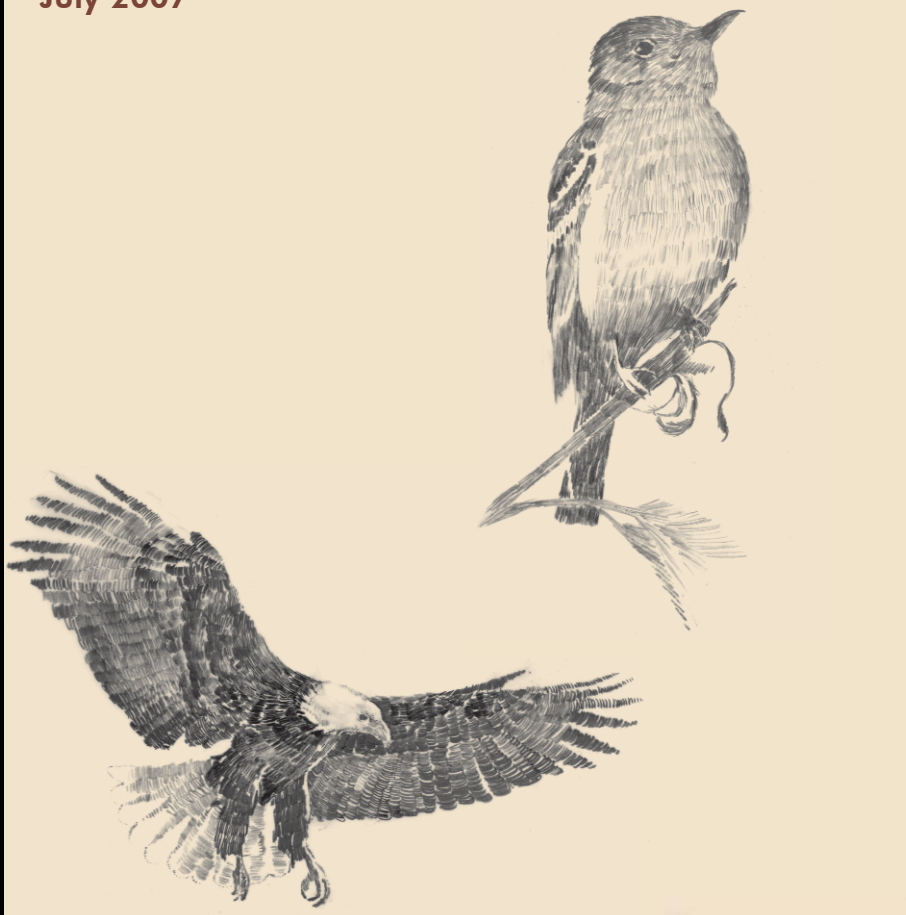
DRAFT

Environmental Impact Statement

Incidental Take Permit for Operation of Horseshoe and Bartlett Reservoirs

July 2007



U.S. Fish and Wildlife Service
Department of the Interior

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

INCIDENTAL TAKE PERMIT FOR OPERATION OF HORSESHOE AND BARTLETT RESERVOIRS

U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

JULY 2007

Additional information may be obtained from:

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LIST OF ACRONYMS AND ABBREVIATIONS USED IN THIS DOCUMENT

Action area	Area covered by Permit plus HCP mitigation lands
ADWR	Arizona Department of Water Resources
AF	acre-feet
AGFD	Arizona Game and Fish Department
AMA	Active Management Area
Association	Salt River Valley Water Users' Association
BA	Biological Assessment
BAEs	biological assessments and evaluations
Bartlett	Bartlett Dam and Reservoir
BO	Biological Opinion
CAP	Central Arizona Project
CAWCS	Central Arizona Water Control Study
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic Feet Per Second
Cities	Phoenix, Mesa, Chandler, Tempe, Glendale, Gilbert, Scottsdale, Tolleson, and Avondale
CO	carbon monoxide
Committee	Fish and Watershed Committee
Corps	U.S. Army Corps of Engineers
Covered species	See Table ES-1 on page ES-2
Cuckoo	Yellow-billed Cuckoo
DEIS	Draft Environmental Impact Statement
District	Salt River Project Agricultural Improvement and Power District
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
ERO	ERO Resources Corporation
ESA	Endangered Species Act of 1973, as amended
FEIS	Final Environmental Impact Statement
Flycatcher	Southwestern willow flycatcher
FMYN	Fort McDowell Yavapai Nation
Frog	Lowland leopard frog
FONSI	Finding of No Significant Impact
FR	Federal Register
FWS	U.S. Fish and Wildlife Service
Gartersnakes	Northern Mexican and narrow-headed gartersnakes
GIS	Geographic Information System
HCP	Habitat Conservation Plan
HDMS	Heritage Data Management System
Horseshoe	Horseshoe Dam and Reservoir
IA	Implementing Agreement

Listed species	Species listed as federally threatened or endangered under the ESA
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
Permit	Incidental Take Permit
PM-10	particulate matter less than or equal to 10 microns in diameter
Reclamation	Bureau of Reclamation
ROD	Record of Decision
Roosevelt	Roosevelt Dam and Reservoir
RWCD	Roosevelt Water Conservation District
SCA	State conservation agreement
Section 10	Section 10(a)(1)(B) of the ESA
Section 7	Section 7 of the ESA
SRP	Salt River Project
SRPMIC	Salt River Pima-Maricopa Indian Community
SRRD	Salt River Reservoir District
Study area	Action area plus SRP water service area (Figure ES-2)
Take	Incidental take of a federally listed species
TNC	The Nature Conservancy
TNF	Tonto National Forest
USFS	U.S. Forest Service
WSCA	Wildlife of Special Concern in Arizona

ABSTRACT

The U.S. Fish and Wildlife Service (FWS) is considering issuance of a permit pursuant to Section 10(a)(1)(B) of the Endangered Species Act (ESA) to the Salt River Project (SRP). The permit would authorize the incidental take of species protected by the ESA associated with SRP's continued operation of Horseshoe Dam and Reservoir and Bartlett Dam and Reservoir, consistent with their purpose to store and release water, and implementation of an HCP. The species addressed in the Section 10(a)(1)(B) Permit application include southwestern willow flycatcher, bald eagle, yellow-billed cuckoo, 10 species of native fish, lowland leopard frog, and northern Mexican and narrow-headed gartersnakes. Species that would be covered by the Permit are listed in Table ES-1. These species are collectively referred to as "covered species." If the permit is approved, SRP will implement a Habitat Conservation Plan (HCP) in fulfillment of requirements of the ESA. The HCP provides measures to minimize and mitigate, to the maximum extent practicable, the impacts of Horseshoe and Bartlett operation on covered species and their habitat and to ensure that any take of covered species will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.

FWS is issuing this Draft Environmental Impact Statement to evaluate the potential impacts associated with implementation of the HCP and issuance of a Section 10(a)(1)(B) Permit, and to evaluate alternatives. Three alternatives are considered in this Draft EIS, including a no action alternative (No Permit Alternative). The FWS preferred alternative is issuance of a Permit associated with the Optimum Operation Alternative and the HCP involving measures to minimize and mitigate the incidental take of covered species. A third alternative, Modified Historical Operation, is included for comparison to the No Permit and Optimum Operation alternatives. The consequences of these actions on natural, cultural, and socioeconomic resources are discussed in this Draft Environmental Impact Statement.

The formal comment period on this Draft EIS will end on September 18, 2007. The FWS will review the written comments on the DEIS as well oral statements given at a pubic hearing on August 29, 2007. A Final EIS will address all substantive public comments. If you have any questions regarding this document, you may contact:

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EXECUTIVE SUMMARY

Introduction

The Salt River Project (SRP) has applied to the U.S. Fish and Wildlife Service (FWS) for an incidental take permit (Permit) pursuant to Section 10(a)(1)(B) (Section 10) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended. SRP has developed and would implement a Habitat Conservation Plan (HCP) for Horseshoe Dam and Reservoir (Horseshoe) and Bartlett Dam and Reservoir (Bartlett) to meet the requirements of a Section 10 permit. FWS is issuing this Draft Environmental Impact Statement (DEIS) to evaluate the potential impacts associated with issuance of a Permit for implementation of the HCP, and to evaluate potential impacts associated with alternatives. The HCP (Attachment 1) supplements the information contained in this DEIS.

The proposed action being considered by this DEIS is FWS approval of SRP's application for a Permit for species that are currently listed under the ESA and for species that may become listed in the future (covered species). Issuance of the Permit would allow incidental take associated with SRP's operation of Horseshoe and Bartlett (Figure ES-1), consistent with their purpose to store and release water for SRP and its contractors. The HCP is intended to fully comply with the ESA and provide for the long-term protection and conservation of habitat for covered species.

Species that would be covered by the Permit are listed in Table ES-1. The requested duration of the Permit is 50 years. The areas covered by the Permit would include Horseshoe up to an elevation of 2,026 feet, Bartlett up to an elevation of 1,748 feet, the Salt River from Granite Reef Dam to the Verde River, and most of the Verde River upstream from the Salt River, and portions of the Verde River tributaries. The action area for the Permit also includes mitigation lands acquired as part of the HCP. The study area for the DEIS includes the action area plus the SRP water service area, which receives water from Horseshoe and Bartlett (Figure ES-2). The SRP water service area is included in the DEIS for purposes of socioeconomic analysis.

Three alternatives are considered in this Draft EIS, including a no action alternative (No Permit Alternative). The FWS preferred alternative is issuance of a Permit associated with the Optimum Operation Alternative and the HCP, which specifies measures to minimize and mitigate incidental take of the covered species to the maximum extent practicable, and which ensures that incidental take will not appreciably reduce the likelihood of the survival and recovery of these species in the wild. The HCP includes detailed information on the minimization and mitigation measures to be implemented as part of the HCP (Attachment 1, Chapter IV). A third alternative, Modified Historical Operation, is included for comparison to the No Permit and Optimum Operation alternatives.

Table ES-1. Covered species.

Scientific Name	Common Name	ESA	AGFD	Critical Habitat
Empidonax traillii extimus	Southwestern willow flycatcher	LE	WSCA	Yes
Haliaeetus leucocephalus	Bald eagle	LT	WSCA	No
Coccyzus americanus	Yellow-billed cuckoo	C	WSCA	-
Xyrauchen texanus	Razorback sucker	LE	WSCA	Yes
Ptychocheilus lucius	Colorado pikeminnow	LE, XN	WSCA	Yes (elsewhere)
Poeciliopsis occidentalis occidentalis	Gila topminnow	LE	WSCA	No
Meda fulgida	Spikedace	LT	WSCA	Yes (upstream)
Tiaroga cobitis	Loach minnow	LT	WSCA	Yes (elsewhere)
Gila robusta	Roundtail chub	-	WSCA	-
Agosia chrysogaster	Longfin dace	-	-	-
Catostomus insignis	Sonora sucker	-	-	-
Catostomus clarki	Desert sucker	-	-	-
Rhinichthys osculus	Speckled dace	-	-	-
Rana yavapaiensis	Lowland leopard frog	-	WSCA	-
Thamnophis eques megalops	Northern Mexican gartersnake	-	WSCA	-
Thamnophis rufipunctatus	Narrow-headed gartersnake	-	WSCA	-

KEY: **ESA**=Endangered Species Act as amended, 1973 (LE=Listed Endangered; LT=Listed Threatened; C=Candidate; XN=Experimental, non-essential population)
AGFD=Arizona Game and Fish Dept (WSCA=Wildlife of Special Concern in Arizona)
Critical Habitat=designated under the ESA (relationship to Action Area)

Figure ES-1. Vicinity map, Horseshoe and Bartlett Reservoirs near Phoenix, Arizona.

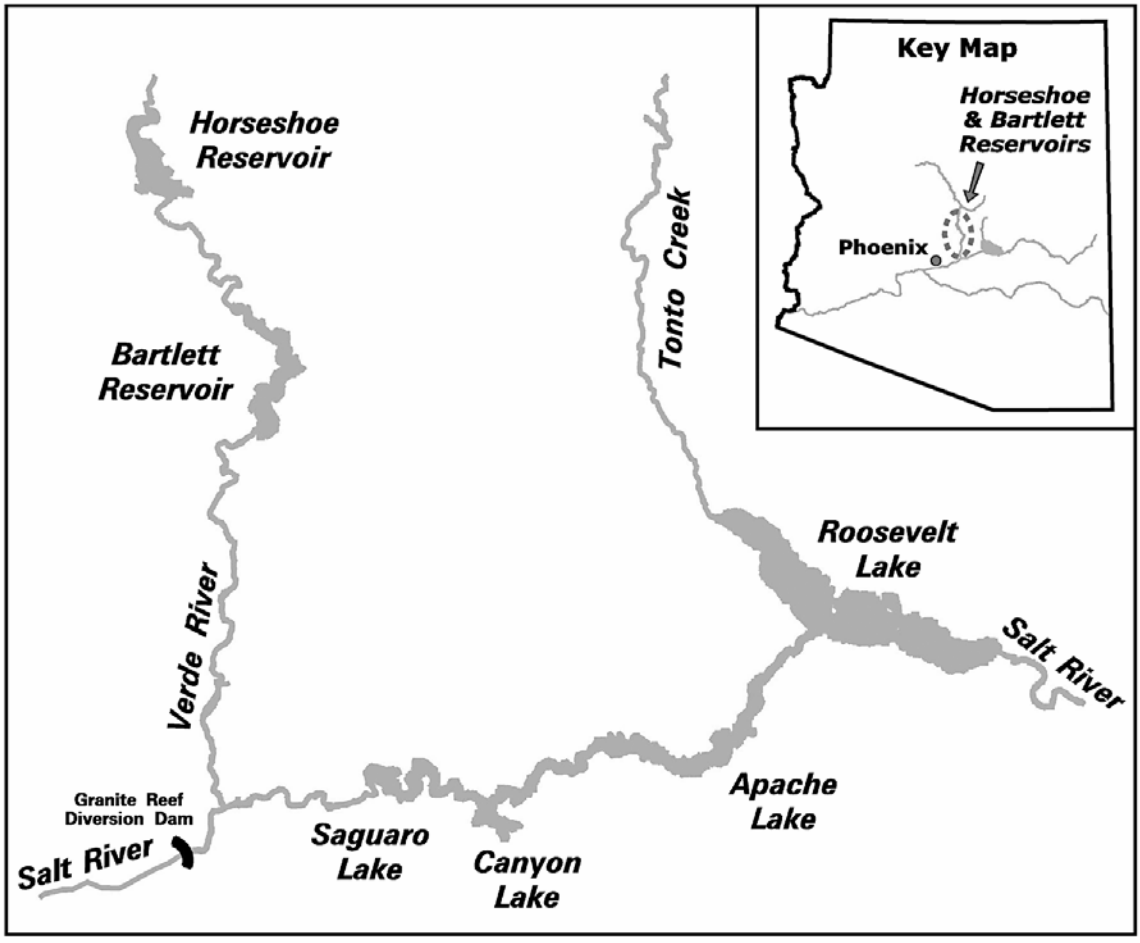
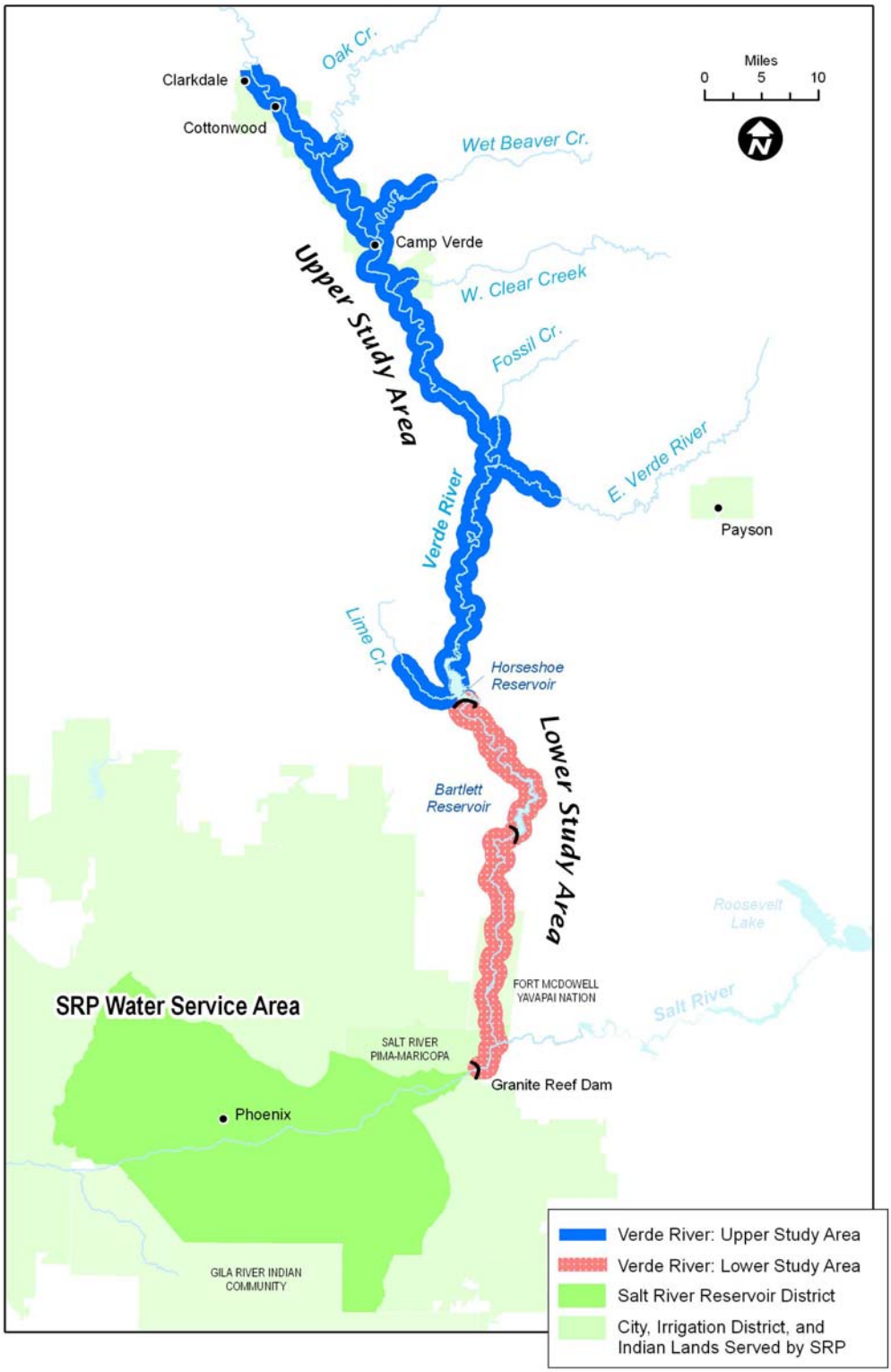


Figure ES-2. Study area (HCP mitigation lands in other watersheds are not shown).



Background

Horseshoe and Bartlett are operated by SRP in conjunction with four reservoirs on the Salt River and a small reservoir on East Clear Creek with a trans-basin diversion to the East Verde River. All seven reservoirs are integral features of the Salt River Reclamation Project, authorized by the Reclamation Act of 1902. SRP operates the reservoirs pursuant to a 1917 contract with the United States. Since completion in the 1930s and 1940s, Horseshoe and Bartlett have provided water for irrigation, municipal, and other uses. Currently, SRP reservoirs supply water to more than 2.6 million people in the cities of Phoenix, Mesa, Chandler, Tempe, Glendale, Gilbert, Scottsdale, Tolleson, and Avondale. In addition, water is provided to irrigate agricultural lands and for other uses within the SRP service area. Also, water is delivered to the Salt River Pima-Maricopa Indian Community (SRPMIC), Fort McDowell Yavapai Nation (FMYN), Gila River Indian Community, Buckeye Irrigation Company, Roosevelt Irrigation District, Roosevelt Water Conservation District (RWCD), and others. Horseshoe and Bartlett also provide a variety of recreational uses and environmental benefits in central Arizona such as wildlife habitat.

Horseshoe and Bartlett contain about 12 percent of the total storage capacity in the SRP reservoir system. Although relatively small in comparison with SRP's reservoir capacity on the Salt River, Horseshoe and Bartlett are particularly important to the City of Phoenix, the SRPMIC, and the FMYN, which receive key water supplies from these two reservoirs under contract with SRP. SRP's flexibility in operating Horseshoe and Bartlett is affected by, among other things: 1) SRP's legal obligations to deliver water stored in these two reservoirs to its shareholders, cities, irrigation districts, Indian communities, and individual water users pursuant to numerous water rights and contracts; and 2) the capacity of dam outlet works and spillways.

As noted above, the preferred alternative is FWS approval of SRP's application for a Permit to allow incidental take associated with SRP's filling of the reservoir conservation storage space and continued operation of Horseshoe and Bartlett, consistent with their purpose for water storage. The HCP and Permit would comply with the ESA and provide for the long-term protection and conservation of habitat for covered species. One of the goals of Section 10, in addition to providing a regulatory mechanism to permit the incidental take of federally listed species by non-federal entities, is to encourage partnerships among the public, municipal, state, and federal agencies in the interests of endangered and threatened species and habitat conservation. Thus, the HCP was developed by SRP in consultation with the FWS, Arizona Game and Fish Department, Arizona Department of Water Resources, City of Phoenix, local municipalities, and other interested parties.

The need for the proposed action is to address future impacts of reservoir operation on the habitat of covered species. In particular, species that use riparian habitat have colonized newly established vegetation growing on the Horseshoe lakebed due to low water levels resulting from recent years of drought. A Permit is needed because continued operation of the reservoirs may adversely impact habitat used by the covered species and may directly result in the death or injury of covered individuals. Habitat

occupied by flycatchers and cuckoos can be unavailable, modified, or lost due to reservoir operations. Nonnative fish produced in Horseshoe and Bartlett can adversely impact covered fish, frog, and gartersnake species through predation, competition, and alteration of habitat in the Verde River and portions of its tributaries.

Alternatives

This DEIS focuses on analyzing the No Permit Alternative and the Proposed Action (the Optimum Operation Alternative) in relation to the Modified Historical Operation Alternative. In formulating alternatives for the EIS, FWS reviewed written comments received during scoping, input from an advisory group, and information gathered during the HCP planning process. The comments and recommendations were considered in the development of reservoir operation alternatives and minimization and mitigation measures proposed in the HCP and used in this DEIS. Many other alternatives were determined to be infeasible or impracticable, were inconsistent with the reservoir purposes, or were simply minor variations on one of the three primary alternatives.

This DEIS analyzes three alternatives, each of which is described in detail in Chapter 2:

1. **No Permit**—No action by FWS, meaning that a Permit would not be issued to SRP. Under this alternative, SRP would do everything within its control to avoid take of federally listed species associated with its continued operation of Horseshoe and Bartlett. This alternative would result in reduced operation of Horseshoe and, in the future, might result in reduced water storage at Bartlett or implementation of other measures.
2. **Optimum Operation, the Proposed Action**—FWS approval of the application for a Permit authorizing the continued full operation of Horseshoe and Bartlett with the addition of operating objectives to support stands of tall riparian vegetation at the upper end of Horseshoe to minimize impacts to covered bird species, and to manage Horseshoe Reservoir levels to minimize impacts to covered native fish, frog, and gartersnake species. This alternative includes implementation of all measures described in the HCP to minimize and mitigate the take of covered species.
3. **Modified Historical Operation**—FWS approval of an application for a Permit authorizing the continued full operation of Horseshoe and Bartlett by SRP using historical operating objectives, along with additional measures to minimize and mitigate the potential take of covered species.

To aid in the analysis of the three alternatives, the alternatives formulation and evaluation process used in the HCP to identify the preferred HCP alternative (Optimum Operation) is incorporated into the DEIS and is discussed further in Chapter 2.

Potential Environmental Impacts

For each of the three alternatives, an evaluation was made of the potential impacts to natural, cultural, and socioeconomic resources. Those impacts are summarized in Table ES-2.

Table ES-2. Summary comparison of alternatives and impacts.

No Permit (No Action by FWS)	Modified Historical Operation	Optimum Operation (Preferred Alternative)
WATER RESOURCES AND FLOOD CONTROL		
Reduction in local and regional water supply, including an average annual decrease in SRP, Phoenix, and SRPMIC supplies of 11,000 acre-feet. Water users would have to find a replacement water supply other than ground water. Possible depletions of ground water resources. Slight benefit to flood control.	No change in storage capacity or local and regional water supply. No change in water supplies. No change in flood control.	No change in storage capacity or local and regional water supply. No change in water supplies. No change in flood control.
GEOLOGY AND GEOMORPHOLOGY		
May result in insignificant changes in flows and sediment deposition patterns.	Current influence of reservoirs on flows and sediment deposition would not change.	May result in insignificant changes in flows and sediment deposition patterns.
VEGETATION		
Long-term presence of riparian vegetation at Horseshoe is not certain. During drought, reservoir levels would not be managed to maintain riparian vegetation. Quantity of riparian vegetation at Horseshoe likely to be less over time relative to the Modified Historical Operation and Optimum Operation alternatives. No change in quantity or quality of existing upland vegetation surrounding reservoirs.	No significant long-term change in the amount of riparian vegetation, but less than Optimum Operation Alternative. Could result in increased riparian habitat at mitigation sites. No change in quantity or quality of existing upland vegetation surrounding reservoirs.	Long-term maintenance of riparian habitat at Horseshoe. No significant adverse impacts on woody riparian vegetation downstream of the dams due to dam operations. Could result in increased riparian habitat at mitigation sites. No change in quantity or quality of existing upland vegetation surrounding reservoirs.
GENERAL WILDLIFE		
Wildlife favoring upland habitat may benefit. Species favoring riparian habitat would be adversely impacted in the long term.	No change in wildlife habitat at Horseshoe or Bartlett. Habitat acquisition and management, and additional habitat conservation measures would benefit wildlife and aquatic resources at mitigation sites.	Maintenance of riparian habitat at Horseshoe would benefit riparian-dependent species. Habitat acquisition and management, and additional habitat conservation measures would benefit wildlife and aquatic resources at mitigation sites.

COVERED SPECIES		
Flycatcher—Unlikely to have a significant adverse impact in the short term, but a long-term reduction of habitat at Horseshoe is likely without periodic inundation. No significant adverse impact on critical habitat. No mitigation measures would be implemented. ***Cuckoo***—Impacts and mitigation the same as those described for flycatcher. ***Bald Eagle***—No impacts to eagle nests at the reservoirs because no nests currently occur within the conservation space of the reservoirs; no significant adverse impacts to riparian habitat downstream of the dams that is used by eagles. Likely will be fewer bald eagle perching trees available at upper end of Horseshoe over the long term, but would not cause significant adverse impacts. No significant adverse impacts to eagle forage base in the action area – diversity and abundance of important prey species not significantly adversely impacted. ***Covered Native Fish, Frogs, and Gartersnakes***— Impacts to covered native fish, frog, and gartersnake habitat would be 31.9 river miles over the long term. No significant adverse impacts to currently listed species (razorback sucker, Colorado pikeminnow, Gila topminnow) with implementation of mitigation measures described below. No significant adverse impact to critical habitat of razorback sucker. Nonnative fish would continue to reproduce in Horseshoe and Bartlett. Mitigation measures include: 1. rapid drawdown, 2. Lime Creek fish barrier, and 3. working with AGFD and FWS to modify the existing native fish stocking program to prevent take of currently listed species.	***Flycatcher***—Anticipated periodic losses of an annual average of up to 200 acres of habitat due to inundation or desiccation. Long-term flycatcher productivity lower than under Optimum Operation Alternative. No significant adverse impact on critical habitat. Acquire off-site riparian habitat for mitigation. ***Cuckoo***— Impacts and mitigation the same as those described for flycatcher. ***Bald Eagle***—No impacts to eagle nests at the reservoirs because no nests currently occur within the conservation space of the reservoirs - adaptive management would be implemented if bald eagles move nests into conservation space of reservoirs. No significant adverse impacts to riparian habitat downstream of the dams that is used by eagle. No significant adverse impacts to eagle forage base in the action area – diversity and abundance of important prey species not significantly adversely impacted. ***Covered Native Fish, Frogs, and Gartersnakes*** — Impacts to covered native fish, frog, and gartersnake habitat would be 39.5 river miles over the long term. No significant adverse impact to critical habitat of razorback sucker. Nonnative fish would continue to reproduce in Horseshoe and Bartlett. Mitigation measures include: 1. rapid drawdown and keeping Horseshoe empty as much as possible, 2. Lime Creek fish barrier, 3. participating in native fish stocking program, 4. funding native fish hatchery improvements, 5. conducting watershed management activities, and 6. adaptive management.	***Flycatcher***—Additional vegetation growth and flycatcher population growth over the long term, with periodic losses of flycatcher habitat occurring over the life of the Permit. Periodic inundation of an annual average of up to 200 acres of Horseshoe habitat would likely result in delayed or lost breeding attempts, decreased productivity and survivorship of dispersing adults in search of suitable breeding habitat, and decreased productivity of adults that attempt to breed at Horseshoe. No significant adverse impact on critical habitat. Mitigation measures include: 1. early season drawdown to maximize nesting habitat, 2. managing operations to support stands of tall dense vegetation at the upper end of Horseshoe, 3. acquiring off-site riparian habitat, and 4. adaptive management. ***Cuckoo***—Impacts and mitigation the same as those described for flycatcher. ***Bald Eagle***— No impacts to eagle nests at the reservoirs because no nests currently occur within the conservation space of the reservoirs - adaptive management would be implemented if bald eagles move nests into conservation space of reservoirs. No significant adverse impacts to riparian habitat downstream of the dams that is used by eagle. No significant adverse impacts to eagle forage base in the action area – diversity and abundance of important prey species not significantly adversely impacted ***Covered Native Fish, Frogs, and Gartersnakes*** — Impacts to covered native fish, frog, and gartersnake habitat would be 33.9 river miles over the long term. No significant adverse impact to critical habitat of razorback sucker. Nonnative fish would continue to reproduce in Horseshoe and Bartlett. Mitigation measures include: 1. rapid drawdown and keeping Horseshoe empty as much as possible, 2. Lime Creek fish barrier, 3. participating in native fish stocking program, 4. funding native fish hatchery improvements, 5. conducting watershed management activities, and 6. adaptive management.

OTHER THREATENED, ENDANGERED, AND SENSITIVE SPECIES		
No adverse impact on other threatened, endangered, or sensitive species.	No adverse impact on other threatened, endangered, or sensitive species.	No adverse impact on other threatened, endangered, or sensitive species.
RECREATION		
Lowered Horseshoe water levels earlier in the year than historical operations would slightly reduce recreation opportunities at Horseshoe.	Recreation use at Horseshoe would vary with water levels similar to historical conditions.	Recreation use at Horseshoe would vary with water levels similar to current conditions. Operational changes to maintain riparian vegetation at Horseshoe could periodically increase recreation opportunities above current opportunities during drought; and slightly decrease recreational opportunities at Bartlett.
SOCIO-ECONOMICS AND ENVIRONMENTAL JUSTICE		
Water Use—If sources could be found, the cost to replace lost water supplies would be about $5.0 to 5.6 million per year. Increased costs would result in secondary impacts to the regional economy. Local residents and businesses would be impacted by increased water costs. ***Environmental Justice***—Minority and low-income populations would not be disproportionately impacted.	***Water Use***—No impact to current water supply costs. ***Environmental Justice***—Minority and low-income populations would not be disproportionately impacted.	***Water Use***— No impact to current water supply costs. ***Environmental Justice***—Minority and low-income populations would not be disproportionately impacted.
LAND USE AND LAND OWNERSHIP		
No change in land use or land ownership.	No change in land use patterns at Horseshoe and Bartlett. Acquisition of land at mitigation sites would preserve land in a natural condition, but may eliminate grazing, agriculture, or other land practices.	No change in land use patterns at Horseshoe and Bartlett. Acquisition of land at mitigation sites would preserve land in a natural condition, but may eliminate grazing, agriculture, or other land practices.
CULTURAL RESOURCES		
Cultural resource sites that are currently periodically inundated would be exposed for longer durations, which could subject the sites to degradation and vandalism.	The timing and duration of inundation of cultural resource sites would remain the same as current conditions.	Cultural resource sites would be inundated slightly more often than under the Historic Operations Alternative, which could reduce degradation and vandalism.
AIR QUALITY		
No impact at reservoir sites. Possible short-term impact from fugitive dust associated with Lime Creek fish barrier construction.	No impact at reservoir sites. Possible short-term impact from fugitive dust associated with Lime Creek fish barrier construction.	No impact at reservoir sites. Possible short-term impact from fugitive dust associated with Lime Creek fish barrier construction.

Preferred Alternative

The analysis of alternatives determined that issuing a Permit for implementation of the Optimum Operation Alternative proposed in the HCP would be the alternative that best minimizes adverse impacts to biological, environmental, and socioeconomic resources from future reservoir operations.

Under the Optimum Operation Alternative, SRP would continue to operate Horseshoe and Bartlett as part of its reservoir system in a manner consistent with their purpose as water storage facilities. However, two objectives would be added: 1) maintain tall dense riparian vegetation in Horseshoe, and 2) manage Horseshoe water levels to minimize impacts to covered native fish, frog, and gartersnake species and to promote reproduction and recruitment of razorback suckers. The addition of those two objectives would result in the following set of objectives for Horseshoe and Bartlett:

- Maintain the safety and integrity of the dams
- Maintain sufficient storage to meet water delivery obligations
- Optimize reservoir storage within the reservoir system
- Maintain adequate carryover storage in case of low runoff
- Conjunctively manage ground water pumping given reservoir storage and projected runoff and demand
- Maximize hydrogeneration
- Permit necessary facility maintenance
- Support stands of tall dense vegetation at the upper end of Horseshoe
- Manage Horseshoe water levels to minimize impacts to covered native fish, frog, and gartersnake species and to benefit the razorback sucker

The Optimum Operation Alternative includes a number of measures to minimize adverse impacts to covered species and to mitigate for unavoidable impacts (Table ES-3).

Table ES-3. Minimization and mitigation for Optimum Operation.

Component	Minimization and Mitigation Measures
Measures for Covered Bird Species	1. Periodic reservoir fills to support stands of tall dense vegetation at the upper end of Horseshoe 2. Acquire offsite riparian habitat 3. Adaptive management as needed including: acquiring additional riparian habitat, bald eagle nest structure(s), and native fish (prey) fish stocking.
Measures for Covered Fish, Frog, and Gartersnake Species	1. Minimize reproduction, recruitment, and survival of nonnative fish in Horseshoe and provide opportunities for razorback sucker reproduction and recruitment 2. Construct Lime Creek fish barrier 3. Native fish stocking 4. Native fish hatchery funding 5. Watershed management activities 6. Adaptive management as needed

DRAFT
ENVIRONMENTAL IMPACT STATEMENT

INCIDENTAL TAKE PERMIT FOR OPERATION OF HORSESHOE AND BARTLETT RESERVOIRS

Introduction

The U.S. Fish and Wildlife Service (FWS) has received an application from the Salt River Project (SRP) for an incidental take permit (Permit) pursuant to Section 10(a)(1)(B) (Section 10) of the Endangered Species Act of 1973, as amended. The Permit would cover take of listed species resulting from reservoir operations. As discussed in depth in Chapter 3, take of covered bird species from Horseshoe and Bartlett operations would occur as a result of periodic loss of individuals or reduced productivity of the covered species due to habitat unavailability, modification, or loss. Take of native fish, frog and gartersnake species from Horseshoe and Bartlett operations would occur as a result of increased competition with and predation from nonnative fish species that indirectly benefit from reservoir operations, or from direct loss by stranding in the reservoir or passage through the outlet works. The Permit application is supported by a Habitat Conservation Plan (HCP) to address the incidental take of species currently protected under the Endangered Species Act (ESA) and species of special concern, which may be listed in the future.[1]

Section 9 of the ESA prohibits the "take" of any fish or wildlife species listed as threatened or endangered under the ESA, unless specifically authorized. Take, as defined by the ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in such conduct" (16 U.S.C. § 1531(18)). "Harm" is further defined to include "significant habitat modifications or degradation where it actually kills or injures wildlife by significantly impairing behavioral patterns such as breeding, feeding, or sheltering" (50 C.F.R. § 17.3). "Harass" is defined (50 C.F.R. § 17.3) as intentional or negligent actions that create

[1] A "listed" species is a species that has been federally listed as threatened or endangered by the FWS (*see* 16 U.S.C. § 1533(a)). "Species of special concern" include "candidate" species, which are "… those species for which the Service has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species" (50 C.F.R. §§ 17.22 and 17.32); species proposed for listing; and those species that may be listed over the life of the permit. In the event that a species covered by a HCP is listed under the ESA, the Permit would authorize incidental take of the species and habitat modification or degradation.

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.

