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In Reply Refer To:
AESO/SE
22410-2010-F-0487

March 22, 2011

Mr. Robert Dummer
Los Angeles District, Corps of Engineers
Arizona-Nevada Area Office
3636 North Central Avenue, Suite 760
Phoenix, Arizona 85021-1936

RE: Final Biological Opinion on the Clean Water Act 404 Permit Associated with Proposed Restoration of the Gila River at Apache Grove (SPL-2010-00233-RWF)

Dear Mr. Dummer

Thank you for your request for formal consultation with the U.S. Fish and Wildlife Service (FWS) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). Your request was dated December 16, 2010, and was received by us on December 20, 2010. At issue are effects that may result from the proposed Army Corps of Engineers (Corps) issuance of a 404 Clean Water Act permit associated with the implementation of the Gila River Restoration Project at Apache Grove in Greenlee County, Arizona. Your memorandum concluded that the proposed action "may affect, is not likely to adversely effect" the endangered southwestern willow flycatcher (*Empidonax traillii extimus*), the endangered razorback sucker (*Xyrauchen texanus*) and its critical habitat, and the threatened Chiricahua leopard frog (*Lithobates chiricahuensis*).

This biological opinion is based on information provided in: (1) the December 2010 *Biological Assessment of the Restoration of the Gila River at Apache Grove, Greenlee County, Arizona* (BA) transmitted with your memorandum; (2) the project design plan submitted with the 404 permit application; and (3) other published and unpublished sources of information. Literature cited in this biological opinion is not a complete bibliography of all literature available on the species of concern, and its effects, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office.

Consultation History

Spring/Summer 2010:	FWS personnel conducted formal surveys of southwestern willow flycatchers.
December 20, 2010:	We received your December 16, 2010, request for formal consultation on the proposed action and the final biological assessment.
December 21, 2010:	We initiated formal consultation.
March 8, 2011:	A draft biological opinion was sent to the Corps.
March 22, 2011	FWS received comments from the Corps on the draft biological opinion and all comments were incorporated.

BIOLOGICAL OPINION

DESCRIPTION OF THE ACTION AREA AND PROPOSED ACTION

Proposed Action

The proposed action is the issuance of a Clean Water Act 404 permit in conjunction with the restoration of natural floodplain function and riparian habitats along 1.6-miles of the Gila River in the Apache Grove area near Duncan, Arizona. Sediment discharged into the river from dredged or filled material associated with restoration activities and the removal of a dike has triggered the need for a Section 404 permit. The project is located along the eastern side of the river upstream of Apache Creek. This project is funded by the Arizona Water Protection Fund and the US Fish and Wildlife Service's Partner's for Fish and Wildlife Program. All aspects of the restoration project are evaluated in this biological opinion.

The objectives of the proposed project are to:

1. Restore natural stream function by the removal of dikes in the project area thereby allowing natural flooding to occur during high flow events.

2. Reduce the risk of lateral erosion and land loss to the adjacent private property by removing the dike and stabilizing at-risk banks within the project area using bioengineering practices with native plants and low-impact structural measures.

3. Manage the invasive *Tamarix spp.* (tamarisk) community and re-vegetate with native species to improve the riparian habitats and stream function.

4. Provide a successful example for other landowners along the upper Gila River.

A dike (3,390 feet long, 27,665 cubic yards) at the northeast end of the property will be removed to restore natural floodplain function and allow flooding to occur during high flows. Material removed from the dike will be spread over the existing irrigated fields. The floodplain below the existing dike will be re-contoured to a 20:1 slope and re- planted with native willow and *Baccharis sp*. The entire disturbed floodplain will be replanted with locally harvested native willow, cottonwood, grasses and shrubs. Bank sections will be sloped to a minimum of 2:1 to provide stability for the establishment of vegetation. This will be completed by using a hydraulic excavator. Banks will then be treated with structural or bioengineering practices to provide further stabilization. All disturbed areas will be reseeded and protected with erosion control fabric. Approximately 850 feet of stream bank on the Gila River will be re-sloped (5,830 cu yd).

Brush revetments and vegetative spurs will be used to armor the bank toe, promote sediment deposition and decrease channel velocities. Installation of spurs requires excavation of a shallow trench along the bottom of the river to house the spur and ground anchors or rock bolsters. Approximately 1,350 feet of brush revetment and 8 vegetative spurs will be installed at two locations.

Invasive plant species will be managed to improve the riparian habitats and stream function. Regions marked for invasive species management are divided into two categories; selective tamarisk removal (20.6 acres) and complete vegetation removal (13.1 acres). Existing native vegetation will be left in areas that do not require floodplain reshaping. Vegetation management will include both complete and selective removal of non-natives depending on earthwork requirements native vegetation slated for removal will be harvested for replanting after earthwork is accomplished. A single patch of native habitat in the project area approximately one acre in size will be left undisturbed.

Excess plant materials that are removed will be piled and burned on-site or utilized to build vegetative spurs. If re-sprout of tamarisk occurs, foliar applications of herbicide (Garlon 4 or imazapyr), utilizing backpack sprayers will be used or cut stump methods may be applied to individual trees.

Disturbed farm infrastructure will be replaced including the realignment of 450 feet of farm road and 450 feet of irrigation ditch. Tailwater ditches will be realigned to move tailwaters away from sensitive eroding banks towards less erodible portions of the floodplain. All construction access will be via the landowner's property on the eastern side of the Gila River. No stream crossing is anticipated since the thalweg of the stream forms the property boundary and project limits. Construction material and equipment staging/fueling will be in the vicinity of landowner's barn parking area or along the farm access roads.

Project Schedule

The construction schedule has been restricted to minimize disturbance to nesting willow flycatchers and to keep the farm's planting and harvest schedule on track. Specifically, agricultural fields where spoils from dike removal operations are to be placed need to be harvested prior to spoil placement. Harvesting will occur around the first of August. Once spoils are placed on the agricultural fields they will need to be leveled and prepared for planting. The suggested schedule and sequence for planting is given below.

Stage 1 Selective removal of tamarisk and pile burning. January 1 –April 15, 2011

Stage 2 Removal of dike and leveling of fields. August 1 –September 1, 2011

Stage 3 Vegetation removal, grading, and replanting. September 2, 2011 – April 15, 2012

Some follow up treatment of sprouting tamarisk may be required. Foliar or cut stump herbicide applications will be made as needed outside of willow flycatcher nesting season (September 2011 to April 2012).

<u>Description of the Action Area</u>

The action area is defined as those areas influenced by direct and indirect effects of the proposed action (USFWS 1998a). The Gila River Restoration Project at Apache Grove is located north of the town of Duncan in Greenlee County, Arizona. The action area includes approximately 30 acres of private agricultural lands between Section 5, T7S, R31E and Section 32, T6S, R31E on the east side of the Gila River. The action area continues the length of the rivers and includes the channel and riparian corridor to the west of the active channel (Figure 1 on the following page).

