



ECONOMIC ANALYSIS OF CRITICAL
HABITAT DESIGNATION FOR THE
SPIKEDACE AND LOACH MINNOW

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EXECUTIVE SUMMARY

1. The purpose of this report is to evaluate the potential economic impacts associated with the designation of critical habitat for the federally listed spikedace (*Meda fulgida*) and loach minnow (*Tiaroga cobitis*). This report was prepared by Industrial Economics, Incorporated (IEc), under contract to the U.S. Fish and Wildlife Service (Service).
2. The Service listed the spikedace and loach minnow as threatened on July 1 and October 28, 1986, respectively. Since listing, the Service has designated critical habitat for the species three times. The current proposed rule, published in the Federal Register on October 28, 2010, represents the fourth critical habitat proposal for these species.
3. In the October 28, 2010 proposed rule, the Service proposed approximately 726 stream miles as critical habitat for the spikedace, and 709 stream miles as critical habitat for the loach minnow in Arizona and New Mexico.¹ In October 2011, the Service revised the rule to include additional stream miles for loach minnow, bringing the total to 723 stream miles.² Many of these stream miles represent overlapping habitat for both species, but some streams are proposed solely for one of the two species. Approximately 28 percent of the proposed critical habitat designation is unoccupied or is of uncertain occupancy by the species.
4. The proposed designation is subdivided into eight units and 42 stream segments. Of the stream miles proposed, approximately 63 percent intersect Federal lands (managed by the Bureau of Land Management, the Bureau of Reclamation or the Forest Service), 29 percent are privately owned, 6.5 percent are local or Tribal lands, and two percent are State lands. Critical habitat includes the wetted channel and adjacent floodplains within 300 lateral feet on either side of the bankfull stage.³ Following the publication of the Notice of Availability for the Draft Economic Analysis on October 4, 2011, approximately 32 public comments were received by the Service. This Final Economic Analysis responds to those public comments, where relevant. However, the geographic boundaries of this analysis continue to reflect the proposed rule, i.e., this analysis does not reflect any exclusions that the Service may make as part of its Final Rule.
5. This analysis focuses on quantification of the incremental costs of the proposed rulemaking, but also provides information on expected costs of conservation efforts expected to occur under the regulatory baseline in order to provide context. The

¹ 2010 Proposed Critical Habitat Rule. 75 FR 66482.

² 2011 Revised Proposed Critical Habitat Rule and Notice of Availability. 76 FR 61330.

³ 16 U.S.C. §1533(b)(2). Please refer to the proposed rule for legal descriptions of proposed critical habitat.

“incremental” economic impacts are costs of the proposed rule that are not expected to occur absent the designation of critical habitat for the spikedace and loach minnow. This information is intended to assist the Secretary of the U.S. Department of the Interior (DOI) in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation.⁴

6. This analysis forecasts potential economic impacts on ongoing and future activities, including water use and management, livestock grazing, recreation, species management, residential and commercial development, and transportation, and fire management. Impacts to activities ongoing by the Yavapai-Apache Nation, White Mountain Apache Tribe, and San Carlos Apache Tribe are also addressed. Quantified incremental impacts are estimated to be \$2.95 million to \$6.7 million over twenty years (\$261,000 to \$592,000 annually) using a real rate of seven percent, or \$3.55 million to \$8.3 million over 20 years (\$232,000 to \$540,000 annually) using a real rate of three percent. In addition to quantified impacts, some potential impacts associated with certain activities and projects are not quantified in this analysis. These potential impacts are nonetheless important, and should be considered as part of the impacts of this rule.
7. Impacts are presented by stream reach in Exhibits ES-1 and ES-2 below, with quantified impacts presented at a seven percent discount rate, and a three percent discount rate, respectively. As shown, in Unit 3A, the San Pedro River Unit, is anticipated to bear the highest incremental costs in both the low and high end scenarios. Quantified incremental costs are related to an anticipated large and costly consultation at Fort Huachuca Military Reservation, as well as annual monitoring costs on the San Pedro River of \$100,000 to \$200,000 annually. The next largest quantified incremental impacts are expected in the Gila River, Unit 8A, primarily related to anticipated costs related to riparian fencing construction. The relative rankings of these units, in terms of cost, do not change significantly when future costs are discounted at three percent or when undiscounted costs are considered.
8. The relative distribution of quantified incremental costs across activities is provided in Exhibits ES-3 and ES-4. As shown, in both the low and high end scenarios, the largest quantified incremental impacts are expected to be associated with water management, notwithstanding the unquantified incremental costs of the rule.
9. While potential impacts on water users are considered in this analysis, there are currently no data that indicate whether current or future diversions of water (including groundwater use) reduce stream flow or modify hydrologic conditions to a degree that adversely impacts spikedace and loach minnow or their habitat, although hydrologic models exist for some proposed areas.⁵ As such, this analysis does not quantify the probability or extent to which water use would need to be curtailed or modified to remedy impacts on the spikedace and loach minnow or their habitat. It does, however, provide information

⁴ 16 U.S.C. §1533(b)(2).

⁵ For example, a U.S. Geological Survey hydrologic model for the Upper San Pedro River exists, as noted in Public comments of Department of the Army, US Army Installation Management Command Headquarters, United States Army Garrison, Fort Huachuca, dated November 3, 2011.; Personal communication with the Service on December 8, 2011.

on the potential scale of the economic impacts that could occur if requirements associated with spinedace and loach minnow conservation result in changes in water diversions or conveyance.

KEY FINDINGS

Total Incremental Impacts: Incremental impacts are estimated to be \$2.95 million to \$6.7 million over twenty years (\$261,000 to \$592,000 annually) using a real rate of seven percent, or \$3.6 million to \$8.3 million over 20 years (\$232,000 to \$540,000 annually) using a real rate of three percent, excluding potential unquantified impacts associated with certain activities or projects.

Affected Activities: In both the low and high end scenarios, quantified costs are highest associated with water management.

- **Water Use and Management:** Quantified incremental costs associated with the loss of irrigated agricultural land value range from \$155,000 to \$282,000, on an annualized basis (seven percent), but do not include potential impacts to other water users that may occur. In particular, impacts to groundwater pumping at Fort Huachuca (San Pedro Unit) and by the Cities of Prescott/Prescott Valley (Granite Creek/Verde River mainstem) are possible, but not quantified. Potential affects on New Mexico Interstate Stream Commission CAP projects are discussed. Potential for reduced participation in NRCS funding is also not quantified. Potential impacts to mining and Tribal interests related to water issues are presented below.
- **Grazing:** Incremental impacts related to grazing activities are estimated to range from \$77,900 to \$147,000 on an annualized basis (seven percent). These costs are associated with the construction and maintenance of riparian exclusions, such as fencing, on eight allotments that are not currently excluded. Impacts also include administrative costs associated with 33 section 7 consultations.
- **Mining:** The mining industry has expressed concern that water use by existing or potential mining operations could be affected by spikedace and loach minnow conservation efforts and the designation of critical habitat. The analysis qualitatively discusses two large mining operations that could be affected if critical habitat results in changes in water diversions or conveyance for mining activities, but does not quantify these impacts because of the high level of uncertainty regarding changes in water use for mining.
- **Species Management and Recreation:** Incremental impacts associated with species management and recreation activities are estimated to be \$10,200 on an annualized basis (seven percent). Impacts include costs associated with the construction of fish barriers on unoccupied reaches and administrative costs.
- **Residential and Commercial Development:** Incremental impacts to development are forecast to be \$0 to \$71,300 on an annualized basis (seven percent). These impacts consist of monitoring, studies, and offsite mitigation that may be required of new development activity on private lands adjacent to unoccupied stream reaches in Unit 1.
- **Tribes:** Stream reaches proposed as critical habitat fall on the lands of the Yavapai-Apache Nation, San Carlos Apache Tribe, and White Mountain Apache Tribe. The Tribes are concerned that critical habitat on Reservation lands will have a disproportionate impact on their ability to use resources on their sovereign lands and to successfully achieve economic self-sufficiency. Quantified costs associated with Tribal activities are forecast at \$10,800 on an annualized basis (seven percent) for administrative costs, but do not include potential impacts of conservation efforts associated with potential water exchanges or other potential economic activities that may require conservation efforts. As such, impacts to Tribes are likely to be understated.
- **Transportation:** Incremental impacts to transportation activities are estimated to be \$5,000 to \$68,700 on an annualized basis (seven percent).
- **Fire Management:** Incremental impacts to fire management activities are estimated at \$1,250 on an annualized basis (seven percent), and are expected to consist entirely of administrative effort to conduct section 7 consultation.

Unit with Highest Impacts: The stream reach with the greatest project impacts is the San Pedro River Unit (Unit 3A). This stream is unoccupied with a variety of economic activities occurring in surrounding areas. In particular, Fort Huachuca Military Reservation anticipates conducting an involved and costly consultation, as well as annual monitoring efforts for the spikedace and loach minnow.

EXHIBIT ES-1. INCREMENTAL IMPACTS BY REACH, 2011-2030(2011\$, DISCOUNTED AT 7%)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS		POTENTIAL UNQUANTIFIED IMPACTS
		LOW	HIGH	LOW	HIGH	
1	Verde River	\$78,700	\$81,600	\$6,950	\$7,200	City of Prescott water supply; Yavapai-Apache Nation water exchange/water development project; NRCS Funding. ¹
	Granite Creek	\$61,600	\$61,600	\$5,430	\$5,430	
	Oak Creek	\$1,090	\$608,000	\$96	\$53,700	
	Beaver and Wet Beaver Creek	\$1,090	\$230,000	\$96	\$20,300	
	West Clear Creek	\$25,900	\$188,000	\$2,290	\$16,600	
	Fossil Creek	\$606	\$606	\$54	\$54	
2	Tonto Creek	\$32,100	\$277,000	\$2,830	\$24,500	NRCS funding White Mountain Apache (Fort Apache Reservation) <ul style="list-style-type: none"> • Water rights; settlement and dam project; • Tourism and outdoor recreation industry; • Housing and agricultural development; • Traditional uses of land; • Prescribed burns and other fire management activities.
	Greenback Creek	\$3,640	\$3,640	\$321	\$321	
	Rye Creek	\$689	\$689	\$61	\$61	
	Spring Creek	\$35,300	\$35,300	\$3,120	\$3,120	
	Rock Creek	\$15,600	\$15,600	\$1,380	\$1,380	
	White River	\$17,300	\$17,300	\$1,530	\$1,530	
	East Fork White River	\$17,300	\$17,300	\$1,530	\$1,530	
	North Fork East Fork Black River	\$3,410	\$3,410	\$301	\$301	
	East Fork Black River	\$5,710	\$5,710	\$504	\$504	
	Boneyard Creek	\$562	\$562	\$50	\$50	
	Coyote Creek	\$274	\$274	\$24	\$24	
3	San Pedro River	\$1,680,000	\$3,420,000	\$149,000	\$302,000	On the San Pedro River, the Service or outside parties could request that Fort Huachuca provide additional water for spikedace and loach minnow, causing the Fort to replace or reduce its water consumption. This requirement could result in substantial economic costs to the Fort, and potentially, cause regional economic effects. Because any such requirements are not currently known, they are not quantified.
	Hot Springs Canyon	\$6,980	\$6,980	\$616	\$616	
	Bass Canyon	\$1,340	\$1,340	\$118	\$118	
	Redfield Canyon	\$14,100	\$14,100	\$1,240	\$1,240	
	Aravaipa Creek	\$12,600	\$12,600	\$1,110	\$1,110	
	Deer Creek	\$5,740	\$5,740	\$507	\$507	
	Turkey Creek	\$5,800	\$5,800	\$511	\$511	
4	Bonita Creek	\$12,400	\$12,400	\$1,090	\$1,090	San Carlos Apache water use, recreation, traditional activities
5	Eagle Creek	\$52,600	\$52,600	\$4,640	\$4,640	Mining activities; White Mountain Apache and

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS		POTENTIAL UNQUANTIFIED IMPACTS
		LOW	HIGH	LOW	HIGH	
						San Carlos Apache: <ul style="list-style-type: none"> • Water use, as well as potential water exchanges; • Livestock use of proposed critical habitat for grazing and water; • Fire management activities; • Recreation; • Traditional activities.
6	San Francisco River	\$139,000	\$237,000	\$12,200	\$20,900	
	Tularosa River	\$2,410	\$2,410	\$213	\$213	
	Negrito Creek	\$549	\$549	\$49	\$49	
	Whitewater Creek	\$0	\$0	\$0	\$0	
7	Blue River	\$23,900	\$23,900	\$2,110	\$2,110	
	Campbell Blue Creek	\$998	\$998	\$88	\$88	
	Dry Blue Creek	\$383	\$383	\$34	\$34	
	Little Blue Creek	\$0	\$0	\$0	\$0	
	Pace Creek	\$100	\$100	\$9	\$9	
	Frieborn Creek	\$143	\$143	\$13	\$13	
8	Gila River	\$563,000	\$1,110,000	\$49,700	\$98,400	-NMISC proposed CAP projects
	West Fork Gila River	\$1,050	\$1,050	\$92	\$92	
	Middle Fork Gila River	\$1,540	\$1,540	\$136	\$136	
	East Fork Gila River	\$3,400	\$3,400	\$300	\$300	
	Mangas Creek	\$119,000	\$242,000	\$10,500	\$21,300	
	Bear Creek	\$2,530	\$2,530	\$223	\$223	
Total		\$2,950,000	\$6,710,000	\$261,000	\$592,000	N/A

Note: Totals may not sum due to rounding.

1. It is possible that some farmers may choose not to participate in NRCS programs after critical habitat is designated.

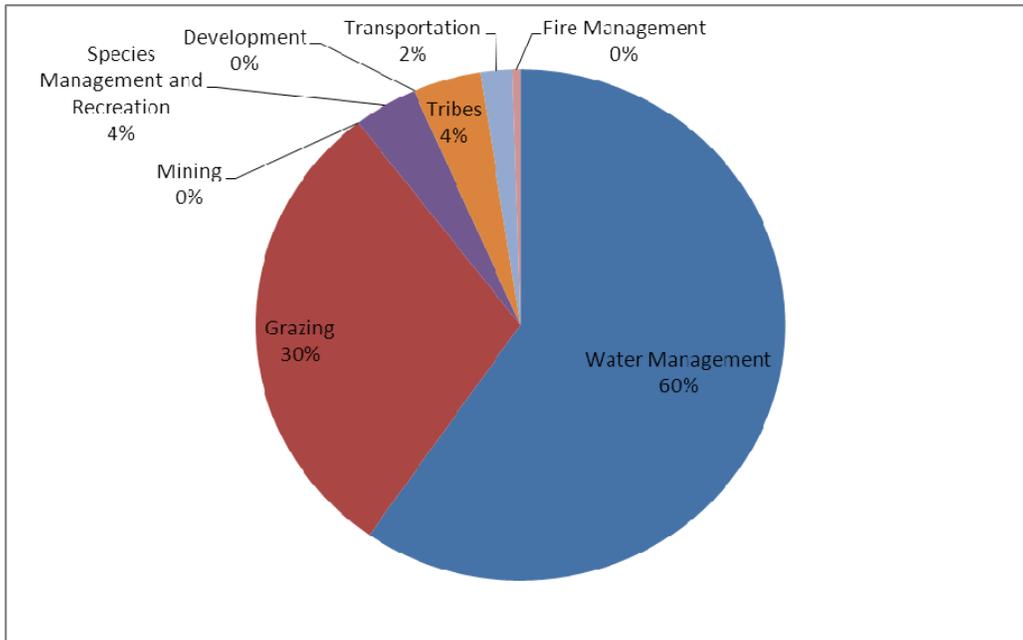
**EXHIBIT ES-2. QUANTIFIED INCREMENTAL IMPACTS BY REACH, 2011-2030 (2011\$,
DISCOUNTED AT 3%)**

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS		POTENTIAL UNQUANTIFIED IMPACTS
		LOW	HIGH	LOW	HIGH	
1	Verde River	\$98,500	\$102,000	\$6,430	\$6,680	City of Prescott water supply; Yavapai-Apache Nation water exchange/water development project; NRCS funding ¹
	Granite Creek	\$68,300	\$68,300	\$4,460	\$4,460	
	Oak Creek	\$1,590	\$817,000	\$104	\$53,300	
	Beaver and Wet Beaver Creek	\$1,590	\$306,000	\$104	\$20,000	
	West Clear Creek	\$35,200	\$247,000	\$2,290	\$16,100	
	Fossil Creek	\$820	\$820	\$54	\$54	
2	Tonto Creek	\$38,100	\$300,000	\$2,490	\$19,600	NRCS funding White Mountain Apache (Fort Apache Reservation): <ul style="list-style-type: none"> • Water rights settlement and dam project. • Tourism and outdoor recreation industry. • Housing and agricultural development. • Traditional uses of land. • Prescribed burns and other fire management activities.
	Greenback Creek	\$4,920	\$4,920	\$321	\$321	
	Rye Creek	\$931	\$931	\$61	\$61	
	Spring Creek	\$40,600	\$40,600	\$2,650	\$2,650	
	Rock Creek	\$17,600	\$17,600	\$1,150	\$1,150	
	White River	\$22,000	\$22,000	\$1,440	\$1,440	
	East Fork White River	\$22,000	\$22,000	\$1,440	\$1,440	
	North Fork East Fork Black River	\$4,610	\$4,610	\$301	\$301	
	East Fork Black River	\$7,850	\$7,850	\$512	\$512	
	Boneyard Creek	\$760	\$760	\$50	\$50	
	Coyote Creek	\$370	\$370	\$24	\$24	
3	San Pedro River	\$2,100,000	\$4,300,000	\$137,000	\$281,000	On the San Pedro River, the Service or outside parties could request that Fort Huachuca provide additional water for spikedace and loach minnow, causing the Fort to replace or reduce its water consumption. This requirement could result in substantial economic costs to the Fort, and potentially, cause regional economic effects. Because
	Hot Springs Canyon	\$9,440	\$9,440	\$616	\$616	
	Bass Canyon	\$1,810	\$1,810	\$118	\$118	
	Redfield Canyon	\$14,700	\$14,700	\$960	\$960	
	Aravaipa Creek	\$16,400	\$16,400	\$1,070	\$1,070	
	Deer Creek	\$7,770	\$7,770	\$507	\$507	
	Turkey Creek	\$7,840	\$7,840	\$511	\$511	

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS		POTENTIAL UNQUANTIFIED IMPACTS
		LOW	HIGH	LOW	HIGH	
						any such requirements are not currently known, they are not quantified.
4	Bonita Creek	\$15,000	\$15,000	\$976	\$976	San Carlos Apache water use, recreation, traditional activities
5	Eagle Creek	\$67,800	\$67,800	\$4,430	\$4,430	Mining activities; White Mountain Apache and San Carlos Apache: <ul style="list-style-type: none"> • Water use, as well as potential water exchanges; • Livestock use of proposed critical habitat for grazing and water; • Fire management activities; • Recreation; • Traditional activities.
6	San Francisco River	\$160,000	\$278,000	\$10,500	\$18,200	
	Tularosa River	\$3,260	\$3,260	\$213	\$213	
	Negrito Creek	\$743	\$743	\$49	\$49	
	Whitewater Creek	\$0	\$0	\$0	\$0	
7	Blue River	\$28,300	\$28,300	\$1,850	\$1,850	
	Campbell Blue Creek	\$1,350	\$1,350	\$88	\$88	
	Dry Blue Creek	\$517	\$517	\$34	\$34	
	Little Blue Creek	\$0	\$0	\$0	\$0	
	Pace Creek	\$136	\$136	\$9	\$9	
	Frieborn Creek	\$193	\$193	\$13	\$13	
8	Gila River	\$608,000	\$1,270,000	\$39,700	\$82,700	--NMISC proposed CAP projects
	West Fork Gila River	\$1,410	\$1,410	\$92	\$92	
	Middle Fork Gila River	\$2,090	\$2,090	\$136	\$136	
	East Fork Gila River	\$4,590	\$4,590	\$300	\$300	

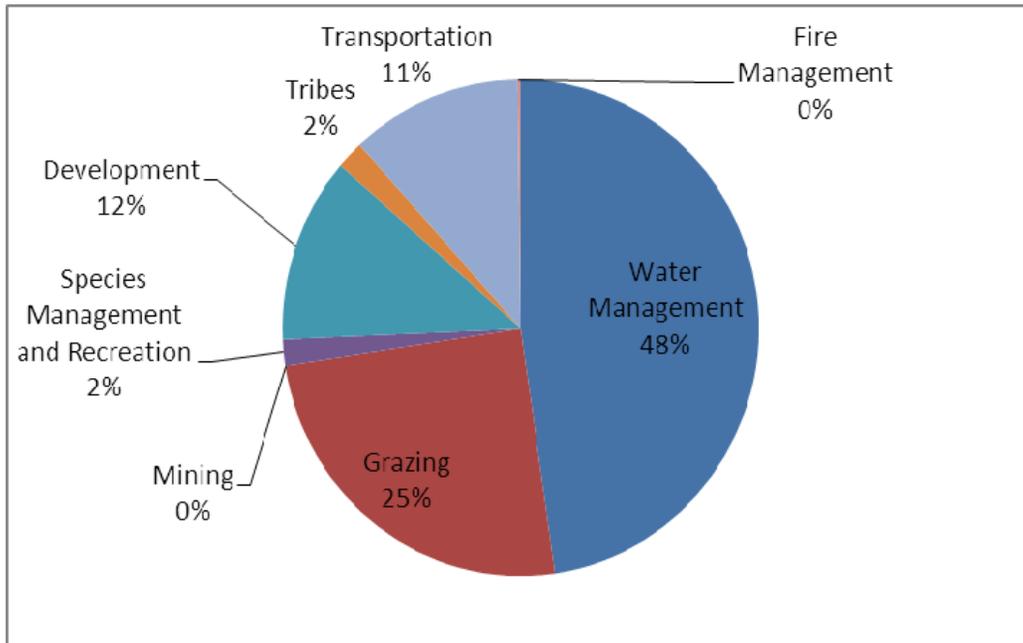
UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS		POTENTIAL UNQUANTIFIED IMPACTS
		LOW	HIGH	LOW	HIGH	
	Mangas Creek	\$127,000	\$274,000	\$8,290	\$17,900	
	Bear Creek	\$3,420	\$3,420	\$223	\$223	
	Total	\$3,550,000	\$8,270,000	\$232,000	\$540,000	N/A
Note: Totals may not sum due to rounding.						

**EXHIBIT ES-3. LOW-END QUANTIFIED INCREMENTAL IMPACTS BY ACTIVITY, 2011-2030
(2011\$, DISCOUNTED AT SEVEN PERCENT)**



* Note, distribution of impacts does not reflect potential unquantified costs.

**EXHIBIT ES-4. HIGH-END QUANTIFIED INCREMENTAL IMPACTS BY ACTIVITY, 2011-2030
(2011\$, DISCOUNTED AT SEVEN PERCENT)**



* Note, distribution of impacts does not reflect potential unquantified costs.

POTENTIAL BENEFITS OF SPIKEDACE AND LOACH MINNOW CONSERVATION

10. Conservation efforts for spikedace and loach minnow critical habitat have the potential to result in increased populations and enhanced habitat conditions, which in turn could result in enhanced non-use value by the public (i.e., existence value), improved water quality, flood protection and aesthetic improvements to the landscape. However, while the quality of the proposed critical habitat areas may be improved as a result of this designation in some areas, the degree to which such improvements may occur, and the extent to which critical habitat can be attributed as the cause, is unknown. Thus, these estimates are not quantified in the Economic Analysis.

POTENTIAL IMPACTS TO SMALL ENTITIES

11. This analysis estimates that 84 small entities may be affected by this rule, each with estimated revenues ranging from \$750,000 to \$33.5 million per entity, depending on the industry affected. Depending on the activity, annualized impacts may represent between 0 percent and 0.5 percent of annual revenues.

COSTS EXPECTED UNDER THE BASELINE

12. A substantial number of conservation actions that are likely to be protective of spikedace and loach minnow are expected to be undertaken even absent critical habitat, i.e., under the baseline for this analysis. For example, some of these efforts have been undertaken for other listed species under the Act, or for protection of riparian areas under other regulatory mechanisms. We estimate the total costs associated with these efforts will be approximately \$74.6 million to \$99.6 million over 20 years, or \$6.6 million to \$8.8 million, annualized at a seven percent discount rate. Quantified baseline costs are primarily associated with:
 - Water conservation and protection measures that are currently ongoing at Fort Huachuca related to the San Pedro River unit (\$4.4 million, annualized at a seven percent discount rate). Many of these actions have been undertaken at the Fort to be protective of the Huachuca water umbel, but are expected to provide baseline protections to the spikedace and loach minnow.
 - \$0.2 million to \$0.7 million (annualized at a seven percent discount rate) related to grazing-related conservation efforts, including riparian fencing construction and maintenance.
 - \$1.7 to \$3.0 million (annualized at a seven percent discount rate) in other species management efforts, including activities undertaken by the US Bureau of Reclamation (USBR), the Arizona Game and Fish Department (AZGFD), and the New Mexico Department of Game and Fish (NMDGF). Some reductions in recreational fishing expenditures are also assumed to be incurred under the baseline.

CHAPTER 1 | BACKGROUND

1.1 INTRODUCTION

1. This chapter provides an overview of the proposed critical habitat for the spikedace (*Meda fulgida*) and loach minnow (*Tiaroga cobitis*). It includes a summary of past legal actions that relate to the current proposal, the area proposed for designation, and threats to the proposed critical habitat.

1.1.1 PREVIOUS FEDERAL ACTIONS

2. The Service listed the spikedace and loach minnow as threatened on July 1 and October 28, 1986, respectively. The Service has designated critical habitat for the species three times previously. The current proposed rule represents the fourth critical habitat proposal for these species. Specifically:
 - On March 8, 1994, the Service designated critical habitat for both species. The designation was later set aside by court order due to the failure of the Service to analyze the effects of critical habitat designation under the National Environmental Policy Act.
 - The Service published a second proposed critical habitat designation on December 10, 1999, and a final critical habitat designation on April 25, 2000 for each species. On August 31, 2004, the United States District Court for the District of New Mexico set aside the critical habitat designation in its entirety due to a flawed economic analysis, and remanded it to the Service for preparation of a new proposed and final designation. This case ruled that the approach to the economic analysis was flawed.
 - On December 20, 2005, the Service published a third proposed critical habitat designation for the spikedace and loach minnow, and a final designation on March 21, 2007. On February 2, 2009, the Service filed a motion for voluntary remand of the final rule, which was granted on May 4, 2009.
 - The current Proposed Rule was published in the Federal Register on October 28, 2010.

1.1.2 PROPOSED CRITICAL HABITAT DESIGNATION

3. In the October 28, 2010 proposed rule, the Service proposed approximately 726 stream miles as critical habitat for the spikedace, and 709 stream miles as critical habitat for the loach minnow in Arizona and New Mexico.⁶ In October 2011, the Service revised the rule to include additional stream miles for loach minnow, bringing the total to 723 stream

⁶ 2010 Proposed Critical Habitat Rule. 75 FR 66482.

miles.⁷ Many of these stream miles represent overlapping habitat for both species, but some streams are proposed solely for one of the two species. Approximately 28 percent of the proposed critical habitat designation is unoccupied or is of uncertain occupancy by the species.

4. The streams and reaches proposed for designation under the 2010 rule differ somewhat from each of the three previous designations. The Service believes the current proposal is most similar to the 2000 designation. Exhibit 1-1 presents the geographical extent of the current proposed designation. Exhibit 1-2 highlights differences between the 2005 proposed rule, which was analyzed in the previous economic analysis, and the 2010 proposal. Exhibit 1-3 summarizes land ownership for the units proposed in the 2010 rule.
5. To perform analyses of impacts to water use and residential development, this analysis approximates the acreage of proposed critical habitat by creating a buffer of 300 feet on either side of the proposed critical habitat centerline. This buffer is based on the definition of critical habitat provided in the Proposed Rule, which states “the lateral extent of streams included in this proposed designation is 91.4m (300 ft) to either side of the bankfull stage.”⁸ Because the stream centerline and bankfull stage are not equivalent, this method results in an acreage estimate. While this may not be an exact measure of critical habitat acreage, the acreage estimate is suitable for the purposes of this analysis.

1.2 ECONOMIC ACTIVITIES CONSIDERED IN THIS ANALYSIS

6. Reviewing the proposed rule and the previous economic analysis identified the following activities as potential threats to the spikedace and loach minnow and their habitat:
 - 1) **Water management:** Including agricultural, municipal, and industrial water diversions. Other affected activities may include flood control and dam operation and maintenance.
 - 2) **Grazing:** Particularly, increased sedimentation and erosion related to grazing on Bureau of Land Management and US Forest Service lands.
 - 3) **Mining:** In particular, copper mining operations along Eagle Creek and the Gila River previously have expressed concerns about the potential for critical habitat designation to affect ongoing operations.
 - 4) **Species management:** Including installation of fish barriers, native species recovery, annual monitoring, and impacts to sportfishing.
 - 5) **Residential and commercial development:** Including construction in riparian areas and runoff from roads and golf courses.
 - 6) **Transportation:** Particularly construction and maintenance of bridges, roads, and culverts.

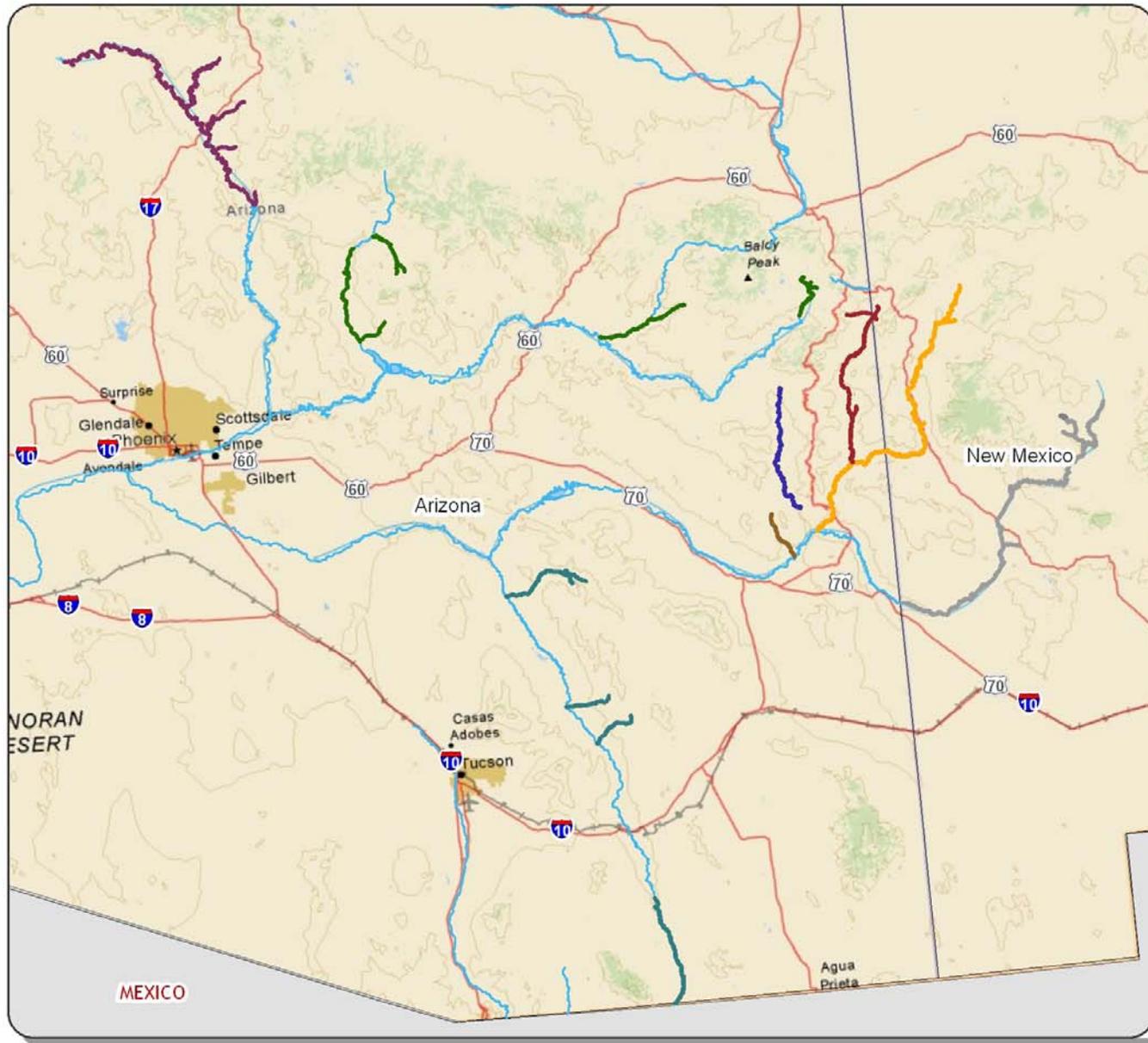
⁷ 2011 Revised Proposed Critical Habitat Rule and Notice of Availability. 76 FR 61330.

⁸ Note that this analysis presents only approximate estimates of land acreage included in critical habitat areas. Please refer to the proposed rule for legal descriptions of proposed critical habitat

- 7) **Fire Management.** Including increased ash, change in water temperature, debris flows, and the use of chemical flame retardants.

These activities are addressed in Chapters 3 through 10 of the economic analysis.

EXHIBIT 1-1. 2010 PROPOSED CRITICAL HABITAT FOR THE SPIKEDACE AND LOACH MINNOW



Spikedace and Loach Minnow Proposed Critical Habitat

1:2,269,525

Legend

UNIT

- Unit 1--Verde River Subbasin
- Unit 2--Salt River Subbasin
- Unit 3--San Pedro River Subbasin
- Unit 4--Bonita Creek Subbasin
- Unit 5--Eagle Creek Subbasin
- Unit 6--San Francisco River Subbasin
- Unit 7--Blue River Subbasin
- Unit 8--Gila River Subbasin
- Other Major Streams and Rivers



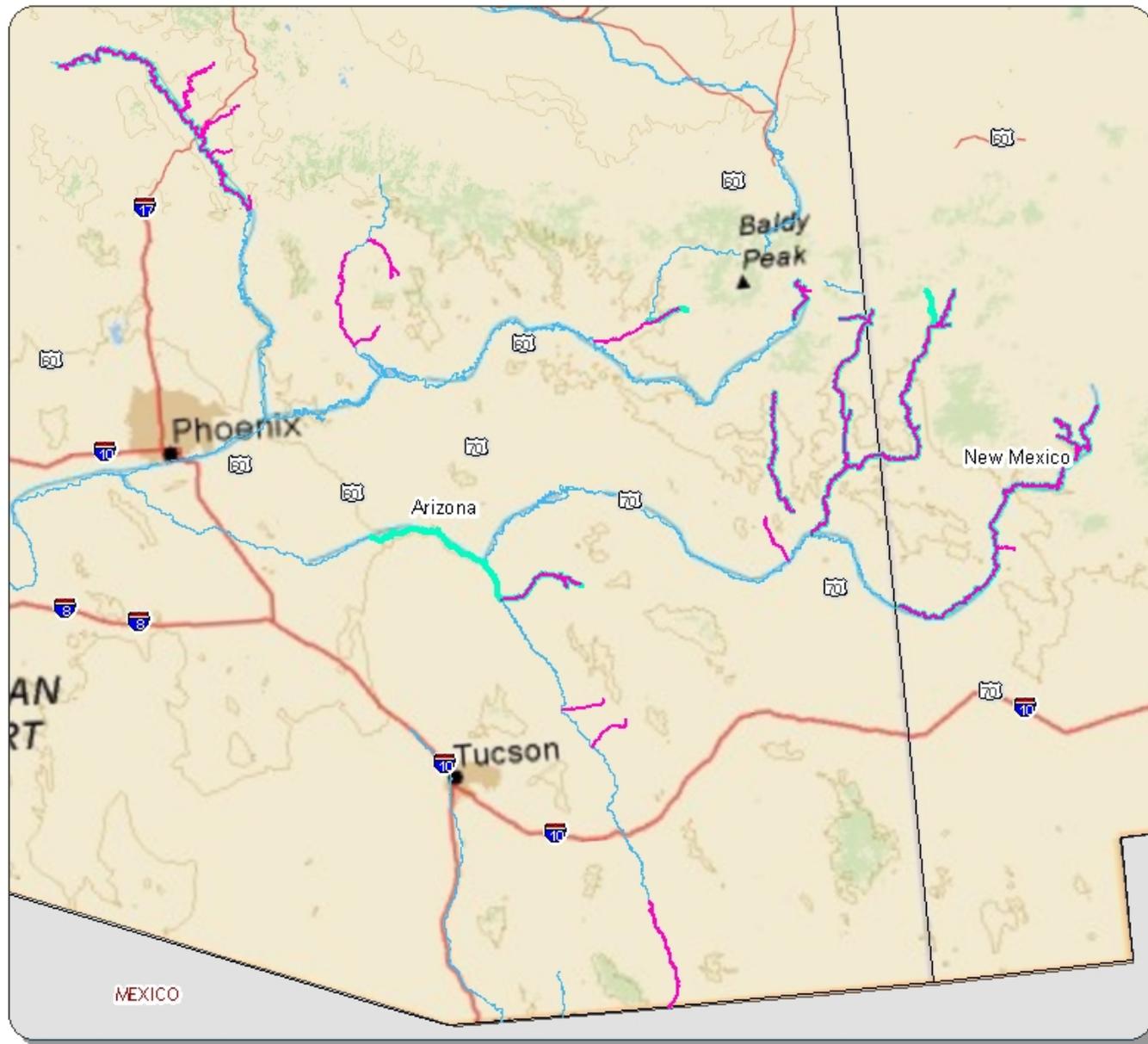
Source:
 1. US Fish and Wildlife Service, Field Office
 2. Environmental Systems Research Institute, Inc. (ESRI), Redlands, California, USA



IEC

INDUSTRIAL ECONOMICS, INCORPORATED

EXHIBIT 1-2. COMPARISON OF 2010 PROPOSAL TO 2005 PROPOSAL



Spikedace and Loach Minnow Areas New to Proposed Designation in 2010

12,269,525

Legend

- Proposed Critical Habitat - 2010
- Proposed Critical Habitat - 2005
- Other Major Streams and Rivers



Source:
1. US Fish and Wildlife Service, Field Office
2. Environmental Systems Research Institute, Inc. (ESRI), Redlands, California, USA



IEc

INDUSTRIAL ECONOMICS, INCORPORATED

EXHIBIT 1-3. 2010 PROPOSED CRITICAL HABITAT UNITS FOR THE SPIKEDACE AND LOACH MINNOW (STREAM MILES, ROUNDED)

UNIT	NAME	FEDERAL	STATE	LOCAL OR TRIBAL	PRIVATE	TOTAL
1	Verde River	90	2	7	70	169
2	Salt River	74	0	28	7	109
3	San Pedro River	55	11	2	31	99
4	Bonita Creek*	11	0	0	3	14
5	Eagle Creek	13	0	17	17	47
6	San Francisco River	105	2	0	44	151
7	Blue River	58	0	0	9	67
8	Gila River	117	1	0	56	174
TOTAL		523	16	54	237	829

Source: U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Endangered Status and Designation of Critical Habitat for Spikedace and Loach Minnow; Proposed Rule. Published in the Federal Register on October 28, 2010, 75 FR 66482, Table 5. For Units 6 and 8, additional mileage estimates based on GIS data provided by the Service. This data represents the areal view of the proposed critical habitat; i.e., units proposed for both spikedace and loach minnow are not duplicated.

*The San Carlos Apache Tribe also hold water rights along Bonita Creek.

1.3 ORGANIZATION OF THE REPORT

7. The remainder of this report is organized into nine chapters and three appendices. Chapter 2 discusses the framework employed in the analysis, while Chapters 3 through 10 describe baseline protections and incremental impacts of critical habitat designation by economic activity.

