

**Upper Verde River Wildlife Area Turbidity Reduction  
Water Quality Improvement Grant  
FINAL REPORT**



Submitted by:

**Arizona Game and Fish Department**  
ADEQ GRANT # 6-003

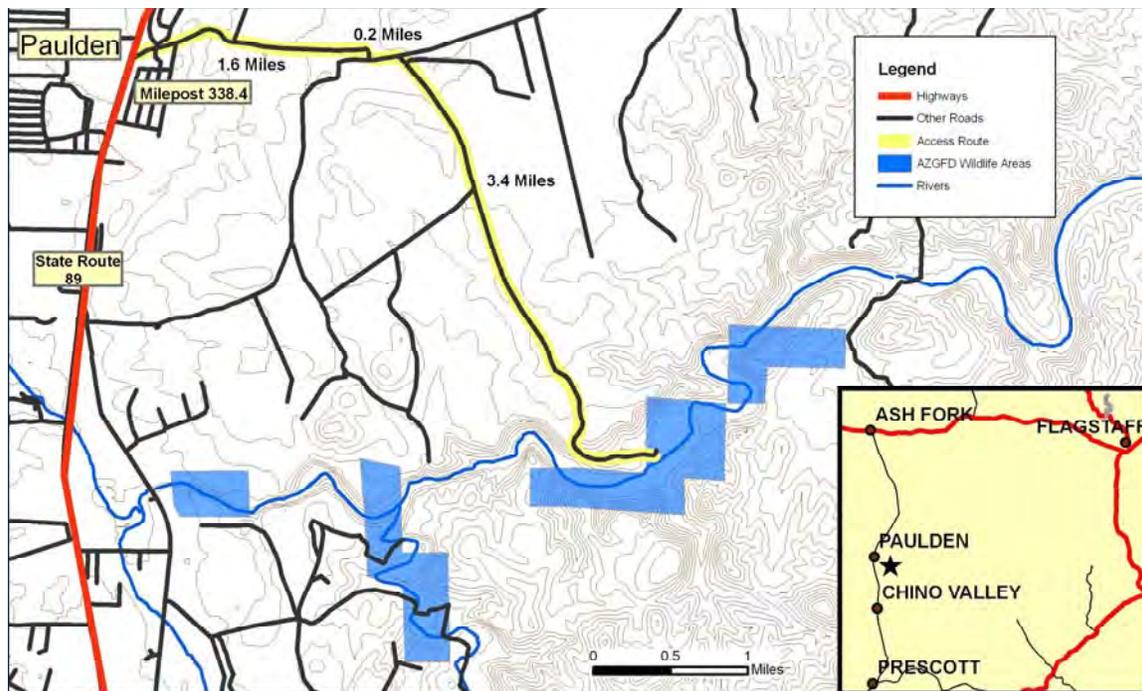
## Introduction

The Verde River originates in the Big Chino Valley north of Prescott, Arizona at the confluence of Chino Wash and Granite Creek, and terminates at the confluence to the Salt River, near Mesa, Arizona. The river provides recreational and drinking water needs for the communities along the river and, ultimately, for metropolitan Phoenix. The Verde River above Horseshoe Lake Reservoir is identified by the Arizona Game and Fish Department (AGFD) and U.S. Fish and Wildlife Service as high value habitat for fish and wildlife species and is unique and irreplaceable on a national basis (Bowman 2001).

