survey.

The site was originally recorded by Archaeological Research Services, Inc. (ARS) as part of an ADOT right-of-way survey (Hathaway 1991). The site was not re-recorded, but rather was inspected to see if the information on the existing site card was up-to-date and conformed to the current observations. The following information is presented in the ASM site card:

AZ U:12:56(ASM)
Site Size: 70.1 meters x 54.9 meters (230 feet x 180+ feet)
Land Ownership: ADOT/Private
Time Period: Prehistoric (A.D. 1300–1600)
Site Type: Habitation/Scatter

The site consists of a large, moderate-to-high density scatter of prehistoric ceramics and lithic debitage, including tools (Figure 2). Cultural material noted within this scatter includes 350+ ceramic sherds (Gila and Wingfield Plain, Gila Redware, and Gila Polychrome), 100+ pieces of lithic debitage (obsidian, quartz, chert, and chalcedony), groundstone tools, schist fragments, a marine shell fragment, copper ore, and a turquoise pendant fragment. Several areas within the scatter, particularly in the western half of the site, contain possible wall alignments, wall fall, and room outlines. A wall segment was exposed by vandals in one area.

Site Condition and Assessment. The southern portion of the site has been impacted by the construction of US 60, the western portion of the site was impacted by the installation of a natural gas pipeline (8 ft. wide trench), and other areas have been impacted by the installation of utility poles and by vandalism (pothunting). The site is considered potentially eligible[2] for inclusion in the National Register of Historic Places (NRHP) based on its apparent content of scientific information pertaining to the prehistoric occupation of this region of central Arizona.

Discussion

The site was easily relocated during the survey. The site was then inspected to try and correlate current observations with the previously recorded information. The following observations/modifications are recommended. The original site card denotes a wall alignment, wall fall, mounded areas and a possible room (Hathaway 1991). David Hart observed numerous structural and non-structural wall alignments, several rooms, and numerous mounded areas that appear to be additional rooms. Based on a cursory inspection, he observed considerably more evidence for habitation and related structures then were originally identified.

The original report also identified 350+ ceramics and 100+ fragments of lithic debitage (Hathaway). The materials and subtypes identified are accurate, although the quantities of artifacts should be doubled. It is estimated that 500 to 750 ceramics were scattered across the site surface and in exposed profiles from looter's pits. In addition, 150 to 300 pieces of chipped stone were also observed. The original report indicates that ground stone, shell, copper ore, and a turquoise pendant were recorded (Hathway 1991). These items were not located during the

[2] In the original report (Hart 2002) the recommendations for AZ U:12:55(ASM) and AZ U:12:56(ASM) were reversed as a result of the records search. Therefore, AZ U:12:55(ASM) should be considered not eligible and AZ U:12:56(ASM) should be considered "potentially eligible" in Table 3.

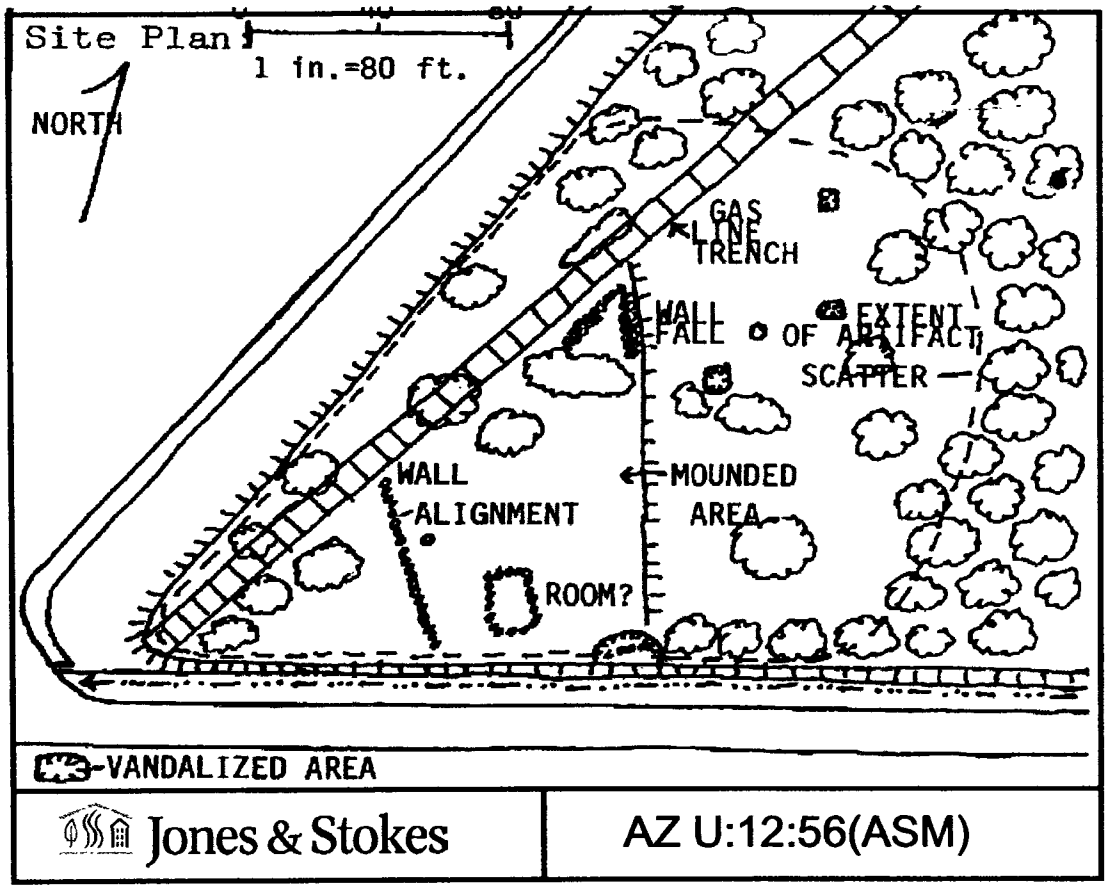


Figure 2. Site Map of AZ U:12:56(ASM) [Map Reference: ASM Site Card and Hathaway 1991].

current inspection. It is likely that these items were simply not visible, or had been removed from the site as a result of vandalism.

Summary and Recommendations. The site retains much of its integrity despite impacts from the construction of US 60 and a gas line. Recent looting and pothunting of the site has also caused a considerable amount of damage to the site. However, inspection of the mounded areas, the cutbanks, and looter's pits indicate that there are undisturbed subsurface deposits. The site is therefore considered eligible to the NRHP under Criteria D for its potential to yield significant scientific information pertaining to the Salado Culture, their economy and settlement.

David Hart recommends that the site be avoided by the proposed waterline. This should be possible if the pipeline is located adjacent to US 60 below the terrace. If, however, the pipeline will pass through the terrace and site boundaries, then Phase I Data recovery, or archaeological extent testing, is recommended prior to construction of the waterline. Phase I Data Recovery would result in the detailed mapping of the site and its internal features and artifacts. Subsurface testing is necessary to determine the nature and extent of the buried cultural remains. Phase II Data Recovery may or may not be necessary, depending on the results of the Phase I operations.

References Cited

Hathaway, Jeffrey B.
1991 *Cultural Resources Survey of a 3.14 Mile Segment of U.S. Highway 60 Right-of-Way within and West of Superior in Northwestern Pinal County, Arizona.* Archaeological Research Services, Inc. Tempe, AZ.