- Chapter 2 – Framework for Analysis
- Chapter 3 – Potential Economic Impacts to Water Management and Use
- Chapter 4 – Potential Economic Impacts to Grazing Activities
- Chapter 5 – Potential Economic Impacts to Mining Operations
- Chapter 6 – Potential Economic Impacts to Species and Habitat Management Actions
- Chapter 7 – Potential Economic Impacts to Residential and Commercial Development
- Chapter 8 – Potential Economic Impacts to Tribes
- Chapter 9 – Potential Economic Impacts to Transportation Activities
- Chapter 10 – Potential Economic Impacts to Fire Management Activities
- Chapter 11 – Economic Benefits

- Appendix A – Small Business and Energy Impacts Analyses
- Appendix B – Three Percent Discount Rate Exhibits
- Appendix C – Incremental Memorandum

CHAPTER 2 | FRAMEWORK FOR ANALYSIS

8. The purpose of this report is to estimate the economic impact of actions taken to protect the spinedace and loach minnow and their habitat. This analysis examines the impacts of restricting or modifying specific land uses or activities for the benefit of the species and its habitat within the proposed critical habitat area. This analysis employs "without critical habitat" and "with critical habitat" scenarios. The "without critical habitat" scenario represents the baseline for the analysis, considering protections otherwise accorded the spinedace and loach minnow; for example, under the Federal listing and other Federal, State, and local regulations. The "with critical habitat" scenario describes the incremental impacts associated specifically with the designation of critical habitat for the species. The incremental conservation efforts and associated impacts are those not expected to occur absent the designation of critical habitat for the spinedace and loach minnow. The analysis forecasts both baseline and incremental impacts likely to occur after the proposed critical habitat is finalized (post-designation impacts).
9. This information is intended to assist the Secretary of the DOI in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation.³⁹ In addition, this information allows the Service to address the requirements of Executive Orders 12866 and 13211, and the Regulatory Flexibility Act (RFA), as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA).⁴⁰
10. This chapter describes the framework for this analysis. First, it describes the differences in framework between the 2006 and 2011 Economic Analyses. It then describes case law that led to the selection of the framework applied in this report. Next, we describe in economic terms the general categories of economic effects that are the focus of the impact analysis, including a discussion of both efficiency and distributional effects. This chapter then defines the analytic framework used to measure these impacts in the context of critical habitat regulation and the consideration of benefits. It concludes with a presentation of the information sources relied upon in the analysis.
11. Because the 2010 proposed rule identifies units of critical habitat that coincide with those previously evaluated for the 2005 proposed rule, this analysis draws on some of the

³⁹ 16 U.S.C. §1533(b)(2).

⁴⁰ Executive Order 12866, Regulatory Planning and Review, September 30, 1993; Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use, May 18, 2001; 5. U.S.C. §§601 *et seq.*; and Pub Law No. 104-121.

economic cost information documented in the 2006 Economic Analysis.⁴¹ However, this analysis applies a fundamentally different analytical approach from that applied in the 2006 Economic Analysis. Exhibit 2-1 summarizes how this analysis reflects new elements and analytical approaches that the Service has provided or adopted since the 2005 proposed rule.

EXHIBIT 2-1. DIFFERENCES IN ANALYTICAL APPROACH BETWEEN THE 2006 AND CURRENT (2011) ECONOMIC ANALYSES

CHANGE IN ANALYTICAL APPROACH
<ul style="list-style-type: none"> • The 2011 Economic Analysis distinguishes the <i>incremental</i> costs of designation from baseline costs whereas the 2006 Economic Analysis evaluated all “co-extensive” costs of all spokedace and loach minnow conservation collectively. That is, the impacts estimated in the 2006 Economic Analysis capture costs of spokedace and loach minnow conservation regardless of whether they resulted specifically from critical habitat designation. • This 2011 Economic Analysis instead characterizes all potential future spokedace and loach minnow conservation as either baseline (i.e., expected to occur absent the designation of critical habitat) or incremental (i.e., expected to occur as a result of critical habitat designation). The Service provided guidance on distinguishing the incremental costs of the designation, as described in Section 2.3.2 of this report. • This analysis considers and estimates the impacts of the rule as currently proposed and as if the existing 2007 critical habitat designation does not exist. In other words, this analysis considers and estimates the impacts associated with designating areas as critical habitat versus not designating these areas. This analysis is intended to assist the Secretary of the DOI in determining whether the benefits of excluding particular areas from the designation outweigh the benefits of including those areas in the designation. These particular areas include those already designated as critical habitat under the 2007 designation and subject to re-examination by the Secretary. As a result, costs incurred as a result of the 2007 designation are not separately documented in this analysis.

2.1 BACKGROUND

12. The U.S. Office of Management and Budget’s (OMB) guidelines for conducting economic analysis of regulations direct Federal agencies to measure the costs of a regulatory action against a baseline, which it defines as the “best assessment of the way the world would look absent the proposed action.”⁴² In other words, the baseline includes the existing regulatory and socio-economic burden imposed on landowners, managers, or other resource users potentially affected by the designation of critical habitat. Impacts

⁴¹ Industrial Economics, Inc. *Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow*, prepared for the U.S. Fish and Wildlife Service, October 25, 2006.

⁴² OMB, “Circular A-4,” September 17, 2003, available at <http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf>.

that are incremental to that baseline (i.e., occurring over and above existing constraints) are attributable to the proposed regulation. Significant debate has occurred regarding whether assessing the impacts of the Service’s proposed regulations using this baseline approach is appropriate in the context of critical habitat designations.

13. In 2001, the U.S. Tenth Circuit Court of Appeals instructed the Service to conduct a full analysis of all of the economic impacts of proposed critical habitat, regardless of whether those impacts are attributable co-extensively to other causes.⁴³ Specifically, the court stated,

“The statutory language is plain in requiring some kind of consideration of economic impact in the CHD [critical habitat designation] phase. Although 50 C.F.R. 402.02 is not at issue here, the regulation’s definition of the jeopardy standard as fully encompassing the adverse modification standard renders any purported economic analysis done utilizing the baseline approach virtually meaningless. We are compelled by the canons of statutory interpretation to give some effect to the congressional directive that economic impacts be considered at the time of critical habitat designation.... Because economic analysis done using the FWS’s [Fish and Wildlife Service’s] baseline model is rendered essentially without meaning by 50 C.F.R. § 402.02, we conclude Congress intended that the FWS conduct a full analysis of all of the economic impacts of a critical habitat designation, regardless of whether those impacts are attributable co-extensively to other causes. Thus, we hold the baseline approach to economic analysis is not in accord with the language or intent of the ESA [Endangered Species Act].”⁴⁴

14. Since that decision, however, courts in other cases have held that an incremental analysis of impacts stemming solely from the critical habitat rulemaking is proper.⁴⁵ For example, in the March 2006 ruling that the August 2004 critical habitat rule for the Peirson's milk-vetch was arbitrary and capricious, the United States District Court for the Northern District of California stated,

“The Court is not persuaded by the reasoning of *New Mexico Cattle Growers*, and instead agrees with the reasoning and holding of *Cape Hatteras Access Preservation Alliance v. U.S. Dep’t of the Interior*, 344 F. Supp 2d 108 (D.D.C. 2004). That case also involved a challenge to the Service’s baseline approach and the court held that the baseline approach was both consistent with the language and purpose of the ESA and that it was a reasonable method for assessing the actual costs of a particular critical habitat designation *Id* at 130. ‘To find the true cost of a

⁴³ *New Mexico Cattle Growers Assn v. United States Fish and Wildlife Service*, 248 F.3d 1277 (10th Cir. 2001).

⁴⁴ *Ibid.*

⁴⁵ *Cape Hatteras Access Preservation Alliance v. Department of Interior*, 344 F. Supp. 2d 108 (D.D.C.); *Center for Biological Diversity v. United States Bureau of Land Management*, 422 F. Supp. 2d 1115 (N.D. Cal. 2006).

designation, the world with the designation must be compared to the world without it.”⁴⁶

15. More recently, in 2010, the U.S. Ninth Circuit Court of Appeals came to similar conclusions during its review of critical habitat designations for the Mexican spotted owl and 15 vernal pool species.⁴⁷ Plaintiffs in both cases requested review by the Supreme Court, which declined to hear the cases in 2011.
16. In order to address the divergent opinions of the courts and provide the most complete information to decision-makers, this economic analysis reports both:
 - a. The baseline impacts of protections afforded the spikedace and loach minnow absent critical habitat designation; and
 - b. The estimated incremental impacts precipitated specifically by the designation of critical habitat for the species.

Summed, these two types of impacts comprise the fully co-extensive impacts of conservation in areas considered for critical habitat designation.

17. Several Courts of Appeal, including the Ninth Circuit and the Fifth Circuit, have invalidated the Service’s regulation defining destruction or adverse modification of critical habitat.⁴⁸ At this time the Service is analyzing whether destruction or adverse modification would occur based on the statutory language of the ESA itself, which requires the Service to consider whether the agency’s action is likely “to result in the destruction or adverse modification of habitat which is determined by the Service to be critical” to the conservation of the species. To perform this analysis, the Service considers how the proposed action is likely to impact the function of the critical habitat unit in question. To assist us in evaluating these likely impacts, the Service provided information regarding what potential consultations could occur in the critical habitat units for the spikedace and loach minnow and what projection modifications may be imposed as a result of critical habitat designation. The Service also provided a memorandum characterizing the effects of critical habitat designation over and above those associated with the listing. (Appendix C). A detailed description of the methodology used to define baseline and incremental impacts is provided later in this section.

⁴⁶ *Center for Biological Diversity et al, Plaintiffs, v. United States Bureau of Land Management et al., Defendants and American Sand Association, et al, Defendant Intervenors*. Order re: Cross Motions for Summary Judgment, Case 3:03-cv-02509 Document 174 Filed 03/14/2006, pages 44-45.

⁴⁷ *Home Builders Association of Northern California v. United States Fish and Wildlife Service*, 616 F.3d 983 (9th Cir. 2010), cert. denied, 179 L. Ed 2d 301, 2011 U.S. Lexis 1392, 79 U.S.L.W. 3475 (2011); *Arizona Cattle Growers v. Salazar*, 606 F. 3d 1160 (9th Cir. 2010), cert. denied, 179 L. Ed. 2d 300, 2011 U.S. LEXIS 1362, 79 U.S.L.W. 3475 (2011).

⁴⁸ *Gifford Pinchot Task Force v. United States Fish and Wildlife Service*, 378 F.3d 1059 (9th Cir. 2004); *Sierra Club v. U. S. Fish and Wildlife Service*, 245 F.3d 434 (5th Cir. 2001).

2.2 CATEGORIES OF POTENTIAL ECONOMIC EFFECTS OF SPECIES CONSERVATION

18. This economic analysis considers both the economic efficiency and distributional effects that may result from efforts to protect the spikedace and loach minnow and their habitat (hereinafter referred to collectively as “spikedace and loach minnow conservation efforts”). Economic efficiency effects generally reflect “opportunity costs” associated with the commitment of resources required to accomplish species and habitat conservation. For example, if the set of activities that may take place on a parcel of land is limited as a result of the designation or the presence of the species, and thus the market value of the land is reduced, this reduction in value represents one measure of opportunity cost or change in economic efficiency. Similarly, the costs incurred by a Federal action agency to consult with the Service under section 7 represent opportunity costs of spikedace and loach minnow conservation efforts.
19. This analysis also addresses the distribution of impacts associated with the designation, including an assessment of any local or regional impacts of habitat conservation and the potential effects of conservation efforts on small entities and the energy industry. This information may be used by decision-makers to assess whether the effects of species conservation efforts unduly burden a particular group or economic sector. For example, while conservation efforts may have a small impact relative to the national economy, individuals employed in a particular sector of the regional economy may experience relatively greater impacts.

2.2.1 EFFICIENCY EFFECTS

20. At the guidance of OMB and in compliance with Executive Order 12866 "Regulatory Planning and Review," Federal agencies measure changes in economic efficiency in order to understand how society, as a whole, will be affected by a regulatory action. In the context of regulations that protect spikedace and loach minnow habitat, these efficiency effects represent the opportunity cost of resources used or benefits foregone by society as a result of the regulations. Economists generally characterize opportunity costs in terms of changes in producer and consumer surpluses in affected markets.⁴⁹

⁴⁹ For additional information on the definition of "surplus" and an explanation of consumer and producer surplus in the context of regulatory analysis, see: Gramlich, Edward M., A Guide to Benefit-Cost Analysis (2nd Ed.), Prospect Heights, Illinois: Waveland Press, Inc., 1990; and U.S. Environmental Protection Agency, Guidelines for Preparing Economic Analyses, EPA 240-R-00-003, September 2000, available at <http://yosemite.epa.gov/ee/epa/eed.nsf/webpages/Guidelines.html>.

CALCULATING PRESENT VALUE AND ANNUALIZED IMPACTS

This analysis compares economic impacts incurred in different time periods in present value terms. The present value represents the value of a payment or stream of payments in common dollar terms. That is, it is the sum of a series of past or future cash flows expressed in today's dollars. Translation of economic impacts of past or future costs to present value terms requires the following: a) past or projected future costs of critical habitat designation; and b) the specific years in which these impacts have been or are expected to be incurred. With these data, the present value of the past or future stream of impacts (PV_c) from year t to T is measured in 2011 dollars according to the following standard formula:

$$PV_c = \sum_t^T \frac{C_t}{(1+r)^{t-2011}}$$

C_t = cost of spikedace and loach minnow critical habitat conservation efforts in year t

r = discount rate^a

Impacts for each activity in each unit are also expressed as annualized values. Annualized values are calculated to provide comparison of impacts across activities with varying forecast periods (T). For this analysis, activities employ a forecast period of 20 years. Annualized future impacts (APV_c) are calculated by the following standard formula:

$$APV_c = PV_c \left[\frac{r}{1 - (1+r)^{-N}} \right]$$

N = number of years in the forecast period (in this analysis, 20 years)

^a To discount and annualize costs, guidance provided by the OMB specifies the use of a real rate of seven percent. In addition, OMB recommends sensitivity analysis using other discount rates such as three percent, which some economists believe better reflects the social rate of time preference. (U.S. Office of Management and Budget, Circular A-4, September 17, 2003 and U.S. Office of Management and Budget, "Draft 2003 Report to Congress on the Costs and Benefits of Federal Regulations; Notice," 68 *Federal Register* 5492, February 3, 2003.)

21. In some instances, compliance costs may provide a reasonable approximation for the efficiency effects associated with a regulatory action. For example, a Federal land manager may enter into a section 7 consultation with the Service to ensure that a particular activity will not adversely modify critical habitat. The effort required for the consultation is an economic opportunity cost because the landowner or manager's time and effort would have been spent in an alternative activity had the parcel not been included in the designation. When compliance activity is not expected to significantly affect markets -- that is, not result in a shift in the quantity of a good or service provided at a given price, or in the quantity of a good or service demanded given a change in price -- the measurement of compliance costs can provide a reasonable estimate of the change in economic efficiency.
22. Where habitat protection measures are expected to significantly impact a market, it may be necessary to estimate changes in producer and consumer surpluses. For example, protection measures that reduce or preclude the development of large areas of land may shift the price and quantity of housing supplied in a region. In this case, changes in economic efficiency (i.e., social welfare) can be measured by considering changes in producer and consumer surplus in the market.

2.2.2 DISTRIBUTIONAL AND REGIONAL ECONOMIC EFFECTS

23. Measurements of changes in economic efficiency focus on the net impact of conservation efforts, without consideration of how certain economic sectors or groups of people are affected. Thus, a discussion of efficiency effects alone may miss important distributional considerations. OMB encourages Federal agencies to consider distributional effects separately from efficiency effects.⁵⁰ This analysis considers several types of distributional effects, including impacts on small entities; impacts on energy supply, distribution, and use; and regional economic impacts. It is important to note that these are fundamentally different measures of economic impact than efficiency effects, and thus cannot be added to or compared with estimates of changes in economic efficiency.

Impacts on Small Entities and Energy Supply, Distribution, and Use

24. This analysis considers how small entities, including small businesses, organizations, and governments, as defined by the RFA, might be affected by future species conservation efforts.⁵¹ In addition, in response to Executive Order 13211 "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," this analysis considers the future impacts of conservation efforts on the energy industry and its customers.⁵²

⁵⁰ U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at <http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf>.

⁵¹ 5 U.S.C. §§601 *et seq.*

⁵² Executive Order 13211, Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use, May 18, 2001.

Regional Economic Effects

25. Regional economic impact analysis can provide an assessment of the potential localized effects of conservation efforts. Specifically, regional economic impact analysis produces a quantitative estimate of the potential magnitude of the initial change in the regional economy resulting from a regulatory action. Regional economic impacts are commonly measured using regional input/output models. These models rely on multipliers that represent the relationship between a change in one sector of the economy (e.g., expenditures by recreators) and the effect of that change on economic output, income, or employment in other local industries (e.g., suppliers of goods and services to recreators). These economic data provide a quantitative estimate of the magnitude of shifts of jobs and revenues in the local economy.
26. The use of regional input-output models in an analysis of the impacts of species and habitat conservation efforts can overstate the long-term impacts of a regulatory change. Most importantly, these models provide a static view of the economy of a region. That is, they measure the initial impact of a regulatory change on an economy but do not consider long-term adjustments that the economy will make in response to this change. For example, these models provide estimates of the number of jobs lost as a result of a regulatory change, but do not consider re-employment of these individuals over time or other adaptive responses by impacted businesses. In addition, the flow of goods and services across the regional boundaries defined in the model may change as a result of the regulation, compensating for a potential decrease in economic activity within the region.
27. Despite these and other limitations, in certain circumstances regional economic impact analysis may provide useful information about the scale and scope of localized impacts. It is important to remember that measures of regional economic effects generally reflect shifts in resource use rather than efficiency losses. Thus, these types of distributional effects are reported separately from efficiency effects (i.e., not summed). In addition, measures of regional economic impact cannot be compared with estimates of efficiency effects, but should be considered as distinct measures of impact.

2.3 ANALYTIC FRAMEWORK AND SCOPE OF THE ANALYSIS

28. This analysis: 1) identifies those economic activities most likely to threaten the spikedace and loach minnow and their habitat; 2) describes the baseline regulation protection for the species; and 3) monetizes the incremental economic impacts to avoid adverse modification of the proposed critical habitat area. This section provides a description of the methodology used to separately identify baseline protections from the incremental impacts stemming from the proposed designation of critical habitat for the spikedace and loach minnow. This evaluation of impacts in a "with critical habitat designation" versus a "without critical habitat designation" framework effectively measures the net change in economic activity associated with the proposed rulemaking.

2.3.1 IDENTIFYING BASELINE IMPACTS

29. The baseline for this analysis is the existing state of regulation, prior to the designation of critical habitat, which provides protection to the species under Act, as well as under other Federal, State and local laws and guidelines. This "without critical habitat designation" scenario also considers a wide range of additional factors beyond the compliance costs of regulations that provide protection to the listed species. As recommended by OMB, the baseline incorporates, as appropriate, trends in market conditions, implementation of other regulations and policies by the Service and other government entities, and trends in other factors that have the potential to affect economic costs and benefits, such as the rate of regional economic growth in potentially affected industries.
30. Baseline protections include sections 7, 9, and 10 of the Act, and economic impacts resulting from these protections to the extent that they are expected to occur absent the designation of critical habitat for the species. This analysis describes these baseline regulations, and where possible, provides examples of the potential magnitude of the costs of these baseline protections. The primary focus, however, is not on baseline costs, since these will not be affected by the proposed regulation. Instead, the focus of this analysis is on monetizing the incremental impacts forecast to result from the proposed critical habitat designation.
- Section 7 of Act, absent critical habitat designation, requires Federal agencies to consult with the Service to ensure that any action authorized, funded, or carried out will not likely jeopardize the continued existence of any endangered or threatened species. Consultations under the jeopardy standard result in administrative costs, as well as impacts of conservation efforts resulting from consideration of this standard.
 - Section 9 defines the actions that are prohibited by the Act. In particular, it prohibits the "take" of endangered wildlife, where "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."⁵³ The economic impacts associated with this section manifest themselves in sections 7 and 10.
 - Under section 10(a)(1)(B) of the Act, an entity (e.g., a landowner or local government) may develop a Habitat Conservation Plan (HCP) for a listed animal species in order to meet the conditions for issuance of an incidental take permit in connection with a land or water use activity or project.⁵⁴ The requirements posed by the HCP may have economic impacts associated with the goal of ensuring that the effects of incidental take are adequately avoided or minimized. The development and implementation of HCPs is considered a baseline protection for the species and habitat unless the HCP is determined to be precipitated by the

⁵³ 16 U.S.C. 1532.

⁵⁴ U.S. Fish and Wildlife Service, "Endangered Species and Habitat Conservation Planning," August 6, 2002, accessed at <http://endangered.fws.gov/hcp/>.

designation of critical habitat, or the designation influences stipulated conservation efforts under HCPs.

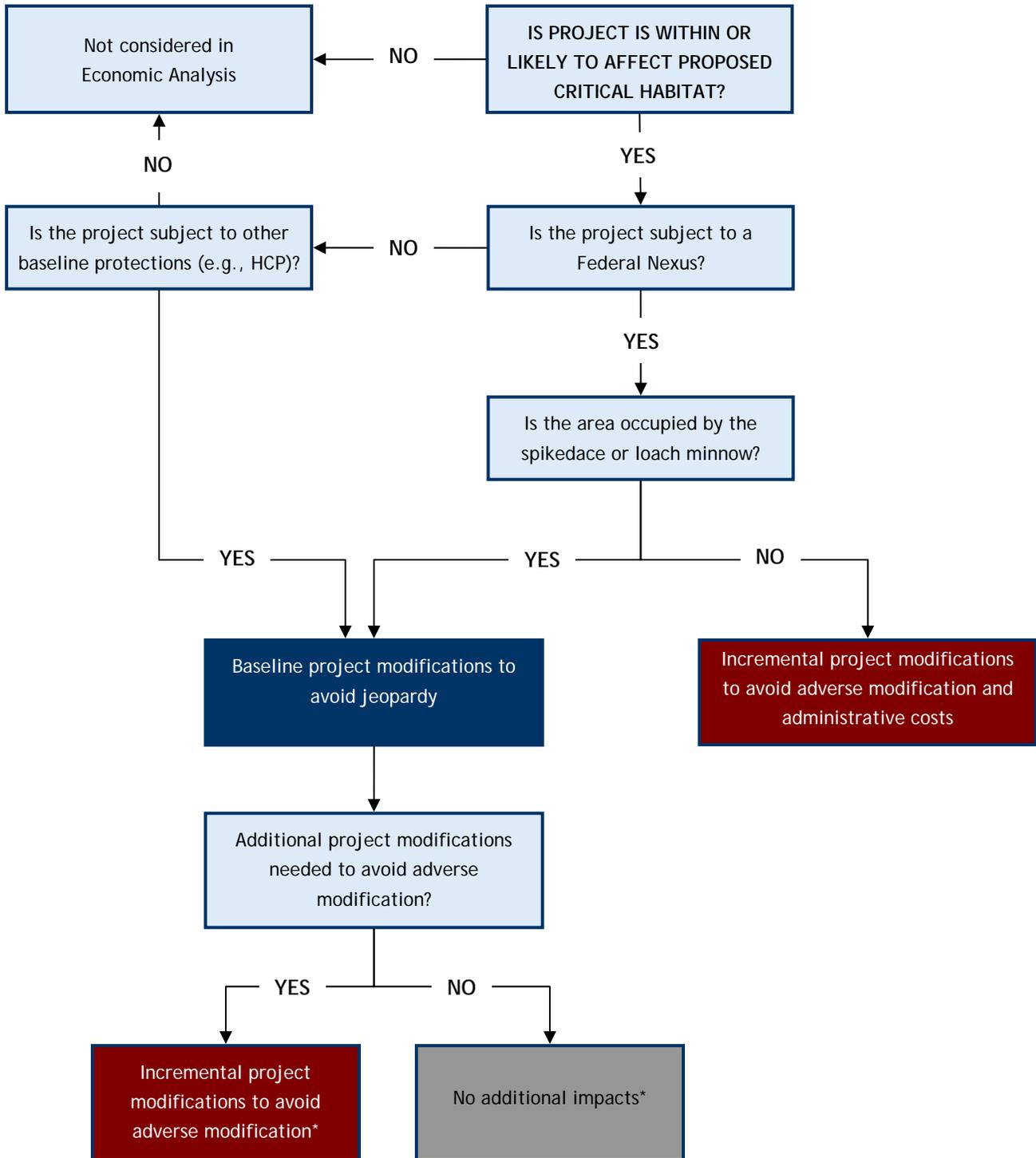
Enforcement actions taken in response to violations of the Act are not included in this analysis.

31. The protection of listed species and habitat is not limited to the Act. Other Federal agencies, as well as State and local governments, may also seek to protect the natural resources under their jurisdiction. If compliance with the Clean Water Act or State environmental quality laws, for example, protects habitat for the species, such protective efforts are considered to be baseline protections and costs associated with these efforts are categorized accordingly. Of note, however, is that such efforts may not be considered baseline in the case that they would not have been triggered absent the designation of critical habitat. In these cases, they are considered incremental impacts and are discussed below.

2.3.2 IDENTIFYING INCREMENTAL IMPACTS

32. This analysis quantifies the potential incremental impacts of this rulemaking. The focus of the incremental analysis is to determine the impacts on land uses and activities from the designation of critical habitat that are above and beyond those impacts resulting from existing required or voluntary conservation efforts being undertaken due to other Federal, State, and local regulations or guidelines.
33. When critical habitat is designated, section 7 requires Federal agencies to ensure that their actions will not result in the destruction or adverse modification of critical habitat (in addition to considering whether the actions are likely to jeopardize the continued existence of the species). The added administrative costs of including consideration of critical habitat in section 7 consultations, and the additional impacts of implementing conservation efforts (i.e., reasonable and prudent alternatives) resulting from the protection of critical habitat are the direct compliance costs of designating critical habitat. These costs are not in the baseline and are considered incremental impacts of the rulemaking. Exhibit 2-2 depicts the decision analysis regarding whether an impact should be considered incremental.
34. Incremental impacts may be the direct compliance costs associated with additional effort for consultations, reinitiated consultations, new consultations occurring specifically because of the designation, and additional conservation efforts that would not have been requested under the jeopardy standard. Additionally, incremental impacts may include indirect impacts resulting from reaction to the potential designation of critical habitat (e.g., implementing spikedace and loach minnow conservation in an effort to avoid designation of critical habitat), triggering of additional requirements under State or local laws intended to protect sensitive habitat, and uncertainty and perceptual effects on markets.

EXHIBIT 2-2. IDENTIFYING INCREMENTAL IMPACTS OF CRITICAL HABITAT DESIGNATION



Key:

Baseline Impacts Incremental Impacts

* Minor administrative costs of adding adverse modification to consultation are counted as incremental impacts.

Approach to Identifying Incremental Impacts of Spikedace and Loach Minnow
Critical Habitat

35. To inform the economic analysis, the Service provided a memorandum describing its expected approach to conservation for the spikedace and loach minnow following critical habitat designation (Appendix C). Specifically, the Service’s memorandum provides information on how the Service intends to address projects that might lead to adverse modification of critical habitat as distinct from projects that may jeopardize the species. In its memorandum, the Service states that, “jeopardy and adverse modification are not equivalent standards; however, the outcome of section 7 consultations may be similar in some cases under these standards.”²⁶ In particular, the Service states that in critical habitat areas that are considered occupied by the species, there usually will not be a difference in the outcome of section 7 consultations because “the ability of the species to exist is closely tied to the quality of their habitats.”²⁷ In critical habitat areas that are unoccupied by the species, the Service states that consideration of adverse modification in section 7 consultations may result in some additional or potentially different conservation measures compared to a jeopardy analysis. Specifically, the Service states in its memorandum:

“Therefore, we anticipate that section 7 consultation analyses may follow two scenarios: 1) no difference between recommendations to avoid jeopardy or adverse modification in occupied areas of critical habitat; or 2) recommendations to avoid adverse modification which are not duplicated by the need to prevent jeopardy will usually occur only in unoccupied critical habitat that is essential to the species’ conservation.”²⁸

Direct Impacts

36. The direct, incremental impacts of critical habitat designation stem from the consideration of the potential for destruction or adverse modification of critical habitat during section 7 consultations. The two categories of direct, incremental impacts of critical habitat designation are: 1) the administrative costs of conducting section 7 consultation; and 2) implementation of any conservation efforts requested by the Service through section 7 consultation to avoid potential destruction or adverse modification of critical habitat.²⁹
37. Section 7(a)(2) of the Act requires Federal agencies to consult with the Service whenever activities that they undertake, authorize, permit, or fund may affect a listed species or designated critical habitat. In some cases, consultations will involve the Service and another Federal agency only, such as the U.S. Army Corps of Engineers. Often, they will

²⁶ Ibid.

²⁷ Ibid.

²⁸ Ibid.

²⁹ The term conservation efforts is intended to broadly capture efforts that stakeholders may undertake for the species, regardless of whether these efforts are explicitly called for in a section 7 consultation.

also include a third party involved in projects that involve a permitted entity, such as the recipient of a Clean Water Act section 404 permit.

38. During a consultation, the Service, the Action agency, and the entity applying for Federal funding or permitting (if applicable) communicate in an effort to minimize potential adverse effects to the species and/or to the proposed critical habitat. Communication between these parties may occur via written letters, phone calls, in-person meetings, or any combination of these. The duration and complexity of these interactions depends on a number of variables, including the type of consultation, the species, the activity of concern, and the potential effects to the species and designated critical habitat associated with the proposed activity, the Federal agency, and whether there is a private applicant involved.
39. Section 7 consultations with the Service may be either informal or formal. *Informal consultations* consist of discussions between the Service, the Action agency, and the applicant concerning an action that may affect a listed species or its designated critical habitat, and are designed to identify and resolve potential concerns at an early stage in the planning process. By contrast, a *formal consultation* is required if the Action agency determines that its proposed action may or will adversely affect the listed species or designated critical habitat in ways that cannot be resolved through informal consultation. The formal consultation process results in the Service's determination in its Biological Opinion of whether the action is likely to jeopardize a species or adversely modify critical habitat, and recommendations to minimize those impacts. Regardless of the type of consultation or proposed project, section 7 consultations can require substantial administrative effort on the part of all participants.

Administrative Section 7 Consultation Costs

40. Parties involved in section 7 consultations include the Service, a Federal "action agency," and in some cases, a private entity involved in the project or land use activity. The action agency (i.e., the Federal nexus necessitating the consultation) serves as the liaison with the Service. While consultations are required for activities that involve a Federal nexus and may affect a species regardless of whether critical habitat is designated, the designation may increase the effort for consultations in the case that the project or activity in question may adversely modify critical habitat. Administrative efforts for consultation may therefore result in both baseline and incremental impacts.
41. In general, three different scenarios associated with the designation of critical habitat may trigger incremental administrative consultation costs:
1. **Additional effort to address adverse modification in a new consultation -** New consultations taking place after critical habitat designation may require additional effort to address critical habitat issues above and beyond the listing issues. In this case, only the additional administrative effort required to consider critical habitat is considered an incremental impact of the designation.
 2. **Re-initiation of consultation to address adverse modification -** Consultations that have already been completed on a project or activity (but for which the

project or activity is not yet completed) may require re-initiation to address critical habitat. In this case, the costs of re-initiating the consultation, including all associated administrative and project modification costs are considered incremental impacts of the designation.

3. **Incremental consultation resulting entirely from critical habitat designation** - Critical habitat designation may trigger additional consultations that may not occur absent the designation (e.g., for an activity for which adverse modification may be an issue, while jeopardy is not, or consultations resulting from the new information about the location of species habitat provided by the designation). Such consultations may, for example, be triggered in critical habitat areas that are not occupied by the species. All associated administrative and project modification costs of these consultations are considered incremental impacts of the designation.

42. The administrative costs of these consultations vary depending on the specifics of the project. One way to address this variability is to show a range of possible costs of consultation, as it may not be possible to predict the precise outcome of each future consultation in terms of level of effort. Review of consultation records and discussions with multiple Service field offices resulted in a range of estimated administrative costs of consultation. For simplicity, the average of the range of costs in each category is applied in this analysis (see Exhibit 2-3).

Section 7 Conservation Effort Impacts

43. Section 7 consultation considering critical habitat may also result in additional conservation effort recommendations specifically addressing potential destruction or adverse modification of critical habitat. For future consultations considering jeopardy and adverse modification, and for re-initiations of past consultations to consider critical habitat, the economic impacts of conservation efforts undertaken to avoid adverse modification are considered incremental impacts of critical habitat designation. For consultations that are forecast to occur specifically because of the designation (incremental consultations), impacts of all associated conservation efforts are assumed to be incremental impacts of the designation.

EXHIBIT 2-3. RANGE OF ADMINISTRATIVE CONSULTATIONS COSTS (2011 DOLLARS)

BASELINE ADMINISTRATIVE COSTS OF CONSULTATION					
CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
CONSULTATION CONSIDERING JEOPARDY (DOES NOT INCLUDE CONSIDERATION OF ADVERSE MODIFICATION)					
Technical Assistance	\$428	n/a	\$788	n/a	\$1,220
Informal	\$1,840	\$2,330	\$1,540	\$1,500	\$7,130
Formal	\$4,130	\$4,650	\$2,630	\$3,600	\$15,000
Programmatic	\$12,500	\$10,400	n/a	\$4,200	\$27,100
INCREMENTAL ADMINISTRATIVE COSTS OF CONSULTATION					
CONSULTATION TYPE	SERVICE	FEDERAL AGENCY	THIRD PARTY	BIOLOGICAL ASSESSMENT	TOTAL COSTS
NEW CONSULTATION RESULTING ENTIRELY FROM CRITICAL HABITAT DESIGNATION (TOTAL COST OF A CONSULTATION CONSIDERING BOTH JEOPARDY AND ADVERSE MODIFICATION)					
Technical Assistance	\$570	n/a	\$1,050	n/a	\$1,620
Informal	\$2,450	\$3,100	\$2,050	\$2,000	\$9,500
Formal	\$5,500	\$6,200	\$3,500	\$4,800	\$20,000
Programmatic	\$16,700	\$13,900	n/a	\$5,600	\$36,100
NEW CONSULTATION CONSIDERING ONLY ADVERSE MODIFICATION (UNOCCUPIED HABITAT)					
Technical Assistance	\$428	n/a	\$788	n/a	\$1,220
Informal	\$1,840	\$2,330	\$1,540	\$1,500	\$7,130
Formal	\$4,130	\$4,650	\$2,630	\$3,600	\$15,000
Programmatic	\$12,500	\$10,400	n/a	\$4,200	\$27,100
RE-INITIATION OF CONSULTATION TO ADDRESS ADVERSE MODIFICATION					
Technical Assistance	\$285	n/a	\$525	n/a	\$810
Informal	\$1,230	\$1,550	\$1,030	\$1,000	\$4,750
Formal	\$2,750	\$3,100	\$1,750	\$2,400	\$10,000
Programmatic	\$8,330	\$6,930	n/a	\$2,800	\$18,100
ADDITIONAL EFFORT TO ADDRESS ADVERSE MODIFICATION IN A NEW CONSULTATION (ADDITIVE WITH BASELINE COSTS, SHOWN ABOVE, OF CONSIDERING JEOPARDY)					
Technical Assistance	\$143	n/a	\$263	n/a	\$405
Informal	\$613	\$775	\$513	\$500	\$2,380
Formal	\$1,380	\$1,550	\$875	\$1,200	\$5,000
Programmatic	\$4,160	\$3,460	n/a	\$1,400	\$9,030
Source: IEC analysis of full administrative costs is based on data from the Federal Government Schedule Rates, Office of Personnel Management, 2011, and a review of consultation records from several Service field offices across the country conducted in 2002.					
Notes:					
1. Estimates are rounded to three significant digits and may not sum due to rounding.					
2. Estimates reflect average hourly time required by staff.					

Indirect Impacts

44. The designation of critical habitat may, under certain circumstances, affect actions that do not have a Federal nexus and thus are not subject to the provisions of section 7 under the Act. Indirect impacts are those unintended changes in economic behavior that may occur outside of the Act, through other Federal, State, or local actions, and that are caused by the designation of critical habitat. For example:
- **Triggering Other State and Local Laws.** Under certain circumstances, critical habitat designation may provide new information to a community about the sensitive ecological nature of a geographic region, potentially triggering additional economic impacts under other State or local laws, such as the California Environmental Quality Act (CEQA). In cases where these impacts would not have been triggered absent critical habitat designation, they are considered indirect, incremental impacts of the designation.
 - **Time Delays.** Both public and private entities may experience incremental time delays for projects and other activities due to requirements associated with the need to reinitiate the section 7 consultation process and/or compliance with other laws triggered by the designation. To the extent that delays result from the designation, they are considered indirect, incremental impacts of the designation.
 - **Regulatory Uncertainty or Stigma -** Government agencies and affiliated private parties who consult with the Service under section 7 may face uncertainty concerning whether reasonable and prudent alternatives will be recommended by the Service and what the nature of these alternatives will be. This uncertainty may diminish as consultations are completed and additional information becomes available on the effects of critical habitat on specific activities. Where information suggests that this type of regulatory uncertainty stemming from the designation may affect a project or economic behavior, associated impacts are considered indirect, incremental impacts of the designation. In some cases, the public may perceive that critical habitat designation may result in limitations on private property uses above and beyond those associated with anticipated conservation efforts and regulatory uncertainty described above. Public attitudes about the limits or restrictions that critical habitat may impose can cause real economic effects to property owners, regardless of whether such limits are actually imposed. As the public becomes aware of the true regulatory burden imposed by critical habitat, the impact of the designation on property markets may decrease.

2.3.3 BENEFITS

45. Under Executive Order 12866, OMB directs Federal agencies to provide an assessment of both the social costs and benefits of proposed regulatory actions.³⁰ OMB's Circular A-4 distinguishes two types of economic benefits: *direct benefits and ancillary benefits*.

³⁰ Executive Order 12866, Regulatory Planning and Review, September 30, 1993.

Ancillary benefits are defined as favorable impacts of a rulemaking that are typically unrelated, or secondary, to the statutory purpose of the rulemaking.³¹

46. In the context of critical habitat, the primary purpose of the rulemaking (i.e., the direct benefit) is the potential to enhance conservation of the species. The published economics literature has documented that social welfare benefits can result from the conservation and recovery of endangered and threatened species. In its guidance for implementing Executive Order 12866, OMB acknowledges that it may not be feasible to monetize, or even quantify, the benefits of environmental regulations due to either an absence of defensible, relevant studies or a lack of resources on the implementing agency's part to conduct new research.³² *Rather than rely on economic measures, the Service believes that the direct benefits of the proposed rule are best expressed in biological terms that can be weighed against the expected cost impacts of the rulemaking.*
47. Critical habitat designation may also generate ancillary benefits. Critical habitat aids in the conservation of species specifically by protecting the primary constituent elements on which the species depends. To this end, critical habitat designation can result in maintenance of particular environmental conditions that may generate other social benefits aside from the preservation of the species. That is, management actions undertaken to conserve a species or habitat may have coincident, positive social welfare implications, such as increased recreational opportunities in a region. While they are not the primary purpose of critical habitat, these ancillary benefits may result in gains in employment, output, or income that may offset the direct, negative impacts to a region's economy resulting from actions to conserve a species or its habitat.

2.3.4 GEOGRAPHIC SCOPE OF THE ANALYSIS

48. Economic impacts of spikedace and loach minnow conservation are considered across the entire area proposed for revised critical habitat designation, as defined in Chapter 1. Results are presented by proposed critical habitat unit.

2.3.5 ANALYTIC TIME FRAME

49. Ideally, the time frame of this analysis would be based on the expected time period over which the critical habitat regulation is expected to be in place. Specifically, the analysis would forecast impacts of implementing this rule through species recovery (i.e., when the rule is no longer required). However, absent specific information on the expected time frame for recovery of the spikedace and loach minnow, this analysis forecasts impacts over a "reasonably foreseeable" time frame. Based on available data, this analysis considers economic impacts to activities from 2011 (expected year of final critical habitat designation) through 2030. We recognize that in some cases, the timeframe over which future impacts can be reasonably forecast may be shorter than this period, and this is discussed where appropriate in the analysis.