The Environmental Protection Agency (EPA) has designated three reaches of the Verde River as impaired (303d List): 1) Sycamore to Oak Creek (25 miles of river), 2) Below Railroad Draw (6 miles), and 3) above West Clear Creek (6 miles). The Total Maximum Daily Load report (TMDL) prepared by ADEQ (Bowman 2001) identifies turbidity (a qualitative measure of water clarity or opacity) as the primary impairment in all three waters. Excessive suspended sediments can lead to the formation of bottom deposits that can impact aquatic ecosystems. Various mechanisms by which turbidity affects fishes has been described, including physiological stress from clogged gills and other sensitive surfaces, smothering of eggs and larvae, and disruption of normal feeding and other activities dependant on vision (Cordone and Kelly 1961). The addition of fine substrates to streams can result in significant changes to stream macroinvertebrate assemblages (Minshall 1984). Specifically, fine sediment abundance has distinct effects on macroinvertebrate colonization within the hyporheic zone and is known to reduce availability of dissolved oxygen in stream gravels (Tagart 1984), which can limit potential secondary production in the stream. Secondary effects due to trophic changes and altered habitat conditions brought about by channel siltation are also likely impacts and may not be short term in nature. The length of time increased sediment remains in the area is a function of frequency and magnitude of high flow events. Wolman and Miller (1960) found that the role of shaping stream channels and moving sediment is accomplished by flows that occur at least once each year or two. In the Verde River, these high flow events equate to the 1.5-1.7 year recurrence interval or bankfull flows. Research suggests that impairment varies seasonally and is largely driven by large flows from storm events that exceed bankfull (~1.5 yr return interval events) (Bowman 2001). During these higher flows, water inundates floodplain terraces, entrains alluvium, and can erode exposed banks leading to increased sediment within the water column. Similarly, bare soils in the uplands (due to loss of vegetation ground cover) erode and contribute sediment to the river during heavy precipitation runoff.

The Arizona Game and Fish Department (AGFD) owns and manages the 796-acre Upper Verde River Wildlife Area on the headwaters of the Verde River. The property is located 8 miles NE of Chino Valley, Arizona (Figure 1). Approximately 3 miles of the Verde River and 1 mile of Granite Creek flow through the property. The area is located 5 miles upstream of an impaired segment of the Verde River (Railroad Draw). The purpose of this grant is to reduce turbidity (the primary impairment) in the river through restoration efforts on the Wildlife Area and to conduct outreach/education efforts on the site and in the local community.

**Figure 1. Project Location – Upper Verde River Wildlife Area**



## **Project Goals and Objectives**

The primary goal of this project is to conduct restoration activities and education efforts on the property that benefit both local fish and wildlife resources and to reduce downstream turbidity impairment. Livestock fencing, road obliteration and closures, bank sloping, reseeding and revegetation, and education/outreach are the main conservation measures utilized to meet this goal.

### Livestock Fencing

Trespass grazing has been a significant problem on the wildlife area since the AGFD purchased the property in 1996. The objective of this conservation measure is to control livestock access to the entire property by replacing or repairing four miles of fence along the property boundary. In Arizona, a landowner who is concerned with livestock damaging plants and other private property, has an obligation to fence his/her private land with a lawful fence to keep animals out (ARS 3-1427).

Water and lush riparian forage often attract livestock from surrounding upland areas. Cattle typically will not move far from these riparian corridors even if forage is available in the uplands. Overgrazing of these areas results in reduced vegetation and stream bank stability in the riparian zone. Regeneration of palatable woody vegetation such as cottonwood and willows is reduced or eliminated. Uplands immediately adjacent to the riparian zone can also lead to increased erosion, less infiltration, loss of organic matter,

and impaired nutrient cycling. Within the project area, steep slopes and canyons lead down to floodplain terraces immediately adjacent to the Verde River. These floodplain terraces are important for infiltration and slowing the velocity of runoff. Trespass cattle use these terraces heavily because of forage, easy access, and proximity to the riparian corridor. Many of these areas have been severely overgrazed.