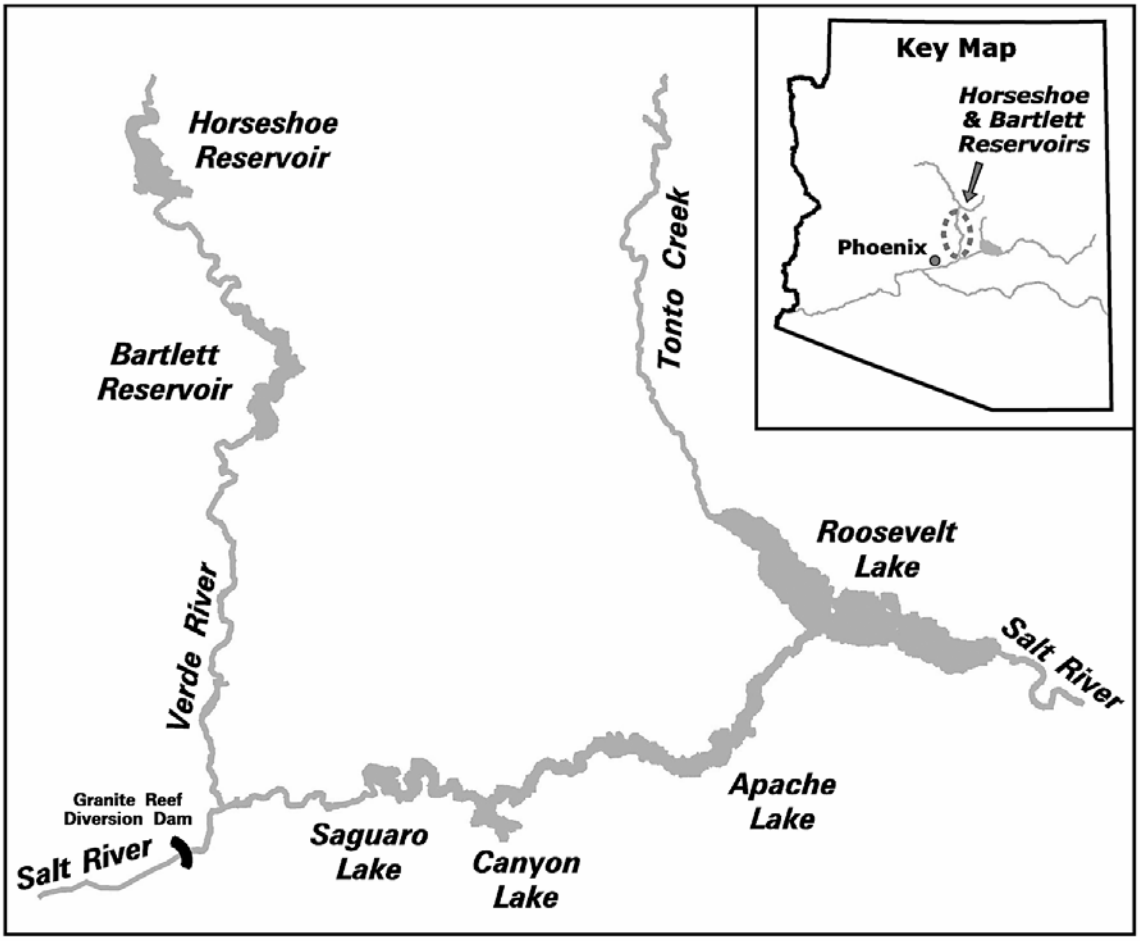
Amendments to the ESA enacted in 1982 provide for the issuance of permits authorizing the "incidental take" of endangered or threatened species of wildlife by non-federal entities. Incidental take is defined by the ESA as take that is "incidental to, and not the purpose of, the carrying out of an otherwise lawful activity" (50 C.F.R. §§ 17.22 and 17.32). The "incidental take permit" process was established under Section 10 of the ESA. Section 10 requires an applicant for a permit to submit a conservation plan that specifies, among other things, the impacts that are likely to result from the taking and the measures the permit applicant will undertake to minimize and mitigate such impacts. Conservation plans under Section 10 of the ESA are referred to as "habitat conservation plans" or "HCPs."

SRP submitted a Draft HCP to the FWS in June 2007. The HCP addresses: alternatives considered; potential impacts to federally threatened, endangered, and covered species; measures to minimize and mitigate impacts; and methods to implement and fund the HCP. The incidental take would be associated with SRP's continued operation of Horseshoe and Bartlett reservoirs to store and release water (Figure 1-1). If the Permit application is approved, SRP will implement the HCP in fulfillment of requirements of the ESA. The HCP provides measures: 1) to minimize and mitigate, to the maximum extent practicable, the impacts of continued reservoir operations on covered species and the habitat they use or occupy; and 2) to ensure that any incidental take of listed species will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. The HCP also addresses potential adverse impacts on critical habitat, where such habitat has been designated for listed species or in the event critical habitat is designated in the future for species covered by the HCP. **Attachment 1 is the Draft HCP, which is frequently referred to in this DEIS as the "Draft HCP" or "HCP."**

The issuance of a Permit is a federal action subject to National Environmental Policy Act (NEPA) compliance. The purpose of the NEPA process is to promote analysis and disclosure of the environmental issues surrounding a proposed federal action in order to reach a decision that reflects the NEPA mandate to strive for harmony between human activity and the natural world. Although Section 10 and NEPA requirements overlap considerably, the scope of NEPA goes beyond that of the ESA by requiring consideration of the impacts of a federal action on a wider variety of resources, such as water quality, visual resources, cultural resources, and socioeconomics. An Environmental Impact Statement (EIS) is prepared when the proposed activity addressed by the HCP is a major federal action significantly affecting the quality of the human environment.

This Draft EIS (DEIS) has been prepared in accordance with NEPA requirements and the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of the NEPA (40 C.F.R. § 1500-1508). FWS is the lead agency for preparation of the DEIS.

Figure 1-1. Vicinity map, Horseshoe and Bartlett Reservoirs near Phoenix, Arizona.



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Chapter 1
Purpose and Need

This Draft Environmental Impact Statement (DEIS) and the Draft HCP address 7 species currently listed under the ESA and 6 species that may be listed in the future, all of which may be impacted by the continued full operation of Horseshoe and Bartlett. Table 1-1 lists the 13 total species, which are referred to in this DEIS as "covered species" because they are included in the HCP and Permit sought by SRP.

Ongoing operation of Horseshoe and Bartlett will result in periodic fluctuations of reservoir levels and stream flows, which will impact the covered species and their habitat. Each of the alternatives evaluated in the Draft HCP result in a range of reservoir levels and stream flows, with corresponding impacts on the covered species and their habitat, as well as varying impacts on water supply and other resources. The HCP

Table 1-1. Covered species.

Scientific Name	Common Name	ESA	AGFD	Critical Habitat
Empidonax traillii extimus	Southwestern willow flycatcher	LE	WSCA	Yes
Haliaeetus leucocephalus	Bald eagle	LT	WSCA	No
Coccyzus americanus	Yellow-billed cuckoo	C	WSCA	-
Xyrauchen texanus	Razorback sucker	LE	WSCA	Yes
Ptychocheilus lucius	Colorado pikeminnow	LE, XN	WSCA	Yes (elsewhere)
Poeciliopsis occidentalis occidentalis	Gila topminnow	LE	WSCA	No
Meda fulgida	Spikedace	LT	WSCA	Yes (upstream)
Tiaroga cobitis	Loach minnow	LT	WSCA	Yes (elsewhere)
Gila robusta	Roundtail chub	-	WSCA	-
Agosia chrysogaster	Longfin dace	-	-	-
Catostomus insignis	Sonora sucker	-	-	-
Catostomus clarki	Desert sucker	-	-	-
Rhinichthys osculus	Speckled dace	-	-	-
Rana yavapaiensis	Lowland leopard frog	-	WSCA	-
Thamnophis eques megalops	Northern Mexican gartersnake	-	WSCA	-
Thamnophis rufipunctatus	Narrow-headed gartersnake	-	WSCA	-

KEY: **ESA**=Endangered Species Act as amended, 1973 (LE=Listed Endangered; LT=Listed Threatened; C=Candidate; XN=Experimental, non-essential population)
AGFD=Arizona Game and Fish Dept (WSCA=Wildlife of Special Concern in Arizona)
Critical Habitat=designated under the ESA (relation to action area)

identified a preferred alternative that would be implemented under the Permit. The purpose of the DEIS is to evaluate the effects of issuing a Permit, as well as to evaluate the minimization and mitigation measures proposed in the Draft HCP.

This DEIS has been prepared to evaluate the potential for significant adverse impacts to the environment from:

- Approving the requested authorization for incidental take of the covered species, whether currently listed or listed in the future
- Implementing the HCP

This DEIS analyzes three alternatives, each of which is described in detail in Chapter 2:

1. **No Permit**—No action by FWS, meaning that no Permit would be issued to SRP. Under this alternative, SRP would do everything within its control to avoid take of federally listed species associated with its continued operation of Horseshoe and Bartlett. This alternative would result in reduced operation of Horseshoe and, in the future, might result in reduced water storage at Bartlett or implementation of other measures.
2. **Optimum Operation, the Proposed Action**—FWS approval of the application for a Permit authorizing the continued full operation of Horseshoe and Bartlett with the addition of operating objectives to support stands of tall dense vegetation[2] at the upper end of Horseshoe to minimize impacts to flycatchers and other covered bird species and to manage Horseshoe Reservoir levels to minimize impacts to covered native fish, frog, and gartersnake species. This alternative includes implementation of all measures described in the HCP to minimize and mitigate the take of covered species.
3. **Modified Historical Operation**—FWS approval of an application for a Permit authorizing the continued full operation of Horseshoe and Bartlett by SRP using historical operating objectives, along with additional measures to minimize and mitigate the potential take of covered species.

To aid in the analysis of the three alternatives, the alternatives formulation and evaluation process used in the HCP to identify the preferred HCP alternative (Optimum Operation) is incorporated into the DEIS and is discussed further in Chapter 2.

1.1 Document Organization

Chapter 1 of the DEIS provides information on the purpose and need for the proposed action, the scoping process, and significant issues that were identified for further analysis. This chapter also describes

[2] "Tall dense vegetation" refers to riparian vegetation mapping units in Horseshoe and along the Verde River that may be used by flycatchers as breeding habitat; and is one component of the total area occupied flycatchers. Definitions of tall dense vegetation and occupied habitat are provided in HCP Subchapters III.A.1 (Flycatcher Breeding Habitat), III.B.4 (Vegetation); and IV.B.1 (Flycatcher Impacts).

the decisions, permits, and approvals associated with the DEIS and HCP, and supporting background material on SRP and the current operation of Horseshoe and Bartlett. Chapter 1 concludes with a summary of the history of ESA and NEPA compliance at and near these two reservoirs. Chapter 2 describes SRP's proposal to implement the HCP and other alternatives that were considered. In addition, alternatives that were considered but eliminated from further consideration are described. Chapter 2 also identifies the environmentally preferred alternative. Baseline information on natural, cultural, and socioeconomic resources is provided in Chapter 3. An analysis of the potential environmental consequences for each of the alternatives is also provided in Chapter 3. Chapter 4 provides information on the preparers and recipients of the DEIS. Chapter 5 lists references.

This DEIS includes the Draft HCP as Attachment 1. Public comments on the DEIS and Draft HCP, and responses to those comments, will be included in a separate volume with the Final EIS (FEIS).

1.2 Purpose of the Proposed Action

The proposed action being considered by this DEIS is FWS approval of SRP's application for a Permit for the covered species, whether currently listed or listed in the future under the ESA. The purposes of the proposed action are to comply with the ESA and to provide for the long-term protection and conservation of habitat for covered species during the operation of the reservoirs. Issuance of the Permit would allow approved incidental take associated with SRP's continued full operation of Horseshoe and Bartlett, consistent with their purpose to store and release water for SRP and its contractors. The Permit would also allow incidental take associated with SRP's implementation of the HCP including managing Horseshoe water levels to maintain tall dense vegetation in Horseshoe and reduce impacts to covered native fish, frog, and gartersnake species, and providing off-site mitigation and management measures. The HCP is intended to fully comply with the ESA and provide for the long-term protection and conservation of habitat for covered species.

Section 10 and regulations at 50 C.F.R. §§ 17.22 and 17.32 contain provisions for issuing permits to non-federal entities, provided the following criteria are met:

1. The taking will be incidental to an otherwise lawful activity;
2. The applicant will, to the maximum extent practicable, minimize and mitigate the impacts of such taking;
3. The applicant will develop the HCP and ensure that adequate funding for the HCP will be provided;
4. The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and
5. The applicant agrees to implement other measures that FWS may require as being necessary or appropriate for the purposes of the HCP.

SRP developed the HCP to satisfy these criteria (Attachment 1, Executive Summary). The goal of the HCP is to provide habitat conservation for federally listed, candidate, and other species of concern that inhabit Horseshoe and Bartlett and the Verde River above and below the two dams while allowing the continued

operation of the two reservoirs. The goals of the HCP would be accomplished by a number of minimization and mitigation measures including:

- Maintaining riparian habitat in Horseshoe and minimizing impacts to flycatchers and cuckoos;
- Acquiring and managing riparian habitat along the Verde River, Gila River, or elsewhere in central Arizona to provide a diversity of geographic locations;
- Focusing acquisition of riparian land in locations that flycatchers and cuckoos are expected to occupy, i.e., in proximity to existing populations;
- Acquiring mitigation riparian habitat that is similar to Horseshoe habitat in terms of vegetation composition and patch sizes;
- Ensuring that these measures are consistent with the Flycatcher Recovery Plan (FWS 2002a);
- Adaptive management if bald eagles nest in Horseshoe or Bartlett;
- Ensuring that these measures are consistent with the Razorback Sucker Recovery Plan and Recovery Goals (FWS 1998 and FWS 2002b), the Spikedace Recovery Plan (FWS 1991a), and the Loach Minnow Recovery Plan (FWS 1991b).
- Early and rapid drawdown of Horseshoe to reduce the recruitment of nonnative fish species;
- Operating and stocking Horseshoe or the Verde River to promote reproduction and recruitment of razorback suckers;
- Installing a fish barrier on Lime Creek;
- Providing contributions and in-kind support to improve and expand the Bubbling Ponds Native Fish Hatchery, and to assist in stocking native fishes, including bald eagle prey species if necessary; and
- Continuing watershed management efforts to maintain or improve stream flows.

One of the goals of Section 10, beyond providing a regulatory mechanism to permit the incidental take of federally listed species by non-federal entities, is to reduce conflicts between listed species and economic development activities. Congress has encouraged partnerships among the public, municipal, state, and federal agencies in the interests of endangered and threatened species and habitat conservation (H.R. Rep. No. 97-835, 97th Congress, Second Session). To this end, the HCP was developed by SRP in consultation with the FWS, Arizona Game and Fish Department (AGFD), U.S. Forest Service (USFS), City of Phoenix, Arizona Department of Water Resources (ADWR), local municipalities, affected Indian tribes, and other interested parties (see Attachment 1, Subchapter I.E for additional details).

1.3 Need for the Proposed Action

Due to dry conditions in central Arizona since 1995, the reservoir levels behind Horseshoe and Bartlett dams were below normal until 2005, especially in Horseshoe (Attachment 1, Figure I-2). As a result, the number of riparian trees and shrubs has increased in the Horseshoe storage space used by SRP to store water for use within the Phoenix metropolitan area for irrigation, municipal, and other purposes.

In 2002, a population of breeding southwestern willow flycatchers was found in habitat within the storage space at Horseshoe and along the Verde River below the reservoir. The riparian vegetation around Horseshoe and along the Verde River below the dams also provides nesting habitat for bald eagles and cuckoos. In addition, the Verde River above and below Horseshoe and Bartlett provides habitat for covered fish, frog, and gartersnake species, of which some of the fish species are prey for bald eagle, and Horseshoe and the Verde River upstream from the reservoir have been designated as critical habitat for the razorback sucker.

A Permit is needed because continued operation of Horseshoe and Bartlett will periodically result in fluctuations in reservoir water levels and stream flows that will impact the covered species by modification of habitat, or by the direct loss of birds, or direct or indirect loss of native fish, frog, or gartersnake species in the action area via predation from and competition with nonnative fish that benefit from operations at Horseshoe and Bartlett. The Permit also would allow SRP to implement the HCP, which includes conservation measures: (1) to minimize and mitigate, to the maximum extent practicable, impacts of continued reservoir operation on covered species and their habitat; and (2) to ensure that any incidental take of listed species will not appreciably reduce the likelihood of the survival and recovery of the species in the wild. Other species for which SRP is not seeking Permit coverage are also likely to benefit from the conservation measures provided in the HCP.

1.4 Scoping and Public Involvement

1.4.1 Advisory Group, Scoping, and Meetings

Public involvement in scoping the EIS and developing the HCP was initiated with the establishment of an Advisory Group. In early April 2003, invitations to participate in the Advisory Group were sent to representatives of state and federal agencies, Indian tribes, cities, recreational groups, and environmental groups. Meetings of the Advisory Group were held on May 5, September 22, and December 16, 2003; March 16, 2005; and May 4, 2006 to solicit input on all aspects of the EIS and HCP. Representatives of the following organizations attended all or some of the Advisory Group meetings and provided input to SRP and FWS:

- Arizona Department of Water Resources
- Arizona Game and Fish Department
- Arizona Municipal Water Users Association
- Bartlett Marina
- Bureau of Reclamation (Reclamation)
- Center for Biological Diversity
- Cities of Phoenix, Mesa, and Tempe
- Fort McDowell Yavapai Nation
- Maricopa Audubon Society
- Salt River Pima-Maricopa Indian Community
- Sierra Club
- U.S. Forest Service

Public involvement in scoping the EIS and HCP also was solicited through public notice in the Federal Register (68 FR 36829,

June 19, 2003), mailing approximately 300 scoping announcements in June 2003, and a FWS news release dated June 23, 2003. On June 30, 2003, legal advertisements of the scoping process ran in the Scottsdale and East Valley Tribunes. A public scoping meeting was held by FWS and SRP on July 15, 2003 to solicit comments on the preparation of the EIS and HCP. Approximately 40 people attended the public meeting. A total of 11 sets of written comments were received from individuals, environmental organizations, government agencies, and water user groups.

1.4.2 Issues Raised During Scoping

The scoping process identified a variety of issues associated with the proposed action. The identification of significant issues is an important component of NEPA analysis. Significant issues are analyzed in detail, while minor issues are either dismissed or briefly discussed. This section describes significant issues identified during scoping that are discussed in the following sections of this DEIS.

Based on comments received during the scoping process and additional information considered during preparation of the DEIS, eight categories of significant issues were identified:

1. Water Supply Alternatives
2. Impacts on the Flycatcher and Recovery Efforts
3. Impacts on the Razorback Sucker and Other Native Fishes
4. Mitigation of Impacts on Listed Species
5. Impacts on Recreation
6. Impacts on Flood Control
7. Impacts on Wildlife Habitat
8. Socioeconomic Impacts

Each of these issues is described briefly below. In accordance with NEPA regulations, FWS used these significant issues as the focus of the environmental analysis in the DEIS.

1.4.2.1 Water Supply Alternatives

Because Horseshoe and Bartlett reservoirs supply water to SRP water users, cities, and the Indian communities, there is concern that potential changes to the operation at these two reservoirs could impact their available water supplies. There is also a concern that it may not be possible for SRP, Phoenix, or the Indian communities to secure alternative water supplies to replace lost storage space at Horseshoe and Bartlett. A change in the current operations at these two reservoirs may require acquisition or development of alternative water supplies, which 1) may not be as reliable, 2) may displace other existing or future uses, or 3) may hinder state water management goals. A loss of reliable water supplies, particularly during drought, is an issue of concern to several commenters. Other comments suggest that it would be feasible to replace Horseshoe and Bartlett water supplies with increased use of ground water, additional use of Central Arizona Project (CAP) water, improved water conservation measures, retirement of agricultural lands, ground water recharge, or other water sources to augment water supplied by Horseshoe and Bartlett. There is concern that any alternative considered should balance the need to provide a secure water supply for the Phoenix area with conserving protected species. Numerous questions were raised concerning the historical distribution and cost of various sources of water to certain users.

1.4.2.2 Impacts on the Flycatcher and Recovery Efforts

A population of the endangered flycatcher now occupies and breeds in habitat within the reservoir bed of Horseshoe. There is concern about how the operation of the reservoir would affect flycatcher recovery efforts. Commenters noted the complexity of maintaining habitat for flycatchers given the sometimes conflicting needs of other species, particularly native fishes. Commenters questioned whether flycatchers would find new breeding grounds, how their migration and movement would be impacted, and the likelihood of survival of the Horseshoe flycatcher breeding population.

1.4.2.3 Impacts on Razorback Sucker and Other Native Fishes

Endangered razorback sucker and other native fish species use habitat in the Verde River and its tributaries above and below Horseshoe and Bartlett. There is concern that continued operation of the reservoirs would adversely impact habitat used by these species.

1.4.2.4 Mitigation of Impacts on Listed Species

Implementation of the HCP is intended to minimize and mitigate impacts to covered species and their habitat associated with SRP's continued operation of Horseshoe and Bartlett. Commenters raised concerns regarding the timing, amount, location, and suitability of mitigation habitat. Two comments stressed the importance of protecting or creating habitat near Horseshoe or Bartlett or enhancing habitat elsewhere in the Verde basin. One comment indicated a desire to reduce grazing in the watershed as part of the mitigation plan. One comment suggested that FWS simply direct SRP to purchase appropriate mitigation land and not require studies and a plan. Another comment suggested that research and education should be part of the HCP.

1.4.2.5 Impacts on Recreation

Horseshoe and Bartlett currently support a variety of recreational uses including fishing, boating, and camping. There is a concern about the potential impact on these activities, Bartlett marina operations, and recreation-related businesses in the area from possible changes in reservoir operations.

1.4.2.6 Impacts on Flood Control

Horseshoe and Bartlett currently provide limited flood control benefits to downstream Phoenix metropolitan area cities. There is a concern that changes to reservoir operations could increase the frequency or magnitude of flood flows through Phoenix. Of related concern is how possible flooding from reservoir re-operation would affect downstream improvements on the Salt River, such as the Tempe Town Lake or the Rio Salado Environmental Restoration Project.

1.4.2.7 Impacts on Wildlife Habitat

Horseshoe, Bartlett, and the Verde River provide habitat for a variety of wildlife other than the covered species. There is concern that continued reservoir operations or a change in the operation of Horseshoe and Bartlett reservoirs may impact habitat for other wildlife species present in the area.

1.4.2.8 Socioeconomic Impacts

The City of Phoenix and two Indian communities, Fort McDowell Yavapai Nation (FMYN) and Salt River Pima-Maricopa Indian Community (SRPMIC), have substantial rights to water stored in

Horseshoe and Bartlett. One comment suggested that legal constraints to changes in reservoir operations should be fully evaluated. Commenters expressed concerns that development of alternative water supplies would be very expensive and would result in additional direct and indirect impacts to the regional economy.

1.4.3 Issues Selected for Further Consideration

Based on information received during the scoping process from the Advisory Group and public comments, FWS and SRP determined that all of the issues described in Section 1.4.2 (water supply, listed species, mitigation measures, recreation, flood control, wildlife, and socioeconomics) should be considered in detail in the DEIS. The biological issues regarding the potential impacts to the covered species would be addressed in the greatest level of detail. Additional impact topics selected for discussion in this DEIS include vegetation, water resources, cultural resources, land use, geology, and air quality. Because there are unlikely to be significant impacts from the alternatives on visual resources, water quality, or soils, these resources are not evaluated in this DEIS.

1.4.4 Public Hearing on Draft EIS and Draft HCP

A public hearing will be held at the Salt River Project office in Phoenix, Arizona on the DEIS and Draft HCP. The hearing will be preceded by presentations by FWS and SRP, and a question and answer session to enhance public understanding of the DEIS and Draft HCP. The purpose of the hearing will be to receive public comment on the DEIS and Draft HCP.

1.5 Decisions, Permits, and Approvals

Several decisions and actions by FWS and SRP are necessary to authorize incidental take and to implement the HCP. The actions required by each entity are described below.

1.5.1 Decisions and Actions by FWS

FWS is the agency delegated the authority by the Secretary of the Interior to approve or deny a Permit in accordance with the ESA. To act on SRP's Permit application, FWS must determine whether the HCP meets the approval criteria specified in the ESA and federal regulations listed in Section 1.2.

FWS will provide the public an opportunity to comment on the DEIS and Draft HCP as required by NEPA and Section 10 of the ESA. Both the FEIS and final HCP may include revisions based on comments received from government agencies, interest groups, and the public during the comment period. Under the ESA, issuance of a permit by FWS is a federal action subject to Section 7 compliance. This requires FWS to conduct an IntraService formal Section 7 consultation on permit issuance. Formal consultation terminates with preparation of a Biological Opinion (BO) that provides FWS' determination as to whether the proposed action, including SRP's implementation of the HCP, is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat. For this action, the section 7 consultation process will parallel the NEPA process.

If FWS determines that issuance of a permit is not likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat and that the criteria of Section 10(a)(2)(B) of the ESA have been met, FWS must issue the permit. If FWS determines other measures are necessary or appropriate to carry out the purposes of Section 10, it may require that other measures be implemented as a condition of the permit. If the issuance criteria are not met, FWS will deny the permit. A Record of Decision (ROD) will be issued by FWS no sooner than 30 days following release of the FEIS. The ROD is the decision-making document explaining the rationale for selection of an alternative and any required mitigation.

If FWS decides to issue the Permit, it will enter into an Implementing Agreement (IA) with SRP to formalize assurances regarding implementation of the HCP. The IA must be approved by the Office of the Solicitor in the Department of the Interior. SRP has provided a draft IA and draft Permit terms and conditions (Attachment 1, Appendices 10 and 11). Permit approval and implementation of the HCP as determined by the ROD would require FWS to:

- Ensure that measures in the HCP minimize and mitigate impacts to the covered species to the maximum extent practicable, and that incidental take will not appreciably reduce the likelihood of the survival and recovery of the species in the wild;
- Monitor implementation of the HCP and compliance with the terms and conditions of the Permit and IA; and
- Act on proposed amendments to the HCP, Permit, or IA.

In 1998, the Department of Interior promulgated rules with respect to assurances under Section 10 permits, commonly known as "No Surprises" (50 C.F.R. §§ 17.3; 17.22(b)(5), (6), and (7); 17.32 (b)(5), (6), and (7)). The rules provide certainty for non-federal entities that if changed or unforeseen circumstances occur during the life of a HCP:

> … provided the plan is being properly implemented…[FWS] will not require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for the species covered by the conservation plan without the consent of the permittee.

1.5.2 Decisions and Actions by SRP

SRP is requesting a 50-year Permit and agreement that authorizes the incidental take of the covered species. If the Permit were approved, SRP would be required to sign the IA prior to implementing the HCP. The IA would require SRP to implement the mitigation and monitoring requirements described in the HCP. Mitigation and monitoring measures may require entering into agreements with public agencies or private landowners regarding the conservation and management of flycatcher habitat or the purchase and management of mitigation properties. SRP also would be responsible for adaptive management to address future changes in conditions as specifically provided in the IA, Permit, and HCP.

1.6 Description of Applicant and Beneficiaries

1.6.1 Applicant

The applicant for the Permit is the Salt River Project Agricultural Improvement and Power District (District). The Salt River Valley Water Users' Association (Association) consists of shareholders owning lands within the Salt River Reservoir District (SRRD). Jointly, the District and the Association are referred to as the Salt River Project (SRP).

SRP was authorized in 1903 under the 1902 Reclamation Act as a federal reclamation project. In a 1917 contract, the United States turned the care, operation, and maintenance of all facilities over to SRP. The District was formed by SRP in 1937. Under contract with the Association, the District assumed the obligations of the Association for the overall operation, care, and maintenance of certain SRP facilities, including reservoirs; thus, the District is applying for the Permit. The Association continues to operate the irrigation system as an agent of the District. The District owns and operates the electric and power operation, transmission, and distribution facilities. SRP provides water from Horseshoe and Bartlett directly to various beneficiaries of these storage facilities for irrigation and other uses as summarized below. Additional information on SRP and its history is provided in Attachment 1, Subchapter I.E.1.

1.6.2 Beneficiaries

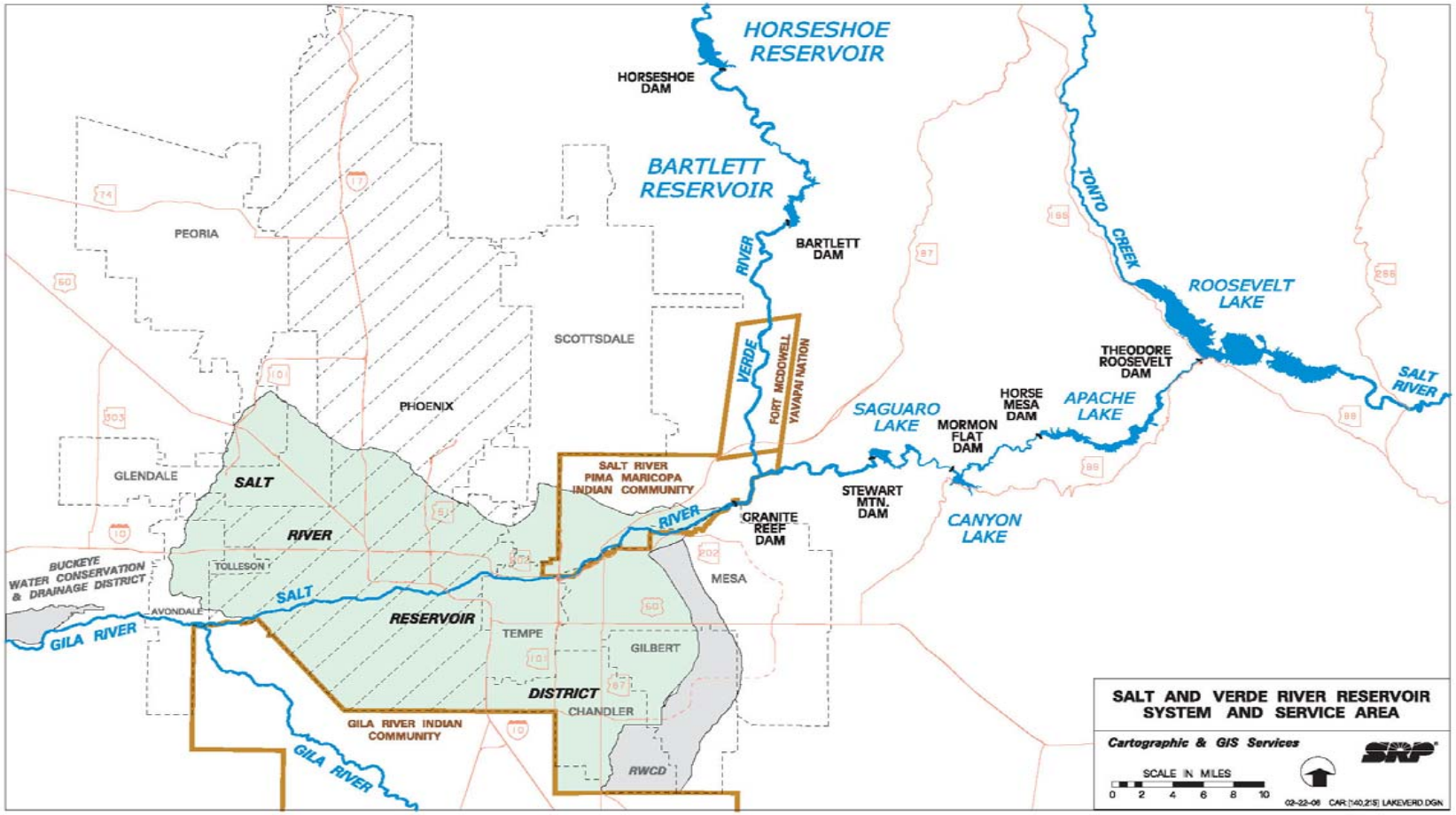
As described in the HCP (Attachment 1, Subchapter I.E.2 and Appendix 1), water from Horseshoe, Bartlett, and SRP's other reservoirs is provided directly by SRP to shareholder lands for irrigation and other uses, and is delivered to the cities of Avondale, Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, and Scottsdale for municipal use on shareholder lands. Water deliveries are also made pursuant to specific water rights in Horseshoe and Bartlett held by the City of Phoenix, SRPMIC, and FMYN. In addition, water is delivered from the SRP reservoir system to the cities, Gila River Indian Community, Buckeye Irrigation Company, RWCD, and others in satisfaction of their independent water rights. Finally, exchange agreements between a number of entities and SRP pursuant to state and federal law are facilitated by stored water from Horseshoe and Bartlett. The location of SRP shareholder lands within the SRRD, irrigation districts, and Indian communities receiving water from SRP are shown in Figure 1-2.

1.7 Description of SRP System, Horseshoe and Bartlett Reservoirs, and Reservoir Operations

SRP delivers an average of 1 million acre-feet (AF) of water each year from various sources of surface and ground water for use on more than 240,000 acres or 375 square miles (SRP 2000).[3] Most of SRP's deliveries are to cities for municipal use on

[3] SRP average annual deliveries of 1 million AF, measured at the delivery point to water users, include surface water, ground water, and any other available supply such as CAP water. SRP diversions from these sources average about 1.1 to 1.2 million AF per year due to losses in the system, many of which recharge ground water.

Figure 1-2. SRP reservoir system and water service area in the vicinity of Phoenix, Arizona.



shareholder lands having water rights or for urban irrigation uses. Annual surface water diversions by SRP average about 900,000 AF, approximately 40 percent of the water supply to the Phoenix Active Management Area (AMA), an area of approximately 5,600 square miles (ADWR 1994). Horseshoe and Bartlett supply about 40 percent of SRP's surface water supplies, or about 360,000 AF per year (Ester, pers. comm. 2001).

Water stored in Horseshoe and Bartlett is a major source of water to Phoenix, FMYN, and SRPMIC. From 1995 through 2002, Phoenix chose to take delivery of an average of about 15,000 AF/year from its storage entitlement in Horseshoe (Attachment 1, Appendix 1). FMYN obtains all of its water supplies from the Verde River, including ground water pumped from the alluvial aquifer along the river (Attachment 1, Chapter I, and Appendix 1). SRPMIC receives a substantial amount of water from the Verde River, including about an average of about 18,000 AF/year from storage developed by Bartlett (Attachment 1, Appendix 1).

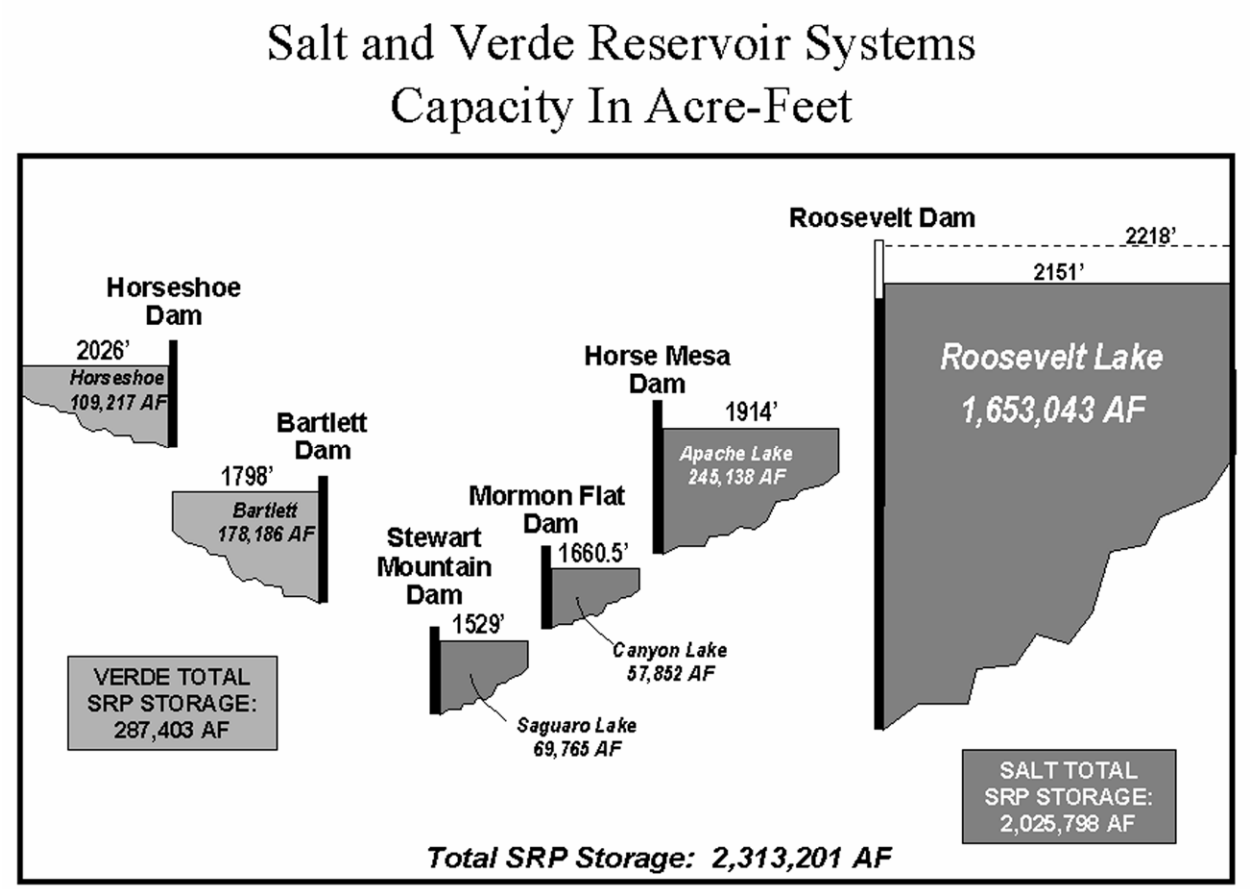
The SRP system and a description of Horseshoe and Bartlett reservoir operations are described in further detail in Attachment 1, Chapter I.F. A profile view of the SRP reservoir system is presented in Figure 1-3. The HCP describes the role of Horseshoe and Bartlett in providing water to a portion of the Phoenix metropolitan area. SRP's system and Horseshoe and Bartlett reservoir operations are summarized below.

1.7.1 Overall Reservoir Operations

SRP manages the SRP reservoir system, including Horseshoe and Bartlett, to minimize releases of water downstream of Granite Reef Diversion Dam in accordance with the conservation storage objectives outlined in Chapter I of the HCP (Attachment 1, Subchapter I.F.3). Supplemental sources include ground water and surplus CAP water, although use of these supplies is restricted (in the case of ground water) or is only a short-term option (in the case of CAP water). Ground water is used to supplement the available surface water supplies throughout each cycle of drought (Attachment 1, Figure I-5). Arizona law discourages reliance on ground water by mandating strict conservation requirements and other limits on ground water use because ground water has been depleted historically, causing land subsidence and concerns about future water supply. For these reasons, additional ground water pumping is not a feasible source to develop for replacement of surface water supplies.