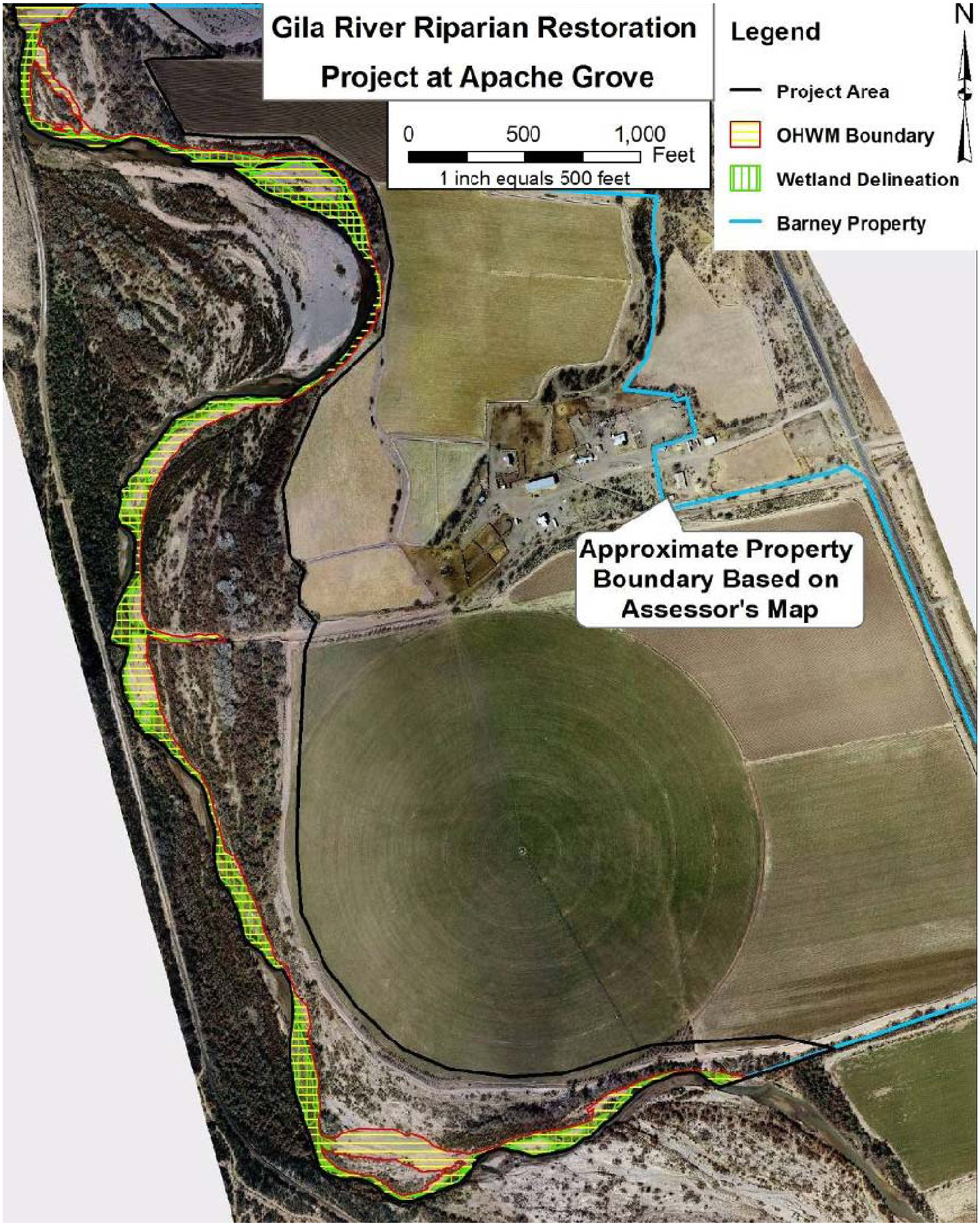

Figure 1. Project Site

Proposed Conservation Measures

Several avoidance, minimization, and conservation measures are described in the biological assessment. The measures consist of:

1. Prior to in-water work, barrier nets will be placed at the upstream and downstream boundaries of the in-water work areas to facilitate fish and amphibian removal and relocation upstream of the project footprint. Fish and amphibians will be handled, transported, and released under provision of an Arizona Game and Fish Department (AZGFD) or FWS 10a1A permit.

2. Removal of established native riparian vegetation will be minimized for equipment access. Cleared areas will be re-planted with native vegetation as soon as practicable. Patches of riparian vegetation with documented southwestern willow flycatcher use will be left intact.

3. In-water construction activities will be timed during low water periods while utilizing erosion and sediment control measures. All water intakes used for the project, including pumps will be equipped and operated with fish screens.

4. Pollution control measures will be implemented to minimize the release of oil, grease, fuel and other deleterious substances into the channel and/or riparian corridor.

5. Construction activities will not occur during the nesting period of the southwestern willow flycatcher (April 15- September 1).

Status of Species - Southwestern willow flycatcher

The southwestern willow flycatcher was listed as endangered, without critical habitat on February 27, 1995 (USFWS 1995). Critical habitat was later designated on July 22, 1997 (USFWS 1997a). A correction notice was published in the Federal Register on August 20, 1997 to clarify the lateral extent of the designation (USFWS 1997b).

On May 11, 2001, the 10th circuit court of appeals set aside designated critical habitat in those states under the 10th circuit's jurisdiction (New Mexico). The FWS decided to set aside critical habitat designated for the southwestern willow flycatcher in all other states (California and Arizona) until it could re-assess the economic analysis.

On October 19, 2005, the FWS re-designated critical habitat for the southwestern willow flycatcher (USFWS 2005). A total of 737 river miles across southern California, Arizona, New Mexico, southern Nevada, and southern Utah were included in the final designation. The lateral extent of critical habitat includes areas within the 100-year floodplain.

A final recovery plan for the southwestern willow flycatcher was signed by the FWS Region 2 Director and released to the public in March, 2003 (USFWS 2002a). The Plan describes the reasons for endangerment, status of the flycatcher, addresses important recovery actions, includes detailed issue papers on management issues, and provides recovery goals. Recovery is based on reaching numerical and habitat related goals for each specific Management Unit established throughout the subspecies range and establishing long-term conservation plans (USFWS 2002a).

The southwestern willow flycatcher breeds in dense riparian habitats from sea level in California to approximately 8,500 feet in Arizona and southwestern Colorado. Historical egg/nest collections and species' descriptions throughout its range describe the southwestern willow flycatcher's widespread use of willow (*Salix* spp.) for nesting (Phillips 1948, Phillips *et al.* 1964, Hubbard 1987, Unitt 1987, San Diego Natural History Museum 1995). Currently, southwestern willow flycatchers primarily use Geyer willow (*Salix geyeriana*), coyote willow (*Salix exigua*), Goodding's willow (*Salix gooddingii*), boxelder (*Acer negundo*), saltcedar (*Tamarix* sp.), Russian olive (*Elaeagnus angustifolio*), and live oak (*Quercus agrifolia*) for nesting. Other plant species less commonly used for nesting include: buttonbush (*Cephalanthus* sp.), black twinberry (*Lonicera involucrata*), cottonwood (*Populus* spp.), white alder (*Alnus rhombifolia*), blackberry (*Rubus ursinus*), and stinging nettle (*Urtica* spp.). Based on the diversity of plant species composition and complexity of habitat structure, four basic habitat types can be described for the southwestern willow flycatcher: monotypic willow, monotypic exotic, native broadleaf dominated, and mixed native/exotic (Sogge *et al.* 1997).

The flycatcher's habitat is dynamic and can change rapidly: river channels, floodplain width, location, and vegetation density may change over time; nesting habitat can grow out of suitability; saltcedar habitat can develop from seeds to suitability in five years; heavy runoff can remove/reduce habitat suitability in a day. The flycatcher's use of habitat in different successional stages may also be dynamic. For example, over-mature or young habitat not suitable for nest placement can be occupied and used for foraging and shelter by migrating, breeding, dispersing, or non-territorial southwestern willow flycatchers (McLeod *et al.* 2005, Cardinal and Paxton 2005). Flycatcher habitat can quickly change and vary in suitability, location, use, and occupancy over time (Finch and Stoleson 2000).

Tamarisk is an important component of the flycatcher's nesting and foraging habitat in Arizona and other parts of the bird's range. In 2001 in Arizona, 323 of the 404 (80 percent) known flycatcher nests (in 346 territories) were built in tamarisk (Smith *et al.* 2002). Tamarisk had been believed by some to be a habitat type of lesser quality for the southwestern willow flycatcher, however comparisons of reproductive performance (USFWS 2002a), prey populations (Durst 2004) and physiological conditions (Owen and Sogge 2002) of flycatchers breeding in native and exotic vegetation has revealed no difference (Sogge *et al.* 2005).