Photo 1. Trespass cows utilizing floodplain terrace

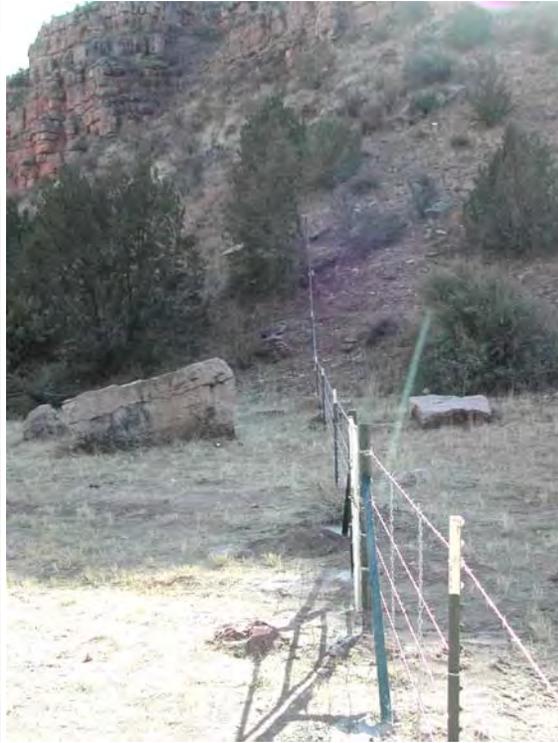


Hopkins Fence Company of Wickenburg, Arizona was contracted to complete fencing for the project. Due to extremely rough terrain and mixed land ownership, fencing on this project was extremely difficult. Cliffs and other impassible terrain were incorporated where possible to minimize the amount of fence. AGFD personnel traversed all proposed fencelines on foot or horseback. New construction was confirmed and marked using GPS coordinates. Four-strand barbwire fences were constructed to AGFD standards (Photos 2-5). These fences are designed to be wildlife friendly and utilize a 42" overall height with a barbless bottom strand set 16" above the ground. In some remote areas, salvageable existing fence was rebuilt to save on fencing costs. Steel gates were installed at major access points to facilitate travel by recreationists and allow removal of trespass cattle.

Total fencing completed on the project includes 4,758m (2.96 miles) of new fence and 2,571m (1.60 miles) of rebuilt fence (Figure 2). Cliffs and other inaccessible areas make up the remainder of the property boundary. One small section of fence was constructed on adjacent state trust land. AGFD personnel contacted the current lessee for permission and submitted the appropriate paperwork to the Arizona State Land Department.