Appendix D

Cultural Resources Survey of the Queen Creek Riparian Corridor, Superior, Arizona

July 2002

Cultural Resources Survey of the Queen Creek Riparian Corridor Superior, Arizona

Prepared for:

U.S. Bureau of Reclamation
P.O. Box 81169
Phoenix, AZ 85021-2801
Contact: John McGlothlen
602/216-3866

Prepared by:

David Hart
Northland Research, Inc.
2510 S. Rural Road, Suite 102
Tempe, AZ 85282
(480) 894-0020

July 2002

Cultural Resources Survey of the Queen Creek Riparian Corridor, Superior, Arizona

INTRODUCTION

David Hart of Northland Research completed a Class III cultural resources survey of approximately 162 acres (66 hectares) along the Queen Creek riparian corridor as it passes through the town of Superior, Arizona (Figure 1). The project area traverses private land and Arizona Department of Transportation right-of-way, as well as land owned by Tonto National Forest and the Town of Superior (Table 1). The survey was conducted between 17 and 20 June 2002, under Arizona State Museum (ASM) permit No. 2002-7bl.

Table 1. Land Ownership

Township and Range	Section No.	Land Agency
T1S, R12E	35	Private, Tonto National Forest, and ADOT
T2S, R12E	2	Private and Town of Superior
	3	Private, BHP Mining, and Town of Superior
	4	Private, BHP Mining, Tonto National Forest, Town of Superior
	9	Private and Town of Superior

The pedestrian survey and associated records search resulted in the identification of six archaeological sites and 26 isolated occurrences. Previously recorded sites were briefly inspected to determine if additional work would be necessary. All newly identified cultural remains were recorded according to standard professional procedures included in the Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation at 48 FR 44716–44742, and in conformance with the Secretary's Standards for Identification at 48 FR 44720–44723. One of the previously recorded sites is not considered eligible to the National Register of Historic Places (NRHP). The remaining sites are all considered NRHP-eligible under Criterion D for their potential to yield additional information pertaining to the historical growth and development of the Town of Superior.

PROJECT SETTING

The project area is located in Sections 3, 4, 9, T2S, R12E, and Sections 35, T1S, R12E, Pinal County, Arizona. The elevation of the project area ranges from 2,580 feet (786 meters) to 2,950 (1,027 meters) above mean sea level. The project area passes through the Town of Superior and is located within the Basin and Range Physiographic Province of central Arizona (Hendricks 1985:17–26; Plate 2). Vegetation in the project area is characteristic of the Arizona Upland

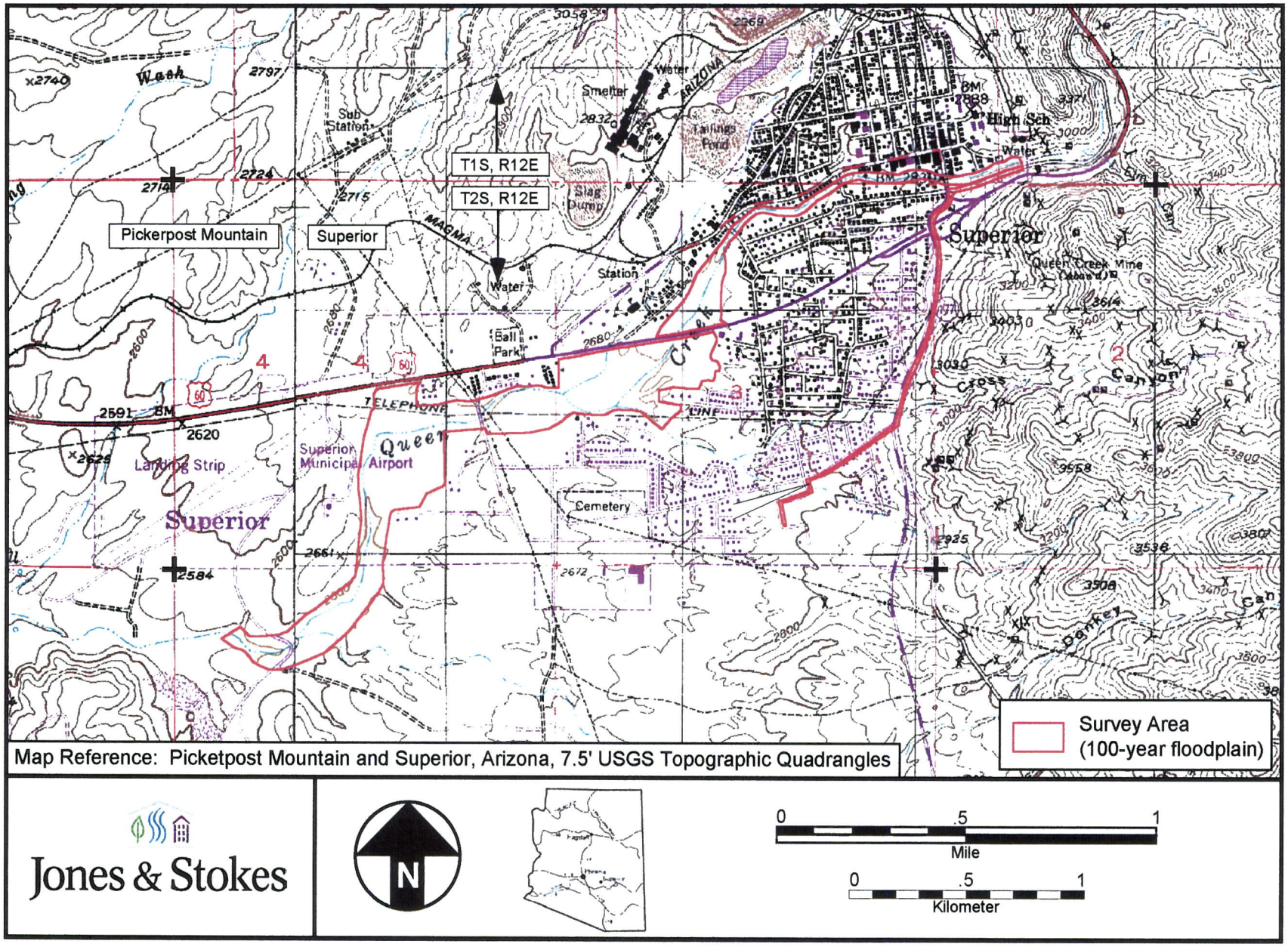


Figure 1. July 2002 Survey Area.

Subdivision of the Sonoran Desertscrub Biotic Community (Turner and Brown 1994:180–200). Such vegetation includes bursage, palo verde, yucca, ocotillo, buckhorn cholla, prickly pear, saguaro, and barrel cacti, as well as several varieties of grasses and bushes. Riparian flora along the creek include cottonwood, willow, sycamore, ash, catclaw, mesquite, and numerous grasses and weeds.

CULTURAL SETTING

Paleoindian Period (10,000 to 7,500 B.C.)

The earliest known occupation in North America is the Paleoindian period. No evidence of cultural remains from this time period has been found in the vicinity of Superior. Mammoth and bison kill sites have been identified in southeastern Arizona. Although these sites clearly demonstrate human reliance upon now-extinct megafauna during the late Pleistocene, Paleoindians undoubtedly exploited a variety of plant resources as well. Isolated Paleoindian projectile points have been found throughout Arizona (Mabry 1999), though such finds are extremely rare for a variety of reasons. Paleoindian population was low, consisting of small groups of mobile hunter-gatherers. Their subsistence and settlement pattern have left few material remains in the archaeological record. Paleoindian sites are also associated with Pleistocene surfaces, which have eroded over the past 12,000 years. Therefore, Paleoindian presence is often identified by Clovis or Folsom projectile points. These large, fluted, lanceolate projectile points are the most diagnostic element of Paleoindian tool kits. The relatively recent development of the upper bajada around Superior makes it unlikely that Paleoindian sites or artifacts would be found on the surface in this area.

Archaic Period (7,500 B.C. to A.D. 200)

Early Archaic (7,500 to 4,800 B.C.) sites are rare in Arizona. Following the amelioration of Pleistocene climate and the extinction of Pleistocene megafauna, humans in southeastern Arizona began to adapt to a warmer, drier climate and the widespread availability of small game animals. A substantial reliance upon collected plant material is assumed to have occurred because of numerous grinding implements that have been found at Early Archaic sites (Huckell 1996). Presumably, a similar transition would have occurred along Queen Creek if the area was occupied at that time.