³¹ U.S. Office of Management and Budget, "Circular A-4," September 17, 2003, available at <http://www.whitehouse.gov/omb/circulars/a004/a-4.pdf>.

³² *Ibid.*

2.4 INFORMATION SOURCES

50. The primary sources of information for this report are communications with, and data provided by, personnel from the Service, local governments and other stakeholders. In addition, this analysis relies upon the Service's section 7 consultation records, as well data on baseline land use obtained from county planning authorities. Finally, this analysis also relies on still pertinent information and data from the economic analysis prepared in support of the 2005 critical habitat rule.³³ A complete list of references is provided at the end of this document.

³³ Industrial Economics, Inc. *Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow*, prepared for the U.S. Fish and Wildlife Service, October 25, 2006.

CHAPTER 3 | POTENTIAL ECONOMIC IMPACTS TO WATER MANAGEMENT AND USE

51. This section examines the potential economic effects resulting from spikedace and loach minnow critical habitat designation on water use and users. This section presents an overview of the methodology used to evaluate water use activities and associated economic impacts, and estimates impacts by river segment. Water issues specific to mining and Tribal interests are addressed in Chapters 5 and 8, respectively.

3.1 SUMMARY OF IMPACTS

3.1.1 INCREMENTAL IMPACTS OF CRITICAL HABITAT

52. Past modifications to water supply and diversion projects in proposed critical habitat areas have generally not involved water quantity or water flow issues. Instead, they involved modest changes to a few projects, primarily involving water diversion repair.
53. Exhibit 3-1 presents a summary of estimated future incremental critical habitat costs related to water management and use. In total, quantified incremental impacts are estimated to range from \$1.8 million to \$3.2 million, or \$155,000 to \$282,000 on an annualized basis (discounted at seven percent).
54. In addition to quantified impacts, there may be impacts on water users if critical habitat results in incremental changes in or restrictions on water use. However, there are currently no data that indicates whether existing or future diversions of water (or groundwater pumping) reduce stream flow or modify hydrologic conditions to a degree that adversely modify spikedace and loach minnow habitat. As such, this analysis does not quantify the probability or extent to which water use would need to be curtailed or modified to remedy impacts on spikedace and loach minnow habitat. It does, however, qualitatively discuss potential water users and projects that may be affected if critical habitat results in additional requirements related to water diversions or conveyance.
55. Irrigated agriculture has the potential to adversely affect spikedace and loach minnow proposed critical habitat areas by affecting water quality, altering habitat and reducing water availability. As with other water use activities, agricultural irrigation activity has generally not been affected by spikedace and loach minnow conservation activities since the listing of the two species in 1986 (i.e., past project modifications to agricultural activities have not occurred other than consultations on diversion repair).

EXHIBIT 3-1. SUMMARY OF INCREMENTAL IMPACTS TO WATER MANAGEMENT AND USE BY REACH (2011\$, DISCOUNTED AT SEVEN PERCENT)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS		UNQUANTIFIED INCREMENTAL IMPACTS [1]
		LOW	HIGH	LOW	HIGH	
1	Verde River	\$5,450	\$5,450	\$481	\$481	City of Prescott water supply; Yavapai Apache Nation: • water exchange/water development project; • CAP project and other water rights. NRCS Funding
	Granite Creek	\$48,400	\$48,400	\$4,270	\$4,270	
	Oak Creek	\$0	\$17,100	\$0	\$1,510	
	Beaver and Wet Beaver Creek	\$0	\$14,400	\$0	\$1,270	
	West Clear Creek	\$16,300	\$37,000	\$1,440	\$3,260	
2	Tonto Creek	\$0	\$25,800	\$0	\$2,280	NRCS Funding
3	San Pedro River	\$1,630,000	\$2,990,000	\$144,000	\$264,000	San Pedro River: the Service or outside parties could request that Fort Huachuca provide additional water for spikedace and loach minnow, causing the Fort to replace or reduce its water consumption. This requirement could result in substantial economic costs to the Fort, and potentially, cause regional economic effects. Because any such requirements are not currently known, they are not quantified.
	Hot Springs Canyon	\$5,450	\$5,450	\$481	\$481	
	Aravaipa Creek	\$5,450	\$5,450	\$481	\$481	
	Deer Creek	\$5,450	\$5,450	\$481	\$481	
	Turkey Creek	\$5,450	\$5,450	\$481	\$481	
4	Bonita Creek	\$5,450	\$5,450	\$481	\$481	San Carlos Apache
5	Eagle Creek	\$0	\$0	\$0	\$0	Mining activities; White Mountain Apache and San Carlos Apache water use
6	San Francisco River	\$21,800	\$21,800	\$1,920	\$1,920	-
7	Blue River	\$5,450	\$5,450	\$481	\$481	-
8	Gila River	\$5,450	\$5,450	\$481	\$481	-
Total		\$1,760,000	\$3,200,000	\$155,000	\$282,000	-

[1] Potential impacts to mining activities that utilize surface water in proposed critical habitat are discussed in Chapter 5, and are not included in quantified impacts here. Potential impacts to Tribes are discussed in Chapter 8. Impacts associated with species management efforts, such as control of non-native species, are discussed in Chapter 6.

56. It is possible that irrigation activities could be incrementally affected by critical habitat if farmers, or other water users, make efforts to maintain adequate water quantity and flow to protect water flows in critical habitat areas in the future. In particular, there are numerous examples of agricultural water exchanges occurring for the benefit of listed species in the West.⁵⁸ Incremental impacts on agricultural production would be possible if water exchanges occur in areas considered unoccupied by the species. Because the total volume of water used by agriculture comprises 98 percent of surface water use and 81 percent of groundwater use in counties that contain critical habitat, it appears most likely that, for areas other than the San Pedro River area, where groundwater use is dominated by domestic and military withdrawals, if additional water supplies are needed for these species, they would come from current agricultural water use. Therefore, the analysis assumes that to accommodate spikedace and loach minnow, under the high end scenario, farmers that draw water from 26 acres of unoccupied reaches may give up water and cease to farm, resulting in losses of agricultural land value. However, we note that there is no evidence that agricultural water users have given up farming activities in the past related to these species.
57. Should irrigated agriculture be curtailed to accommodate spikedace and loach minnow, we estimate that 26 acres adjacent to unoccupied reaches could be retired from production. The value of these 26 acres of cropland is estimated at approximately \$305,000. This total cropland value potentially foregone is included in high end estimates of impacts on water use.⁵⁹

3.1.2 BASELINE IMPACTS

58. Exhibit 3-2 presents a summary of estimated future baseline impacts related to water management and use. In total, quantified baseline impacts are estimated to range from \$51.7 to \$54.9 million, or \$4.6 to \$4.9 million on an annualized basis. The largest share of these impacts is expected to occur on the San Pedro River in Unit 3. These impacts are associated with conservation efforts expected to be undertaken by Fort Huachuca for the protection of other endangered species, including the Huachuca water umbel.

⁵⁸ See for example, conservation efforts for the razorback sucker, and Colorado pikeminnow conducted under the San Juan River Basin Recovery Implementation Program, and water acquisitions for the Southwestern willow flycatcher conducted under the Lower Colorado Multi-Species Conservation Program.

⁵⁹ The value added of cropland is estimated as the difference in land value between irrigated farmland (i.e., cropland) and non-irrigated farmland (i.e., pasture), using USDA estimates of cropland values and pasturelands.

**EXHIBIT 3-2. SUMMARY OF BASELINE IMPACTS TO WATER MANAGEMENT AND USE BY REACH
(2011\$, DISCOUNTED AT SEVEN PERCENT)**

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$1,920,000	\$3,240,000	\$169,000	\$286,000
2	White River	\$0	\$34,700	\$0	\$3,060
	East Fork White River	\$0	\$81,600	\$0	\$7,200
3	San Pedro River*	\$49,700,000	\$49,700,000	\$4,380,000	\$4,380,000
	Hot Springs Canyon	\$16,300	\$16,300	\$1,440	\$1,440
	Redfield Canyon	\$0	\$46,500	\$0	\$4,100
	Aravaipa Creek	\$16,300	\$671,000	\$1,440	\$59,200
	Deer Creek	\$16,300	\$16,300	\$1,440	\$1,440
	Turkey Creek	\$16,300	\$16,300	\$1,440	\$1,440
4	Bonita Creek [2]	\$16,300	\$16,300	\$1,440	\$1,440
6	San Francisco River	\$16,300	\$36,100	\$1,440	\$3,180
7	Blue River	\$16,300	\$16,300	\$1,440	\$1,440
8	Gila River	\$16,300	\$1,060,000	\$1,440	\$93,600
	West Fork Gila River	\$0	\$11,600	\$0	\$1,020
Total		\$51,700,000	\$54,900,000	\$4,560,000	\$4,850,000

* Unquantified impacts also in this reach also include the purchase of conservation easements by Fort Huachuca.

[1] Potential impacts to mining activities that utilize surface water in proposed critical habitat are discussed in Chapter 5, and are not included in quantified impacts here. Potential impacts to Tribes are discussed in Chapter 8. Impacts associated with species management efforts, such as control of non-native species, are discussed in Chapter 6.

[2] Potential impacts to water uses on Bonita Creek are not quantified.

3.2 APPROACH TO ANALYSIS OF WATER MANAGEMENT AND USE

59. Historically, the Service has been most concerned in its section 7 consultations with the threat of non-native species introductions/presence, rather than the *quantity* of water available for the spinedace and loach minnow.⁶⁰ Nonetheless, the Proposed Rule states that spinedace and loach minnow need permanent, flowing water. The Service also states

⁶⁰ See Section 6 for a detailed discussion of activities related to non-native species removal.

that the spokedace and loach minnow are less likely to occur where substantial diversions or impoundments have been constructed, and that these fish survive better when rivers have natural flow regimes, including flood events. The Proposed Rule lists water diversions as a threat to 14 river segments. Thus, while not a focal point of most past consultations, having adequate water flow is critical to these fish.

60. Because the climate in which the fish live is arid, water is scarce. A primary concern of water users and managers in proposed critical habitat areas is the potential for impacts on the availability of water for use.⁶¹ Thus, this analysis focuses on identifying stream segments where water diversions or nearby groundwater pumping activities may impact flow regimes to such a degree that proposed critical habitat areas may be affected. Within those areas, the analysis focuses on unoccupied stream reaches, where the Service has identified critical habitat to be the most likely to cause impacts.
61. The Proposed Rule states that water depth requirements for the spokedace and loach minnow can be as little as 1.2 inches (juvenile/larval spokedace) to as much as 18.0 inches for adult loach minnow. Flow velocities vary from 1.2 inches/second (juvenile loach minnow) to 33.6 inches/second (juvenile loach minnow). Ideally, this analysis would consider streamflow requirements for the spokedace and loach minnow coupled with actual flow data for each area to identify and quantify potential impacts associated with proposed critical habitat for the spokedace and loach minnow. It would then assess how critical habitat needs would be addressed in unoccupied areas, and how critical habitat might be expected to increase those requirements, if at all, in occupied areas. However, it is difficult to rely on this approach due to several important uncertainties, including: 1) the volume of water needed to augment flow in a given year to benefit the spokedace and loach minnow is unknown; 2) any specific requirements for critical habitat that may differ from those needed for the species themselves are unknown; 3) the relationship between water withdrawals and river flow in proposed critical habitat areas are not well understood;⁶² and 4) future water demand, as well as other management activities, are uncertain. Thus, this analysis relies on both quantitative and qualitative assessments of water use and demand in proposed critical habitat areas to understand potential impacts. Specifically, this analysis was conducted in five steps:

1) Identify water users in proposed critical habitat areas that are considered unoccupied by the species:

⁶¹ One past public comment underscores the importance of water availability in one area by stating that "the potential loss of the ability to divert surface water and possibly groundwater is perhaps the most important economic, social, and environmental consideration in the Verde River unit." Public comments on proposed spokedace and loach minnow critical habitat, David A. Brown and Michael J. Brown, Brown & Brown Law Offices, on behalf of Park Central Properties and NBJ Ranch Limited Partnership, July 6, 2006.

⁶² Hydrologic models exist for some areas proposed as critical habitat. For example, a U.S. Geological Survey groundwater model for the Upper San Pedro River exists, as noted in public comments of Fort Huachuca, November 3, 2011. However, hydrologic models alone cannot determine the volume of water needed for the spokedace and loach minnow, nor any behavioral shift that could be requested associated with critical habitat designation.

- United States Geological Survey (USGS), Arizona Department of Water Resource (AZDWR), and New Mexico State Engineer Office (NMSEO) water withdrawal data were queried to understand annual surface water and groundwater use in proposed critical habitat areas. This assessment identified irrigation as the primary use of both surface water (98 percent of withdrawals) and groundwater (72 percent of withdrawals) in counties containing proposed critical habitat. It also identified public/domestic water supply as an important user of groundwater (nine percent) in affected counties.
 - AZDWR and NMSEO groundwater well data were overlaid with proposed critical habitat areas using GIS to identify groundwater wells in proposed critical habitat areas.⁶³ This assessment identified 1,116 groundwater wells used for water production that fall within proposed critical habitat, of which most (approximately 85 percent) are small wells used to serve single-family homes for domestic purposes.⁶⁴ It also found that groundwater wells are clustered geographically: 722 groundwater wells (65 percent) in proposed critical habitat are found in the Verde River segment of proposed critical habitat. Of these, 49 percent (352 wells) occur on the unoccupied Beaver/Wet Beaver and Oak Creek segments.
 - Public comments on the Proposed Rule, past Proposed Rules, and Rules relating to other native fish in Arizona and New Mexico were reviewed. This assessment identified several concerned water user groups who were contacted and interviewed.
- 2) **Assess impacts on cropland agriculture.** Irrigated agriculture may adversely affect spikedace and loach minnow proposed critical habitat areas by affecting water quality, altering habitat, and affecting water availability. However, agricultural lands used for growing crops generally have not been affected by spikedace and loach minnow conservation activities since the listing of the two species in 1986 (i.e., past project modifications to agricultural activities have not occurred). One potential Federal nexus involves Federal funding received by farmers as part of farm assistance programs.

⁶³ Note that this analysis presents only approximate estimates of land acreage included in critical habitat areas. Please refer to the Proposed Rule for legal descriptions of proposed critical habitat. This analysis approximates the acreage of proposed critical habitat by creating a buffer of 300 feet on either side of the proposed critical habitat centerline. The centerline was developed by the Service, and the analysis then uses a 300 foot buffer in an effort to best approximate the definition of critical habitat provided in the Proposed Rule (critical habitat includes the wetted channel and the adjacent floodplains within 300 lateral feet on either side of bankfull stage). Because the stream centerline and bankfull stage are not equivalent, this method results in an acreage estimate. While this may not be an exact measure of critical habitat acreage, the acreage estimate is suitable for the purposes of this analysis.

⁶⁴ Analysis conducted for wells in Arizona. GIS data were not available to perform a similar analysis in New Mexico. Arizona Department of Water Resources, Wells 55 Database CD, 2002.

Because the vast majority of water used in proposed critical habitat is for irrigation purposes, and because the agricultural community has expressed concern,⁶⁵ the analysis looks closely at potential impacts to cropland agriculture. Responses by farmers to avoid impacts on spikedace and loach minnow habitat could result in adverse impacts to the farming community in the future. The analysis quantifies potential impacts of reduced water availability on agricultural production.

- Reduced agricultural production.** If irrigation water diversions are curtailed to be protective of spikedace and loach minnow, either through purchase, exchange, lease, or otherwise in order to avoid adverse impacts on spikedace and loach minnow, some agricultural lands would most likely cease to be farmed. This is because irrigation is necessary for farming in the Southwest, and few substitute water supplies exist.⁶⁶ This analysis calculates the economic value of agricultural resources that fall within proposed critical habitat, and the value of resources that rely on water withdrawals from proposed critical habitat. The analysis estimates the value of agricultural lands over unimproved lands using USDA estimates of cropland values and pasturelands. The difference between these land values is used to estimate the value added by crop agriculture, as shown in Exhibit 3-3. Incremental impacts of critical habitat are assigned in unoccupied reaches, across a total of 26 acres.

EXHIBIT 3-3. CROP AND PASTURE LAND VALUES USED TO CALCULATE VALUE OF CROPS IN PROPOSED CRITICAL HABITAT (2011\$)

STATE	VALUE OF CROPLAND PER ACRE [1]	VALUE OF PASTURELAND PER ACRE	DIFFERENCE (INCREMENTAL VALUE OF CROP PRODUCTION)
Arizona	\$11,898	\$931	\$10,967
New Mexico	\$5,545	\$321	\$5,225

[1] Reported irrigated cropland values.
 Source: USDA NASS, Agricultural Land Values and Cash Rents, 2005 Summary;
<http://www.usda.gov/nass/aggraphs/landcash.htm> on Feb 1, 2006.

- 3) **Assess impacts on public water supply/domestic use.** Because the majority of domestic and municipal water uses occur in the Verde River segment, the

⁶⁵ See for example, Public comments of the Black Range Resource Conservation and Development District, Inc., re: Proposed Designation of Critical Habitat for the Spikedace and Loach Minnow," January 11, 2000.

⁶⁶ The likelihood of these water transfers, and the mechanism by which this may occur, are unknown.

analysis focuses on Unit 1 in its assessment of potential impacts to domestic and municipal water supplies. Interviews with water users and managers identified particular areas of concern as well as potential costs within the Verde River unit.

4) **Assess impacts to Tribal water use and industrial use of water for mining.**

Potential impacts to mining activities that utilize surface water in proposed critical habitat are discussed in Chapter 5. Potential impacts to Tribes are discussed in Chapter 8.

3.3 PAST IMPACTS ON WATER USE IN PROPOSED CHD AREAS

62. The majority of past consultations on water issues did not focus on water availability or water quantity issues. Instead, consultations focused on non-native species reintroduction issues for multiple native fish species, diversion repair and bank stabilization-type projects, and occasionally, proposed water exchanges.

63. One past consultation with the Department of Defense at Fort Huachuca addressed groundwater use at the installation as it related to native fish, native plant, and other riparian and aquatic species. As a result of this consultation, the Army agreed to limit its groundwater use to accommodate these species in the San Pedro River, which is proposed as critical habitat for the spokedace and loach minnow.⁶⁷ Because one remedy for low water situations in streams has been to reduce groundwater pumping, this analysis looks at the groundwater uses that occur within critical habitat areas, and assesses the extent to which they could be affected by spokedace and loach minnow conservation activities. However, it should be noted that because groundwater withdrawals frequently do not involve a Federal nexus, groundwater issues have rarely been addressed through section 7 consultations in the past. For example, the City of Sierra Vista has not consulted with the Service nor has it opted to undertake the same water conservation strategy as the federally owned Fort Huachuca, though they share groundwater resources. Other past impacts on water use and management in critical habitat areas include:

- **Unit 1, Verde River: Operation of Horseshoe/Bartlett Reservoirs.** While no Salt River Project (SRP) facilities fall in proposed critical habitat areas, SRP has water rights to a large portion of the flow of the Verde River, and has completed an HCP in the Verde River Watershed for Horseshoe and Bartlett Reservoirs, which are located downstream of proposed critical habitat for the spokedace and loach minnow. The HCP covers many species, including several native fish species. These species include: razorback sucker, Colorado pikeminnow, Gila topminnow, spokedace, loach minnow, roundtail chub, desert sucker, Sonoran sucker, longfin dace and speckled dace. As part of the HCP process, SRP expended \$442,900 in studies, administrative, and legal costs and \$15,000 in survey costs associated with native fish species to be covered under the HCP. Estimates do not include in-house staff time spent by SRP. SRP estimates that approximately 10 percent of native

⁶⁷ U.S. Department of the Interior, Fish and Wildlife Service, Re-initiation of Consultation on Fort Huachuca Programmatic Biological Opinion (2-21-02-F-229 and 2-21-98-F-266), August 23, 2002.

fish costs are attributable to spokedace and loach minnow conservation, or \$45,000.⁶⁸

- **Unit 1, Verde River: Low-Flow Gauge.** In addition to HCP efforts, SRP was involved with a 2003 consultation regarding installation of a low-flow gauge with a flume on the Campbell Ranch to measure flow in the Verde River near its headwaters (the Upper Verde portion of the Verde River segment). This action required a section 404 permit from US Army Corps of Engineers (USACE). Following consultation, the total project costs were \$142,600, of which SRP estimates \$13,500 were spent on conservation activities attributable to spokedace and loach minnow concerns, including estimated in-kind fish survey expenses incurred by the Arizona Game and Fish Department (AZGFD).
- **CAP Project.** One consultation for which a final biological opinion was issued in 2001 with USBR considered potential nonnative species introductions that could occur as part of interbasin water transfer through the CAP in the Gila River Basin. This consultation, which included numerous listed species, resulted in a number of off-site modifications that were implemented by USBR, including an agreement to install numerous non-native fish barriers, monitor fish populations, and fund non-native fish recovery efforts annually for 21 years. Several mitigation efforts for this opinion have been undertaken within proposed critical habitat. Costs associated with implementing this biological opinion are discussed in Section 6.
- **Other** past consultations in proposed critical habitat areas have resulted in relatively modest changes to proposed projects. Typical project modifications have included minimizing construction activities within the wetted channel, ensuring no pollutants enter surface waters, replanting riparian vegetation, monitoring for up to ten years, and conducting research studies. These modifications have been recommended for approximately 10 diversion repair and bank stabilization-type projects (not including SRP's low-flow gauge).

3.4 IDENTIFICATION OF WATER USERS IN PROPOSED CHD AREAS

64. In counties that contain proposed critical habitat, agricultural water use, primarily for crop irrigation, represents 98 percent of surface water withdrawals, as presented in Exhibit 3-4.⁶⁹ In affected counties, surface water is only used for public water supplies in Pinal County, Arizona, and Grant County, New Mexico. Surface water withdrawals in Pinal County dominate withdrawals among affected counties. However, much of the surface water supply in Pinal County is derived from Lower Colorado River water that is

⁶⁸ Written communication with C. Sommers, ERO Resources, "Re: Critical Habitat Economic Analysis, Spikedace and Loach Minnow," February 2, 2005.

⁶⁹ Estimated Use of Water in the United States, County-Level Data for 2000, USGS, Freshwater Use estimates. Accessed at <http://water.usgs.gov/watuse/data/2000/>.

provided via the CAP, and which lies outside of proposed critical habitat for the spikedace and loach minnow.

65. Total groundwater withdrawals in affected counties exceed surface water withdrawals. As presented in Exhibit 3-5, groundwater use is also dominated by irrigation, which represents 72 percent of groundwater withdrawals in affected counties. Pinal County, which has the largest agricultural production in Arizona, also dominates groundwater use in affected counties.
66. Exhibit 3-6 presents detailed information on the location and type of the 1,116 groundwater wells that appear to fall in proposed critical habitat.⁷⁰ The majority (86 percent) of wells in proposed critical habitat are small domestic wells in Arizona (wells pumping less than 35 gallons per minute (gpm)).⁷¹
67. Of the 124 wells in Arizona critical habitat areas that pump more than 35 gpm, 71 are irrigation wells (57 percent), 43 are domestic wells (35 percent), four are stock wells (three percent), and six are used for other purposes (five percent).

⁷⁰ Arizona Department of Water Resources, Wells 55 Database CD, 2002; New Mexico Office of the State Engineer, W.A.T.E.R.S. (Water Administration Technical Engineering Resource System) Project, GIS data, accessed at <http://www.ose.state.nm.us/water-info/gis-data/index.html> on January 16, 2006. This database is a record of all wells registered with the state of Arizona since reporting began in 1980 (though many wells were reported to the state retroactively). The positional accuracy of the data is somewhat limited because the well locations are reported to ADWR by township, range, section and section subdivision down to the nearest ten acres (quarter-quarter-quarter section). Thus, center points of ten-acre cells are used to represent the approximate locations of the wells. In addition, 0.05 percent of the wells in the database have no locational information. Thus, in some cases, wells may have been identified as falling within critical habitat when they do not, and vice versa.

⁷¹ Wells pumping less than 35 gpm would be exempt from reporting requirements if they occur in an Active Management Area (AMA). Outside of AMAs, there are no reporting requirements for groundwater wells. Personal communication with W. Werner, Arizona Department of Water Resources, March 22, 2006.

EXHIBIT 3-4. SURFACE WATER USE IN COUNTIES CONTAINING SPIKEDACE AND LOACH MINNOW CRITICAL HABITAT, MGD (2005)

STATE	COUNTY	PUBLIC WATER SUPPLY ^[1]	IRRIGATION	MINING	TOTAL
Arizona	Apache	0.00	8.35	0.00	8.35
	Cochise	0.00	4.53	0.00	4.53
	Gila	0.00	0.53	0.05	0.58
	Graham	0.05	98.01	0.00	98.06
	Greenlee	0.00	6.88	8.64	15.52
	Navajo	0.00	8.83	0.00	8.83
	Pima	0.00	20.40	0.00	20.40
	Pinal	5.26	583.41	0.24	588.91 ^[2]
	Yavapai	0.00	30.25	0.00	30.25
New Mexico	Catron	0.04	16.40	0.00	16.44
	Grant	0.04	23.23	0.00	23.27
	Hidalgo	0.00	7.19	0.00	7.19
Total		5.39	808.01	8.93	822.33
Percent of Total		1%	98%	1%	100%

Notes:

[1] One MGD for a year is equivalent to the annual water use by approximately 2,550 households.

[2] Much of the surface water supply in Pinal County is derived from Lower Colorado River water that is provided via the Central Arizona Project, and which lies outside of proposed critical habitat for the spikedace and loach minnow.

Source: Estimated Use of Water in the United States, County-Level Data for 2005, USGS, Freshwater Use estimates. Accessed at <http://water.usgs.gov/watuse/data/2005/>

EXHIBIT 3-5. GROUNDWATER USE IN COUNTIES CONTAINING SPIKEDACE AND LOACH MINNOW CRITICAL HABITAT, MILLION GALLONS PER DAY (MGD) (2005)

STATE	COUNTY	PUBLIC WATER SUPPLY	DOMESTIC ^[1]	INDUSTRIAL	IRRIGATION	MINING	THERMOELECTRIC	TOTAL
Arizona	Apache	5.34	1.95	0.00	1.02	0.00	18.12	26.43
	Cochise	15.96	2.74	0.14	225.00	0.18	5.13	249.15
	Gila	6.14	1.01	0.03	1.74	18.42	0.00	27.34
	Graham	4.71	1.06	0.17	68.55	0.17	0.00	74.66
	Greenlee	1.52	0.27	0.00	6.46	5.33	0.00	13.58
	Navajo	11.82	1.27	12.71	7.10	4.26	14.60	51.76
	Pima	159.12	2.37	0.48	86.78	34.66	2.62	286.03
	Pinal	39.04	1.78	1.86	649.62	3.70	0.23	696.23
	Yavapai	25.21	2.66	1.11	14.24	17.25	0.00	60.47
New Mexico	Catron	0.14	0.19	0.00	0.26	0.12	0.00	0.71
	Grant	3.64	0.66	0.01	3.49	19.51	0.00	27.31
	Hidalgo	0.95	0.15	0.17	76.79	3.30	0.69	82.05
Total		273.59	16.11	16.68	1141.05	106.9	41.39	1,595.72
Percent of Total		17.1%	1.0%	1.0%	71.5%	6.7%	2.6%	100%

Note:

[1] One MGD of domestic water use is equivalent to the annual water use by approximately 2,550 households assuming that each household uses 0.44 acre-feet per year, and the average gallons per capita per day (GPCD) delivered is 166 gallons. Pearson, Rita, Verde Watershed Study, Arizona Department of Water Resources, 2000.

Source: Estimated Use of Water in the United States, County-Level Data for 2005, USGS, Freshwater Use estimates. Accessed at <http://water.usgs.gov/watuse/data/2005/>.

EXHIBIT 3-6. NUMBER OF GROUNDWATER WELLS LOCATED IN SPIKEDACE AND LOACH MINNOW PROPOSED CRITICAL HABITAT AREAS

UNIT	RIVER SEGMENT	DOMESTIC	INDUSTRIAL	IRRIGATION	MUNICIPAL	STOCK	UNKNOWN	TOTAL
Unoccupied Reaches								
1	Oak Creek	214	1	17		3		235
	Beaver Creek/Wet Beaver Creek	101		10	2	2		115
	West Clear Creek	32	1	10				43
2	Tonto Creek	34		11				45
	Greenback Creek	9		4		1		14
	Spring Creek	2						2
	East Fork Black River	1						1
3	San Pedro River	18		8		1		27
6	Whitewater Creek	8		2			2	12
	Subtotal	419	2	62	2	7	2	494
	Percent	84.8%	0.4%	12.6%	0.4%	1.4%	0.4%	100.0%
Occupied Reaches								
1	Verde River	331		33		4		368
3	Hot Springs Canyon	3		2				5
	Redfield Canyon	2						2
	Aravaipa Creek	30		9		2		41
4	Bonita Creek	7						7
5	Eagle Creek	6		1		2		9
6	San Francisco River	3		5		1		9
	San Francisco River	11		20			12	43
	Tularosa River	4		1			2	7

UNIT	RIVER SEGMENT	DOMESTIC	INDUSTRIAL	IRRIGATION	MUNICIPAL	STOCK	UNKNOWN	TOTAL
7	Blue River	8		2		1		11
	Dry Blue Creek	1						1
8	Gila River	5	1	35		2	7	50
	West Fork Gila River	7		1			3	11
	Middle Fork Gila River	1						1
	East Fork Gila River	3		3			1	7
Subtotal		422	1	112	0	12	25	572
Percent		73.8%	0.2%	19.6%	0.0%	2.1%	4.4%	100.0%
Total		841	3	174	2	19	27	1,066
Percent		78.9%	0.3%	16.3%	0.2%	1.8%	2.5%	100.0%

Source: Arizona Department of Water Resources, Wells 55 Database CD, 2002; New Mexico Office of the State Engineer, W.A.T.E.R.S. (Water Administration Technical Engineering Resource System) Project, GIS data, accessed at http://www.ose.state.nm.us/water_info_data.html on February 21, 2011. The Wells 55 database is a record of all wells registered with the state of Arizona since reporting began in 1980 (though many wells were reported to the state retroactively). The positional accuracy of the data is somewhat limited because the well locations are reported to ADWR by township, range, section and section subdivision down to the nearest ten acres (quarter-quarter-quarter section). Thus, center points of ten-acre cells are used to represent the approximate locations of the wells. In addition, 0.05 percent of the wells in the database have no locational information. Thus, in some cases, wells may have been identified as falling within critical habitat when they do not, and vice versa.

3.5 IDENTIFYING FUTURE ECONOMIC INCREMENTAL IMPACTS RELATED TO WATER SUPPLY

68. While potential administrative costs and impacts to existing infrastructure are relatively predictable, potential impacts on municipal, agricultural, Tribal, and industrial water use that could result from spikedace and loach minnow conservation, particularly in areas that are currently unoccupied by the species, are, in large part, uncertain.⁷² As described above, few impacts on water use have occurred in the past. In fact there is only one known example of impacts on water use to accommodate these species, and this only affected a Federal entity (Fort Huachuca).⁷³ Nonetheless, due to the intense competition for water resources in the Southwest, there is concern that spikedace and loach minnow will need to be considered to be additional "water users" in water systems for which water is already fully allocated. While potential impacts on water users are considered in this analysis, there are currently no data that indicate whether current or future diversions of water (including groundwater use) reduce stream flow or modify hydrologic conditions to a degree that adversely impacts spikedace and loach minnow or their habitat, although hydrologic models exist for some proposed areas.⁷⁴ Therefore, the analysis is not able to answer the question of whether impacts to water users are likely (i.e., the probability of such impacts). It does, however, provide information on the potential scale of the economic impacts that could occur if requirements associated with spikedace and loach minnow conservation result in changes in water diversions or conveyance in unoccupied stream reaches.⁷⁵ Detailed information by river segment is presented below, then summarized in Exhibits 3-7 to 3-8.

3.5.1 UNIT 1: VERDE RIVER SUBBASIN

69. As shown in Exhibit 3-8, the Verde River Unit has the largest number of domestic wells (646), of which nearly half are located on unoccupied reaches of Oak Creek and Beaver/Wet Beaver Creek. The proposed segment of the mainstem Verde River has perennial flow of approximately 25 to 30 cfs (average flow),⁷⁶ which flows through the communities of Camp Verde, Middle Verde, Bridgeport, Cottonwood, and Clarkdale. Most of the surface water rights to the water in the Verde are held by the SRP, which impounds water downstream of the proposed stream segment for water delivery purposes. The only significant upstream impoundment is Sullivan Dam, a heavily silted dam that

⁷² Potential impacts to water use for mining activities are discussed in Chapter 5. Potential impacts to Tribal water use are discussed in Chapter 8.

⁷³ Section 7 regarding Fort Huachuca (02-21-02-F-229; 02-21-98-F-266). This consultation addressed the following listed species: Huachuca water umbel, southwestern willow flycatcher, Mexican spotted owl, lesser long-nosed bat, Sonora tiger salamander, spikedace, loach minnow, bald eagle, jaguar, and Canelo Hills ladies' tresses.

⁷⁴ For example, a U.S. Geological Survey hydrologic model for the Upper San Pedro River exists, as noted in public comments of Fort Huachuca, November 3, 2011; Personal communication with the Service on December 8, 2011.

⁷⁵ See previous footnote.

⁷⁶ Personal communication with J. Rasmussen, Yavapai County Board of Supervisors, Yavapai County Water Advisory Board, February 7, 2006.

serves little current use. Other surface water rights are primarily held by irrigators, who divert water for agricultural purposes. Some surface water rights are held by mining interests, though they are not currently used for mining activities. Residential and commercial users in this area rely on groundwater supplies, either through private or municipal supplies.⁷⁷

70. The relatively large number of groundwater wells that fall in unoccupied proposed critical habitat in Unit 1 represent 30 percent of all groundwater wells that fall in proposed critical habitat. Of these wells, most (89 percent) are small wells that are used for domestic purposes.⁷⁸ Thirty-six wells that pump greater than 35 gpm fall on Oak and Beaver/Wet Beaver Creeks, of which half are designated for domestic use and half are designated for irrigation use.
71. Economies in these communities have traditionally been agricultural, but residential populations have grown quickly in recent years, and continued growth is expected in the future.⁷⁹ The Verde Natural Resource Conservation District observes a recent trend of conversion of croplands to residential development.⁸⁰ Although the recent economic downturn has affected development projections, residential development growth is still expected (see Chapter 7).
72. Crop agriculture in the Verde Valley area consists mostly of alfalfa or other forage. At least nine ditch companies utilize Verde surface water.⁸¹ Approximately 433 acres of irrigated lands occur within proposed critical habitat for the spikedace and loach minnow, but only 27 of those acres occur along unoccupied reaches.⁸² The estimated value of these 27 acres of irrigated cropland is approximately \$305,000.⁸³
73. Freeport McMoRan Copper and Gold, Inc. (Freeport), a large mining company, also owns property in the Verde Valley that it leases to farmers and ranchers who irrigate the leased lands. Freeport has been concerned that, if the proposed critical habitat delays or prevents maintenance or repair for water diversion structures, lessees could be adversely

⁷⁷ Estimated Use of Water in the United States, County-Level Data for 2005, USGS, Freshwater Use estimates. Accessed at <http://water.usgs.gov/watuse/data/2005/>. Personal communication with J. Rasmussen, Yavapai County Board of Supervisors, Yavapai County Water Advisory Board, February 7, 2006.

⁷⁸ Wells pumping less than 35 gpm would be exempt from reporting requirements if they occur in an Active Management Area (AMA). Outside of AMAs, there are no reporting requirements for groundwater wells. Personal communication with W. Werner, Arizona Department of Water Resources, March 22, 2006.

⁷⁹ Verde River Watershed Study, Arizona Department of Water Resources, 2000.

⁸⁰ Verde NRC, accessed at www.verde.org, May 2, 2011.

⁸¹ These ditches include: OK Ditch, Eureka Ditch, Diamond Ditch, Pioneer Ditch, Wingfield Ditch, Woods (Verde) Ditch, Jordan Ditch, Cottonwood Ditch, Hickey Ditch. Source: Natural Resource Conservation District, Maps of Irrigated lands of the Cottonwood-Clarkdale Area, and Irrigated Lands of the Camp Verde Area, accessed at www.verde.org, January 31, 2006.

⁸² United States Geological Survey, National Land Cover Data, 2001.

⁸³ Reported irrigated cropland values compared with pastureland values. USDA NASS, Agricultural Land Values and Cash Rents, 2009; Final Estimates 2004-2008; Accessed at <http://usda.mannlib.cornell.edu/usda/nass/SB993/sb1018.pdf> on May 2, 2011.

affected, which would potentially reduce the value of the leases to Freeport. Freeport has been similarly concerned that the value of these "non-mineralized" properties, which are becoming valuable assets in the Verde Valley, could be affected by restrictions on use imposed by spikedace and loach minnow conservation efforts.⁸⁴ The Service notes that, to date, prevention of facility maintenance has not occurred at Freeport facilities related to spikedace and loach minnow concerns.⁸⁵

Granite Creek/Mainstem Verde

Salt River Project

74. The SRP operates six reservoirs and dams on the Salt and Verde Rivers. Together, these reservoirs provide 40 percent of the water supply to the Phoenix Active Management Area, an area of approximately 5,600 square miles.⁸⁶ SRP diverts about 900,000 acre-feet of surface water annually for use by the City of Phoenix, Salt River Pima-Maricopa Indian Community, Fort McDowell Yavapai Nation, Phelps Dodge Corporation (PDC), irrigation users, and other communities in the Phoenix area, including Chandler, Glendale, Mesa, Scottsdale, and Tempe. The system serves 240,000 acres over an area of 375 square miles. While no SRP facilities fall in proposed critical habitat areas, SRP has water rights to a large portion of the flow of the Verde River, and recently developed an HCP in the Verde River Watershed for Horseshoe and Bartlett Reservoirs, which are located downstream of proposed critical habitat for the spikedace and loach minnow on the Verde River.⁸⁷ As stated above, the HCP covers many species, including ten native fish species. SRP estimates that the costs of the Horseshoe/Bartlett HCP associated with protections for the ten native fish species will be approximately \$3.3 million over the next 50 years, and will include⁸⁸:

- Capital costs for fish hatchery improvements: \$500,000
- Habitat protection, management, restoration, and maintenance: \$1,400,000
- Survey and monitoring: \$670,000
- Adaptive management and contingency: \$720,000

SRP anticipates that approximately 10 percent of these costs will specifically be attributable to spikedace and loach minnow conservation efforts, or \$330,000 over 50

⁸⁴ NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

⁸⁵ Written comments of Service, Arizona Ecological Field Services Office, June 16, 2011.

⁸⁶ Final Environmental Impact Statement for the Roosevelt Habitat Conservation Plan, Gila And Maricopa Counties, Arizona Volume 1 of the FEIS. Service, 2002. p 15

⁸⁷ Draft Habitat Conservation Plan: Horseshoe and Bartlett Reservoirs, July 2007, submitted to U.S. Fish and Wildlife Service; permit issued October 2008.

⁸⁸ Written communication with C. Sommers, ERO Resources, " Re: Critical Habitat Economic Analysis, Spikedace and Loach Minnow," February 2, 2005.

years. In addition, SRP estimates that approximately \$2,800 annually would be spent on spikedace and loach minnow as part of watershed management and improvement efforts.⁸⁹ While these costs are not insignificant, they are likely to have been conducted under the baseline, even absent critical habitat for spikedace and loach minnow.