The introduced tamarisk leaf beetle was first detected affecting tamarisk within the range of the southwestern willow flycatcher in 2008 along the Virgin River in St. George, Utah. Initially, this insect was not believed to be able to move into or survive within the southwestern United States. Along this Virgin River site in 2009, 13 of 15 flycatcher nests failed following vegetation defoliation (Paxton *et al.* 2010). As of 2010, the beetle has now been found in southern Nevada/Utah and northern Arizona within the flycatcher's breeding range. Because tamarisk is a component of about 50 percent of all known flycatcher territories (Durst *et al.* 2008), continued spread of the beetle has the potential to significantly alter the distribution, abundance, and quality of suitable flycatcher nesting habitat.

There are currently 288 known southwestern willow flycatcher breeding sites in California, Nevada, Arizona, Utah, New Mexico, and Colorado (all sites from 1993 to 2007 where a territorial flycatcher has been detected) holding an estimated 1,299 territories (Durst *et al.* 2008). It is difficult to arrive at a grand total of flycatcher territories since not all sites are surveyed annually. Numbers have increased since the bird was listed and some habitat remains un-surveyed; however, after nearly a decade of intense surveys, the existing numbers are just past the upper end of Unitt's (1987) estimate of 20 years ago (500-1000 pairs). About 50 percent of the 1,299 estimated territories throughout the subspecies range are located at four general locations (Cliff/Gila Valley – New Mexico, Roosevelt Lake - Arizona, San Pedro River/Gila River confluence – Arizona, Middle Rio Grande, New Mexico).

While numbers have significantly increased in Arizona (145 to 459 territories from 1996 to 2007) (English *et al.* 2006, Durst *et al.* 2008), overall distribution of flycatchers throughout the state has not changed much. Currently, population stability in Arizona is believed to be largely dependent on the presence of two large populations (Roosevelt Lake and San Pedro/Gila River confluence). Therefore, the result of catastrophic events or losses of significant populations either in size or location could greatly change the status and survival of the bird. Conversely, expansion into new habitats or discovery of other populations would improve the known stability and status of the flycatcher.

Status of the Species – Razorback Sucker

The razorback sucker was listed as an endangered species October 23, 1991 (56 FR 54957). The Razorback Sucker Recovery Plan was released in 1998 (USFWS 1998). The Recovery Plan was updated with the Razorback Sucker Recovery Goals in 2002 (USFWS 2002b).

Critical habitat was designated in 15 river reaches in the historical range of the razorback sucker on March 21, 1994 (56 FR 13374). Critical habitat includes portions of the Colorado, Duchesne, Green, Gunnison, San Juan, White, and Yampa rivers in the Upper Colorado River Basin, and the Colorado, Gila, Salt, and Verde rivers in the Lower Colorado River Basin.

The razorback sucker was once abundant in the Colorado River and its major tributaries throughout the Basin, occupying 3,500 miles of river in the United States and Mexico (USFWS 1993). Records from the late 1800 and early 1900 indicated the species was abundant in the lower Colorado and Gila river drainages (Krisch 1889, Gilbert and Scofield 1898, Minckley 1983, Bestgen 1990).

Since 1997, significant new information on recruitment to the wild razorback sucker population in Lake Mead has been developed. Holden *et al.* (2000) determined that some degree of successful recruitment is occurring. This degree of recruitment has not been documented elsewhere in the species**'** remaining populations.

Adult razorback suckers use most of the available riverine habitats, although there may be an avoidance of whitewater. Main channels used by razorback suckers tend to be low velocity such as pools, eddies, nearshore runs, and channels associated with sand or gravel bars (Bestgen 1990). Adjacent to the main channel, backwaters, oxbows, sloughs, and flooded bottomlands are also used by this species. From studies conducted in the upper Colorado River basin, habitat selection by adult razorback suckers changes seasonally. They move into pools and slow eddies from November through April; runs and pools from July through October; runs and backwaters during May; and backwaters, eddies, and flooded gravel pits during June. In early spring, adults move into flooded bottomlands. They use relatively shallow water (approximately 3 feet deep) during spring and deeper water (5 to 6 feet) during winter.

Data from radio-telemetered razorback suckers in the Verde River showed they used shallower depths and slower velocities than in the upper basin. They avoided depths less than 1.3 feet, but selected depths between 2.0 and 3.9 feet, which likely reflected a reduced availability of deeper waters compared to the larger upper basin rivers. However, use of slower velocities (mean = 0.1 foot/sec) may have been an influence of rearing in hatchery ponds. Similar to the upper basin, razorback suckers were found most often in pools or runs over silt substrates, and avoided substrates of larger material (Clarkson *et al.* 1993).

Habitat needs of larval and juvenile razorback sucker are reasonably well known. In reservoirs, larvae are found in shallow backwater coves or inlets (USFWS 1998). In riverine habitats, captures have involved backwaters, creek mouths, and wetlands. These environments provide quiet, warm water where there is a potential for increased food availability. During higher flows, flooded bottomland and tributary mouths may provide these types of habitats.

Razorback sucker diet varies depending on life stage, habitat, and food availability. Larvae feed mostly on phytoplankton and small zooplankton, and in riverine environments, on midge larvae. Diet of adults taken from riverine habitats consisted chiefly of immature mayflies, caddisflies, and midges, along with algae, detritus, and inorganic material (USFWS 1998).

The primary constituent elements determined necessary for razorback sucker survival include, but are not limited to:

<u>Water</u> – This includes a quantity of water of sufficient quality (i.e. temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc) that is delivered to a specific location in accordance with a hydrological regime that is required for a particular life stage.

<u>Physical Habitat</u> – This includes rivers in the southwestern United States that are inhabited or potentially habitable by fish for use for spawning, nursery, feeding, and rearing, or corridors between these areas. In addition to river channels, these areas also include bottomlands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated provide spawning, nursery, feeding, and rearing habitats, or access to these habitats.

<u>Biological</u> -- Food supply, predation, and competition are important elements of the biological environment. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to the introduced non-native fish species in many areas.

The appropriate and desirable level of these factors may vary seasonally and is highly influenced by site-specific circumstances. Therefore, assessment of the presence/absence, level, or value of the constituent elements must include consideration of the season of concern and the characteristics of the specific location. The constituent elements are not independent of each other and must be assessed holistically, as a functioning system, rather than individually. In addition, the constituent elements need to be assessed in relation to larger habitat factors, such as watershed, floodplain, and streambank conditions, stream channel geomorphology, riparian vegetation, hydrological patterns, and overall aquatic faunal community structure.

Razorbacks persist on the Colorado River in Lakes Mead, Mohave, and Havasu and in the mainstem between the reservoirs and downstream of Lake Havasu. In the Gila, Salt, and Verde rivers of interior Arizona, stocking activities have created small populations but no recruitment of wild-born young has been observed in these populations. The wild adults in the Mohave population were estimated at 9,087 individuals in 1999 with an additional 3,104 repatriated sub-adults captured on the spawning grounds with the adults (Pacey and Marsh 1999). The Lake Mead population was estimated 100-200 individuals (Welker and Holden 2003). Population estimates of wild or stocked individuals for other Colorado River sites are not available, but populations are very small.

Spawning by razorback suckers has been documented in Lakes Mead and Mohave. Large recruitment events after Lakes Mead and Mohave filled (in the 1930 and 1950 respectively), created the adult populations found there (summarized in Minckley *et al.* 1991). Recruitment into the Lake Mohave population has not occurred since that time, resulting in the decline from an estimated 60,000 adults in the 1980s to 2,698 in 2002 (Marsh *et al*. 2003) and an estimated 475 fish in 2004 (Marsh 2004). Wild populations in Lake Havasu and the river between Parker and Imperial dams are extremely small, and past stocking activities with marked fish, especially in the Parker Dam to Imperial Dam reach, confuse the identification of fish captured there. Recent declines in wild fish numbers are a result of the old adults that comprise these populations dying of old age. None of the populations are confirmed to be self-sustaining, with recent recruitment of wild-bred young only documented in Lake Mead (Welker and Holden 2003). Captures of small razorback suckers in a canal below Parker Dam may also represent some recruitment occurring in this area. The normal pattern seen for razorback populations in reservoirs is to die out approximately 40-50 years after formation of the reservoir as fish reach the end of their life span.