Prehistoric occupation along Queen Creek near Superior has been verified by the Middle Archaic (4,800 to 1,500 B.C.). As part of their regional exploitation, small mobile groups exploited the seasonally ripe plant resources and available small game in the area. The mobile lifestyle resulted in the reuse of some locations over multiple generations, often for a small number of specialized activities such as collecting or processing food resources.

The Late Archaic (1,500 B.C. to A.D. 100) represents a time of increasing population size and experimentation with different subsistence systems. Collected resources continue to be an important part of the diet, but evidence of agriculture begins to appear at some sites. As agricultural resources play an increasing role in Late Archaic subsistence, corresponding changes included activity scheduling, task unit size, and increasing sedentism.

Ceramic Period (A.D. 200 to 1450)

The Hohokam culture represents the most widespread archaeological culture identified in southern Arizona. The Hohokam lifestyle developed out of the preceding Late Archaic and represents an elaboration of previous patterns. There is considerable variation for the 15 centuries that the Hohokam occupied the Salt River Valley and its margins, but a general cultural history of the region is outlined in the following paragraphs.

The first settled villages known in the Salt River Valley mark the Red Mountain phase (A.D. 100 to 400). Evidence of subsistence practices from Red Mountain phase sites indicates reliance upon collected resources, but with a growing dependence upon agricultural products. Evidence of ceramic production involves small, neckless jars that were likely used for the storage of seed grains. Lithic inventories typically reflect locally available materials that were used on an expedient basis. Burials generally consisted of flexed inhumations, often stained with red ochre and displaying few grave goods.

The Pioneer period (A.D. 400 to 700) is associated with the first appearance of irrigation agriculture and decorated ceramics identified in the Gila and Salt River Valleys. Ceramic production continued to be dominated by plainware pottery. Decorated ceramics include fugitive red paints on gray or buff vessels. Additional ceramics include figurines that were part of an inventory of ritual paraphernalia.

Residential architecture is variable during the Pioneer period. Small field houses were made with bent poles to produce low, rounded structures that were used on a temporary basis. These small houses were typically used while tending crops at agricultural fields (Cable and Doyel 1984). Few artifacts are found in association with these structures, and they appear to have been abandoned and reused regularly. Habitation sites contained more substantial structures with formal, plaster hearths and rectangular floor plans. Less-common house types include large square buildings that are thought to represent the residences of local leaders, and which also served as public meeting places.

The Colonial period (A.D. 750 to 950) was an era of expansion and elaboration for the Hohokam. Areas that were distant from the Gila and Salt Rivers were occupied as the number and size of Hohokam sites increased. Colonial period sites have been found as far north as Prescott, south into Mexico, west of the Gila Bend area, and east near the New Mexico border. Colonial period subsistence is characterized by a continued reliance upon both domesticated crops and wild plants. Irrigation canals are established throughout the Gila and Salt River basins, while dry farming was practiced in upland areas.

Decorative motifs range from stylized life forms to negative designs and repetitive geometric friezes. Incised lines were common decorative elements early in the period, but become less prevalent later. Vessel shape and size is highly variable and includes animal effigies used as censers. Residential architecture continues to be similar to the previous period. The dominant form of public architecture during the Colonial period is the ball court. Ball courts were widely distributed and were often found at large habitation sites. As a locus of exchange and ritual, the ball courts acted as an integrative community facility.

Colonial Hohokam social organization was linked to the exchange of ritual and subsistence goods (Doyel 1985). Broad interaction spheres and long-distance trade across Arizona established links between the Hohokam and distant areas. Secondary cremation becomes the dominant burial practice, while the presence of burials with elaborate grave goods in prominent locations suggests a complex social hierarchy.

The Sedentary Period (A.D. 950 to 1150) was a time of decline for the formerly flourishing Hohokam. Sedentary period subsistence continues to show an increased reliance upon domesticated crops, along with intensification in procurement of selected wild resources. Corn, beans, and squash remain the focus of agriculture, while cholla becomes increasingly prominent in the material record. The qualitative decline in ceramic production and shell manufacture is indicated by less precision and reduced variability. The production of the traditional red-on-buff pottery style continued, though the artistic quality declined. The widespread production of red-on-buff pottery was ultimately eclipsed by the production of redwares towards the end of the period.

Residential architecture consists of semi-subterranean house-in-pit structures. Domestic houses are typically arranged around small plazas and form courtyard groups. Ball courts are the dominant form of public architecture early in the period. The subsequent construction of capped mounds, or platform mounds, corresponds with abandonment of ball courts. The cessation of ball court construction and advent of platform mounds is associated with a reorganization of the Hohokam political sphere at the end of the Sedentary period. After a period of intensive growth, many of the large traditional villages were abandoned. Secondary cremations remain the common mortuary practice, though a decrease in the amount of grave goods is also associated with the use of redware ceramics.

The Hohokam Classic period (A.D. 1150 to 1450) exhibits an increased reliance upon irrigation agriculture and domesticated products. Collected resources are present in the assemblage, but play a small role in comparison with corn and agave. A significant lack of animal protein in the diet was probably a contributing factor in the declining health of the population (Van Gerven and Sheriden 1994). Red-on-buff ceramics are still manufactured during the early part of the Classic period, though the increasing use of redwares results in the near exclusion of buffwares by the end of the Classic. The inclusion of polychromes after A.D. 1320 (Reid and Whittlesey 1992) marks the addition of a southwestern regional style to the Hohokam material culture.

The use of semi-subterranean pit structures continued early in the Classic period, though with a decreasing frequency as aboveground, post-reinforced, adobe-walled structures become more common. Public architecture is characterized by the dominance of platform mounds to the near total exclusion of ball courts. A segment of the population, possibly a priestly class, resided on top of the platform mounds. Late in the Classic period, "big houses" become important hallmarks of

public architecture. Big houses are elaborate, multi-story structures that required a significant labor force for construction and maintenance. Big houses are often associated with platform mounds and likely served multiple functions, not least of which was a symbol of elite power in late Classic society. Population size reaches its pinnacle during the Classic period, though much of the population coalesced into fewer, larger sites. Inhumations and cremations are equally common, while the presence of grave goods with adolescent individuals is evidence for ascribed status.

Archaeological remains associated with the Salado culture are prevalent in the areas surrounding Superior by the Classic period. The Salado are identified by adobe, or masonry, compound architecture and polychrome pottery. The intrusion of Salado materials into areas occupied by the Hohokam likely represents the migration of peoples and ideas to the margins of the Salt and Gila River valleys from regions to the north and east. The heart of the Salado culture is in the Tonto Basin, north of Globe, Arizona.

Protohistoric (A.D. 1450 to 1700)

Population in and around the Salt River Valley declined precipitously after the Hohokam Classic period. Significant habitation of the area was absent until the nineteenth century, though at least two aboriginal cultures continued to procure resources in the area. Small groups of Yavapai exploited the uplands, while Pima farms and villages were established south of the Salt River. Fishing, hunting, and wild plant collection have been documented for areas near the Salt River in the early nineteenth century.

Historical Period (A.D. 1521 to 1950)

The Historical period overlaps the Protohistoric because written records are not available for the entire region at the same time. The Historical period begins with the Spanish military entradas into Arizona. Members of these expeditions recorded events and Native American groups that they encountered along their routes.

The United States came into possession of the territory of Arizona in 1853 as a result of the Gadsden Purchase. The government sent numerous personnel to explore and record information about the newly acquired lands. Euroamericans soon began immigrating to the area. The influx of Anglo-Americans resulted in hostilities between the newcomers and various native groups such as the Apache. The United States military was dispatched to subdue the Western Apache. After nearly 40 years of warfare, the Apache were moved to the San Carlos Reservation.