Cities of Prescott/Cities/Prescott Valley

75. The Cities of Prescott and Prescott Valley (Cities) are located in the Prescott Active Management Area, where water is scarce. For this reason, the Cities recently purchased a ranch that lies 40 to 50 miles north of the Cities in the vicinity of the Verde River headwaters, which are located upstream of proposed critical habitat. The Cities plan to utilize the groundwater water rights obtained by purchasing this ranch to supply the Cities with approximately 8,000 acre-feet of water annually for domestic use.⁹⁰ The Cities plan to develop a pipeline system in order to deliver the water to residents.⁹¹ This project has been held up by litigation with SRP and others, but appears to be moving forward.⁹²
76. It is possible that the Cities' ability to make use of the existing groundwater resource at Big Chino Ranch (formerly JWK Ranch) could be limited as a result of spikedace and loach minnow conservation measures, should the ranch be shown to draw water from the Verde River headwaters and thus to adversely affect flow in proposed critical habitat areas. However, a clear Federal nexus does not exist for this project. A recent USGS report on the Big Chino Aquifer (in which the JWK ranch is likely to fall), also finds that the aquifer provides 80 to 86 percent of the base flow to the Upper Verde River at the Paulden gauge (northern portion of proposed critical habitat).⁹³ In a worst case scenario, the Cities could be compelled by a court to abandon the ranch project in order to prevent take and or adverse modification of critical habitat for the spikedace and loach minnow, resulting in a loss of the Cities' ability to use water from the ranch. Under this scenario, the City would lose some of its investment in the ranch, and be forced to seek another, likely more remote and costly water source for its residents. While the Center for Biological Diversity has filed a Notice of Intent to sue the Cities for section 9 violations under the Act (baseline),⁹⁴ it is possible that critical habitat designation, particularly on the unoccupied Granite Creek Reach, could be used to support this case.

⁸⁹ Ibid.

⁹⁰ Arizona SB 1445, HB 2561, "Big Chino sub-basin groundwater transportation," codified that the Cities of Prescott and Prescott Valley could import 8,068 acre-feet per year from outside their Active Management Area, with possible additions if water is supplied to a Tribe. Signed into law, April 26, 2010.

⁹¹ Personal communication with N. James, Fennemore Craig, Attorney for City of Prescott, March 22, 2011.

⁹² For example, see "SRP strikes deal over Prescott area water" <http://www.azcentral.com/arizonarepublic/news/articles/2010/02/12/20100212water-prescott0212.html> .

⁹³ Laurie Wirt, Ed DeWitt, and V.E. Langenheim, eds. United States Geological Survey, "Geologic Framework of Aquifer Units and Ground-Water Flowpaths, Verde River Headwaters, North-Central Arizona," 2005.

⁹⁴ Center For Biological Diversity, "Protecting the Verde River," http://www.biologicaldiversity.org/publications/slideshows/Protecting_the_Verde_River-VRCA.pdf accessed on February 15, 2011.

77. While abandonment of the ranch project due to spiketail and loach minnow concerns appears unlikely, this analysis presents information on this scenario in order to document potential impacts. The impact can be viewed in terms of a lost capital investment; the loss of a reliable, high-quality water supply; and a constraint on the Cities' ability to flexibly and effectively manage regional water supply and demand.

Yavapai-Apache Nation

78. The Yavapai Apache Nation has water rights to the CAP, and are currently negotiating a water exchange that would allow for water diversion from the Verde to their lands. A detailed discussion of potential impacts to Tribal interests is presented in Chapter 8 of this report, and is not included in this chapter.

3.5.2 UNIT 3: SAN PEDRO RIVER SUBBASIN

79. Within the San Pedro River subbasin, the Service has proposed two unoccupied stream reaches for designation, the San Pedro mainstem and Bass Canyon. The Proposed Rule does not identify water diversions as a threat in Bass Canyon; therefore, this section focuses on potential impacts to water withdrawals in the mainstem San Pedro River.
80. The sources of surface water in the San Pedro River include precipitation, snowmelt runoff, and baseflow from groundwater from the regional aquifer. The Department of Defense (DOD) United States Army Garrison Fort Huachuca (Fort) has made claims to groundwater rights for the regional aquifer within the San Pedro River basin since the establishment of the Fort in the 1880s. All potable water used by the Fort is pumped from the regional aquifer. These groundwater resources have been shown to be hydrologically connected to the surface water in the San Pedro River, despite the placement of wells on Fort Huachuca more than seven miles from proposed critical habitat.⁹⁵
81. For nearly twenty years, the Fort has been a defendant in a series of four lawsuits related to its water use and its potential impact on endangered species.⁹⁶ As result of these lawsuits and because of its clear Federal nexus as an US Army installation, the Fort has undertaken multiple section 7 consultations on its water use. Under these consultations, which focused on species other than the spiketail and loach minnow, the Fort has significantly reduced its groundwater pumping from 3,300 acre-feet a year twenty years ago to its current usage of 1,142 acre-feet.⁹⁷
82. Specifically, the Fort states that it has “made significant strides forward to reduce impacts of groundwater pumping associated with the fort by reusing or recharging treated effluent and through the acquisition of conservation easements for retirement of agricultural

⁹⁵ Public comments of Department of the Army, US Army Installation Management Command Headquarters, United States Army Garrison, Fort Huachuca, dated December 22, 2010.

⁹⁶ Public comments of Department of the Army, US Army Installation Management Command Headquarters, United States Army Garrison, Fort Huachuca, dated November 3, 2011.

⁹⁷ Personal communication with Fort Huachuca personnel, March 7, 2011.

pumping rights and avoided future groundwater pumping.”⁹⁸ The Fort reports that these efforts have cost tens of millions of dollars, including approximately \$5.7 million to purchase conservation easements.⁹⁹ In the future, the Fort estimates that approximately \$4.4 million in annual costs are expected to be incurred associated with mitigation measures, conservation easement acquisition, and labor requirements, recognizing that future budgets are uncertain.¹⁰⁰

83. The Fort estimates that monitoring and surveying for spikedace and loach minnow following critical habitat will cost \$100,000 to \$200,000 annually to either the Fort or the BLM (who is responsible for managing the San Pedro River Natural Conservation Area surrounding the river itself). As noted in Chapter 6 of this report, the USBR is already conducting monitoring for spikedace and loach minnow along the San Pedro River.¹⁰¹ The Service does not currently believe that additional monitoring would be necessary.¹⁰² Still, the Fort anticipates that a future consultation on their activities will be required, which will require a detailed biological assessment and supporting studies that may cost \$450,000.¹⁰³ These anticipated costs are included in cost estimates that are forecast in this analysis.
84. There is considerable uncertainty about whether critical habitat designation will result in additional requirements or changes to the Fort’s groundwater pumping regime. As such, we do not quantify impacts associated with potential changes to water usage at the Fort. The Fort believes that the additional reductions in water usage may be cost-prohibitive, potentially costing up to \$30,000 per acre foot.¹⁰⁴ If additional reductions in water use are required, the Fort believes the associated economic impact would be significant.¹⁰⁵ This assessment appears reasonable given the recorded history of substantial changes to Fort Operations in support of endangered species protection efforts. The Service states that anticipates requesting few additional changes related to spikedace and loach minnow.¹⁰⁶ However, the Fort’s long litigation history leaves open the question of whether a court may intervene and impose requirements that are not currently anticipated by the Service.

⁹⁸ Public comments of Department of the Army, US Army Installation Management Command Headquarters, United States Army Garrison, Fort Huachuca, dated December 22, 2010.

⁹⁹ Personal communication with Fort Huachuca personnel, March 7, 2011.

¹⁰⁰ Written communication with K. Mulhern, Chief, Environmental and Natural Resources Division, Fort Huachuca, on April 29, 2011.

¹⁰¹ Personal communication with Rob Clarkson, U.S. Bureau of Reclamation, July 5, 2011.

¹⁰² Written communication with Service, Arizona Ecological Field Services Office, June 13, 2011.

¹⁰³ Public comments of Department of the Army, US Army Installation Management Command Headquarters, United States Army Garrison, Fort Huachuca, dated November 3, 2011.

¹⁰⁴ Personal communication with Fort Huachuca personnel, March 7, 2011.

¹⁰⁵ Public comments of Department of the Army, US Army Installation Management Command Headquarters, United States Army Garrison, Fort Huachuca, dated December 22, 2010.

¹⁰⁶ Written comments of Service, Arizona Ecological Field Services Office, June 13, 2011.

85. In addition to the direct economic impact of project modifications to reduce groundwater pumping, changes in water usage at the Fort also have the potential to result in regional economic impacts. The Fort is the largest employer in Sierra Vista, Cochise County, and all of Southeastern Arizona, annually paying more than \$779.9 million in direct wages in the Sierra Vista watershed alone.¹⁰⁷ According to one public comment, the Fort's total economic impact within the Cochise County as a whole is \$1.7 billion.¹⁰⁸ The Fort is concerned that additional restrictions on its water usage may result in the Fort losing missions and thus personnel, resulting in regional economic impacts.¹⁰⁹ One commenter expressed concern that reductions in operations on Fort Huachuca could impact more than 50 local and regional businesses.¹¹⁰ Because of the uncertainty about whether water restrictions will occur, this analysis does not include these potential regional economic impacts as quantified impacts expected incrementally as a result of critical habitat designation for spikedace and loach minnow.

3.5.3 UNIT 4: BONITA CREEK SUBBASIN

86. Unit 4 contains only the Bonita Creek stream reach. Spikedace and loach minnow were translocated into this reach in 2008, and it is currently occupied by the species. Past species management efforts included treatment for non-native species. Gila chub critical habitat was proposed, but not finalized, in this reach.
87. The City of Safford has a groundwater infiltration gallery that collects water from an artesian well in the Bonita Creek streambed.¹¹¹ The City of Safford owns full rights to the groundwater source at the infiltration gallery and can therefore increase its existing diverted flow of 3,876 acre-feet/year up to a maximum flow of 5,310 acre-feet/year (AFY). The United States as trustee for the San Carlos Apache Tribe and the San Carlos Apache Tribe itself has filed water rights claims to all of the surface waters in Bonita Creek.¹¹²

¹⁰⁷ Vernadero Group and Elliott D. Pollack and Company under contract to the Department of Army, *Fiscal Year 2008 Economic Impact Analysis: Fort Huachuca, Arizona*, July 2009.

¹⁰⁸ Public comments of Department of the Army, US Army Installation Management Command Headquarters, United States Army Garrison, Fort Huachuca, dated November 3, 2011.

¹⁰⁹ Personal communication with Fort Huachuca personnel, March 7, 2011; Public comments of Department of the Army, US Army Installation Management Command Headquarters, United States Army Garrison, Fort Huachuca, dated November 3, 2011.

¹¹⁰ Public comments of the Hereford Natural Resource Conservation District on the Draft Economic Analysis and Draft Environmental Assessment on the Proposed Designation of Critical Habitat for Spikedace and Loach Minnow, submitted on November 3, 2011.

¹¹¹ An infiltration gallery is defined by EPA as a sub-surface groundwater collection system, typically shallow in depth, constructed with open-jointed or perforated pipes that discharge collected water into a watertight chamber from which the water is pumped to treatment facilities and into the distribution system. Source: EPA. Terms of Environment: Glossary, Abbreviations and Acronyms. Accessed at <http://www.epa.gov/OCEPAterms/iterns.html> on August 10, 2005.

¹¹² Public comments of Susan B. Montgomery, Sparks, Tehan, and Ryley P.C., Special Counsel to the San Carlos Apache Tribe, "Comments to Proposed Rule to Draft Environmental Assessment and Final Draft Economic Analysis of Critical Habitat for the Gila chub." September 30, 2005.

88. The City of Safford and the Bureau of Land Management signed a Memorandum of Understanding (MOU) and 10-Year Operating Plan that addressed Safford's plans to expand their system to withdraw and transport their full allocated water right of 5,310 acre-feet per year within their existing right-of-way. The Service subsequently consulted on this MOU and found that it was not likely to adversely affect spikedace or loach minnow.¹¹³ Since this reach is considered occupied, critical habitat designation for these species is not expected to result in impacts to the City of Safford's use of its water filtration gallery; any impacts would already be expected to occur under the baseline. Potential impacts to the San Carlos Apache Tribe are discussed in Chapter 5.

3.5.4 UNIT 5: EAGLE CREEK SUBBASIN

89. Unit 5 contains only the Eagle Creek stream reach, which is considered occupied. The primary water users along this reach include the Morenci Mine, owned by Freeport McMoran, and the San Carlos Apache Tribe. Public comments from local residents note that the Eagle Creek area has been monitored for these species by Arizona Game and Fish Department, the U.S. Forest Service, Eastern Arizona College on behalf of Upper Eagle Creek Watershed Association, Freeport McMoran and the San Carlos Apache.¹¹⁴ Potential impacts to water use for mining operations are discussed in Chapter 5 of this report, while Chapter 8 discusses potential impacts to the San Carlos Apache.

3.5.5 UNIT 6: SAN FRANCISCO RIVER SUBBASIN

90. The surface waters of the San Francisco and Blue Rivers in New Mexico are primarily used for agriculture. Along the San Francisco, this agricultural activity consists of irrigated pasture and ranching activities.
91. Of the reaches in this unit, only Whitewater Creek is considered unoccupied. While water diversions are listed as a threat for this reach, the land surrounding the 1.2 river miles proposed for designation is all privately owned, and does not appear to have ongoing crop agriculture activities.

3.5.6 UNIT 7: BLUE RIVER SUBBASIN

92. The Blue River in Unit 7 runs through the forest lands and rural inholdings of the Apache-Sitgreaves and Gila National Forests. Accordingly, water diversions from these reaches are more limited. Of the proposed reaches in this unit, only Little Blue Creek is considered unoccupied, but water diversions are not identified as a threat for this reach. Therefore, this analysis does not quantify any incremental impacts for this unit.

3.5.7 UNIT 8: GILA RIVER SUBBASIN

93. The Proposed Rule lists water diversions as a threat to the reaches in this basin, which are all considered occupied. Surface waters of the Gila River in New Mexico are primarily

¹¹³ Biological Opinion for Restoration of Native Fishes in Lower Bonita Creek and Implementation of a Memorandum of Understanding (MOU) and 10-Year Operation Plan between the Bureau of Land Management (BLM) and the City of Safford, June 28, 2007.

¹¹⁴ Public comments of Darcy Ely on proposed critical habitat for spikedace and loach minnow, December 27, 2010.

used for agriculture and mining uses. Major cities in Southwestern New Mexico do not rely on surface water for domestic supply purposes.¹¹⁵ Approximately 202 acres of lands used for cropland irrigation are located within the proposed Gila River, East Fork Gila River, and West Fork Gila River segments, with an estimated value of \$1.06 million.¹¹⁶ However, because these reaches are considered occupied, any potential loss in land value would be considered baseline.

94. In addition to smaller water diversions, discussions have been ongoing since the 1980s about constructing a dam on the Gila River to allow New Mexico to utilize Gila River water as part of the CAP. The 2004 Arizona Water Settlements Act, PL 108-451 (December 2004) states that the Secretary of the Interior shall "offer to contract with water users in the State of New Mexico, with the approval of the Interstate Stream Commission, or with the State of New Mexico through its Interstate Stream Commission, for water from the Gila River, its tributaries and underground water sources in amounts that will permit consumptive use of water in New Mexico of not to exceed an annual average in any period of 10 consecutive years of 14,000 acre-feet, including reservoir evaporation, over and above the consumptive uses provided for by article IV of the decree of the Supreme Court of the United States in *Arizona v. California* (376 US 340)." The New Mexico Interstate Stream Commission states that \$66 to \$128 million is available to Catron, Grant, Hidalgo, and Luna counties to develop this CAP project under the 2004 settlement.¹¹⁷
95. The ISC states that it is beginning Tier II of its process for evaluating proposals to utilize the 14,000 acre feet a year allocated to it under the AWSA. NMISC states that "while some proposals include storage of water, a large dam remains an unforeseeable option. The deadline for submission of proposals to the ISC was June 30, 2011. The only proposals submitted to build main stem or tributary dams did not pass in Tier-1 evaluations. Passage of Tier-1 evaluation is a prerequisite for passage to Tier-2 and further consideration."¹¹⁸ The ISC states that it has recently approved a list of twenty-one proposed projects that could qualify to become part of the New Mexico Unit of CAP approved in the Arizona Water Settlements Act, Pub. L. 108-451 (2004). Those twenty-one proposed projects are:¹¹⁹
- Bayard Effluent Re-use (tertiary treatment of wastewater for irrigation)

¹¹⁵ "Fact Sheet: Water Supply," Southwest New Mexico Regional Water Planning. Accessed at: www.cityofdeming.org on January 10, 2006.

¹¹⁶ Reported irrigated cropland values compared with pastureland values. USDA NASS, Agricultural Land Values and Cash Rents, 2005; Accessed at <http://www.usda.gov/nass/aggraphs/landcash.htm> on Feb 1, 2006.

¹¹⁷ Public comments of the New Mexico Interstate Stream Commission dated December 27, 2010.

¹¹⁸ Public comments of the New Mexico Interstate Stream Commission dated December 27, 2010 (submitted November 2011).

¹¹⁹ Public comments of the New Mexico Interstate Stream Commission dated December 27, 2010 (submitted November 2011).

- Catron County Watershed Restoration (restoring the complete overgrown watershed on three adjacent tributaries to the San Francisco River. Devils, Deep, & Mineral Creeks)
 - Deming Conservation Fund (implement municipal water conservation projects)
 - Deming Diversion Project (regional water supply project)
 - Deming Water Re-use Project (expand reclaimed effluent re-use irrigation system)
 - Gila Basin Irrigation Commission (divert, store and distribute water available under the AWSA to assure a dependable and adequate water supply in the river throughout the year to provide for all needs)
 - Gila Conservation Coalition Diversion - Rosgen (improve efficiency of diversions and maintain in-stream flows in the Gila River)
 - Gila Conservation Coalition Domestic Wells (purchase unused water rights for outside domestic use)
 - Gila Conservation Coalition Municipal Conservation Project (reduce net depletions to groundwater)
 - Grant County storage and release facility (to recharge groundwater and release a steady flow of water downstream from Fort Bayard)
 - Grant County Water Commission regional supply and distribution system (to ensure a drinking water supply for municipalities)
 - Grant SWCD Restoration (a 10-year project restoration project aimed at improving water yield and watershed health in the Gila Basin in New Mexico)
 - Hidalgo County off-stream storage project (to impound approximately 10,000 acre feet of water)
 - Luna Ditch Project (to build a more efficient diversion structure to minimize water loss and maintenance costs in the irrigation ditches)
 - New Mexico Forestry Industry project (to enhance surface water yield and watershed health in the San Francisco Basin in New Mexico and to mitigate development of water under the AWSA)
 - NMSU Cram Ochoa (paired-watershed management project that will potentially increase water yield)
 - Pleasanton Eastside Ditch/San Vicente Cameron Creek (improve delivery of irrigation water to 24 users by decreasing conveyance losses)
 - Stream Dynamics Water Harvesting project (proposes a large number of small water harvesting projects)
-

- Sunset & New Model Ditches (lining of two main irrigation canals on the Gila River to improve water usage, stop leakage and reduce maintenance and repair costs)
- Gila National Forest San Francisco River Diversion/Ditch (improvements)
- Gila National Forest Watershed Restoration project (including riparian and wetland enhancements)

These projects are in Tier II of the ISCs review process. By December 31, 2014, the ISC is statutorily mandated to have chosen one or more projects to recommend to the Secretary of the Interior to be built as the New Mexico Unit of the Central Arizona Project. NMISC states that “it is highly unlikely that the New Mexico ISC will not choose and recommend one or more projects to the Secretary of the Interior as New Mexico’s selection for the New Mexico Unit of CAP.”¹²⁰ NMISC states that “because the formally-adopted policy of the ISC is that the projects must fully protect the Gila environment, the proposed projects have great potential to improve the health of the river and the species.”¹²¹ Because the future of these projects are not specifically unknown, potential impacts of spikedace and loach minnow critical habitat on this project are not estimated.

3.6 SUMMARY OF WATER USE IMPACTS DUE TO SPIKEDACE AND LOACH MINNOW CRITICAL HABITAT

96. Future incremental impacts associated with changes in water use and management are presented in Exhibit 3-7. Impacts include both the administrative costs associated with section 7 consultation on water management activities, and the value of agricultural croplands within proposed critical habitat. As discussed in greater detail above, these impacts do not include potential impacts to the City of Prescott, Fort Huachuca, mining interests, Tribal interests, or impacts related to reduced participation of farmers in NRCS programs, due to the high level of uncertainty about how the designation will affect those entities.

¹²⁰ Public comments of the New Mexico Interstate Stream Commission dated December 27, 2010 (submitted November 2011).

¹²¹ Public comments of the New Mexico Interstate Stream Commission dated December 27, 2010 (submitted November 2011).

EXHIBIT 3-7. SUMMARY OF QUANTIFIED INCREMENTAL IMPACTS TO WATER MANAGEMENT AND USE BY REACH (2011\$, DISCOUNTED AT SEVEN PERCENT)

UNIT	REACH	LOST AGRICULTURAL LAND VALUE		CONSERVATION EFFORTS	ADMINISTRATIVE COSTS
		LOW	HIGH		
1	Verde River	\$0	\$0		\$5,450
	Granite Creek	\$0	\$0		\$48,400
	Oak Creek	\$0	\$17,100		\$0
	Beaver and Wet Beaver Creek	\$0	\$14,400		\$0
	West Clear Creek	\$0	\$20,600		\$16,300
2	Tonto Creek	\$0	\$25,800		\$0
3	San Pedro River	\$0	\$227,000	\$1,380,000 to \$2,520,0000	\$48,400
	Hot Springs Canyon	\$0	\$0		\$5,450
	Aravaipa Creek	\$0	\$0		\$5,450
	Deer Creek	\$0	\$0		\$5,450
	Turkey Creek	\$0	\$0		\$5,450
4	Bonita Creek	\$0	\$0		\$5,450
5	Eagle Creek	\$0	\$0		\$0
6	San Francisco River	\$0	\$0		\$21,800
7	Blue River	\$0	\$0		\$5,450
8	Gila River	\$0	\$0		\$5,450
Total		\$0	\$305,000	\$1,380,000 to \$2,520,0000	\$179,000
Note: Table may not sum due to rounding.					

97. The quantified impacts also do not include potential losses in federal Natural Resource Conservation Service (NRCS) and the Farm Service Agency (FSA) funding. Agricultural activities on private lands may be supported by voluntary participation in a number of programs sponsored by Federal agencies, including the NRCS and the Farm Service Agency (FSA). These agencies provide funding and technical assistance for agriculture-related activities. It is possible that, fearing that receiving Federal funding would potentially require them to bear the burden of maintaining fish habitat, irrigators could decline participation in Federal programs. NRCS staff state that funds not allocated within proposed critical habitat would likely be reallocated within the state, and NRCS questions the assumption that farmers would refuse funding to avoid a Federal nexus, particularly as its awards typically go to farmers who wish to promote conservation. As a result, these potential impacts are not included in estimated costs.¹²²

¹²² Personal communications with Eric Banks, NRCS, Arizona, February 1, 2006; Personal communication with Mike Neubeiser, NRCS, New Mexico, February 2, 2006.

98. The administrative costs shown in Exhibit 3-7 assume that future section 7 consultation on water management and water diversions takes place at a similar rate and in similar units as in the past. In total, it projects approximately 47 formal and informal consultations over the next 20 years.
99. Due to the high level of uncertainty about whether the designation will result in changes in water management such that water diversions for agricultural use are curtailed, this analysis presents a range of possible impacts to agriculture. As shown in Exhibit 3-7, the low end estimate assumes that critical habitat does not result in any changes to agricultural water use. At the high end, it assumes that agricultural water use is limited, resulting in the complete loss of the value of agricultural lands located adjacent to unoccupied stream reaches.
100. Exhibit 3-8 presents an estimate of the value of agricultural croplands within proposed critical habitat. In total, these lands are valued at approximately \$3.5 million. Croplands along unoccupied reaches proposed for designation are valued at approximately \$305,000. We consider the potential land value loss associated with these six unoccupied stream reaches as potential incremental impacts.

EXHIBIT 3-8. VALUE OF AGRICULTURAL CROPLAND WITHIN CRITICAL HABITAT (2011\$)

UNIT	REACH	STATE	CULTIVATED CROPS AREA	VALUE PER ACRE	TOTAL VALUE	INCREMENTAL IMPACTS*
1	Verde River	AZ	120.69	\$10,967	\$1,323,526	--
	Oak Creek	AZ	1.56	\$10,967	\$17,073	\$17,073
	Beaver Creek/ Wet Beaver Creek	AZ	1.32	\$10,967	\$14,430	\$14,430
	West Clear Creek	AZ	1.88	\$10,967	\$20,645	\$20,645
2	Tonto Creek	AZ	2.35	\$10,967	\$25,822	\$25,822
	White River	AZ	3.16	\$10,967	\$34,671	--
	East Fork White River	AZ	7.44	\$10,967	\$81,584	--
3	San Pedro River	AZ	20.74	\$10,967	\$227,484	\$227,484
	Redfield Canyon	NM	8.89	\$5,225	\$46,464	--
	Aravaipa Creek	AZ	59.67	\$10,967	\$654,413	--
	Turkey Creek	AZ	0.00	\$10,967	\$0	--
6	San Francisco River	NM	3.78	\$5,225	\$19,730	--
	Tularosa River	NM	0.00	\$5,225	\$0	--
	Whitewater Creek	NM	0.00	\$5,225	\$0	\$0
8	Gila River	NM	199.91	\$5,225	\$1,044,485	--
	West Fork Gila River	NM	2.22	\$5,225	\$11,605	--
	East Fork Gila River	NM	0.00	\$5,225	\$0	--
Total					\$3,521,933	\$305,454
<p>Note: Table may not sum due to rounding.</p> <p>* Incremental impacts reflect only potential land value losses in unoccupied reaches. Changes in water management in occupied areas, and associated losses in land value, are considered baseline for purposes of this analysis.</p>						

CHAPTER 4 | POTENTIAL ECONOMIC IMPACTS TO LIVESTOCK GRAZING ACTIVITIES

101. This chapter provides an analysis of potential economic impacts to livestock grazing activities associated with conservation efforts for the spikedace and loach minnow. We first provide a summary of the results of this analysis, including a summary of forecast baseline and incremental impacts. Next, Section 4.2 provides an overview of past conservation efforts undertaken for the spikedace and loach minnow related to grazing activities. Specifically, it describes typical conservation efforts that have been recommended to provide protection from improperly managed grazing activities that may pose a threat to the species. The chapter then discusses the analytic method used to calculate potential impacts to grazing. It then calculates potential baseline impacts resulting from riparian fence maintenance and section 7 consultations on grazing. It concludes by considering the potential for critical habitat to result in incremental changes to grazing activity such as riparian fence construction and maintenance, including administrative costs associated with section 7 consultations on grazing.

4.1 SUMMARY OF IMPACTS TO GRAZING ACTIVITIES

102. Exhibit 4-1 summarizes the anticipated incremental impacts of critical habitat on grazing activities by stream reach. The present value of incremental impacts to grazing activities is estimated at \$883,000 to \$1.67 million assuming a seven percent real discount rate over 20 years. This figure represents an annualized impact of approximately \$77,900 to \$147,000. These impacts include the costs of additional riparian fencing in four grazing allotments, as well as administrative efforts to consider potential adverse modification of habitat as part of future section 7 consultations related to these, as well as other allotments in critical habitat areas. Because grazing activities occur in most critical habitat units, future administrative costs are anticipated in most units.

EXHIBIT 4-1. SUMMARY OF INCREMENTAL IMPACTS TO GRAZING ACTIVITIES BY REACH, 2011 TO 2030 (2011\$, DISCOUNTED AT SEVEN PERCENT)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$13,800	\$13,800	\$1,220	\$1,220
	Granite Creek	\$0	\$0	\$0	\$0
	Oak Creek	\$0	\$0	\$0	\$0
	Beaver and Wet Beaver Creek	\$0	\$0	\$0	\$0
	West Clear Creek	\$0	\$0	\$0	\$0
	Fossil Creek	\$606	\$606	\$54	\$54
2	Tonto Creek	\$11,600	\$11,600	\$1,020	\$1,020
	Greenback Creek	\$3,640	\$3,640	\$321	\$321
	Rye Creek	\$689	\$689	\$61	\$61
	Spring Creek	\$6,570	\$6,570	\$580	\$580
	Rock Creek	\$1,380	\$1,380	\$122	\$122
	White River	\$0	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0	\$0
	North Fork East Fork Black River	\$574	\$574	\$51	\$51
	East Fork Black River	\$4,630	\$4,630	\$408	\$408
	Boneyard Creek	\$562	\$562	\$50	\$50
	Coyote Creek	\$274	\$274	\$24	\$24
3	San Pedro River	\$28,300	\$42,600	\$2,500	\$3,760
	Hot Springs Canyon	\$1,530	\$1,530	\$135	\$135
	Bass Canyon	\$1,340	\$1,340	\$118	\$118
	Redfield Canyon	\$1,820	\$1,820	\$160	\$160
	Aravaipa Creek	\$2,190	\$2,190	\$193	\$193
	Deer Creek	\$296	\$296	\$26	\$26
	Turkey Creek	\$349	\$349	\$31	\$31
4	Bonita Creek	\$1,920	\$1,920	\$169	\$169
5	Eagle Creek	\$6,090	\$6,090	\$537	\$537
6	San Francisco River	\$111,000	\$210,000	\$9,820	\$18,500
	Tularosa River	\$2,410	\$2,410	\$213	\$213
	Negrito Creek	\$549	\$549	\$49	\$49
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$6,560	\$6,560	\$579	\$579
	Campbell Blue Creek	\$998	\$998	\$88	\$88
	Dry Blue Creek	\$383	\$383	\$34	\$34
	Little Blue Creek	\$0	\$0	\$0	\$0
	Pace Creek	\$100	\$100	\$9	\$9

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
	Frieborn Creek	\$143	\$143	\$13	\$13
8	Gila River	\$544,000	\$1,100,000	\$48,000	\$96,700
	West Fork Gila River	\$1,050	\$1,050	\$92	\$92
	Middle Fork Gila River	\$1,540	\$1,540	\$136	\$136
	East Fork Gila River	\$3,400	\$3,400	\$300	\$300
	Mangas Creek	\$119,000	\$242,000	\$10,500	\$21,300
	Beak Creek	\$2,530	\$2,530	\$223	\$223
	Total	\$883,000	\$1,670,000	\$77,900	\$147,000

Note: Totals may not sum due to rounding.

103. We assume that fencing will be needed on both sides of streams for all potentially grazed areas in proposed critical habitat, and will need to be maintained for 20 years. For stream reaches where riparian fencing or other exclusion is known to exist currently, efforts to maintain existing fencing are assumed to occur under the baseline.
104. Exhibit 4-2 summarizes the anticipated baseline impacts of critical habitat on grazing activities by stream reach. The present value of baseline impacts to grazing activities is estimated at \$2.0 to \$7.5 million assuming a seven percent real discount rate over 20 years. This figure represents an annualized impact of approximately \$178,000 to \$658,000. These impacts include the assumed costs of maintaining existing riparian fencing in 104 grazing allotments where adequate riparian exclusion already exists, as well as administrative effort to consider jeopardy in future section 7 consultations.
105. The Service notes that in some cases, alternative management scenarios, such as seasonal rest combined with grazing rotation, can serve to reduce impacts to spikedeace and loach minnow and reduce the need for additional riparian fencing.¹²³ To be conservative, this analysis assumes that landowners will implement the more costly measures of installing and maintaining riparian fencing. This assumption may result in an overestimate of future incremental costs for some reaches.

¹²³ Written communication with Service, Arizona Ecological Services Office, July 1, 2005. In public comments, private ranchers have suggested that current management has been successful at mitigating the negative effects of grazing on spikedeace and loach minnow habitat and that further limitation of grazing would create conditions conducive to non-native species. Some commenters have also suggested that fencing may actually be detrimental to the species. These commenters reference the publications of J.N. Rinne, such as "Rinne, J. N. 2002. *Hydrology, geomorphology and management: Implications for sustain ability of native southwestern fishes*. Hydrology and Water Resources of the Southwest 32: 45-50." Public comments of David Ogilvie, Feb. 20, 2006; Public comments of Dennis Parker on behalf of George Yard, Jan. 31, 2006; Public comments of Richard Searle, Coalition of Arizona/New Mexico Counties for Stable Economic Growth, "President," July 6, 2006; Public comments of Patrick Bray, Arizona Cattle Grower's Association, "Executive Vice President," November 2, 2011.

EXHIBIT 4-2. SUMMARY OF BASELINE IMPACTS TO GRAZING ACTIVITIES BY REACH, 2011 TO 2030 (2011\$, DISCOUNTED AT SEVEN PERCENT)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$287,000	\$1,040,000	\$25,300	\$91,600
	Granite Creek	\$0	\$0	\$0	\$0
	Oak Creek	\$0	\$0	\$0	\$0
	Beaver and Wet Beaver Creek	\$0	\$0	\$0	\$0
	West Clear Creek	\$0	\$0	\$0	\$0
	Fossil Creek	\$20,800	\$78,700	\$1,830	\$6,940
2	Tonto Creek	\$120,000	\$488,000	\$10,600	\$43,100
	Greenback Creek	\$37,900	\$154,000	\$3,350	\$13,600
	Rye Creek	\$7,170	\$29,100	\$633	\$2,570
	Spring Creek	\$56,200	\$228,000	\$4,960	\$20,100
	Rock Creek	\$12,200	\$49,600	\$1,080	\$4,370
	White River	\$0	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0	\$0
	North Fork East Fork Black River	\$19,700	\$74,400	\$1,730	\$6,570
	East Fork Black River	\$48,200	\$195,000	\$4,250	\$17,200
	Boneyard Creek	\$5,850	\$23,700	\$516	\$2,090
	Coyote Creek	\$8,070	\$30,200	\$712	\$2,670
3	San Pedro River	\$0	\$0	\$0	\$0
	Hot Springs Canyon	\$4,600	\$4,600	\$406	\$406
	Bass Canyon	\$0	\$0	\$0	\$0
	Redfield Canyon	\$5,450	\$5,450	\$481	\$481
	Aravaipa Creek	\$95,600	\$368,000	\$8,440	\$32,400
	Deer Creek	\$10,100	\$38,400	\$894	\$3,390
	Turkey Creek	\$11,900	\$45,200	\$1,050	\$3,990
4	Bonita Creek	\$65,500	\$248,000	\$5,780	\$21,900
5	Eagle Creek	\$74,500	\$246,000	\$6,570	\$21,700
6	San Francisco River	\$327,000	\$1,170,000	\$28,800	\$104,000
	Tularosa River	\$72,900	\$273,000	\$6,430	\$24,100
	Negrito Creek	\$14,900	\$55,300	\$1,310	\$4,880
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$44,200	\$119,000	\$3,900	\$10,500
	Campbell Blue Creek	\$28,600	\$107,000	\$2,520	\$9,420

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
	Dry Blue Creek	\$13,100	\$49,600	\$1,160	\$4,380
	Little Blue Creek	\$0	\$0	\$0	\$0
	Pace Creek	\$3,440	\$13,000	\$303	\$1,150
	Frieborn Creek	\$4,890	\$18,500	\$431	\$1,630
8	Gila River	\$402,000	\$1,510,000	\$35,500	\$133,000
	West Fork Gila River	\$7,050	\$19,000	\$622	\$1,680
	Middle Fork Gila River	\$4,790	\$5,300	\$423	\$467
	East Fork Gila River	\$116,000	\$440,000	\$10,300	\$38,800
	Mangas Creek	\$3,430	\$7,210	\$303	\$636
	Beak Creek	\$86,700	\$328,000	\$7,650	\$29,000
	Total	\$2,020,000	\$7,460,000	\$178,000	\$658,000

Note: Totals may not sum due to rounding.

4.2 OVERVIEW OF ACTIVITY AND PAST CONSERVATION EFFORTS

106. The Proposed Rule identifies “improperly managed livestock grazing” as a threat to the species. Improperly managed livestock grazing can threaten the spikedace and loach minnow through the removal of riparian vegetation, reduced bank stability, increased sedimentation due to streambank trampling, higher peak flows and channel incisement, lower base flows, changes in channel morphology, and loss of nutrients within the stream channel.¹²⁴
107. This section discusses the typical project modifications that have been implemented to provide protection for the spikedace and loach minnow from livestock grazing activities on Federal lands. Exhibit 4-3 presents a list of example project modifications from past consultations on US Forest Service (USFS) and Bureau of Land Management (BLM) grazing allotments. Examples of conservation activities implemented on grazing allotments for spikedace and loach minnow protection include:
- Conducting surveys at occupied and/or potential spikedace and loach minnow locations;
 - Construction and maintenance of livestock exclosures in riparian areas;
 - Monitoring of forage utilization within all allotments within three weeks after livestock exit each pasture.

These actions can be grouped into three categories: grazing restrictions, other project modifications, and administrative costs.

¹²⁴ U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Endangered Status and Designation of Critical Habitat for Spikedace and Loach Minnow; Proposed Rule. Published in the Federal Register on October 28, 2010, 75 FR 66482.

EXHIBIT 4-3. PROJECT MODIFICATIONS FROM PAST CONSULTATIONS ON SPIKEDACE AND LOACH MINNOW

EXAMPLE SPIKEDACE AND LOACH MINNOW CONSERVATION EFFORTS
Changes in Utilization Rates and Other Limitations on Usage
<ul style="list-style-type: none"> • Severe grazing use (>70%) in any key area in any year shall result in notification to the Service within 30 days and a change in management (a) • For the Fossil Creek Allotment, which currently has a maximum utilization level of 60 to 70 percent, establish a utilization level of 35-40 percent in key areas (b) • For the Apache Maid, Beaver Creek Hackberry/Pivot Rock, and Windmill Allotments, which currently have maximum utilization levels of 50 percent, establish utilization levels of 35-40 percent in key areas (b) • All reasonable efforts will be made to exclude livestock from the riparian corridor (c)
Maintain Off-River Water Vessels
<ul style="list-style-type: none"> • In the Thirteen-Mile Rock Allotment, Heifer Pasture, explore options for providing water sources other than the three water gaps currently located within critical habitat on West Clear Creek. If earthen tanks are used, they should be located outside of the 100-year floodplain (b) • The Bureau should evaluate stock tanks in the San Pedro River watershed that are within 5 miles of the river for risk of nonnative fish introductions (d)
Create/Maintain Livestock Enclosures
<ul style="list-style-type: none"> • In year one of the permit, establish key areas and grazing enclosures of 50 feet by 50 feet within each pasture. A minimum of two key areas and two enclosures per pasture should be developed. Key areas should be located on those portions of the range which serve as an indicative example of range conditions, trend, or degree of seasonal use, and shall not include those areas remote from waters, steep slopes, or with poor accessibility as they are not representative of areas used by cattle (a) • Check and repair as necessary all fences required to maintain the exclusion of livestock from the tributaries of the East Fork of the Black River (e)
Conduct Surveys and Monitoring
<ul style="list-style-type: none"> • Annual reports detailing measurements taken, methods used, and results of the quantitative measurements shall be made to the Service (a) • Monitor forage utilization on pastures within all allotments within three weeks after livestock exit each pasture (a, f) • Monitor forage utilization (b, e, g) • Establish permanent photopoints to document stream channel condition and trend, and at the same sites, establish cross-channel transects to monitor condition and trend for stream channel morphology (e)
<p>Sources:</p> <p>(a) "Reauthorization of grazing on the Pleasant Valley Allotment," 02-21-01-F-189</p> <p>(b) "Possibly effects of on-going grazing activities on eight livestock grazing allotments," 02-22-99-F-016R, 000089ROR, 02-21-92-F-500R, 02-21-94-F-239R, 02-21-92-F-404R, 02-21-96-F-058R, 02-21-01-F-124R, 02-21-01-F-293, 02-21-01-F-294, 02-21-01-F-295, 02-21-01-F-296</p> <p>(c) "Land and Resource Management Plans for 11 National Forests," 000087RO</p> <p>(d) "Reinitiation: Programmatic Biological Opinion for the Safford/Tucson Grazing Program," 02-21-96-F-160R5</p> <p>(e) "Ongoing Livestock Grazing on Allotments," 00089RO</p> <p>(f) "Reissuance of Term Grazing permits for six allotments," 02-21-95-F-020R, 02-21-01-F-308, 02-21-01-F-105, 02-21-01-F-309, 02-21-01-F-310</p> <p>(g) "Grazing on four allotments in Apache-Sitgreaves National Forest," 02-21-00-F-286</p>

108. In some areas, the use of riparian areas for livestock grazing and reductions in the level of grazing activity has already been restricted. On Federal lands, reductions in available grazing area can be realized by reducing the number of authorized or permitted Animal Unit-Months (AUM, which is a measure of the amount of forage consumed by one cow and calf during one month). With the exception of eight allotments managed by BLM, riparian areas have already been excluded from grazing either year-round or seasonally along streams proposed as critical habitat.
109. In the past, riparian fencing activities and associated reductions in AUMs have been undertaken for the protection of several endangered species and native fish, including the spikedace and loach minnow. Specifically, in 1998, USFS Region 3 (New Mexico and Arizona) conducted a region-wide consultation on all of their grazing actions, resulting in the allotment-by-allotment review of 963 allotments. This review was the result of two lawsuits filed against the USFS by environmental groups in 1997, the Forest Guardians and the Center for Biological Diversity. The Forest Guardians' initial lawsuit focused upon four endangered species and threatened species: the southwestern willow flycatcher, the loach minnow, the spikedace, and the Mexican spotted owl (spotted owl). Their lawsuit challenged the issuance of grazing permits on allotments located in the Apache-Sitgreaves, Carson, Cibola, Gila, Prescott, and Santa Fe National Forests. The Center for Biological Diversity's initial lawsuit did not focus on any specific endangered or threatened species, but challenged the issuance of grazing permits on allotments in six national forests: Apache-Sitgreaves, Coconino, Coronado, Gila, Prescott, and Tonto. Because the complaints shared common issues and challenged many of the same allotments, the cases were consolidated.
110. In response to the lawsuit, USFS initiated informal consultation with the Service in February 1998 on the 158 allotments named in the complaints as well as hundreds of other allotments (962 in total) in the National Forests of Arizona and New Mexico (USFS Region 3). The purpose of the consultation was to determine the potential effects of livestock grazing on endangered and threatened species on the allotments and therefore whether formal consultation between USFS and the Service was necessary. As part of the informal consultation process, the Forest Service also developed "Grazing Guidance Criteria for Preliminary Effects Determinations for Species Listed as Threatened, Endangered or Proposed for Listing," ("Guidance Criteria") dated February 13, 1998.
111. Of the 962 allotments under consultation, 619 "No Effect," 321 "NLAA" (not likely to adversely affect) findings, and 22 "LAA" (likely to adversely affect) determinations were made. "No Effect" findings concluded the Forest Service's obligations under the Act and do not require Service concurrence. The Forest Service received concurrence from the Service for the 321 "NLAA" determinations thus no further action was necessary on those allotments.
112. This left 22 allotments where the Forest Service made LAA determinations with regards to listed species, including spikedace and loach minnow. In February 1999, the Service released a biological opinion in which it concluded that the impacts of grazing on 21 of the 22 allotments would not jeopardize the continued existence of the spikedace and loach minnow.