Construction of this 200m fence eliminated 3 additional river crossings and reduced the amount of fence required by approximately 1,200m.

Photo 2 through 5. Fence Construction



Four large flood events occurred between September 2004 and March 2005. Four Verde River crossings and 1 Granite Creek crossing were required to fence out private land sections. Portions of fence that cross the river or creek are designed to break-away during flood events to minimize the amount of fence that is damaged. Two crossings had to be rebuilt after they were destroyed by flooding (Photo 6). High water levels in the river during this period delayed construction of the fence due to poor access (Photo 7).

Fencing for the project was finished in May 2006. Cattle have been removed from the property since June 2006. AGFD personnel continue to patrol the property to identify fence breeches and trespass cattle. Total riparian area excluded from livestock grazing following construction of the fence is 6 miles of the Verde River and 1 mile of Granite Creek.

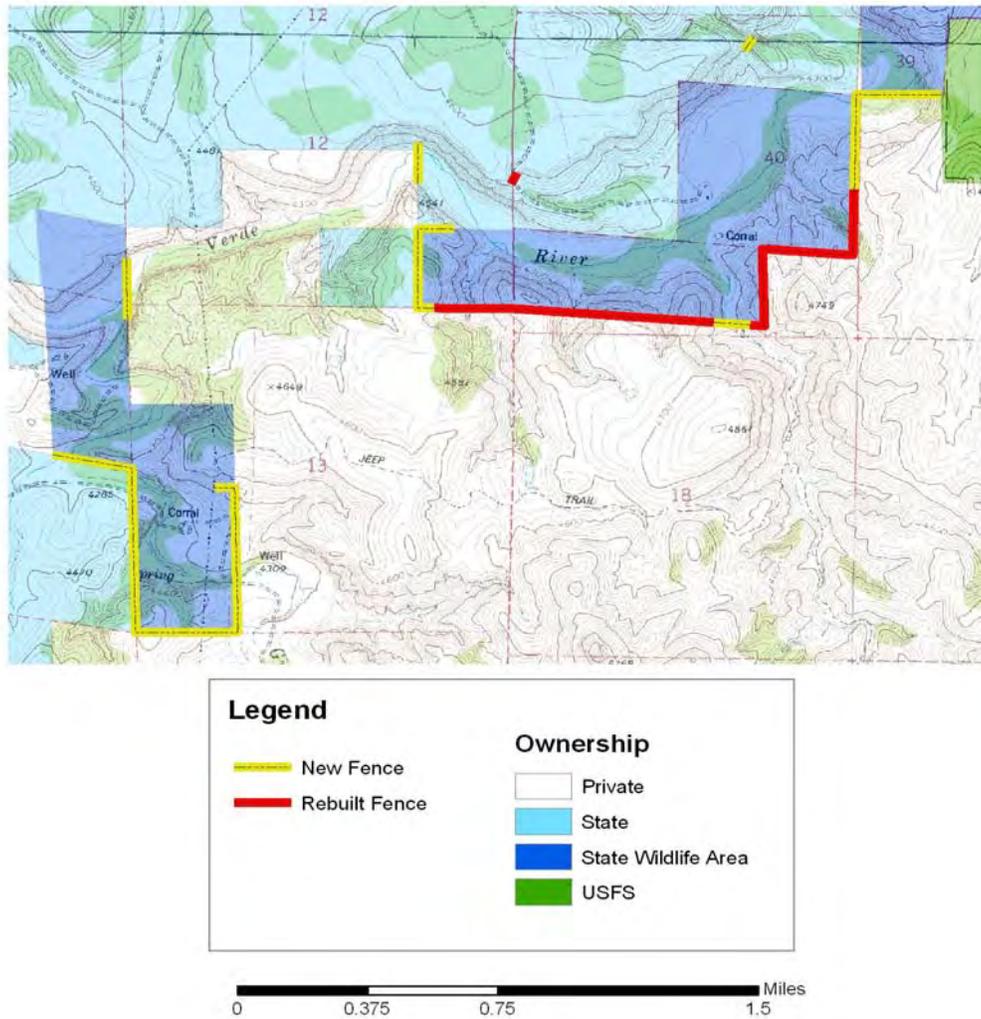
Photo 6. Flood Damage to Granite Creek Fence