As raids and Native American uprisings become increasingly infrequent, mining and ranching in Arizona, along with supporting industries, began to thrive. Near what is now Superior, the Silver King and the Pioneer Mining Districts were established after the discovery of silver in the 1870s. Ore from the Silver King and surrounding mining districts such as Reymert, Mineral Hill, and Martinez was processed at a nearby mill, which developed into the bustling town of Pinal. The town of Pinal in the Pioneer mining district had as many as three ore mills in operation at one time

to process the rich ores during the town's heyday. The Town of Superior was originally known as the Queen Mining Camp, associated with the Silver Queen mine.

RECORDS REVIEW

As part of the cultural resources survey, David Hart of Northland Research conducted a records search and literature review of the approximate 162-acre (66-hectare) corridor along Queen Creek, corresponding with the creek's 100-year floodplain. The Arizona State Museum, the State Historic Preservation Office, the Bureau of Land Management, and Tonto National Forest were consulted during the records search.

The 1912 GLO plat map for T2S, R12E and the 1912 GLO plat map for T1S, R12E depict the Florence to Superior road, which is now State Route 60, adjacent to Queen Creek. The GLO also depicts the Pinal townsite in Section 5, Bellamy Pasture in the southern half of Section 4, and Ray Road crossing Queen Creek in Section 3.

A total of nine archaeological investigations have been conducted in the vicinity of the project area (Table 2). A total of 18 archaeological sites have been located within an approximate 1-mile radius of the project area as a result of previous investigations (Table 3). The nature of the previously recorded sites is varied, with a diversity of prehistoric and historical site types represented. For example, prehistoric sites consist of Hohokam habitation sites and artifact scatters, as well as a Salado village and artifact scatter. The historical remains are primarily associated with mines and mining related activities such as claims, prospects, adits, shafts, tailings, access roads, and associated machinery. Historical trash dumps, which may or may not be associated with mining, are also common.

Only two of the previously recorded sites, AZ V:2:101(ASM) and AZ U:12:105(ASM), are located on or adjacent to the current project boundary. AZ V:2:101(ASM) consists of the U.S. Highway 60 from Florence to Globe. The modern road usurps much of the original alignment, though historical features such as culverts and bridges may remain intact. In addition, large sections of the original road are still visible from eastern Superior to Miami. The road is listed as "potentially" eligible to the NRHP. AZ U:12:105 consists of a small historical period trash dump, or artifact scatter located on an island of land created by the U.S. Highway 60 and SR 177 interchange. The site is not considered NRHP-eligible.

Table 2. Previous Investigations within a 1-Mile Radius of the Project Area

ASM/SHPO Survey #	Location	Results	Reference
1991-228	Sec. 3, 4, 5, T2S, R12E	Sites	Hathaway 1991
1993-216	Sec. 5, T2S, R12E	No Sites	Duff 1993
1993-369	Sec. 4, 5, 10, T2S, R12E; Sec 34, 35, 36, T1S, R12E	Sites	Motsinger and Roberts 1993
1995-23	Sec. 2, T2S, R12E; Sec. 35, 36, Sec. T1S, R12E	Sites	Stone 1995
1997-429	Sec. 3, T2S, R12E	No Sites	Wright 1997
1998-375	Sec. 4, T2S, R12E	No Sites	Boloyan 1998
1999-510	Sec. 10, 11, TS2, R12E	Sites	Brown 1999
2000-305	Sec. 2, 3, 10, 11, TS2, R12E	Sites	DeMaagd 2000
2000-638	Sec. 2, 3, T2S, R12E	Sites	Stokes 2000

Table 3. Previously Recorded Sites in the Project Vicinity

Site #	Site Type	Age	NRHP Eligibility	Reference
AZ U:12:3(ASM)	Salado village	Prehistoric	Unknown	Unknown
AZ U:12:54(ASM)	Hohokam village/artifact scatter	Prehistoric	Potentially	Hathaway 1991
AZ U:12:55(ASM)	Trash scatter	Historical	Potentially	Hathaway 1991
AZ U:12:56(ASM)	Salado artifact scatter	Prehistoric	Not eligible	Hathaway 1991
AZ U:12:77(ASM)	Hohokam village	Prehistoric	Eligible	Motsinger and Roberts 1993
AZ U:12:84(ASM)	Check dams	Prehistoric	Potentially	Motsinger and Roberts 1993
AZ U:12:85(ASM)	Hohokam habitation	Prehistoric	Eligible	Motsinger and Roberts 1993
AZ U:12:88(ASM)	Mine-adit, tailings	Historical	Potentially	Stone 1995
AZ U:12:89(ASM)	Mine-prospect, shaft, and road	Historical	Potentially	Stone 1995
AZ U:12:90(ASM)	Roadways	Historical	Not eligible	Stone 1995
AZ U:12:91(ASM)	Mine-shaft, machinery	Historical	Potentially	Stone 1995
AZ U:12:92(ASM)	Dirt Road	Historical	Potentially	Stone 1995
AZ U:12:103(ASM)	Ray Road	Historical	Not eligible	Brown 1999
AZ U:12:104(ASM)	Superior town dump	Historical	Eligible	DeMaagd 2000
AZ U:12:105(ASM)	Trash dump	Historical	Not eligible	DeMaagd 2000
AZ U:12:139(ASM)	Trash dump	Historical	Not eligible	Stokes 2000
AZ U:12:140(ASM)	Unknown	Unknown	Unknown	Unknown
AZ V:2:101	U.S. Highway 60	Historical	Potentially	Unknown

FIELD METHODS AND RESULTS

A full coverage[1] (100%) cultural resources survey was conducted of the approximate 162-acre (66-hectare) riparian corridor of Queen Creek, Superior, Arizona. The pedestrian survey

[1] Two parcels of private land with posted "No Trespassing" signs were omitted from survey. Additional areas were sampled due to the density of vegetation, which precluded standard transects. However, every effort was made to

primarily consisted of an archaeologist walking parallel transects spaced approximately 66 feet (20 meters) apart. The area along and between transects was inspected for cultural remains. Ground visibility ranged from extremely poor (ca. 5%) to fair (ca. 65%). The average ground visibility was approximately 40% due to the dense vegetation covering much of the project area. David Hart of Northland Research identified and recorded four sites and 26 isolated occurrences, in addition to field-checking two previously identified sites.

Newly Recorded Sites

AZ U:12:152(ASM)
Site Size: 38 meters x 25 meters (125 feet x 82 feet)
Land Ownership: private land (BHP Mining Claim)
Time Period: Historical
Site Type: Trash Dump/Artifact Scatter

The site consists of a historical period trash dump, or artifact scatter (Figure 2). Vegetation around the site consists of catclaw and mesquite, with cottonwood and sycamore closer to the creek itself. A variety of weeds and shrubs were also observed. Soils at the site consisted of tannish-brown, silty sand with some pebbles. There appears to be some depth to the site based on the presence of artifacts eroding out of the hillside.

The only feature identified consisted of a wellhead located on the west side of the site on the uppermost terrace. It was not possible to determine if the artifacts were the result of a single dumping episode or repeated refuse disposal. The artifacts primarily consisted of glass bottles, including numerous bases, lips, and necks (Table 4). Ceramics were also abundant. Other artifacts consisted of various pieces of metal. Numerous glassmaker's marks were observed (Table 5). Maker's marks indicate the site may have been formed as early as the period 1920–1929.

Table 4. AZ U:12:152(ASM) Historical Artifacts

Artifact Type	Sub-Type	Count
Glass	Clear	68
	Brown	15
	Green	12
	SCA	10
	Blue	4
	Milk	3
Ceramic	White	53
	Stoneware	1
Metal	Unidentifiable	24
Total		190

follow game trails and create paths through the thickets of catclaw and mesquite in order to fully survey those areas where 20-meter transects were not possible.