Status of Species - Chiricahua Leopard Frog

The Chiricahua leopard frog was listed as a threatened species without critical habitat in a Federal Register notice dated June 13, 2002. Included was a special rule to exempt operation and maintenance of livestock tanks on non-Federal lands from the section 9 take prohibitions of the Act. The frog is distinguished from other members of the *Lithobates pipiens* complex by a combination of characters, including a distinctive pattern on the rear of the thigh consisting of small, raised, cream-colored spots or tubercles on a dark background; dorsolateral folds that are interrupted and deflected medially; stocky body proportions; relatively rough skin on the back and sides; and often green coloration on the head and back (Platz and Mecham 1979). The species also has a distinctive call consisting of a relatively long snore of 1 to 2 seconds in duration (Platz and Mecham 1979, Davidson 1996). Snout-vent lengths of adults range from approximately 2.1 to 5.4 inches (Platz and Mecham 1979, Stebbins 2003). The Ramsey Canyon leopard frog (*Lithobates* "*subaquavocalis*"), found on the eastern slopes of the Huachuca Mountains, Cochise County, Arizona, has recently been subsumed into *Lithobates chiricahuensis* (Crother 2008) and recognized by the FWS as part of the listed entity (USFWS 2009).

The range of the Chiricahua leopard frog includes central and southeastern Arizona; west-central and southwestern New Mexico; and, in Mexico, northeastern Sonora, the Sierra Madre Occidental of northwestern and west-central Chihuahua, and possibly as far south as northern Durango (Platz and Mecham 1984, Degenhardt *et al*. 1996, Lemos-Espinal and Smith 2007, Rorabaugh 2008). Reports of the species from the State of Aguascalientes (Diaz and Diaz 1997) are questionable. The distribution of the species in Mexico is unclear due to limited survey work and the presence of closely related taxa (especially *Lithobates lemosespinali*) in the southern part of the range of the Chiricahua leopard frog. Historically, the frog was an inhabitant of a wide variety of aquatic habitats, including cienegas, pools, livestock tanks, lakes, reservoirs, streams, and rivers at elevations of 3,281 to 8,890 feet. However, the species is now limited primarily to headwater streams, springs and cienegas, and cattle tanks into which nonnative predators (e.g. sport fishes, American bullfrogs, crayfish, and tiger salamanders) have not yet invaded or where their numbers are low (USFWS 2007). The large valley-bottom cienegas, rivers, and lakes where the species occurred historically are populated with non-native predators at densities with which the species cannot coexist. The primary threats to this species are predation by non-native organisms and die offs caused by a fungal skin disease – chytridiomycosis. Additional threats include drought; floods; degradation and loss of habitat as a result of water diversions and groundwater pumping; improper livestock management; altered fire regimes due to fire suppression and livestock grazing; mining, development, and other human activities; disruption of metapopulation dynamics; increased chance of extirpation or extinction resulting from small numbers of populations and individuals; and environmental contamination (USFWS 2007). Loss of Chiricahua leopard frog populations is part of a pattern of global amphibian decline, suggesting other regional or global causes of decline may be important as well (Carey *et al*. 2001). Witte *et al*. (2008) analyzed risk factors associated with disappearances of ranid frogs in Arizona and found that population loss was more common at higher elevations and in areas where other ranid population disappearances occurred. Disappearances were also more likely where introduced crayfish occur, but were less likely in areas close to a source population of frogs.

Based on 2009 data, the species is still extant in the major drainage basins in Arizona and New Mexico where it occurred historically; with the exception of the Little Colorado River drainage in Arizona and possibly the Yaqui drainage in New Mexico. It has not been found recently in many rivers within those major drainage basins, valleys, and mountains ranges, including the following in Arizona: White River, West Clear Creek, Tonto Creek, Verde River mainstem, San Francisco River, San Carlos River, upper San Pedro River mainstem, Santa Cruz River mainstem, Aravaipa Creek, Babocomari River mainstem, and Sonoita Creek mainstem. In southeastern Arizona, no recent records (1995 to the present) exist for the Pinaleño Mountains or Sulphur Springs Valley; and the species is now apparently extirpated from the Chiricahua Mountains. Moreover, the species is now absent from all but one of the southeastern Arizona valley bottom cienega complexes. In many of these regions Chiricahua leopard frogs were not found for a decade or more despite repeated surveys. As of 2009, there were 84 sites in Arizona at which Chiricahua leopard frogs occur or are likely to occur in the wild, with an additional four captive or partially captive refugia sites. At least 33 of the wild sites support breeding. In New Mexico, 15-23 breeding sites were known in 2008; the frogs occur at additional dispersal sites. The species has been extirpated from about 80 percent of its historical localities in Arizona and New Mexico. Nineteen and eight localities are known from Sonora and Chihuahua, respectively. The species' current status in Mexico is poorly understood; however, it has been found in recent years in western Chihuahua. Some threats, such as introduced non-native predators and the threat of catastrophic wildfire, appear to be less important south of the border, particularly in the mountains where Chiricahua leopard frogs have been found (Gingrich 2003, Rosen and Melendez 2006, Rorabaugh 2008).

Dispersal of leopard frogs away from water in the arid Southwest may occur less commonly than in mesic environments such as Alberta, Michigan, or the Yucatan Peninsula during the wet season. However, there is evidence of substantial movements even in Arizona. Movement may occur via locomotion of frogs or passive movement of tadpoles along stream courses. These movements away from water do not appear to be random. Streams are important dispersal corridors for young northern leopard frogs (Seburn *et al*. 1997). Rainfall or humidity may be an important factor in dispersal because odors carry well in moist air, making it easier for frogs to find other wetland sites (Sinsch 1991). Based on these studies, the Chiricahua leopard frog recovery plan (USFWS 2007) provides a general rule on dispersal capabilities. Chiricahua leopard frogs are assumed to be able to disperse one mile overland, three miles along ephemeral drainages, and five miles along perennial water courses.

A recovery plan has been completed (USFWS 2007), to improve the status of the species to the point that it no longer needs the protection of the Endangered Species Act. The recovery strategy calls for reducing threats to existing populations; maintaining, restoring, and creating habitat that will be managed in the long term; translocating frogs to establish, reestablish, or augment populations; building support for the recovery effort through outreach and education; monitoring; conducting research needed to provide effective conservation and recovery; and application of research and monitoring through adaptive management. Recovery actions are recommended in each of eight recovery units throughout the range of the species. Management areas are also identified within recovery units where the potential for successful recovery actions is greatest.

ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

Status of the Species and its Habitat in the Action Area

Southwestern Willow Flycatcher

The action area is described as an incised perennial river channel with cut banks and a densely vegetated riparian corridor consisting of both native plants and exotic tamarisk and the adjacent private property. An artificial levee separates the Gila River channel from its floodplain and irrigated agricultural fields to the east.

USFWS conducted four southwestern willow flycatcher presence/absence surveys between May 27 and July 2, 2010. Southwestern willow flycatchers were detected on each of the survey days with one to seven birds detected per survey. Birds were detected in the action area and neighboring property across the river. All birds were found in suitable nesting habitat and it was assumed that birds remained resident through the nesting season, but nesting status was not verified. Suitable habitat was considered to be any dense cover of native or non-native tall trees or shrubs. Areas without dense cover were excluded from survey transects. Suitable habitat may also occur downstream of the project area. Examination of aerial photography and observations of existing habitat viewable from the highway indicate that there is dense cover of riparian vegetation within several miles downstream of the project. However, quality of the habitat and occupancy by birds has not been determined.

Razorback Sucker

Habitat conditions within the Gila River have not been evaluated, but Minckley and Sommerfeld (1979) stated that the Gila River through the Gila Box (approximately 29 river miles downstream of the project site) "...is one of the last, low-desert unmodified streams in the American Southwest." The biological components of the habitat have been altered by the loss of co-occurring native fishes, and the addition of predatory and competitive non-native fishes (Minckley *et a.l* 1991, Marsh and Brooks 1990). However, the Gila River's natural hydrograph remains unimpaired by large dams (USFWS 1993). Flooded bottomland is not a common habitat feature along the San Francisco River or Bonita Creek, but such a condition occurs irregularly in the mainstem Gila River.