SRP has supplemented its declining surface water supplies in recent years with surplus CAP water. However, SRP does not have a contract for CAP water. This short-term option will no longer be available to SRP once CAP water users fully utilize their allocations, or when Colorado River shortages result from low runoff years or increased use by Upper Colorado River Basin states (Attachment 1, Subchapter I.F.3).

Figure 1-3. Profile of SRP Water Storage System.



Note: The maximum conservation storage elevation above mean sea level is shown for each dam, and the maximum flood control elevation (2,218 feet) is also shown for Roosevelt.

1.7.2 Horseshoe and Bartlett Reservoirs

Based on a 2001 sediment survey, current storage capacity in Horseshoe is 109,217 AF, divided between 41,515 AF of storage for SRP and 67,702 AF for Phoenix. Current Bartlett storage capacity is 178,186 AF. The lowest 8,909 AF of storage in Bartlett is for SRP and the remaining 169,277 AF is divided 20 percent for SRPMIC and 80 percent for SRP (Attachment 1, Figure I-6, and Appendix 1).

SRP operates Horseshoe and Bartlett on the Verde River in conjunction with the Salt River reservoirs and a small reservoir on upper East Clear Creek in the little Colorado River watershed, which has a trans-basin diversion to the East Verde River. To most effectively and efficiently maximize the conservation of water in storage, SRP releases water stored in Horseshoe Reservoir first. Early water release from Horseshoe provides space for storage of additional runoff on the Verde. For the same reason, a high percentage of Bartlett stored water is used each year compared to the Salt River reservoirs because that use creates additional storage space to capture Verde runoff. By using Horseshoe and Bartlett stored water to the maximum extent possible, these relatively small reservoirs provide an average of about 40 percent of the surface water used by SRP and its contractors.

Operating Horseshoe and Bartlett with early season releases and maximizing storage also allows for maximum use of hydropower generation at the Salt River dams. The hydrogenation facilities on the Salt River reservoirs help SRP meet peak summer energy demands. Without this source of power to meet peak demands, SRP would have to generate or purchase non-renewable fossil fuel-produced energy.

Given the factors described above, water releases to meet demands are shifted from the Verde River reservoirs to the Salt River reservoirs in late April or early May, except for maintaining a minimum release of 100 cfs from Bartlett. The 100 cfs minimum release is the result of a contractual agreement with the FMYN agreed to in 1993 intended to maintain fish habitat and riparian vegetation downstream of Bartlett.

In summary, Horseshoe and Bartlett play a key role in providing water to the Phoenix metropolitan area. Major components of that role include:

- Providing about 40 percent of the average surface water delivered by SRP to shareholders and contractors (about 360,000 AF).
- Providing specific water supplies to the City of Phoenix, FMYN, and SRPMIC under contractual entitlements to storage capacity in these two reservoirs pursuant to state and federal law.
- Providing a minimum flow on the Verde River to ensure ample quantity of fish habitat and maintain riparian vegetation.

1.8 History of NEPA and ESA Compliance in the Vicinity of Horseshoe and Bartlett

Prior NEPA and ESA compliance at Bartlett and Horseshoe primarily involved the planning, construction, and funding of safety modifications to the two dams in the 1980s and 1990s by Reclamation. Reclamation's construction and funding of these modifications were federal actions, which required compliance with NEPA and Section 7(a)(2) of the ESA. Downstream of Horseshoe and Bartlett, Reclamation complied with NEPA and the ESA for construction of irrigation facilities on the Fort McDowell Reservation. Upstream from the reservoirs, in the middle Verde Valley,[4] Reclamation consulted with FWS on the transfer of CAP allocations from Verde Valley water companies to Scottsdale. In Section 1.8.2 below is a summary of Reclamation's NEPA and ESA compliance related to Horseshoe, Bartlett, and along the Verde.

The USFS has consulted with FWS under the ESA for activities near the reservoirs and along the lower Verde. A summary of these USFS consultations is also provided in Section 1.8.3 below.

[4] The area upstream of Horseshoe along the Verde River between Clarkdale and Camp Verde is commonly referred to as the "Verde Valley."

1.8.1 Relationship of Activities Addressed in the HCP to Previous Actions at Horseshoe and Bartlett Dams

The HCP addresses the future impacts of SRP's ongoing operation of all water conservation storage space at Horseshoe and Bartlett. Impacts due to the presence of the dams and historical operations will not be addressed in this process.

Through SRP's 1917 contract with the Secretary of the Interior, SRP has the authority to care for, operate, and maintain Horseshoe and Bartlett dams to store and release water. Because the actions at issue in the HCP are SRP's actions taken pursuant to its authority to operate the dams, the future impacts of dam operations are properly considered through an application for a permit under Section 10 of the ESA. In contrast, prior consultations under Section 7 of the ESA for Horseshoe and Bartlett, described below, were the result of projects funded, authorize, or carried out by Reclamation.

1.8.2 Reclamation Compliance

1.8.2.1 Horseshoe and Bartlett—1983/1984

Reclamation evaluated a number of options for new water storage facilities and safety modifications to dams in central Arizona under the authority to construct CAP facilities (Colorado River Basin Project Act of 1968, 82 Stat. 886, 43 U.S.C. § 1501 et seq.) and the Safety of Dams Act (43 U.S.C. § 506 et seq.). As part of that process, a final environmental impact statement was completed on the Central Arizona Water Control Study (CAWCS; Reclamation 1984). FWS issued its BO on March 8, 1983 (FWS 1990a). The ROD selecting the preferred alternative, known as the Plan 6 alternative, was issued on April 3, 1984. The Verde River component of Plan 6 was modified substantially in 1988 with the deletion of Cliff Dam, which would have replaced Horseshoe Dam. Due to the deletion of Cliff Dam and other modifications of Plan 6 relative to the Verde River dams, the 1983 BO became obsolete with respect to the Verde River component.

1.8.2.2 Horseshoe and Bartlett—1989 to 1992

In 1989, after the changes to Plan 6 in 1988, Reclamation submitted several alternatives to FWS for consultation involving modifications of Horseshoe and Bartlett Dams and their spillways to provide sufficient capacity to safely pass the probable maximum flood (FWS 1989). FWS issued a BO in 1989 with respect to the dam safety modifications to Horseshoe and Bartlett proposed by Reclamation (FWS 1989). In the BO, FWS evaluated the impacts of construction on bald eagles nesting in the vicinity of the two dams. FWS found no jeopardy to bald eagles at either dam from the proposed modifications and did not anticipate any take of bald eagles at Horseshoe. However, FWS anticipated that approximately three bald eagles would be harassed by construction activities at Bartlett. In order to minimize the impacts of take on these bald eagles, FWS requested that Reclamation ensure that: 1) no helicopter use or blasting occur from December 1 to July 1; 2) no vehicle or foot traffic occur near the Bartlett breeding area during that same period; 3) monitoring of the Bartlett breeding area be conducted during the breeding and wintering period; and 4) reports be submitted of any adverse

impacts on the bald eagles associated with construction.

In 1990, FWS amended the 1989 BO in response to concerns raised by Reclamation regarding construction delays and increased costs due to the restrictions on helicopter use and blasting (FWS 1990b). The amended BO modified those restrictions by narrowing the geographic area where helicopter use was prohibited, and allowing studies and tests to be conducted to potentially modify the blasting restrictions.

Reclamation issued a final Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for the proposed safety modifications to Horseshoe and Bartlett Dams in the fall of 1990 (Reclamation 1990). In 1992, Reclamation issued a Horseshoe Dam Supplement to the 1990 EA and FONSI as a result of design refinements related to dam and spillway modifications (Reclamation 1992). The 1992 Supplement did not identify any significant impacts from the design refinements. FWS concurred in Reclamation's finding that the Horseshoe modifications would have no effect on the razorback sucker (FWS 1992a).

1.8.2.3 Fort McDowell—1984/1985

Reclamation consulted with FWS after discovering a bald eagle nest with three eaglets adjacent to a construction area. The construction was the initial phase of rehabilitation of the main canal serving irrigated land on the Fort McDowell Indian Reservation (FWS 1985). FWS concluded that the project would jeopardize the bald eagle population but provided a reasonable and prudent alternative involving: 1) buffer zones around nest trees; 2) planting cottonwood trees as a visual and acoustic barrier between the nests and agricultural fields; 3) conducting a bald eagle nest watch program on the reservation in 1986; 4) adjusting farming practices to prevent adverse impacts to nesting bald eagles; and 5) reinitiating consultation if farming activities disturb the bald eagles.

1.8.2.4 Fort McDowell—1991/1992

A second consultation by Reclamation with FWS and a series of Environmental Assessments on the Fort McDowell Indian Reservation resulted from the potential impacts on bald eagles of a planned irrigation project. This new irrigation development stemmed from water supplies and funding provided in the 1990 Fort McDowell Water Rights Settlement Act (FWS 1992b; see Attachment 1, Appendix 1 for a summary of the Act). The proposed project was to irrigate approximately 1,660 acres of new orchards and vineyards on the Reservation. In 1998, an additional 277 acres were proposed for development (Reclamation 1998). In the 1992 BO, FWS concluded that the project as planned was likely to jeopardize the bald eagle and recommended a reasonable and prudent alternative that involved: 1) establishing nest site management areas to prevent disturbance to the eagles and their nest trees; 2) protecting and managing foraging habitat to prevent adverse modification; 3) creating a habitat rehabilitation fund to improve bald eagle habitat on the Reservation; 4) establishing buffer zones around nest trees during construction; 5) allowing the bald eagle nest watch program to continue on the Reservation; and 6) reinitiating consultation if these measures did not work or if agricultural activities disturbed the bald eagles. Subsequently, the habitat mitigation component of the alternative was moved off-reservation (Reclamation 2001).

1.8.2.5 Cottonwood and Camp Verde—1997/1998

In 1997, Reclamation requested consultation on assignment of CAP allocations from the Cottonwood and Camp Verde water systems to Scottsdale (FWS 1998) in exchange for money that would be used to develop wells in the Verde Valley. In the BO, FWS evaluated the impacts of increased water development and use in the Verde Valley as an interdependent and interrelated action to Reclamation's approval of the transfer of the CAP allocations. The impacts evaluated by FWS included depletion of the flow of the Verde River as the result of increased ground water pumping. However, the FWS analysis of effects was primarily directed at the Verde Valley near Cottonwood and Camp Verde and did not extend downstream to Horseshoe or below. FWS concluded in the BO that there was no jeopardy to the listed species in the area—razorback sucker, bald eagle, flycatcher, and Arizona cliffrose; and no adverse modification of critical habitat. In order to minimize take of the listed fish and bird species, FWS required Reclamation to implement a number of reasonable and prudent measures and terms and conditions:

- Provide technical assistance to the Cottonwood and Camp Verde water systems to minimize adverse modification of razorback sucker critical habitat.
- Provide annual reports to FWS on the progress of the Cottonwood and Camp Verde water systems in retiring surface water rights to augment the flow of the Verde.
- Provide information to FWS on the wells drilled by the Cottonwood and Camp Verde water systems and any recharge projects planned by those entities.
- Require wells, pipelines, and other water delivery facilities constructed by the Cottonwood and Camp Verde water systems to occur outside of suitable or occupied flycatcher habitat.
- Work with local landowners and conservation groups to monitor and manage flycatchers and their habitat.
- Require the Cottonwood and Camp Verde water systems to set aside funds to be used to inform and educate the public on the "significant cumulative effects of economic development and population growth on riparian habitat, threatened and endangered species, and water resources in the Verde Valley" (FWS 1998).
- Determine and promote methods to encourage voluntary water conservation measures in the Verde Valley.

1.8.3 Forest Service Consultations

The Tonto National Forest (TNF) is in ongoing consultation with FWS for the Sears Club/Chalk Mountain, Red Creek, and Cartwright grazing allotments in the vicinity of Horseshoe. Previous biological assessments and evaluations (BAEs) by the TNF and BOs on these allotments are summarized below. NEPA and ESA compliance by the TNF for construction of a new recreation facility at Bartlett are also summarized below.

1.8.3.1 Red Creek Allotment BO

The Red Creek Allotment includes about 14 miles of the Verde River upstream from Horseshoe. In 2000, FWS issued a BO on the grazing strategy and associated improvements for the Red Creek Allotment (FWS 2000). The TNF consulted on a new grazing strategy that reduced the number of cattle permitted to use the allotment, retired a pasture, precluded grazing along the Verde River, and included a number of other measures and development of improvements to facilitate the strategy. The intent of the grazing strategy was to be consistent with the Tonto Forest Land Management Plan for the area covered by the allotment, which includes management for the wildlife habitat improvement, livestock forage production, and dispersed recreation (FWS 2000). The BO concluded that take of loach minnows was unlikely because loach minnows are not known to exist in this reach of the Verde River. Similarly, take of flycatchers or cactus ferruginous pygmy-owls was determined to be unlikely because these species had not been found in the area. However, take of Gila topminnows in headwater reaches of small tributaries to the Verde River was anticipated by FWS, which resulted in various terms and conditions identified in the reasonable and prudent measures, which minimized incidental take.

1.8.3.2 Sears Club/Chalk Mountain and Cartwright BAEs

The Sears Club/Chalk Mountain Allotment entirely surrounds Horseshoe and extends downstream in the tributary watersheds on the east side of the Verde to the head of Bartlett Reservoir. The Cartwright Allotment lies west of Horseshoe, adjoining the northern portion of the Sears Club/Chalk Mountain Allotment and extending west into the Cave Creek drainage. In 2001, TNF prepared the most recent BAEs for grazing authorization and management plans for the Sears Club/Chalk Mountain and Cartwright allotments (USFS 2001a, 2001b).

These most recent BAEs are the latest in a series of NEPA and ESA compliance efforts by TNF, which began in 1998 at about the same time as a legal challenge to authorization of grazing on these and other allotments filed by the Southwest Center for Biological Diversity. The challenge by the Southwest Center was based on the continuation of grazing prior to completion of consultation with FWS. In 1999, TNF completed BAEs for these allotments and entered into consultation with FWS. In 2000 and 2001, grazing on these allotments was greatly reduced or eliminated due to drought conditions. On the Cartwright Allotment, TNF has notified FWS that cattle will not be restocked until the range recovers from the drought, and NEPA and ESA compliance is complete. A reduced level of grazing is ongoing on the Sears Club/Chalk Mountain Allotment. In the 2001 BAEs, TNF made “may affect, likely to adversely affect” determinations for the ongoing grazing program relative to a number of listed species, including the flycatcher, Gila topminnow, spikedace, loach minnow, bald eagle, and razorback sucker. These determinations are based primarily on regional grazing guidance criteria issued in August 1998 by FWS (USFS 2001a; USFS 2001b).

1.8.3.3 SB Cove Recreation Site

The Tonto National Forest prepared a BA for construction of the new SB Cove recreation facilities at Bartlett Reservoir (USFS 2002). After informal consultation with FWS, the BA determined that the new recreation facilities may affect, but are not

likely to adversely affect, the bald eagle. The BA also determined that the project will have no effect on the flycatcher because there is no habitat for this species at or near Bartlett and such habitat is not likely to become established at the reservoir (USFS 2002).

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Chapter 2
Alternatives

2.1 Introduction

Chapter 2 describes the formulation and evaluation of alternatives including the criteria for identifying the environmentally preferred alternative. Information on the three alternatives evaluated in detail is provided and alternatives that were excluded from further consideration are summarized. The chapter concludes by identifying the environmentally preferred alternative.

This DEIS focuses on analyzing the No Permit Alternative and the Proposed Action, also known as the Optimum Operation Alternative, in relation to the Modified Historical Operation Alternative. In formulating alternatives for the HCP, FWS and SRP reviewed written comments received during scoping, input from an advisory group, and information gathered during the HCP planning process. The comments and recommendations were considered in the development of reservoir operation alternatives and minimization and mitigation measures proposed in the HCP and used in this DEIS.

The process for alternative development was somewhat unique because this DEIS and the HCP address the continued operation of facilities that have been in operation for more that 60 years, rather than development of a new project. Thus, the formulation of the alternatives involved two primary components:

- Reservoir operation objectives for Horseshoe and Bartlett
- Measures to avoid, minimize, and mitigate possible biological or socioeconomic impacts from continued reservoir operations

The goal of providing habitat conservation for covered species while permitting the continued operation of Horseshoe and Bartlett was determined to be attainable through various combinations of these components. Three alternatives were evaluated in detail in the HCP — No Permit, Modified Historical Operation, and Optimum Operation (the alternative for which SRP has requested a Permit). Other alternatives were considered, such as breaching the dams or different reservoir operations, but these alternatives did not provide an adequate supply of water or had other deficiencies as summarized below in Section 2.6. In addition, various methods to minimize or mitigate impacts to covered species and water supply also were considered but were eventually eliminated from consideration for the reasons summarized in Section 2.6.

2.2 Formulation and Evaluation of Alternatives

FWS and SRP considered a wide range of options and alternatives during development of the HCP. A systematic screening process was used to identify alternatives to be evaluated in detail or to be eliminated from further consideration. The primary factors used during formulation, screening, and evaluation were:

- Compliance with NEPA and ESA
- Impacts on listed, candidate, and other covered species
- Public input

- Impacts on water rights and deliveries
- Extent and feasibility of minimization and mitigation measures
- FWS guidance

Each of these factors is discussed below.

2.2.1 Compliance with NEPA and ESA

As described in Chapter 1, the issuance of a Permit is a federal action requiring compliance with NEPA. NEPA guidelines emphasize that the primary purpose of the alternatives analysis in an EIS is to provide decision makers and the public with an objective comparison to evaluate the merits of different alternatives. Preferably, alternatives selected for analysis should be capable of either eliminating a project's significant adverse impacts or reducing them to a level of insignificance through mitigation. The No Action alternative (termed the No Permit Alternative in this case) should be considered along with a reasonable array of alternatives that are technically and economically feasible. In addition, the lead agency's (FWS) "preferred alternative" must be identified. The "environmentally preferable" alternative as defined in NEPA also should be indicated.

In addition to NEPA requirements for alternatives development and analysis, ESA requirements were considered in the formulation of alternatives. The criteria for Section 10 permits described in Section 1.2 provided guidance for developing alternatives.

2.2.2 Impacts on Covered Species

The purpose of this DEIS and the HCP is to address the potential impacts of SRP's continued full operation of Horseshoe and Bartlett on the listed and unlisted covered species. Unlisted covered species are considered in the HCP as if they were already listed. Thus, potential impacts on the covered species are a primary factor in the development and consideration of alternatives. In particular, alternatives were evaluated in light of two permit issuance criteria: 1) "the applicant will … minimize and mitigate the impacts of such takings," and 2) "the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild" (50 C.F.R. § 17.22). In other words, alternatives that would minimize and mitigate the impact of Horseshoe and Bartlett operations and that would maintain or improve the likelihood of survival and recovery of the species were given priority over alternatives that do not satisfy these permit criteria.

The primary alternatives considered during the development of the HCP involved two components: 1) goals for reservoir operations; and 2) measures to minimize and mitigate biological, environmental, or socioeconomic impacts from each set of reservoir operation goals. With respect to each of the alternatives examined in detail, both components were considered simultaneously because the analysis must address the continued operation of two existing reservoirs (in contrast to evaluation of a new project where alternatives such as build/no build are options).

2.2.3 Public Input

Public input on alternatives was obtained from the Advisory Group established for the

HCP and through public notice and scoping (Section 1.4). Alternatives or mitigation suggested by the public included:

- Change Horseshoe and Bartlett operations to benefit riparian habitat in Horseshoe and along the Verde River
- Do not change Horseshoe and Bartlett operations
- Increase management of livestock grazing as mitigation
- Acquire and protect off-site riparian habitat as mitigation
- Require SRP, the cities, and Indian communities to utilize alternative water supplies

2.2.4 Impacts on Water Rights and Deliveries

As described in Chapter 1, SRP operates Horseshoe and Bartlett in conjunction with other components of its water supply system to provide water to shareholders, cities, Indian communities, and other water users in the Salt River Valley to satisfy water rights under state and federal law. SRP water deliveries are made pursuant to numerous water rights and contracts dating back over a century (Attachment 1, Table I-2 and Appendices 1 and 2). SRP does not lease or sell water; it charges for delivery of water pursuant to the various water rights and contracts. The primary purpose of Horseshoe and Bartlett, as well as the other SRP reservoirs, is to maximize storage of water in times of high runoff for use during times of low runoff to satisfy water delivery obligations to specific water users. Any alternative that does not allow SRP to maximize water storage would not meet the purpose of the reservoirs, would result in adverse impacts to its water users, and would create potential legal liability to SRP. Thus, higher priority was given to alternatives that avoid impacts to water supplies.

2.2.5 Extent and Feasibility of Minimization and Mitigation Measures

The ESA requires HCPs to minimize and mitigate the impacts of taking listed species to the "maximum extent practicable" (50 C.F.R. § 17.22). As part of the evaluation of HCP alternatives, a comprehensive list of potential impact minimization and mitigation measures at Horseshoe and Bartlett and in other areas nearby with potential habitat was developed. Measures on the list that are subject to Section 7(a)(1) and (2) of the ESA were eliminated from further consideration because federal agencies already have a duty to manage federal lands and actions for listed species. Measures on the list that SRP could use to conserve listed species were retained for consideration. The remaining minimization and mitigation measures were then prioritized with highest priority given to measures at or close to Horseshoe and Bartlett, with diminishing priority further from the reservoirs. Finally, the feasibility of the measures was then evaluated and those measures that were found to be impracticable or not cost effective were eliminated from further consideration. The requirement to minimize and mitigate impacts to the maximum extent practicable was satisfied for each alternative by selecting sufficient measures to fully minimize and mitigate the impacts from the specific reservoir operation alternative.

2.2.6 FWS Guidance

Regular meetings between FWS and SRP have occurred since March 2003. Nine

meetings directly involving FWS to discuss development of the HCP were held in 2003, eight in 2004, nine in 2005, seven in 2006 and three in 2007. In addition, fish and watershed technical representatives of FWS, SRP, the Arizona Game and Fish Department (AGFD), and Arizona Department of Water Resources (ADWR) held a number of meetings in 2004 and 2005 to discuss impacts and minimization/ mitigation measures for native fish species. During and between these meetings, FWS provided guidance to SRP by responding to questions and proposals. This guidance included input into the development and evaluation of alternatives.

2.2.7 Alternatives Examined in Detail

Alternative measures to minimize or mitigate biological impacts focus on riparian habitat used by flycatchers because the flycatcher was the primary reason for the development of the HCP. These measures also will benefit cuckoos to a large extent. Minimization and mitigation measures are also provided for impacts from reservoir operations on bald eagles, razorback suckers, and other species of native fishes.

Three primary reservoir operation alternatives were identified for detailed evaluation in the HCP and are considered in this DEIS. Many other alternatives were determined to be infeasible or impracticable, were inconsistent with the reservoir purposes, or were simply minor variations on one of the three primary alternatives. Alternatives that were eliminated from further consideration during the screening process are summarized below in Section 2.6. The alternatives considered in detail are:

- **No Permit** — No issuance of a Permit by FWS. Under this alternative, SRP would do everything within its control to avoid take of federally listed species associated with its continued operation of Horseshoe and Bartlett. This alternative would result in reduced operation of Horseshoe and, in the future, might result in reduced water storage at Bartlett or implementation of other measures to avoid take.
- **Optimum Operation (Proposed Action)** — Issuance of a Permit by FWS allowing SRP's continued full operation of Horseshoe and Bartlett up to their maximum storage elevations, with the addition of operating objectives to support stands of tall dense vegetation at the upper end of Horseshoe to minimize impacts to flycatchers and other covered bird species and to manage Horseshoe Reservoir levels to minimize impacts to covered native fish, frog, and gartersnake species. This alternative includes implementation of all measures provided in this HCP to minimize and mitigate the take of covered species.
- **Modified Historical Operation** — Issuance of a Permit by FWS allowing SRP's continued full operation of Horseshoe and Bartlett up to their maximum storage elevations consistent with historical operating objectives. This alternative would include implementation of measures to minimize and mitigate the take of covered species.

Each of these alternatives is described below.

2.3 No Permit

Under the No Permit Alternative, FWS would not issue a Permit to SRP for continued operation of Horseshoe and Bartlett. Without a Permit, SRP would be expected to do everything within its control to avoid take of federally listed species associated with the continued operation of the reservoirs. To avoid the risk of potential take of flycatchers, Horseshoe would be operated to reduce the water level below the elevation at which flycatchers nested in the previous year before commencement of the nesting season. Unless a large runoff event occurred that could not be passed through the reservoir immediately, the reservoir elevation would be lowered in April to reach a target elevation in early May to expose the vegetation previously used for flycatcher nesting. The maximum target elevation before the nesting season begins, coupled with SRP's practice to draw down Horseshoe before any of the other reservoirs, would ensure that habitat would have leaf canopy available so that previously occupied flycatcher and cuckoo habitat is unlikely to be significantly adversely impacted (see Subchapter IV.A.2 of the HCP for a description of nest height considerations). Although the target elevation might be exceeded in about 3 percent of the years due to uncontrollably high runoff in late spring or summer, the reservoir level would be lowered to the specified elevation as soon as physically feasible (see Attachment 1, Appendix 5, Figure 2). Minimal impact to tree survival or habitat structure is anticipated from these relatively short periods of inundation based on the results of research conducted at Horseshoe in 2005 (Green and Baluff 2007).

To avoid the risk of potential take of currently listed native fishes under the No Permit Alternative, SRP would empty Horseshoe as rapidly as practicable and keep it empty for as long as possible each year to minimize the production of nonnative fish species. In this alternative, Horseshoe would typically be drained by June, although the Verde River would continue to flow through the reservoir bed during periods when Horseshoe is empty. Each year, initiation of the early draw down schedule would be determined by considering factors such as demand for water, inflows into Horseshoe, and available storage capacity in other SRP reservoirs. For example, in years when demand is high, inflows are low to moderate, and other SRP reservoirs are not close to capacity, Horseshoe draw down would begin earlier than in other years. Draw down would begin earlier because there would be demand for the water at the time of release, and other SRP reservoirs would be able to meet demand for water later in the year. See Attachment 1, Subchapter II.B.3 for an expanded description of early and rapid drawdown operations.

Horseshoe would be drained to minimum pool each year unless inflow exceeded outlet capacity and the reservoir could not physically be completely drained. Based on reservoir operation modeling using historical inflows, the probability of not being able to completely drain Horseshoe in any given year is less than 1 percent (1 in 113 years). In almost all years, Horseshoe would be drained by June 1. The timing and frequency of reservoir drawdown under the No Permit Alternative would be nearly identical to the Optimum Operation Alternative (see Attachment 1, Appendix 5, Figures 2 and 3) except that the reservoir level would not be temporarily held at a higher level for a short period of time during droughts when possible to maintain vegetation. SRP would also construct a fish

barrier on Lime Creek to prevent nonnative fishes from moving up that tributary from Horseshoe. Finally, SRP would work with AGFD and FWS to modify the existing Verde native fish stocking and management program to avoid the take of stocked razorback sucker, Colorado pikeminnow, or other listed fishes from Horseshoe and Bartlett operations.

Table 2-1 summarizes measures to avoid take under the No Permit Alternative.

In the future, currently unlisted native fish, frog, and gartersnake species that occur upstream from Horseshoe or downstream from Bartlett may become federally listed and reservoir operations might result in take. In the event these fish, frog, and gartersnake species are listed, the protective provisions of the ESA would be made applicable to activities affecting the species, including the take provisions of Section 9. In order to avoid Section 9 liability, SRP's options would include seeking an incidental take permit, further modifying reservoir operations, or implementing other measures such as blocking fish movement or removing nonnative fishes from the reservoirs. SRP's decision on which option to pursue would depend on the circumstances present at the time, e.g., the certainty of the relationship between take and reservoir operations, technological options for preventing nonnative fishes from moving out of the reservoirs, the then-existing laws and regulations pertaining to federally listed species, legal liabilities to the water users that SRP serves, and the ability to obtain permits for removal of fish or wildlife.

2.4 Optimum Operation (Proposed Action)

The Optimum Operation Alternative would involve issuance of a Permit by FWS for continued full operation of Horseshoe and Bartlett with the addition of reservoir operating goals to support flycatcher and cuckoo habitat at the upper end of Horseshoe and to manage Horseshoe water levels to minimize impacts to covered native fish, frog, and gartersnake species and to benefit the razorback sucker.

2.4.1 Objectives

The reservoirs would be operated consistent with the objectives set forth below. The intent of this alternative is to minimize adverse biological, environmental, and socioeconomic impacts from future reservoir operations, continue water storage at these two reservoirs, and satisfy the criteria of Section 10(a)(2)(B) of the ESA.

Table 2-1. Take avoidance measures for the No Permit Alternative.

Component	No Permit Alternative Take Avoidance Measures
Reservoir Operations	1. Earlier and more rapid Horseshoe drawdown when feasible 2. Minimize Horseshoe summer pool and carryover storage 3. No change in Bartlett operations
Measures for Federally Listed Birds	1. Early drawdown to reach a target elevation in early May to expose stands of tall dense vegetation
Measures for Federally Listed Fish Species	1. Minimize reproduction, recruitment, and survival of nonnative fishes in Horseshoe 2. Construct Lime Creek fish barrier 3. Work with AGFD and FWS to modify the Verde native fish stocking program to avoid take of stocked listed fishes

SRP selected this as the preferred alternative because it believes that this alternative: 1) best minimizes adverse biological, environmental, and socioeconomic impacts from future reservoir operations; and 2) best meets the priorities identified during the process of evaluating alternatives, which are described in Section 2.2.

Under the Optimum Operation Alternative, SRP would continue to operate Horseshoe and Bartlett as part of its reservoir system in a manner consistent with their purpose as water storage facilities. However, two objectives would be added: 1) maintain tall dense vegetation in Horseshoe, and 2) manage Horseshoe water levels to minimize impacts to covered native fish, frog, and gartersnake species and promote reproduction and recruitment of razorback suckers. The addition of those two objectives would result in the following set of objectives for Horseshoe and Bartlett:

- Maintain the safety and integrity of the dams
- Maintain sufficient storage to meet water delivery obligations
- Optimize reservoir storage within the reservoir system
- Maintain adequate carryover storage in case of low runoff
- Conjunctively manage ground water pumping given reservoir storage and projected runoff and demand
- Maximize hydrogeneration
- Permit necessary facility maintenance
- Support stands of tall dense vegetation at the upper end of Horseshoe
- Manage Horseshoe water levels to minimize impacts to covered native fish, frog, and gartersnake species and to promote reproduction and recruitment of razorback suckers

2.4.2 Minimization, Mitigation, Monitoring, and Management

2.4.2.1 Covered Bird Species

Impacts to covered bird species under the Optimum Operation Alternative would be minimized and mitigated as summarized in Table 2-2.

Impacts would be minimized by modifying reservoir operations to make riparian habitat available earlier in the nesting season, and also to maintain riparian vegetation at higher elevations in the reservoir. Under the Optimum Operation Alternative, after two successive years without storage above elevation 1,990 feet, the objective would be to fill Horseshoe in order to saturate the soil and relieve the drought stress on stands of willow trees. Filling Horseshoe after two dry years would depend on whether adequate water supply is

Table 2-2. Covered bird species, minimization and mitigation for Optimum Operation (Proposed Action).

Component	Minimization and Mitigation Measures
Measures for Covered Bird Species	1. Periodic reservoir fills to support stands of tall dense vegetation at the upper end of Horseshoe 2. Acquire offsite riparian habitat 3. Adaptive management as needed including: acquiring additional riparian habitat, bald eagle nest structure(s), and native fish (prey) fish stocking

Table 2-3. Location of proposed riparian habitat acquisition and management.

Site	Acreage	Priority and Probability of Acquisition
Verde Valley	At least 50 acres if feasible	• High priority site for acquisition and management of riparian habitat. • There is a moderate probability that at least 50 acres of habitat can be acquired out of the 290 parcels and 1,900 acres of priority acquisitions identified by The Nature Conservancy (TNC; Fichtel and Marshall 1999). High land costs and small parcel sizes make it difficult to acquire a large enough contiguous tract for suitable habitat. • If additional acres are needed for adaptive management, the Verde Valley will be a priority for acquisition.
Safford Valley	At least 150 acres	• High priority site for acquisition and management of riparian habitat. • SRP has an option on one parcel with 150 mitigation acres, which is adjacent to a large block of habitat that has already been acquired as part of the Roosevelt HCP. • If additional acres are needed for adaptive management, there is a high probability that the necessary amount of habitat can be acquired out of the 125 parcels and over 2,500 acres of priority acquisitions identified by TNC (Id.).
San Pedro or Elsewhere in Central Arizona	Balance of habitat and other measures needed to reach 200 acres, or up to 400 acres if adaptive management is necessary	• Acquisition and management of riparian habitat in other areas in central Arizona will depend on whether sufficient mitigation habitat is obtained in the sites listed above. • There is a high probability that any remaining acres of habitat can be acquired out of the numerous parcels and thousands of acres of priority acquisitions identified by TNC (Id.).

available, consistency with the other reservoir operation objectives, and maintenance of a minimum pool of 50,000 AF in Bartlett to minimize impacts on recreation at that reservoir. As discussed in Attachment 1, Subchapters II.B.3 and IV.B.1.b, the need to manage Horseshoe levels to support stands of tall dense vegetation would occur about once every 14 years on average based on historical runoff patterns.

In order to mitigate the remaining impacts, off-site riparian habitat would be purchased. The average amount of occupied habitat for covered bird species that is predicted to be unavailable due to reservoir operation is not expected to exceed 200 acres. As part of the proposed action, SRP would acquire and manage 200 acres of suitable riparian habitat in the locations and acreages shown in Table 2-3. More information on the mitigation sites, riparian habitat characteristics, details of habitat acquisition, and management of habitat are described in more detail in Attachment 1, Subchapter V.C.2.

Monitoring and adaptive management measures are provided in the HCP in accordance with FWS policies for such permits. The goals for monitoring are to:

1. Assess compliance with Permit terms and conditions
2. Determine species status and trends at Horseshoe and mitigation sites
3. Assess the need for adaptive management in response to changes in circumstances

To accomplish these goals, SRP would monitor the condition and distribution of riparian vegetation at both Horseshoe and the mitigation sites, monitor occupied flycatcher and cuckoo habitat at Horseshoe, monitor long-term flycatcher and cuckoo population trends at the mitigation sites, and monitor future bald eagle nesting in Horseshoe and Bartlett. Additional details about the monitoring programs are in Attachment 1, Subchapter V.C.3.

Adaptive management would be employed for changes in circumstances. Up to 200 acres of additional mitigation habitat would be acquired if impacts at Horseshoe are predicted to exceed 200 acres. If other conditions change—including degradation of mitigation habitat quality or if proposed mitigation land acquisition in particular areas is not feasible—other adaptive management measures would be implemented as described in Attachment 1, Subchapter V.C.4.

2.4.2.2 Covered Fish, Frog, and Gartersnake Species

Impacts to covered fish, frog, and gartersnake species under the Optimum Operation Alternative would be minimized and mitigated as summarized in Table 2-4.

Some minimization and mitigation measures implemented for covered bird species also would benefit covered fish, frog, and gartersnake species. For example, periodically maintaining high reservoir levels to support stands of willow trees at the upper end of Horseshoe would provide favorable conditions for recruitment and growth of razorback suckers, which would be stocked or might spawn during mid-winter if reservoir levels are high before February. In all other years, the goal would be to empty Horseshoe as early and rapidly as feasible to reduce the reproduction and recruitment of nonnative fish species that prey on or compete with native fish, frog, and gartersnake species. About one-third of the time, Horseshoe does not fill at all and drawdown objectives are not relevant. Another one-third of the time, Horseshoe drawdown would begin four to six weeks earlier than the Modified Historical Operation Alternatives, typically in March or April and be complete by May or early June. The remaining one-third of the time, it would not be feasible to draw down Horseshoe early and rapidly because of the water supply impacts described in Attachment 1, Subchapter II.B.3.e. In years when early draw down is not feasible, the draw down schedule would be similar to that for Modified Historical Operation, which would typically empty the reservoir by July. Horseshoe would be completely drained each year, which minimizes nonnative fish recruitment and survival, unless: 1) inflow exceeds outlet capacity and the reservoir could not physically be completely drained,

Table 2-4. Covered fish, frog, and gartersnake species, minimization and mitigation for Optimum Operation.

Component	Optimum Operation (Proposed Action)
Measures for Covered Fish, Frog, and Gartersnake Species	1. Minimize reproduction, recruitment, and survival of nonnative fishes in Horseshoe and provide opportunities for razorback sucker recruitment 2. Construct Lime Creek fish barrier 3. Native fish stocking 4. Native fish hatchery funding 5. Watershed management activities 6. Adaptive management as needed

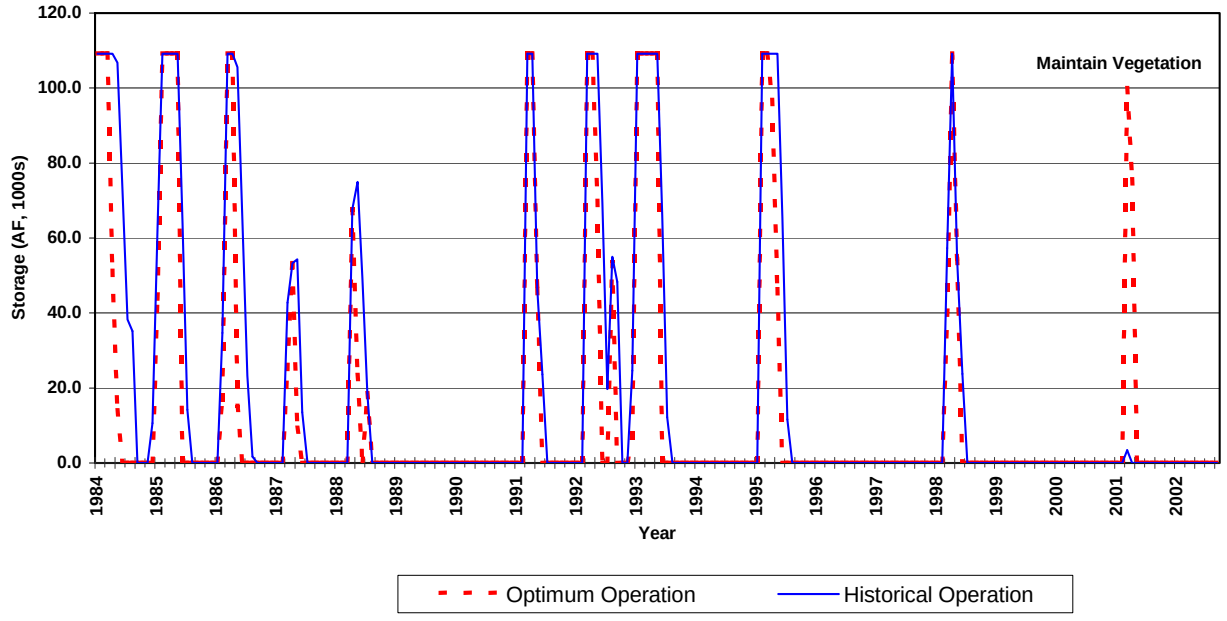
or 2) lack of storage space in Bartlett means that water released from Horseshoe would be spilled. Based on reservoir operation modeling using historical inflows, the probability of not being able to completely drain Horseshoe in any given year is less than 1 percent (1 in 113 years).