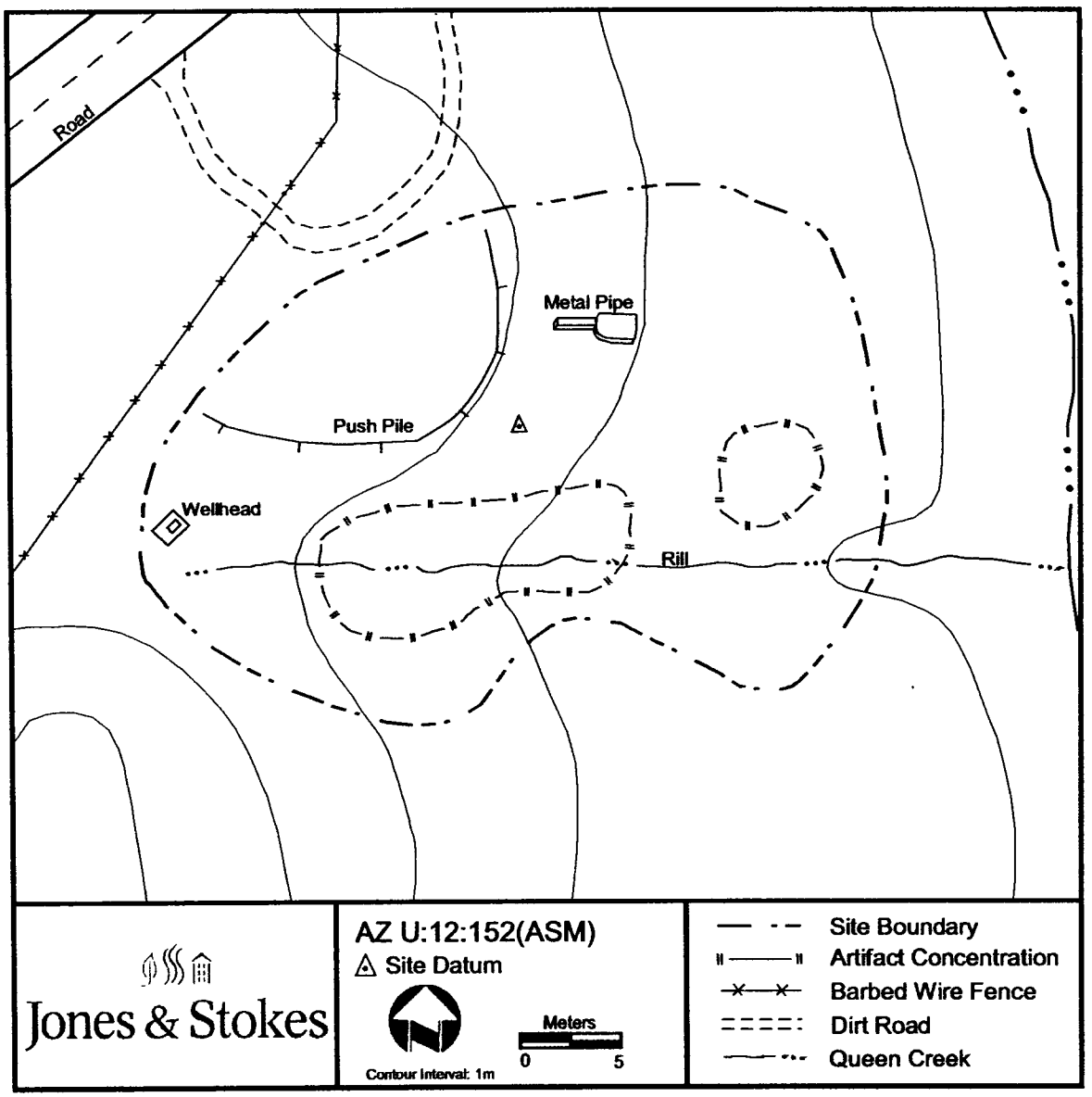


Figure 2. Site Map of AZ U:12:152(ASM)

Table 5. AZ U:12:152(ASM) Glassmaker's Marks

Company/Design	Date	Reference
Hazel-Atlas Glass Co.	1920 to 1964	Toulouse 1971:239
Owens Bottle Co.	1911 to 1929	Toulouse 1971:393
Southern Glass Co.	1917 to 1931	Toulouse 1971:457
Design Patent #53,694	1919 to 19??	Hull-Walski & Ayres 1989:76

Site Condition and Assessment. The site is in decent condition despite natural processes such as erosion. Modern debris and refuse are also interspersed with the historical artifacts. However, the site is considered eligible to the NRHP under Criterion D for its potential to yield information. The site is located outside of the town of Superior and may provide information pertaining to domestic life associated with homesteading and mining in the region.

AZ U:12:153(ASM)
Site Size: 55 meters x 52 meters (180 feet x 171 feet)
Land Ownership: private land (BHP Mining Claim)
Time Period: Historical
Site Type: Trash Dump/Artifact Scatter

The site consists of several historical artifact concentrations and various car parts (Figure 3). Vegetation around the site primarily consists of mesquite, catclaw, and a variety of weeds and shrubs. Soils at the site consisted of tannish-brown sandy silt with a large some pebbles and gravel. Site depth is unknown.

Numerous Model T cars parts were scattered across the site. There was one nearly complete chassis and body, several fenders, and various body parts. The scattered car parts appear to represent between two and four disassembled autos. The only other feature at the site consists of a small push pile of small cobbles and historical debris such as glass and ceramics. This feature was approximately 3 meters long and 2 meters wide.

There were five concentrations of artifacts and/or car parts identified across the site. The density of artifacts within the concentrations ranged from 3 to 30 artifacts per square meter. Artifacts primarily consisted of glass and ceramics (Table 6). Metal objects were also common. Maker's marks identified on several bottle bases suggest the site may have been formed in the 1920s at the earliest (Table 7). It is not possible to determine if the site is the result of multiple dumping episodes, or the result of a single event. The site is located within the area identified as "Bellamy Pasture" on the 1912 GLO plat map. However, the relationship of the site to the pasture is unknown.