Historically, the razorback sucker was found in the Gila River upstream to the New Mexico border (Bestgen 1990), but was likely extirpated in the mainstem by the late 1970s. Razorback suckers were re-introduced into the Gila River and its tributaries between 1981 and 1989. The BLM reported a large razorback sucker found in Bonita Creek (approximately 30 miles downstream) in 1991; however, there is no evidence that introductions have established self-sustaining populations. These transplants were not formally monitored until 2001, when a baseline fish inventory was conducted outside of the action area in the Gila Box portion of the Gila River. The inventory found no razorback suckers. No razorback suckers were found during depletion surveys of a plunge pool below the Eagle Creek diversion dam (upstream of the Gila Box) in 1996 (SWCA 1997). Fish surveys have been conducted regularly within the Upper Gila River in Arizona since 1998 (WestLand 2009). The BLM and AZGFD inventoried the Gila Box Riparian National Conservation Area (RNCA) in 2001, and the BLM, Safford Field Office monitors the fish community in the Gila Box RNCA and a site near Duncan, Arizona annually (WestLand 2009). No razorback suckers were detected during these surveys. Benthic fishes occurring at exceedingly low abundance are difficult to detect (Marsh *et al.* 2003); however, suitable habitat exists, therefore we conclude that small numbers of released razorback suckers may survive in the Gila River and Bonita and Eagle creeks. Given this uncertainty, there is a small, but finite, possibility that razorback suckers may occur intermittently and in immeasurably small numbers in this portion of the Gila River.

Razorback critical habitat on the Gila River extends from the Arizona-New Mexico border to Coolidge Dam and includes the river and its 100-year floodplain and therefore is present at the project area. The critical habitat designation and its supporting documentation (Maddux *et al*. 1993) identified the following Primary Constituent Elements for the Gila River unit:

- Water: despite significant diversions, the Gila River through the Safford Valley maintains a hydrograph capable of supporting aquatic communities. Flood- and low-flow hydrology and water quality are within the range of tolerance for razorback suckers.

- Physical habitat: Geomorphic features remain suitable for razorback suckers. Pools, runs, and riffles are present and these features, as well as depths and water velocities, vary spatially and temporally. Spawning gravels are present and flooded vegetation and tributary streams serve as backwater areas for rearing.

- Biological environment: Nutrient levels are adequate to support aquatic communities. Periodic floods can reduce the proportions of nonnative fishes.

The razorback sucker Recovery Goals (USFWS 2002b) describe the criteria, in terms of physical habitat, that need to be met for the species to be delisted. We determined that certain flow regimes were necessary for all life stages of razorback sucker to support recovered populations in the mainstem, floodplain, and tributaries. Specific flow regime requirements are as follows:

- Adequate spawning habitat and appropriate spawning cues (e.g., flow patterns and water temperatures) are available to maintain self-sustaining populations, as reflected by delisting demographic criteria in section 5.3.2.1.2 of the Recovery Plan.

- Adequate nursery habitat is available to maintain self-sustaining populations, as reflected by delisting demographic criteria in section 5.3.2.1.2 of the Recovery Plan.

- Adequate juvenile and adult habitat (e.g., cover, resting, and feeding areas) is available to maintain self-sustaining populations, as reflected by delisting demographic criteria in section 5.3.2.1.2 of the Recovery Plan.

Chiricahua Leopard Frog

The primary habitat type of the CLF is oak, mixed oak and pine woodlands. Other habitat types range into areas of chaparral, grassland, and even desert. CLFs are habitat generalists that live and breed in lentic and lotic habitats in natural and man-made systems (Frost and Bagnara 1977). Natural aquatic systems include cienegas, rocky streams with deep rock-bound pools, river overflow pools, oxbows, permanent springs, permanent pools in intermittent streams, and beaver ponds. Man-made aquatic systems include earthen stock tanks, livestock drinkers, irrigation sloughs, wells, mine adits, abandoned swimming pools, and ornamental backyard ponds. CLF are known to exist in Greenlee County, including the Gila River. The action area falls within the elevation range of 1,000 feet to 2,710 where CLFs are most commonly present. Furthermore, man-made water features such as stock tanks and other livestock watering devices are present within the action area. Though habitat utilized by CLF is present within and adjacent to the action area, presence of CLF within the action area has not been documented.

Most important threats are disease (Chytridiomycosis), non-native predators and competitors (bullfrogs, sport fish, crayfish), effects of small and isolated populations, loss of aquatic habitat through drying, damming, diverting, or siltation, and heavy grazing" (USFWS 2002c).

At high elevation, CLF's breed in late May through August (Zweifel 1968, Frost and Platz 1983). Scott and Jennings (1985) did not note a difference in the time of breeding and different elevations, but did find a relationship between the time of breeding and water temperatures at sites in New Mexico (Jennings 1988, 1990). Proximate cues that stimulate mating are not well studied, but oviposition has been correlated with rainstorms (Fernandez 1996) and changes in water temperature (Platz 1993). Although unconfirmed, there remains the potential for CLF to occur as eggs, larvae, or adults within the action area.

EFFECTS OF THE PROPOSED ACTION

Effects of the proposed action refers to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, which will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Southwestern Willow Flycatcher

Southwestern willow flycatchers are known to nest within the riparian corridor proposed for selective and complete vegetation removal. Tamarisk, willow and other riparian vegetation will be removed for non-native plant control, construction access for river channel modifications, and contouring of the floodplain. A total of 28 acres of southwestern willow flycatcher habitat will be temporarily lost. It is anticipated that removal of riparian vegetation will result in an undetermined number of lost breeding cycles at the site.

Naturally, portions of the Gila River are likely to transition into and out of conditions suitable for southwestern willow flycatcher nesting resulting from channel migration. These riparian successional processes will be replicated mechanically by this channel contouring and replacement of riparian vegetation. Over a period of three to five years, it is anticipated that replanting activities will restore the site or improve existing conditions and support southwestern willow flycatcher forage, cover and nesting.

The proposed conservation measures are anticipated to be effective in reducing the adverse effects of the proposed action. Scheduling vegetation removal activities prior to April 15 will avoid direct effects during the nesting season. Furthermore, broadening of the floodplain may encourage the establishment of a wider riparian corridor and ultimately increase the availability southwestern willow flycatcher nesting habitat within the action area.

Razorback Sucker

The proposed action will disturb the streambed and banks, temporarily reduce stream bank vegetation and increase sediment input both during construction activities and for some undetermined time after construction. However, overall, the project will serve as a benefit to the species by increasing wetted perimeter and decreasing water velocities. Construction activities are timed to minimize disturbance to nesting and breeding southwestern willow flycatchers, thus increasing the possibility of disturbing spawning razorback sucker. However, these activities are unlikely to directly affect individual razorback suckers due to their extreme rarity in the action area. Proposed conservation measures such as pre-construction fish removal and sediment control treatments will further decrease the likelihood of construction activities impacting individual fish.

The Gila River within the action area is critical habitat for the species, though geomorphically inactive due to river levees, the river provides near-perennial flow. Bank stabilization will require work in the floodplain. The proposed action will alter the existing channel which is mostly incised and flanked by vegetation, open gravel and sand bars subject to scour and deposition. Although some flow related habitat improvements may occur, the river may continue to lack connectivity to the floodplain and associated flooded vegetation rendering the use of overbank and slow water areas for reproduction and rearing unlikely. The removal of dikes is designed to restore natural floodplain function which will benefit the razorback sucker.

Effects to razorback sucker critical habitat will occur primarily in the areas currently prone to inundation by high flow events where vegetation is proposed for removal. These effects will reduce the amount of critical habitat available for refuge during floods. This small loss of rearing habitat is inconsequential given the future increase in quantities of these habitats that will be created by the project. The proposed action will likely positively affect PCEs pertaining to the overall geomorphic character of the Gila River (i.e. proportion of pools, riffles and runs; water quantity and quality by restoring natural stream functions with the removal of dikes and re-contouring of the floodplain.