Photo 7. Verde High Water Flows



Figure 2. New and Rebuilt fence



### Road Obliteration and Closure

Unauthorized off-road vehicle traffic by ATV's, motorcycles, and 4-wheel drive vehicles has been an ongoing problem on the wildlife area. Damage to riparian vegetation, stream banks, riparian terraces, and fences have occurred. The objective of this conservation measure is to close all non-essential roads on the property. In 2002, the AGFD constructed a large pipe-rail fence to prevent motorized vehicles from accessing the river and other sensitive habitats. While this has been effective in eliminating much of the

illegal use, vandalism and breeches from adjoining private land parcels have provided additional unauthorized access. Several steps were taken to implement this objective. Road closure signs were erected at all major access points and road diversions on the property (Photo 8-9). For the most part, signs have been ineffective due to theft and vandalism. New fence and gates were installed at remote access points. At the east boundary of the property, a pipe-rail fence was constructed to block a road entering the property from adjacent private land (Photo 10). A pipe and cable fence was erected to concentrate traffic on the main entrance road and prevent use of numerous wildcat roads around cultural sites (Photo 11-12).

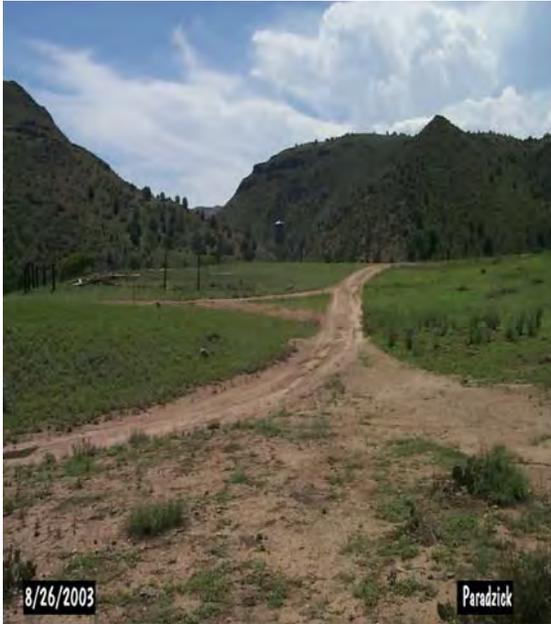
Photo 8 and 9. Road Closure Signs



Photo 10. East Boundary Pipe Rail Fence



Photo 11 and 12. Post-and-Cable Fence

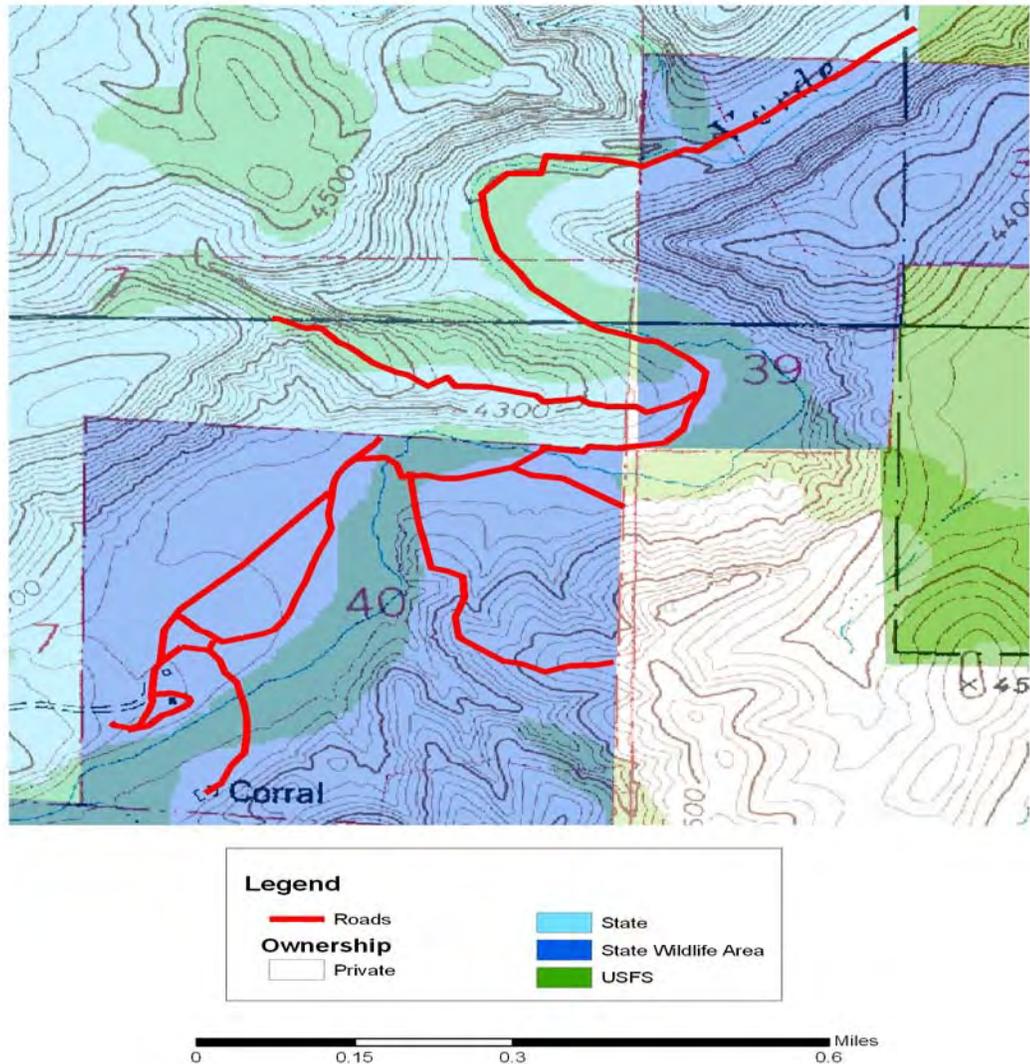


The length of all roads was calculated (using GPS) at the beginning of the project and at the end of the project to compare the amount of roads closed. Total length of all roads surveyed is 5,506m (3.42 miles) (Figure 3). All of the roads are currently closed except for 200m of the main access road and approximately 150m of a new wildcat road that was started illegally around the end of the post-and-cable fence. This new road is scheduled to be closed using boulders by October 2006. An additional 350m of road will be kept open for administrative use to access the Salt River Project low flow monitoring gauge and AGFD maintained facilities. Many of the roads and river crossings are now starting to revegetate and show signs of healing (Photos 12-13).