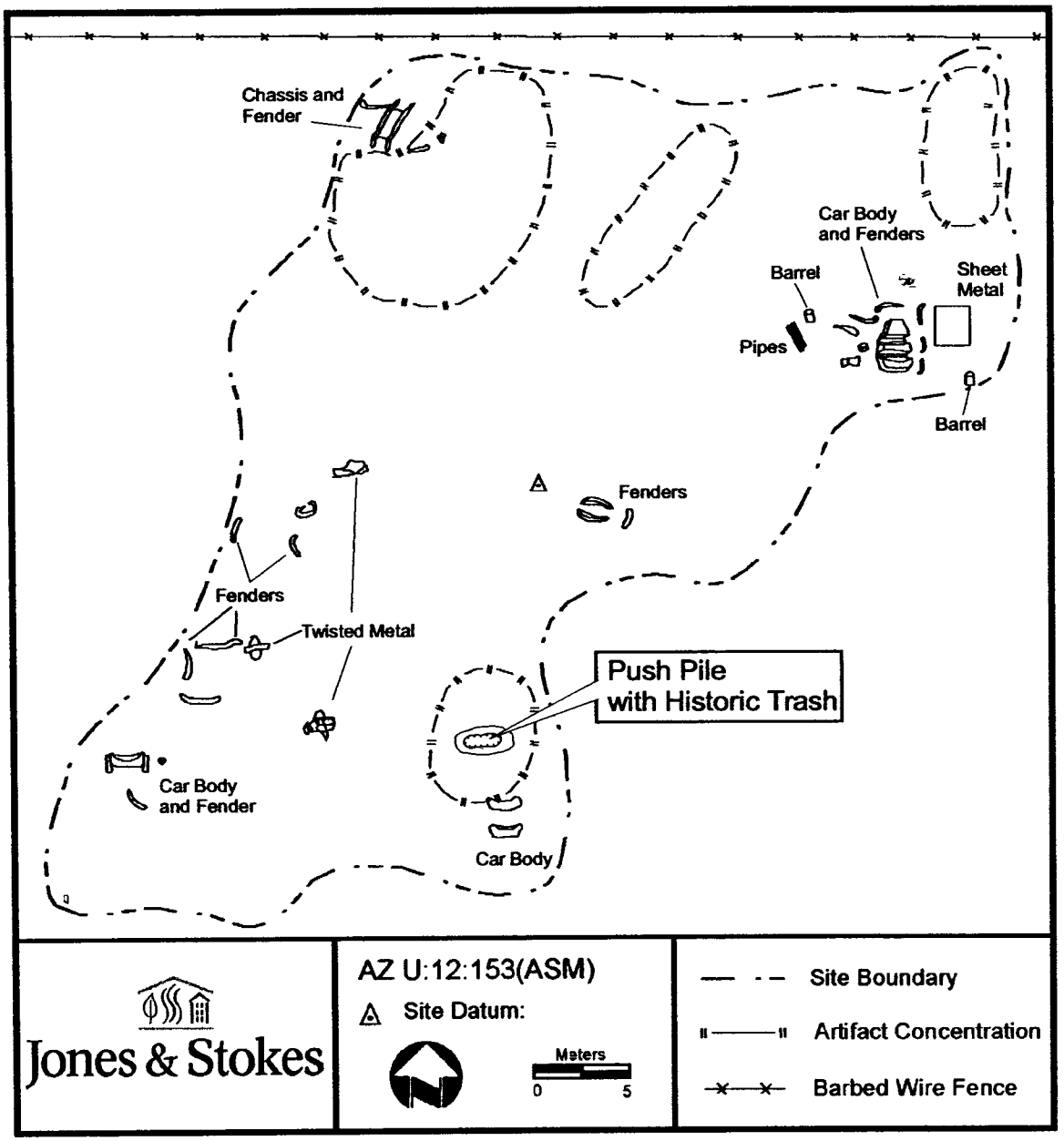


Figure 3. Site Map of AZ U:12:153(ASM)

Table 6. AZ U:12:153(ASM) Historical Artifacts

Artifact Type	Sub-Type	Count
Glass	Clear	112
	Brown	36
	SCA	12
	Green	9
	Milk	8
	Aqua	7
	Blue	4
	Frosted	4
Ceramic	White	90
	Stoneware	6
	Orange	1
	Yellow-green	1
Metal	Unidentified	27
Other	Brick	2
Total		326

Table 7. AZ U:12:153(ASM) Glassmaker's Marks

Company/Design	Date	Reference
Hazel-Atlas Glass Co.	1920 to 1964	Toulouse 1971:239
William Franzen & Son	1900 to 1929	Toulouse 1971:536
Drene	Unknown	Hull-Walski & Ayres 1989:108

Site Condition and Assessment. The site is in good condition, and is considered eligible to the NRHP under Criterion D for its potential to yield information. The site is located outside of Superior proper and may provide information on nearby homesteading and mining. It may also be possible to determine the relationship, if any, to Bellamy Pasture.

AZ U:12:154(ASM)
Site Size: 15 meters x 10 meters (49 feet x 33 feet)
Land Ownership: Town of Superior
Time Period: Historical
Site Type: Trash Dump/Artifact Scatter

The site consists of a historical period trash dump, or artifact scatter, eroding out of the bank of a wash (Figure 4). The refuse is likely associated with the historic concrete foundation located above it. A trailer is now located on the foundation. Vegetation around the site consists of catclaw and mesquite, grasses and weeds. Soils at the site consisted of dark gray-brown silts with a high ash and organic content. There appears to be considerable depth to the sediments based on the numerous artifacts eroding out of the edge of the creek.

There were no features associated with the site. The artifacts consisted primarily of glass, as well as historical ceramic and metal (Table 8). It is likely that the site is the result of repeated trash

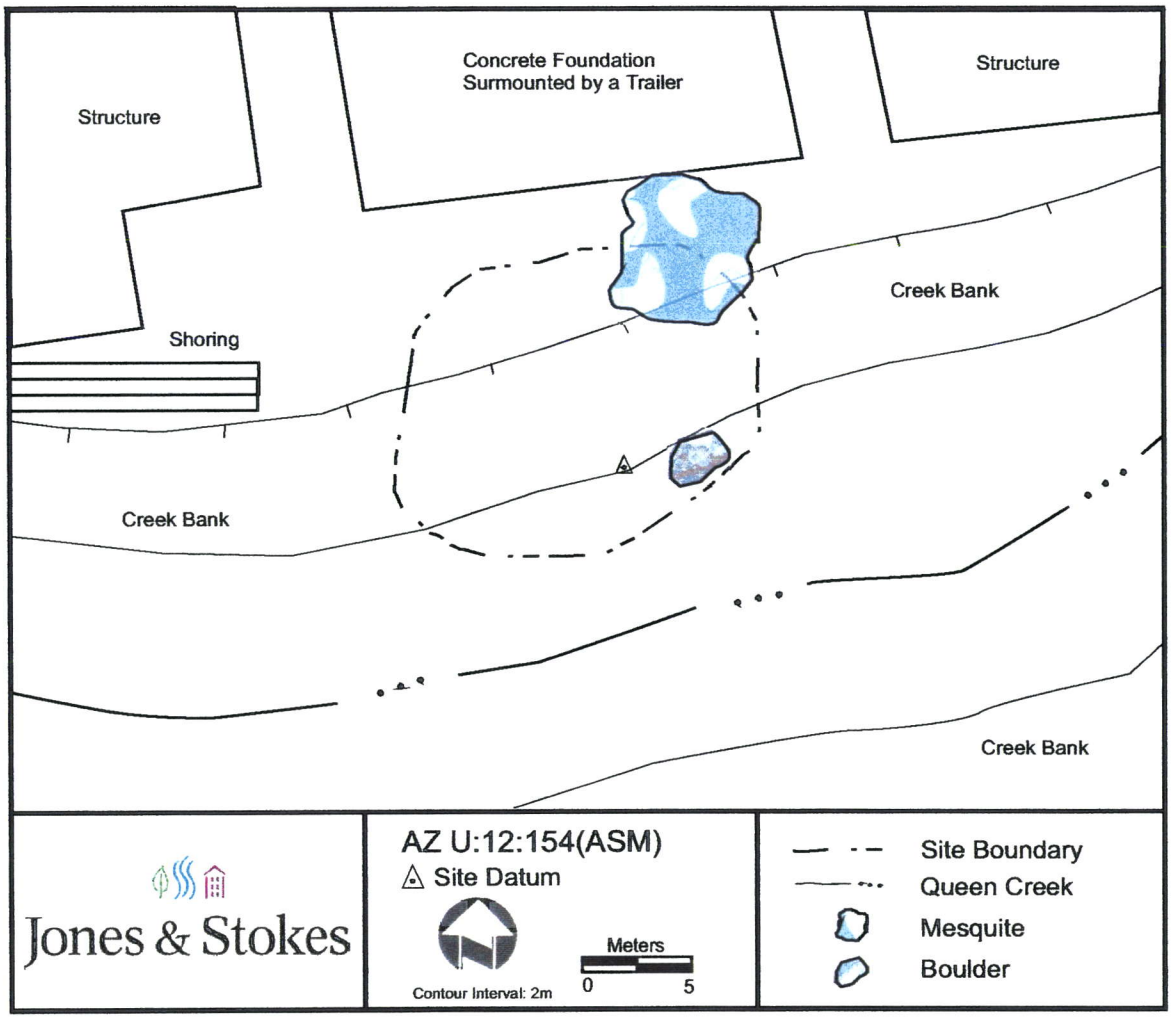


Figure 4. Site Map of AZ U:12:154(ASM)

disposal "out the back door" from the former structure located above the wash. The average artifact density was approximately 30 artifacts per square meter. Based on the observed maker's marks (Table 9), it is likely that the site was formed in the late 1930s and 1940s and continued to grow as more refuse was added over the following decades.