113. The 962-allotment review prompted both Plaintiffs to amend their complaints in September 1999. The Forest Guardians narrowed their complaint to the loach minnow, the spikedace, and the spotted owl on allotments in the Apache-Sitgreaves, Gila and Cibola National Forests while the Center for Biological Diversity re-focused their complaint to the loach minnow and spikedace on allotments in the Apache-Sitgreaves and Gila National Forests.¹²⁵ The result of this process was the exclusion of the majority of the riparian corridor on grazing allotments in USFS Region 3.¹²⁶

4.3 ANALYTIC APPROACH

114. As stated above, previous lawsuits have resulted in the exclusion of cattle grazing from much of the riparian corridor in proposed critical habitat areas. Because the remaining unfenced areas are small relative to the area covered by the proposed critical habitat and based on communications with land managers, we assume that no additional reductions in AUMs are likely.¹²⁷ Past riparian fencing activities and associated AUM reductions are considered baseline and retrospective impacts because the reductions were implemented previously, and thus are not quantified here.¹²⁸
115. Potential impacts to grazing quantified in this chapter may consist of:
1. **Fencing Construction.** For areas where fencing is known not to exist, or where it could not be determined if adequate fencing exists, fencing is assumed to be needed on both sides of streams for all potentially grazed areas in proposed critical habitat. These impacts are considered to be incremental regardless of whether the reach is considered to be occupied.
 2. **Fencing Maintenance.** All fencing is assumed to be maintained for 20 years. This may result in an overestimate of future costs for some reaches. For areas previously fenced, continued maintenance is assumed to be baseline. For fencing assumed to be constructed as a result of critical habitat, fencing maintenance is assumed to be incremental.
 3. **Administrative Costs.** These impacts consist of the administrative effort associated with section 7 consultations on grazing activities.

¹²⁵ United States District Court of Arizona. Southwest Center for Biological Diversity, et al., Plaintiff v. United States Forest Service et al., Defendants, and Arizona Cattle Growers' Association, Applicant-in-Intervention. Forest Guardians, Plaintiff v. United States Forest Service, et al., Defendants. No. CV 97-666 TUC JMR consolidated with No. CIV 97-2562 PHX-SMM.

¹²⁶ Personal communication, Wally Murphy, USFS Region 3, September 3, 2004.

¹²⁷ Written communication from Leticia Lister, Supervisory Rangeland Management Specialist, Las Cruces District Office, New Mexico BLM, on February 25, 2011 and written communication from Tim Hughes, Endangered Species Coordinator, Arizona BLM, on March 1, 2011.

¹²⁸ This past loss of AUMs has been an economic burden on local ranchers, especially when coupled with other natural occurrences such as drought. Recent public comments expressed the concern that each addition of a species and/or critical habitat area takes its toll on the economic viability of ranching and that this cumulative impact is important. The commenter is concerned that a single additional restriction or requirement that decreases the profitability of an operation could be the one that causes the operator to go out of business. Public comments of Patrick Bray, Arizona Cattle Growers' Association, November 2, 2011. Public comments of Jim and Clarice Holder, July 6, 2006.

The remainder of this section discusses the approach to quantifying these categories of impacts.

4.3.1 FENCING CONSTRUCTION AND MAINTENANCE

116. Costs of fencing exclosures for spikedace and loach minnow are anticipated to range from \$8,940 to \$14,500 per river mile (\$1.69 to \$2.75 per foot) of fence construction, with an additional \$179 to \$725 annually in maintenance (see Exhibit 4-4). Land managers point out that maintenance of riparian fencing ultimately outweighs the costs of installing it, as animals, weather, water, and human abuse all contribute to fence wear and tear over time.¹²⁹ BLM states that the agency usually funds fence construction, while maintenance programs may be shouldered by the permittees.¹³⁰ However, staff from Partners for Wildlife state that on private lands, landowners sometimes do not wish to receive Federal assistance for fence construction due to concerns that there may be "strings attached," such as allowing Federal access to their property over time.¹³¹

EXHIBIT 4-4. COST ESTIMATES: INSTALLING AND MAINTAINING CATTLE EXCLUSION FENCING AND ALTERNATIVE WATER SOURCES (UNDISCOUNTED 2011\$)

ACTION	COST	
	LOW	HIGH
Livestock Fencing (Per Mile)		
Fence Construction ¹	\$8,940	\$14,500
Fence Maintenance and inspection (annual) ²	\$179	\$725
<p>Source: Personal and written communication with Seth Piedler, NRCS, Albuquerque, New Mexico Office, on December 14, 2011, based on expected fence construction rates for NRCS' Southern Mountain Region (Nevada, Utah, Arizona, New Mexico, and Colorado) for the year 2012. Low-end estimates represent costs of construction of smooth or barbed wire fencing and annual maintenance costs of two percent of the cost of construction. High-end estimates represent the costs of construction of smooth or barbed wire fence in difficult terrain and annual maintenance costs of five percent of the cost of construction.</p> <p>Notes:</p> <p>1. Assumed to be a one-time cost over 20 years.</p> <p>2. Fence maintenance costs are estimated to range from two percent of installation costs annually to five percent of installation costs annually.</p> <p>3. Costs related to species surveying and monitoring are included under Species Management Costs in Section 6.</p>		

117. To estimate potential future fence construction and maintenance costs in critical habitat areas, we first contacted USFS and BLM land managers to identify the extent to which allotments intersecting the proposed designation already contain riparian exclusions. The

¹²⁹ Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.

¹³⁰ Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.

¹³¹ Service, Partners for Wildlife, Arizona Ecological Services Office, July 15, 2005.

analysis relies on GIS data to calculate the length of each stream reach falling within a particular allotment. For all reaches where fencing is not known to exist, fencing is assumed to be constructed on both sides of the river and maintained for 20 years. In reaches where fencing or other riparian exclusions have been identified, only fencing maintenance is assumed for the next twenty years.

4.3.2 ADMINISTRATIVE COSTS

118. The analysis also forecasts administrative costs associated with section 7 consultation for grazing activities. A review of the past consultation history for these species suggests that there is a high level of section 7 consultation activity for grazing, with 45 formal consultations completed since these species were listed. Because of uncertainty about future grazing rotations and the timing of transfers of grazing permits, it is difficult to forecast the number of grazing projects that may be subject to section 7 consultation. Therefore, we estimate an average number of consultations based on the past consultation history of 1.67 formal section 7 consultations on grazing activities per year. We distribute these 1.67 consultations per year across the reaches with grazing allotments proportional to the number of stream miles. That is, it assumes the longer the reach, the greater costs associated with consultation.
119. In unoccupied reaches, these consultations are assumed to result from the critical habitat designation, and thus all associated administrative costs are considered incremental. In occupied reaches, administrative effort is needed to address both jeopardy and adverse modification issues. The portion of administrative effort to address adverse modification is considered to be an incremental cost.

4.4 BASELINE IMPACTS

120. GIS analysis identified a total of 112 grazing allotments intersecting with the proposed critical habitat. Of these, land managers identified all but eight of the allotments as already containing riparian exclusions. This analysis assumes that the 104 allotments which already contain adequate riparian exclusions, and which intersect 440 river miles of proposed critical habitat, will require only maintenance of existing fencing over the next twenty years. Of the eight unfenced allotments, four are located on the Muleshoe Preserve. Because grazing is limited in the preserve, the Service expects that no additional fencing will be necessary for these allotments.¹³²
121. At a cost of between \$179 and \$725 per mile, total baseline impacts are estimated at \$2.0 to \$7.5 million (see Exhibit 4-5), including administrative costs. The majority of these impacts is associated with fencing construction and maintenance at approximately \$1.7 to \$7.2 million. The remaining \$239,000 is administrative effort associated with considering jeopardy in section 7 consultation. In cases where the reach is considered unoccupied, all administrative effort is assumed to be incremental.

¹³² Written communication from the Service, Arizona Field Office, June 13, 2010..

EXHIBIT 4-5. SUMMARY OF BASELINE FENCING AND ADMINISTRATIVE COSTS BY REACH (2011\$,
TOTAL PRESENT VALUE IMPACTS DISCOUNTED AT SEVEN PERCENT)

UNIT	REACH	FENCING MAINTENANCE COSTS		ADMINISTRATIVE COSTS
		LOW	HIGH	
1	Verde River	\$246,000	\$996,000	\$41,500
	Granite Creek	\$0	\$0	\$0
	Oak Creek	\$0	\$0	\$0
	Beaver and Wet Beaver Creek	\$0	\$0	\$0
	West Clear Creek	\$0	\$0	\$0
	Fossil Creek	\$19,000	\$76,800	\$1,820
2	Tonto Creek	\$120,000	\$488,000	\$0
	Greenback Creek	\$37,900	\$154,000	\$0
	Rye Creek	\$7,180	\$29,100	\$0
	Spring Creek	\$56,200	\$228,000	\$0
	Rock Creek	\$12,200	\$49,600	\$0
	White River	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0
	North Fork East Fork Black River	\$17,900	\$72,700	\$1,720
	East Fork Black River	\$48,100	\$195,000	\$0
	Boneyard Creek	\$5,850	\$23,700	\$0
	Coyote Creek	\$7,250	\$29,400	\$822
3	San Pedro River	\$0	\$0	\$0
	Hot Springs Canyon	\$0	\$0	\$4,600
	Bass Canyon	\$0	\$0	\$0
	Redfield Canyon	\$0	\$0	\$5,450
	Aravaipa Creek	\$89,100	\$361,000	\$6,570
	Deer Creek	\$9,250	\$37,500	\$888
	Turkey Creek	\$10,900	\$44,200	\$1,060
4	Bonita Creek	\$59,700	\$242,000	\$5,760
5	Eagle Creek	\$56,200	\$228,000	\$18,300
6	San Francisco River	\$278,000	\$1,126,000	\$49,000
	Tularosa River	\$65,700	\$266,000	\$7,250
	Negrito Creek	\$13,200	\$53,700	\$1,650
	Whitewater Creek	\$0	\$0	\$0
7	Blue River	\$24,500	\$99,500	\$19,700
	Campbell Blue Creek	\$25,600	\$104,000	\$2,990
	Dry Blue Creek	\$11,100	\$48,500	\$1,150

UNIT	REACH	FENCING MAINTENANCE COSTS		ADMINISTRATIVE COSTS
		LOW	HIGH	
	Little Blue Creek	\$0	\$0	\$0
	Pace Creek	\$3,140	\$12,700	\$301
	Frieborn Creek	\$4,460	\$18,100	\$428
8	Gila River	\$362,00	\$1,468,000	\$39,900
	West Fork Gila River	\$3,910	\$15,900	\$3,140
	Middle Fork Gila River	\$166	\$671	\$4,630
	East Fork Gila River	\$106,000	\$430,000	\$10,200
	Mangas Creek	\$1,240	\$5,000	\$2,200
	Bear Creek	\$79,100	\$321,000	\$7,600
	Total	\$1,782,000	\$7,224,000	\$239,000
Note: Totals may not sum due to rounding.				

4.5 INCREMENTAL IMPACTS

122. To estimate the incremental impacts on grazing activities, this analysis assumes that the four allotments that do not currently have riparian exclusions will construct and maintain riparian fencing as a result of critical habitat. We further assume that this fencing will be maintained for the next twenty years. These fencing construction and maintenance costs are considered to be incremental, regardless of whether the reach itself is considered occupied. We believe this to be a reasonable assumption given the past history of requiring fencing for grazing activities wherever listed species are known to be present.
123. For these eight reaches, fencing construction and maintenance costs are estimated at \$883,000 to \$1.7 million in present value terms over the next twenty years, or \$77,900 to \$147,000 on an annualized basis, discounted at seven percent. Impacts by reach are presented in Exhibit 4-6. In addition to the fencing costs, the analysis forecasts administrative costs associated with section 7 consultation at \$124,000 in present value terms, or \$11,000 on an annualized basis, assuming a discount rate of seven percent (see Exhibit 4-6).

**EXHIBIT 4-6. SUMMARY OF INCREMENTAL FENCING AND ADMINISTRATIVE COSTS BY REACH
(2011\$, TOTAL PRESENT VALUE IMPACTS DISCOUNTED AT SEVEN PERCENT)**

UNIT	REACH	FENCING CONSTRUCTION AND MAINTENANCE IMPACTS		ADMINISTRATIVE IMPACTS
		LOW	HIGH	
1	Verde River	\$0	\$0	\$13,800
	Granite Creek	\$0	\$0	\$0
	Oak Creek	\$0	\$0	\$0
	Beaver and Wet Beaver Creek	\$0	\$0	\$0
	West Clear Creek	\$0	\$0	\$0
	Fossil Creek	\$0	\$0	\$606
2	Tonto Creek	\$0	\$0	\$11,600
	Greenback Creek	\$0	\$0	\$3,640
	Rye Creek	\$0	\$0	\$689
	Spring Creek	\$0	\$0	\$6,570
	Rock Creek	\$0	\$0	\$1,390
	White River	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0
	North Fork East Fork Black River	\$0	\$0	\$574
	East Fork Black River	\$0	\$0	\$4,630
	Boneyard Creek	\$0	\$0	\$562
	Coyote Creek	\$0	\$0	\$274
3	San Pedro River	\$13,800	\$28,200	\$14,500
	Hot Springs Canyon	\$0	\$0	\$1,540
	Bass Canyon	\$0	\$0	\$1,340
	Redfield Canyon	\$0	\$0	\$1,820
	Aravaipa Creek	\$0	\$0	\$2,190
	Deer Creek	\$0	\$0	\$296
	Turkey Creek	\$0	\$0	\$349
4	Bonita Creek	\$0	\$0	\$1,920
5	Eagle Creek	\$0	\$0	\$6,090
6	San Francisco River	\$95,000	\$194,000	\$16,330
	Tularosa River	\$0	\$0	\$2,420
	Negrato Creek	\$0	\$0	\$549
	Whitewater Creek	\$0	\$0	\$0
7	Blue River	\$0	\$0	\$6,560
	Campbell Blue Creek	\$0	\$0	\$998
	Dry Blue Creek	\$0	\$0	\$383

UNIT	REACH	FENCING CONSTRUCTION AND MAINTENANCE IMPACTS		ADMINISTRATIVE IMPACTS
		LOW	HIGH	
	Little Blue Creek	\$0	\$0	\$0
	Pace Creek	\$0	\$0	\$100
	Frieborn Creek	\$0	\$0	\$143
8	Gila River	\$531,000	\$1,083,000	\$13,300
	West Fork Gila River	\$0	\$0	\$1,050
	Middle Fork Gila River	\$0	\$0	\$1,540
	East Fork Gila River	\$0	\$0	\$3,400
	Mangas Creek	\$118,000	\$241,000	\$733
	Bear Creek	\$0	\$0	\$2,530
	Total	\$758,000	\$1,546,000	\$124,000

Note: Totals may not sum due to rounding.

CHAPTER 5 | POTENTIAL ECONOMIC IMPACTS TO MINING OPERATIONS

124. This section describes the potential for economic impacts to mining activities in areas proposed as critical habitat for the spikedace and loach minnow. Unlike other chapters in this report, it does not quantify either baseline or incremental impacts to mining activities, because of the high level of uncertainty about whether and the extent to which mining operations may undertake spikedace and loach minnow conservation efforts.
125. Instead, the chapter first provides an overview of the economic importance of the mining industry to the counties containing proposed critical habitat and to the state of Arizona. Next, it provides a discussion of past economic impacts to mining operations related to spikedace and loach minnow conservation activities. The final section discusses qualitatively the mining operations that may be affected by proposed critical habitat, including impacts to Freeport McMoRan Copper & Gold Inc. and its affiliates (hereafter “Freeport”).

5.1 SUMMARY OF POTENTIAL IMPACTS TO MINING ACTIVITIES

126. While few active mineral mining activities occur within the proposed critical habitat, the mining industry has previously expressed concern that water use by existing or potential mining operations could be affected by spikedace and loach minnow conservation activities, particularly the designation of critical habitat. Critical to an understanding of the potential for impacts on water diversions or conveyance for mining purposes is an understanding of the probability and magnitude of any such changes. As detailed in this chapter, there are currently no data that indicate whether existing or future diversions of water for mining activities (including groundwater use) reduce stream flow or modify hydrologic conditions to a degree that adversely impacts the spikedace and loach minnow or their habitat. In addition, although certain groundwater hydrologic models exist for the areas in question, as indicated by one public commenter, considerable uncertainty surrounds the specific quantity of water, if any, that Service would request to be conserved for spikedace and loach minnow as part of a section 7 consultation.¹³³ As such, this analysis does not quantify the probability or extent to which water use for mining purposes would need to be curtailed or modified to remedy impacts on spikedace and loach minnow.

¹³³ Personal communication with the Service on December 8, 2011.

127. Given data and model limitations, this analysis does not answer the question of whether impacts to mining operations are likely (i.e., the probability of such impacts), or define the expected magnitude of these impacts. It does, however, provide information on the potential scale of the future baseline and incremental economic impact that could occur if requirements associated with spikedace and loach minnow conservation result in changes in water diversions or conveyance. Specifically, to allow for an understanding of the economic activities that could be at risk if modifications to water use or conveyance are required because of the designation of critical habitat, this analysis provides data on the location of mining activities potentially associated with unoccupied critical habitat areas, as well as data on the regional economic importance of these operations.

5.2 OVERVIEW OF MINING ACTIVITIES IN ARIZONA AND NEW MEXICO

128. Mining is a large industry in the counties containing spikedace and loach minnow critical habitat, particularly in the state of Arizona. According to the Department of Mines and Mineral Resources, the estimated value of Arizona's non-fuel mineral production in 2007 was \$7.26 billion, a 7.6 percent increase over the 2006 value. In 2007, the value of Arizona's non-fuel mineral production ranked first in the U.S.¹³⁴
129. Copper production makes up the majority of non-fuel mineral production in Arizona. The Arizona Department of Mines and Minerals states that "Arizona continued to be the Nation's leading copper producing State in 2007 and accounted for 63 percent of the total U.S. copper mine production."¹³⁵ A major producer of copper and mineral resources in the southwest, Phelps Dodge Corporation merged with Freeport McMoRan Copper & Gold Inc. in 2007, becoming the world's largest publicly traded copper producer. Before the merger, PDC accounted for more nearly 75 percent of Arizona's total copper production in 2006.¹³⁶
130. In addition to copper, the Arizona Mining Association (AMA) notes that Arizona is a leader in the production of gemstones, molybdenum, silver, perlite, sand, and gravel. In all, 72 mining companies operated 126 mines in Arizona and employed more than 15,000 people in 2003.¹³⁷ Consequently, the mining industry's contribution to Arizona's economy is important, particularly to some rural communities who rely on mining activities to provide employment and tax revenue. According to the U.S. Census, the combined direct and indirect impacts of the copper industry on Arizona's economy was

¹³⁴ Arizona Department of Mines and Minerals/U.S. Geological Survey, "The Mineral Industry of Arizona," U.S. Geological Survey Minerals Yearbook, 2007, accessed at minerals.usgs.gov/minerals/pubs/state/az.html.

¹³⁵ Ibid.

¹³⁶ Ibid.

¹³⁷ Arizona Mining Association, Public Comment of Draft EA for Southwestern Willow Flycatcher, submitted on July 18, 2005.

approximately \$9.3 billion in 2009,¹³⁸ or 3.7 percent of Arizona's total gross state product.¹³⁹

131. New Mexico is a leading producer of coal, copper, molybdenum, and potash. From 2008 to 2009, due to worldwide dips in the price of copper and consequent closings of several major New Mexico mines, the state's copper production decreased 46.5 percent to 121.2 million pounds, and copper production value fell 58.6 percent to \$289.6 million. Despite this decrease, New Mexico was the third largest state in terms of the amount of copper produced in 2009 as well as being the sixth largest producer of molybdenum and the largest producer of potash, perlite, and zeolite.¹⁴⁰

5.3 POTENTIAL IMPACTS TO MINING OPERATIONS

132. Because certain types of mining activities use considerable volumes of water, spikedace and loach minnow protection measures that require significant modifications in management regimes at dams or in surface or groundwater diversions could impact mining activities that utilize water on these stream reaches. The Proposed Rule identifies groundwater pumping associated with mining activities as a threat for Eagle Creek. Specifically, it states:

Groundwater pumping also poses a threat to surface flows in the remaining spikedace and loach minnow habitat in Eagle Creek. Groundwater withdrawal in Eagle Creek, primarily for water supply of a large open-pit copper mine at Morenci dries portions of the stream.

133. The Service considers Eagle Creek to be occupied by both spikedace and loach minnow. Other proposed stream reaches that are located adjacent to or which provide water to mining operations include the San Francisco River in Arizona and New Mexico, which is considered occupied by loach minnow, and the Gila River in New Mexico, which is considered occupied by both species.
134. As previously mentioned in this report, incremental impacts are most likely to occur in unoccupied reaches of critical habitat. However, we recognize that mining interests remain concerned about the potential impact that the designation may have on their operations. In particular, there is uncertainty about whether critical habitat designation may provide additional leverage for third party intervention in ongoing activities, but these are not quantifiable in the context of the current analysis. In response to these comments, inherent uncertainties, and because the Service specifically identified mining as a threat on Eagle Creek, this analysis provides some additional information related to potential impacts to mining activities on reaches that are considered occupied, even though incremental impacts are unlikely to occur on occupied reaches.

¹³⁸ George F. Leaming, Western Economic Analysis Center, "The Economic Impact of the Arizona Copper Industry 2009", March 2010.

¹³⁹ U.S. Department of Commerce, Bureau of Economic Analysis. Gross State Product News Release accessed at <http://www.bea.gov/bea/newsreel/GSPNewsRelease.htm> on February 7, 2011.

¹⁴⁰ New Mexico Energy, Minerals, and Natural Resources Department. Annual Report 2010. Accessed at <http://www.emnrd.state.nm.us/MAIN/documents/EMNRD-2010-Annual-Report.pdf> on February 7, 2011.

135. In the past, no formal section 7 consultations on spikedace and loach minnow have directly addressed impacts of mining activities in the areas proposed for critical habitat. There have, however, been several informal consultations regarding surface mining since the listing of the species. In addition, the Service conducted one formal consultation on spikedace and razorback sucker regarding spillway repair to the Phelps Dodge Diversion dam on Eagle Creek in 1996.¹⁴¹ This consultation did not directly address impacts of the diversion dam itself, though the Service recommended that such a consultation be conducted. The consultation found that the proposed action was not likely to adversely affect the fish species, and recommended minimizing the use of heavy equipment in the wetted area, making reasonable efforts to ensure no pollutants enter surface water, catch and release of any spikedace found, as well as monitoring activities.

5.4 POTENTIAL FUTURE IMPACTS OF CRITICAL HABITAT ON MINING ACTIVITIES

136. As discussed above, the Service identifies Eagle Creek as the only reach in the proposed designation where mining activities are considered a threat. Past public comments have also identified the San Francisco River and the Gila River as reaches that provide water to mining operations that therefore could be affected by critical habitat designation.
137. In 2006, Phelps Dodge Corporation (which merged with Freeport in 2007) identified two operating mines, Morenci and Tyrone, for which spikedace and loach minnow impacts were a concern.¹⁴² According to Fennemore Craig, P.C., attorneys who represent Freeport, in their comments on the 2006 critical habitat designation for the spikedace and loach minnow:
- “the utility of [Freeport McMoRan Copper & Gold Inc.] operations depends on the certainty of available water supplies. It is well known that mining requires the use and availability of dependable water supplies and that such supplies are in limited quantity in the arid southwest. If the availability of water is curtailed or precluded, [Freeport] operations would be severely impacted and their viability placed at risk.”¹⁴³
138. These concerns are repeated in Freeport’s most recent comments on the 2011 Draft Economic Analysis.¹⁴⁴ Freeport has also expressed concern that some potential ore reserves may not be exploitable if critical habitat for spikedace and loach minnow leads to unavailability of water supplies, large mitigation costs and/or project delays. While clearly water availability is a concern for these mining operations, the Service notes that

¹⁴¹ 02-21-96-F-0335

¹⁴² NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

¹⁴³ Public comments of Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

¹⁴⁴ The Brattle Group, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), November 3, 2011, submitted with public comments by Norman James, Fennemore Craig, on behalf of FreeportMcMoRan, November 3, 2011.

curtailment of water supplies had not happened under previous designations of critical habitat for these species.¹⁴⁵

139. The following sections discuss the two potentially affected mines in more detail, focusing on their connection to proposed critical habitat reaches and associated water rights. This information is further summarized in Exhibit 5-1. As previously stated, this analysis does not answer the question of whether impacts to mining operations are likely (i.e., the probability of such impacts), or define the expected magnitude of these impacts. Therefore, no potential impacts, whether baseline or incremental, are quantified for the following mining operations.

5.4.1 UNIT 5: EAGLE CREEK: MORENCI MINE

140. The Morenci mine is an active open-pit copper mine located in Greenlee County, Arizona. It is located two to three miles from occupied stream segments in Unit 5 and Unit 6 of the proposed critical habitat. Water for the Morenci mine is supplied by a combination of sources, including decreed surface water rights in the San Francisco River and Eagle Creek drainages, groundwater from the Eagle Creek wellfield, and CAP water leased from the San Carlos Apache Tribe and delivered to Morenci via exchange through the Black River Pump Station. Much of this water is diverted through Eagle Creek (which has been proposed as critical habitat) on route to the mine.¹⁴⁶ Freeport diverts water from the Black River into Willow Creek (a tributary of middle Eagle Creek), augmenting flow in Eagle Creek by about 27 percent. That water plus an additional nine percent is removed about 15 miles downstream at the diversion dam and pumping station.¹⁴⁷
141. Of Freeport's North American mines, the Morenci mine has consistently produced the largest volume of copper sold by Freeport (434 million pounds in 2010, valued at \$1.75 billion using an average price of copper in North America of \$3.42 per pound).¹⁴⁸ Morenci mine contains 14.45 billion pounds of total recoverable copper reserves owned by Freeport, valued at \$48.6 billion at \$3.42 per pound.¹⁴⁹ Freeport has expressed concern that the maintenance of the diversion dam could act as a Federal nexus for consultation because the diversion dam is subject to USACE 404 permit requirements. Indeed, as described above, one consultation on repair to the spillway of this diversion has already occurred, and the Service did recommend that a consultation on the diversion itself be conducted.¹⁵⁰

¹⁴⁵ Written comments of Service, Arizona Ecological Services Office, received March 15, 2006.

¹⁴⁶ The Brattle Group, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), November 3, 2011, submitted with public comments by Norman James, Fennemore Craig, on behalf of FreeportMcMoRan, November 3, 2011.

¹⁴⁷ 02-21-96-F-0335

¹⁴⁸ The Brattle Group, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

¹⁴⁹ Ibid.

¹⁵⁰ 02-21-96-F-0335

142. Freeport has also expressed concern that, if critical habitat affects its ability to utilize its current water supplies, it could be forced to undertake a costly search for replacement supplies.¹⁵¹ In the case of Morenci, Freeport estimates that the combined Eagle Creek and Black River delivery system has provided on average 14,000 acre-feet per year for mining operations and for potable uses at the mine itself and the town of Clifton. If Freeport had to find alternative sources for 14,000 acre-feet at the average cost for water in Arizona of \$6,473 per acre-foot, it would cost \$91 million to replace that 14,000 acre-feet.¹⁵² If Freeport paid the maximum price of \$24,650 per acre-foot, the replacement cost could be \$345 million.¹⁵³ As previously stated, this analysis does not answer the question of whether critical habitat is likely to affect Freeport's water supplies (i.e., the probability of such impacts), and therefore does not quantify any economic impacts associated with the possible need for replacement water supplies. The Service notes that water supplies for mining operations have not been previously affected by critical habitat designation.¹⁵⁴
143. Freeport also leases lands along Eagle Creek north of its water diversion. Freeport is concerned that, if critical habitat causes restrictions on the timing or quantity of surface water withdrawals for irrigating crops or other grazing or agricultural use, the value of leased land could decrease.¹⁵⁵ Potential incremental impacts on agricultural land values resulting from reduced water use are further discussed in Chapter 3 of this report. Freeport has also expressed concerns that limits on water diversions could affect the water supplies of the communities of Clifton and Morenci.¹⁵⁶

5.4.2 UNIT 8: GILA RIVER: TYRONE MINE

144. The Tyrone mine is an active open-pit copper mine located in Grant County, New Mexico. In 2010, Freeport produced 82 million pounds of copper at the Tyrone site with a production value of \$280 million.¹⁵⁷ The Tyrone mine is located 20 miles

¹⁵¹ According to a NERA report submitted by PDC, "identifying viable supplies involves researching and analyzing information on the availability of water and water rights in areas within piping distance of an affected area. This may involve considerable investigation and negotiation by specialist staff to secure and undertake the transaction." NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

¹⁵² The Brattle Group, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), November 3, 2011, submitted with public comments by Norman James, Fennemore Craig, on behalf of FreeportMcMoRan, November 3, 2011.

¹⁵³ Ibid.

¹⁵⁴ Written communication from the Service, Arizona Field Office, dated June 13, 2011.

¹⁵⁵ NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

¹⁵⁶ The Brattle Group, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), November 3, 2011, submitted with public comments by Norman James, Fennemore Craig, on behalf of FreeportMcMoRan, November 3, 2011.

¹⁵⁷ The Brattle Group, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), November 3, 2011, submitted with public comments by Norman James, Fennemore Craig, on behalf of FreeportMcMoRan, November 3, 2011.

from the Gila River and its tributaries and relies on surface and groundwater supplies for its mining operations. Freeport maintains a water diversion from within proposed critical habitat that leads to an off-river water storage area called Bill Evans Lake which feeds an underground pipeline to the mine. While the surface water diversion constitutes only a portion of the water used by this mine, the volumes used are significant in that it may be difficult for this operation to access substitute water sources.¹⁵⁸

145. Under a hypothetical situation in which critical habitat related restrictions were to prevent Freeport from using 6,580 acre-feet per year of Gila River water rights associated with the Tyrone mine, Freeport would have to seek alternate sources for those 6,580 acre-feet. Using an average cost for a water right in New Mexico of \$5,064 per acre-foot, Freeport estimates that replacing this water would cost approximately \$335 million. Freeport notes that replacements costs could, in fact, be higher as this mine is located in remote areas where the water costs may be higher.¹⁵⁹ Using five example transactions from 2001, Freeport estimates that water prices in the Gila River area could be as much as \$12,000 per acre-foot, which would result in costs to replace 6,580 acre-feet of \$79 million.¹⁶⁰
146. Similar to the Morenci mine, Freeport is also concerned that the maintenance of the diversion dam for the Tyrone mine could act as a Federal nexus for consultation.

¹⁵⁸ 02-21-96-F-0335

¹⁵⁹ NERA Economic Consulting, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), July 6, 2006 submitted with public comments by Norman James, Fennemore Craig, on behalf of Phelps Dodge Company, July 6, 2006.

¹⁶⁰ The Brattle Group, Comments on 'Economic Analysis of Critical Habitat Designation for the Spikedace and Loach Minnow,' prepared by Industrial Economics, Inc. (IEC), November 3, 2011, submitted with public comments by Norman James, Fennemore Craig, on behalf of FreeportMcMoRan, November 3, 2011.

EXHIBIT 5-1. MINE OPERATIONS FOR WHICH WATER CONCERNS HAVE BEEN RAISED RELATED TO SPIKEDACE AND LOACH MINNOW PROPOSED CHD

OWNER	MINE	STATE	SITE IN CHD?	MINE IS OPERATIONAL?	HYDROLOGIC CONNECTION TO PROPOSED CHD	DEPENDENCE ON PROPOSED CHD STREAM REACH	CURRENT OR POTENTIAL SOURCE OF WATER FOR MINING ACTIVITIES	QUANTITY AND VALUE OF PRODUCTION
Freeport McMoRan	Tyrone Mine	NM	No. Site is 17 miles southeast of the Gila River in Unit 8.	Yes.	Water diversion from proposed critical habitat	Surface water provides partial supply to mining operations.	Mine diverts water from Gila River to stores in Bill Evans Lake for operations.	In 2010, 0.8 billion pounds of recoverable copper (net of copper extracted), with a net value of \$2.7 billion at \$3.42 per pound. 82 million pounds of copper produced in 2010, with a production value of \$280 million.
Freeport McMoRan	Morenci Mine	AZ	No. Site is 6 miles east of Eagle Creek and 2-3 miles west of the San Francisco River in Units 5 and 6 respectively.	Yes.	Water diversion from proposed critical habitat.	Water supply to the mine is diverted through proposed critical habitat. Land/water leased to farmers and ranchers.	Mine uses water from a variety of sources including surface water rights in the San Francisco River, Chase Creek, and Eagle Creek as well as groundwater from the Upper Eagle Creek wellfield and CAP water from the San Carlos Apache	434 million pounds of copper produced in 2010, with a value of \$1.75 billion, using the 2010 North American average price of copper of \$3.42 per pound. Morenci mine contains 14.45 billion pounds of total recoverable copper reserves owned by Freeport, valued at \$48.6 billion at \$3.42 per pound.

CHAPTER 6 | POTENTIAL COSTS OF SPECIES AND HABITAT MANAGEMENT ACTIONS, INCLUDING ECONOMIC IMPACTS TO RECREATION

147. This chapter describes estimated baseline and incremental costs associated with species and habitat management actions, including impacts of those efforts on recreation, in areas proposed as critical habitat for the spikedace and loach minnow. Specifically, this analysis discusses potential economic impacts resulting from actions to mitigate the threat of non-native species to spikedace and loach minnow critical habitat. The analysis also estimates direct and indirect economic impacts on recreational activities such as fishing and off-highway vehicle (OHV) use due to spikedace and loach minnow conservation activities. This section is divided into two parts: (1) an overview of the activities, such as fish management, recreational angling, and OHV use that have the potential to be affected by proposed critical habitat; and (2) a discussion of the potential economic impacts of spikedace and loach minnow conservation by river reach.

6.1 SUMMARY OF COSTS OF SPECIES MANAGEMENT ACTIONS

148. Future incremental costs associated with species management activities associated with spikedace and loach minnow conservation are estimated at \$115,000, or \$10,200 on an annualized basis, assuming a discount rate of seven percent (see Exhibit 6-1). These costs are comprised of administrative costs associated with consultations related to fish barrier construction, repatriation, non-native fish removal, sportfish stocking, and monitoring.
149. The proposed critical habitat areas where OHV use is most prevalent are along the Verde River and Oak Creek. No past closures have been documented associated with past critical habitats for spikedace and loach minnow, nor does the Service anticipate impacts. Thus, this analysis does not quantify future impacts of spikedace and loach minnow critical habitat on OHV use.
150. Future costs already expected to be incurred absent critical habitat, (i.e., assumed to occur under the baseline) associated with spikedace and loach minnow conservation activities under the baseline include species management activities undertaken by the US Bureau of Reclamation (USBR), the Arizona Game and Fish Department (AZGFD), and the New Mexico Department of Game and Fish (NMDGF). These costs are outlined in Exhibit 6-2.

EXHIBIT 6-1. SUMMARY OF INCREMENTAL IMPACTS TO SPECIES MANAGEMENT AND RECREATION ACTIVITIES BY REACH (2011\$, DISCOUNTED AT SEVEN PERCENT)

UNIT	REACH	PRESENT VALUE (20 YEARS)	ANNUALIZED
1	Verde River	\$6,360	\$561
	Granite Creek	\$13,200	\$1,160
	Oak Creek	\$1,090	\$96
	Beaver and Wet Beaver Creek	\$1,090	\$96
	West Clear Creek	\$1,090	\$96
	Fossil Creek	\$0	\$0
2	Tonto Creek	\$14,300	\$1,260
	Greenback Creek	\$0	\$0
	Rye Creek	\$0	\$0
	Spring Creek	\$28,800	\$2,540
	Rock Creek	\$14,300	\$1,260
	White River	\$0	\$0
	East Fork White River	\$0	\$0
	North Fork East Fork Black River	\$0	\$0
	East Fork Black River	\$1,090	\$96
	Boneyard Creek	\$0	\$0
	Coyote Creek	\$0	\$0
3	San Pedro River	\$0	\$0
	Hot Springs Canyon	\$0	\$0
	Bass Canyon	\$0	\$0
	Redfield Canyon	\$12,300	\$1,080
	Aravaipa Creek	\$0	\$0
	Deer Creek	\$0	\$0
	Turkey Creek	\$0	\$0
4	Bonita Creek	\$5,000	\$441
5	Eagle Creek	\$0	\$0
6	San Francisco River	\$0	\$0
	Tularosa River	\$0	\$0
	Negrato Creek	\$0	\$0
	Whitewater Creek	\$0	\$0
7	Blue River	\$11,900	\$1,050
	Campbell Blue Creek	\$0	\$0

UNIT	REACH	PRESENT VALUE (20 YEARS)	ANNUALIZED
	Dry Blue Creek	\$0	\$0
	Little Blue Creek	\$0	\$0
	Pace Creek	\$0	\$0
	Frieborn Creek	\$0	\$0
8	Gila River	\$5,000	\$441
	West Fork Gila River	\$0	\$0
	Middle Fork Gila River	\$0	\$0
	East Fork Gila River	\$0	\$0
	Mangas Creek	\$0	\$0
	Bear Creek	\$0	\$0
Total		\$115,000	\$10,200
Note: Totals may not sum due to rounding.			