Chiricahua Leopard Frog

Chiricahua leopard frog habitat exists within the action area and there is remote possibility that the species is present. Several project related scenarios exist that could adversely affect Chiricahua leopard frogs.

In-water construction activities will begin during a time when Chiricahua leopard frogs could be depositing eggs. In-water construction activities may continue until larvae become motile and therefore could encounter construction activities and be physically injured. The potential exists for tadpoles to be washed downstream from extant populations during precipitation-induced increases in stream flows and introduced into the project site. This scenario holds true for adult Chiricahua leopard frogs as well.

Proposed conservation measures will reduce the likelihood that adults, larvae, or eggs are present during construction. The use of 0.25 inch blocking nets and multi-pass seining techniques will be employed to remove the species at all life stages from the site. Furthermore, in-water work areas will be isolated and drained with pumps equipped with screened intakes prior to construction. These activities are expected to minimize adverse effects to Chiricahua leopard frogs or adverse effects to its habitat.

CUMULATIVE EFFECTS

The current land use in the action area consists of privately owned residences and agricultural lands. Agricultural production is primarily irrigated hay cropland and grazing for livestock. Both center pivot and flood irrigation techniques are used. Though agriculture activities will continue, riparian corridor exclusionary fencing will be constructed and maintained for a minimum of 20 years.

CONCLUSION

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.01. Instead, we have relied upon the statutory provisions of the Act complete the following analysis with respect to critical habitat. [1]1

Southwestern Willow Flycatcher

After reviewing the current status of the southwestern willow flycatcher, the environmental baseline for the action area, the effects of the proposed vegetation clearing activities in the action area, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the southwestern willow flycatcher. We present this conclusion for the following reasons:

- The proposed action will result in temporary loss of 28 acres of currently utilized habitat, through vegetation clearing and grading, this habitat will be restored and again functional within five years.

- Implementation of the conservation measures (see the Description of the Proposed Conservation Measures section above) would greatly minimize negative impacts to nesting willow flycatchers, as well as occupied, suitable, and potential habitat.

Razorback Sucker

After reviewing the current status of the razorback sucker, the environmental baseline for the action area, the effects of the proposed clearing and channel modification activities in the action are, and the cumulative effects, it is our biological opinion that the action, as proposed, is neither likely to jeopardize the continued existence of the razorback sucker, nor likely to destroy or adversely modify critical habitat for the species. We present these conclusions for the following reasons:

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1 See December 27, 2004, memo from Acting Director Fish and Wildlife Service

- Razorback suckers may be present in the upper Gila River near Apache Grove, however, they would exist in immeasurably small numbers. Direct effects to individuals of the species from implementation of the proposed action are thus unlikely due to the low probability that they are present in the action area.

- The minute effects to razorback sucker critical habitat are not of large enough scale where recovery of the species would be affected in the upper Gila River. Moreover, the proposed action will result in an overall benefit to the upper Gila River's habitat quantity and complexity.

- The proposed action will therefore not appreciably reduce the conservation value of critical habitat on the upper Gila River.

Chiricahua Leopard Frog

After reviewing the current status of the Chiricahua leopard frog, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the Chiricahua leopard frog. We make this finding for the following reasons:

1) The likelihood that frogs will be encountered during construction activities is remote.

2) Proposed conservation measures will remove any Chiricahua leopard frogs or egg masses that might be present in the construction area.

Currently, no critical habitat has been designated for this species; therefore, none will be affected. We expect that a proposed rule for the designation of critical habitat will be developed prior to the conclusion of this proposed action; however, we are not certain the action area will be included as proposed critical habitat.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Amount or Extent of Take – Southwestern Willow Flycatcher

We anticipate that the proposed removal of riparian vegetation will result in incidental take of southwestern willow flycatchers along the Gila River within the action area. Breeding flycatchers have been detected at this location and have been utilizing the vegetation planned for renovation. A patch of riparian vegetation approximately one acre in size will be left intact to provide dispersal and nesting opportunities within the area to be cleared.

Vegetation patch size and shape that flycatchers use for nesting can vary from 0.25 ac to 175 ac with the mean reported size of breeding patches of 21.2 ac. Mean patch size of breeding sites supporting 10 or more flycatcher territories was 62.2 ac. Based upon the number of flycatcher territories reported in each patch, it required an average of 2.7 ac for each territory in a patch (USFWS 2002a). To clarify, these are generalizations across the subspecies range, and because breeding patches include areas that are not actively defended as territories, these numbers do not equate to average territory size.

These variations in the size of breeding patches used by flycatchers and the number of nesting flycatchers within a patch of habitat makes it impossible to predict exactly how many pairs of flycatchers will be nesting at these locations. The dynamic aspect of habitat conditions and annual fluctuations in breeding bird numbers causes additional challenges. As a result, we cannot verify exactly how many breeding flycatchers will be taken at the project location.

The areas to be cleared of all vegetation are planned for replanting and it is anticipated that those areas will not be usable by breeding southwestern willow flycatchers for up to a five year period. It also assumed that, due to construction disturbance during grading and in-channel work, all breeding attempts will be impaired and nesting may not be successful during the first year of the project at the preserved one acre vegetation patch. Therefore, due to this disturbance and the temporary loss of potential nesting habitat we anticipate that the project will result in harm or harassment of all breeding southwestern willow flycatchers in the 29 acres in year one, and continue to harm some or all southwestern willow flycatchers in years 2 through 5 in approximately 28 acres.

Incidental take will be considered to have been exceeded if after 5 years, replanted riparian vegetation has not been successfully reestablished within the project site. Successfully reestablished riparian vegetation will be considered dense vegetation with average heights of three to six meters as based on the Recovery Pan guidance (USFWS 2002).

Amount or Extent of Take – Razorback Sucker and Chiricahua Leopard Frog

We do not anticipate that the proposed action will result in incidental take of any razorback suckers or Chiricahua leopard frogs because both species are immeasurably rare in the area. The proposed action includes removal of any individuals from the action area further reducing the chances of direct harm to individuals.

EFFECT OF THE TAKE

In this biological opinion, the FWS determines that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat for the reasons stated in the Conclusions section.

REASONABLE AND PRUDENT MEASURES

In order to be exempt from the prohibitions of section 9 of the Act, the Corps must comply with the following terms and conditions and the reasonable and prudent measures. These terms and conditions are non-discretionary.

Southwestern Willow Flycatcher

The following reasonable and prudent measure and term and conditions are necessary and appropriate to minimize take of Southwestern Willow Flycatcher:

1. Monitor the effects of the proposed action and report the finding to this office.

    1.1 The Corps of Engineers shall ensure that the grantee for Arizona Water Protection Fund Grand #08-155 WPF monitors the riparian plantings in accordance with the approved contract for the grant.

Review requirement: The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with our office the need for possible modification of the reasonable and prudent measures.

Reporting Requirements/Disposition of Dead or Injured Listed Animals

Upon finding a dead or injured threatened or endangered animal, initial notification must be made to the FWS's Division of Law Enforcement, 2450 West Broadway, Mesa, Arizona (480-967-7900) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph, and any other pertinent information. Care must be taken in handling injured animals to ensure effective treatment and care, and in handling dead specimens to preserve biological material in the best possible condition. If feasible, the remains of intact specimens of listed animal species shall be submitted as soon as possible to the nearest FWS or Arizona Game and Fish Department office, educational, or research institutions (e.g., University of Arizona in Tucson) holding appropriate state and Federal permits.

Arrangements regarding proper disposition of potential museum specimens shall be made with the institution before implementation of the action. A qualified biologist should transport injured animals to a qualified veterinarian. Should any treated listed animal survive, the FWS should be contacted regarding the final disposition of the animal.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

No conservation recommendations are necessary for the proposed action.