Figure 2-1 shows model results for the Optimum Operation Alternative in comparison to the Modified Historical Operation Alternative for runoff conditions in 1984 through 2002 (see Attachment 1, Appendix 5 for results from 1889 through 2002). As can be seen in this example, the Optimum Operation Alternative would result in significantly earlier drawdown in years such as 1984, 1986, and 1995. In the other years when fill occurs, drawdown would begin at about the same time or slightly earlier than modified historical operations, but the rate of drawdown would always be rapid.

Other minimization and mitigation measures to offset impacts to native fish, frog, and gartersnake species would include constructing a fish barrier on Lime Creek, assisting with stocking razorback suckers in Horseshoe and other native fishes in the action area, funding improvements to Bubbling Ponds Native Fish Hatchery, watershed management activities and, if necessary, other mitigation and minimization actions deemed appropriate later in time through adaptive management. The minimization and mitigation measures for native fish, frog, and gartersnake species are described in more detail in Chapter 3 in this DEIS and in Attachment 1, Subchapter V.D.2.

Monitoring native fish, frog, and gartersnake populations and the effectiveness of the minimization and mitigation measures would require periodic surveys in Horseshoe and at several locations on the Verde above and below Horseshoe and Bartlett. SRP would conduct or provide funding for an average of three surveys a year at a maximum of four

Figure 2-1. Comparison of Horseshoe storage, Modified Historical Operation versus Optimum Operation, model results for 1984-2002.



locations. General locations of fish, frog, and gartersnake surveys would be in Horseshoe, above Horseshoe (three locations to be determined), Lime Creek, and at or below Bartlett (at least one location above the Fort McDowell Reservation to be determined). To the extent feasible, especially during the first 5 years, nonnative fishes in Horseshoe would be marked to provide data on survivorship and movement patterns to help assess the effectiveness of the minimization and mitigation measures. The monitoring measures are described in more detail in Attachment 1, Subchapter V.D.3.

As with the covered bird species, monitoring efforts would guide the adaptive management program, with alternative minimization and mitigation measures planned if there are changes in circumstances. The Optimum Operation Alternative covers a specific set of possible changed circumstances, including failure to improve/expand the Bubbling Ponds Native Fish Hatchery; ineffectiveness of the minimization and mitigation actions such as fish stocking; infeasibility of barrier construction on Lime Creek or finding nonnative fishes above the Lime Creek barrier; and increased evidence of a reservoir influence in the periphery of the action area by finding tagged fish in those locations. Each of these changed circumstances, as well as proposed adaptive management measures, is discussed in more detail in Attachment 1, Subchapter V.D.4.

2.5 Modified Historical Operation

The Modified Historical Operation Alternative would involve issuance of a Permit by FWS allowing the continued full operation of Horseshoe and Bartlett consistent with the historical operating objectives set forth below, along with implementation of mitigation measures. The intent of this alternative would be to mitigate the biological and socioeconomic impacts from future reservoir operations, to continue full water storage at these two reservoirs, and to satisfy the criteria of Section 10(a)(2)(B) of the ESA. This alternative also provides a measure of impacts relative to the Optimum Operation Alternative, which is the Proposed Action, and the No Permit Alternative.

2.5.1 Objectives

Under the Modified Historical Operation Alternative, Horseshoe and Bartlett would continue to be operated with the same objectives that SRP has used in the past. As discussed in the HCP (Attachment 1, Subchapter I.F), SRP operates the reservoir system to minimize spills of water past Granite Reef Dam with the following objectives:

- Maintain the safety and integrity of the dams
- Maintain sufficient storage to meet water delivery obligations
- Optimize reservoir storage within the reservoir system
- Maintain adequate carryover storage in case of low runoff
- Conjunctively manage ground water pumping given reservoir storage and projected runoff and demand
- Maximize hydrogeneration
- Operate to permit necessary facility maintenance

2.5.2 Minimization, Mitigation, Monitoring, and Management

As part of the Modified Historical Operation Alternative, the primary mitigation measure for flycatchers and cuckoos would be acquisition and management of off-site riparian habitat in the Verde Valley and in the Safford Valley, or elsewhere in central Arizona. Slightly more habitat would need to be acquired than the Optimum Operation Alternative because of greater impact. Adaptive management would be implemented in the event bald eagles moved their nests into the reservoir storage area.

Mitigation measures for impacts of the Modified Historical Operation Alternative on native fish, frog, or gartersnake species would include greater amounts of the same types of measures employed for the Optimum Operation Alternative, i.e., construction of a fish barrier on Lime Creek, rapid drawdown of Horseshoe during mid to late spring, minimization of summer pool and carryover storage in Horseshoe, assistance with stocking of razorback suckers in Horseshoe and covered native fish, frog, or gartersnake species in the Verde watershed, contributions to Bubbling Ponds Native Fish Hatchery, watershed management efforts and, if necessary, adaptive management. These measures are described in detail in the HCP (Attachment 1, Subchapter V.D.2).

Mitigation measures under the Modified Historical Operation Alternative are summarized in Table 2-5.

Implementation of the Modified Historical Operation Alternative would also require monitoring and adaptive management measures similar to those described for the Optimum Operation Alternative in Sections 2.4.2.1 and 2.4.2.2.

2.6 Alternatives Eliminated From Further Consideration

A number of alternatives, including certain minimization or mitigation measures for biological and socioeconomic impacts, were determined to be infeasible, would not meet the project purposes, or were simply minor variations of the three alternatives summarized above. The alternatives that

Table 2-5. Minimization and mitigation measures for Modified Historical Operation.

Component	Minimization and Mitigation Measures
Reservoir Operations	1. Earlier and more rapid Horseshoe drawdown when feasible 2. Minimize Horseshoe summer pool and carryover storage 3. Hold water in spring if Horseshoe dry for 2 years
Measures for Covered Bird Species	1. Acquire offsite riparian habitat (stands of tall dense vegetation are present at Horseshoe but only intermittently available) 2. Adaptive management if bald eagles move their nests into the reservoir storage area.
Measures for Covered Fish, Frog, or Gartersnake Species	1. Construct Lime Creek fish barrier 2. Native fish stocking 3. Native fish hatchery funding 4. Watershed management activities 5. Adaptive management as needed

were eliminated and the reasons for elimination are summarized below in Table 2-6. The eliminated alternatives are discussed in detail in Appendix 3 of the HCP (Attachment 1).

Table 2-6. Alternatives eliminated from further consideration.

ALTERNATIVE OR MEASURE	PRIMARY REASONS FOR ELIMINATION
Reservoir Operation Alternatives	
Breach Horseshoe and Bartlett	• Entirely defeats the purpose of Horseshoe and Bartlett. • Breach of Horseshoe and Bartlett is infeasible due to Congressional approval of the FMYM, SPMIC, and GRIC water rights settlements. • Breaching is beyond the scope of FWS review of SRP reservoir operations. • Large socioeconomic impacts.
Modified full operations with vegetation management	• Modified full operation (storing water longer and higher in the reservoir) to promote riparian tree growth at upper end of the lake is likely to increase nonnative fish production and likely would not provide more flycatcher and cuckoo habitat on average than optimum operations. • Vegetation management (removing trees) in lower parts of the conservation pool to prevent flycatchers from occupying habitat that would be frequently inundated was controversial and not supported by resource agencies.
Major changes in Horseshoe and Bartlett Operations (releases to mimic natural hydrograph, and sediment transport around the dams)	• Major changes in Horseshoe and Bartlett operations are infeasible because of the effect on the Congressional approval of water rights settlements with the FMYN, SPMIC, and GRIC. • Natural hydrograph releases would not allow SRP to meet contractual water demands and would provide only limited additional benefits to downstream riparian vegetation and native fish, frog, or gartersnake populations compared to Optimum Operation Alternative (see HCP Appendix 3). • Sediment transport would be very expensive, with uncertain benefits to riparian vegetation and possible adverse impacts on some wildlife. • Large socioeconomic impacts.
Measures to Minimize or Mitigate Impact on Listed Species — Salt and Verde Watersheds	
Protect and restore riparian habitat on public land outside of Horseshoe	• Already subject to 7(a)(1) and 7(a)(2) of ESA. • Limited amounts of riparian habitat for flycatchers are available on USFS land due to narrow floodplains and high gradient.
Removal of catch limits on nonnative fishes	• Beyond SRP control.
Chemical removal of nonnative fishes in and below Bartlett	• Uncertain effectiveness and high cost in large river system. • Significant concern over the controversy that may arise from the public over concerns about impacts to water quality, including drinking water supply, and impacts to sport fishing opportunities. • AGFD has determined that chemical renovation in the reach would not be feasible.

ALTERNATIVE OR MEASURE	PRIMARY REASONS FOR ELIMINATION
Chemical removal of nonnative fishes in and above Horseshoe	• Same reasons listed immediately above for chemical removal of nonnative fishes in and below Bartlett.
Salvage of native fishes from SRP canals	• Implementation at this time is not appropriate due to golden algae that can cause native and sport fish mortality, and low abundance of native fishes in the canals. • Expands the Action Area.
Develop refugia ponds in upper Verde	• Lack of suitable locations not already utilized.
Develop quarantine facility	• More suitable for native fish transplant activities. • Higher priority conservation measures are available.
Participate in and support development of state conservation agreement (SCA), including funding of AGFD fish biologist position	• Not supported by FWS as a mitigation measure under this HCP due to failure to meet Permit issuance criteria as per current policy.
Fund spikedace-loach minnow surveys	• Research measures not favored for HCPs.
Fund information and education program for native fishes	• Uncertain effectiveness. • Other measures would provide more immediate and direct benefit.
Prioritize stocking listed fish species below Bartlett	• Would likely result in concerns from third parties by increasing presence of fish in an area where potential take from existing activities such as water diversions and recreational uses occur.
Measures to Minimize or Mitigate Water Supply Impacts Resulting from Changes in Reservoir Operations	
Additional ground water pumping	• Severely limited by the 1980 Arizona Groundwater Management Act. The Act passed because ground water is a non-renewable resource, and because continued depletion would have large socioeconomic and environmental impacts.
Reduction of water use through conservation measures	• Already being implemented as required by sound water management, the Arizona Groundwater Management Act, and sometimes in response to drought.
Recharge of water that cannot be stored at Horseshoe and Bartlett	• Severely limited by legal, institutional, practical, and cost constraints.
Use of CAP water	• Limited by availability and cost.
Use of effluent	• Limited by availability, practical considerations, and cost.
Acquisition of water from other sources or water users	• Limited quantity is available locally; importing large amounts is infeasible due to availability and cost. • Environmental impacts from use or relocation of other water sources.

2.7 Environmentally Preferred Alternative

The environmentally preferred alternative is determined by applying the criteria suggested in the National Environmental Policy Act of 1969, which is guided by the Council of Environmental Quality (CEQ Section 1505.2[b]). The CEQ provides direction that the environmentally preferable alternative is the alternative "that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural and natural resources." As expressed in Section 101 of NEPA (42 U.S.C. § 4331), "it is the continuing responsibility of the Federal Government to:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- Assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings;
- Attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences;
- Preserve important historic, cultural and natural aspects of our national heritage and maintain, wherever possible, an environment that supports diversity and variety of individual choice;
- Achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources."

The environmentally preferred alternative for Horseshoe and Bartlett was identified using these national environmental policy goals. A discussion of how each alternative meets these goals is provided following a summary comparison of the alternatives.

2.7.1 Comparison of Alternatives

Table 2-7 provides a summary comparing the potential impacts of the three alternatives. Chapter 3—Affected Environment and Environmental Consequences provides a detailed discussion of the impact of these actions on each resource.

Table 2-7. Summary comparison of alternatives and impacts.

No Permit (No Action by FWS)	Modified Historical Operation	Optimum Operation (Preferred Alternative)
WATER RESOURCES AND FLOOD CONTROL		
Reduction in local and regional water supply, including an average annual decrease in SRP, Phoenix, and SRPMIC supplies of 11,000 acre-feet. Water users would have to find a replacement water supply other than ground water. Possible depletions of ground water resources. Slight benefit to flood control.	No change in storage capacity or local and regional water supply. No change in water supplies. No change in flood control.	No change in storage capacity or local and regional water supply. No change in water supplies. No change in flood control.
GEOLOGY AND GEOMORPHOLOGY		
May result in insignificant changes in flows and sediment deposition patterns.	Current influence of reservoirs on flows and sediment deposition would not change.	May result in insignificant changes in flows and sediment deposition patterns.
VEGETATION		
Long-term presence of riparian vegetation at Horseshoe is not certain. During drought, reservoir levels would not be managed to maintain riparian vegetation. Quantity of riparian vegetation at Horseshoe likely to be less over time relative to the Modified Historical Operation and Optimum Operation alternatives. No change in quantity or quality of existing upland vegetation surrounding reservoirs.	No significant long-term change in the amount of riparian vegetation, but less than Optimum Operation Alternative. Could result in increased riparian habitat at mitigation sites. No change in quantity or quality of existing upland vegetation surrounding reservoirs.	Long-term maintenance of riparian habitat at Horseshoe. No significant adverse impacts on woody riparian vegetation downstream of the dams due to dam operations. Could result in increased riparian habitat at mitigation sites. No change in quantity or quality of existing upland vegetation surrounding reservoirs.
GENERAL WILDLIFE		
Wildlife favoring upland habitat may benefit. Species favoring riparian habitat would be adversely impacted in the long term.	No change in wildlife habitat at Horseshoe or Bartlett. Habitat acquisition and management, and additional habitat conservation measures would benefit wildlife and aquatic resources at mitigation sites.	Maintenance of riparian habitat at Horseshoe would benefit riparian-dependent species. Habitat acquisition and management, and additional habitat conservation measures would benefit wildlife and aquatic resources at mitigation sites.

COVERED SPECIES		
Flycatcher—Unlikely to have a significant adverse impact in the short term, but a long-term reduction of habitat at Horseshoe is likely without periodic inundation. No significant adverse impact on critical habitat. No mitigation measures would be implemented. ***Cuckoo***—Impacts and mitigation the same as those described for flycatcher. ***Bald Eagle***—No impacts to eagle nests at the reservoirs because no nests currently occur within the conservation space of the reservoirs; no significant adverse impacts to riparian habitat downstream of the dams that is used by eagles. Likely will be fewer bald eagle perching trees available at upper end of Horseshoe over the long term, but would not cause significant adverse impacts. No significant adverse impacts to eagle forage base in the action area – diversity and abundance of important prey species not significantly adversely impacted. ***Covered Native Fish, Frogs, and Gartersnakes***— Impacts to covered native fish, frog, and gartersnake habitat would be 31.9 river miles over the long term. No significant adverse impacts to currently listed species (razorback sucker, Colorado pikeminnow, Gila topminnow) with implementation of mitigation measures described below. No significant adverse impact to critical habitat of razorback sucker. Nonnative fish would continue to reproduce in Horseshoe and Bartlett. Mitigation measures include: 1. rapid drawdown, 2. Lime Creek fish barrier, and 3. working with AGFD and FWS to modify the existing native fish stocking program to prevent take of currently listed species.	***Flycatcher***—Anticipated periodic losses of an annual average of up to 200 acres of habitat due to inundation or desiccation. Long-term flycatcher productivity lower than under Optimum Operation Alternative. No significant adverse impact on critical habitat. Acquire off-site riparian habitat for mitigation. ***Cuckoo***— Impacts and mitigation the same as those described for flycatcher. ***Bald Eagle***—No impacts to eagle nests at the reservoirs because no nests currently occur within the conservation space of the reservoirs - adaptive management would be implemented if bald eagles move nests into conservation space of reservoirs. No significant adverse impacts to riparian habitat downstream of the dams that is used by eagle. No significant adverse impacts to eagle forage base in the action area – diversity and abundance of important prey species not significantly adversely impacted. ***Covered Native Fish, Frogs, and Gartersnakes*** — Impacts to covered native fish, frog, and gartersnake habitat would be 39.5 river miles over the long term. No significant adverse impact to critical habitat of razorback sucker. Nonnative fish would continue to reproduce in Horseshoe and Bartlett. Mitigation measures include: 1. rapid drawdown and keeping Horseshoe empty as much as possible, 2. Lime Creek fish barrier, 3. participating in native fish stocking program, 4. funding native fish hatchery improvements, 5. conducting watershed management activities, and 6. adaptive management.	***Flycatcher***—Additional vegetation growth and flycatcher population growth over the long term, with periodic losses of flycatcher habitat occurring over the life of the Permit. Periodic inundation of an annual average of up to 200 acres of Horseshoe habitat would likely result in delayed or lost breeding attempts, decreased productivity and survivorship of dispersing adults in search of suitable breeding habitat, and decreased productivity of adults that attempt to breed at Horseshoe. No significant adverse impact on critical habitat. Mitigation measures include: 1. early season drawdown to maximize nesting habitat, 2. managing operations to support stands of tall dense vegetation at the upper end of Horseshoe, 3. acquiring off-site riparian habitat, and 4. adaptive management. ***Cuckoo***—Impacts and mitigation the same as those described for flycatcher. ***Bald Eagle***— No impacts to eagle nests at the reservoirs because no nests currently occur within the conservation space of the reservoirs - adaptive management would be implemented if bald eagles move nests into conservation space of reservoirs. No significant adverse impacts to riparian habitat downstream of the dams that is used by eagle. No significant adverse impacts to eagle forage base in the action area – diversity and abundance of important prey species not significantly adversely impacted ***Covered Native Fish, Frogs, and Gartersnakes*** — Impacts to covered native fish, frog, and gartersnake habitat would be 33.9 river miles over the long term. No significant adverse impact to critical habitat of razorback sucker. Nonnative fish would continue to reproduce in Horseshoe and Bartlett. Mitigation measures include: 1. rapid drawdown and keeping Horseshoe empty as much as possible, 2. Lime Creek fish barrier, 3. participating in native fish stocking program, 4. funding native fish hatchery improvements, 5. conducting watershed management activities, and 6. adaptive management.

OTHER THREATENED, ENDANGERED, AND SENSITIVE SPECIES		
No adverse impact on other threatened, endangered, or sensitive species.	No adverse impact on other threatened, endangered, or sensitive species.	No adverse impact on other threatened, endangered, or sensitive species.
RECREATION		
Lowered Horseshoe water levels earlier in the year than historical operations would slightly reduce recreation opportunities at Horseshoe.	Recreation use at Horseshoe would vary with water levels similar to historical conditions.	Recreation use at Horseshoe would vary with water levels similar to current conditions. Operational changes to maintain riparian vegetation at Horseshoe could periodically increase recreation opportunities above current opportunities during drought; and slightly decrease recreational opportunities at Bartlett.
SOCIO-ECONOMICS AND ENVIRONMENTAL JUSTICE		
Water Use—If sources could be found, the cost to replace lost water supplies would be about $5.0 to 5.6 million per year. Increased costs would result in secondary impacts to the regional economy. Local residents and businesses would be impacted by increased water costs. ***Environmental Justice***—Minority and low-income populations would not be disproportionately impacted.	***Water Use***—No impact to current water supply costs. ***Environmental Justice***—Minority and low-income populations would not be disproportionately impacted.	***Water Use***— No impact to current water supply costs. ***Environmental Justice***—Minority and low-income populations would not be disproportionately impacted.
LAND USE AND LAND OWNERSHIP		
No change in land use or land ownership.	No change in land use patterns at Horseshoe and Bartlett. Acquisition of land at mitigation sites would preserve land in a natural condition, but may eliminate grazing, agriculture, or other land practices.	No change in land use patterns at Horseshoe and Bartlett. Acquisition of land at mitigation sites would preserve land in a natural condition, but may eliminate grazing, agriculture, or other land practices.
CULTURAL RESOURCES		
Cultural resource sites that are currently periodically inundated would be exposed for longer durations, which could subject the sites to degradation and vandalism.	The timing and duration of inundation of cultural resource sites would remain the same as current conditions.	Cultural resource sites would be inundated slightly more often than under the Historic Operations Alternative, which could reduce degradation and vandalism.
AIR QUALITY		
No impact at reservoir sites. Possible short-term impact from fugitive dust associated with Lime Creek fish barrier construction.	No impact at reservoir sites. Possible short-term impact from fugitive dust associated with Lime Creek fish barrier construction.	No impact at reservoir sites. Possible short-term impact from fugitive dust associated with Lime Creek fish barrier construction.

2.7.2 No Permit Summary (No Action by FWS)

This alternative provides for the short-term protection of natural resources, including threatened, endangered, and candidate species by maintaining existing levels of habitat at Horseshoe and Bartlett. However, long-term maintenance of existing riparian habitat may not occur in the event of sustained drought. Additionally, this alternative does not address currently unlisted species that may be listed in the future. The No Permit Alternative would maintain a safe environment, although there would be some degradation of the aesthetic quality at Horseshoe and possibly Bartlett with lower water levels and greater exposure of unvegetated slopes around the reservoir perimeters. Natural and cultural resources would be maintained with a slight increase in potential disturbance of cultural resources exposed by lower lake water levels. Recreation opportunities would be diminished at Horseshoe and possibly Bartlett with a reduction in reservoir surface area. The No Permit Alternative would result in a decreased use of renewable resources by reducing water storage. Development of replacement water sources may be insufficient to meet existing and future needs, may be detrimental to the environment, and may require increased use of declining aquifers. This alternative may result in higher water costs for many Arizona residents and businesses and there would be secondary impacts on the regional economy. While this alternative would provide for the near-term protection of threatened and endangered species, it does not fully meet the provisions of the environmental policy goals.

2.7.3 Modified Historical Operation Summary

Modified Historical Operation would result in a periodic loss of habitat for threatened, endangered, and candidate species from inundation of tall dense vegetation. Over the long term, suitable habitat would be available on average, but fluctuations in reservoir levels would result in greater periodic decreases in species productivity than the Optimum Operation Alternative. Replacement of impacted habitat at off-site areas could provide long-term protection and availability of habitat for federally listed species. Modified Historical Operation would allow for continued public use of existing recreation capacity. The quality of the aesthetic environment would be maintained and adverse impacts to cultural resources would be unlikely. Available water to support the residents and businesses in the Phoenix area would be maintained, with no impact to the local and regional economy. The use of renewable water resources would continue. Although off-site mitigation proposed under this alternative would provide long-term protection of threatened and endangered species, it does not fully meet the provisions of the environmental policy goals because it does not use on-site mechanisms to help address the periodic loss of habitat that would result from periodic inundation and so does not as fully minimize impacts as the Optimum Operation Alternative.

2.7.4 Optimum Operation Summary (Preferred Alternative)

The Optimum Operation Alternative provides on-site benefits for threatened, endangered, and candidate wildlife species

by managing the reservoir elevations to minimize habitat inundation and nonnative fish production. The Optimum Operation Alternative would maintain tall dense vegetation at Horseshoe during droughts. Habitat acquisition, management, and conservation would provide another long-term source of available habitat. Unlike the No Permit Alternative, this alternative includes strategies to address currently unlisted species that may be listed in the future. Scenic values at Horseshoe and Bartlett would be near current conditions and public safety would be maintained. Recreational opportunities and exposure of cultural resources would be maintained at near current levels. The water supply available to the Phoenix area would be maintained with no additional investment in developing new water supplies with adverse environmental consequences.

2.7.5 The Environmentally Preferred Alternative

The Optimum Operation Alternative is the environmentally preferred alternative because it surpasses other alternatives in realizing the full range of environmental policy goals in Section 101 of NEPA. Although the No Permit Alternative provides for the immediate protection of threatened, endangered, and candidate species, it is likely to provide less long-term habitat for those species in comparison to the other alternatives. Short-term protection of habitat would result in adverse impacts to other natural resources, recreation, the local and regional economy, and use of renewable resources. Modified Historical Operation has few impacts on recreation, socio-economics, renewable resources, or cultural resources, but it does not minimize impacts to flycatcher habitat at Horseshoe. The Optimum Operation Alternative provides for a high level of resource protection by managing reservoir operations to maintain riparian habitat at Horseshoe, acquiring and permanently protecting suitable replacement habitat for species impacted by periodic habitat inundation at Horseshoe and Bartlett, and mitigating impacts on native fish, frog, and gartersnake species. This alternative also provides the widest range of beneficial uses of the environment, maintains an environment that supports a diversity and variety of individual choices, and provides the best overall balance in integrating resource protection with permitting a high standard of living for the local population.

Chapter 3 Affected Environment and Environmental Consequences

This chapter includes a discussion of the affected environment and provides information on existing conditions in areas potentially affected by the proposed alternatives. Background information is provided for natural and physical resources, cultural resources, and socioeconomic resources. This information establishes the existing conditions against which the potential impacts on resources from implementation of the proposed alternatives are evaluated.

In a typical NEPA analysis, existing and future environmental conditions are defined by the no action alternative and other alternatives are compared to these conditions. However, for this project, the Modified Historical Operation Alternative is the continued operation of Horseshoe and Bartlett reservoirs and the No Permit or No Action alternative may require a modification in the operation of the reservoirs. Thus, for comparison purposes in the discussion of environmental consequences, the No Permit and Optimum Operation alternatives are the primary alternatives and the Modified Historical Operation Alternative is used for comparing impacts with those alternatives.

The study area within which environmental conditions are described includes areas that would be directly and indirectly impacted by the proposed alternatives. Direct impacts would be caused by the proposed alternatives and would occur at the same time and place as the activities in the alternatives. Indirect impacts of the proposed alternatives would take place later in time or farther away, but are still reasonably foreseeable.

Areas that might be directly impacted by the proposed alternatives are:

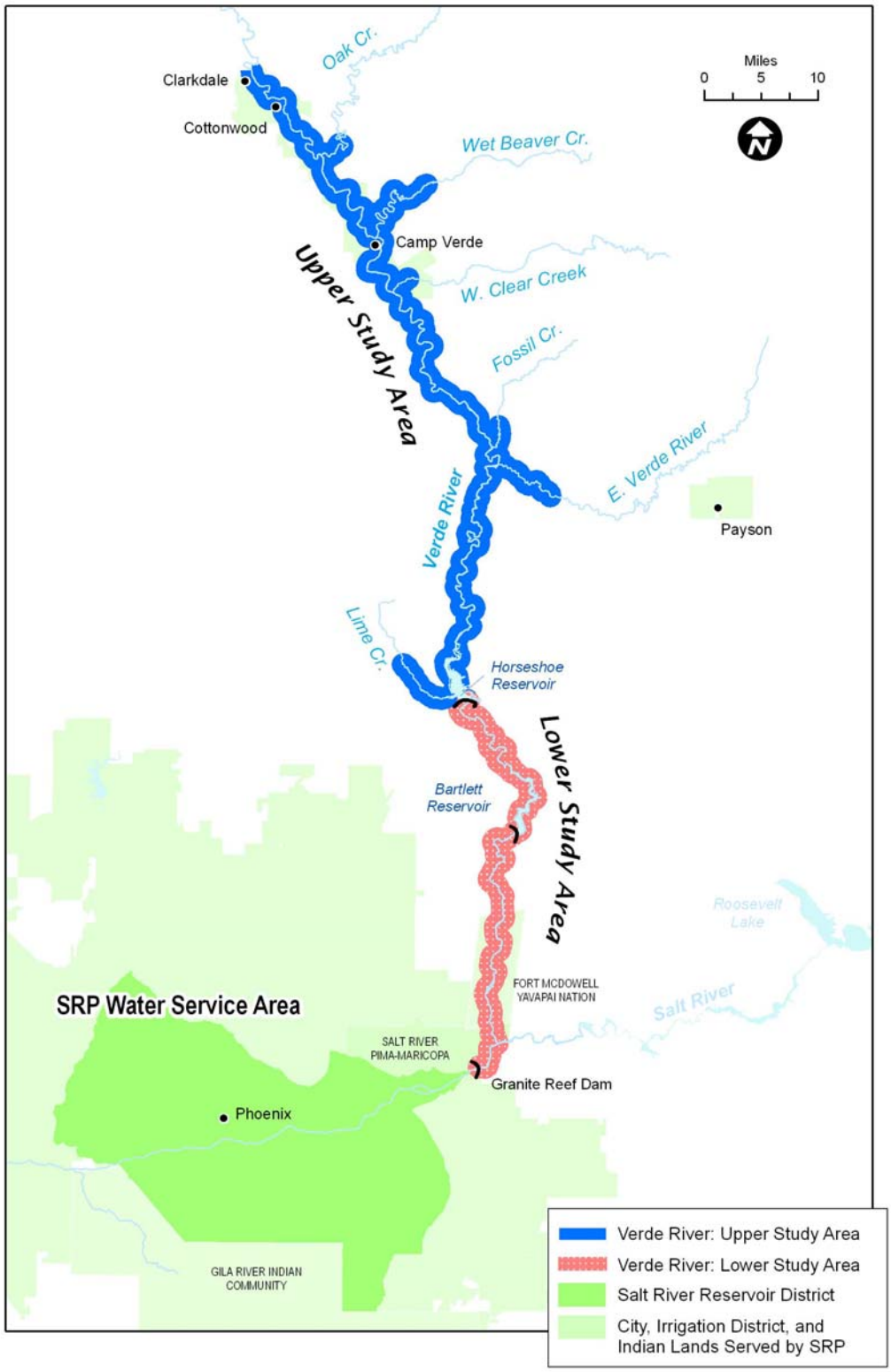
- The Salt River and 100-year floodplain between Granite Reef Dam and the confluence with the Verde River
- The Verde River and the 100-year floodplain between the confluence with the Salt River and the upper end of Horseshoe at full pool
- The maximum footprint of the reservoirs, which for Horseshoe is up to an elevation of 2,026 feet, and for Bartlett is up to an elevation of 1,798 feet

Areas that might be indirectly impacted by the proposed alternatives are:

- The Verde River between the upper end of Horseshoe at full pool and the Allen Ditch Diversion near Peck's Lake
- Certain reaches of tributaries to the Verde River (Attachment 1, Subchapter I.B.2)
- Lands acquired for flycatcher mitigation as part of the HCP
- The SRP water service area (socioeconomic impacts)

Figure 3-1 shows the study area for purposes of this DEIS.

Figure 3-1. Study area (HCP mitigation lands in other watersheds are not shown).



In compliance with the guidelines contained in the NEPA and Section 1502.15 of the regulations for implementing that Act developed by the CEQ (48 FR 34263 (1983)), the description of the affected environment focuses on only those environmental resources potentially subject to the impacts resulting from the proposed alternatives.

Major resources that may be impacted by alternative reservoir operations considered in the DEIS are:

- Water resources and flood control
- Geology and geomorphology
- Vegetation
- General wildlife
- Threatened, endangered, candidate, and sensitive species
- Recreation
- Socioeconomics and environmental justice
- Land use and land ownership
- Cultural resources
- Air quality

The existing condition for these resources is described for various parts of the study area from the upper end of Horseshoe downstream to the SRP water service area. The reaches of the Verde River and its tributaries above Horseshoe are included in the study area because fish, frog, and gartersnake species would potentially be subject to indirect impacts resulting from reservoir operation alternatives. Although a number of environmental resource issues impact fish, frog, and gartersnake populations in these reaches (e.g., water quality, recreation, and water diversions), other resources would not be impacted by the reservoir operation alternatives. Thus, only impacts on threatened, endangered, and sensitive fish, frog, and gartersnake species are considered as part of the affected environment above Horseshoe.

3.1 General Description of the Study Area

Within the study area, the Verde River flows through central Arizona from an elevation of about 3,400 feet at the Allen Ditch Diversion to 1,313 feet at Granite Reef Dam. Vegetation along the Verde River and its floodplain from upper Horseshoe to Granite Reef Dam is classified as Deciduous Riparian Woodland and Emergent Marshland according to Brown (1973, 1982). Dominant species in the riparian woodland community type include Fremont cottonwood (*Populus fremontii*), Goodding's willow (*Salix gooddingii*), velvet ash (*Fraxinus velutina*), velvet mesquite (*Prosopis velutina*), salt cedar (*Tamarix ramosissima*), and seepwillow (*Baccharis salicifolia*). Dominant wetland plant species include cattail (*Typha* spp.), horsetail (*Equisetum* spp.), bulrush (*Scirpus* spp.), rush (*Juncus* spp.), spike rush (*Eleocharis* spp.), and sedge (*Carex* spp.).

In the study area, the Verde River flows through a variety of geologic settings from the thick Verde Formation in the Verde Valley to the basalt and Precambrian granitoid outcrops found along the lower reaches of the river (Arizona Bureau of Mines 1958; Reynolds 1988). In general, the geomorphology of the Verde River reflects the geologic setting, forming broad basins through less-resistant formations and narrow valleys as it flows through harder materials (Pearthree 1996). Canyon reaches, such as those above Horseshoe and between Horseshoe and Bartlett, constrain the river to a narrow valley bottom, with discontinuous pockets of floodplain material. Alluvial

terraces are less common, often merging with colluvial deposits, tributary debris flow deposits, and alluvial fans to form uneven higher areas along the valley sidewalls (Beyer 1997). In the Verde Valley and downstream from Bartlett Dam, the river valley is broad and the floodplain is relatively wide. Generally, the river exhibits a distinct low-flow channel within a wider flood channel (Beyer 1997; MEI 2004).

The study area is within a region classified as a semi-arid climate, exhibiting a range of temperature and precipitation conditions (Beyer 1997). These conditions influence the type of vegetation and infiltration characteristics found along the river corridor. Precipitation tends to be seasonal, induced in the winter by frontal storms and in the summer by monsoon convectional events (Owen-Joyce and Bell 1983; Owen-Joyce 1984). At higher elevations in the watershed, precipitation occurs as both rain and snow; while precipitation at lower elevations, including most of the study area, is primarily rain. The highest runoff commonly occurs between March and April from snowmelt. May and June tend to be the driest months. About 40 percent of precipitation occurs in July, August, and September during short-duration, intense thunderstorms associated with monsoon patterns (Owen-Joyce 1984).

Perennial flow in the Verde River and its major tributaries is maintained by ground water discharge from several large geologic units – the Verde Formation, Coconino Sandstone, Supai Formation, Naco Formation, Redwall limestone, Martin Formation, and Tapeats Sandstone (Owen-Joyce and Bell 1983). Ground water in the alluvium adjacent to streams is hydraulically connected to the Verde River and its tributaries throughout the study area (Owen-Joyce and Bell 1983).

A variety of factors influence the hydrologic system of the Verde River in the study area. These factors include precipitation, stream flow, subsurface flow, inflow to and outflow from the underlying ground water system, and water loss from evaporation and transpiration (Owen-Joyce and Bell 1983). Anthropogenic influences on these factors include surface water diversions, ground water pumping from the alluvial aquifer and source aquifers, and changes in watershed condition that affect runoff amounts and patterns.

The aquatic and riparian communities of the Verde River and its major tributaries have been, and continue to be, altered by impacts from land uses, water use, livestock grazing, sand and gravel extraction operations, recreation, and a number of other activities.

Land ownership varies throughout the study area. The USFS manages much of the study area, portions of which are in Tonto National Forest, Coconino National Forest, and Prescott National Forest. Other portions of the study area are owned by private parties and by Indian communities.

With the exception of covered fish, frog, and gartersnake species upstream of the upper end of Horseshoe (upper study area), the following descriptions of resources are applicable to the lower portion of the study area downstream of the upper end of Horseshoe. As explained earlier, resources above Horseshoe other than covered fish, frog, and gartersnake species would not be impacted by the proposed alternatives.

The HCP contains detailed descriptions of existing conditions in mitigation areas targeted for acquisition under the Modified Historical Operation and Optimum Operation alternatives. (Attachment 1, Subchapter V.C.2.b). In the following

discussion of resources and potential impacts of the alternatives, mitigation areas are discussed only when a particular resource associated with the mitigation areas would be impacted by acquisition and subsequent management of the property.

3.2 Water Resources and Flood Control

3.2.1 Water Resources and Flood Control Affected Environment

This section provides hydrological information for the Verde River in the study area. It also includes Horseshoe and Bartlett reservoir operation information. Additional information on the Verde River, its tributaries, and the reservoirs is in Chapters I, II, and IV of the HCP (Attachment 1).

Annual precipitation in the study area is 12 inches or less (ADWR 2000). However, mountain ranges in the upper Verde River basin average up to 25 inches of precipitation per year (ADWR 2005). Precipitation at higher elevations in the Verde River basin is not always reflected in runoff at lower elevations if snowmelt proceeds slowly or if rains are relatively gentle and soils are unsaturated. However, high intensity rainfall, rapid snowmelt, or a combination of both, occasionally results in flooding.