EXHIBIT 6-2. SUMMARY OF BASELINE IMPACTS TO SPECIES MANAGEMENT AND RECREATION ACTIVITIES BY REACH (2011\$, DISCOUNTED AT SEVEN PERCENT)

UNIT	REACH	PRESENT VALUE		ANNUALIZED	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$8,290,000	\$20,800,000	\$731,000	\$1,830,000
	Granite Creek	\$50,800	\$50,800	\$4,480	\$4,480
	Oak Creek	\$0	\$0	\$0	\$0
	Beaver and Wet Beaver Creek	\$0	\$0	\$0	\$0
	West Clear Creek	\$0	\$0	\$0	\$0
	Fossil Creek	\$81,300	\$81,300	\$7,170	\$7,170
2	Tonto Creek	\$877,000	\$1,750,000	\$77,400	\$155,000
	Greenback Creek	\$0	\$0	\$0	\$0
	Rye Creek	\$0	\$0	\$0	\$0
	Spring Creek	\$861,000	\$1,680,000	\$76,000	\$148,000
	Rock Creek	\$12,300	\$12,300	\$1,080	\$1,080
	White River	\$0	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0	\$0
	North Fork East Fork Black River	\$46,100	\$46,100	\$4,060	\$4,060
	East Fork Black River	\$35,100	\$35,100	\$3,100	\$3,100
	Boneyard Creek	\$13,200	\$13,200	\$1,160	\$1,160
	Coyote Creek	\$0	\$0	\$0	\$0
3	San Pedro River	\$0	\$0	\$0	\$0
	Hot Springs Canyon	\$27,100	\$27,100	\$2,390	\$2,390
	Bass Canyon	\$0	\$0	\$0	\$0
	Redfield Canyon	\$1,030,000	\$2,000,000	\$91,100	\$176,000
	Aravaipa Creek	\$0	\$0	\$0	\$0
	Deer Creek	\$0	\$0	\$0	\$0
	Turkey Creek	\$0	\$0	\$0	\$0
4	Bonita Creek	\$80,800	\$80,800	\$7,130	\$7,130
5	Eagle Creek	\$8,770	\$8,770	\$774	\$774
6	San Francisco River	\$89,500	\$148,000	\$7,900	\$13,100
	Tularosa River	\$68,000	\$96,400	\$6,000	\$8,500
	Negrito Creek	\$0	\$0	\$0	\$0
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$6,850,000	\$6,850,000	\$604,000	\$604,000

UNIT	REACH	PRESENT VALUE		ANNUALIZED	
		LOW	HIGH	LOW	HIGH
	Campbell Blue Creek	\$4,390	\$4,390	\$387	\$387
	Dry Blue Creek	\$0	\$0	\$0	\$0
	Little Blue Creek	\$4,390	\$4,390	\$387	\$387
	Pace Creek	\$0	\$0	\$0	\$0
	Frieborn Creek	\$0	\$0	\$0	\$0
8	Gila River	\$287,000	\$400,000	\$25,300	\$35,300
	West Fork Gila River	\$68,000	\$96,400	\$6,000	\$8,500
	Middle Fork Gila River	\$68,000	\$96,400	\$6,000	\$8,500
	East Fork Gila River	\$68,000	\$96,400	\$6,000	\$8,500
	Mangas Creek	\$0	\$0	\$0	\$0
	Bear Creek	\$0	\$0	\$0	\$0
Total		\$18,900,000	\$34,400,000	\$1,670,000	\$3,030,000
Note: Totals may not sum due to rounding.					

6.2 OVERVIEW OF SPECIES MANAGEMENT ACTIVITY IN CRITICAL HABITAT

6.2.1 FISH MANAGEMENT ACTIONS

151. The Desert Fishes Team in Arizona found in 2003 that "...the control and removal of nonnative fish and certain other aquatic flora and fauna is the most urgent and overriding need in preventing the continued decline and ultimate extinction of the native fish assemblage of the Basin."²³⁰ The presence of non-native fish is identified as a threat on 21 out of the 43 proposed critical habitat reaches. While this analysis recognizes that numerous treatment efforts associated with non-native fish removal areas are expected in occupied areas, the analysis focuses on unoccupied stream reaches to identify likely incremental costs associated with critical habitat designation (aside from administrative costs).
152. In some reaches, non-native fish species have been and are currently introduced deliberately by state and Federal agencies in order to provide game fish for recreational anglers. Other non-native species, including algae, parasites and plants, have been introduced from other sources such as boats and bait fish. Many of these species live in waters where spokedace and loach minnow are found. As presented in Section 6.5.2, stocking of non-native fish currently occurs in five unoccupied stream reaches proposed

²³⁰ Status of Federal and State Listed Warm Water Fishes of the Gila River Basin, with Recommendations for Management. Desert Fishes Team, Report Number 1, October 15, 2003.

as critical habitat, including Oak Creek, Beaver/Wet Beaver Creek, West Clear Creek, Tonto Creek, and East Fork Black River.²³¹

6.2.2 BACKGROUND ON RECREATIONAL FISHING ACTIVITY IN CRITICAL HABITAT AREAS

153. The Arizona State University West School of Management's Dr. Silberman published two reports on the importance of recreation to Arizona's economy in 2001.²³² In "The Economic Importance of Fishing and Hunting," he estimates that roughly 5.3 million days were spent on fishing trips in the State of Arizona annually. Roughly 34.2 percent of the total fishing days in the State were spent within Arizona counties containing proposed critical habitat for the spinedace and loach minnow (see Exhibit 6-3). Approximately 1.4 percent of total Arizona angler days (73,255 angler days) are estimated to occur on stream reaches that contain critical habitat, including Oak Creek, Beaver/Wet Beaver Creek, West Clear Creek, Tonto Creek, and East Fork Black River.²³³ Of the \$415 million spent on fishing trips in the State, 32.1 percent of those expenditures occurred in counties that contain proposed critical habitat. Fishing recreation in New Mexico generated fewer expenditures overall, only \$128 million in the entire State in 2006.²³⁴
154. Specific information on fishing activity on stream segments located within unoccupied proposed critical habitat is presented in Section 6.5.2. This data indicates that, while several reservoirs upstream of proposed critical habitat are heavily used by recreational anglers, critical habitat stream reaches are generally not heavily used by recreational anglers, with the exception of the Verde River segment. This data is supported in a recent biological opinion issued by the Service in regard to the impacts of sportfish stocking on spinedace and loach minnow populations and their critical habitat.²³⁵

²³¹ Personal communication with Tony Robinson, CAP Projects Program Manager for AZGFD, on April 20, 2011.

²³² 1) Silberman, Jonathan. The Economic Importance of Fishing and Hunting. Arizona State University, School of Management 2001; 2) Silberman, Jonathan. The Economic Importance of Off-Highway Vehicle Recreation. Arizona State University, School of Management. 2001.

²³³ Pringle, Todd. Statewide Survey of 2001 Arizona Anglers. Statewide Fisheries Investigations, Federal Aid Project F-7-M-46, 2004.

²³⁴ U.S. Department of the Interior. 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: New Mexico. 2007.

²³⁵ U.S. Department of the Interior, Fish and Wildlife Service, Official Final Draft for Environmental Assessment: Biological and Conference Opinion for 10-Year Sportfish Restoration Grant to Arizona Game and Fish Department. BCO 22410-2008-F-0486, March 2011.

EXHIBIT 6-3. TRIP-RELATED EXPENDITURES ON FISHING BY COUNTIES IN ARIZONA THAT CONTAIN SPIKEDACE AND LOACH MINNOW PROPOSED CRITICAL HABITAT (2001)

STATE/COUNTY	TRIP EXPENDITURES	% OF STATE
Arizona	\$415,981,000	100.0%
Apache	\$36,965,000	8.9%
Cochise	\$3,297,210	0.8%
Gila	\$25,402,249	6.1%
Graham	\$2,508,000	0.6%
Greenlee	\$440,000	0.1%
Navajo	\$15,491,000	3.7%
Pima	\$22,702,699	5.5%
Pinal	\$6,870,000	1.7%
Yavapai	\$19,875,000	4.8%
Total critical habitat counties	\$133,551,158	32.1%

Source: Silberman, Jonathan. The Economic Importance of Fishing and Hunting. Arizona State University, School of Management, 2001.

EXHIBIT 6-4. NUMBER OF FISHING DAYS BY COUNTIES IN ARIZONA THAT CONTAIN SPIKEDACE AND LOACH MINNOW PROPOSED CRITICAL HABITAT (2002)

STATE/COUNTY	ANGLER DAYS COUNTY-RESIDENTS	ANGLER DAYS TRAVELING	ANGLER DAYS NON-RESIDENT	TOTAL ANGLER DAYS	PERCENT OF STATE
Arizona	2,262,000	2,702,000	338,000	5,303,000	100%
Apache	39,000	580,000	29,000	648,000	12.22%
Cochise	6,000	26,000	728	33,000	0.63%
Gila	48,000	350,000	16,000	413,000	7.80%
Graham	7,000	29,000	2,000	38,000	0.71%
Greenlee	324	245	910	1,000	0.03%
Navajo	82,000	141,000	849	224,000	4.22%
Pima	128,000	26,000	182	154,000	2.90%
Pinal	2,000	23,000	279	25,000	0.47%
Yavapai	81,000	192,000	3,000	276,000	5.21%
Total critical habitat counties	393,000	1,367,000	53,000	1,813,000	34.18%

Source: Silberman, Jonathan. The Economic Importance of Fishing and Hunting. Arizona State University, School of Management, 2001.

Notes: "Residents" are defined as local residents within their own county. "Traveling" is defined as residents traveling within the state. "Non-resident" is defined as individuals who do not live in Arizona. Information related to fishing on stream segments located within proposed critical habitat is presented in Section 6.5.2.

6.2.3 BACKGROUND ON OFF-HIGHWAY VEHICLE USE IN CRITICAL HABITAT AREAS

155. In addition to his overview of the economic impact of fishing, Dr. Silberman published a similar report on the OHV market in Arizona. In "The Economic Importance of Off-Highway Vehicle Recreation," which includes economic data on off-highway vehicle recreation for the State of Arizona by county, he estimates that OHV drivers in Arizona spend about \$842.3 million on off-highway recreation annually.²³⁶ An estimated 46.5 percent of these OHV-related expenditures are made within counties containing proposed critical habitat for the spokedace and loach minnow.²³⁷
156. The proposed critical habitat areas where OHV use is most prevalent are along the Verde River and Oak Creek units. In response to previously proposed designations for spokedace and loach minnow, representatives of two OHV groups expressed concerns that OHV use could be curtailed as a result of proposed critical habitat for the spokedace and loach minnow.²³⁸ No such public comments were received on the current Proposed Rule, but the Rule does identify OHV use as a potential threat in Oak Creek and the mainstem Verde River. As shown in Exhibit 6-5, Silberman estimates that approximately 8.4 percent of OHV use in Arizona occurred in Yavapai County in 2001.²³⁹ OHV use on USFS lands in Arizona is currently being re-examined as part of a Public Motorized Travel Management Plan that examines, among other issues, travel by OHVs in Arizona National Forests.²⁴⁰

EXHIBIT 6-5. EXPENDITURES ON OFF-HIGHWAY RECREATION IN ARIZONA (2002)

COUNTY	TOTAL DAYS	ACTIVITY DAYS RESIDENTS	ACTIVITY DAYS TRAVELING	TRIP EXPENDITURES	% OF STATE EXPENDITURES
Arizona Total	12,225,000	5,500,000	6,725,000	842,316,000	100%
Yavapai	1,196,000	417,000	779,000	70,556,000	8.4%

Source: Silberman, Jonathan. The Economic Importance of Off-Highway Vehicle Recreation. Arizona State University, School of Management. 2003.

Note: "Residents" are defined as local residents within their own county. "Traveling" is defined as residents traveling within the state in pursuit of OHV recreation.

²³⁶ Silberman, Jonathan. The Economic Importance of Off-Highway Vehicle Recreation. Arizona State University, School of Management. 2001.

²³⁷ Silberman, Jonathan. The Economic Importance of Off-Highway Vehicle Recreation. Arizona State University, School of Management. 2001.

²³⁸ Public Hearing, Thatcher, Arizona, December 15, 1999.

²³⁹ Silberman, Jonathan. The Economic Importance of Off-Highway Vehicle Recreation. Arizona State University, School of Management. 2001.

²⁴⁰ Forest Service, Draft Environmental Impact Statement for Public Motorized Travel Management Plan: Apache-Sitgreaves National Forests, Apache, Coconino, Greenlee and Navajo Counties, Arizona. October 2010. Accessed at http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5209759.pdf on March 22, 2011.

6.3 APPROACH TO IDENTIFYING INCREMENTAL IMPACTS RELATED TO FISH HABITAT MANAGEMENT EFFORTS

157. The Service anticipates that critical habitat will primarily result in incremental impacts over and above impacts related to the listing of the species in areas that are considered unoccupied. In these areas, State and Federal agencies may bear additional costs associated with managing fish habitat following critical habitat designation. USBR, ASGFD, and NMDGF carry out spokedace and loach minnow management activities that include repatriation of spokedace and loach minnow populations, monitoring of these populations, removal of non-native species, construction of fish barriers to aid in non-native fish removal, and habitat renovation or improvement. In addition, recreational activities may pose threats to spokedace and loach minnow, in which case agencies may discontinue the stocking of non-native sportfish. As such, this analysis addresses the following categories of potential economic impacts of fish habitat management:

- **Administrative costs:** Costs resulting from the need for affected Federal agencies to address critical habitat in section 7 consultations on fish habitat management activities. This analysis forecasts section 7 consultations based on currently planned or ongoing species management or recreation activities.
- **Recovery actions:** Costs resulting from efforts made to preserve and recover spokedace and loach minnow habitat, especially to protect these species against the threat of non-native species. The recovery plans for spokedace and loach minnow indicate that the introduction of non-native species, whether for sport, forage, bait or by accident, has contributed to the decline of spokedace and loach minnow population. Non-native fish species that could potentially impact spokedace and loach minnow include catfish, largemouth bass, smallmouth bass, green sunfish, brown trout, rainbow trout, and red shiner. Possible recovery actions include the installation of fish barriers, increased monitoring, and non-native fish removal.
- **Limits on recreation:** Costs resulting from cessation of stocking of game fish in critical habitat or placing restrictions on OHV use within critical habitat. This analysis does not anticipate future recreation reductions related to critical habitat designation.

6.4 BASELINE SPECIES MANAGEMENT IMPACTS

158. Since the listing of the species, the Service has conducted nine formal consultations on spokedace and loach minnow that addressed non-native species issues. The most significant of these, with the highest associated costs, was a consultation with the US Bureau of Reclamation (USBR) for which a final biological opinion was issued in 2001. This consultation considered potential non-native species introductions that could occur as part of interbasin water transfer through the CAP, and its potential impacts on native fish species. Its action area is the entire Gila River basin. It resulted in a number of project modifications that were implemented by USBR, including an agreement to install non-native fish barriers, monitor fish populations, and transfer \$500,000 annually from USBR to the Service for the control of non-natives species and to recover native species

for 30 years. Past activities under this consultation include, but are not limited to, the installation of a pair of fish barriers on Aravaipa Creek, barriers at Hot Springs Creek and Bonita Creek, annual monitoring of these barriers, and annual monitoring of the Gila River.²⁴¹ USBR carries out fish management activities under the 2001 programmatic consultation. Thus, for USBR actions in critical habitat, formal consultations are not required. However, when critical habitat is finalized, the 2001 programmatic consultation will require reinitiation, and the associated administrative costs will be considered incremental.

159. USBR, AZGFD, and NMDGF currently carry out species and habitat management activities in 21 reaches in proposed critical habitat, 15 of which are occupied.²⁴² These activities include fish barrier construction, non-native species removal, repatriation, monitoring, and habitat improvement.²⁴³ Exhibit 6-6 outlines species management efforts of the AZGFD and NMDGF. USBR species management efforts are described in the text below.
160. The Service states that in critical habitat areas that are considered occupied by the spinedace and loach minnow, there usually will not be a difference in the outcome of section 7 consultations following critical habitat from those that would be expected under the listing because “the ability of the species to exist is closely tied to the quality of their habitats.”²⁴⁴ In critical habitat areas that are unoccupied by the species, the Service states that consideration of adverse modification in section 7 consultations may result in some additional or potentially different conservation measures compared to a jeopardy analysis. Under this framework, incremental costs are most likely to occur in unoccupied reaches. However, in the case of USBR, AZGFD, and NMDGF species management activities, including repatriation, non-native fish removal, fish-barrier construction, and monitoring projects in both occupied and unoccupied reaches, these projects were planned before the 2010 designation of critical habitat.²⁴⁵ Therefore, we assume that these projects would have occurred even in the absence of spinedace and loach minnow critical habitat. In addition, no additional costs associated with these projects are expected due to critical habitat designation.²⁴⁶ Thus, this analysis assigns costs associated with the species management efforts related to the 2001 consultation to the baseline in both occupied and

²⁴¹ Personal communication with Rob Clarkson, U.S. Bureau of Reclamation, February 24, 2011.

²⁴² Occupied reaches of critical habitat with ongoing or planned species management projects include: Gila River mainstem, East Fork Gila River, West Fork Gila River, Middle Fork Gila River, San Francisco River, Tularosa River, North Fork East Fork Black River, Little Blue Creek, Fossil Creek, Hot Springs Canyon, Redfield Canyon, Aravaipa Creek, Bonita Creek, Eagle Creek, Blue River, and Campbell Blue Creek. Unoccupied reaches with ongoing or planned species management projects include: Granite Creek, Spring Creek, East Fork Black River, Rock Creek, Boneyard Creek, and Tonto Creek.

²⁴³ Personal communication with Tony Robinson, CAP Projects Program Manager for AZGFD, on April 20, 2011.

²⁴⁴ Personal communication with Rob Clarkson, U.S. Bureau of Reclamation, February 24, 2011.

²⁴⁵ Personal communication with Rob Clarkson, U.S. Bureau of Reclamation, April 22, 2011; personal communication with Jill Wick, Aquatic/Riparian Habitat Expert for NMDGF, on April 21, 2011; personal communication with Tony Robinson, CAP Projects Program Manager for AZGFD, on April 20, 2011.

²⁴⁶ Ibid.

unoccupied reaches. Baseline species management project modification costs are anticipated to range from \$18.9 million to \$34.4 million over 20 years (\$1.7 million to \$3.0 million on an annualized basis), assuming a seven percent discount rate. These costs are detailed below.

161. The USBR is currently conducting or planning four fish barrier construction projects in proposed critical habitat in Arizona.²⁴⁷ One project is planned on an unoccupied reach, Spring Creek, and the rest occur on occupied reaches, the Verde River, Blue River, and Redfield Canyon. Spring Creek fish barrier construction is ongoing and will likely be completed by 2014. USBR reports that construction of fish barriers on Blue River and Redfield Canyon is ongoing and both projects are likely to be completed by 2012. USBR is in the early planning stages of constructing a fish barrier on the Verde River and will likely begin construction sometime in 2012.²⁴⁸ USBR also conducts annual monitoring efforts for spinedace and loach minnow on the San Pedro River.²⁴⁹ Exhibit 6-6 presents potential costs associated with these fish barriers.

EXHIBIT 6-6. USBR FISH BARRIER CONSTRUCTION COSTS

ACTIVITY	LOCATION	DURATION	COST (UNDISCOUNTED, 2011 DOLLARS)	
			LOW	HIGH
Fish Barrier Construction	Spring Creek	2013-2015	\$1,000,000	\$2,000,000
Fish Barrier Construction	Redfield Canyon	2010-2012	\$1,000,000	\$2,000,000
Fish Barrier Construction	Verde River	2012-2016	\$10,000,000	\$10,000,000
Fish Barrier Construction	Blue River	2011-2012	\$7,000,000	\$7,000,000
Source: Personal communication with Rob Clarkson, U.S. Bureau of Reclamation, February 24, 2011.				

162. Both Arizona Game and Fish Department (AZGFD) and New Mexico Department of Game and Fish (NMDGF) currently conduct repatriation of spinedace and loach minnow populations, as well removal of non-native species from reaches within occupied reaches of proposed critical habitat. In Arizona, AZGFD currently conducts species repatriation in Fossil Creek, Redfield Canyon, Hot Springs Canyon, and Bonita Creek. Repatriation efforts have occurred in Fossil Creek, Redfield Canyon, and Hot Springs Canyon annually since 2007. Bonita Creek has been stocked once, in 2010. Non-native species removal is ongoing in Bonita Creek, and AZGFD plans to continue these efforts. Non-

²⁴⁷ Ibid.

²⁴⁸ Ibid.

²⁴⁹ Personal communication with Rob Clarkson, U.S. Bureau of Reclamation, April 22, 2011.

native species removal is also planned for the Blue River. AZGFD also acts in support of The Nature Conservancy's efforts to remove non-native species in Redfield Canyon.²⁵⁰

163. AZGFD reports that native fish management efforts, including monitoring and repatriation of spinedace and loach minnow, habitat improvement efforts for these as well as other native fish species, including removal of non-native fish species, is ongoing or planned on 15 reaches in proposed critical habitat, six of which are unoccupied.²⁵¹ The University of Arizona also conducts monitoring and other management practices on Aravaipa Creek.
164. NMDGF reports that it is currently planning or conducting repatriation, non-native fish removal, and monitoring activities within six occupied reaches of critical habitat in New Mexico. Eight permanent monitoring locations are operated, one on the San Francisco River, one on the Tularosa River, three on the Gila River, and one on each of the West, East, and Middle Fork Gila Rivers. NMGFD anticipates that monitoring will occur indefinitely as funding allows.²⁵² NMDGF also plans to conduct repatriation the Gila River and plans to remove non-native fish species from the San Francisco River.²⁵³
165. These State-conducted native fish species and habitat activities, which are already expected to occur under the baseline for this analysis, are summarized in Exhibit 6-7.

EXHIBIT 6-7. BASELINE ARIZONA DEPARTMENT OF GAME AND FISH ONGOING AND PLANNED CONSERVATION EFFORTS FOR NATIVE FISH SPECIES IN CRITICAL HABITAT AREAS

UNIT	REACH	REPATRIATION	NON-NATIVE FISH REMOVAL	MONITORING	HABITAT IMPROVEMENT/RENOVATION	EXPECTED YEAR OF COMPLETION
1	Granite Creek ¹	x	x	x		2015
1	Verde River ¹	x	x			Ongoing
1	Fossil Creek ¹	x		x		2012
2	Spring Creek ¹	x	x		x	2015
2	Rock Creek ¹	x	x		x	2015
2	East Fork Black River ¹		x	x		2015
2	Boneyard Creek ¹		x	x		2015
2	North Fork East Fork Black River ¹		x	x		2015
2	Tonto Creek ¹				x	2015
3	Hot Springs Canyon ¹	x		x		2012

²⁵⁰ Personal communication with Tony Robinson, CAP Projects Program Manager for AZGFD, on February 16, 2011.

²⁵¹ Ibid.

²⁵² Personal communication with Jill Wick, Aquatic/Riparian Habitat Expert for NMDGF, on April 21, 2011.

²⁵³ Ibid.

UNIT	REACH	REPATRIATION	NON-NATIVE FISH REMOVAL	MONITORING	HABITAT IMPROVEMENT/ RENOVATION	EXPECTED YEAR OF COMPLETION
3	Redfield Canyon ¹	x		x		2012
3	Aravaipa Creek ¹			x		-
4	Bonita Creek ¹	x	x	x		2015
5	Eagle Creek ¹			x		2015
6	Tularosa Creek ²			x		Ongoing
6	San Francisco River ²	x		x		2018
7	Little Blue Creek ¹			x		2015
7	Blue River ¹	x	x	x		2017
7	Campbell Blue River ¹	x	x	x		2015
8	Gila River mainstem ²		x	x		Ongoing
8	East Fork Gila River ²			x		Ongoing
8	Middle Fork Gila River ²			x		Ongoing
8	West Fork Gila River ²			x		Ongoing

Sources:
1. Personal communications with Tony Robinson, Arizona Game and Fish Department, on February 16, 2011 and April 20, 2011.
2. Personal communication with Jill Wick, Aquatic/Riparian Habitat Expert for NMDGF, on April 21, 2011.

6.4.1 BASELINE RECREATIONAL FISHING IMPACTS

166. The AZGFD ceased stocking sportfish in Eagle Creek and the Blue River in Apache-Sitgreaves National Forest due to native fish considerations in the late 1990s. Spikedace and loach minnow were among numerous species considered when these stocking cessations were put in place.
167. Under AZGFD Fish Commission guidelines, to avoid net losses in angler days, AZGFD must identify alternate stocking sites when stocking is discontinued at a particular location. As a result, AZGFD estimates that changes in stocking on Eagle Creek and the Blue River have not affected the overall amount fish stocking taking place in Arizona.²⁵⁴ Recent data on angler use is not available at the creek level for most areas. However, alternate angling sites for fishing Arctic grayling, rainbow trout, German brown trout, Apache trout, and cutthroat trout are known to exist within Apache-Sitgreaves National

²⁵⁴ Personal communication with Kirk Young, Arizona Game and Fish Department, February 13, 2006; personal communication with Bill Wall, Feb. 17, 2006.

Forest.²⁵⁵ Given the existence of these alternate sites, this analysis assumes that past cessation of non-native fish stocking activities did not result in impacts to overall angler use. However, there may have been some consumer surplus losses associated with these management changes because anglers may now fish at less preferred sites. Even if local reductions in angler visitation to critical habitat areas occurred as a result of past actions, economic impacts associated with these changes would not be captured in this analysis since they occurred in the past. AZGFD has no planned or ongoing sportfish stocking projects on occupied reaches, with the exception of native Apache trout stocking on East Fork Black River.²⁵⁶ In New Mexico, NMDGF stocked the East Fork Gila River in 2008 and 2009 and plans to continue stocking in the future.²⁵⁷ However, the Service has recently issued a draft biological opinion on sportfish stocking activity that suggests that future stocking activities will not be found to jeopardize spikedace or loach minnow. Thus, even absent critical habitat designation for spikedace and loach minnow, it appears unlikely that sportfish stocking activities would be altered to accommodate spikedace and loach minnow concerns.

6.4.2 BASELINE ADMINISTRATIVE IMPACTS

168. Baseline administrative costs include formal and informal section 7 consultation costs associated with species management in Arizona. These costs are estimated at \$143,000 over 20 years (\$12,700 on an annualized basis) assuming a seven percent discount rate.

6.5 INCREMENTAL IMPACTS

6.5.1 INCREMENTAL SPECIES MANAGEMENT IMPACTS

169. As mentioned above, USBR, AZGFD, and NMDGF currently conduct and plan to conduct native fish species and habitat management efforts in 21 reaches of proposed critical habitat, all but six of which are occupied by spikedace and loach minnow, in proposed critical habitat. Because these actions were not planned or carried out in response to critical habitat designation, this analysis considers these species management activities and associated impacts to be baseline. Incremental costs associated with species management include administrative costs associated with consideration of critical habitat in section 7 consultations that are already expected to occur under the baseline. USBR monitoring and fish-barrier construction projects are currently being carried out under the 2001 USBR programmatic consultation on the CAP. We assume this consultation will be reinitiated when the critical habitat rule is passed and that associated costs are incremental. Many of the other actions described in the baseline section are not expected to require formal consultation.

²⁵⁵ Apache-Sitgreaves National Forest: Wildlife, accessed at <http://www.fs.fed.us/r3/asnf/recreation/wildfish.shtml> on March 15, 2006.

²⁵⁶ Written communication with Tony Robinson, CAP Projects Program Manager for AZGFD, on May 12, 2011; public comments submitted by AZGFD on November 3, 2011.

²⁵⁷ Written communication with Jill Wick, Aquatic and Riparian Habitat Specialist, New Mexico Department of Game and Fish, on February 21, 2011.

6.5.2 INCREMENTAL RECREATIONAL FISHING IMPACTS

170. The Service has recently released a draft biological opinion that addresses the potential impacts of the Arizona Sportfish stocking program.²⁵⁸ This opinion includes an assessment of the stocking program on spokedace and loach minnow as well as proposed critical habitat. The opinion finds that the effects of the proposed sportfish stocking and the cumulative effects thereof are not likely to destroy or adversely modify designated critical habitat for the spokedace and loach minnow.²⁵⁹ In particular, it finds for several reaches that continued stocking of non-native fish species upstream of critical habitat is “not likely to contribute numbers of fish sufficient to reach a level precluding the persistence of spokedace in the critical habitat reach.” As such, impacts to stocking of non-native sportfish as a result of critical habitat designation are not expected. The following text notes places where unoccupied proposed critical habitat and current sportfish stocking regimes overlap. Five unoccupied reaches located in proposed critical habitat currently have ongoing stocking:

- **East Fork Black River:** in 2001, the reach was stocked with approximately 28,000 catchable Apache trout and supported approximately 38,687 angler-use days annually.²⁶⁰ Currently, both Apache and rainbow trout are stocked in this reach, and AZGFD plans to continue such stocking. More recent data on the volume of fish stocked or angler-use days are not available. Apache trout is a native fish, which, according to a public comment from AZGFD as well as the Service's 2000 Final Rule designating critical habitat, are "not known to conflict with the recovery of either spokedace or loach minnow."²⁶¹
- **Oak Creek:** the reach is currently stocked with rainbow trout and provides 15,632 angler-use days annually.²⁶² The AZGFD plans to continue stocking the reach with rainbow trout.
- **Beaver/Wet Beaver Creek:** the reach is currently stocked with rainbow trout and provides 5,992 angler-use days annually.²⁶³ The AZGFD plans to continue stocking the reach with rainbow trout.

²⁵⁸ U.S. Department of the Interior, Fish and Wildlife Service, Official Final Draft for Environmental Assessment: Biological and Conference Opinion for 10-Year Sportfish Restoration Grant to Arizona Game and Fish Department. BCO 22410-2008-F-0486, March 2011.

²⁵⁹ U.S. Department of the Interior, Fish and Wildlife Service, Official Final Draft for Environmental Assessment: Biological and Conference Opinion for 10-Year Sportfish Restoration Grant to Arizona Game and Fish Department. BCO 22410-2008-F-0486, March 2011.

²⁶⁰ Pringle, Todd. Statewide Survey of 2001 Arizona Anglers. Statewide Fisheries Investigations, Federal Aid Project F-7-M-46, 2004.

²⁶¹ Public comment from the Arizona Game and Fish Department, dated February 21, 2006.

²⁶² Pringle, Todd. Statewide Survey of 2001 Arizona Anglers. Statewide Fisheries Investigations, Federal Aid Project F-7-M-46, 2004.

²⁶³ Ibid.

- **West Clear Creek:** the reach is currently stocked with rainbow trout and provides 2,834 angler-use days annually.²⁶⁴ The AZGFD plans to continue stocking the reach with rainbow trout.
 - **Tonto Creek:** the reach is currently stocked with rainbow trout and provides 10,110 angler-use days annually.²⁶⁵ The AZGFD plans to continue stocking the reach with rainbow trout.
171. In addition, AZGFD plans to stock Spring Creek and Rock Creek with native sportfish, Gila Trout or Apache Trout. The Service has stated in its rules that Apache Trout do not threaten the spikedace or loach minnow.
172. Non-native fish are stocked in lakes upstream of several unoccupied proposed critical habitat reaches. AZGFD and the Service state that such stocking does not negatively affect downstream critical habitat areas. This analysis assumes that upstream stocking regimes will not be affected by proposed critical habitat. AZGFD notes that if upstream stocking were affected by proposed critical habitat, significant economic impacts could occur.²⁶⁶
- **East Fork Black River, Boneyard Creek:** Big Lake and Crescent Lake are located upstream of all segments in Unit 2. According to AZGFD, "Big Lake is likely the most popular angling/camping destination in the White Mountains, generating 168,990 angler days a year." It is stocked with rainbow trout, brook trout, cutthroat trout, and occasionally Apache trout. Crescent Lake is stocked with rainbow trout and brook trout. It supports 25,769 angler-use days annually. AZGFD notes that both of these lakes "rarely spill," meaning nonnative trout rarely escape downstream to critical habitat areas.²⁶⁷ If a spill is anticipated, AZGFD will install a fish weir downstream to capture any fish and prevent downstream movement. If no weir is installed prior to a spill, a survey for trout species will be performed within that spring/summer season and all fish species encountered during that survey will be removed.²⁶⁸
 - **Whitewater Creek:** in 2006 Glenwood Pond (adjacent to the creek) was stocked with approximately 5,500 rainbow trout per year.²⁶⁹ The pond continues to be stocked.

²⁶⁴ Ibid.

²⁶⁵ Ibid.

²⁶⁶ Personal communication with Tony Robinson, Arizona Game and Fish Department, February 16, 2011.

²⁶⁷ Pringle, Todd. Statewide Survey of 2001 Arizona Anglers. Statewide Fisheries Investigations, Federal Aid Project F-7-M-46, 2004.

²⁶⁸ U.S. Department of the Interior, Fish and Wildlife Service, Official Final Draft for Environmental Assessment: Biological and Conference Opinion for 10-Year Sportfish Restoration Grant to Arizona Game and Fish Department. BCO 22410-2008-F-0486, March 2011

²⁶⁹ Written communication with David Propst, New Mexico Game and Fish Department, February 20, 2006.

- **Granite Creek:** Three lakes upstream of Granite Creek are stocked with non-native sportfish. Goldwater Lake is stocked with largemouth bass, black crappie, bluegill, and rainbow trout. Willow Springs and Watson Lake are stocked with black crappie, bluegill, and rainbow trout. Each lake supports moderate angler-use days annually and AZGFD plans to continue stocking these lakes.²⁷⁰ According to the Service’s Biological Opinion on sportfish stocking statewide, “The small numbers of stocked sportfish that may access the Upper Verde River reach is not likely to lead to the establishment of these species in the area, and the effect of the small numbers of individuals likely to move into the area from the Granite Creek stocking sites does not alter the existing predator and competitor community currently present.”²⁷¹

6.5.3 INCREMENTAL ADMINISTRATIVE IMPACTS

173. Incremental administrative costs include formal and informal section 7 consultation costs associated with sportfish stocking and species management, as well as costs associated with reinitiation of the 2001 USBR programmatic consultation. These costs are estimated at \$128,000 over 20 years (\$11,300 on an annualized basis) assuming a seven percent discount rate.

²⁷⁰ Written communication with T. Robinson, CAP Projects Program Manager for AZGFD, March 4, 2011.

²⁷¹ U.S. Department of the Interior, Fish and Wildlife Service, Official Final Draft for Environmental Assessment: Biological and Conference Opinion for 10-Year Sportfish Restoration Grant to Arizona Game and Fish Department. BCO 22410-2008-F-0486, March 2011.

CHAPTER 7 | POTENTIAL ECONOMIC IMPACTS TO RESIDENTIAL AND COMMERCIAL DEVELOPMENT

174. Some lands in proposed critical habitat are privately owned, and have the potential to be developed for residential or commercial uses in the future. Construction of residential and commercial properties within or adjacent to critical habitat may cause riparian habitat loss, siltation, and degradation that could adversely affect spikedace and loach minnow proposed critical habitat.²⁷² Real estate development also increases demand for domestic, commercial, and industrial water use, transportation infrastructure, and recreational opportunities; each of these activities is addressed elsewhere in this report.
175. This section focuses on identifying planned residential development activities on private lands in the vicinity of critical habitat to determine whether they have been or will be affected by incremental conservation efforts for spikedace and loach minnow critical habitat. The chapter first describes our analytic approach to estimating potential future impacts to development activities, and provides a discussion of existing baseline protections. It then estimates future incremental and baseline impacts to development.

7.1 SUMMARY OF IMPACTS TO DEVELOPMENT

176. In general, spikedace and loach minnow conservation efforts have the greatest potential to affect new construction within proposed critical habitat areas rather than existing developments. The most likely locations for new development activities in unoccupied spikedace and loach minnow critical habitat areas, where incremental impacts of critical habitat are deemed to be most likely, are along Oak and Beaver/Wet Beaver Creeks, which contain a relatively large amount of private land, a relatively large current population, and have existing residential and commercial development nearby unoccupied critical habitat.²⁷³
177. On Oak and Beaver/Wet Beaver Creeks, 36 percent of parcels that intersect proposed critical habitat along Oak and Beaver/Wet Beaver Creeks do not currently contain any structures.²⁷⁴ According to current zoning, an estimated 4,770 additional structures are

²⁷² For example, see "Candidate and Listing Priority Assignment Form" for Loach Minnow, Service, Phoenix Ecological Services Office, August 2004.

²⁷³ Yavapai County GIS data, 2007 Building footprints (build04.shp), 2011 Parcels data (parcels.shp), 2011 Zoning data (zonediss.shp). Written communication with K. Blake, GIS Coordinator, Yavapai County, February 22, 2011.

²⁷⁴ Yavapai County GIS data, 2011 Building footprints (build07.shp), 2011 Parcels data (parcels.shp). Written communication with K. Blake, GIS Coordinator, Yavapai County, February 22, 2011.

allowable on these parcels. This analysis utilizes a range of assumptions to estimate the potential impact of critical habitat on development activities in these areas, based on the following:

- 1) Individual single-family home development has rarely been subject to consultation or habitat conservation plan requirements in Arizona. Only one development has undergone a formal section 7 consultation related to development activities that included spikedace and loach minnow in the past (a large-scale development in 2001), and this development was never built.
- 2) Because riparian buffers for development have already been established along Oak and Beaver/Wet Beaver Creeks in some areas, development is already prohibited from some proposed acres.
- 3) Recent poor economic conditions have halted development on Oak Creek and significantly slowed development throughout Yavapai County.²⁷⁵
- 4) Although critical habitat areas are riparian in nature, some projects on parcels that intersect critical habitat may not include lands that the U.S. Army Corps of Engineers considers jurisdictional. As a result, some developments may not require Federal Section 404 permit under the Clean Water Act, and hence may not require consultation with the Service.

In addition to the rarity of consultations in the past, potential for baseline protections, and potential lack of Federal permit requirement, the Service does not expect that conservation efforts related to future development activities in critical habitat areas are likely to occur. As a result, the low end scenario assumes that no future consultations or conservation efforts on development will occur related to spikedace and loach minnow over the next 20 years. However, because it is not certain that no consultations or conservation efforts for spikedace and loach minnow will occur related to development activities, the analysis also considers a high end scenario, where proposed critical habitat areas will be built out at a rate that is proportional to the county-wide housing unit growth rate within the next 20 years.

178. Using the above assumptions, the future incremental impacts associated with spikedace and loach minnow critical habitat on development activities are estimated to range from \$0 to \$215,000 for Beaver/Wet Beaver Creek (\$0 to \$19,000 on an annualized basis) and from \$0 to \$590,000 for Oak Creek (\$0 to \$52,100 on an annualized basis) over the next 20 years using a seven percent discount rate. In addition, expected incremental administrative costs on the Verde River are estimated to range from \$0 to \$2,830 over 20 years (\$0 to \$250 on an annualized basis), assuming a seven percent discount rate. A summary of total incremental costs is presented in Exhibit 7-1.

²⁷⁵ Personal communication with Tammy Dewitt, Yavapai County Development Services, Cottonwood Office, on March 9, 2011.

EXHIBIT 7-1. SUMMARY OF INCREMENTAL IMPACTS TO DEVELOPMENT ACTIVITIES BY REACH (2011\$, DISCOUNTED AT SEVEN PERCENT)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$0	\$2,834	\$0	\$250
	Oak Creek	\$0	\$590,233	\$0	\$52,100
	Beaver and Wet Beaver Creek	\$0	\$214,816	\$0	\$19,000
Total		\$0	\$807,883	\$0	\$71,300
Note: Totals may not sum due to rounding.					

179. We also estimate the potential costs of conservation efforts that are already expected to be undertaken related to development activities under the baseline related to development activities. The high-end baseline scenario assumes that consideration of spiketail and loach minnow would lead to conservation efforts in the Verde River unit. The Verde River unit is the most likely location for development activities in occupied critical habitat areas. Following this assumption, baseline impacts to development on the Verde River are estimated to range from \$0 to \$822,000 (\$0 to \$72,500 on an annualized basis) assuming a discount rate of seven percent. We do not quantify the impacts to development associated with establishment of riparian buffers for other purposes, though these efforts are also expected to benefit the species under the baseline. A summary of estimated baseline costs is presented in Exhibit 7-2.