Reinitiation and Closing Statement

This concludes formal consultation on the issuance of a 404 permit for the Restoration of the Gila River at Apache Grove in Greenlee County, Arizona. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by this action.

For further information please contact Marc Wicke (602) 242-0210 (x217) or Debra Bills (x239). We also encourage you to coordinate this project with the Arizona Game and Fish Department. Please refer to the consultation number 22410-2010-F-0487 in future correspondence concerning this project.

Sincerely,

/s/ Debra Bills for

Steven L. Spangle
Field Supervisor

cc: Chief, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Natural Channel Design, Flagstaff, AZ
Wildlife Biologist, Fish and Wildlife Service, Phoenix and Tucson, AZ
(Attn: J. Kaplan, L. Fitzpatrick, C. Crawford, G. Beatty, M. Crites)

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LITERATURE CITED

Bestgen, K.R. 1990. Status review of the razorback sucker Xyrauchen texanus. Colorado State Univ. Larval Fish Laboratory, Contribution 44, Fort Collins, Colorado.

Carey, C., W.R. Heyer, J. Wilkinson, R.A. Alford, J.W. Arntzen, T. Halliday, L. Hungerford, K.R. Lips, E.M. Middleton, S.A. Orchard, and A.S. Rand. 2001. Amphibian declines and environmental change: use of remote sensing data to identify environmental correlates. Conservation Biology 15(4):903-913.

Cardinal S.N. and E. H. Paxton. 2005. Home range, movement, and habitat use of the southwestern willow flycatcher at Roosevelt Lake, AZ – 2004. U.S. Geological Survey Report to the U.S. Bureau of Reclamation, Phoenix, AZ.

Clarkson, R.W., E.D. Creed, and D.K. McGuinn-Roberts. 1993. Movements and habitat utilization of reintroduced razorback suckers (*Xyrauchen texanus*) and Colorado squawfish (*Ptychocheilus lucius*) in the Verde River, Arizona. Nongame and Endangered Wildlife Program Report, Arizona Game and Fish Department, Phoenix, Arizona.

Crother, B.I. (ed.). 2008. Scientific and Common Names for Amphibians and Reptiles of North America North of México. Society for the Study of Amphibians and Reptiles, Herpetological Circular No. 37:1-84.

Davidson, C. 1996. Frog and toad calls of the Rocky Mountains. Library of Natural Sounds, Cornell Laboratory of Ornithology, Ithaca, NY.

Degenhardt, W.G., C.W. Painter, and A.H. Price. 1996. Amphibians and reptiles of New Mexico. University of New Mexico Press, Albuquerque.

Diaz, J.V., and G.E.Q. Diaz. 1997. Anfibios y reptiles de Aguascalientes. Grupo Impressor Mexico, Aguascalientes, Aguascalientes, MX.

Durst, S.L., M.K. Sogge, S.D. Stump, H.A. Walker, B.E. Kus, and S.J. Sferra. 2008. Southwestern willow flycatcher breeding sites and territory summary - 2007: U.S. Geological Survey Open–File Report 2008–1303, 31 p.

Durst, S.L. 2004. Southwestern willow flycatcher potential prey base and diet in native and exotic habitat. Masters Thesis. Northern Arizona University, Flagstaff, AZ.

English, H.C., A.E. Graber, S.D. Stump, H.E. Telle, and L.A. Ellis. 2006. Southwestern willow flycatcher 2005 survey and nest monitoring report. Nongame and Endangered Wildlife Program Technical Report 248. Arizona Game and Fish Department, Phoenix, AZ.

Fernandez, P.J., and P.C. Rosen. 1996. Effects of the introduced crayfish Oronectes virilis on the native aquatic herpetofauna in Arizona. Report to the Arizona Game and Fish Department, Heritage Program, IIPAM Project No. I94054.

Finch, D.M. and S.H. Stoleson, eds. 2000. Status, ecology, and conservation of the southwestern willow flycatcher. Gen. Tech. Rep. RMRS-GTR-60. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 131 p.

Frost, J. S. and J. E. Platz. 1983. Comparative assessment of modes of reproductive isolation among four species of leopard frogs (Rana pipiens complex). Evolution 37:66-78.

Frost, J.S., and J.T. Bagnara. 1977. Sympatry between *Rana blairi* and the southern form of leopard frog in southeastern Arizona (Anura: Ranidae). The Southwestern Naturalist 22(4):443-453.

Gilbert, C.H., and N.B. Scofield. 1898. Notes on a collection of fishes from the Colorado basin in Arizona. Proceedings of the U.S. National Museum 20:1131.

Gingrich, R.W. 2003. The political ecology of deforestation in the Sierra Madre Occidental of Chihuahua. Online publication.

Holden, P.B., P.D. Abate, and J.B. Ruppert. 2000. Razorback sucker studies on Lake Mead, Nevada. 1998-1999 Annual Report PR-578-3 to Southern Nevada Water Authority, Las Vegas, Nevada. 49 pp.

Hubbard, J.P. 1987. The Status of the Willow Flycatcher in New Mexico. Endangered Species Program, New Mexico Department of Game and Fish, Sante Fe, New Mexico. 29 pp.

Jennings, R. D. 1990. Activity and reproductive phonologies and their ecological correlates among populations of the Chiricahua leopard frog, Rana chiricahuensis. Report to Endangered Species Program, New Mexico Department of Game and Fish, Santa Fe, NM, USA.

Jennings, R. D. 1988. Ecological studies of the Chiricahua leopard frog, Rana chiricahuensis, in New Mexico. Report to Share with Wildlife, New Mexico Department of Game and Fish, Santa Fe, New Mexico, USA.

Krisch, P.H. 1889. Notes on a collection of fishes obtained in the Gila River at Fort Thomas, Arizona. Proceedings of the U.S. National Museum 11:555-558.

Lemos-Espinal, J.A., and H.M. Smith. 2007. Anfibios y Reptiles del Estado de Chihuahua, México/Amphibians and Reptiles of the State of Chihuahua, México. Universidad Nacional Autonoma de México y CONABIO, México D.F.

Maddux, H.R., L.A. Fitzpatrick, W. Noonan and H. Tyus. 1993. Colorado River endangered fishes critical habitat: biological support document. U.S. Fish and Wildlife Service, Salt Lake City, Utah. 225 pages.

Marsh, P.C. 2004. Pers. comm. to L. Fitzpatrick, USFWS.

Marsh, P.C. and J.E. Brooks 1990. Predation by Ictalurid Catfishes as a Deterrent to Re-establishment of Hatchery-reared Razorback Suckers. *Southwestern Naturalist* 34(2):188-195.

Marsh, P.C., C.A. Pacey and B.R. Kesrier. 2003. Decline of the razorback sucker in lake Mohave, Colorado River, Arizona and Nevada. Trans. Amer. Fisheries Soc. 132:1251-256.

McLeod, M.A., T.J. Koronkiewicz, B.T. Brown, and S.W. Carothers. 2005. Southwestern willow flycatcher surveys, demography, and ecology along the lower Colorado River and tributaries. Annual report submitted U.S. Bureau of Reclamation, Boulder City, NV, by SWCA Environmental Consultants, Flagstaff, AZ.

Minckley, W.L. 1983. Status of the razorback sucker, *Xyrauchen texanus* (Abbott), in the lower Colorado River Basin. The Southwestern Naturalist 28:165-187.

Minckley, W.L., P.C. Marsh, J.E. Brooks, J.E. Johnson, and B.L. Jensen. 1991. Management toward recovery of the razorback sucker. In: W.L. Minckley and J.E. Deacon (eds.) Battle Against Extinction, Native Fish Management in the American West. University of Arizona Press, Tucson, Arizona. 517 pp.

Minckley, W.L. and M.R. Sommerfeld. 1979. Resource inventory of the Gila River complex, eastern Arizona. Report to Safford District, Bureau of Land Management. 159 pp.

Owen, J.C. and M.K. Sogge. 2002. Physiological condition of southwestern willow flycatchers in native and saltcedar habitats. U.S. Geological Survey report to the Arizona Department of Transportation.