3.2.1.1 Surface Water

The Verde River watershed lies within the Gila River basin, an irregular area of approximately 58,200 square miles extending from the Continental Divide in southwestern New Mexico to the Colorado River at Yuma, Arizona. It includes most of central and southern Arizona and constitutes a region of diverse topographical and climatological characteristics. The Salt River is the largest tributary of the Gila River and drains approximately 13,700 square miles within the central and eastern portions of Arizona. The Verde River, which joins the Salt River just upstream of Granite Reef, is the largest tributary of the Salt River and drains an area of approximately 6,250 square miles (USGS 1991).

3.2.1.2 Ground Water

The lower study area is located in the Verde Canyon basin (ADWR 2005) of the Basin and Range aquifer (USGS 2005) where there is relatively little ground water development. Water from wells and springs is used mainly for domestic and stock purposes. The ground water varies because of variation in topography and geologic units (e.g., unconsolidated sediments vs. basalt flows) (ADWR 2005). Wells can yield between 50 to several hundred gallons per minute depending on the water-bearing characteristics of the underlying geologic units (ADWR 2005).

3.2.1.3 Flood Control

Indirectly, Horseshoe and Bartlett reservoirs slightly reduce downstream flood hazard. The reservoirs provide limited attenuation of floods because their capacity is relatively small compared to flood volumes. In order to minimize evaporation losses Horseshoe is drawn down completely before lowering Bartlett; and as a result, Horseshoe has more flood capacity than Bartlett during draw down months.

3.2.1.4 Operation of Horseshoe and Bartlett

Surface water resources are critical components of the SRP water supply. Existing water supplies in the arid climate of central Arizona are limited. The primary

purpose of Horseshoe and Bartlett has been to maximize the conservation of water by storing water in times of high runoff for later use. The reservoirs are an integral part of the Salt River Project system of storage reservoirs that provide municipal and irrigation water, hydropower, and some flood attenuation for central Arizona.

Horseshoe and Bartlett are at the lower end of the Verde River, below nearly all of the major tributaries. Dam operations alter flow parameters such as the magnitude, frequency, duration, timing, and rate of change. Differences in flow parameters above and below Horseshoe and Bartlett dams are discussed below.

The extent of flow alteration by dams and reservoirs is related to their storage and outlet capacities. Horseshoe and Bartlett are relatively small in proportion to average runoff, which means that they fill quickly and large inflows pass through with relatively little change in flow characteristics. The outlet valves at the dams have low capacities relative to peak Verde River flows. The maximum capacity of the Horseshoe Dam outlet valve is 1,800 cfs at full reservoir levels. The maximum release at full reservoir levels through Bartlett Dam's two outlet valves is 2,400 cfs. Thus, unless the spillway gates are being used to pass flood flows or the reservoirs are spilling, the maximum flows below Horseshoe are 1,800 cfs and the maximum flows below Bartlett are 2,400 cfs.

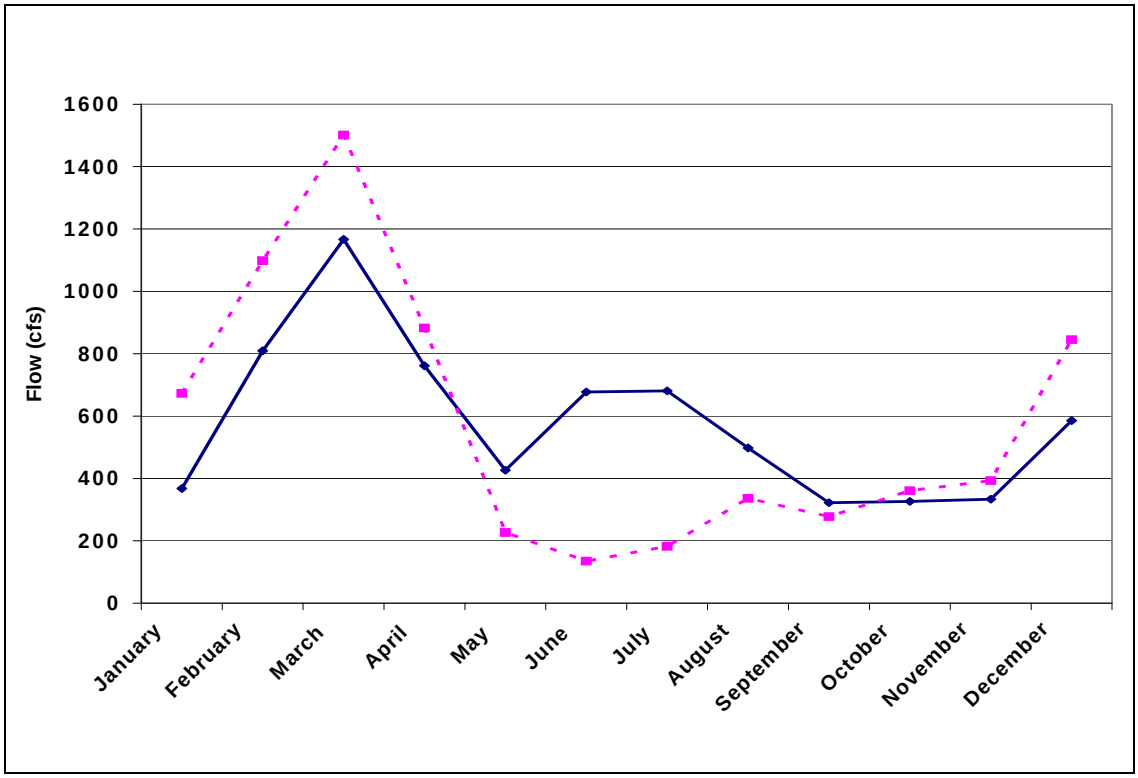
Minimum Flow. Following closure of Bartlett in 1939 and Horseshoe in 1945, the minimum flow of the Verde River below Bartlett was reduced — "most years experienced low flows below 50 cfs, with many years recording some days with zero flow" (Graf 1999). However, in 1993, SRP and the Fort McDowell Indian Community (now known as the Fort McDowell Yavapai Nation) entered into a permanent agreement that stipulates that a 100 cfs flow will be released from Bartlett Dam year-round except in extreme drought or an emergency (Attachment 1, Appendix 2). The minimum flow releases became effective on February 7, 1994 and have been continuous since that time except for brief interruptions in 1994 and early 1995 due to dam repair and maintenance activities. The 100 cfs minimum flow is in addition to reservoir releases to meet water orders along the Verde River and is part of the diversion at Granite Reef Dam.

This minimum flow is intended to help maintain fish habitat and riparian vegetation along the Verde River below Bartlett (McNatt et al. 1980; Farrer Consulting Services 1991). The minimum flow of 100 cfs can be greater than the minimum inflow (natural hydrograph) above Horseshoe at times. The long-term average monthly minimum flow between May and September is 99 cfs with a mean monthly range from 76 to 127 cfs (Pope et al. 1998). Above Horseshoe, the minimum flow drops below 100 cfs for more than 7 consecutive days in half of the years (Pope et al. 1998; reporting flow statistics for the USGS gage on the Verde River below Tangle Creek, 1947-1996).

Changes in Flow. The average monthly flow downstream of Bartlett is lower than the inflow to Horseshoe in winter and higher in summer, a pattern typical of reservoirs in the western United States (Figure 3-2). Horseshoe and Bartlett also have changed other flow patterns downstream of the reservoirs:

- Mean annual peak flow is decreased
- Annual peak flows are more variable

Figure 3-2. Mean monthly flow above and below Verde reservoirs, 1951-1990.



Dashed line = above Horseshoe; solid line = below Bartlett.

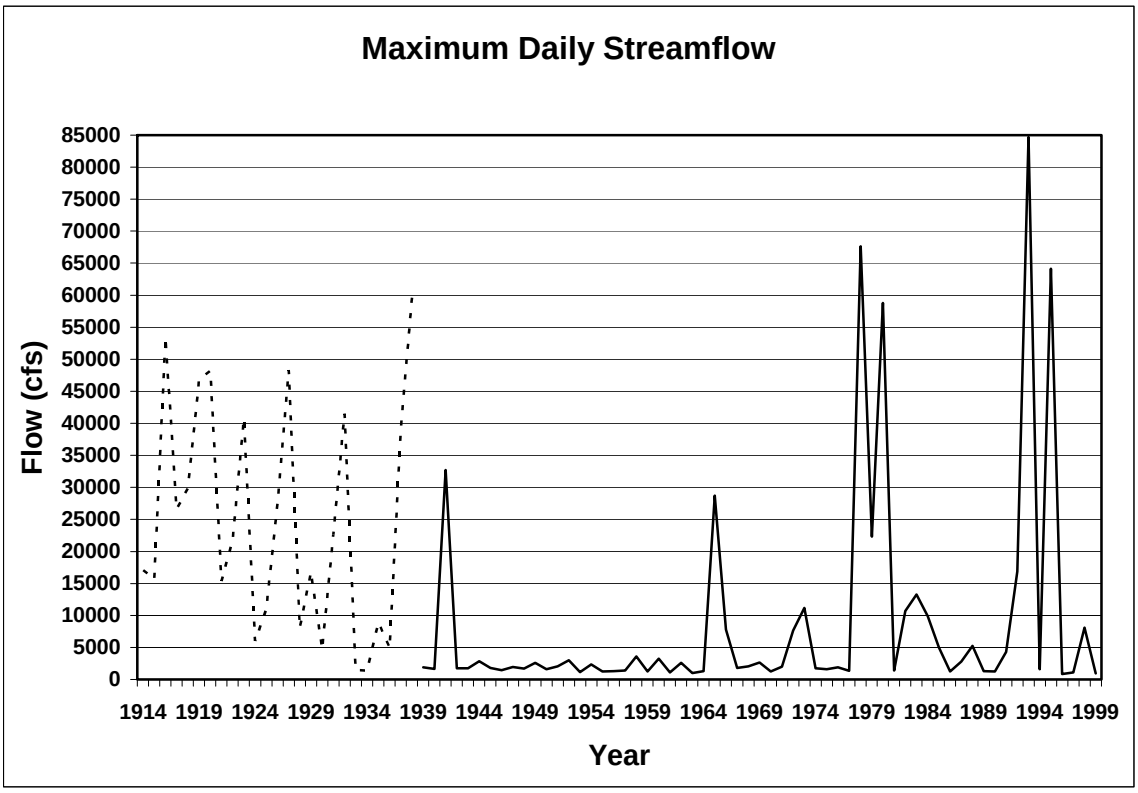
- Mean annual low flows are increased (Graf 1999)
- The frequency of small and mid-sized floods have decreased (HCP Appendix 4, Fig 1)

The cumulative frequency of flows above Horseshoe and below Bartlett for each month can be used to describe the historical impact of dam operations. A complete set of monthly cumulative frequency graphs is provided in Appendix 4 of the HCP (Attachment 1).

Spring runoff provides the highest average monthly inflow to Horseshoe during the year. Above Horseshoe, June and July have the lowest average monthly flow. In July, releases of water from Bartlett to meet downstream diversion demands create a divergence in the frequency of flows above Horseshoe and below Bartlett over the range of about 100 to 1,000 cfs. On average, May through August flows are substantially greater downstream of Bartlett in comparison to inflow to Horseshoe (Attachment 1, Appendix 4).

Flood Flows. One of the most significant flow patterns impacting the river channel and floodplain along the Verde River are periodic large flood flows. Figure 3-3 shows the maximum daily flow at the gage below Bartlett Dam for the period 1914-2000. Except for the extended drought from the mid-1940s through the 1960s, peak flows exceeding 30,000 cfs occur regularly below Bartlett, even though the dams attenuate flood peaks (Attachment 1, Figure III-8 and Appendix 4, Figure 2). More frequent flood peaks in the early years of

Figure 3-3. Maximum annual daily flow, Verde River below Bartlett Dam, 1914-2000.



Dashed line = pre-Bartlett; solid line = post-Bartlett.

record reflect a relatively wet period as well as the absence of dams.

3.2.2 Water Resources and Flood Control Environmental Consequences

3.2.2.1 No Permit Alternative

In the short term, no impacts on water resources are expected to occur from the No Permit Alternative. In 2005, Horseshoe was full from March through early June without apparent impacts to nesting flycatchers or other listed species. However, in the future, as nesting vegetation grows at lower elevations in the reservoir and the flycatcher population continues to expand, the reservoir would likely have to be periodically lowered in April and early May to expose vegetation previously used by flycatchers for nesting in order to avoid take in the form of harm or harassment due to habitat being unavailable, modified or lost. At that time, significant losses of water supply would occur to SRP and other downstream water users due to releases of water to expose flycatcher habitat.

It is difficult to precisely predict the extent of water supply impacts given the uncertainties of how much future occupied nesting habitat would occur at lower elevations in Horseshoe and how much water would be released to expose that habitat. As described in the HCP (Attachment 1, Subchapter IV.C.1.d), SRP applied an approach to estimating net water loss that was developed as part of the

Roosevelt HCP and EIS. Using that approach, the No Permit Alternative would result in a long-term average annual net loss of water supplies to SRP and other water users of about 11,000 AF/yr.

Releases of water to expose habitat would also have other minor water resource impacts. Such releases would result in slightly higher flows in spring than historical levels in the lower Verde and cause spills at Granite Reef Dam on the Verde River. Given the relatively small volumes of water to be released compared to the wide natural variation in flows during the spring, these impacts are expected to be insignificant.

Because Horseshoe would be drawn down as early as possible and kept as empty as possible, the No Permit Alternative might retain more flood water in spring than under existing conditions. This change would not provide a significant beneficial flood control effect.

3.2.2.2 Modified Historical Operation Alternative

There would be no impact on water resources or flood control as a result of the Modified Historical Operation Alternative because operations would not change from past practices.

3.2.2.3 Optimum Operation Alternative

There would be little or no impact on water supply of SRP and other water users as a result of the Optimum Operation Alternative. Relative to modified historical operations, a small amount of increased evaporation and consumptive use by riparian vegetation may occur in years when Horseshoe temporarily stores water to maintain tall dense vegetation. However, this increased evaporation and consumptive use would be at least partially offset in years when more rapid draw down occurs relative to modified historical operations.

In the occasional years when Horseshoe is allowed to fill to maintain riparian vegetation, Horseshoe would have lower flood control capacity than under existing conditions. Because Horseshoe does not provide significant flood control functions under existing conditions, the changes to flood control functions under the Optimum Operation Alternative would not have a significant adverse impact on flood control.

3.3 Geology and Geomorphology

3.3.1 Geology and Geomorphology Affected Environment

The primary geologic and geomorphic (surface feature) resources of concern are the stream and floodplain below the dams and the impact of Horseshoe and Bartlett operation on them, especially if changes might impact riparian vegetation or stream habitat for covered species.

The Verde River's location on the land and the characteristics of the river and its floodplain through the study area reflect the physical setting of the stream as it cuts through the mountains in central Arizona (Pearthree 1996). About 2 to 2.5 million years ago, the Verde River began rapidly downcutting like other major rivers draining central Arizona (Pearthree 1996). Thin terrace deposits on the mountain slopes adjacent to the Verde River trace the successive entrenchment of the drainage (Pearthree 1996).

As the Verde River flows though areas with easily eroded soil, subsoil, and bedrock, such as most of the Verde Valley

and downstream from Bartlett Dam, the river gradually drops in elevation over distance, the valley is broad, and the floodplain is typically wide. In areas more resistant to erosion, such as north of the Verde Valley and the reach between the southern Verde Valley and Bartlett Dam, the river quickly drops elevation over a short distance, the river valley is steep and narrow, and the floodplain is limited (Pearthree 1996).

Material recently deposited by regular flows and flood events along the Verde River channel is dominated by coarse gravel and cobble material, with pockets of sand and silt deposited in slackwater and overbank flood areas (Pearthree 1996; MEI 2004). Some sand and silt contributed to the system upstream of each respective reservoir falls out of the water column, is deposited in the reservoir, and therefore not fully processed downstream.

The gradient of the Verde River both above and below the dams is relatively steep, with the channel constrained to a braided channel about 600 to 4,000 feet wide by bedrock and resistant deposits of cobble and gravel (MEI 2004). The main channel of the lower Verde River has a capacity of about 16,000 to 20,000 cfs. The active floodplain is shaped by large floods that occur about once in 10 years (MEI 2004). Although Horseshoe Dam captures about 620 AF of sediment per year (SRP 2002), the channel slope limits sediment deposition below the reservoirs (MEI 2004). Significant sediment mobilization occurs when flow is near channel capacity. As flow approaches channel capacity, secondary chute channels that are common along the lower Verde become inundated (MEI 2004). The similarity of geomorphic characteristics above and below the Verde reservoirs indicates that there has been little or no modification of the Verde River channel and floodplain due to the operation of the dams (MEI 2004). MEI (2004) is a primary support document for this assessment, and can be found online at <http://www.fws.gov/southwest/es/arizona/HCPs.htm>.

3.3.2 Geology and Geomorphology Environmental Consequences

3.3.2.1 No Permit Alternative

Under the No Permit Alternative, reservoir sedimentation would not significantly change from the current rate, although the pattern of sediment deposition may change slightly. Additional sediment deposition likely would occur closer to the dam because water would not be held in storage as frequently as under the Modified Historical Operation Alternative. Also, water released from the reservoir to expose occupied flycatcher habitat may be slightly higher in fine suspended sediments than under existing conditions. However, this slight increase in fine suspended sediments would have no significant impact on the Verde River or its floodplain (Attachment 1, Subchapter IV.B.8). The earlier release of water in some years is not expected to have a significant impact on stream and floodplain morphology.

3.3.2.2 Modified Historical Operation Alternative

The Modified Historical Operation Alternative would have no significant impact on geology and geomorphology because operations would not change from past practices.

3.3.2.3 Optimum Operation Alternative

The Optimum Operation Alternative would have no significant impact on stream and floodplain morphology, including sedimentation. There would be no impact on stream and floodplain morphology upstream of Horseshoe, although watershed management mitigation measures discussed in Section 2.4.2.2 may result in small improvements in some upstream areas due to watershed management activities.

At Horseshoe, changes in the amount of suspended sediment in reservoir outflow and the pattern of sediment deposition may vary slightly from existing conditions under the Optimum Operation Alternative. Because large floods would continue to fill Horseshoe, current sediment deposition patterns during these floods would not significantly change. However, under the Optimum Operation Alternative, SRP would periodically hold water in Horseshoe to maintain tall dense vegetation at the upper end of the reservoir. This may cause slight shifts in patterns of deposition because coarser sediments would settle out at the upper end at higher reservoir levels and additional vegetation may retain sediment at higher elevations. Impacts below Horseshoe would be limited. Because the reservoir would be periodically filled to a higher elevation, water released from the reservoir may have slightly lower levels of fine suspended sediments than if river flows were allowed to pass more quickly through the reservoir. However, this slight change in sediment load would have no significant impact on downstream channel geomorphology and floodplain characteristics (MEI 2004).

3.4 Vegetation

3.4.1 Vegetation Affected Environment

Dams and their operation have varying impacts on downstream riparian vegetation communities depending on the extent and timing of changes to fluvial processes. Examples of the impacts of dams include increases or decreases in abundance of particular native or exotic plant species, shifts in vegetation community composition and structure, or changes in plant species diversity (Williams and Wolman 1984; Fenner et al. 1985; Rood and Mahoney 1990; Everitt 1995; Braatne et al. 1996; Poff et al. 1997; FWS 2002a; Shafroth et al. 2002; Stromberg et al. 2007). ERO (2004) provides an analysis of reservoir operations on riparian vegetation downstream of Bartlett Dam, and can be found online at <http://www.fws.gov/southwest/es/arizona/HCPs.htm>.

Historical riparian vegetation, recent vegetation mapping, categorization, and trends at Horseshoe, Bartlett, and along the lower Verde River (the lower study area) are summarized below. The HCP contains detailed information on vegetation present prior to and following dam construction (Attachment 1, Subchapter III.B.4). The HCP also describes vegetation in potential mitigation areas targeted for acquisition (Attachment 1, Subchapter V.C.2.b).

A vegetation study conducted in support of the HCP identified the following vegetation types in the study area: cottonwood/willow, mixed riparian, salt cedar, mesquite, strand, shrub, sparsely vegetated, and nonwoody (ERO 2004). Several of the vegetation classes were further divided into subcategories based on

height characteristics and density to better identify potential flycatcher habitat areas.

Studies (Beauchamp 2004; ERO 2004; Stromberg et al. 2007) along the Verde River above and below Horseshoe and Bartlett, indicate that riparian vegetation communities downstream of these dams, relative to above Horseshoe, have:

- Slightly greater amounts of salt cedar
- Lower cover, richness, and diversity of herbaceous vegetation
- Lower cottonwood-willow root colonization levels of mycorrhizal fungal communities, which are important for plant nutrition
- Similar recruitment, abundance, composition, and age-class distribution of cottonwood-willow.

Stromberg et al. (2007) summarizes how Horseshoe and Bartlett dams and their operations have influenced the woody riparian vegetation on the lower Verde River:

> "The degree of change in *Populus* [cottonwood] and *Salix* [willow] abundance and age structure parallels the degree of change in the flood hydrograph, as exemplified by a case study of the Verde River in central Arizona. The two major dams and reservoirs on the Verde River are managed to supply water to downstream Phoenix metropolitan area. The total flow volume is not altered, but typical of many rivers (Richter et al. 1996) dam operation has decreased average peak flow rate, flood frequency, and variability of some flow components, and shifted the timing of flow maxima and minima. Compared to some western rivers, the Verde reservoirs have a low storage to runoff ratio. Although small floods are captured in the reservoirs, large floods still occur in very wet years in which the reservoir capacity is exceeded, allowing for periodic channel movement, sediment redistribution, and *Populus* and *Salix* regeneration. During the wet winter of 1995, for example, reservoir spills during March and April were largely unmodified (i.e., larger run-of-the-river), and *Populus* and *Salix* established at about equal densities above and below the dam (Beauchamp and Stromberg, in review [2007]). Tree recruitment during wet years also has been observed on other regulated rivers in the regions (Zamora-Arroyo et al. 2001). Smaller-scale recruitment events, associated with smaller floods, are likely to be pre-empted along such rivers" (or occur less frequently, see Attachment 1, Appendix 4).

The findings of Stromberg et al. (2007) relative to the similar abundance of cottonwood-willow forest above and below dams are not unique to the Verde River. Lytle and Merritt (2004) found that cottonwood forest was most abundant when floods were slightly less frequent than the natural flood regime due to dams because flood scour of seedlings is reduced and mortality caused by drought may be minimized though elevated base flows.

The Verde River experiences periods of drought interspersed with extreme flood events. Historically, flood events of varying intensity scoured the floodplain—removing different amounts of vegetation—and redistributed sediment and raised the water table, allowing establishment and regeneration of tall woody vegetation. This natural cycle favors establishment of woody vegetation along the main river channel and in backwater areas where shallow water tables persist and provide supportive hydrology.

The recent drought reduced stream flows and resulted in low reservoir levels throughout the West. Often, this resulted in the growth of vegetation at lower elevations of affected reservoirs. In the Verde River system, the most dramatic vegetation changes of this type have occurred at the Horseshoe inflow. New vegetation now occurs on the Horseshoe bed (Figure 3-4). Some of this new vegetation has developed into patches of tall dense willow nesting habitat that flycatchers occupy, but much of the new vegetation remains relatively short or sparse.

The drought also has impacted streamside vegetation somewhat, although minimum flow requirements in the Verde River below Bartlett provide year-round flow to maintain the riparian water table, which benefits deep rooted woody plant species that utilize ground water.

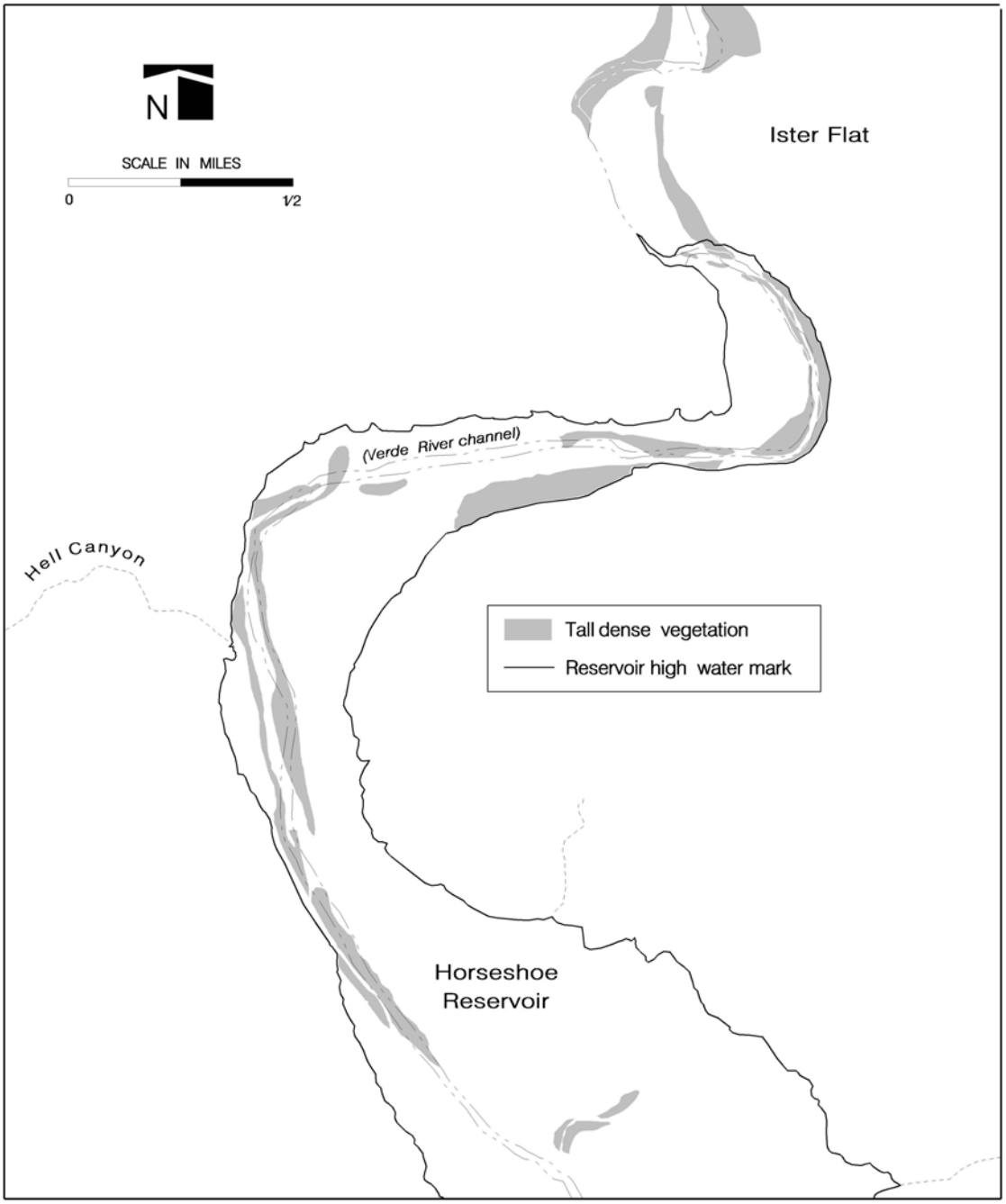
Livestock grazing since the late 1800s has influenced the pattern of riparian vegetation development along the Verde River. Livestock grazing has little impact on established trees, but can prevent recruitment of riparian plant species by trampling or eating young trees and seedlings (FWS 2002a).

Horseshoe and Bartlett have relatively small storage capacities, allowing large runoff events to pass through the reservoirs. Capture of sediment by Horseshoe and Bartlett operations slightly impact the distribution of fine sediment along the Verde River below the dams (MEI 2004). In an undammed system, sediment deposition provides seed beds for establishing vegetation. In the current system, slightly less fine sediment is available to support vegetation establishment, particularly in areas directly downstream of the two dams. However, flows that pass the dams and inflows from tributaries below the dams continue to provide sediment to the lower Verde (MEI 2004).

Recently, recreation activities along the Verde River, predominantly from Bartlett downstream to the Salt River confluence, have had a significant impact of vegetation patterns. For example, use of vehicles on cobble and sand bars inhibits colonization by vegetation (Attachment 1, Subchapter III.B.4.f).

Riparian vegetation in the Safford, Verde, and San Pedro valleys, where SRP intends to acquire mitigation lands, is similar to that occurring in Horseshoe. Tall woody species include cottonwood, willow, salt cedar, and mesquite (Attachment 1, Subchapter V.C.2).

Figure 3-4. Tall dense vegetation, Horseshoe inlet, 2002.



3.4.2 Vegetation Environmental Consequences

Potential adverse impacts to vegetation from reservoir operation alternatives would result from either 1) a change in stream and floodplain characteristics that would reduce establishment and survivorship of riparian vegetation downstream of Horseshoe and Bartlett dams, or 2) from a change in the hydrology that supports the riparian vegetation at the upper end of Horseshoe. Vegetation in areas acquired for mitigation would be affected by implementing management plans developed to provide ecological and conservation benefits to species covered by the HCP (Attachment 1, Subchapter V.B.1 and Appendix 7).

As discussed in detail above, woody riparian vegetation and/or channel geomorphology are minimally impacted by dam operations. All the three operation alternatives would be similar in there influence to downstream geomorphology, hydrology, and vegetation (Attachment 1, Appendix 3, Section II. A-C). Horseshoe releases, frequency of flood flows, and sediment impacts are similar among all three alternative such that there would be no measurable difference in impacts to geomorphology, hydrology, or vegetation downstream of the dams among the alternatives. Because water levels would be higher longer in the delta area of Horseshoe Reservoir some differences in woody riparian vegetation abundance and distribution is expected in the upstream portion of the conservation pool. Because there is no change of Bartlett operation from recent historical operations under any of the alternatives, the influences of operation is the same as those detailed above (Section 3.4.1).

3.4.2.1 No Permit Alternative

The No Permit Alternative influences the timing, frequency, and intensity of flood flows in the Verde River, but the related impacts to riparian woody vegetation downstream from Horseshoe and Bartlett reservoirs due to these changes will be minimal based on the geomorphology, hydrology, and vegetation research and results detailed above (Sections 3.3.1, 3.4.1). However, the amount of riparian habitat at the upper end of Horseshoe would likely decrease over time because of change in hydrology resulting from the early draw downs to expose occupied flycatcher habitat (Section 3.2.2.1 and Attachment 1, Subchapter IV.C.1.a).

3.4.2.2 Modified Historical Operation Alternative

The Modified Historical Operation Alternative would have no significant adverse impacts on riparian vegetation, but the impacts would be greater than those of the Optimum Operation Alternative and less than those of the No Permit Alterative. Because the reservoirs would not be managed to maintain riparian vegetation at the upper end of Horseshoe and because existing riparian vegetation that has become established in the lakebed during the drought would be periodically inundated for longer than under the two other alternatives, riparian vegetation at the upper end of Horseshoe under the Modified Historical Operation Alternative is likely to expand more slowly than under the Optimum Operation Alternative but would not decrease as expected under the No Permit Alternative. Although important because of the potential benefits for the flycatcher, the slightly lower growth in amount of riparian vegetation at Horseshoe would not have a significant impact on the overall amount of

riparian vegetation in the study area. As described above, the Modified Historical Operation Alternative is expected to have minimal impacts on riparian woody vegetation below Horseshoe and Bartlett (Section 3.4.1) due to changes in geomorphology (Section 3.3.1) and hydrology (timing, frequency, and intensity of flooding).

In addition to potential impacts of the Modified Historical Operation Alternative on vegetation at and below the upper end of Horseshoe, this alternative would also impact vegetation at the sites acquired as mitigation for impacts to covered bird species. Vegetation in these areas would be managed to maximize tall dense riparian vegetation, limit invasive species, and reduce the threat of fire (Attachment 1, Subchapter V.B.1 and Appendix 7). This could result in a beneficial effect by increasing the number and density of native species.

3.4.2.3 Optimum Operation Alternative

Impacts on riparian vegetation from the Optimum Operation Alternative are discussed in relation to habitat for covered bird species in Section 3.6.2. In summary, the amount of tall woody vegetation in Horseshoe is expected to increase, and minimal impacts on riparian woody vegetation below Horseshoe and Bartlett are expected based on research described above (Sections 3.3.1, 3.4.1). As analyzed and discussed in Section 3.4.1, no significant adverse impacts to cottonwood, willow, or tamarisk abundance or distribution downstream of the dams is anticipated due to future operations of the reservoirs.

Compared to the No Permit and Modified Historical Operation alternatives, the potential impacts of the Optimum Operation Alternative on tall woody vegetation at the upper end of Horseshoe are anticipated to be the most beneficial because water levels would be specifically managed to maintain this vegetation during a drought lasting more than two years. In addition, this alternative would benefit riparian vegetation at the sites acquired as mitigation for impacts to covered birds. Vegetation in these areas would be managed to maximize tall dense riparian vegetation, limit invasive species, and reduce the threat of fire (Attachment 1, Subchapter V.B.1 and Appendix 7). This could result in the beneficial effect of increasing the number and density of native vegetation species. As noted above, all three operation alternatives are expected to have similar minimal impacts to the riparian vegetation downstream of Horseshoe and Bartlett dams due to changes to geomorphology and hydrology.

3.5 General Wildlife

3.5.1 General Wildlife Affected Environment

Terrestrial wildlife in the study area and in proposed mitigation areas is characteristic of the Sonoran Desert Scrub community as described by Turner and Brown (1982). A diversity of mammals is present in the desert scrub vegetation surrounding the reservoirs and riparian habitat on the Verde River and its tributaries. Big game species such as mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), and javelina (*Tayassu tajacu*) are occasionally seen, although populations are greater in the adjacent uplands. Predators in the area include coyote (*Canis latrans*), bobcat (*Lynx rufus*), and gray fox (*Urocyon cinereoargenteus*). Nongame species such as beaver (*Castor canadensis*) and raccoon

(*Procyon lotor*) occur in riparian areas. Numerous birds are found in upland, riparian, and open water habitats including great blue heron (*Ardea herodias*), green-winged teal (*Anas crecca*), common flicker (*Colaptes auratus*), and red-tailed hawk (*Buteo jamaicensis*).

The majority of the lands surrounding the reservoirs are managed by the USFS in accordance with the Tonto Forest Plan (USDA 1985). The Tonto Forest Plan includes provisions to ensure that fish and wildlife habitats on National Forest lands are managed to maintain viable populations of existing native vertebrate species (USDA 1985). Management prescriptions in the Tonto Forest Plan include managing desert scrub vegetation to emphasize production of javelina and Gambel's quail. Prescriptions in the higher elevation of the desert scrub type emphasize desert cottontail (*Sylvilagus audubonii*) production.

In the Safford, Verde, and San Pedro valleys, where SRP intends to acquire mitigation lands, general wildlife species are similar to those present near the reservoirs. In general, the same types and species of wildlife occur in both the proposed mitigation areas and at Horseshoe and Bartlett (Attachment 1, Subchapter V.C.2).

3.5.2 General Wildlife Environmental Consequences

Because terrestrial wildlife species are mobile and can avoid rising lake levels, current reservoir operations have little or no direct impact on wildlife. Alternative reservoir operations may have an indirect impact on wildlife by changing the amount and type of potential upland habitat available at different times of the year.

3.5.2.1 No Permit Alternative

The No Permit Alternative may have minor seasonal impacts on wildlife. Under the No Permit Alternative, in some years the lakebed would be exposed for longer periods than under current operations. Longer exposure may provide additional foraging habitat in spring and summer that may prove beneficial for upland wildlife. The potential beneficial effects on upland wildlife compared to the existing condition would be minor on a local scale and insignificant on a regional scale.

3.5.2.2 Modified Historical Operation Alternative

Because the Modified Historical Operation Alternative is based on current methods of operation, this alternative would maintain current wildlife habitat conditions in the study area. Implementation of management plans in mitigation areas would help ensure the quality of riparian habitat by maintaining native plant species, managing noxious weeds, and minimizing livestock grazing and all-terrain vehicle use.

3.5.2.3 Optimum Operation Alternative

Holding water in Horseshoe to maintain tall dense vegetation may slightly reduce the amount of upland habitat available in some years compared to the Modified Historical Operation Alternative. Because water would be maintained in Horseshoe to support tall dense riparian vegetation only about once in every 14 years (Section 2.4.2.1), the reduction in available upland habitat would have no significant impact on wildlife. Implementation of management plans in mitigation areas would help ensure the quality of riparian habitat by maintaining native plant species, managing noxious

weeds, and minimizing livestock grazing and all-terrain vehicle use.

3.6 Covered Birds

3.6.1 Covered Birds Affected Environment

Additional information and literature citations for the covered bird species are provided in the HCP (Attachment 1, Subchapter III.A.1).

3.6.1.1 Southwestern Willow Flycatcher Species Description

The southwestern willow flycatcher (flycatcher) is a 6-inch migratory riparian obligate bird that breeds in Arizona and other southwestern states during late spring and summer. Flycatchers nest in dense thickets of trees and shrubs along streams and wetlands where cottonwood, willow, tamarisk, and other riparian species are present. A "territory," the area selected and defended by a male, is a common unit of measure for flycatchers because it is often difficult to determine whether a particular male is paired with a female.

The flycatcher was listed as endangered in 1995. Critical habitat designated in 2005 along the Verde River includes: 1) the middle Verde Valley, 2) a reach between the confluence of the East Verde River to the upper end of Horseshoe; and 3) a 4-mile reach below Horseshoe. A recovery plan for the flycatcher was issued in 2002. The flycatcher is listed as Wildlife of Special Concern by AGFD and a Sensitive Species by the USFS. Factors that contributed to the decline of the flycatcher include: loss and modification of riparian habitat due to urban and agricultural development, water diversion and impoundment, channelization, ground water pumping, livestock grazing, invasion by nonnative plant species, off-road vehicle and other recreational uses, as well as parasitism by the brown-headed cowbird.

Southwestern willow flycatcher.