Table 8. AZ U:12:154(ASM) Historical Artifacts

Artifact Type	Sub-Type	Approximate Count
Glass	Clear	250
	Brown	65
	Blue	15
	Milk	11
	Green	7
Ceramic	White	17
	Turquoise Blue	4
	Brown and Yellow	2
	Beige	2
	Stoneware	1
Metal	Unidentified	4
Other	Bone	3
Total		381

Table 9. AZ U:12:154(ASM) Glassmaker's Marks

Company/Design	Date	Reference
Anchor Hocking Glass Corp.	1938 to Present	Toulouse 1971:48
Fairmount Bottle & Glass Co.	1945 to 1960	Toulouse 1971:201
Owens Illinois Glass Co.	1919 to 1954	Toulouse 1971:403
Wine	Unknown	Hull-Walski & Ayres 1989:81
Vicks Chemical Co.	1894 to Present	Hull-Walski & Ayres 1989:87

Site Condition and Assessment. The site is in decent condition despite natural processes such as erosion. Modern debris and refuse is also interspersed with the historical artifacts. However, the site is considered eligible to the NRHP under Criterion D for its potential to yield information. The site is likely to provide information on domestic or commercial activities in the town of Superior during the first half of the twentieth century.

AZ U:12:155(ASM)
Site Size: 15 meters x 5 meters (49 feet x 16 feet)
Land Ownership: private land (Town of Superior)
Time Period: Historical
Site Type: Trash Dump/Artifact Scatter

The site is consists of a historical period trash dump, or artifact scatter, eroding out of the bank of a wash (Figure 5). The refuse is likely associated with several houses to the south. Vegetation around the site consists of catclaw and mesquite, grasses and weeds. Soils at the site consisted of

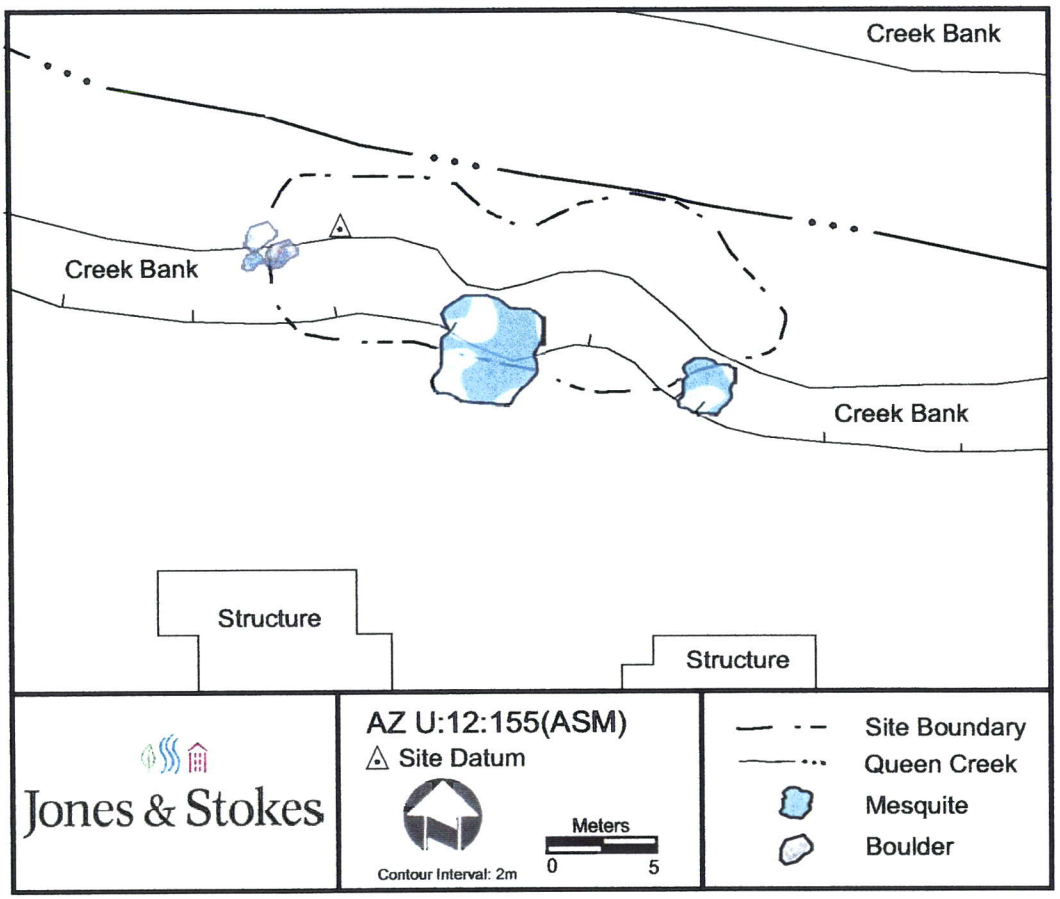


Figure 5. Site Map of AZ U:12:155(ASM)

dark gray-brown silts with a high ash and organic content. There appears to be depth to the sediments based on the numerous artifacts eroding out of the edge of the creek.

There were no features associated with the site. The artifacts consisted primarily of glass, as well as historical ceramic and metal (Table 10). It is likely that the site is the result of repeated trash disposal "out the back door" from the former structure located above the wash. The average artifact density was approximately 20 artifacts per square meter. Based on the observed maker's marks, it is likely that the site was formed in the late 1930s and 1940s and continued to grow as more refuse was added over the following decades.

Table 10. AZ U:12:155(ASM) Historical Artifacts

Artifact Type	Sub-Type	Approximate Count
Glass	Clear	150
	Brown	50
	Green	8
	Blue	3
	Milk	2
Ceramic	White	30
	Stoneware	3
	Blue	1
	Green	1
Metal	Unidentified	3
Other	Bone	1
Total		252

Table 11. AZ U:12:155(ASM) Glassmaker's Marks

Company/Design	Date	Reference
Armstrong Cork Co., Glass Division	1938 to 1969	Toulouse 1971:24
The Clorox Co.	1933 to 1939	Hull-Walski & Ayres 1989:83
Owens Illinois Glass Co.	1919 to 1954	Toulouse 1971:403

Site Condition and Assessment. The site is in decent condition despite natural processes such as erosion. Modern debris and refuse is also interspersed with the historical artifacts. However the site is considered eligible to the NRHP under Criterion D for its potential to yield information. The site is likely to provide information on domestic activities in the town Superior during the first half of the twentieth century.

Previously Recorded Sites

AZ V:2:101(ASM)

This site consists of the historical period road that connected Florence to Superior to Miami and Globe. The construction of U.S. Highway 60 usurped the majority of the historical period alignment. However, certain roadway related features, such as bridges remain intact. Very little remains of the original roadway, besides its orientation and alignment, in the vicinity of the project area. However, a portion of the original road still exists on the eastern side of Superior as it leaves town, paralleling Queen Creek on its south side as it heads up the canyon. This portion of the site intersects the project area. The original site card and report were not found, but the site is listed as eligible to the NRHP. Dave Hart of Northland Research agrees with the original NRHP eligibility recommendation. The site is eligible under Criterion D for its potential to yield information pertaining to historical era communication and transportation.

AZ U:12:105(ASM)

This site consists of a small historical period trash scatter. The site is located on an "island" of land created by the U.S. 60 and SR 177 interchange on the east side of Superior. The site is originally described as a two-track road alignment and historic trash dump consisting of glass, ceramics, metal, and a clay doll observed (DeMaagd 2000). The site is listed as not eligible to the NRHP. The site was inspected in the field as part of the current project area. It should be noted that the project corridor will not impact any cultural remains associated with this site. Furthermore, Dave Hart agrees with the original eligibility assessment. The site is considered not NRHP-eligible due to the lack of information potential associated with the site.