Photos 12 and 13. Before and After River Crossing



Figure 3. Closed Roads



### Bank Sloping

Most of the Verde River within the project area has been incised below the level of adjacent floodplain terraces. Steep banks and slopes associated with this down-cutting are prone to accelerated erosion and head-cutting especially when exposed to heavy livestock grazing and OHV use. The objective of this conservation measure is to mechanically reshape and reseed cut banks and gullies that have high erosion potential. Mechanical restoration of eroded banks was started in late summer 2004, but was discontinued due to high water flows and flooding between September 2004 and March 2005. Four large flood events during this period had dramatic effects on the riparian corridor and associated banks. Water flows were high enough to reach the adjacent floodplain terraces. Large amounts of sediment deposited during this period effectively

reshaped and contoured most of the eroding banks that were scheduled for restoration. No additional mechanical work on these banks was deemed necessary following the flood events.

Photo 14. Sediment deposition adjacent to floodplain terrace



Photo 15. Area that was severely headcut prior to flooding



## Reseeding and Revegetation

Exposed soils due to heavy grazing, trampling, and illegal OHV use are subject to increased runoff and erosion. The objective of this conservation measure is to establish native trees, shrubs, forbs, and grasses in these areas to reduce erosion and sediment deposition into the Verde River. Floodplain terraces and associated banks that slope to the river and closed roads are the major problem areas on the project. A native seed mixture consisting of shrubs, forbs, and grasses appropriate for the area was obtained from Granite Seed Company of Lehi, Utah and used to reseed areas with exposed soils (Table 1). Because of archaeological considerations, an ATV mounted broadcast spreader was used to distribute seed (Photo 16). Adequate moisture for germination of the seed did not occur until late in the project cycle. Substantial monsoon rains in late summer 2006 have provided the moisture necessary for germination and plant growth on the site. Removal of off-road vehicles and livestock grazing from the project area will allow the area to recover and minimize erosion and exposed soils. The project is currently in the early stages of recovery and grasses and forbs are growing on banks and floodplain terraces (Photo 17).

Originally, cottonwood and willow poles were scheduled for planting on appropriate zones adjacent to the river. Flooding of the Verde River between September 2004 and March 2005 made this measure largely unnecessary. Cottonwoods and willows are disturbance adapted species and regeneration is tied to floods (Beauchamp and Stromberg, 2004). Cottonwoods and Willows regenerate profusely following appropriate flood events. Conditions were excellent for establishment of cottonwoods and willows following the 2004-05 flood events and regeneration is evident throughout the project area (Photos 18 and 19). Livestock grazing is detrimental to the establishment of cottonwood and willows. Livestock will readily consume young leaves and branches of cottonwoods and willows when nutritional quality of upland grasses falls during dry periods. Continued growth and establishment of these species is expected now that livestock have been removed from the project area.

Table 1. Seed mixture used for reseeding banks and terraces

<b>Species</b>	<b>% Composition</b>
Sideoats grama	22.46
Western wheatgrass	21.06
Indian ricegrass	16.67
Fourwing saltbush	13.94
Mexican cliffrose	5.46
Needle & thread grass	4.49
Sand dropseed	4.30
Desert Globemallow	4.13

Photo 16. Seeding of grass, forb, and shrub mixture with ATV



Photo 17. Grass and Forb establishment on banks and floodplain terrace



Photo 18. Cottonwood regeneration



Photo 19. Willow regeneration



## Education/Outreach

Educating the public is an integral part of the management approach for the wildlife area. The objective of this conservation measure is to support and increase education and outreach efforts on the importance of riparian areas and the results of current management and restoration efforts.

AGFD wildlife managers and Region III staff have conducted monthly field contacts with recreationists throughout the term of the project. Information on laws, unauthorized OHV use, trespass livestock issues, littering, pollution, and riparian and wildlife values have been provided to visitors. A volunteer caretaker has also been present at the site full time since July 2006 providing visitors with information about the importance of protecting the area from illegal OHV use, littering, and vandalism.

An interpretive kiosk was designed by an AGFD engineer and sent out for contract through a competitive bid process. A local welding fabricator was awarded the bid, but defaulted after a lengthy time period and numerous discussions with AGFD staff. A different interpretive kiosk has been purchased for the area from Rock Art Signs and Markers of Phoenix, Arizona. This kiosk is a multi-panel model with 3 plastic vandal resistant panels measuring 48"x48" each. Delivery of the kiosk did not occur until July 2006. To reduce potential vandalism, installation has been delayed to occur concurrently with construction of a volunteer host/caretaker site at the wildlife area. Funding has been acquired for this facility and construction will commence no later than November 2006.