Flycatchers at Horseshoe have increased in recent years, from six territories in 2002 to 18 territories in 2006. Most of the Horseshoe territories have been found at the upper end of the reservoir. In 2005, no flycatchers were observed at the previously occupied Davenport site about 1 mile below Horseshoe because a fire burned through the area in June. No suitable flycatcher habitat has been found in or surrounding Bartlett and is unlikely to occur in the future due to the steep, rocky shoreline and reservoir operations. Although surveys have been conducted since 2003 on Forest Service Land below Bartlett Dam, no breeding (resident) or migratory flycatchers have been detected. However, no comprehensive surveys have been conducted on tribal land.

3.6.1.2 Bald Eagle Species Description

The bald eagle is a large bird of prey usually found along lakes, rivers, and reservoirs in Arizona. Bald eagle prey in Arizona is mainly fish, but also includes waterfowl, small mammals, and carrion. Fish abundance and species diversity are important for successful bald eagle breeding in Arizona. Arizona bald eagles lay eggs between December and March and usually nest on cliffs and rock pinnacles, or in cottonwood trees.

The bald eagle is a large bird of prey that historically ranged and nested throughout North America except extreme northern Alaska and Canada, and central and southern Mexico. The bald eagle south of the 40th parallel was listed on March 11, 1967 as endangered under the Endangered Species Preservation Act of 1966 (FWS 1967), and was reclassified to threatened status on July 12, 1995 (60 FR 36000). No critical habitat has been designated for this species. The bald eagle was proposed for delisting on July 6, 1999 (64 FR 36454). A final decision on delisting the bald eagle is expected by June 2007. AGFD (2006) lists the bald eagle as Wildlife of Special Concern and the Forest Service lists the bald eagle as a Sensitive Species (AGFD 2002a).

Historically, the bald eagle experienced rangewide reductions in distribution and abundance largely due to significant declines in reproductive rates caused by the use of the pesticide DDT. Current threats to the species are habitat loss, human encroachment into breeding habitat, entanglement in fishing line, reduction or significant changes in fish populations, illegal shooting, and heavy metals.

There are seven bald eagle pairs that nest and/or forage on the Verde River between the Allen Ditch Diversion dam and Horseshoe Lake (Tower, Oak Creek, Beaver, Ladders, Coldwater, East Verde, and Table Mountain Breeding Areas). Eleven pairs of bald eagles have nested in recent years along the Verde River from Horseshoe Lake downstream to its confluence with the Salt River (Horseshoe, Cliff, Yellow Cliffs, Bartlett, Needle Rock, Box Bar, Fort McDowell, Doka, Sycamore, Rodeo, and Orme Breeding Areas). Another pair forages on the Verde River, but nests and also forages on the Salt River (Granite Reef Breeding Area). Over time, The Fort McDowell breeding area along the lower Verde River has been one of the most productive sites in Arizona.

Bald eagle.

3.6.1.3 Yellow-billed Cuckoo Species Description

The yellow-billed cuckoo (cuckoo) is a 12-inch migratory bird that breeds in Arizona and other southwestern states during the summer. Cuckoos are typically found in cottonwood-willow stands but also use tamarisk and mesquite.

In 2001, FWS concluded that listing of the western population segment of cuckoo was warranted but precluded by higher priority listing actions. The western population of this species has been added to

the FWS candidate list, and is listed as a Wildlife of Special Concern by AGFD and a Sensitive Species by the USFS. Factors contributing to the decline of the yellow-billed cuckoo in the western U.S. include: degradation and loss of riparian habitat due to vegetation clearing, stream diversion, water management, agriculture, urbanization, over-grazing, and recreation.

Between 2003 and 2005, five to seven cuckoos were documented each year during surveys at Horseshoe.

Yellow-billed cuckoo.

3.6.2 Covered Bird Species Environmental Consequences

The environmental consequences of the alternatives on covered bird species are primarily associated with changes in vegetation communities.

The analysis of the impacts of future reservoir operations at Horseshoe and Bartlett on covered bird species involves impacts on flycatchers, eagles, and cuckoos within the conservation pool of Horseshoe and habitat for the species downstream of both dams. The area of analysis for birds and habitat extends from the top of the conservation pool at Horseshoe downstream to Granite Reef Dam, where water is diverted into the SRP canals. The analysis for bald eagles also included potential impacts to fish prey base extending upstream and downstream from the reservoirs.

Because of the complex variation in runoff and lake levels over time, models were used to estimate the future impacts of reservoir operations on bird habitat. As discussed in the HCP (Attachment 1, Subchapter IV.A), the models and relationships between hydrologic conditions and habitat or water supply are based on reservoir operations, ecological principles, historical data, and empirical evidence.

3.6.2.1 Southwestern Willow Flycatcher Environmental Consequences

Impacts resulting from the reservoir operation alternatives as well as minimization and mitigation measures are described in this section. Measures taken to avoid and minimize direct and indirect impacts and mitigation measures under the Modified Historical Operation and Optimum Operation alternatives are discussed more fully in Sections 2.3, 2.4.2.1, and 2.5.2, and in the HCP (Attachment 1, Subchapter V.C).

For purpose of this analysis, the definitions of various flycatcher and flycatcher habitat terms (e.g., occupied habitat, flycatcher habitat, tall dense vegetation) as described in the HCP (Subchapter IV A.2.a) were used.

No significant adverse impacts are anticipated from implementation of the mitigation measures. Impacts associated

with acquisition of mitigation lands are described in Sections 3.4.2 (Vegetation), 3.5.2 (General Wildlife), and 3.11.2 (Land Use and Land Ownership).

No Permit Alternative. As described in Section 2.3, the FWS would not issue a Permit to SRP for continued operation of Horseshoe and Bartlett under the No Permit Alternative. Without a Permit, SRP would be expected to do everything within its control to avoid take of federally listed species associated with the continued operation of the reservoirs. To avoid the risk of take of flycatchers, Horseshoe would be operated to reduce the water level below the elevation at which flycatchers nested in the previous year before commencement of the nesting season, if necessary. When needed, and unless not physically feasible due to high runoff, Horseshoe would be lowered in April to reach a target elevation in early May to expose flycatcher habitat. As a result, direct impacts to flycatchers, their nests, or eggs from changes in reservoir pool elevation would be unlikely.

The No Permit Alternative may have an adverse indirect impact on flycatchers because SRP would draw down Horseshoe as early as possible and would not periodically hold water in Horseshoe to maintain riparian vegetation. This would likely result in a long-term decrease in flycatcher habitat and possibly productivity compared to existing conditions. However, flycatcher habitat would be inundated less frequently than under existing conditions, which would somewhat offset the decreased amount of habitat at the reservoir. Indirect impacts on flycatchers would be minor on a local scale and insignificant on a regional scale.

Flycatchers have occupied habitat along the Verde River below Horseshoe in recent years and riparian habitat below Bartlett may become occupied in the future. However, the No Permit Alternative would not significantly change downstream flows or significantly adversely impact the habitat based on studies of the historical impact of the two dams on downstream tall dense vegetation (Section 3.4.1, 3.4.2; Attachment 1, Section II.A.2 of Appendix 3). All operation alternatives were found to have minimal impacts on the duration of inundation and sediment mobilization on the floodplain as related to changes that could cause alteration of woody riparian vegetation (Section 3.3.1; Attachment 1, Appendix 3, Section II.A.2.b, citing MEI 2004). As a result of the minimal impacts to the physical and hydrological conditions, there would be no significant adverse impacts to cottonwood, willow, or tamarisk distribution or abundance below the dams (3.4.1, 3.4.2). As described in Section 3.4.1 woody plant species composition and structure was similar above and below the dams.

The key hydrogeomorphic variables that create and maintain tall dense vegetation over time would not be significantly adversely impacted by future operations. Thus, if flycatchers occupy this habitat in the future, it is unlikely that they would be significantly adversely impacted by the No Permit Alternative.

The No Permit Alternative would have no significant adverse impact on designated critical habitat along the Verde River. Horseshoe Reservoir operations do not impact areas upstream of the reservoir that are designated critical habitat. With respect to the segment of critical habitat below Horseshoe, reservoir operations do not significantly adversely impact the physical and biological features essential to the conservation of the flycatcher (i.e., primary

constituent elements, PCEs). The PCEs protected in the critical habitat designation rule (FR 70: 60912, October 19, 2005) include: 1) riparian habitat in a dynamic successional riverine environment with suitable woody plant species composition, foliage density, canopy cover, and surrounding habitat mosaic with water or short stature vegetation; and 2) variety of insect prey populations. As noted above, all operation alternatives were found to have an insignificant impact on the duration of inundation and sediment mobilization on the floodplain (Section 3.3.1; Attachment 1, Appendix 3, Section II.A.2.b, citing MEI 2004). Thus, there would not be significant adverse impacts to the flooding/disturbance regime, which is key to supporting a "dynamic successional riverine environment" that in turn creates and maintains the essential habitat characteristics to conserve flycatchers. This conclusion is supported by the research results of Stromberg et al. (2007) (summarized in Section 3.4.1) who found that the floodplain and riparian habitat is dynamic below the dams, and woody plant species composition and structure was similar above and below the dams (willow, cottonwood, and tamarisk were recruiting and forming new patches over time). Thus, no significant adverse impacts to woody plant species composition, vegetation density, canopy cover and vegetation structure, or patch mosaic are anticipated due to future operations. This dynamism, and the associated vegetation community and flows, also supports the insect food base essential to the conservation of the flycatcher; thus, no measurable impacts to the insect community is anticipated.

Because the No Permit Alternative would have no significant short-term adverse impacts on the flycatcher due to reservoir operation, no minimization or mitigation measures are proposed.

Modified Historical Operation Alternative. As more fully described in Section 2.4.1, the Modified Historical Operation Alternative would involve issuance of a Permit by the FWS allowing the continued full operation of Horseshoe and Bartlett consistent with past operating objectives, along with implementation of minimization and mitigation measures.

As with the No Permit Alternative, direct impacts to flycatchers, their nests, or eggs are not expected unless a nest tree with eggs or nestlings in it falls due to inundation or drying or if a fledgling falls out of a nest over water and drowns. Because the Modified Historical Operation Alternative continues existing conditions, frequency of direct impacts would not change.

The flycatcher habitat model described in the HCP (Attachment 1, Subchapter IV.A.2) was run with the results of reservoir levels from the Modified Historical Operation Alternative. Because the water levels would not be managed to maintain tall dense vegetation at the upper end of the Horseshoe, it is estimated that the maximum possible habitat at the upper end of the reservoir would be about 55 acres less than under the Optimum Operation Alternative. Although less riparian habitat would likely be present at the upper elevations in the reservoir, the predicted average amount of impact due to unavailable flycatcher habitat would be about 200 acres. This impact is slightly more than the 190 acres under the Optimum Operation Alternative because of the slower draw down of Horseshoe in the spring and early summer under the Modified Historical Operation Alternative. Thus, the overall long-term productivity of flycatchers is likely to be slightly less than under the

Optimum Operation Alternative because less flycatcher habitat would be available on average.

As with the No Permit Alternative, the Modified Historical Operation Alternative would not significantly change downstream flows or cause significant adverse impacts to downstream flycatcher habitat (see No Permit section above; also Section 3.4.1, 3.4.2; Attachment 1, Section II.A.2 of Appendix 3). Thus, if flycatchers occupy this habitat in the future, it is unlikely that they would be significantly adversely impacted by this alternative.

The Modified Historical Operation Alternative would have no significant adverse impact on designated critical habitat along the Verde River. Horseshoe operations do not impact areas upstream of the reservoir. With respect to the segment of critical habitat below Horseshoe, reservoir operations do not significantly adversely impact flycatcher habitat downstream from the dams (see critical habitat discussion under No Permit Alternative above; also Section 3.4.1, 3.4.2; Attachment 1, Section II.A.2 of Appendix 3). If additional critical habitat is designated in Horseshoe in the future, SRP intends that the minimization and mitigation measures would have addressed all impacts on that habitat.

In order to mitigate for periodic unavailability of an average of up to 200 acres of flycatcher habitat at the upper end of Horseshoe, SRP would acquire and manage 200 acres of off-site riparian habitat in the Verde Valley and in the Safford Valley, or elsewhere in central Arizona. If monitoring indicates a need for more mitigation, a maximum of 400 acres of mitigation area would be acquired. Criteria used to identify appropriate mitigation areas and locations of potential mitigation areas for flycatcher habitat are provided in the HCP (Attachment 1, Subchapters V.C.2 and V.C.4).

Optimum Operation Alternative. The analysis of the impact of the Optimum Operation Alternative focuses on the availability of habitat occupied by flycatchers and resulting impacts on productivity. Under the Optimum Operation Alternative, operation of Horseshoe and Bartlett by SRP would involve the periodic inundation and potential modification of habitat occupied by flycatchers in Horseshoe. The periodic inundation and modification of previously occupied flycatcher habitat at Horseshoe would result in a reduction of available habitat in some future years, which is expected to adversely impact flycatchers.

Direct impacts to flycatchers, their nests, or eggs are only expected to occur if a nest tree with eggs or nestlings in it falls due to inundation or drying, or a fledgling falls out of a nest over water and drowns. Direct impacts may also occur from recreation use at high lake levels (e.g., boats disturbing nesting flycatchers). USFS authorization of recreation use is a separate federal action; thus, recreation impacts on flycatchers and other listed species are addressed as a cumulative impact in Section 3.14.5.

Under the Optimum Operation Alternative, Horseshoe lake levels would typically peak in March or April and would be steadily drawn down during the flycatcher breeding season. Thus, impacts would be primarily expected through periodic inundation of previously occupied habitat (which precludes its use), or habitat modification or loss caused by periodic inundation or drying. These periodic impacts would vary over time. In many

years, the Optimum Operation Alternative would not be expected to adversely impact any occupied flycatcher habitat at all or would benefit the habitat by stimulating the growth of riparian vegetation (Attachment 1, Subchapter III.B.4). Under the Optimum Operation Alternative, the average amount of flycatcher habitat in Horseshoe is expected to gradually increase as the amount of tall dense vegetation increases, but is likely to fluctuate over time similar to many natural southwestern riparian ecosystems.

The Optimum Operation Alternative would result in additional vegetation growth and flycatcher population growth over the long term, with periodic losses of flycatcher habitat occurring over the life of the Permit. As much as 450 acres of habitat would be available 50 percent of the time; however, in particular years when the reservoir fills (about 30 percent of the time), up to 390 acres of occupied habitat are anticipated to be unavailable for flycatchers. The average annual amount of occupied habitat that would be unavailable over the life of the Permit is predicted to be 190 acres, which is rounded up to 200 for purposes of the analysis done for the HCP (Attachment 1, Subchapter IV.B.1.b).

It is unlikely that more than an average of 200 acres of occupied habitat would be adversely impacted by periodically filling the reservoir over the next 50 years at Horseshoe. However, this is an estimate, and uncertainty remains regarding the actual maximum future impact. Future hydrological conditions, changes in vegetation or population dynamics, or other factors could possibly combine to result in greater average unavailability of occupied habitat at Horseshoe. These uncertainties are addressed in the HCP using adaptive management (Attachment 1, Subchapter V.C.4).

As with the other alternatives, the Optimum Operation Alternative would not significantly change downstream flows or cause significant adverse impacts to downstream flycatcher habitat (see No Permit Section above; also Section 3.4.1, 3.4.2; Attachment 1, Section II.A.2 of Appendix 3). Thus, if flycatchers occupy this habitat in the future, it is unlikely that the operation alternative would cause significant adverse impacts to the bird or its habitat.

Under the Optimum Operation Alternative, indirect impacts to flycatchers would result because periodic inundation of Horseshoe habitat would likely result in delayed or lost breeding attempts, decreased productivity and survivorship of dispersing adults in search of suitable breeding habitat, and decreased productivity of adults that attempt to breed at Horseshoe. If flycatcher density at Horseshoe increased to levels of flycatcher density observed at Roosevelt in 2002, which were about 1 bird per 2 acres (SRP 2002), then about 195 birds could occupy the 390 acres of maximum predicted occupied habitat at Horseshoe that would be unavailable due to a complete fill of the reservoir.

At higher or lower densities, the number of birds occupying a given amount of habitat would vary above or below the numbers of birds listed above. Similarly, the amount of occupied habitat significantly adversely impacted by higher reservoir levels would vary from a few acres to most of the occupied acres depending on the extent of habitat that has developed and is occupied, the height and elevation of the habitat, and the degree and duration of fill in a particular year. Based on historical hydrology, the predicted frequency of inundation resulting in significant adverse impacts to occupied flycatcher habitat and flycatcher

productivity in the long term would average about 1 out of every 2 years (Attachment 1, Subchapter IV.B.1.b).

The Optimum Operation Alternative would have no significant adverse impact on designated critical habitat along the Verde River. Horseshoe Reservoir operations do not impact areas upstream of the reservoir. With respect to the segment of critical habitat below Horseshoe, reservoir operations do not significantly adversely impact flycatcher habitat downstream from the dams (see critical habitat discussion under No Permit Alternative).

Minimization and mitigation measures proposed under the Optimum Operation Alternative for unavoidable impacts to flycatchers include managing Horseshoe to maximize available nesting habitat and support riparian vegetation at the upper end of Horseshoe and acquiring 200 acres (up to 400 acres under adaptive management) of mitigation lands. The HCP includes detailed descriptions of proposed minimization, mitigation, monitoring, and management measures for the Optimum Operation Alternative (Attachment 1, Subchapter V.C). Combined, the minimization and mitigation measures are anticipated to fully offset the impact of reservoir operations and may provide a net benefit to the species by providing more habitat over the long-term.

3.6.2.2 Bald Eagle Environmental Consequences

No Permit Alternative. The No Permit Alternative would have no direct impact on the bald eagle because currently no eagles have nests within the reservoirs. However, there may be indirect impacts because early draw down of Horseshoe would likely result in a reduction in the amount of riparian vegetation at the upper end of Horseshoe compared to the Modified Historical Operation and Optimum Operation alternatives. As a result, fewer bald eagle perching trees are likely to be available over the long term under the No Permit Alternative. Reduction in the number of perches would not cause significant adverse impacts to the eagles because perches for foraging will continue to be available and would not limit the ability of eagles to acquire prey.

As discussed under the Optimum Operation Alternative below, no significant adverse impacts on the bald eagle forage base are expected for the No Permit Alternative. The difference between operation alternatives on the fish community is small and the impact of any of the operation alternatives is not expected to cause widespread shifts in fish community composition or decrease individual fish abundance (see Optimum Operation Alternative discussion below). All three operation alternatives reduce nonnative fish produced from Horseshoe (with least impact on carp) through minimizing carry-over storage and rapid drawdown of Horseshoe. Bartlett operation is the same under all alternatives, and as discussed below for the Optimum Operation, the operations that support the current fish population will continue in the future. Populations of important bald eagle prey species (i.e., carp, catfish, native suckers) have self-sustaining populations with varying abundances and distributions in the action area. The abundance and distribution of nonnative fish produced due to reservoir operations, which could compete or prey upon individual native species (e.g., native suckers), would not significantly adversely impact eagle prey abundance. There is no existing or proposed critical habitat for bald eagles, so none would be impacted.

Modified Historical Operation Alternative. Because the Modified Historical Operation Alternative continues existing conditions, no significant adverse impacts on bald eagles are expected under the Modified Historical Operation Alternative. If bald eagles move their nests into the active conservation space of the reservoirs below the high water level, SRP would implement the same adaptive management measures specified for the Optimum Operation Alternative, which are described in the HCP (Attachment 1, Subchapter V.C.4.d).

As discussed under the Optimum Operation Alternative below and No Permit Alternative above, no significant adverse impacts on the bald eagle forage base are expected for the Modified Historical Operation Alternative. There is no existing or proposed critical habitat for bald eagles, so none would be impacted.

Optimum Operation Alternative. The HCP provides the supporting data (Attachment 1, Subchapter III.A.1.b) and approach used for the analysis of impacts on threatened bald eagles from the Optimum Operation Alternative for Horseshoe and Bartlett (Attachment 1, Subchapter IV.B.2.a). The same subchapter describes the potential impacts of reservoir operations on bald eagles and is the basis for the following discussion of impacts.

The Optimum Operation Alternative is not expected to involve inundation of nesting habitat used by bald eagles. The primary change in reservoir fluctuations due to the Optimum Operation Alternative that might impact bald eagles would be a higher elevation of Horseshoe reservoir level in the winter and early spring in a few years (Attachment 1, Appendix 5, Figure 3). Other potential impacts include changes to riparian vegetation downstream of the dams (eagles use large riparian trees as perch and nest sites) and changes to the fish community, which is a primary component of the eagle's food base. However, as explained below, these changes to the environment due to the proposed operations of the reservoirs are not expected to cause significant adverse impacts to bald eagles.

Riparian Vegetation Habitat Impact Assessment:

Currently, bald eagles do not have nests in riparian trees or snags in Horseshoe or Bartlett conservation pools (Subchapter III.A.1.b). However, if one or more pairs moved their nests into the active conservation space of the reservoirs below the high water mark, inundation of the nests could occur. SRP will develop a coordinated plan with FWS and AGFD to identify how nesting in the conservation pool would be identified, when rescue actions would be required, and the process to rescue any bald eagles, bald eagle eggs, or nestlings at Horseshoe or Bartlett. The plan will include SRP continuing its ongoing coordination with the FWS and AGFD as a member of the Southwestern Bald Eagle Management Committee to schedule winter monitoring and survey flights at appropriate times and frequencies to determine if a nest has been built in the conservation space of the reservoir, and coordination with SRP staff hydrologists to determine the likelihood that the nest would be impacted by spring storage. If a bald eagle establishes a nest below the high water mark of the reservoirs, SRP would implement an adaptive management plan and work with AGFD and FWS to rescue eggs or chicks threatened by inundation for subsequent reintroduction into the original nest after the water subsides or introduction into a foster nest in another territory if the nest is

destroyed, and SRP would construct an alternative nest structure in the immediate area and maintain such structure for the remaining duration of the Permit. The HCP describes bald eagle adaptive management strategies in more detail (Attachment 1, Subchapter V.C.4.d).

The breeding areas along the lower Verde have nests in mature cottonwood or sycamore trees. Recent vegetation mapping and changes in vegetation are described in the HCP (Attachment 1, Subchapter III.B.4). The most important vegetation types for bald eagles along the lower Verde are cottonwood, willow, and mixed riparian because mature cottonwood and willow trees are used as nesting and perching sites by bald eagles. As discussed in the HCP (Subchapter III.B.4 and Appendix 3), Horseshoe, Bartlett, and the Verde River below the dams continue to be dynamic systems characterized by cycles of high and low flows that periodically inundate and deposit sediment on the floodplain, scour vegetation along the stream, and maintain relatively high ground water levels (see Sections 3.3.1, 3.3.2, 3.4.1, and 3.4.2). As a result, these flow cycles create and maintain riparian vegetation, including cottonwood and willow trees, some of which is used as nesting and perching habitat by bald eagles.

The mature willows at the upper end of Horseshoe, which are occasionally used by bald eagles for perching, have a base elevation of about 1,995 to 2,025 feet. These trees have been growing in Horseshoe for over a decade and high lake levels do not appear to currently impact their suitability for use by bald eagles, and a minimum of 50 acres of tall dense vegetation is expected to be present in the conservation pool of Horseshoe over the term of the permit (Attachment 1, Subchapter IV B.1), some of which would be suitable as perching habitat.

Eagle Forage Base Impact Assessment:

The best available data (Hunt et al. 1992, Driscoll et al. 2006, and data presented and summarized in Attachment 1, Subchapter III.A.1.b.8) do not indicate a clear, definitive relationship between bald eagle nest success for breeding areas near Bartlett and Horseshoe with reservoir water levels or that storage levels influence the fish community composition to the degree that would significantly adversely impact their forage base. The optimum operation at Horseshoe will impact carp reproduction the least due to the timing of their spawn; bass and sunfish reproduction and recruitment will be reduced due to fluctuating reservoir levels; and catfish that spawn in summer will be reduced because the reservoir will be at its lowest levels (Committee 2006; Robinson 2006). Overall, minimizing carry-over storage between years will reduce recruitment of all species at Horseshoe. However, all species have self-sustaining populations in the river and fish can freely enter or exit Horseshoe or pass downstream. During winter and spring, carp will continue to be available at Horseshoe, but the overall community assemblage in the river is not expected to significantly change due to operations – thus, those fish species and density of those species upstream of Horseshoe will continue to be available as they have been in the past. Similarly, no change in fish community composition is expected between the reservoirs – the density and composition of fish that have been available in the past are expected to be available in the future.

No operational change will be made at Bartlett Lake. Bartlett is managed as a sportfishery by AGFD and eagles have successfully nested and utilized those species in the past (Attachment 1, Subchapter III A.1.b.8). The influence of

Bartlett and releases on the downstream fish community are described in detail in the HCP (Attachment 1, Subchapter III.A.1.b.8), but in general, releases have had both positive and negative influence on the downstream fish community, and those influences are expected to continue. The current populations of native suckers, as well as other prey species, are high in this reach, the eagle population has expanded in recent years, and have had high success. The optimum operation (as well as the historical, and no permit operation alternatives), maintains the flow regime that supports these conditions (see Attachment 1, subchapter IV B.2). The impacts of nonnative fish produced in Bartlett that could move downstream and prey or compete with individual covered fish, or the future influence of the flow regime (either positive or negative) will be small and is not expected to significantly adversely impact the current amount, spatial and temporal availability, or temporal sequencing (see Attachment IV B.2) of important eagle prey species (native suckers, catfish, carp).

Critical habitat is not currently proposed or designated for bald eagles, so there would be no impact to bald eagle critical habitat.

3.6.2.3 Cuckoo Environmental Consequences

No Permit Alternative. Impacts of the No Permit Alternative on cuckoos would be that same as that for the flycatcher and are described in Section 3.6.2.1.

Modified Historical Operation Alternative. Significant adverse impacts of the Historical Operation Alternative on cuckoos would be that same as that for the flycatcher and are described in Section 3.6.2.1.

Optimum Operation Alternative. As with flycatchers (Section 3.6.2.1 and Attachment 1, Subchapter IV.B.1.b), the potential direct incidental take of cuckoos from the Optimum Operation Alternative is uncertain. Thus, the potential impacts that could occur are addressed below in terms of harm to cuckoos through impacts to occupied habitat described for the flycatcher.

As discussed for flycatchers in the HCP (Attachment 1, Subchapter IV.B.1.b), periodic modification or elimination of cuckoo habitat from inundation likely would result in indirect significant adverse impacts such as delayed or lost breeding attempts, decreased productivity and survivorship of adults that disperse, and decreased productivity at Horseshoe. Estimates of periodic lost productivity for cuckoos at Horseshoe are difficult to determine because little is known about the population. However, for purposes of the HCP, assuming an average territory size of about 50 acres based on the reported range of 10 to 100 acres in the literature (Attachment 1, Subchapter III.A.1.c), about 4 pairs could occupy the average predicted occupied habitat of 200 acres impacted by inundation. If occupied habitat increased to 400 acres and the territory size is 50 acres, about 8 pairs could be impacted.

The Optimum Operation Alternative, as with the other alternatives, would not significantly change downstream flows or cause significant adverse impacts to downstream cuckoo habitat (Section 3.4.2; Attachment 1, Section II.A.2 of Appendix 3). Thus, to the extent that cuckoos occupy this habitat, it is unlikely that they would be significantly adversely impacted by this alternative.

Because critical habitat is not currently proposed or designated for cuckoos, the

Optimum Operation Alternative would have no impact on critical habitat for the cuckoo.

Mitigation measures for unavoidable impacts to cuckoos resulting from the Modified Historical Operation Alternative and the Optimum Operation Alternative are the same as those described for southwestern willow flycatcher in Section 3.6.2.2.

3.7 Covered Fishes

3.7.1 Covered Fishes Affected Environment

The affected environment of covered fish species is intertwined with the overall fish community or fishery. Sections 3.7.1 and 3.7.2 provide descriptions of fishes in the study area. Fishes are described below by whether they would be directly impacted (lower study area) or indirectly impacted (upper study area) by the operation alternatives. The HCP and Fish Committee Report contain more detailed descriptions of fishes and their habitat in the study area (Attachment 1, Subchapter III.A.1.d; Committee 2006, which is available at <http://www.fws.gov/southwest/es/arizona/HCPs.htm>).

3.7.1.1 Lower Study Area Fishes

Verde Mainstem. Fishes in the lower study area are typical of reservoir and river habitats in central Arizona. Between Granite Reef and Bartlett Dam, Bonar et al. (2004) found high densities of desert sucker (*Catostomus clarki*) and Sonora sucker (*Catostomus insignis*) compared to other reaches of the Verde River. Similarly, Bryan et al. (2000) documented large populations of those sucker species, roundtail chub, and longfin dace. However, Bryan and Hyatt (2004) noted a subsequent decline in the roundtail chub population in the lower Verde River. Both researchers also found abundant and self-sustaining populations of nonnative species in the reach, including green sunfish, bluegill, largemouth bass, mosquitofish, red shiner, channel catfish, flathead catfish, and common carp.

Overall, Bartlett Lake has healthy and abundant self-sustaining populations of nonnative fishes, primarily largemouth bass, black crappie, green and redear sunfish, bluegill, threadfin shad, channel and flathead catfish, and common carp (Weedman, pers. comm. 2005). No native fishes have been documented in the reservoir in recent surveys. No data exist concerning the fish population between Bartlett and Horseshoe. However, based on angler use, Hunt et al. (1992), and its location between the reservoirs, the fish community is thought to be dominated by nonnative species including carp, largemouth bass, channel and flathead catfish, and green sunfish.

Robinson (2007) conducted fish sampling in Horseshoe at both high and low water conditions in spring and fall of 2005 and 2006 to determine community composition and population structure. He found that common carp and goldfish comprised 89 percent of the fish community. Other species that were captured with lower abundance were red shiner, green sunfish, largemouth bass, channel catfish, and flathead catfish. During 2006 spring sampling, seven adult male razorback suckers in spawning condition were captured in the upper end of the reservoir. Based on their size, these razorback suckers may have been stocked in the winter of 2004 or 2005 and either flushed down from the upstream stocking site during winter high flow events or migrated naturally downstream. He also observed a pikeminnow that was dead on the bank and

appeared to be raptor prey. No other native fishes were captured in the reservoir.

Lime Creek. Surveys by AGFD (Voeltz 2005) documented Gila topminnow and longfin dace in the upper reaches of Lime Creek. Nonnative fishes (e.g., green sunfish and goldfish) have been periodically detected in the lower reaches of the creek downstream of occupied Gila topminnow habitat, but have been repeatedly absent for periods of time, probably due to large floods or drying of the stream during droughts (Voeltz 2005).

3.7.1.2 Upper Study Area Fishes

Verde Mainstem. Bonar et al. (2004) reported 15 fish species from the upper end of Horseshoe to near Beasley Flats. Four native fish species were captured (razorback sucker, desert sucker, Sonora sucker, and roundtail chub). They reported that razorback sucker density was the highest in this reach compared to other reaches due to stocking. Eleven nonnative species were documented. Both Rinne et al. (1998) and Bonar et al. (2004) reported that native species generally comprise less than 20 percent of the fish community in this segment of the river.

From Beasley Flats to the Allen Ditch Diversion, the fish community composition was similar to that from upper Horseshoe to Beasley Flats, but largemouth bass and smallmouth bass were more prominent. Razorback sucker was not found, but Colorado pikeminnow (stocked), desert and Sonora sucker, and roundtail chub were detected. Rainbow trout are stocked during winter months for recreational angling between Tuzigoot National Monument and Bridgeport Bridge (Sullivan and Richardson 1993) and near Camp Verde. Of the reaches of the Verde River between Granite Reef Dam and the Allen Ditch Diversion analyzed by Bonar et al. (2004), nonnative fishes had the highest standing crop from Beasley Flats to the Allen Ditch Diversion.

East Verde River. Prior to a major fire-related die-off in 2004, nonnative fishes were reported to be dominant at the confluence of the East Verde and Verde rivers (Hunt et al. 1992, AGFD 2004). Native species included roundtail chub, desert sucker, Sonora sucker, and razorback sucker. Additional native species found below the ponderosa pine level included longfin dace, speckled dace, desert sucker, and Sonora sucker (FWS 1989). Although not documented in the reach of East Verde River in the study area, the reach is considered potential roundtail chub habitat (Committee 2006).

Fossil Creek. Fisheries data indicate that Fossil Creek supported a wide variety of nonnative species above the fish barrier that delineates the terminus of the study area on this tributary, but this reach (above the fish barrier) has been recently renovated for native fishes (more information at http://watershed.nau.edu/fossilcreekproject/index.htm). Downstream of the barrier was not renovated, and the fish community included both native and nonnative fish. Native species occurring near the confluence include roundtail chub, desert sucker, and Sonora sucker (AGFD 2004).

West Clear Creek. Roundtail chub, longfin dace, speckled dace, desert sucker, and Sonora sucker are found in West Clear Creek. Nonnative species include rainbow trout (stocked by AGFD), smallmouth bass, yellow bullhead, green sunfish, and channel catfish. No largemouth bass or carp have been detected (Benedict, pers. comm. 2005).

Wet Beaver Creek. Roundtail chub, longfin dace, speckled dace, desert sucker, and Sonora sucker are found in Wet Beaver

Creek. Nonnative species include rainbow trout (stocked by AGFD), brown trout, smallmouth bass, yellow bullhead, channel catfish, and green sunfish. No largemouth bass or carp have been found in the creek (Benedict, pers. comm. 2005).

Oak Creek. Oak Creek is dominated by nonnative fish species. The creek is managed as a put-and-take rainbow trout recreational fishery (Committee 2006). Recent surveys conducted by AGFD found a number of nonnative fishes, but did not detect largemouth bass (Benedict, pers. comm. 2005); however, largemouth bass have been found in the past (Minckley 1993). Native fishes found in Oak Creek include roundtail chub, speckled dace, desert sucker, and Sonora sucker. USFS records from 1988 indicate that longfin dace also previously occurred in Oak Creek but has not been found since 1983 (Sullivan and Richardson 1993).

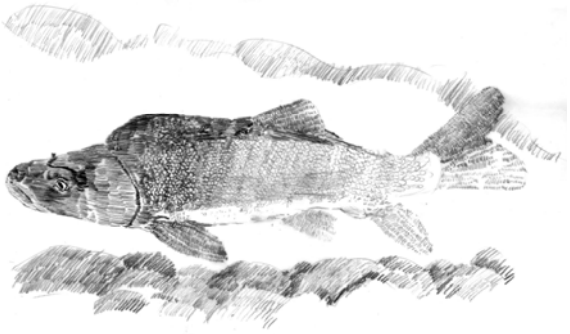
3.7.1.3 Covered Fish Species

There are 10 species of fish proposed for coverage under the Permit. These species are summarized in Table 3-1 and in the following sections. Additional information and citations for these species is provided in the HCP (Attachment 1, Subchapter III.A.1). Critical habitat for the razorback sucker extends from Horseshoe Dam upstream to the Tonto and Prescott National Forest boundaries; therefore, this species is discussed in greater detail than the other nine species.

Table 3-1. Fishes proposed to be covered by the HCP.

Common Name	Listing History	Breeding Biology	Habitat	Status in Study Area
Razorback sucker	Listed, Endangered—1991 Recovery Plan—2002 Critical Habitat—1994	Spawn January through March over coarse substrates	Medium to large rivers, lakes, or reservoirs	Reaches of the Verde River upstream and including Horseshoe Lake is designated as critical habitat. Stocked above Childs since the 1980s. Survivorship of stocked fish is not fully understood but presumed to be low. Natural recruitment has not been documented. A few individuals were found in Horseshoe in 2005 and 2006.
Gila topminnow	Listed, Endangered—1967, 1973	Spawn March through August; live-bearers	Headwaters and springs	Stocked and persist in Lime Creek.
Colorado pikeminnow	Listed, Endangered—1967, 1969, 1973 Section 10(j) experimental nonessential population—1985	Spawn in summer over coarse substrates	Warm, swift, large rivers	Stocked in Verde River above Childs since the 1980s. Found in the Verde Valley in 2004. A few individuals were found in Horseshoe in 2006.
Spikedace	Listed, Threatened—1986 Critical Habitat—1994 (vacated 1998); 2000 (vacated 2004); final 2007	Spawn from March through May	Moderate to large streams and small rivers with coarse substrate	Most recently found in 1999 by the AGFD in the upper Verde (upstream of the study area) near Paulden. Not present in the action area, but may be introduced into Verde River or perennial tributaries in the future. May have designated critical habitat in the basin in the future.
Loach minnow	Listed, Threatened—1986 Recovery Plan—1991 Critical Habitat—same as spikedace	Spawn from March through May	Shallow, swift water with gravel, cobble, and rubble substrates	Populations in the Verde basin have been extirpated, but may be stocked in the future in Upper Verde and selected tributaries in the study area; May have designated critical habitat in the basin in the future.
Roundtail chub	Not listed	Spawn February through June	Small streams to rivers; often in pools and eddies	Roundtail chub observed by Bonar et al. (2004) in all sections of the Verde River (except for between the reservoirs), and known to occur in some larger perennial tributaries. Recently detected decline below Bartlett Dam (Bryan and Hyatt 2004).
Longfin dace	Not listed	Spawn December to August, peak in April	Shallow water in cool, small streams	Likely present in most perennial tributaries in the upper study area and in the Verde River below Bartlett.
Sonora sucker	Not listed	Spawn late winter through mid-summer in riffles	Wide range of temperature tolerance; prefer gravelly or rocky pools	Found by Bonar et al. (2004) in all reaches of the Verde River, except for between the reservoirs. Greatest abundance in the project area were detected downstream of Bartlett Dam (Bonar et al. 2004).
Desert sucker	Not listed	Spawn late winter and early spring in riffles	Streams and rivers, mainly over bottoms of gravel-rubble with sandy silt	Found by Bonar et al. (2004) in all reaches of the Verde River, except for between the reservoirs; may occupy perennial tributaries; considered to be the most abundant native species in the study area due to population below Bartlett Dam. Greatest abundance occurred downstream of Bartlett Dam (Bonar et al. 2004).
Speckled dace	Not listed	Two spawning periods: spring and late fall	Headwaters, creeks, and small to medium rivers	Found in upper end of the study area and in some tributaries.