EXHIBIT 7-2. SUMMARY OF BASELINE IMPACTS TO DEVELOPMENT ACTIVITIES BY REACH (2011\$, DISCOUNTED AT SEVEN PERCENT)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$0	\$822,000	\$0	\$72,500
Total		\$0	\$822,000	\$0	\$72,500
Note: Totals may not sum due to rounding. Does not include costs associated with establishment of riparian buffers for other purposes under the baseline, which is also expected to benefit the species.					

7.2 OVERVIEW OF DEVELOPMENT ACTIVITY IN CRITICAL HABITAT AREAS

180. From 1999 to 2011, the Arizona Ecological Service Office completed approximately 765 consultations or technical assistance efforts on residential development. Of the 765 efforts, 31 (four percent) were formal consultations.²⁷⁶ Of the 31 formal consultations completed for residential development, four were never completed, and 14 involved plant species only (no take).²⁷⁷
181. One section 7 consultation for a development project occurred in Yavapai County and considered potential impacts to the spikedace, loach minnow and the southwestern willow flycatcher on the lower Verde River.²⁷⁸ The consultation focused on the issuance of a National Pollution Discharge Elimination System permit for the Homestead at Camp Verde master planned community in Arizona, a proposed community of 800 single-family residential units and 300 apartment units on 363 acres. The original consultation only considered the southwestern willow flycatcher, but was amended to include the spikedace and loach minnow. The Homestead Project consultation recommended the following conservation measures:
- Fencing;
 - Producing educational materials for homeowners;
 - Conducting scientific studies over 20 years;
 - Surveying and monitoring over 20 years; and
 - Off-setting mitigation (habitat set-asides).
182. To ensure that the action would not adversely affect the spikedace and loach minnow, the following measures were added:
- Developing a recreation and habitat monitoring plan;
 - Monitoring effects of recreation on habitat;
 - Implementing measures to ensure that habitat and streambanks are not degraded;
 - Reducing risk of exotic species reintroduction through educational programs, prohibiting backyard ponds, and prohibiting fishing and in-stream recreation in the 25-acre Conservation Area on the property;
 - Improving human barriers to entrance to the river area and preventing trespass; and
 - Increasing fence maintenance.²⁷⁹
183. The developer for this project stated that 95 percent of costs to accommodate threatened and endangered species stemmed from southwestern willow flycatcher needs, and that

²⁷⁶ Written communication with Arizona Ecological Service Office, May 16, 2011.

²⁷⁷ Written communication with Arizona Ecological Service Office, May 16, 2011.

²⁷⁸ U.S. Fish and Wildlife Service, Biological Opinion Harvard Homestead (2-21-01-F-148), December 26, 2001.

²⁷⁹ U.S. Fish and Wildlife Service, Biological Opinion Harvard Homestead (2-21-01-F-148), December 26, 2001.

total costs to implement conservation measures would have been \$4.4 million to \$4.8 million.²⁸⁰ These conservation costs were included in the economic analysis for the southwestern willow flycatcher. However, the Service states that this project did not go forward, and that the property has since been sold.²⁸¹ Thus, it is unclear to what extent these conservation efforts were undertaken, and that costs were incurred.

7.2.1 EXISTING BASELINE PROTECTIONS

184. This analysis sought confirmation from Yavapai County planning as well as Verde Valley city offices regarding potential future development activities in the Verde River segment of proposed critical habitat.²⁸² Planners confirmed that many private lands along the Verde River, Oak Creek, and Beaver/Wet Beaver Creek generally can be developed, i.e., development is not restricted outright by regulation, other than in a small buffer along channel banks and floodways. Other baseline restrictions also exist. These include:

- Federal guidelines govern real estate development in floodplains for jurisdictions in flood-prone areas that choose to participate in the National Flood Insurance Program (NFIP), managed by the Mitigation Division of the Federal Emergency Management Agency (FEMA). Communities in this program adopt FEMA's floodplain management ordinances in exchange for Federally-backed flood insurance. FEMA defines the floodplain lands as Special Flood Hazard Areas and places special requirements on development within these areas. The lowest floor of all new residential buildings in the floodplain must be at or above the level of the 100-year flood, in order to qualify for FEMA-backed insurance. Non-residential buildings must be at or above the level of the 100-year flood, or be flood-proofed to that level. Using these guidelines, construction in a floodplain is possible in lower-risk locations, such as areas where the floodplain is wide.
- Within the floodplain, the "floodway" is defined as all land required to convey the 100-year flood without structural improvements and/or all land required to convey the 100-year flood without increasing water surface elevation by more than one foot at any single point.²⁸³ FEMA does not prohibit all construction in floodways, but does require developers to obtain a "No Rise Certificate" by demonstrating that there will be no increase in water level as a result of construction. The No Rise Certificate must be certified by an engineer.²⁸⁴ This development regulation may require special engineering, often making development in floodways impractical and prohibitively expensive.

²⁸⁰ Personal communication with D. Zuber, Harvard Investments, September 21, 2004.

²⁸¹ Written communication with Service, Phoenix Ecological Services Office, April 8, 2006.

²⁸² Personal communication with E. Link, Yavapai County Development Services, February 16, 2006; Personal communication with M. Jenkins, R. Martin, R. Long, Camp Verde Planning Department, February 24, 2011.

²⁸³ The floodway is the part of a waterway where water is likely to be fastest and highest, and it is therefore important that the floodway be kept free of obstructions in order to avoid increasing the water level.

²⁸⁴ Personal communication with A. Sanchez, Yavapai County Flood Control District, February 17, 2006.

- Where flood is a risk, development is generally discouraged.²⁸⁵
- A minimum building setback of 20 feet applies to all channel banks and floodways.²⁸⁶
- Within the Town of Camp Verde, development is not permitted on "meanderlands," lands with boundaries that move with the location of the river, and which have a "clouded title," where an owner does not have clear title to the land.²⁸⁷

Additionally, recent poor economic conditions have halted development on Oak Creek and significantly slowed development throughout Yavapai County. County planners as well as Camp Verde Town planners do not anticipate development along these reaches. The town of Camp Verde currently plans to build a recreational trail system along in the town, either along the Verde River, Beaver Creek, or Wet Beaver Creek.²⁸⁸ However, this development is not likely to require a Federal permit and thus is not expected to require a section 7 consultation.

7.3 ANALYTIC APPROACH

185. Because of its riparian nature, proposed critical habitat for spikedace and loach minnow generally falls within the FEMA 100-year floodplain. This analysis evaluates the likelihood of development activity occurring in the floodplain area on private lands within the proposed critical habitat.
186. Several regulatory programs affecting the construction of new development activities frequently involve Federal permits or funding. The most common of these programs involve USACE, the Environmental Protection Agency (EPA), and FEMA. USACE issues permits for private activities that involve modifying navigable waterways and/or wetlands for construction and maintenance of structures.²⁸⁹ EPA's NPDES permit program regulates point source pollution into the waters of the United States.²⁹⁰ EPA's Phase II NPDES Storm Water Program (published December 8, 1999), requires permit coverage for storm water discharges from "construction activity disturbing between one and five acres of land (i.e., small construction activities)."²⁹¹ In Arizona, EPA's program

²⁸⁵ Personal communication with E. Link, Yavapai County Development Services, February 16, 2006.

²⁸⁶ Drainage Criteria Manual, Yavapai County Flood Control District, Flood Damage Prevention Ordinance: [http://www.co.yavapai.az.us/uploadedFiles/Departments/Flood_Control/Reference/DrainageCriteriaManual\(1\).pdf](http://www.co.yavapai.az.us/uploadedFiles/Departments/Flood_Control/Reference/DrainageCriteriaManual(1).pdf)

²⁸⁷ Personal communication with M. Jenkins, R. Martin, R. Long, Camp Verde Planning Department, February 24, 2011.

²⁸⁸ Personal communication with Tammy Dewitt, Yavapai County Development Services, Cottonwood Office, on March 9, 2011; personal communication with M. Jenkins, R. Martin, R. Long, Camp Verde Planning Department, February 24, 2011.

²⁸⁹ ACOE issues four types of permits: (1) individual permit, a type of standard permit requiring public comment; (2) letter of permission (LOP), a type of standard permit requiring coordination with adjacent property owners; (3) nationwide permits, which authorize a category of activities and are issued for individual small projects across the United States; and (4) regional or general permits, which authorize a category of activities in a specific region.

²⁹⁰ Accessed at http://cfpub2.epa.gov/npdes/statestats.cfm?program_id=45&view=specific on August 30, 2002.

²⁹¹ Accessed at http://cfpub.epa.gov/npdes/stormwater/swphase2.cfm?program_id=6 on August 30, 2002.

has been delegated to the State of Arizona for management, thus the Service typically interacts with Arizona Department of Environmental quality on stormwater permit issues via technical assistance letters rather than through formal section 7 consultation.²⁹² Finally, FEMA guidelines apply to development activity that fall within the 100-year floodplain.

187. Potential modifications to land use projects stemming from spikedace and loach minnow conservation activities could affect landowners, consumers, and even real estate markets. The total economic impact depends on the scope of spikedace and loach minnow conservation activities, pre-existing land use and regulatory controls in the region, and the nature of regional land and real estate markets. However, as discussed above, consultations on development activities have been rare in the past. In addition, riparian buffers already exist, and some developments may not require any Federal permits. Citing a lack of past consultation evidence, the Service does not expect that conservation efforts related to future development activities in critical habitat areas are likely to occur.²⁹³
188. Taking the above information into consideration, the low end scenario assumes that no future consultations or conservation efforts on development will occur related to spikedace and loach minnow over the next 20 years. Because it is not certain that no consultations or conservation efforts for spikedace and loach minnow will occur related to development activities, the analysis also considers a high end scenario, where proposed critical habitat areas will be built out at a rate that is proportional to the county-wide housing unit growth rate within the next 20 years.
189. To identify potential impacts to development activities under the high end scenario, this analysis follows the following method:
- 1) Combine information on the location of private lands in critical habitat areas (which include a 300-foot buffer around stream locations) with county growth rates, locations of existing communities, and input from local planners to identify areas most likely to be developed for residential or commercial purposes in the next 20 years.
 - 2) Use local zoning information to estimate the maximum amount of development likely to occur within the next 20 years in these areas.
 - 3) Estimate the rate of development using county-level housing unit growth statistics. We believe historical housing unit growth is a fair approximation of the future level of real estate development. Conversely, it is assumed that areas which are expected to experience low rates of housing unit growth would not be host to residential or commercial development activities in the future.
 - 4) Use information from past consultation activity to determine the most likely project modifications that will be undertaken by future development activities.

²⁹² Written communication with Service, Southwest Regional Office, June 23, 2011.

²⁹³ Written communication with Arizona Ecological Service Office, May 16, 2011.

- 5) Estimate the likely level of future administrative costs associated with development projects.
190. FEMA regulations and local ordinances do not preclude development on private lands within the proposed critical habitat. In general, existing regulations do aim to minimize obstructions within the floodplain that might otherwise result from unregulated development. Thus, there is theoretical potential for development activities to occur in many areas of proposed critical habitat. However, due to their rural nature, many areas included in the designation are not likely to experience development in the foreseeable future. This analysis identifies areas that are most likely to be impacted by future residential and commercial development using GIS data to identify the overlap of private lands with critical habitat, as well as the number of proposed acres on private lands.
191. By integrating the land ownership and geographic characteristics of the critical habitat stream reaches, as presented in Exhibit 7-3, the analysis identifies potential for development in proposed critical habitat. This information suggests that the most likely location for development activities in unoccupied spikedace and loach minnow critical habitat is along the Oak and Beaver/Wet Beaver Creeks, which contain a large amount of private land and several nearby communities. According to this information, development in occupied critical habitat may also occur along the Verde River. Consultation with local and county planners supports this conclusion.²⁹⁴ Thus, the remainder of this section focuses on potential baseline impacts to development along the Verde River and incremental impacts to development activities on the Oak Creek and Beaver/Wet Beaver Creek segments.
192. The economic indicators summarized above in Exhibit 7-3 were used to identify areas where growth, and therefore commercial and residential development, is likely to occur in the vicinity of proposed critical habitat areas. The majority of private lands in Unit 1 occur in the lower portion of the Verde River and within incorporated areas of several towns, including Redrock, Cornville, Cottonwood, Camp Verde, Clarkdale, and Paulden, Arizona. By overlaying proposed critical habitat with Yavapai County zoning data using GIS, this analysis estimates the acres of proposed critical habitat along the Verde River, Oak Creek, and Beaver/Wet Beaver Creek by zoning type.

²⁹⁴ Personal communication with Tammy Dewitt, Yavapai County Development Services, Cottonwood Office, on March 9, 2011; personal communication with M. Jenkins, R. Martin, R. Long, Camp Verde Planning Department, February 24, 2011.

EXHIBIT 7-3. SUMMARY OF ECONOMIC INDICATORS OF POTENTIAL FOR FUTURE DEVELOPMENT ACTIVITIES NEAR CHD

UNIT	RIVER SEGMENT	COUNTY	COUNTY GROWTH RATE (POPULATION CHANGE 2000 TO 2010)	PRIVATE PROPERTY IN STREAM REACH (ACRES)	NEARBY POPULATION
1	Verde River	Yavapai	26.0%	2,400	39,630
	Beaver/Wet Beaver Creek	Yavapai		599	
	Oak Creek	Yavapai		1,547	
	Granite Creek	Yavapai		48	
	West Clear Creek	Yavapai		242	
2	Greenback Creek	Gila	4.4%	80	7,290
	Rye Creek	Gila		14	
	Spring Creek	Gila		20	
	Tonto Creek	Gila		465	
3	San Pedro River	Cochise	11.5%	340	5,490
	Bass Canyon	Cochise		167	
Total				5,922	52,400

Notes: Acreages were calculated intersecting GIS layers of land ownership and unoccupied proposed critical habitat reaches with lateral component consisting of 300ft on either side of the river segment.

Sources: GIS analysis performed by IEC. ALRIS, Arizona State Lands Department, "places.shp" (2003); New Mexico Resource Geographic Information System (RGIS) "tgrplc00.sph," Incorporated and Census designated places Tiger 2000; Proposed critical habitat for the spikedace and loach minnow, USFWS, 2005.. Population projections: Arizona: July 1, 1997 to July 1, 2050 Arizona County Population Projections, Research Administration, Population Statistics Unit, Arizona. http://www.workforce.az.gov/admin/uploadedPublications/526_coproj97.xls; New Mexico: Revised Population Projections for New Mexico and Counties, July 1, 2000 to July 1, 2030 Bureau of Business and Economic Research, University of New Mexico. Released August 2002 and revised April 2004. <http://www.unm.edu/~bber/demo/table1.htm>.

US Census Bureau, State and County Quick Facts, accessed at <http://quickfacts.census.gov/qfd/states/04000.html> on December 10, 2011.

193. Yavapai County population grew 26.0 percent from 2000 to 2010, the highest growth rate of any counties containing critical habitat. Applying this annual growth rate of 2.6 percent, the Yavapai County population is anticipated to increase by 52 percent over the next 20 years. Using this growth rate as an indicator for the level of future development, the development analysis focuses on Yavapai County. Applying an average housing unit growth rate of 3.5 percent in Yavapai County to the number of undeveloped acres and the allowable density of construction within zoned areas, this analysis estimates the number

of housing units that will be developed within 20 years.²⁹⁵ Assuming that future development projects will be comparable in size (800 housing units) to the Homestead project, this analysis estimates the number of such future projects on these three reaches, based on the estimated build out of each reach, using land parcels data and the Yavapai County housing unit growth rate, as described above. These calculations are detailed in Exhibits 7-5, 7-6, 7-8, and 7-9.

194. As described above, the Homestead Project conservation efforts were, for the most part, not specifically aimed at benefiting the spikedace and loach minnow. However, some conservation efforts that would have been undertaken for the southwestern willow flycatcher would have likely benefited the spikedace and loach minnow. Thus, in future projects where the flycatcher is not involved, fencing, monitoring, and surveying requirements could be required for spikedace and loach minnow. Thus, this analysis assumes a subset of conservation measures associated with the Homestead project may occur. Costs to developers are estimated to be \$1.1 million per large development project. These per-project housing cost estimates are detailed in Exhibit 7-4.

EXHIBIT 7-4. ESTIMATED PER PROJECT COSTS TO DEVELOPMENT ACTIVITIES WITHIN PROPOSED CRITICAL HABITAT

COST TYPE	COST (UNDISCOUNTED DOLLARS)
Per Project Costs	
Educational materials for homeowners ¹	\$200,000
Scientific studies over 20 years ¹	\$50,000
Surveying and monitoring over 20 years ²	\$125,000
Total per project costs (excluding cost of fencing)	\$375,000
Fencing (cost per river mile) ³	\$14,500
<p>Notes: The analysis assumes that these costs are representative of costs related to large, 800-unit development projects of similar size and involvement as the Homestead project. Costs assumed to be one-time cost over 20 years. Fencing costs are calculated on a per-mile basis by reach, and thus are not included in the total per project cost presented here.</p> <p>Sources:</p> <p>1. Personal communication with D. Zuber, Harvard Investments, September 21, 2004.</p> <p>2. Personal communication with Tony Robinson, AZGFD, April 20, 2011; b) AZGFD, Wildlife Management Division. "Project E5 Work Plan, Segment 21, July 1, 2009 - June 30, 2011," August 20, 2009. This figure represents costs associated with five years of monitoring activity.</p> <p>3. Personal and written communication with Seth Piedler, NRCS, Albuquerque, New Mexico Office, on December 14, 2011.</p>	

²⁹⁵ Housing unit growth rate source: US Census Bureau State & County QuickFacts,

<http://quickfacts.census.gov/qfd/states/04000.html>, accessed December 9, 2011; US Census Bureau. *Profiles of General Demographic Characteristics: 2000 Census of Population and Housing, Arizona*. May 2001.

195. To estimate costs associated with residential and commercial development, we assign per project costs as listed above to potential future development projects on the Verde River, Oak Creek, and Beaver/Wet Beaver Creek. These calculations are detailed in Exhibits 7-5, 7-6, 7-8, and 7-9.

7.4. POTENTIAL BASELINE IMPACTS TO DEVELOPMENT ACTIVITIES

196. The proposed rule lists 25 of the 42 river segments in proposed critical habitat as containing private lands.²⁹⁶ Of these 25 river segments, the Verde River is the only occupied reach within five miles of a major population center (Camp Verde). 1,360 parcels and 2,400 acres of private lands occur along the Verde River, approximately 1,300 acres of which are currently undeveloped.
197. Using the methodology described above in section 7.3, we developed a high-end estimate of the potential costs of conservation efforts expected to be undertaken in the baseline related to development activities on the Verde River. The estimated build out of Verde River housing units is detailed below in Exhibit 7-5.
198. Applying per-project costs from Exhibit 7-4 to the estimated number of large development projects (1.5) we calculate total high end project modification costs under the baseline. Baseline project modification costs associated with development are estimated to range from \$0 to \$813,000 (\$0 to \$71,700 on an annualized basis), assuming a seven percent discount rate. Baseline build-out and cost information is outlined in Exhibit 7-6.

²⁹⁶ U.S. Fish and Wildlife Service, 2010 Proposed Rule for the Designation of Critical Habitat for Spikedace and Loach Minnow, 50 CFR Part 17.

EXHIBIT 7-5. ZONING AND MAXIMUM BUILDOUT OF PRIVATE LANDS IN PROPOSED CRITICAL HABITAT ALONG THE VERDE RIVER

ZONE	DEFINITION	UNDEVELOPED ACRES IN CHD	DENSITY (UNITS PER ACRE)	ESTIMATED NUMBER OF UNDEVELOPED UNITS IN PARCELS
INC	Incorporated	613	Undefined	Unknown
C2-3	Medium Commercial; 3000 Sq. Ft. Minimum Lot	4	15	54
PAD	Planned Area Development	1	1	1
R1-10	Residential, Single Family Limited	12	4	54
R1-12	Residential, Single Family	4	1	4
R1-18	Residential, Single Family	42	2	101
R1-35	Residential, Single Family	13	2	32
R1L-10	Residential, Single Family Limited	7	1	4
R1L-12	Residential, Single Family	0	4	0
R1L-175	Residential, Single Family Limited	103	4	369
R1L-18	Residential, Single Family	50	2	121
R1L-35	Residential, Single Family	42	15	614
R1L-70	Planned Area Development	28	4	124
RCU-2A	Low Density Residential	363	0.5	182
<i>Max Build Out</i>		<i>1,280</i>	-	<i>1,660</i>
Estimated Build Out (Using Population Growth Rate)		900	-	1,170
<p>Notes:</p> <p>1. Estimated Build Out assumes that the level of development is proportional to the level of housing unit growth within the county. This analysis uses a housing unit growth rate of 3.5 percent annually, or 70.2 percent over 20 years. Housing unit growth rate source: US Census Bureau State & County QuickFacts, http://quickfacts.census.gov/qfd/states/04000.html, accessed December 9, 2011; US Census Bureau. <i>Profiles of General Demographic Characteristics: 2000 Census of Population and Housing, Arizona</i>. May 2001.</p> <p>2. Density in incorporated areas is not determined at this time by zoning.</p> <p>Sources: Yavapai County zoning GIS layer: zonediss.shp, 2011; Yavapai County 2011 Parcels data: parcels.shp; Yavapai County GIS data, 2011 Building footprints (build07.shp). Written communication with K. Blake, GIS Coordinator, Yavapai County, February 22, 2011. 2003 Yavapai Counting Planning and Zoning Ordinance, accessed online at http://www.co.yavapai.az.us/departments/Dev/unitspc/ordregs/zo/zoningordinance.pdf, on March 2, 2011.</p>				

EXHIBIT 7-6. SUMMARY OF POTENTIAL BASELINE COSTS TO DEVELOPMENTS ASSOCIATED WITH SPIKEDACE AND LOACH MINNOW CONSERVATION EFFORTS ON THE VERDE RIVER

	UNDEVELOPED ACRES IN CHD	ESTIMATED NUMBER OF UNDEVELOPED UNITS IN PARCELS	ESTIMATED NUMBER OF LARGE, 800-UNIT DEVELOPMENTS	ESTIMATED COSTS (2011\$ PRESENT VALUE, 7% DISCOUNT RATE)
<i>Max Build Out</i>	1,280	1,660	2.1	\$1,158,000
Estimated Build Out (Using Housing Unit Growth Rate)	900	1,170	1.5	\$813,000

Note: Estimated Build Out assumes that the level of development is proportional to the level of housing unit growth rate of 3.5 percent annually, or 70.2 percent over 20 years. Housing unit growth rate source: US Census Bureau State & County QuickFacts, <http://quickfacts.census.gov/qfd/states/04000.html>, accessed December 9, 2011; US Census Bureau. *Profiles of General Demographic Characteristics: 2000 Census of Population and Housing, Arizona*. May 2001.

Sources: Yavapai County zoning GIS layer: zonediss.shp, 2011; Yavapai County 2011 Parcels data: parcels.shp; Yavapai County GIS data, 2011 Building footprints (build07.shp).
Written communication with K. Blake, GIS Coordinator, Yavapai County, February 22, 2011. 2003 Yavapai Counting Planning and Zoning Ordinance, accessed online at <http://www.co.yavapai.az.us/departments/Dev/unitspc/ordregs/zo/zoningordinance.pdf>, on March 2, 2011.

7.4.1 POTENTIAL BASELINE ADMINISTRATIVE IMPACTS TO DEVELOPMENT ACTIVITIES

199. In addition to conservation effort costs, the analysis forecasts administrative costs associated with section 7 consultation for development activities. A review of the past consultation history for these species suggests that section 7 consultations on development activities are rare (note that development related to water use is discussed in Chapter 3 of this report). Because of the relatively sparse consultation history, it is difficult to forecast the number of consultations that may be subject to section 7 consultation for development activities in the future. One section 7 consultation, the Homestead project, constitutes the consultation history for this critical habitat. Homestead consisted of 800 single family units and 300 apartment units on 363 acres.
200. This analysis estimates future baseline consultations based on the number of development projects estimated to occur in the baseline. These administrative costs are estimated to be \$8,500 over 20 years (\$750 on an annualized basis), assuming a seven percent discount rate (see Exhibit 7-7).

**EXHIBIT 7-7. SUMMARY OF BASELINE CONSERVATION AND ADMINISTRATIVE COSTS BY REACH
(2011\$ PRESENT VALUE, 7% DISCOUNT RATE)**

UNIT	REACH	CONSERVATION COSTS		ADMINISTRATIVE COSTS
		LOW	HIGH	
1	Verde River	\$0	\$813,000	\$8,500
	Total	\$0	\$813,000	\$8,500
Note: Totals may not sum due to rounding.				

7.5. POTENTIAL INCREMENTAL IMPACTS TO DEVELOPMENT ACTIVITIES

201. Of the nearly 5,000 acres of private land in Unit 1, 2,400 acres (50 percent) fall within four unoccupied reaches: Oak Creek, Beaver/Wet Beaver Creek, Granite Creek, and West Clear Creek. Little development is expected along Granite or West Clear Creeks. Of the 2,146 acres proposed in Beaver/Wet Beaver and Oak Creeks, more than half (56 percent) are zoned as either residential/rural 2-acre zoning (RCU) or incorporated lands (INC). Using the methodology described in Section 7.3, we developed a high-end estimate of the potential incremental costs of conservation efforts related to development activities on Oak Creek and Beaver/Wet Beaver Creek. The estimated build out of Oak Creek and Beaver/Wet Beaver Creek housing units is detailed below in Exhibit 7-8.

EXHIBIT 7-8. ZONING AND MAXIMUM BUILDOUT OF PRIVATE LANDS IN PROPOSED CRITICAL HABITAT ALONG OAK CREEK AND BEAVER/WET BEAVER CREEK

ZONE	DEFINITION	UNDEVELOPED ACRES IN CHD	DENSITY (UNITS PER ACRE)	ESTIMATED NUMBER OF UNDEVELOPED UNITS IN PARCELS
Beaver/Wet Beaver Creek				
INC	Incorporated	46	Undefined	Unknown
PAD	Residential, Rural, 2-acre zoning	0.02	1.2	0.027
R1-10	Residential, Single Family Limited	4	4.4	19
R1-12	Residential, Single Family Limited	-	1.2	-
R1L-10	Residential, Single Family Limited	22	0.6	13
R1L-12	Residential, Single Family	47	3.6	170
R1-35	Residential, Single Family Limited	-	2.4	-
R1L-175	Residential, Single Family Limited	5	3.6	16
R1L-35	Residential, Single Family	10	14.5	138
R1L-5A	Residential, Single Family	-	0.2	-
R1L-70	Planned Area Development	0.5	4.4	2
RCU-10	Residential, Single Family	-	0.1	-
RCU-2A	Commercial, General Sales and Service	87	0.5	43
<i>Total Potential Housing Units</i>		<i>221</i>		<i>402</i>
Expected Build Out Subtotal		155	-	283
Oak Creek				
INC	Incorporated	15	Undefined	Unknown
PAD	Residential, Rural, 2-acre zoning	8	1.2	10
R1-10	Residential, Single Family Limited	3	4.4	15
R1-12	Residential, Single Family Limited	21	1.2	26
R1L-10	Residential, Single Family Limited	-	0.6	0
R1L-12	Residential, Single Family	-	3.6	0
R1-35	Residential, Single Family Limited	43	2.4	104
R1L-175	Residential, Single Family Limited	13	3.6	45
R1L-35	Residential, Single Family	32	14.5	464
R1L-5A	Residential, Single Family	2	0.2	0.4
R1L-70	Planned Area Development	226	4.4	993
RCU-10	Residential, Single Family	12	0.1	1

ZONE	DEFINITION	UNDEVELOPED ACRES IN CHD	DENSITY (UNITS PER ACRE)	ESTIMATED NUMBER OF UNDEVELOPED UNITS IN PARCELS
RCU-2A	Commercial, General Sales and Service	179	0.5	90
<i>Total Potential Housing Units</i>		<i>556</i>		<i>1,750</i>
Expected Build Out Subtotal		391	-	1,230
<i>Beaver/Wet Beaver and Oak Creeks Max Build Out Grand Total</i>		<i>777</i>	-	<i>2,150</i>
Beaver/Wet Beaver and Oak Creek Estimated Build Out Total		546	-	1,510
<p>1 Estimated Build Out assumes that the level of development is proportional to the level of housing unit growth rate of 3.5 percent annually, or 70.2 percent over 20 years. Housing unit growth rate source: US Census Bureau State & County QuickFacts, http://quickfacts.census.gov/qfd/states/04000.html, accessed December 9, 2011; US Census Bureau. <i>Profiles of General Demographic Characteristics: 2000 Census of Population and Housing, Arizona</i>. May 2001.</p> <p>2 Density in incorporated areas is not determined at this time by zoning. Sources: Yavapai County zoning GIS layer: zonediss.shp, 2011; Yavapai County 2011 Parcels data: parcels.shp; Yavapai County GIS data, 2011 Building footprints (build07.shp). Written communication with K. Blake, GIS Coordinator, Yavapai County, February 22, 2011. 2003 Yavapai Counting Planning and Zoning Ordinance, accessed online at http://www.co.yavapai.az.us/departments/Dev/unitspc/ordregs/zo/zoningordinance.pdf, on March 2, 2011.</p>				

202. This analysis calculates future incremental development impacts by applying the per project cost estimates from Exhibit 7-4 to the number of projects expected to occur in critical habitat areas, as presented in Exhibit 7-8. As detailed in Exhibit 7-9, future incremental conservation costs associated with spikedace and loach minnow critical habitat are estimated to range from \$0 to \$780,000 (\$0 to \$68,800 on an annualized basis), with a discount rate of seven percent, over the next 20 years.

EXHIBIT 7-9. SUMMARY OF POTENTIAL INCREMENTAL COSTS TO DEVELOPMENTS ASSOCIATED WITH SPIKEDACE AND LOACH MINNOW CONSERVATION EFFORTS ON BEAVER/WET BEAVER AND OAK CREEKS

STREAM	UNDEVELOPED ACRES IN CHD	NUMBER OF UNDEVELOPED UNITS IN PARCELS	ESTIMATED NUMBER OF LARGE DEVELOPMENTS	ESTIMATED COSTS (2011\$ PRESENT VALUE, 7% DISCOUNT RATE)
Max Build Out				
Beaver/Wet Beaver Creek	221	402	0.5	\$294,000
Oak Creek	556	1,750	2.2	\$816,000
Total	777	2,150	2.7	\$1,110,000
Estimated Build Out (Using Housing Unit Growth Rate)				
Beaver/Wet Beaver Creek	155	283	0.4	\$573,000
Oak Creek	391	1,228	1.5	\$206,000
Total	546	1,510	1.9	\$780,000
Notes:				
1. Estimated Build Out assumes that the level of development is proportional to the level of housing unit growth rate of 3.5 percent annually, or 70.2 percent over 20 years. Housing unit growth rate source: US Census Bureau State & County QuickFacts, http://quickfacts.census.gov/qfd/states/04000.html , accessed December 9, 2011; US Census Bureau. <i>Profiles of General Demographic Characteristics: 2000 Census of Population and Housing, Arizona</i> . May 2001.				
2. Sources: Yavapai County zoning GIS layer: zonediss.shp, 2011; Yavapai County 2011 Parcels data: parcels.shp; Yavapai County GIS data, 2011 Building footprints (build07.shp). Written communication with K. Blake, GIS Coordinator, Yavapai County, February 22, 2011. 2003 Yavapai Counting Planning and Zoning Ordinance, accessed online at http://www.co.yavapai.az.us/departments/Dev/unitspc/ordregs/zo/zoningordinance.pdf , on March 2, 2011.				
3. Totals may not sum due to rounding.				

- 7.6 POTENTIAL INCREMENTAL ADMINISTRATIVE IMPACTS TO DEVELOPMENT ACTIVITIES**
203. Incremental administrative impacts include costs associated with consultations on unoccupied reaches, as well as the portion of consultation costs associated with evaluating adverse modification of habitat on occupied reaches. Because consultations on residential and commercial development have been rare, it is difficult to forecast the number of consultations that may be subject to section 7 consultation for development activities in the future, as the Homestead project constitutes the entire consultation history for this critical habitat.
204. Based on the number of incremental development projects estimated to occur over 20 years (three), we estimate three formal section 7 consultations associated with two future development projects anticipated to occur on Oak Creek and one future development project anticipated to occur on Beaver/Wet Beaver Creek over 20 years. Also included in incremental administrative costs is the cost of evaluating adverse modification of habitat for the single development project anticipated to occur on the Verde River. These

administrative costs are estimated at \$28,300 over 20 years (\$2,500 on an annualized basis), assuming a discount rate of seven percent.

**EXHIBIT 7-10. SUMMARY OF INCREMENTAL CONSERVATION AND ADMINISTRATIVE COSTS BY REACH
(2011\$ PRESENT VALUE, 7% DISCOUNT RATE)**

UNIT	REACH	CONSERVATION EFFORTS		ADMINISTRATIVE COSTS
		LOW	HIGH	
1	Verde River	\$0	\$0	\$2,830
	Oak Creek	\$0	\$573,000	\$17,000
	Beaver and Wet Beaver Creek	\$0	\$206,000	\$8,500
Total		\$0	\$780,000	\$28,300
Note: Totals may not sum due to rounding.				

CHAPTER 8 | POTENTIAL ECONOMIC IMPACTS TO TRIBES

205. Lands belonging to the San Carlos Apache Tribe, Yavapai-Apache Nation, and the White Mountain Apache Tribe are included within the boundaries of the proposed spikedace and loach minnow critical habitat, but are being considered for exclusion from final designation. This chapter considers potential economic impacts to Tribes associated with spikedace and loach minnow conservation efforts. Given the unique characteristics of Tribal economies, the approach used to analyze potentially affected activities on Tribal lands is different than that for other types of activities. This chapter provides a qualitative discussion of potential impacts, both baseline and incremental, and then quantifies the administrative costs associated with potential section 7 consultation.
206. We first provide a summary of potential baseline and incremental impacts to Tribes. Next, we provide a socioeconomic overview of the three Tribes with lands included within the boundaries of proposed critical habitat. We then discuss ongoing Tribal conservation efforts that may protect the spikedace and loach minnow, and the potential for critical habitat to result in incremental changes to Tribal activities. We also forecast administrative costs associated with section 7 consultations related to Tribal activities.
- 8.1 SUMMARY OF IMPACTS TO TRIBAL ACTIVITIES**
207. Exhibit 8-1 summarizes the quantified impacts of critical habitat designation on activities conducted on Tribal lands by stream reach. The present value of quantified incremental impacts to Tribal activities is estimated at \$123,000 assuming a seven percent real discount rate. This figure represents an annualized impact of approximately \$10,800. Total baseline impacts are estimated at \$368,000 in present value terms, or \$32,500 on an annualized basis. These impacts include only administrative effort as part of future section 7 consultations, and do not reflect any potential project modifications that may result from critical habitat designation. In addition, the estimates of administrative costs to third parties of participating in section 7 consultations are based largely on non-Tribal examples. The San Carlos Apache states in its comments that per consultation cost estimates may be too low.²⁹⁷ As a result, quantified costs to Tribes may be underestimated.
208. Of more concern to the Tribes than administrative costs are potential implications that critical habitat could have on their abilities to exercise their water rights, or to otherwise make use of natural resources on their lands. The chapter qualitatively discusses the

²⁹⁷ Public comments of John Bush, Vice-Chairman, San Carlos Apache Tribe, November 3, 2011.

potential for critical habitat to impact Tribal housing projects, traditional use of the river area, commercial development projects, tourism industry, and fire management activities (see Exhibit 8-1). In particular, both the Yavapai-Apache Nation and the White Mountain Apache Tribe have pending water exchange projects with Central Arizona Project water that have the potential to be affected by critical habitat designation. In general, all three Tribes are concerned about other economic development opportunities that could be affected by requirements related to spikedace and loach minnow critical habitat designation. These potential impacts could result in additional incremental impacts that are not quantified in this chapter.

209. It is important to note that because the potentially affected Tribes are sovereign nations, they have a unique relationship with the U.S. government. Secretarial Order 3206 recognizes that Tribes have governmental authority and the desire to protect and manage their resources in the manner that is most beneficial to them. The analysis attempts to capture the concerns that Tribes have about the potential implications that critical habitat could have on their operations that, due to Federal oversight, could compel them to modify their current plans for use of their resources.

8.2 BACKGROUND AND APPROACH TO EVALUATING IMPACTS TO AFFECTED TRIBES

210. Approximately 54 miles of proposed critical habitat fall on lands belonging to the San Carlos Apache Tribe, Yavapai-Apache Nation, and the White Mountain Apache Tribe (see Exhibit 8-2). The Tribes with lands in proposed critical habitat are sovereign nations. As stated in Executive Order 13175:

The United States has a unique legal relationship with Indian tribal governments as set forth in the Constitution of the United States, treaties, statutes, Executive Orders, and court decisions. Since the formation of the Union, the United States has recognized Indian tribes as domestic dependent nations under its protection. The Federal Government has enacted numerous statutes and promulgated numerous regulations that establish and define a trust relationship with Indian tribes.²⁹⁸

A recent presidential memorandum further charged executive departments and agencies with “engaging in regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications.”²⁹⁹

²⁹⁸ Executive Order 13175, Consultation and Coordination with Indian Tribal Governments.

²⁹⁹ White House, *Memorandum for the Heads of Executive Departments and Agencies: Subject: Tribal Consultation*, November 5, 2009. Accessed at: <http://www.whitehouse.gov/the-press-office/memorandum-tribal-consultation-signed-president>.

EXHIBIT 8-1. SUMMARY OF INCREMENTAL AND BASELINE IMPACTS TO TRIBES (2011\$, DISCOUNTED AT SEVEN PERCENT)

UNIT	REACH	INCREMENTAL		BASELINE		UNQUANTIFIED IMPACTS
		PRESENT VALUE	ANNUALIZED	PRESENT VALUE	ANNUALIZED	
1	Verde River	\$44,600	\$3,930	\$134,000	\$11,800	<ul style="list-style-type: none"> • Housing development. • CAP project and other water rights. • Other economic development. • Traditional uses of land.
	Beaver and West Beaver Creek	\$0	\$0	\$0	\$0	
2	White River	\$17,300	\$1,530	\$51,800	\$4,570	<ul style="list-style-type: none"> • Water rights settlement and dam project. • Tourism and outdoor recreation industry. • Housing and agricultural development. • Traditional uses of land. • Prescribed burns and other fire management activities.
	East Fork White River	\$17,300	\$1,530	\$51,800	\$4,570	
4	Bonita Creek	\$0	\$0	\$0	\$0	<ul style="list-style-type: none"> • Water use, as well as potential water exchanges.
5	Eagle Creek	\$43,700	\$3,860	\$131,000	\$11,600	<ul style="list-style-type: none"> • Livestock use of proposed critical habitat for grazing and water. • Fire management activities. • Traditional uses of land. • Tourism and outdoor recreation industry.
Total		\$123,000	\$10,800	\$368,000	\$32,500	
<p>Note: Totals may not sum due to rounding.</p> <p>Note: Tribal lands are considered for exclusion from critical habitat designation in the Proposed Critical Habitat rule.</p>						

EXHIBIT 8-2. TRIBAL LANDS IN PROPOSED CRITICAL HABITAT

UNIT	RIVER SEGMENT	TRIBE	PROPOSED CRITICAL HABITAT RIVER MILES
1	Verde River	Yavapai-Apache Nation (Camp Verde Reservation)	1.20
	Beaver/Wet Beaver Creek		0.12
2	East Fork White River	White Mountain Apache Tribe (Fort Apache Reservation)	17.22
	White River		18.34
5	Eagle Creek	San Carlos Apache Tribe	17.45

Source: GIS analysis.