Information and updates on habitat restoration and the purpose of the grant have been provided to the Prescott National Forest, Nature Conservancy, and Audubon Society. Additional presentations have been planned, including one for the Citizens Water Advocacy Group in October 2006. The AGFD will continue to make presentations to interested groups and organizations.

A color brochure has been developed for the wildlife area that covers restoration efforts and objectives for this project (Appendix 1). The brochure will be available at the wildlife area, all AGFD offices and wildlife areas, local Forest Service ranger stations, local businesses, and local public offices. Initial printing of the brochure was 7500 copies.

### **Additional Conservation Measures**

Although not covered in the original scope of this grant, the AGFD has implemented additional conservation measures that influence water quality in the Verde River. In July 2005, a restroom facility was installed on the wildlife area to reduce nonpoint pollution from recreational users of the area. The restroom utilizes a vaulted toilet system and excess waste will be pumped and removed from the wildlife area.

The AGFD is also in the process of installing facilities for a volunteer host/caretaker. Facilities include a concrete RV pad, solar water system, sewage vault, propane

generator, and prefab concrete building. This measure is necessary to protect existing facilities and projects. Having a person on-site will discourage vandalism and illegal activities that have been prevalent on the wildlife area. Reducing vandalism on fences and signs is necessary for the long-term success of this project. Maintaining these protection measures are necessary for the prevention of illegal OHV use and trespass grazing. Monitoring will occur continuously with a person on-site and documentation and response times will be improved. A full-time volunteer has been present on the wildlife area since early July 2006.

## **Project Evaluation**

Fencing of the wildlife area is completed and benefits from reduction of trespass livestock grazing are being realized. Trespass cattle have been removed from the project area for the first time in over two years and the vegetation growth and recovery is noticeable. Before removal of the cattle, young cottonwood and willow seedlings were being browsed heavily. Cattails, sedges, and perennial grasses were also heavily grazed. To ensure the area remains free of trespass cattle, AGFD personnel will need to patrol fencelines and river crossings on a regular basis. Several flood events that occurred during the project period caused numerous problems for the fence project. Two newly constructed fence crossings were destroyed by the floods and had to be rebuilt. High water levels in the river also caused major delays for contractors, as they were not able to access the site for several months. Fence construction on the wildlife area was much more expensive and difficult than expected due to the extremely rugged terrain. Adjacent landowners and lessees were cooperative during the project and fence contractors were allowed access to property boundaries across private land. Recommendations include possible acquisition of remaining private land in-holdings within the wildlife area. All of the Verde River fence crossings would be eliminated and control of trespass livestock would be improved.

Closing of non-essential roads and reduction of illegal OHV use has been successful. Of the 5,506m of roads surveyed on the project, all but 750m have been closed to motorized vehicles. Eliminating vandalism is the major factor limiting the project's success. A lock on the main gate was removed with a cutting torch allowing vehicles into the closed area for a brief period. During this time, vehicles crossed the river on numerous occasions and damage to the main floodplain terrace occurred when vehicles doing high speed "brodies" destroyed native vegetation. Illegal OHV users cut one new section of fence to allow passage into a closed area. Someone also tried to shoot the lock off the main gate leaving holes in the housing but was unsuccessful. Signs have been largely ineffective in preventing illegal OHV use. Most of the signs installed at the wildlife area have been damaged or destroyed (Photo 20). Recommendations include support and maintenance of a full-time host/caretaker to monitor and prevent illegal activity.

Pole planting and bank sloping became largely unnecessary following flooding of the project area. Seeding of the floodplain terrace and exposed banks was successful. Illegal OHV use when the gate lock was destroyed is the only detrimental activity to the reseeded area that occurred during the project. Monitoring and early detection will be

necessary to prevent damage in the future. Investigation into the restoration of mesquite bosque habitat should be conducted. The creation of mesquite bosque habitat would improve soil stability on cut banks and floodplain terraces and provide critical wildlife habitat.

Photo 20. Sign vandalism



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