Isolated Occurrences

A total of 26 isolated occurrences were recorded as a result of the pedestrian survey. The majority of isolated occurrences consist of linear rock alignments. The rock alignments are likely prehistoric agricultural features related to floodwater farming along Queen Creek. Some of the alignments are parallel rows of rocks with a cleared space between them, whereas others are a single row of rocks with a cleared space behind them, or "upslope." Numerous rock alignments were scattered across portions of the 100-year floodplain where it is broad and relatively flat. It is likely that more of these features exist than were identified by the current project. The identification of these features is difficult due to natural processes of flooding and erosion, as well as the density of vegetation in these low-lying areas. Several possible field houses were also identified in the low-lying area. They were identified as "possible" field houses due to their ephemeral nature and lack of associated artifacts. Archaeological testing, or excavation, would be necessary to determine if cultural sediments or artifacts occur in association with these features.

Cars or parts of cars were also common throughout the project area. Only the locations of vehicles that were clearly historical in age were recorded. The majority of automobiles were

modern in age. A variety of modern trash and debris was also common throughout the project area, while prehistoric and historical artifacts were quite rare. The paucity of archaeological artifacts is likely the result of period flooding which removes some items downstream, while burying others. All isolated occurrences that were clearly prehistoric or historical in nature were recorded according to standard professional procedures. Dave Hart documented information pertaining to their location and morphology.

Discussion

There were no prehistoric sites identified as a result of the pedestrian survey. However, this conforms with our current knowledge of prehistoric settlement patterns. Most villages or habitations, whether Hohokam or Salado, are located on the terraces above the creek and the 100-year floodplain. The prehistoric materials that do occur in the low-lying areas adjacent to the creek consist of agricultural features such as rock alignments, check dams, and associated field houses.

The historic sites consisted of trash dumps, or artifact scatters. It was common for people to dispose of refuse in or along washes during the first half of the twentieth century. Much of the trash was typically washed away along with seasonal rains and floods. It is interesting to note, however, that the two historical trash scatters located outside of Superior were not associated with any obvious homesteads or mining claims. The trash dumps located in the town of Superior were clearly associated with adjacent residential or commercial structures. Furthermore, the majority of historic structures[2] located along the riparian corridor within the Town of Superior were not associated with historical trash. Future research questions may involve different twentieth century waste disposal practices among local populations in relation to environmentally sensitive areas such as Queen Creek.

SUMMARY AND RECOMMENDATIONS

Dave Hart of Northland Research has completed a Class III cultural resources survey of approximately 162 acres (66 hectares) along the Queen Creek riparian corridor within and adjacent to the Town of Superior, Pinal County, Arizona. Two previously recorded sites, four newly recorded sites, and 26 isolated occurrences were identified and recorded as a result of the records search and pedestrian survey. One of the previously recorded sites was determined ineligible for the NRHP. The remaining five sites are all considered NRHP-eligible under Criterion D for their potential to yield additional information beyond what is available on the ground surface. Dave Hart recommends that these sites be avoided if possible. However, if activities associated with the restoration of Queen Creek will have significant impact on any of the sites, he recommends that the site(s) be subjected to archaeological testing to determine the nature and extent of subsurface cultural remains.

[2] Numerous historical structures are located along the riparian corridor in the Town of Superior. However, these structures were not recorded because they are located outside of the project boundary (the 100-year floodplain).

References Cited

Boloyan, David S.
1998 *Archaeological Clearance Survey: Town of Superior Industrial Park Project, Pinal County, Arizona*. David S. Boloyan Archaeological Services, Tempe.

Brown, Gregory B.
1999 *A Cultural Resources Survey of ADOT Materials Source 7525, Superior, Pinal County, Arizona*. Logan Simpson Design, Inc., Tempe.

Cable, J. S., and D. E. Doyel
1984 The Implications of Field Houses for Modeling Hohokam Agricultural Systems. In *City of Phoenix, Archaeology of the Original Townsite: The Murphy's Addition*, edited by J. S. Cable, S. L. Henry, and D. E. Doyel, pp. 259–279. Soil Systems Publications in Archaeology No. 3. Soil Systems, Inc., Phoenix.

DeMaagd, Holly
2000 *Cultural Resources Survey along State Route 177 between Mileposts 167.4 and 164.6, Superior, Pinal County, Arizona*. Archaeological Consulting Services, Ltd., Tempe.

Doyel, David E.
1985 The New River-Palo Verde System. In *Hohokam Settlement and Economic Systems in the Central New River Drainage, Arizona*, edited by D. E. Doyel and M. D. Elson, pp. 681-699. Soil Systems Publications in Archaeology, No. 4, Volumes I and II. Soil Systems, Inc., Phoenix.

Duff, Andrew I.
1993 *Cultural Resources Survey of a .17 Mile Segment of U.S. Route 60 Right-of-Way between Mileposts 212.0 and 223.5, Pinal County, Arizona*. Archaeological Research Services, Inc., Tempe.

Eyring Brown, Patricia and Connie Lynn Stone (editors)
1982 *Granite Reef: A Study in Desert Archaeology*. Anthropological Field Studies No. 3. Arizona State University, Tempe.

Hathaway, Jeffrey B.
1991 *Cultural Resources Survey of a 3.14 Mile Segment of U.S. Highway 60 Right-of-Way within and West of Superior in Northwestern Pinal County, Arizona*. Archaeological Research Services, Inc. Tempe.

Hendricks, David M.
1985 *Arizona Soils*. College of Agriculture, University of Arizona, Tucson.

Huckell, Bruce B.
1996 The Archaic Prehistory of the North American Southwest. *Journal of World Prehistory* 10(3):305–373.

Hull-Walski, Deborah A., and James E. Ayres
1989 *The Historical Archaeology of Dam Construction Camps in Central Arizona, Volume 3: Laboratory Methods and Database Computerization*. Dames and Moore, Phoenix.

Mabry, Jonathan B. (editor)
1999 *Paleoindian and Archaic Sites in Arizona*. Arizona State Historic Preservation Office, Arizona State Parks Board, Phoenix.

Motsinger, Thomas, and Heidi Roberts
1993 *The Eastern mining Area 115 kV Transmission Line Survey*. SWCA, Inc., Phoenix.

Reid, J. Jefferson, and Stephanie Whittlesey
1992 New Evidence for Dating Gila Polychrome. In *Proceedings of the Second Salado Conference, Globe, AZ, 1992*, edited by R. C. Lange and S. Germick, pp. 233–239. Occasional Paper. Arizona Archaeological Society, Phoenix. University of Utah Press, Salt Lake City.

Stokes, Robert J.
2000 *A Cultural Resources Assessment for a New US 60/SR 177 Traffic Interchange, US 60 Mileposts 226.65 to 227.0, Superior, Pinal County, Arizona*. Archaeological Consulting Services, Ltd., Tempe.

Stone, Bradford W.
1995 *Cultural Resources Survey of a 0.9 Mile Segment of U.S. Highway 60 Right-of-Way (Mileposts 226.85–227.5) and an Associated Temporary Construction Easement East of Superior, North-Central Pinal County, Arizona*. Archaeological Research Services, Inc., Tempe.

Toulouse, Julian Harrison
1971 *Bottle Makers and Their Marks*. Thomas Nelson, Inc., New York.

Turner, Raymond M., and David E. Brown
1994 Tropical-Subtropical Desertlands: Sonoran Desertscrub. In *Biotic Communities: Southwestern United States and Northwestern Mexico*, edited by David E. Brown, pp. 180 to 189. University of Utah Press, Salt Lake City.

Van Gerven, D. P., and S. G. Sheridan (editors)
1994 *The Pueblo Grande Project, Volume 6: The Bioethnography of a Classic Period Hohokam Population*. Soil Systems Publications in Archaeology No. 20. Soil Systems, Inc., Phoenix.

Wright, Thomas E.
1997 Cultural Resources Surveys of Five Bridge Scour Locations along U.S. 60 near Superior and Miami, Pinal and Gila Counties, Arizona. Archaeological Research Services, Inc., Tempe.