Razorback sucker.



Razorback Sucker

The razorback sucker is a large river-dwelling fish that can reach lengths of 3.3 feet and weights of 13.2 lbs over a 40-year life span. Some razorback suckers have persisted in portions of Colorado River reservoirs. Spawning occurs mainly in January through March in flat-water areas over cobble, gravel, and course sand substrates.

The species was listed as endangered in 1991 by the FWS. Recovery goals published in 2002 supplemented the 1998 Recovery Plan. Critical habitat was designated in 1994, including Horseshoe and the Verde River for about 40 miles upstream. The razorback sucker is also listed as a Sensitive Species by the USFS and as Wildlife of Special Concern by AGFD. Threats to razorback sucker include stream flow regulation, habitat modification, predation by nonnative fish species, pesticides, and pollutants.

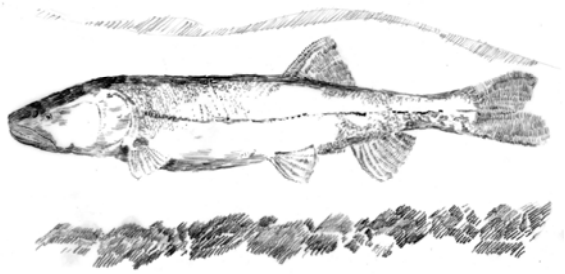
Razorback sucker were extirpated from the Verde River reestablish this population. No long-term survival of the stocked razorback sucker has been reported to date, but a few previously stocked fish are occasionally found in Horseshoe, 1 in 2002; 7 in 2005; and 3 in 2006. Bartlett is not considered to be suitable habitat for razorback sucker recruitment because of the lack of dense aquatic vegetation and the abundance of nonnative fishes.

Colorado Pikeminnow

Colorado pikeminnow are a large fish that occupies warm, swift, turbid main stem rivers, preferring eddies and pools. Colorado pikeminnow can reach lengths of up to 6 feet and weights of 80 pounds. Spawning occurs in the summer over clean cobbles and rubble.

FWS listed the Colorado pikeminnow as endangered in 1967. Recovery goals were published in 2002, which supplement the 1978 Recovery Plan, which was revised in 1991. Critical habitat is designated in the upper Colorado River Basin, but none is designated in Arizona. Colorado pikeminnow is listed as a Sensitive Species by the USFS and as Wildlife of Special Concern by AGFD. Recovery actions have focused on the upper Colorado River Basin. Threats to Colorado pikeminnow include stream diversions, impoundments, reservoir operations, and predation by and competition with nonnative fishes.

Colorado pikeminnow.



Colorado pikeminnow were extirpated from the Verde River and have been reintroduced in the Verde River since the 1980s. The Colorado pikeminnow stocking in the Verde River above Horseshoe is designated as an experimental, nonessential population under section 10(j) of the ESA. No long-term survival of the stocked fishes

has been reported to date. Four previously stocked fish were found in Horseshoe in 2006.

Gila Topminnow

The Gila topminnow is a 1- to 2-inch fish that inhabits headwater springs, small streams, and cienegas. This species prefers warm water in a moderate current with dense aquatic vegetation and algae mats, where it feeds on aquatic insects, mosquito larvae, crustaceans, and detritus. Gila topminnow breed primarily from March to August.

The Gila topminnow was listed as endangered by FWS in 1967. Critical habitat has not been designated for this species. This species is also listed as a Sensitive Species by the USFS and as Wildlife of Special Concern by AGFD. Threats to the Gila topminnow include habitat loss, predation and competition by nonnative fishes (especially the mosquitofish, *Gambusia affinis*), aquifer pumping, drought, and development of springs.

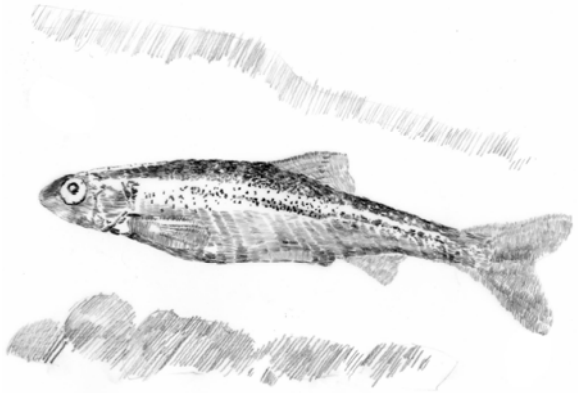
Gila topminnow.

The Gila topminnow was historically considered the most abundant fish in the Gila River Basin, particularly in low- to mid-elevation streams, but is now limited to relatively few sites in southern Arizona. A reproducing, stocked population persists in Lime Creek, a tributary to Horseshoe.

Spikedace

Spikedace are 3-inch fish found in moderate to large perennial streams with gravel, cobble, and sand substrates having moderate to swift currents. Recurrent flooding is an important component of spikedace habitat. Spikedace spawn from March through May with some yearly and geographic variation.

Spikedace.



The spikedace was federally listed as threatened in 1986. A recovery plan was issued in 1991. Critical habitat is designated in the upper Verde River upstream of the action area from the National Forest boundary upstream to Sullivan Dam (FWS 2007). Spikedace is listed as a Sensitive Species by the USFS and as Wildlife of Special Concern by AGFD. Threats include stream flow depletion, diversion, competition with nonnative crayfishes, and predation by and competition with nonnative fishes, especially the red shiner (AGFD 2002b).

Spikedace have not recently been reported from the Verde River or its tributaries. The most recent confirmed presence of spikedace near the study area was from 1999 surveys by the AGFD in the

upper Verde River near Paulden, above the barrier at the Allen Ditch Diversion dam.

Loach Minnow

Habitat for the loach minnow, a 3-inch fish, consists of shallow streams with moderate to swift currents and gravel, cobble, or rubble substrates. Spawning occurs in March through May but may also occur in the fall. As with spikedace, recurrent flooding is an important component of loach minnow habitat.

The loach minnow was federally listed as threatened in 1986 and a Recovery Plan was published in 1991. Loach minnow is also listed as a Sensitive Species by the USFS and as Wildlife of Special Concern by AGFD. Threats include sedimentation and embedding of riffle habitats, diversion, channelization, and predation by and competition with nonnative fishes (Propst et al. 1988).

The loach minnow is considered extirpated from the Verde River watershed; however, it may be reintroduced in the future.

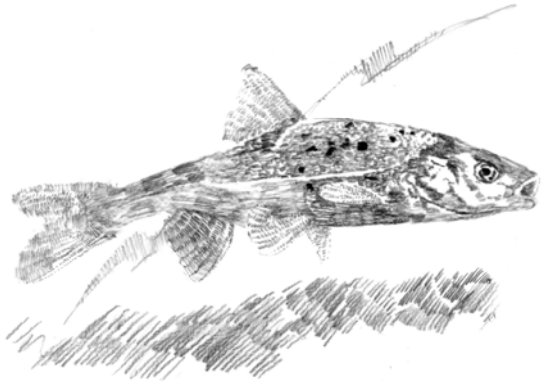
Loach minnow.

Roundtail Chub

Roundtail chub are 10- to 19-inch fish found in mid-elevation streams and often prefer open areas of deeper pools and eddies. Roundtail chub spawn during spring and early summer when flow begins to decline after spring runoff.

Roundtail chub is not currently listed by the FWS, but it is listed as a Sensitive Species by the USFS and as Wildlife of Special Concern by AGFD. Threats include aquifer pumping, stream diversion, reduction in stream flows, and predation by and competition from nonnative fishes.

Roundtail chub.

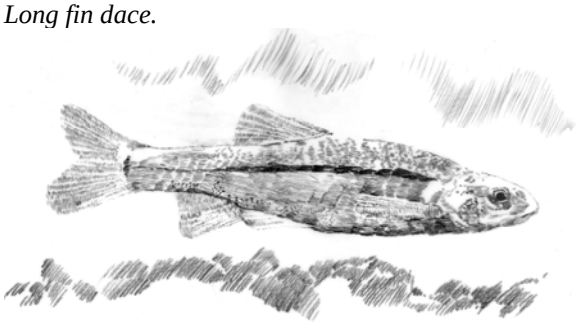


Although not abundant, roundtail chub have been found in all sections of the Verde River, except for the reach between Horseshoe and Bartlett. The largest concentrations in the Verde River basin occur in the upper portion of the watershed (outside the Action Area) and downstream of Bartlett. Recently, Hyatt and Bryan (2004) noted a decline in the roundtail chub population below Bartlett Dam. More information describing the roundtail chub's status and influence of operation and flows can be found in the HCP (Subchapter IV.B.2.).

Longfin Dace

The longfin dace is a 2- to 3-inch fish found in cool upland streams to low desert streams. Spawning occurs between December and July with a surge in spawning activity in April.

Long fin dace.



The longfin dace is not currently listed by FWS, or of special concern to AGFD or the USFS. Threats include human activities that alter the quality or flow of water, particularly flood attenuation and irrigation, as well as predation from and competition with nonnative fishes.

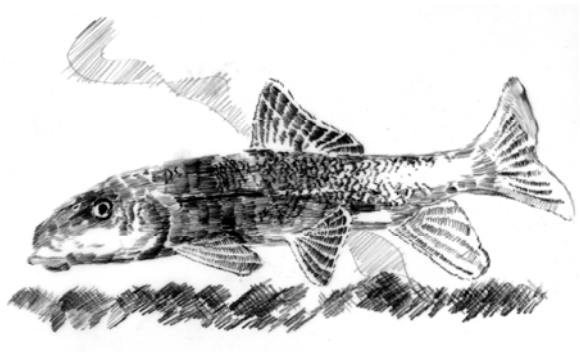
Longfin dace are known to occur in the Verde River below Bartlett Dam and in perennial tributaries in the upper study area.

Sonora Sucker

The Sonora sucker occurs in a wide range of habitats, from warm water rivers to cool, higher elevation streams, preferring gravelly or rocky pools, or quiet waters, while the young inhabit runs and quiet eddies. Sonora suckers can reach 30 inches or more in length. Spawning behavior is observed from late winter through mid-summer.

The Sonora sucker is not currently listed by FWS, or of special concern to AGFD or the USFS. Threats include reduced available habitat due to alteration of historical flow regimes, construction of reservoirs, and predation and competition by nonnative fishes.

Sonora sucker.



Bonar et al. (2004) found Sonora sucker in all sampled reaches of the Verde River. However, the reach between Horseshoe and Bartlett was not sampled, and these fish are not likely present. Sonora and desert suckers were most abundant outside of the action area, upstream of the Allen Ditch diversion and below Bartlett Dam (Bonar et al. 2004). As noted above, Sonora suckers are likely least abundant between the reservoirs, and Bonar et al. (2004) found less suckers in the reach between Allen ditch diversion and Horseshoe Dam than below Bartlett or upstream of the action area.

Desert Sucker

The desert sucker occupies rapids and flowing pools of streams and rivers, mainly over bottoms of gravel-rubble with sandy silt. Desert suckers spawn in late winter and early spring when adults gather in large numbers over riffle substrates where eggs are laid.

The desert sucker is not currently listed by FWS, or of special concern to AGFD or the USFS. Threats include reduced available habitat due to alteration of historical flow regimes, construction of reservoirs, and predation and competition by nonnative fishes.

Bonar et al. (2004) found that the desert sucker was the most abundant species observed throughout the entire length of the

Verde River in both riffle and run habitats. However, the reach between Horseshoe and Bartlett was not sampled, and these fish are not likely present. Sonora and desert suckers were most abundant outside of the action area, upstream of the Allen Ditch diversion and below Bartlett Dam (Bonar et al. 2004). As noted above, desert suckers are likely least abundant between the reservoirs, and Bonar et al. (2004) found less suckers in the reach between Allen ditch diversion and Horseshoe Dam than below Bartlett or upstream of the action area.

Desert sucker.

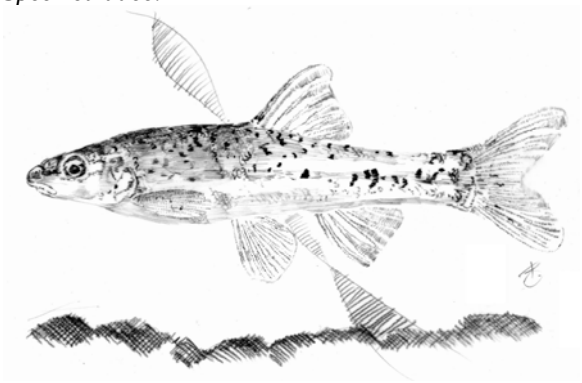
Speckled Dace

The speckled dace is a 3-inch fish that occurs in small- to medium-sized rivers, normally at elevations greater than 5,000 feet. Spawning activity of the speckled dace has two defined periods: spring and late fall.

The speckled dace is not currently listed by FWS, or of special concern to AGFD or the USFS. Threats include nonnative predatory fishes and land uses that damage aquatic habitat (AGFD 2002c).

Although not found recently in the study area, speckled dace are reported by AGFD as occurring below Bartlett and are thought to have historically been widespread in the Verde River and its tributaries.

Speckled dace.



3.7.2 Covered Fish Environmental Consequences

Determining the impacts of operation alternatives for Horseshoe and Bartlett on covered native fish populations over the proposed 50-year Permit period required analysis of numerous complex and interacting ecological factors, including human influences on the Verde River such as past and current land uses, water uses, intentional and accidental introduction of nonnative fish species, past and current AGFD fisheries management policy, reservoir construction and operations, and other activities in the watershed.

Because of these complexities, a Fish and Watershed Committee (Committee) was established to cooperatively develop methods used for impact analysis and to conduct the analysis. The Committee was comprised of biologists and scientists representing FWS, AGFD, Arizona Department of Water Resources, and SRP. The Committee prepared a report of its findings that included an extensive review of existing literature, agency reports, state and federal databases, and discussions with local and nationally recognized experts (Committee 2006).

The HCP (Attachment 1) relies on the Committee's report in its discussion of impacts and includes a summary of the Committee's approach, methods, and findings (Attachment 1, Subchapter IV.B.4). The following subsections summarize impacts described in Subchapters IV.B.4, IV.C.1.b, and IV.C.2.b of the HCP (Attachment 1).

Impacts to native fishes, including covered species, from the three operation alternatives for Horseshoe and Bartlett could occur from two sources: 1) direct impacts due to future reservoir operations (stranding in pools or passage through outlet works); and 2) indirect impacts (predation and competition) from incremental increases of nonnative fishes produced by future reservoir operations. The Committee determined that for all alternatives, the indirect impacts of nonnative fishes would be similar among all covered native fish species based on life history information; thus, the Committee grouped all covered native species to determine the impacts of reservoir operations.

Measuring potential impacts to native fishes from incremental increases of nonnative fishes is difficult. In addition to nonnative fishes already in the reservoir, there are large self-sustaining nonnative fish populations from past stocking efforts and accidental introductions in all stream reaches.

As described in the HCP (Attachment 1, Subchapters IV.B.4.a and IV.B.4.b), in order to estimate the indirect impacts on native fishes from operations-induced increases in nonnative fishes, the Committee developed a method that quantifies relative river miles of impacted habitat. The method weights the relative contributions of impacts to native fish habitat from the proposed alternatives and from existing human-caused impacts to the stream; including the presence of nonnative fish species, grazing, agriculture, water use, residual impacts of past reservoir operations, and other causes. The resultant river miles of habitat impacts take into account that the relative influence of reservoir operations diminishes with increased distance from the reservoirs.

Similarly, the Committee developed minimization and mitigation measures to address the direct impacts of reservoir operations due to stranding and passage injury, and the indirect impacts of additional predation and competition by nonnative fish on covered native fish by:

1. Reducing nonnative fish reproduction, recruitment, and movement;
2. Augmenting/increasing native fish populations, distribution, and relative abundance through stocking efforts; and
3. Maintaining water flows in the Verde River above Horseshoe.

These measures are summarized below under the alternatives and are described in more detail in the HCP (Attachment 1, Subchapter V.D).

3.7.2.1 No Permit Alternative Impacts on Covered Fishes

Impacts of the No Permit Alternative on native fishes would be the lowest of the proposed alternatives. Impacts to native fish habitat from the No Permit Alternative over the next 50 years would be 31.9 river miles (Attachment 1, Subchapter IV.C.1.b). SRP would coordinate with AGFD and FWS to prevent take of individual adult razorback sucker, pikeminnow, or other listed fishes that could be stocked in the future in the

Verde River. Although take would be avoided, at least in the short term, the No Permit Alternative does not include reservoir or fisheries management (e.g., additional stocking) to benefit razorback sucker or pikeminnow. Thus, those species (in particular, the razorback sucker) would not benefit from maintaining high water levels and this alternative would not support or provide suitable habitat for species recruitment. Unless future ESA compliance resulted in mitigation or other actions, these impacts would not be offset by SRP conservation efforts.

Under the No Permit Alternative, no significant adverse impacts from reservoir operations to critical habitat currently designated for razorback sucker are anticipated because the production of nonnative fishes would be minimized (Attachment 1, Subchapter IV.C.1.b).

Under the No Permit Alternative, SRP would implement the measures described in Section 2.3 and in Subchapter II.B.1 of the HCP (Attachment 1) to mitigate for potential significant adverse impacts on listed native fishes. Measures include rapid draw down, a fish barrier on Lime Creek, and working with AGFD and FWS to modify the existing Verde River native fishes stocking program.

3.7.2.2 Modified Historical Operation Alternative Impacts on Covered Fishes

Impacts of the Modified Historical Operation Alternative on native fishes would be slightly greater than those from the Optimum Operation Alternative because Horseshoe would not always be drawn down as rapidly or kept empty as long as possible. Under the Modified Historical Operation Alternative, water would be drawn down at historical rates based on demand and reservoir management constraints. In years when fill occurred, Horseshoe typically would be drawn down over a period of 4 months and return to minimum pool by mid-summer in average and below average water years (Committee 2006), which could allow more nonnative fishes to reproduce when water temperatures are suitable in mid- to late-spring relative to other alternatives. Based on these parameters, impacts to native fish habitat from the continued operation of Horseshoe and Bartlett under the Modified Historical Operation Alternative would be 39.5 river miles (Attachment 1, Subchapter IV.C.2.b).

The nature of impacts of the Modified Historical Operation Alternative on razorback sucker critical habitat would be the same as those summarized below for the Optimum Operation Alternative, but the degree of impact of the Modified Historical Operation Alternative would be slightly greater than impacts from the Optimum Operation Alternative. Under the Modified Historical Operation Alternative, nonnative fish species would be provided a greater opportunity to spawn and reproduce in Horseshoe compared to the other operation alternatives, and therefore would contribute more to the incremental impact of predation and competition on native fish species (Attachment 1, Subchapter IV.C.2.b).

The adverse impacts of the Modified Historical Operation Alternative would be minimized by rapidly drawing down Horseshoe and keeping it empty whenever possible. The remaining impacts would be further offset through mitigation actions similar to those described in Section 2.4.2.2 and in Subchapter V.D.2 of the HCP (Attachment 1). Measures include constructing a fish barrier on Lime Creek, stocking native fishes, funding native fish hatchery improvements, conducting watershed management activities, which

include working to ensure stream flow in the Verde River.

Impacts from implementation of the minimization and mitigation measures are discussed in the next section, under the Optimum Operation Alternative (Section 3.7.2.3).

3.7.2.3 Optimum Operation Alternative Impacts on Covered Fishes

Over the term of the Permit, reservoir operations are anticipated to have a significant adverse impact on native fishes due to stranding in isolated pools, passage through outlet works, increased predation by nonnative fishes, or other mortality caused by reservoir operations in the study area. The impacts on fish habitat from the Optimum Operation Alternative total 33.9 river miles of habitat (Attachment 1, Subchapter IV.B.4.a), which is lower than under the Modified Historical Operations Alternative but higher than the No Permit Alternative.

The Optimum Operation Alternative would not significantly adversely impact critical habitat designated for razorback sucker because operations would not appreciably reduce or impair the value of required habitat characteristics (primary constituent elements or PCEs) that have been identified for that species (Attachment 1, Subchapter IV.B.4.c).

The significant adverse impacts of the Optimum Operation Alternative on listed native fish species would be mitigated by measures described in Section 2.5.2 and in the HCP (Attachment 1, Subchapter V.D). Measures include rapid draw down, constructing a fish barrier on Lime Creek, stocking native fishes, funding native fish hatchery improvements, conducting watershed management activities, and working to ensuring adequate stream flow in the Verde River. These measures are expected to fully offset the impacts from the Optimum Operation Alternative, and will provide for recovery opportunities (e.g., hatchery funding and expansion will provide more overall native fish rearing space and improve facility operation that AGFD and FWS can use for recovery efforts throughout the range of the covered species).

Although intended to benefit covered fish species, implementation of some of the minimization and mitigation measures is also likely to cause direct or indirect impacts to other resources, which will be addressed as follows:

Construction of Lime Creek Fish Barrier. No significant adverse impacts are anticipated from construction of the Lime Creek fish barrier (Section 3.13.2 – Air Quality). Approval of the barrier, or its alternative, by the USFS will be subject to future NEPA compliance.

Rearing and Stocking Native Fishes. Hatchery production and stocking efforts for covered fishes will result in death or injury to some of the individuals during the rearing and stocking process, due to disease, handling, or other reasons. These impacts are addressed through separate AGFD ESA Section 6 consultation. In addition, stocked fishes may be adversely impacted or lost as a result of ongoing actions by third parties such as water users, developers, and ranchers. Specific examples of such existing third-party actions in and near the study area include: water diversions throughout the study area and from the SRP canal system; livestock grazing in or adjacent to the study area; development in and near the study area, groundwater pumping, and recreation use and

management within the study area. The HCP minimizes impacts to these existing third parties that might result from the production and stocking of native fishes as part of the HCP by focusing stocking efforts in locations where those impacts are avoided or addressed by separate consultation.

3.8 Covered Frog and Gartersnake Species

The affected environment and impacts for the lowland leopard frog, northern Mexican gartersnake, and narrow-headed gartersnake are similar to those for the covered fish species described in the preceding subsections. Section 3.7 (above) and the HCP (Attachment 1) contain additional information on the affected environment, reservoir operation impacts, and the species characteristics relevant to the covered frog and gartersnakes.

3.8.1 Frog and Gartersnake Affected Environment

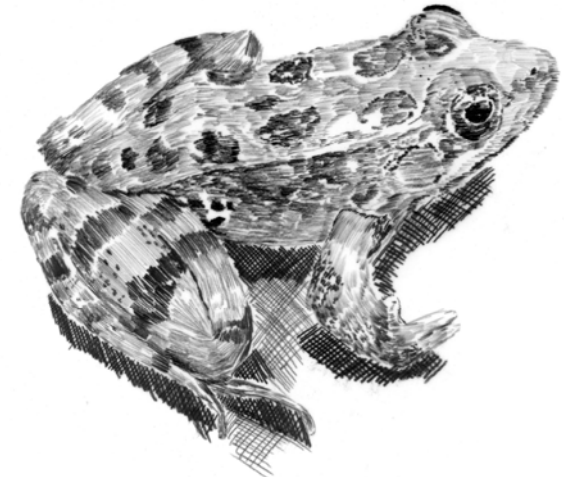
3.8.1.1 Lowland Leopard Frog

The lowland leopard frog generally occurs below 6,400 feet elevation in aquatic systems in desert grasslands to pine-oak woodlands, typically in association with permanent waters and appears to prefer streams rather than ponds or other aquatic habitats, but can be found in beaver ponds, cienegas, and stock tanks. The species primarily reproduces from January to May, and sometimes in summer and early fall during the summer monsoon season. Females deposit egg masses in shallow water which attach to submerged vegetation, bedrock, or gravel. Adult lowland leopard frogs feed on arthropods and other invertebrates, and larvae are herbivorous and likely eat algae, organic debris, and plant tissue (AGFD 2001a).

The lowland leopard frog is not listed by FWS but is on AGFD's list of Wildlife of Special Concern AGFD (2006). "Central Arizona populations appear to be healthy, but some die-offs have been noted and it has disappeared from most of the lower Gila and lower Colorado River systems" (AGFD 2006). Nonnative predaceous fishes, Rio Grande leopard frogs and bullfrogs, human uses of their habitat, and chytrid fungus are among the major threats to lowland leopard frog populations (AGFD 2001a).

The lowland leopard frog is reported by AGFD HDMS (2003) as occurring or potentially occurring throughout the action area, with recent records in Lime Creek and Fossil Creek (AGFD 2001a).

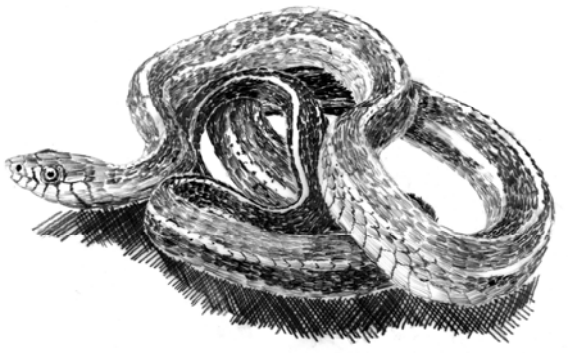
Lowland leopard frog.



3.8.1.2 Northern Mexican Gartersnake

The northern Mexican gartersnake is strongly aquatic, occurring mainly in densely vegetated permanent marshes and streams at middle elevations in central, south central, and southeastern Arizona. It feeds primarily on native fish and amphibians. This species is most active, and reproduces, in the summer (AGFD 2001b).

Northern Mexican gartersnake.



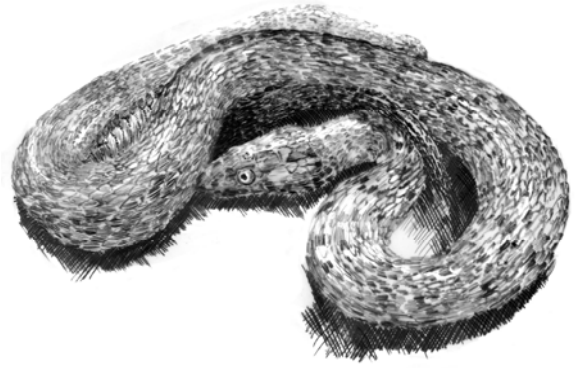
The northern Mexican gartersnake is not listed by FWS but is on AGFD's list of Wildlife of Special Concern AGFD (2006). The Center for Biological Diversity petitioned the FWS to list the species as threatened or endangered with critical habitat on December 15, 2003. In response to that petition the FWS initiated a 90-day finding and status review on January 4, 2006 (71 FR 315). FWS determined that listing of the northern Mexican gartersnake is not warranted due to limited knowledge of its status in Mexico (71 FR 56228; September 26, 2006). Within the United States, the distribution of this species has decreased by 90 percent and it has likely been extirpated from New Mexico (FWS 2006). In a large-scale, two-year sampling effort, Holycross et al. (2006) found this species in only three of 33 targeted sites (9 percent) in central and east-central Arizona. Threats include predation by nonnative aquatic species such as bullfrogs and sportfish, habitat loss and degradation, and a decline in its prey base due to habitat degradation and predation by, and competition with, nonnative species (AGFD 2001b).

The northern Mexican gartersnake is reported as occurring in the action area in nearshore habitats of the Verde River from Fossil Creek and upstream above the action area along lower Oak Creek in the vicinity of Page Springs (71 FR 56228; September 26, 2006).

3.8.1.3 Narrow-headed Gartersnake

The narrow-headed gartersnake is almost strictly aquatic, occurring in or near clear, cool, permanently flowing rocky streams. The elevation range for this species is about 2,300 to 8,080 feet, and its habitat setting generally includes montane forests with piñon-juniper, oak-pine, or ponderosa pine with cover from cottonwood-willow. Important vegetative components include shrub and sapling Arizona alder, velvet ash, willows, and canyon grape. The narrow-headed gartersnake feeds primarily on fish, with some amphibians taken. The narrow-headed gartersnake gives live birth in July and August (AGFD 2002d).

Narrow-headed gartersnake.



The narrow-headed gartersnake is not listed by FWS but is on AGFD's list of Wildlife of Special Concern AGFD (2006). Holycross et al. (2006) found this species in only five of 42 targeted sites (11 percent) in central and east-central Arizona. Some populations appear stable but others are declining (AGFD 2002d). Threats include predation by nonnative aquatic species, primarily crayfish and sportfish; lowered

water table; diminishing prey base; sedimentation of streams; and habitat loss/degradation/fragmentation (AGFD 2002d).

The narrow-headed gartersnake was recently recorded in the action area in the Verde River near the confluence with Fossil Creek, but may also occur in low densities in appropriate mainstem or tributary habitat upstream of there. A remaining, but declining stronghold for this species also occurs above the action area along Oak Creek in Oak Creek Canyon (Nowak and Santana-Bendix 2003).

3.8.2 Frog and Gartersnake Environmental Consequences

Given the similarity in habitat use, the analysis of impacts of the reservoir operation alternatives for native fish was used to estimate the impacts on the covered frog and gartersnake species. The impact is addressed in terms of changes to occupied or potentially occupied habitat resulting from nonnative fish, crayfish, or bullfrogs that are produced in the reservoirs that could prey directly upon the frogs and gartersnakes, or that could prey on or compete with native prey species that are an important food resource for these species. Because these species are semi-aquatic and experience an annual dormant season, it is likely that the impacts to them from reservoir operations are of a smaller magnitude than the impacts to covered native fish.

It is assumed that the entire Action Area could be potentially occupied habitat for these species at some point during the life of the permit. Because some portions of the action area are unsuitable for these species, and because they are semi-aquatic, this approach results in a conservative estimate of potential impacts.

3.8.2.1 No Permit Alternative Impacts on Frogs and Gartersnakes

Impacts of the No Permit Alternative on habitat of the covered frog and gartersnake species would be lower than the other proposed alternatives. Over the next 50 years, the estimated impact would be 31.9 river miles of habitat (Attachment 1, Subchapter IV.C.1.b).

3.8.2.2 Modified Historical Operation Alternative Impacts on Frogs and Gartersnakes

Impacts of the Modified Historical Operation Alternative on covered frog and gartersnake habitat would be slightly greater than the other two alternatives because Horseshoe would not always be drawn down as rapidly or kept empty as long as possible, which could allow more nonnative species to reproduce and grow. Impacts to frog and gartersnake habitat from the continued operation of Horseshoe and Bartlett under the Modified Historical Operation Alternative is estimated to be 39.5 river miles (Attachment 1, Subchapter IV.C.2.b).

3.8.2.3 Optimum Operation Alternative Impacts on Frogs and Gartersnakes

As with the covered fish species, the impacts on frog and gartersnake habitat are lower than under the Modified Historical Operations Alternative but higher than the No Permit Alternative. The estimated impacts total 33.9 river miles of habitat (Attachment 1, Subchapter IV.B.4.a).

3.9 Other Threatened, Endangered, and Sensitive Species

3.9.1 Other Threatened, Endangered, and Sensitive Species Affected Environment

AGFD's Heritage Data Management System (HDMS) was used to identify sensitive plant and wildlife species that could occur in the study area but were not selected for coverage by the HCP. Wildlife species are listed in Table 3-2 and plant species are listed in Table 3-3.

The HCP contains descriptions for each species (Attachment 1, Subchapter III.A.2).

3.9.2 Other Threatened, Endangered, and Sensitive Species Environmental Consequences

The three operation alternatives would be unlikely to have adverse impacts on listed and sensitive species not covered by the HCP for the reasons provided in the following sections. Watershed management activities under the Optimum Operation and Modified Historical Operation alternatives that may impact upland species would be subject to separate NEPA and ESA compliance as necessary.

Table 3-2. Other listed wildlife and species of concern near Horseshoe and Bartlett.

Scientific Name	Common Name	ESA	USFS	AGFD	Critical Habitat Designated	Upland, Riparian, or Aquatic
Glaucidium brasilianum cactorum	Cactus ferruginous pygmy-owl	-	-	WSCA	-	Upland
Rallus longirostris yumanensis	Yuma clapper rail	LE	-	WSCA	-	Aquatic
Gila intermedia	Gila chub	LE	S	WSCA	Yes (upstream)	Aquatic
Gila nigra	Headwater chub	C	-	-	-	Aquatic
Oncorhynchus gilae	Gila trout	LT	S	WSCA	-	Aquatic
Gopherus agassizii (Sonoran population)	Sonoran desert tortoise	-	-	WSCA	-	Upland
Ictinia mississippiensis	Mississippi kite	-	-	WSCA	-	Upland

KEY: ESA=Endangered Species Act as amended, 1973 (LE=Listed Endangered; LT = Listed Threatened; C = Candidate)
USFS=United States Forest Service (S=Sensitive Species)
AGFD=Arizona Game and Fish Dept (WSCA=Wildlife of Special Concern)
Critical Habitat=designated under the ESA (relationship to action area)

Table 3-3. Listed and sensitive plants near Horseshoe and Bartlett.

Scientific Name	Common Name	ESA	USFS	BLM	NPL	Riparian or Upland
Purshia subintegra	Arizona cliffrose	LE	-	-	HS	Upland limestone lakebed deposits
Agave murpheyi	Hohokam agave	-	S	S	HS	Upland
Eriogonum ripleyi	Ripley wild buckwheat	-	S	-	SR	Upland

KEY: ESA=Endangered Species Act as amended, 1973 (LE=Endangered)
USFS=United States Forest Service (S=Sensitive Species)
BLM=United States Bureau of Land Management (S=Sensitive Species)
NPL=A.R.S. § 3-901 et seq. (HS=Highly Safeguarded, no collection; SR=Salvage Restricted, collection with permit)

3.9.2.1 Cactus Ferruginous Pygmy-Owl

The operation alternatives are unlikely to have an impact on the cactus ferruginous pygmy-owl for the following reasons:

- The historical range does not extend into the Verde watershed.
- The cactus ferruginous pygmy-owl is an upland species.

3.9.2.2 Yuma Clapper Rail

The operation alternatives are unlikely to have an impact on the Yuma clapper rail for the following reasons:

- USFS surveys along the Verde River from Childs to Sheep Bridge have not produced any Yuma clapper rail detections in either 2002 or 2003; and in 2003, field review downriver to Horseshoe did not find any suitable habitat below Sheep Bridge (Burger 2003).
- Suitable habitat comprised of relatively large areas of cattail marshes used by this species does not occur at the reservoirs or along the Verde River below the dams.
- Reservoir operations are unlikely to impact habitat downstream of Granite Reef, where the Yuma clapper rail may be found.

3.9.2.3 Gila Chub

The operation alternatives are unlikely to have an adverse impact on the Gila chub for the following reasons:

- The Gila chub occupies small headwater streams that are unlikely to be directly or indirectly impacted by the operation alternatives.
- Reservoir operation alternatives are unlikely to impact existing populations or adversely modify critical habitat.

3.9.2.4 Headwater Chub

The operation alternatives are unlikely to have an adverse impact on the headwater chub for the following reasons:

- There is no known evidence that the headwater chub historically occupied habitat within the study area.
- The headwater chub prefers smaller headwater streams, and reservoir operation alternatives are unlikely to impact the existing populations at these locations.

- The closest known population of headwater chub is located more than 40 miles upstream, outside of the study area.

3.9.2.5 Gila Trout

The operation alternatives are unlikely to have an adverse impact on the Gila trout for the following reasons:

- There is no known evidence that the Gila trout historically occupied habitat close to Horseshoe or Bartlett.
- The Gila trout prefers cold, small headwater streams which occur near or outside the terminus of the study area boundary.
- Where Gila trout have been reintroduced, a fish barrier protects reaches from nonnative fish invasion; thus, reservoir operation alternatives are unlikely to impact the existing occupied habitat.
- Future introductions of Gila trout for sportfishing or urban fishing may occur in many areas of Arizona including within or adjacent to the action area, but survival of these introduced fish would be of seasonal duration in the action area due to lethal summer water temperatures. Thus, the introduced fish occurring in the action area would not be targeted for species recovery (see 71 FR 40657; July 18, 2006).

3.9.2.6 Sonoran Desert Tortoise

Because the Sonoran desert tortoise is an upland species, the reservoir operation alternatives are unlikely to have an impact on the species.

3.9.2.7 Mississippi Kite

The operation alternatives would be unlikely to have an adverse impact on the Mississippi Kite because no part of its natural history or behavior is particularly reliant upon resources that may be impacted by any of the reservoir operation alternatives.

3.9.2.8 Arizona Cliffrose

The operation alternatives would be unlikely to have an impact on the Arizona cliffrose because the known locations and all potential locations for this species occur in upland areas.

3.9.2.9 Hohokam Agave

The operation alternatives would be unlikely to have an impact on the Hohokam agave because this is an upland species.

3.9.2.10 Ripley Wild Buckwheat

The operation alternatives would be unlikely to have an impact on the Ripley wild buckwheat because this is an upland species.

3.10 Recreation

3.10.1 Recreation Affected Environment

Horseshoe, Bartlett, and nearby lands along the lower Verde River provide a wide range of water- and land-based recreation opportunities including boating, angling, personal watercraft use, camping, and off-road vehicle use. Water-based recreation at Horseshoe is limited by its size and frequent draw down of lake levels. About 50 percent of visitation in this area occurs at Bartlett, which is larger than Horseshoe, because Bartlett experiences more stable lake levels and is closer to metropolitan Phoenix (Jardin, pers. comm. 2005).

Public recreation use also occurs along a 12-mile segment of the Verde River between the two reservoirs, and another 11-mile segment that extends from Bartlett to the upstream boundary of the FMYN Reservation. The Verde River includes popular areas for river rafting, kayaking, angling, and camping. The river-running season along the Verde River primarily spans between March and April, depending on the amount of spring runoff. The peak recreation season for the study area is April 1 to October 1, although usage is year-round (Jardin, pers. comm. 2003).