Pacey, C.A. and P.C. Marsh. 1999. Resource use by native and non-native fishes of the Lower Colorado River: literature review, summary, and assessment of relative roles of biotic and abiotic factors in management of an imperiled indigenous ichthyofauna. Final Report submitted to Bureau of Reclamation, Lower Colorado Region, Boulder City, Nevada. Arizona State University, Department of Biology, Tempe, Arizona. 59 pp plus appendices.

Painter, C.W. 2000. Chiricahua leopard frog, Rana chiricahuensis Platz and Mecham 1979. Pages 10-21 and Appendix in Completion Report to the U.S. Fish and Wildlife Service, Albuquerque, New Mexico. Grant No. E-31/1-5.

Paxton, E., K. Day, T. Olson, P. Wheeler, M.A. Macleod, T. Koronkiewicz, and S. O'Meara. 2010. Tamarisk biocontrol impacts occupied breeding habitat of the endangered southwestern willow flycatcher. Poster presented at January, 2010 Tamarix Symposium, Grand Junction, Colorado.

Phillips, A.R. 1948. Geographic variation in *Empidonax traillii*. *The Auk* 65:507-514.

Phillips, A.R., J. Marshall, and G. Monson. 1964. The Birds of Arizona. University of Arizona Press, Tucson, Arizona. 212 pp.

Platz, J. E. 1993. *Rana subaquavocalis*, a remarkable new species of leopard frog (*Rana pipiens* complex) from southeastern Arizona that calls under water. Journal of Herpetology 27:154162.

Platz, J. E. and J. S. Mecham. 1979. *Rana chiricahuensis*, a new species of leopard frog (*Rana pipiens* Complex) from Arizona. Copeia 1979:383-390.

Platz, J.E., and J.S. Mecham. 1984. *Rana chiricahuensis*. Catalogue of American amphibians and reptiles. 347.1

Rorabaugh, J.C. 2008. An introduction to the herpetofauna of mainland Sonora, México, with comments on conservation and management. Journal of the Arizona-Nevada Academy of Science 40(1):20-65.

Rosen, P.C., and C. Melendez. 2006. Observations on the status of aquatic turtles and ranid frogs in northwestern Mexico. Pp. 104-106 *in* Extended Abstracts, Proceedings of the Sixth Conference on Research and Resource Management in the Southwestern Deserts. USGS Southwest Biological
Science Center, Sonoran Desert Research Station, Tucson, AZ.

San Diego Natural History Museum. 1995. *Empidonax traillii extimus* in California. The willow flycatcher workshop. 17 November 1995. 66 pp.

Scott, N.J., and R.D. Jennings. 1985. The tadpoles of five species of New Mexican leopard frogs. Occassional Papers for the Museum of Southwestern Biology 3:1-21.

Seburn, C.N.L., D.C. Seburn, and C.A. Paszkowski. 1997. Northern leopard frog (*Rana pipiens*) dispersal in relation to habitat. Herpetological Conservation 1:64-72.

Sinsch, U. 1991. Mini-review: the orientation behaviour of amphibians. Herpetological Journal 1:541-544.

Smith, A.B., C.E. Paradzick, A.A. Woodward, P.E.T. Dockens, and T.D. McCarthey. 2002. Southwestern willow flycatcher 2001 survey and nest monitoring report. Nongame and Endangered Wildlife Program Technical Report #191. Arizona Game and Fish Department, Phoenix, Arizona.

Sogge, M.K., R. M. Marshall, S. J. Sferra, and T. J. Tibbitts. 1997. A southwestern willow flycatcher survey protocol and breeding ecology summary. National Park Service/Colorado Plateau Res. Station/N. Arizona University, Tech. Rept. NRTR-97/12. 37 pp.

Sogge, M.K., E.H. Paxton, and A.A Tudor. 2005. Saltcedar and southwestern willow flycatchers: lessons from long-term studies in central Arizona. As published on CD ROM in: Aguirre-Bravo, Celedonio, and others. Eds. 2005. Monitoring science and technology symposium: unifying knowledge for sustainability in the Western Hemisphere. 2004 September 20-24; Denver, CO. Proceedings RMRS-P037CD. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Stebbins, R.C. 2003. A Field Guide to Western Reptiles and Amphibians, Third Edition. Houghton Mifflin Company, Boston, MA.

SWCA, Inc. 1997. Eagle Creek fish salvage field work report. Technical memorandum from Jim Tress, SWCA, Inc to Rick Mohr, Phelps Dodge Corporation, Morenci, Arizona.

Unitt, P. 1987. *Empidonax traillii extimus*: An endangered subspecies. *Western Birds* 18:137-162.

U.S. Fish and Wildlife Service. 2009. Endangered and threatened wildlife and plants; partial 90-day finding on a petition to list 475 species in the Southwestern United States as threatened or endangered with critical habitat; proposed rule. Federal Register 74(240):66866-66905.

U.S. Fish and Wildlife Service. 2007. Chiricahua leopard frog (*Rana chiricahuensis*) recovery plan. Region 2, U.S. Fish and Wildlife Service, Albuquerque, NM.

U. S. Fish and Wildlife Service. 2005. Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Southwestern Willow Flycatcher (*Empidonax Traillii extimus*), Final Rule. Federal Register. Vol 70, No. 201, Wednesday October 19, 2005. Pp. 60886 – 61009.

U.S. Fish and Wildlife Service. 2002a. Southwestern Willow Flycatcher Recovery Plan, Region 2, Albuquerque, NM.

U.S. Fish and Wildlife Service. 2002b. Razorback sucker (*Xyrauchen texanus*) Recovery Goals. Amendment and Suppl. to the Razorback Sucker Recovery Plan. U.S. Fish and Wildlife. Service, Denver, Colorado. 78 pp with appendix.

U.S. Fish and Wildlife Service. 2002c. Endangered and threatened wildlife and plants; Listing of the Chiricahua leopard frog (Rana chiricahuensis); Final Rule. Federal Register 67(114):40790-40811.

U.S. Fish and Wildlife Service. 1998. Razorback Sucker Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado. 81 pp.

U.S. Fish and Wildlife Service (USFWS). 1998a. Endangered species consultation handbook. U.S. Fish and Wildlife Service and National Marine Fisheries Service, Washington, DC.

U.S. Fish and Wildlife Service (USFWS). 1998b. Little Colorado River spinedace, *Lepidomeda vittata*, Recovery Plan. Albuquerque, New Mexico. 51 pp.

U.S. Fish and Wildlife Service. 1997a. Final determination of critical habitat for the southwestern willow flycatcher. Federal Register 62(140):39129-39146.

U.S. Fish and Wildlife Service. 1997b. Correction; final determination of critical habitat for the southwestern willow flycatcher. Federal Register 62 (161):44228.

U.S. Fish and Wildlife Service. 1995. Final Rule Determining Endangered Status for the South- western Willow Flycatcher. Federal Register 60: 10694 (February 27, 1995).

U.S. Fish and Wildlife Service. 1993. Colorado River Endangered Fishes Critical Habitat. Draft Biological Support Document. Salt Lake City, UT. 225 pp.

Welker, T.L. and P.B. Holden. 2003. Razorback sucker studies on Lake Mead, Nevada. 2002-2003 Annual Report to Southern Nevada Water Authority, Las Vegas, Nevada. 58 pp.

WestLand Resources, Inc. 2009. Biological Assessment - Programmatic Consultation for the Maintenance of Transmission Line River Crossings. Prepared for: USDA Rural Utilities Service on behalf of Southwest Transmission Cooperative, Inc. 72 pp. with appendices.

Witte, C.L., M.J. Sredl, A.S. Kane, and L.L. Hungerford. 2008. Epidemiological analysis of factors associated with local disappearances of native ranid frogs in Arizona. Conservation Biology 22:375-383.

Zweifel, R.G. 1968. Reproductive biology of anurans of the arid southwest, with adaptation of embryos to temperature. Bulletin of the Museum of Natural History