Estimated annual recreation use levels at Horseshoe, Bartlett, and portions of the Verde River between Horseshoe Dam and the Salt River confluence totaled about 318,000 visitors in 2004 (Jardin, pers. comm. 2005). Recreation facilities in this area have a total daily capacity for 10,700 people (Jardin, pers. comm. 2005).

The HCP contains more detailed descriptions of recreation opportunities at Horseshoe, Bartlett, and along the lower Verde River (Attachment 1, Subchapter III.B.2).

3.10.2 Recreation Environmental Consequences

3.10.2.1 No Permit Alternative

Small impacts on recreation might occur under the No Permit Alternative due to earlier and more rapid draw down of Horseshoe. Given the limited recreation use at Horseshoe, especially in April when most of the draw down would occur, the No Permit Alternative would have no significant adverse impact on recreation.

3.10.2.2 Modified Historical Operation Alternative

There would be no impact on recreation as a result of the Modified Historical Operation Alternative because operations would not change from existing conditions.

3.10.2.3 Optimum Operation Alternative

A small decrease in recreation use would occur at Bartlett in years when Horseshoe is filled ahead of Bartlett in order to maintain flycatcher habitat in Horseshoe after two successive years of drought. These lower Bartlett levels would occur for a few months, about once every 13 years on average, typically in late winter or early spring. The recreation impacts are not expected to be significant because a minimum pool at Bartlett would be maintained that allows boat access, winter and early spring are not peak seasons for recreation at Bartlett, and a portion of the recreation users may choose to use Horseshoe during these infrequent occurrences.

3.11 Socioeconomics and Environmental Justice

3.11.1 Socioeconomics and Environmental Justice Affected Environment

Most of the study area is located in Maricopa County. Slightly less than a quarter of the study area is in Yavapai County. The primary socioeconomic influence area includes the SRP water service area, portions of three Indian reservations, agricultural lands, and other city lands in the Phoenix metropolitan area (Figure 3-1). The Indian reservations are the

FMYN, the SRPMIC, and the Gila River Indian Community. These areas contain about 60 percent of Arizona's total population (U.S. Census Bureau 2005a, 2005b). Maricopa County also benefits from visitors pursuing water-based recreation opportunities provided by the Verde River, Horseshoe, and Bartlett.

3.11.1.1 Population

Maricopa County is the most populous county in Arizona. The U.S. Census Bureau estimates that the Maricopa County population in 2004 was about 3.5 million (U.S. Census Bureau 2005a). Much of the recent population growth can be attributed to population growth in the City of Phoenix and outlying suburbs of Tempe, Chandler, Mesa, Gilbert, and Scottsdale. By 2025, it is estimated Maricopa County could be home to almost 5 million people (ASU Arizona Real Estate Center 2002).

The 2000 population of the FMYN Reservation was 824 residents (Arizona Department of Commerce 2005a). The 2000 population of the SRPMIC Reservation was 6,405 (Arizona Department of Commerce 2005b).

3.11.1.2 Employment and Income

Maricopa County is a major economic center in the southwestern U.S. and comprises about 64 percent of Arizona's total labor force. In 2004, private sector employers accounted for about 87 percent of jobs in Maricopa County (Arizona Department of Commerce 2005c, 2005d).

The employment sector "trade, transportation, and utilities" is the largest employment sector in Maricopa County and in both Indian communities. Agriculture is an important source of jobs and income in both Maricopa and Yavapai counties. In 2000, the agricultural sector in Maricopa County accounted for 30.9 percent of Arizona's total agricultural sales (USDA 2005). The warm climate and irrigation help produce diverse crops including wheat, barley, corn, hay, lettuce, cauliflower, broccoli, melons, and fruits, as well as wool and livestock.

In 2003, Maricopa County's per capita income was $30,160 (U.S. Department of Commerce 2005). In 1999, FMYN Reservation per capita income was $19,293 and SRPMIC Reservation per capita income was $9,592 (Arizona Electronic Atlas 2007).

3.11.1.3 Environmental Justice Communities

Executive Order (EO) 12898, dated February 11, 1994, calls for identification of minority and low-income populations within the impact area. The concern is whether those populations would bear disproportionate impacts from the proposed action. The Indian communities within the study area meet the criteria for consideration under EO 12898 because the communities are primarily comprised of minorities. Also, the SRPMIC would be considered a low-income population.

3.11.1.4 Water Use

As described in the HCP (Attachment 1, Chapter I and Appendix 1), water from Horseshoe, Bartlett, and SRP's other reservoirs is provided directly by SRP to shareholder lands for irrigation and other uses, and is delivered to the cities of Avondale, Chandler, Gilbert, Glendale, Mesa, Peoria, Phoenix, and Scottsdale for municipal use on shareholder lands. Water deliveries are also made pursuant to specific water rights in Horseshoe and Bartlett held by the City of Phoenix, SRPMIC, and FMYN. In addition, water is delivered from the SRP reservoir system to the cities, Gila River Indian Community, Buckeye

Irrigation Company, RWCD, and others in satisfaction of their independent water rights. Finally, exchange agreements between a number of entities and SRP pursuant to state and federal law are facilitated by stored water from Horseshoe and Bartlett.

Horseshoe and Bartlett supply about 40 percent of SRP's surface water supplies, or about 360,000 AF per year (Ester, pers. comm. 2001). Water stored in Horseshoe and Bartlett is a major source of water to Phoenix, FMYN, and SRPMIC. From 1995 through 2002, Phoenix chose to take delivery of about 15,000 AF/year on average from its storage entitlement in Horseshoe (Attachment 1, Appendix 1). FMYN obtains all of its water supplies from the Verde River, including ground water pumped from the alluvial aquifer along the river (Attachment 1, Chapter I and Appendix 1). SRPMIC receives a substantial amount of water from the Verde River, including an average of about 18,000 AF/year from storage developed by Bartlett (Attachment 1, Appendix 1).

3.11.2 Socioeconomics and Environmental Justice Environmental Consequences

For all of the alternatives, there would be no direct impact to minority or low-income populations because Horseshoe and Bartlett are located entirely on upstream federal lands. Indirect impacts to minority or low-income populations within the SRP water service area are possible under the No Permit Alternative because this alternative could lead to increased costs for water and power. However, minority and low-income populations would not be disproportionately impacted because costs would increase for all water users.

The operation alternatives could result in socioeconomic impacts if they affected the amount of water available for agricultural, commercial, or domestic use.

3.11.2.1 No Permit Alternative

As previously described in Section 3.2.2, under the No Permit Alternative, the long-term average annual net loss of surface water supplies to SRP and other water users would be about 11,000 AF/yr. Using replacement costs of $457 to $506 per AF, the total water supply impact from a net loss of 11,000 AF/yr would be about $5.0 to $5.6 million per year. Long-term impacts may be greater or less than this estimate depending on how much water would need to be released to expose occupied flycatcher habitat.

It would be difficult and costly to obtain water to replace or compensate for water lost because of implementing the No Permit Alternative. Replacement alternatives could include building one or more new reservoirs, increasing ground water pumping, and purchasing and conveying water from other basins. The feasibility of each of these replacement alternatives is affected by environmental regulations, limitations on pumping ground water, low availability of surface water rights, and high costs. The water loss could also be compensated for by significantly raising rates to reduce consumption, purchasing agricultural rights for municipal use, or implementing significant restrictions on water use. It is unlikely that these measures individually or together would replace 11,000 AF/yr of water.

Because feasible alternatives for replacing the lost water are few and expensive, the No Permit Alternative would

potentially have a significant adverse impact on the socioeconomics of the study area.

3.11.2.2 Modified Historical Operation Alternative

Because the Modified Historical Operation Alternative would not change water supplies from existing conditions, it would have no impact on the socioeconomics of the study area.

3.11.2.3 Optimum Operation Alternative

As described in Section 3.2.2, the Optimum Operation Alternative would not adversely impact water supplies. Because water supplies would not be adversely impacted, the Optimum Operation Alternative would have no impact on socioeconomics in the study area.

3.12 Land Use and Land Ownership

3.12.1 Land Use and Land Ownership Affected Environment

Primary land uses in the study area and its vicinity include recreation, wildlife habitat, livestock grazing, development on non-Federal lands, and some commercial businesses (e.g., Bartlett Marina). Water stored behind Horseshoe and Bartlett dams is on land withdrawn from the public domain in 1903 and 1904 by Reclamation for purposes of the Salt River Project. A small amount of additional land was withdrawn in 1966. Withdrawn land is managed under a three-way agreement among SRP, Reclamation, and the USFS, with Tonto National Forest being responsible for management of recreation and other non-Reclamation land uses.

Public lands bordering the withdrawn lands are managed by the USFS. The USFS manages National Forest lands according to uses specified under the Tonto National Forest Management Plan (USFS 1985). Horseshoe and Bartlett reservoirs are in Management Area 1E of the Tonto National Forest Management Plan. Management Area 1E is managed primarily for water-oriented recreation. Management directives for Management Area 1E focus on maintenance and management of water-oriented developed and dispersed recreation (mostly serving boaters and their watercraft, and campers), crowd and site capacity control, interpretive activities, recreational trails maintenance, and visitor assistance. None of the activities on or around the reservoirs, including recreation and other permitted uses such as grazing, concessionaires (e.g., Bartlett Marina), and plant collection, are under the control of SRP.

Grazing is permitted throughout much the land adjacent to or near the action area. USFS grazing allotments adjacent to or near the river in the study area include, but are not limited to, Bartlett, Sears Club-Chalk Mountain, and St. Clair. In addition to grazing on USFS land, unrestricted livestock grazing occurs on FMYN lands where both cattle and wild horses graze along the river.

Under the Optimum Operation Alternative (preferred alternative), SRP intends to acquire conservation easements or title to private lands for mitigation purposes in the Safford, Verde, and possibly San Pedro valleys (Attachment 1, Subchapter V.C.2). The total quantity of these lands ranges from 200 to 400 acres, which would not result in a significant change in land use of land ownership in any of these locations.

3.12.2 Land Use and Land Ownership Environmental Consequences

The operation alternatives would have no direct impact on land use or land ownership in the study area. The Modified Historical Operation and Optimum Operation alternatives would indirectly impact land use and land ownership because of the acquisition of mitigation lands. Mitigation lands would be acquired by SRP and permanently protected from development. SRP would manage the areas for the benefit of covered bird species and former private uses would be discontinued.

Because only 200 acres (400 acres maximum) would be impacted and because substantial areas of private property are present in and around the locations where mitigation lands would be acquired, the alternatives would have no significant impact on land use or land ownership.

There are not expected to be impacts on adjacent land uses due to the management of the mitigation lands for flycatchers. SRP's priority for mitigation lands is to acquire unprotected habitat currently occupied by flycatchers, or which is close to occupied habitat (Attachment 1, Subchapter V.C.2. Thus, flycatchers already would be present in the area and the potential for third-party take or the need to consult on activities with a federal nexus would not change on surrounding lands.

3.13 Cultural Resources

Cultural resources include: 1) archaeological materials and sites; 2) standing structures that are over 50 years of age or are important because they represent a major historical theme or era; 3) cultural and natural places, certain natural resources, and sacred objects that have importance for Native Americans; and 4) American folklife traditions and arts (DOE 1993). The National Historic Preservation Act of 1966 (as amended), and it's implementing regulations (36 CFR 800), require federal agencies to consider impacts on cultural resources before undertaking actions. Cultural resources can be separated into two groups: historic and prehistoric. Cultural resources are considered historic if they are more than 50 years old and date to the period after Euroamerican contact (generally post-A.D. 1540), and prehistoric if they date to the period before Euroamerican contact. If cultural resources meet certain criteria, they are considered eligible for inclusion on the National Register of Historic Places (NRHP). If a proposed project would alter or impact the characteristics for which the resources are eligible, measures must be developed and implemented to minimize or mitigate the impacts.

Traditional cultural properties are those cultural resources that are eligible for inclusion on the NRHP because they possess significance to tribal religious beliefs or practices and cultural affiliation. Examples relevant to the Horseshoe and Bartlett area include locations associated with traditional beliefs of a Native American group, locations that Native American religious practitioners have historically used or are known to use today, or locations where a group has traditionally carried out economic, artistic, or other cultural practices.

The land now covered by Horseshoe and Bartlett has been home to nomadic hunter-gatherers and, more recently, by the Hohokam, sedentary horticulturalists. The Hohokam are a distinct group of people who built large permanent settlements and sophisticated irrigation systems. The first

permanent settlements in the area date to before A.D. 1 and end with the Classic Period (A.D. 1150-1350). A large late Classic Period village is located within what is now Horseshoe Reservoir. During draw down periods, this site becomes exposed and remains in remarkable condition despite being inundated for part of many years. No known cultural resource inventories have been conducted within the maximum pool level of the reservoirs (Keane, pers. comm. 2002).

Historic cultural resources include the historical facilities, structures, and features associated with dam construction camps (Douglas et al. 1994). Two camps are associated with Bartlett and three are associated with Horseshoe. All of these camps are located well outside the area of potential impact.

3.13.1 Cultural Resources Environmental Consequences

3.13.1.1 No Permit Alternative

The No Permit Alternative would have no impact on cultural resources beyond the maximum pool elevation of Horseshoe. The No Permit Alternative would expose the Horseshoe lakebed and the Classic Period village more often and for longer periods of time. The impacts of exposure on the degradation of the village are unknown, but it is likely that increased exposure to daily temperature fluctuations and rain would adversely impact the resource. It is also possible that longer periods of exposure would result in more people visiting and adversely impacting the site. A possible beneficial effect of increased exposure would be more thorough documentation of the village by cultural resource specialists.

3.13.1.2 Modified Historical Operation Alternative

Because the Modified Historical Operation Alternative would not result in changes to existing conditions, there would be no change in the current rate of degradation of the Classic Period village.

3.13.1.3 Optimum Operation Alternative

In most years, the Optimum Operation Alternative would be similar to existing conditions and would have no impact on the existing rate of degradation of cultural resources. In years when the reservoir is filled to benefit riparian vegetation, about 1 in 13 years on average, the Classic Period village would be inundated longer. The impacts of longer inundation are unknown. Longer inundation could reduce the rate of degradation by protecting the village from exposure to rain and freeze/thaw cycles. Because Horseshoe would be filled longer than existing conditions only occasionally, the increased inundation is not likely to have a significant impact on the village or other undocumented cultural resources.

3.14 Air Quality

3.14.1 Air Quality Affected Environment

The Clean Air Act requires the Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The Clean Air Act establishes two types of national air quality standards—primary standards and secondary standards. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set

limits to protect public welfare, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

The EPA has classified portions of Maricopa County as nonattainment or maintenance areas with respect to federal air quality standards for four criteria pollutants: carbon monoxide (CO), 1-hour ozone, 8-hour ozone, and particulate matter less than or equal to 10 microns in diameter (PM-10) (MAG 2005). All of the portions of the study area in Maricopa County are within the 8-hour ozone nonattainment area. South of the upstream end of Bartlett, the study area is in the PM-10 nonattainment area. The study area within and south of the Indian reservations is in the carbon monoxide maintenance area (MAG 2005).

3.14.2 Air Quality Environmental Consequences

3.14.2.1 No Permit Alternative

The No Permit Alternative would expose the Horseshoe lakebed for longer periods of time, which could result in increased airborne particulates on windy days. The No Permit Alternative could have a minor adverse impact on local air quality, but it would have an insignificant adverse impact on air quality throughout the study area.

3.14.2.2 Modified Historical Operation Alternative

Because the Modified Historical Operation Alternative would not change air quality over existing conditions, it would have no impact on air quality in the study area.

3.14.2.3 Optimum Operation Alternative

The Optimum Operation Alternative would expose the Horseshoe lakebed for longer periods than under existing conditions. This could result in localized minor reduction in air quality when wind picks up dust from the lakebed, but the Optimum Operation Alternative would have no significant adverse impact on air quality throughout the study area.

3.15 Cumulative Impacts

Cumulative impacts are the impacts on the environment which result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such actions (40 CFR 1508.7). Cumulative impacts can result from individually minor, but collectively significant, actions taking place over time. The CEQ, which implements NEPA, requires assessment of cumulative impacts in the decision-making process for federal projects.

Cumulative impacts to natural, cultural, and socioeconomic resources are possible for each of the alternatives under consideration. The previous description of the affected environment provides existing information on the past and present actions and the condition of resources related to the proposed project. Important past and present actions include: the original construction of Horseshoe and Bartlett dams and subsequent modifications; reservoir operational protocols including water storage, release, and flood control; recreation development at the reservoirs; urban and agricultural development of the Verde River Valley; residential and commercial development along the lower

Verde River; and land management practices on Tonto National Forest lands bordering Horseshoe and Bartlett, such as grazing and recreation.

"Reasonably foreseeable future actions" are defined as actions that are not speculative—they have been approved, are included in short to medium-term planning and budget documents prepared by government agencies or other entities, or are likely given trends (EPA 1999). There are no known specific reasonably foreseeable future actions within the Action Area that would impact the resources evaluated in this EIS. Therefore, the analysis of cumulative impacts in this section is based on the impacts of each alternative when added to the current trends in the region. Because the impacts of regional trends cannot be accurately quantified, the cumulative impacts are expressed in qualitative terms.

The environmental consequences described in this section provide information on the potential cumulative impacts of actions in the preferred Optimum Operation Alternative, as well as the No Permit and Modified Historical Operation alternatives. Reasonably foreseeable future actions considered in this cumulative impacts analysis are associated with continued urban and rural population growth, increasing demand for water, and increasing demand for recreation opportunities. The environmental analysis for all alternatives is based on the long-term hydrology of the basin, which includes the full range of conditions from droughts to floods. Historical hydrologic conditions are likely to be representative of future conditions.

The potential cumulative impacts of past, present, proposed alternative actions, and reasonably foreseeable future actions are evaluated below for each resource category. The time frame for analysis is the 50-year Permit period.

3.15.1 Water Resources and Flood Control

Cumulative impacts on water resources and flood control result from increased development and changes in land use. As Arizona's population grows, the demand for water increases proportionally. New development also can result in encroachment into floodplains and increase the likelihood of property damage or loss of life.

Cumulative impacts to water resources from alternative reservoir operations are possible within the study area downstream of Horseshoe and Bartlett. For the No Permit Alternative, a reduction in storage capacity would reduce available water supplies in the Phoenix metropolitan area and contribute to adverse cumulative impacts on the available water supply. A reduction in the available water supply would indirectly adversely impact other local and regional water supplies as alternative sources of water are sought and developed to meet existing and future demands. The Modified Historical Operation and Optimum Operation alternatives would continue to optimize water storage and utilization and would provide a long-term beneficial effect to meet water and recreation demand.

Because flooding is primarily related to precipitation events rather than upstream development, no future controllable activities upstream of the dams are likely to affect flooding. Because none of the proposed alternatives would have a significant impact on flood control, they would not contribute significantly to cumulative impacts to the Verde River flood regime below the dams.

3.15.2 Geology and Geomorphology

Geology and geomorphology in the study area could be impacted by future increases in development or changes in land use that increase sediment loads in the Verde River and its tributaries, or that physically modify stream channels (e.g., bank stabilization and channelization). These impacts could result in changes in stream and floodplain characteristics. As discussed in Section 3.3.2, the No Permit, Historical, and Optimum Operation alternatives would result in only localized changes in sediment deposition patterns in Horseshoe that would have little incremental contribution to cumulative impacts. Below the dams, the incremental impact of changes in sediment distribution and geomorphology caused by any of the three alternative reservoir operations would not be significant and would have little incremental contribution to cumulative impacts (Attachment 1, Subchapters IV.B.8, IV.C.1, and IV.C.2).

3.15.3 Vegetation

The composition, distribution, and extent of vegetation communities at Horseshoe and Bartlett are in part the product of dam construction, reservoir operations, and climatic events. As described in Section 3.4.2, the alternatives would result in localized changes in vegetation, particularly riparian vegetation. In addition to local changes in the composition and amount of riparian vegetation impacted by each of the alternatives, regional patterns of riparian vegetation are the result of past and current influences of water uses, recreation, livestock grazing, and development. Future actions are likely to follow the historical trend, resulting in areas of riparian vegetation degradation. The Modified Historical Operation alternative would have a small beneficial effect on regional riparian vegetation composition because reservoir operations support riparian vegetation in Horseshoe, and mitigation lands would be acquired and managed to enhance riparian vegetation. The Optimum Operation Alternative would have a slightly greater benefit to regional riparian vegetation because the reservoirs would be managed to help maintain riparian vegetation in Horseshoe, and mitigation lands would be acquired and managed to enhance riparian vegetation. Thus, the incremental impacts of the Modified Historical Operation and Optimum Operation alternatives may slightly offset adverse cumulative impacts on riparian vegetation from other regional impacts. Conversely, the No Permit alternative is likely to reduce the amount of riparian vegetation at Horseshoe, contributing to a decline in regional riparian habitat.

3.15.4 General Wildlife

Directly related to vegetation and reservoir levels, wildlife habitat at Horseshoe and Bartlett varies with reservoir operations and climatic conditions that influence the type of wildlife habitat present. Higher lake levels benefit aquatic species and water-dependent species, while lower lake levels generally favor terrestrial species. Recreational activities such as boating, fishing, off-road ATV use, hiking, and camping have impacted, and would continue to influence, wildlife use and habitat near Horseshoe and Bartlett regardless of the alternative selected. Cumulative impacts to wildlife are not readily comparable by alternative because each alternative would provide habitat for different classes of wildlife.

3.15.5 Covered Species

Throughout the Southwest, and especially in central Arizona, rapid increases in human population have impacted, and will continue to adversely impact, wildlife and plant species including the covered species. The cumulative impacts of the reservoir operation alternatives, when added to the impacts of other past, present, and future actions, are described below.

3.15.5.1 No Permit Alternative

Cumulative impacts on covered species from the No Permit Alternative would be similar to those described for the Optimum Operation Alternative (see below). However, with respect to flycatchers and cuckoos, slightly greater cumulative impacts might occur because total productivity of these species along the Verde River would be lower in the future due to less habitat occurring at Horseshoe. There are unlikely to be any significant cumulative impacts on bald eagles. For native fishes, the No Permit Alternative would result in slightly greater cumulative impacts than the Optimum Operation Alternative because there would be no mitigation measures implemented as part of the HCP.

3.15.5.2 Modified Historical Operation Alternative

Cumulative impacts on covered species from the Modified Historical Operation Alternative would be similar to those described for the Optimum Operation Alternative. Slightly greater cumulative impacts might occur to covered bird and fish species under the Modified Historical Operation Alternative because of slightly greater impacts from reservoir operations. However, mitigation measures would be implemented to offset impacts to covered bird species and native fish habitat from reservoir operations.

3.15.5.3 Optimum Operation Alternative

Cumulative Impacts on Covered Bird Species. There are few privately owned parcels near Horseshoe and Bartlett. Most of the private land along the Verde River occurs upstream of Horseshoe in the Verde Valley near Camp Verde and Cottonwood, and downstream of Bartlett near Rio Verde. Further development or subdivision of these parcels may result in additional loss of riparian habitat, either by direct habitat loss or land use activities that indirectly contribute to habitat loss through accelerated erosion, channel destabilization, and wildfires.

Recreation use at Horseshoe or Bartlett may impact flycatchers, cuckoos, and bald eagles or their habitat. Recreation use at these reservoirs is subject to USFS management, and is outside of SRP control. However, given the mandates of the ESA, it is unlikely that the recreation and reservoir operations will have significant cumulative impacts on the species.

Elsewhere in central Arizona and rangewide for the species, increasing development along rivers will have significant impacts on the covered bird species. Impacts are reasonably certain to occur directly to individuals or to habitat. Habitat fragmentation can have direct impacts including mortality and overall changes in habitat suitability that can further reduce the carrying capacity of a particular area. Increased development also has the secondary impact of increasing predatory pets (e.g., cats). Increases or changes in the types of potential cowbird foraging sites (e.g., bird feeders, corrals, and stockyards) may increase the potential for cowbird

parasitism of local flycatchers. Increased human disturbance including recreational use of the river floodplains, particularly by off-highway vehicles or river floaters, may also adversely impact riparian habitat. Wildfires also destroy riparian habitat. In addition, the pumping of surface and ground water may result in reduced river flows, which in turn would result in decreased habitat quality and quantity.

Loss or degradation of suitable habitat for flycatchers, bald eagles, and cuckoos is likely to continue inside and outside of the study area. Under the Optimum Operation Alternative, there would be no significant adverse impact on bald eagle (see Section 3.6.2.2 – no anticipated significant adverse impact to eagles, their habitat, or their prey base), but periodic inundation of habitat at Horseshoe would result in occasional loss of available habitat and productivity for flycatchers and cuckoos. Over the long term, flycatcher and cuckoo habitat is likely to expand and be maintained by periodic inundation. Cumulative impacts of the Optimum Operation Alternative, in addition to other future actions, could result in the periodic loss of habitat availability. However, the acquisition and management of suitable riparian habitat under the HCP would compensate for this periodic loss of habitat availability. With full implementation of these conservation measures, the Optimum Operation Alternative would not add appreciably to the regional cumulative impacts because mitigation measures would be implemented. In addition, riparian habitat in the Verde watershed is likely to benefit from the watershed management efforts taken by SRP to offset impacts on native fishes, which would reduce the overall cumulative impacts of other activities.

Cumulative Impacts on Covered Fish, Frog, and Gartersnake Species. Cumulative impacts on native fish, frog, and gartersnake species from human activities in the study area are incorporated into the analysis of direct and indirect impacts from continued reservoir operations under the Optimum Operation Alternative. As summarized in the HCP (Attachment 1, Subchapter IV.B.4), these activities will continue to result in large nonnative fish populations, dams and other stream barriers, surface water diversions and ground water pumping, changes in land use including urbanization and development, population growth, recreation, agricultural runoff, sand and gravel mining, other mining activities, roads and trails, livestock grazing, and wildfire. In turn, these activities result in modification of water quantity, water quality, watershed condition, hydrology, stream channel characteristics, riparian and aquatic vegetation, bank stability, and other aquatic habitat characteristics. Elsewhere in Arizona and rangewide, these same types of human activities and impacts affecting native fish, frog, and gartersnake habitat for covered species are also reasonably certain to occur.

The cumulative impacts of the Optimum Operation Alternative, in addition to other future actions, could adversely impact the populations of covered native fish, frog, and gartersnake species. However, implementation of the minimization and mitigation measures that would be implemented under the HCP would offset the small impact from continued reservoir operations, and would provide for recovery opportunities for covered fish, frog, and gartersnake species.

3.15.6 Other Threatened, Endangered, and Sensitive Species

Ongoing regional increases in recreation demand and development, changes in the use and location of water resources, and additional nonnative species or pathogens are likely to result in habitat loss, habitat fragmentation, and reduced populations of these species. However, there would be no cumulative impacts from any of the reservoir operation alternatives because they have either no impact or insignificant adverse impacts on non-covered species.

3.15.7 Recreation

Recreation demands in the study area will increase as population grows. This could result in adverse impacts on recreation if adequate funding is not available to expand recreation facilities. Conversely, increased demand may result in greater recreation opportunities if public and private sector entities respond to the demand by improving or expanding facilities.

Because none of the operation alternatives are likely to have a significant impact on recreation, they would not contribute to cumulative impacts on recreation.

3.15.8 Socioeconomics and Environmental Justice

Future population growth and development is expected to continue in the Phoenix area, as is the need for providing municipal and commercial water supplies. Existing water supply sources, as well as development of future water supplies, will be necessary to meet anticipated demand.

The loss of water supply under the No Permit Alternative would require the development of replacement water supplies to meet demand; however, replacement water supplies are not readily available to offset the full extent of the water supplies that would be lost. Alternative water supply sources, such as treatment and use of wastewater effluent, additional ground water pumping, or construction of new reservoirs to replace Horseshoe and Bartlett stored water would need to be developed to the extent possible, but there may be insufficient water to meet existing and future needs, and costs would increase if alternative supplies could be developed. Thus, the cumulative economic impact from reduced water storage for the No Permit Alternative is likely to include an increased cost to consumers for water, adverse impacts to business development, and the indirect impacts to the local and regional economy associated with a reduced water supply and higher cost.

The Modified Historical Operation and Optimum Operation alternatives would continue to optimize water storage to meet water demand, but supplies may be inadequate to meet future population growth, particularly during periods of drought. These alternatives would not increase cumulative impacts due to population growth.

3.15.9 Land Use and Land Ownership

Land use and land ownership in the immediate vicinity of Horseshoe and Bartlett have been relatively stable for decades and are unlikely to change significantly in the future. Elsewhere in the study area, changes in land use and ownership have been primarily influenced by population growth and by changes in demographics of private land owners. Some private land previously used for agriculture

is being subdivided for residential development or is being converted to "ranchettes" that are no longer used for agriculture. None of the alternatives under consideration would result in substantial changes that would add to cumulative impacts of growth on land use and ownership. Implementation of the mitigation measures under the Modified Historical Operation and Optimum Operation alternatives would include acquiring 200, and possibly as many as 400, acres of land that would be permanently managed by SRP, or its designee, to benefit the flycatcher. Acquisition of mitigation properties would provide long-term protection of natural habitats near locations likely to receive additional development pressure in the future.

3.15.10 Cultural Resources

Previous impacts to cultural resources at Horseshoe have occurred from vandalism, weathering, and other disturbances, including inundation. Future similar types of impacts to cultural features near Horseshoe are possible for all of the alternatives. Maintaining a lower lake level for the No Permit Alternative may add to the cumulative impacts by exposing cultural sites and increasing their susceptibility to vandalism and weathering.

3.15.11 Air Quality

Air quality in the study area has been impacted in the past by emissions from downwind commercial and residential development. Extensive grazing may have also caused a minor increase in airborne particulates in areas where vegetative cover has been reduced or lost and wind picks up dust. Similar activities in the future would continue to contribute incrementally to cumulative impacts. In the Phoenix area, air quality is regulated by the EPA. Changes in air quality compliance requirements could improve or worsen air quality.

Past operations of Horseshoe have had a minor contribution to cumulative impacts. The proposed operation alternatives would similarly have minor contributions, with the No Permit Alternative possibly having the greatest contribution because the lakebed would be exposed longer and more often. The cumulative impact of the operation alternatives are not expected to significantly lower air quality ratings in regulated areas.

3.16 Unavoidable Adverse Impacts

It is not always possible to avoid adverse impacts from implementation of an alternative. Adverse impacts on resources from each of the alternatives are discussed in the environmental consequences section for each resource. Unavoidable adverse impacts for each alternative are summarized below.

3.16.1 No Permit Alternative

If this alternative were implemented, there would be an unavoidable loss in a portion of the water supply provided by Horseshoe. In the near term, the loss of water supply could create shortages in the Phoenix area. Although some of the water supply might be replaceable over time, the development of replacement water supplies would have significant adverse impacts on the regional economies because of the cost, planning, and construction activities needed to replace lost supplies. Compared to the other alternatives, there may be a long-term adverse impact on covered bird species because it is likely that not as much suitable habitat would be maintained at Horseshoe. There may also be a long-term adverse impact on covered fish, frog, and

gartersnake species because no measures would be implemented as part of the HCP to mitigate the impact of nonnative fishes and increase populations of native fish, frog, and gartersnake species.

3.16.2 Modified Historical Operation Alternative

Periodically, there would be unavoidable adverse impacts to flycatcher and cuckoo habitat during periods when Horseshoe is filled and existing riparian habitat is periodically unavailable because of inundation. However, these impacts will be mitigated over the long-term by off-site mitigation and a greater amount of habitat available at Horseshoe due to reservoir operations. Similarly, in the short-term, there would be unavoidable adverse impacts to native fish, frog, and gartersnake species and their habitat near the reservoirs as a result of continued competition with and predation by nonnative fishes. However, in the long-term, these unavoidable adverse impacts would be fully mitigated.

3.16.3 Optimum Operation Alternative

As with the Modified Historical Operation Alternative, there are periodic and short-term unavoidable significant adverse impacts to flycatcher, cuckoo, and native fish, frog, and gartersnake habitat when Horseshoe is filled. Likewise, all of these unavoidable significant adverse impacts are fully minimized and mitigated by the HCP.

3.17 Relationship of Short-Term Uses and Long-Term Productivity

All alternatives result in a long-term use of the environment for water storage and riparian habitat. However, each alternative has trade-offs between short- and long-term impacts on various resources. For purposes of this DEIS, short-term is defined as the next 10 years; long-term is defined as beyond 10 years.

3.17.1 No Permit Alternative

The No Permit Alternative would result in a long-term loss in water supplies from reduced storage and increased reservoir spills. The amount and suitability of habitat in Horseshoe for flycatchers and cuckoos may benefit in the short-term by not being inundated, but extended reductions in reservoir elevations would likely lead to less habitat available in the long-term for these species. Similarly, Horseshoe bald eagle perches may be reduced in the long-term. Native fish, frog, and gartersnake species may benefit in the short-term from the more rapid Horseshoe draw down and construction of a barrier on Lime Creek; however, native fish, frog, and gartersnake species would not benefit in the long-term from the management measures provided by the HCP.

3.17.2 Modified Historical Operation Alternative

This alternative would result in a short-term decrease in habitat for flycatchers and cuckoos because of inundation, but over the long term is expected to provide more suitable habitat for these species on average, particularly from the acquisition and

management of riparian habitat at other locations in central Arizona in perpetuity. There would be short-term impacts on native fish, frog, and gartersnake species until the reservoir operation and mitigation measures offset significant adverse impacts, and in the long-term mitigation measures will allow for recovery opportunities by the resource agencies because mitigation actions provide greater benefits than the estimated impacts of operations. The Modified Historical Operation Alternative also would provide a long-term benefit in meeting water supply needs, particularly during periods of drought.

3.17.3 Optimum Operation Alternative

This alternative would result in long-term habitat protection for flycatchers and cuckoos by managing Horseshoe for riparian vegetation, minimizing habitat inundation, and acquiring and managing riparian habitat as mitigation. There may be a short-term decrease of available habitat during Horseshoe fills. Like the Modified Historical Operation Alternative, there would be short-term impacts on native fish, frog, and gartersnake species until the reservoir operation and mitigation measures offset significant adverse impacts, and in the long-term mitigation measures will allow for recovery opportunities by the resource agencies because mitigation actions provide greater benefits than the estimated impacts of operations. Also, the Optimum Operation Alternative would provide a long-term benefit in meeting water supply needs for the Phoenix metropolitan area.

3.18 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that are lost to use by future generations. Irretrievable commitments are not permanent; the resources are lost to use for a period of time.

3.18.1 No Permit Alternative

A reduction in the conservation storage capacity at Horseshoe may result in the irreversible loss of water rights for SRP, Phoenix, and others that hold legal surface water rights. A substantial portion of the additional water that is spilled and unavailable for use would be an irreversible loss to SRP and Phoenix.

3.18.2 Modified Historical Operation Alternative

The commitment and funding for acquisition and permanent management of mitigation properties would be irreversible. The commitment and funding of mitigation and monitoring activities for the duration of the Permit would be irretrievable.

3.18.3 Optimum Operation Alternative

The commitment and funding for acquisition and permanent management of mitigation properties would be irreversible. The commitment and funding of mitigation and monitoring activities for the duration of the Permit would be irretrievable.

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Chapter 4 List of Preparers and Recipients of the Draft Environmental Impact Statement

This chapter includes a list of preparers and contributors to the DEIS and a list of recipients of the DEIS. Information on scoping, public involvement, and key issues is included in Chapter 1.

4.1 Preparers and Contributors

Fish and Wildlife Service

Name	Responsibilities	Education	Years Experience
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Greg Beatty	Biology	B.S. Wildlife Management	18

Salt River Project

Name	Responsibilities	Education	Years Experience
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Charles Ester III	Reservoir Operations, Hydrology	B.S. Hydrology	22
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Steve Doncaster	In-house Legal Review	B.A. Political Science Juris Doctor	21
Lesly Swanson	Ecology	B.S. Biological Sciences	6
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City of Phoenix

Name	Responsibilities	Education	Years Experience
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ERO Resources Corporation

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Martha Clark	Technical Editor, Document Production	B.A. English	18

4.2 DEIS Recipients

The following is a partial list of agencies, organizations, and individuals who received notice by mail of the availability of the DEIS. A complete list of agencies, public officials, organizations, and individuals to whom a copy of the DEIS was sent is on file at the Fish and Wildlife Service's Phoenix office.

4.2.1 Federal, State, and Local Agencies and Indian Tribes

Arizona State Parks
Arizona Department of Commerce
Arizona Department of Environmental Quality
Arizona Department of Water Resources
Arizona Game and Fish Department
Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation
City of Chandler
City of Gilbert
City of Glendale
City of Globe
City of Mesa
City of Payson
City of Peoria
City of Phoenix
City of Scottsdale
City of Tempe
Fort McDowell Yavapai Nation
National Park Service
Natural Resources Conservation Service
Salt River Pima-Maricopa Indian Tribe
State Historic Preservation Office
State Land Department
Tonto National Forest
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency Region IX
U.S. Geological Survey, Biological Resources Division

4.2.2 Federal and State Legislators

Senator Jon Kyl
Senator John McCain
Representative Trent Franks
Representative Jeff Flake
Representative Harry Mitchell
Representative Gabrielle Giffords
Representative Ed Pastor
Representative John Shadegg
Representative Rick Renzi
Representative Raul Grijalva
Office of the Governor: Janet Napolitano
State Representatives and Senators

4.2.3 Organizations

Arizona Chamber of Commerce
Arizona Municipal Water Users Association
Arizona Nature Conservancy
Arizona State University
Arizona Wilderness Coalition
Arizona Wildlife Federation
Center for Biological Diversity
Central Arizona Water Conservation District
East Valley Partnership
Friends of Arizona Rivers
Maricopa Audubon Society
Northern Arizona University
Roosevelt Water Conservation District
Sierra Club
University of Arizona

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Chapter 5
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