211. Department of Interior Secretarial Order 3206 recognizes that Tribes have governmental authority and the desire to protect and manage their resources in the manner that is most beneficial to them.³⁸⁷ The San Carlos Apache and White Mountain Apache Tribes have their own natural resource programs and staff (the Yavapai-Apache Nation, due to its small size, does not). All three affected Tribes have enacted or are in the process of developing resource management plans, either specifically for native fish species, or for other riparian species (e.g., the southwestern willow flycatcher). In addition, as trustee for land held by the United States for Indian Tribes, the Bureau of Indian Affairs (BIA) provides technical assistance to the Tribes on forest management planning and oversees a variety of programs on Tribal lands. The Yavapai-Apache Nation expressed in public comments, submitted on November 3, 2011, that BIA does not presently have or will have in the future “sufficient funding and/or programs to ‘offset’ the increased administrative and other costs resulting from the designation of critical habitat on Tribal lands such as the Yavapai-Apache Reservation.”³⁸⁸ The Yavapai-Apache Nation states that “it remains the Nation's position that the Secretary of the Interior (“Secretary”) lacks legal authority to designate critical habitat on the Nation's lands.”³⁸⁹ The San Carlos Apache Tribe has made similar remarks in regard to this and other proposed critical habitat designations.³⁹⁰

³⁸⁷ Department of Interior, Secretarial Order # 3206: Subject: American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act, June 1997.

³⁸⁸ Public comments of Susan B Montgomery, Special Counsel to the Yavapai-Apache Nation, submitted on behalf of the Yavapai-Apache Nation on November 3, 2011.

³⁸⁹ Public comments of Susan B Montgomery, Special Counsel to the Yavapai-Apache Nation, submitted on behalf of the Yavapai-Apache Nation on November 3, 2011.

³⁹⁰ Public comments of John Bush, Vice-Chairman, San Carlos Apache Tribe, November 3, 2011; Public comments of Susan B. Montgomery, Sparks, Tehan, and Ryley P.C., Special Counsel to the San Carlos Apache Tribe, “Comments to Proposed Rule to Draft Environmental Assessment and Final Draft Economic Analysis of Critical Habitat for the Gila chub.” September 30, 2005.

212. Given the unique characteristics of Tribal economies, the approach used to analyze potentially affected activities on Tribal lands is different than that for other types of activities. This section provides a discussion of the current economic status of the Tribal community underscoring the conditions on the affected Reservations. Available data demonstrate the economic vulnerability of the Tribes; their economies are characterized by high unemployment, low income, low education levels and high poverty rates (see Exhibit 8-3). In addition, unique circumstances of communities on Tribal lands affect re-employment opportunities. For example, Tribal members may be less mobile than non-Tribal members. That is, Tribal members who lose jobs may be hesitant to move off the reservation to find work elsewhere. Thus, if spikedace and loach minnow conservation impacts job availability on the Reservations, those impacts may be compounded by poor baseline economic conditions, and lack of local alternative opportunities. The remainder of this section discusses each potentially affected Tribe individually.

8.2.1 YAVAPAI-APACHE NATION

213. The Yavapai-Apache Nation is located on a collection of land parcels known as Camp Verde Reservation. The approximately 1,800 acres of the Reservation are distributed in parcels located near Clarkdale, Middle Verde, Camp Verde, Rim Rock, and at the I-17 interchange for the Montezuma Castle National Monument in Arizona.³⁹¹ Approximately five percent of the Camp Verde Reservation along the Verde River and Beaver and Wet Beaver Creek are included in the proposed spikedace and loach minnow critical habitat. The intersection of Camp Verde lands with proposed critical habitat is presented in Exhibit 8-4.
214. The Yavapai-Apache Nation has approximately 2,290 enrolled members as of December 2010. As reported by the 2010 American Community Survey, the unemployment rate was 12.3 percent in 2010, more than four percent higher than the average for Arizona.³⁹² Per capita income was \$10,275 in 2010, less than half the average for Arizona. In addition, approximately 42.4 percent of the Tribe's population lives below the poverty line.³⁹³

8.2.2 WHITE MOUNTAIN APACHE TRIBE

215. The White Mountain Apache Tribe is located on the Fort Apache Reservation, a reservation of 1.7 million acres in Southeastern Arizona that abuts the San Carlos Apache Reservation. The entire reach of the East Fork White River segment falls on the Reservation, as well as parts of the White River. Approximately 35.56 river miles of critical habitat have been proposed on the Fort Apache Reservation. The intersection of White Mountain Apache Tribe lands with proposed critical habitat is presented in Exhibit 8-5.

³⁹¹ Letter of Susan B. Montgomery, Sparks, Tehan, and Ryley, Special Counsel to the Yavapai-Apache Nation, to Industrial Economics, Inc, "re: Information per your request regarding proposed critical habitat for the Spikedace," February 16, 2006.

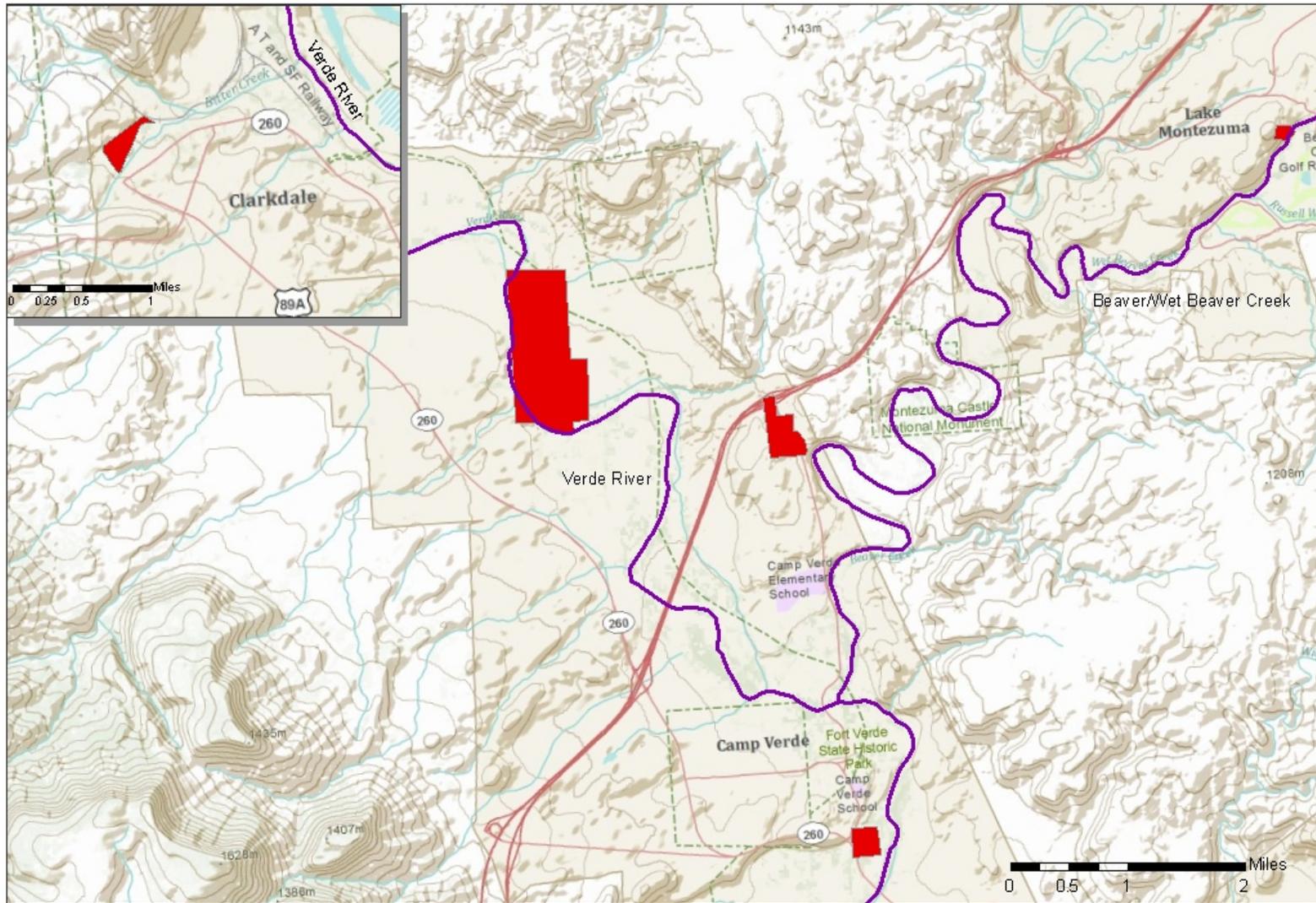
³⁹² Arizona Unemployment Statistics Program, Special Unemployment Report, 2010. Accessed at: <http://www.workforce.az.gov/cgi/databrowsing/?PAGEID=4&SUBID=142> .

³⁹³ American Community Survey 2010, 5-Year Estimates. <http://www.census.gov/acs/www/> accessed December 19, 2011.

EXHIBIT 8-3. CENSUS SOCIOECONOMIC INFORMATION FOR AFFECTED TRIBES (2000)

AREA/TRIBAL LANDS	POPULATION	UNEMPLOYMENT RATE ⁽¹⁾	PER CAPITA INCOME	POVERTY RATE ⁽²⁾
National Level Information				
USA	308,745,538 ⁵	9.6% ⁶	\$40,584 ⁷	14.3% ⁸
State Level Information				
Arizona	6,392,017 ⁵	8.0% ⁶	\$34,999 ⁷	16.5% ⁸
Tribal Level Information				
Yavapai-Apache Nation(Camp Verde Reservation)	718 ^{3,9}	12.3% ^{4,10}	\$10,275 ¹⁰	42.4% ¹⁰
San Carlos Apache Tribe	10,068 ⁹	19.8% ^{4,10}	\$10,222 ¹⁰	46% ¹⁰
White Mountain Apache (Fort Apache Reservation)	13,409 ⁹	30.9% ^{4,10}	\$9,688 ¹⁰	46.7% ¹⁰
Notes:				
1. Unemployment rate provided by the Census is the number of unemployed 16 and over as a percent of the total civilian force. Source:				
2. Poverty rate represents the percent of individuals below the applicable poverty threshold level. Poverty thresholds are the same for all parts of the country, but vary depending on the applicable family size, age of householder, and number of related children under 18. Poverty thresholds are shown at http://www.census.gov/hhes/poverty/threshld/thresh99.html .				
3. Personal communication with Susan Montgomery and Robyn Interpreter, Montgomery & Interpreter, plc on behalf of the Yavapai-Apache Nation, on March 8, 2011.				
4. The Arizona Unemployment Statistics Program reports 2010 unemployment for the tribes as 23.1 percent, 26.8 percent, and 39.1 percent for the Yavapai-Apache, San Carlos Apache, and the White Mountain Apache, respectively. Both the White Mountain Apache Tribe and the San Carlos Apache Tribe have stated that they believe that this estimate is low. The White Mountain Apache Tribe's records indicate that unemployment was hovering between 60 and 67 percent in 2004, while a study by the San Carlos Apache Tribe found that the unemployment rate is 67 percent. Letter from Joe Sparks, Sparks, Tehan & Ryley, P.C. re: Request for Information Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher, dated September 7, 2004; Public comments of John Bush, Vice-Chairman, San Carlos Apache Tribe, November 3, 2011.				
Sources:				
5. U.S. Census Bureau, Census 2010. Arizona Quickfacts, accessed at http://quickfacts.census.gov/qfd/states/04000.html on December 15, 2011.				
6. U.S. Census Bureau, Census 2010. "Table 629 - Total Unemployed and Insured Unemployed by State," accessed at http://www.census.gov/compendia/statab/cats/labor_force_employment_earnings.html on December 15, 2011.				
7. U.S. Census Bureau, Census 2010. "Table 709 - Individuals and Families Below Poverty Level--Number and Rate by State," accessed at http://www.census.gov/compendia/statab/cats/income_expenditures_poverty_wealth.html on December 15, 2011. Per Capita income listed represents 2010 preliminary estimates.				
8. U.S. Census Bureau, Census 2010. "Table 709 - Individuals and Families Below Poverty Level--Number and Rate by State," accessed at http://www.census.gov/compendia/statab/cats/income_expenditures_poverty_wealth.html on December 15, 2011. Poverty rates listed reflect 2009 poverty rates.				
9. U.S. Census Bureau, 2010 Census.				
10. American Community Survey 2010, 5-Year Estimates. http://www.census.gov/acs/www/ accessed December 19, 2011.				

EXHIBIT 8-4. INTERSECTION OF YAVAPAI-APACHE RESERVATION LANDS WITH PROPOSED CRITICAL HABITAT



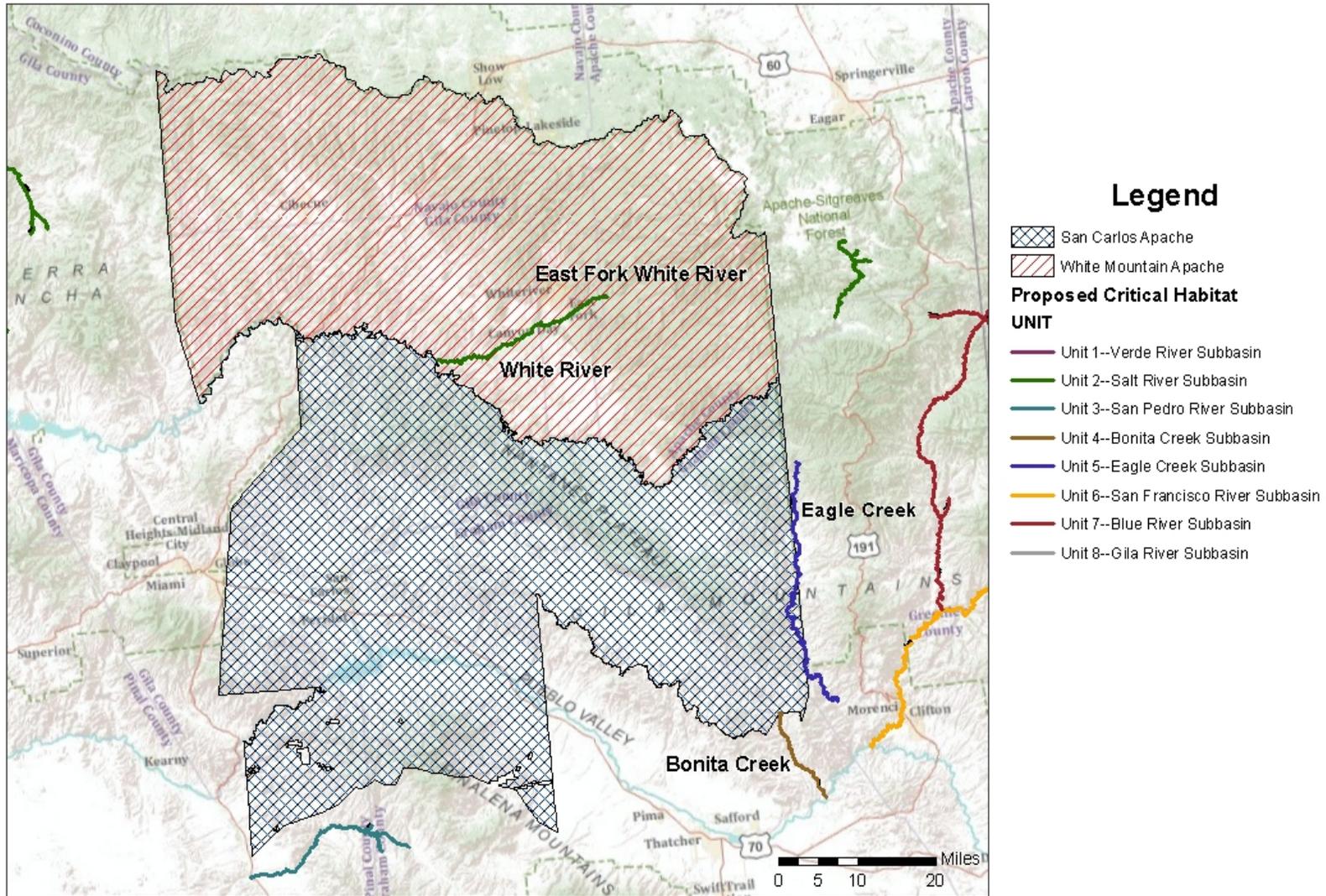
Legend

-  Proposed Critical Habitat
-  Yavapai Apache Nation

Source:

1. US Fish and Wildlife Service, Field Office
2. Environmental Systems Research Institute, Inc. (ESRI), Redlands, California, USA

EXHIBIT 8-5. FORT APACHE AND SAN CARLOS APACHE RESERVATIONS



Source:
 1. US Fish and Wildlife Service, Field Office
 2. Environmental Systems Research Institute, Inc. (ESRI), Redlands, California, USA

216. The U.S. Census estimates that Fort Apache Reservation had a population of 13,409 enrolled members residing on the reservation in 2010.³⁹⁴ The unemployment rate was reported as 30.9 percent for 2010, but the Tribe has previously stated that it believes unemployment to be much higher than this estimate. The Tribe's records indicate that unemployment hovers between 60 and 67 percent.³⁹⁵ The Tribe reports that "the vast majority" of employed Tribal members are employed in Tribal enterprises and governmental departments.³⁹⁶ The Tribe also notes that unemployment on the Reservation has been exacerbated by the 2002 Rodeo-Chediski fire, which burned a large amount of the timber resources on the Reservation.³⁹⁷ Per capita income was \$9,688 in 2010, less than half the average for Arizona. In addition, approximately 46.7 percent of the Tribe's population lives below the poverty line.³⁹⁸

8.2.3 SAN CARLOS APACHE TRIBE

217. The San Carlos Apache Reservation encompasses over 1.8 million acres in southeast Arizona. As shown in Exhibit 8-5, portions of Eagle Creek occur on the San Carlos Apache Reservation. In considering the Service's 300-foot buffer on either side of stream, approximately 17.5 river miles of critical habitat have been proposed on San Carlos Apache Tribal land along Eagle Creek, and the White River. In addition, the Carlos Apache have rights to water on Bonita Creek.
218. As stated in its public comments, "Tribal lands are primarily poor, rural areas that may be particularly vulnerable to economic impact associated with increased regulatory burden."³⁹⁹ Based on U.S. Census data, the Tribe's population was 9,385 in 2000; current population is estimated at more than 10,000.⁴⁰⁰ A recent study by the Tribe found that the unemployment rate is much higher than reported by the U.S. Census, at 76 percent, indicating that at least seven out of ten people in the Tribe's labor force is unemployed.⁴⁰¹ San Carlos Apache per capita income was \$10,222 in 2010, or about two-fifths of the Arizona average. In addition, the poverty rate on the San Carlos Apache Reservation was 46 percent in 2010. These data illustrate the vulnerability of the San Carlos Apache Tribe to economic impact or regulatory burden.

³⁹⁴ American Community Survey 2010, 5-Year Estimates. <http://www.census.gov/acs/www/> accessed December 19, 2011.

³⁹⁵ Written comments of D. Massey Sr., Tribal Chairman, White Mountain Apache Tribe, March 27, 2006, citing information from White Mountain Apache Personnel Department, December 9, 2005 and Testimony of Chairman Dallas Massey Sr, White Mountain Apache Tribe Oversight Hearing, Regulation of Indian Gaming, June 28, 2005.

³⁹⁶ Written comments of D. Massey Sr., Tribal Chairman, White Mountain Apache Tribe, March 27, 2006.

³⁹⁷ Written comments of D. Massey Sr., Tribal Chairman, White Mountain Apache Tribe, March 27, 2006; Personal communication with A. Bernhardt, Counsel for the White Mountain Apache Tribe, and several staff members of the Wildlife and Outdoor Recreation Division, WMAT Department of Fish and Wildlife Management, April 11, 2006.

³⁹⁸ American Community Survey 2010, 5-Year Estimates. <http://www.census.gov/acs/www/> accessed December 19, 2011.

³⁹⁹ Public comments of John Bush, Vice-Chairman, San Carlos Apache Tribe, November 3, 2011.

⁴⁰⁰ American Community Survey 2010, 5-Year Estimates. <http://www.census.gov/acs/www/> accessed December 19, 2011.

⁴⁰¹ Public comments of John Bush, Vice-Chairman, San Carlos Apache Tribe, November 3, 2011.

219. The San Carlos Apache Tribe's economy includes cattle operations, forestry operations, mining, gaming, a small service sector, and tourism and recreation. The Tribe has five cattle associations, generating \$1 million annually in livestock sales, representing the Tribe's third-largest source of income.⁴⁰² The San Carlos Apache Tribe operated the Cutter sawmill outside of Globe, Arizona, but in 2000 the mill was leased to a private company, Precision Pine.

8.3 BASELINE PROTECTIONS

220. All three Tribes currently undertake conservation efforts for native fish, including the spikedace and loach minnow. Tribal activities that may affect spikedace or loach minnow are covered under management plans, established Best Management Practices (BMPs), and Tribal ordinances. The following sections discuss these baseline protections in greater detail by Tribe.

8.3.1 YAVAPAI-APACHE NATION BASELINE PROTECTIONS

221. While the Nation wants to maintain the options to use their lands as they see fit, the Tribe also states that it has historically worked to protect wildlife and the unique riparian habitat of the Verde River, and already protects the riparian areas under its jurisdiction. Ongoing conservation efforts for the spikedace and loach minnow include the passing of Tribal Resolution No. 46-2006, which establishes certain land use restrictions and management goals for the Verde River under Tribal law.
222. Specifically, Tribal Resolution No. 46-2006 formally designates a Riparian Conservation Corridor extending from the center of the river to 300 lateral feet on either side of the bankfull stage of the Verde River. Within this corridor, the Nation has prohibited stocking of non-native fishes, and requires that activities be minimized to prevent habitat loss. The Resolution also sets forth the Nation's commitment to cooperate with the Service on habitat monitoring, surveys, and future activities within the Corridor.⁴⁰³
223. Since the enactment of the Tribal Resolution, the Nation also has taken additional steps to protect the Verde River. For example, the Tribal housing department and planning committee do not allow development within the Riparian Conservation Corridor when evaluating requests for Tribal home sites or when considering other construction activities as part of the Nation's land use planning efforts.⁴⁰⁴ The Nation also states that it has adopted a Southwestern willow flycatcher Management Plan, which also provides protections for the riparian area on the Verde River.⁴⁰⁵

⁴⁰² Tiller, Veronica E. Velarde. *Tiller's Guide to Indian Country*. BowArrow Publishing, Albuquerque, NM, USA. 2005.

⁴⁰³ Public comments of Susan B. Montgomery, Montgomery & Interpreter, plc, on behalf of the Yavapai-Apache Nation, December 27, 2010.

⁴⁰⁴ *Ibid.*

⁴⁰⁵ Letter of Susan B. Montgomery, Sparks, Tehan, and Ryley, Special Counsel to the Yavapai-Apache Nation, to Industrial Economics, Inc. "re: Information per your request, regarding proposed critical habitat for the Spikedace," February 16, 2006.

8.3.2 WHITE MOUNTAIN APACHE TRIBE BASELINE PROTECTIONS

224. The Tribe undertakes a range of conservation efforts. The Tribe has adopted Best Management Practices (BMPs) that must be observed when there is any activity that disturbs Tribal land. These BMPs include the development of a Loach Minnow Management Plan in January 2000. Under this plan, the Tribe's Wildlife and Outdoor Recreation Division inventories, monitors, and manages for the loach minnow.⁴⁰⁶
225. Tribal fish biologists and the sensitive coordinator monitor any land operations or proposed timber sales along the East Fork White River. For example, if river flows fall below a certain flow level, irrigation ditch gates are closed until such time as stream levels are restored. Tribal fish biologists also work to ensure that timber sales that may affect the East Fork White River comply with the BMPs.⁴⁰⁷

8.3.3 SAN CARLOS APACHE TRIBE BASELINE PROTECTIONS

226. As stated in its public comments, "the San Carlos Apache Tribe has been intimately and actively involved in conservation efforts for the spikedace and loach minnow, together with other native, threatened and/or endangered species, with the Service and other stakeholders for years."⁴⁰⁸ The Tribe points out in its public comments that "jeopardizing the existence of any species would be counter the Apache cultural belief that all things were created for a purpose and have value."⁴⁰⁹ The Tribe developed a Draft Fisheries Management Plan in 2003, and subsequently revised this plan September 2005.⁴¹⁰ Under this plan, the Tribe conducts surveying and monitoring for the spikedace and loach minnow.⁴¹¹ In addition, sportfish stocking is prohibited in reservation streams or rivers, and no sportfish stocking in the Bonita Creek watershed.⁴¹²

8.4 POTENTIALLY AFFECTED ACTIVITIES

227. This section highlights Tribal activities occurring within proposed critical habitat areas that the Tribes believe potentially may be affected by the critical habitat designation. As discussed in greater detail below, the likelihood that these activities may be affected by critical habitat designation is unclear, and the Tribes are uncertain about the extent to which critical habitat will result in project modifications. Therefore, this section does not quantify impacts associated with any of these activities, but rather qualitatively discusses the types of activities that the Tribes believe may be affected.

⁴⁰⁶ Public comments of R. Brauchli, Brauchli & Brauchli, P.C., on behalf of the White Mountain Apache Tribe, dated February 21, 2006.

⁴⁰⁷ Ibid.

⁴⁰⁸ Public comments of John Bush, Vice-Chairman, San Carlos Apache Tribe, November 3, 2011.

⁴⁰⁹ Ibid.

⁴¹⁰ Ibid.

⁴¹¹ Personal communication with Stefanie White, San Carlos Apache Recreation and Wildlife Department, August 24, August 26, and September 8, 2004.

⁴¹² Public comments of John Bush, Vice-Chairman, San Carlos Apache Tribe, November 3, 2011.

8.4.1 YAVAPAI-APACHE NATION

228. The Yavapai-Apache Nation states that “given the small size of the Reservation, the proposed designation will have a disproportionate impact on the Nation relative to other potentially affected parties [...] particularly with regard to the Nation’s sovereign and Constitutional right to exercise control over its own lands and water resources on the Reservation.”⁴¹³ Due to the small size of the Reservation, the areas proposed as critical habitat represent nearly five percent of the land holdings of the Nation.
229. With such a small reservation, the Nation needs to be able to manage its lands in such a way as to achieve economic self-sufficiency in the long term, and it is concerned that proposed critical habitat could hinder its management ability. As such, the Nation may wish to use lands within and adjacent to proposed critical habitat areas for uses such as farming, light industrial, or other economic development purposes. Specifically, the Nation notes the potential for the following activities to be impacted by the critical habitat designation:
- **Housing Development.** Using funds from the US Department of Housing and Urban Development, the Nation is presently constructing 45 homes near the Middle Verde, but outside the Riparian Conservation Corridor. These houses are scheduled to be completed within a year, but the Nation hopes to continue residential development on the Reservation over the next twenty years.⁴¹⁴
 - **CAP Project and Other Water Rights.** For the past 30 years, the Nation has been allocated 1,200 acre feet of water from the CAP project. The Nation recently completed an appraisal level study to conduct a water exchange in order to use these rights, and additional studies are anticipated in the near future. The Nation is particularly concerned that the designation of critical habitat may require it to complete an Environmental Impact Statement (EIS) instead of a less costly Environmental Assessment. The Nation also is in the process of negotiating a settlement of its water rights, and is concerned that the designation of critical habitat could affect or delay this settlement.⁴¹⁵
 - **Other Economic Development.** The Nation also operates some wastewater treatment facilities on the Reservation, and has plans to construct a shopping center along the I-17 corridor. While these activities are planned outside of the Riparian Conservation Corridor, the Nation remains concerned that the designation of critical habitat may trigger section 7 consultation for these

⁴¹³ Public comments of Susan B. Montgomery, Montgomery & Interpreter, plc, on behalf of the Yavapai-Apache Nation, December 27, 2010.

⁴¹⁴ Written communication from Susan B. Montgomery, Montgomery & Interpreter, plc, on behalf of the Yavapai-Apache Nation, March 9, 2011.

⁴¹⁵ Personal communication with Susan B. Montgomery and Robyn Interpreter, Montgomery & Interpreter, plc, on behalf of the Yavapai-Apache Nation, March 8, 2011.

projects, and otherwise result in delays and additional administrative burden on the Nation.⁴¹⁶

- **Traditional Purposes.** The Nation uses the Verde River area for traditional purposes, such as willow harvesting, and also claims aboriginal and Federal Reserve water rights to the River.

230. Although the future incremental impacts of designating spikedace and loach minnow critical habitat on the Yavapai-Apache Nation are not certain, the Tribe believes that plans for economic development could be affected by this proposed critical habitat, particularly given the small size of the Reservation.⁴¹⁷ In addition to the above concerns, the Nation is concerned that the designation of critical habitat may hamper or confuse the Nation's own long-standing protections for the Verde River and its habitat, including those protections outlined in the Nation's designation of a Riparian Conservation Corridor (Resolution No. 46-2006).⁴¹⁸

8.4.2 WHITE MOUNTAIN APACHE TRIBE

231. In their public comments on both the current proposed critical habitat and past designations, the Tribe states that critical habitat designation generally would affect "tribal rights and trust resources, including exercise of our water rights, timber, and fisheries. It could affect economic activity, our recreation program, our cultural practices, and our municipal water supply." More specifically, the White Mountain Apache Tribe states that the designation of critical habitat on their lands would:⁴¹⁹

- adversely impact the Tribe's working relationship with the Service and would be contrary to the government-to-government relationship that it has established with the Service for over a decade;
- not comply with the Service's affirmative trust obligation to consider Tribal reserved water rights in the context of implementation of the Act;
- undermine the Tribe's own watershed-based ecosystem management approach and result in needless diversion of resources away from the Tribe's own on-the-ground conservation efforts. Specifically, the Wildlife and Outdoor Recreation Division of the Tribe's Department of Fish and Wildlife Management point out that, in addition to having a loach minnow management plan, the Tribe has a

⁴¹⁶ Personal communication with Susan B. Montgomery and Robyn Interpreter, Montgomery & Interpreter, plc, on behalf of the Yavapai-Apache Nation, March 8, 2011.

⁴¹⁷ Personal communication with Susan B. Montgomery and Robyn Interpreter, Montgomery & Interpreter, plc, on behalf of the Yavapai-Apache Nation, March 8, 2011.

⁴¹⁸ Public comments of Susan B Montgomery, Special Counsel to the Yavapai-Apache Nation, submitted on behalf of the Yavapai-Apache Nation on November 3, 2011.

⁴¹⁹ Public comments of Robert C. Brauchli, Law Office of Robert C. Brauchli, P.C., on behalf of the White Mountain Apache Tribe, dated December 27, 2010. Public comments of R. Brauchli, Brauchli & Brauchli, P.C., on behalf of the White Mountain Apache Tribe, "Re: White Mountain Apache Tribe's Comments on Proposed Rule to Designate Critical Habitat for Spikedace and Loach Minnow, RIN No. 1018-AU33, 70 Fed. Reg. 75546 (December 20, 2005)," Feb. 21, 2006; Written comments of D. Massey Sr., Tribal Chairman, White Mountain Apache Tribe, March 27, 2006.

protective water quality ordinance, water management plan, forest management plan, Arizona willow management plan, Mexican wolf management plan, and is an active member of several native fish working groups, including the Southwest Indian Fisheries Commission.⁴²⁰

- affect Tribal practices that take place adjacent to the river including the Apache Sunrise Dance and sweat lodge activities as well practices dependent on culturally important vegetation that grow along the river;
- create a considerable social and economic hardship for the Tribe, limiting its ability to conduct activities necessary to sustain an economy and its growing population, particularly affecting its developing tourism and outdoor recreation industry and dependent businesses. The Tribe notes that hunting profits were \$1.7 million in 2005, and that fishing, camping, and other outdoor recreation had profits to the Tribe of \$1.3 million in 2005.⁴²¹
- affect its recently approved water rights settlement and the use of these rights. In particular, the Tribe is planning and designing a dam on the North Fork White River with 8,000 acre feet of active storage. The Tribe is concerned that the designation of critical habitat downstream on the White River could interfere with or delay its water rights legislation, and affect its ability to use this water to support housing and agricultural development on the Reservation. While the Tribe has limited acreage available for agricultural cultivation, agricultural development on the Reservation is necessary for the Tribe to be self-sustaining.⁴²²
- impact potential expansion and restoration projects such as the restoration of the Fort Apache Historical District, plans to restore fruit orchards, and expansion of visitor accommodations. The orchard areas, and several planned trails will occur in proposed critical habitat areas. In addition, water supply to some buildings in the Fort Complex could require water from the proposed critical habitat reach.⁴²³
- could impair the tribe's ability to conduct prescribed burns thereby increasing the likelihood of a reservation fire.
- result in an increased administrative burden for the Tribe to conduct section 7 consultations, hire outside experts, and prepare environmental compliance reports.⁴²⁴

⁴²⁰ Personal communication with C. Dale, Wildlife and Outdoor Recreation Division, WMAT Department of Fish and Wildlife Management, April 11, 2006.

⁴²¹ Written comments of D. Massey Sr., Tribal Chairman, White Mountain Apache Tribe, March 27, 2006.

⁴²² Personal communication with Robert C. Brauchli. Law Office of Robert C. Brauchli, P.C., on behalf of the White Mountain Apache Tribe, March 14, 2011.

⁴²³ Personal communication with A. Bernhardt, Counsel for the White Mountain Apache Tribe, and several staff members of the Wildlife and Outdoor Recreation Division, WMAT Department of Fish and Wildlife Management, April 11, 2006.

⁴²⁴ Personal communication with Robert C. Brauchli. Law Office of Robert C. Brauchli, P.C., on behalf of the White Mountain Apache Tribe, March 14, 2011.

232. The White Mountain Apache Tribe questions the legality of and the Service's authority to make such designations and argue that their Tribal lands do not meet the definition of critical habitat because they are already being adequately protected. The Tribe also states that pursuant to Executive Order 13084, the Service cannot make designations without providing funds necessary to pay the direct costs incurred by the Indian tribal government in complying with the regulation.

8.4.3 SAN CARLOS APACHE TRIBE

233. As stated in the San Carlos Apache Tribe's public comments on another native fish, the Gila chub, "due to the unique Trust relationship between the United States and the Tribe, a significant number of Tribal programs, activities, and development projects require Federal government involvement, funding, or oversight. Thus...there will frequently be a Federal nexus requiring costly section 7 consultation with the [Service] for any Tribal project, activity, or development endeavor."⁴²⁵ Based on recent public comments, past conversations with Tribal staff, BIA and the Service, as well as consultation records, past and potential ongoing impacts to San Carlos Apache activities related to spikedace and loach minnow conservation efforts could include the following:

- Impacts on water use by the Tribe, as well as potential water exchanges;
- Limitations on livestock use of proposed critical habitat for grazing and water;
- Traditional uses, such as willow gathering;
- Recreational activities; and
- Limitations on fire management activities.

In addition, the Tribe has also stated concerns that critical habitat designation may be "viewed as an unwarranted and unwanted intrusion on Tribal self-governance and sovereignty, thus compromising the government-to-government relationship essential to achieving our mutual goals of managing for healthy ecosystems upon which the viability of all threatened and endangered species populations depend."⁴²⁶

Water Resources

234. The Gila River flows through the San Carlos Apache Reservation from the east and pools into the San Carlos Lake behind Coolidge Dam on the western portion of the Reservation. This portion of the Gila River is not proposed as critical habitat. Below the Lake, the River flows out of the Reservation and intersects the San Pedro River. Further downstream, the Gila River is diverted to irrigators at Ashurst-Hayden dam. Although the Gila River is the largest river on the Reservation, several smaller tributaries cross the Reservation, including a portion of Eagle Creek which is proposed as critical habitat.

⁴²⁵ Public comments of Susan B. Montgomery, Sparks, Tehan, and Ryley P.C., Special Counsel to the San Carlos Apache Tribe, "Comments to Proposed Rule to Draft Environmental Assessment and Final Draft Economic Analysis of Critical Habitat for the Gila chub." September 30, 2005.

⁴²⁶ Public comments of John Bush, Vice-Chairman, San Carlos Apache Tribe, November 3, 2011.

235. The Tribe is concerned that proposed critical habitat for spikedace and loach minnow may threaten the ability of the Tribe to utilize its water resources on the Reservation. Water use on the Reservation is generally constrained by the arid climate of the Reservation, competing water claims, as well as by the 1935 Globe Equity 59 Decree (on the mainstem Gila River). Thus any restrictions in management of Eagle Creek for spikedace and loach minnow purposes could threaten Tribal uses of this water.
236. If the amount of water available to the San Carlos Apache Tribe for irrigation were to be limited to protect the spikedace and loach minnow, the Tribe's agriculture activities would be affected. The San Carlos Apache Tribe has been farming for hundreds of years in the Gila Valley, with over 9,000 acres of land under cultivation in the late 1800s. According to the Tribe, "the Tribe now struggles to farm a fraction of these lands due to the lack of a reliable water supply."⁴²⁷ The San Carlos Apache Tribe farms approximately 500 acres, generating approximately \$135,000 in annual profits (for the period from October 2003 through July 2004) and supporting six jobs with \$165,000 in payroll. The Tribe has invested heavily in equipment for its agricultural operations, and is looking into expanding farming, possibly beginning with adding approximately 1,000 acres.⁴²⁸ While expansion plans are still uncertain, there are thousands of acres of irrigable lands on the Reservation.⁴²⁹ If restrictions related to spikedace and loach minnow conservation measures impact the Tribe's ability to continue or expand farming on the Reservation, these jobs and revenues may be affected.

Livestock Grazing

237. Livestock grazing is an important source of income for the San Carlos Apache Tribe, as large portions of San Carlos Apache lands are grazed by five livestock associations and two tribal ranches. In the past, livestock association personnel have expressed concerns that grazing could be impacted by other proposed critical habitat designations on the Tribe's lands.⁴³⁰
238. It is unknown what modifications or mitigation measures may be recommended to grazing activities as a result of spikedace and loach minnow concerns. If the Service recommended or the Tribe chose to implement mitigation measures, one option could be the installation of fencing along Eagle Creek to exclude livestock from the streams and adjacent riparian areas. Costs of fencing enclosures are anticipated to range from \$1,690 to \$16,900 per river mile of fence construction. The Tribe would also incur costs related to annual maintenance of the fencing, of approximately \$124 to \$2,930 per mile. In addition, if fencing were installed, water would need to be provided to livestock outside

⁴²⁷ Letter from Susan B. Montgomery, Sparks, Tehan & Ryley, P.C. re: Comments to Draft Economic Analysis Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher on the San Carlos Apache Reservation, dated October 6, 2004.

⁴²⁸ Personal communication with Victoria Wesley, Forest Resource Program, San Carlos Apache Tribe, August 30, 2004.

⁴²⁹ Letter from Joe Sparks, Sparks, Tehan & Ryley, P.C. re: Request for Information Regarding Possible Designation of Critical Habitat for the Southwestern Willow Flycatcher, dated September 7, 2004.

⁴³⁰ Personal communication with San Carlos Apache Tribe and livestock association personnel, May 25, 2005; personal communication with San Carlos Apache personnel, June 16, 2005.

the enclosure. The cost to construct a dirt impoundment to store overland flow ranges between \$2,000 and \$10,000. The annual cost to maintain dirt impoundments ranges between \$333 and \$500.⁴³¹

239. Without knowing the terms of the existing lease agreements, it is difficult to know who would bear the cost of fence installation in this scenario: the Tribe, the livestock associations, BIA, the Service, or some combination. Ultimately, the distinction between the Tribe and the livestock associations may not be that important, as the livestock associations are owned by, operated by, and composed of Tribal members. On non-Tribal lands, Federal landowners frequently bear the costs of constructing riparian fencing, while maintenance costs may be borne by permittees.⁴³²
240. Despite the potential impacts on livestock activities, it appears unlikely that there will be much change in grazing effort on the San Carlos Apache Reservation as a result of proposed critical habitat for spikedace and loach minnow, primarily because: (1) the area of proposed critical habitat is a small percentage of the total area available for grazing to each livestock association; (2) each of the livestock associations has access to multiple water sources; and (3) the herds are of relatively small size.

Fire Management Activities

241. Under Public Law 93-638, activities related to fire management and forest health on Tribal lands are conducted by BIA and the Tribe. The Tribe has not experienced impacts to these activities in the past. However, the Tribe's goal is to have prescribed burns on the majority of reservation land every ten years. The Tribe could experience impacts in the form of restrictions on burning.⁴³³ If the Tribe were not able to perform fire management activities as planned, the risk of catastrophic fire on Tribal lands could increase.

8.5 ADMINISTRATIVE COSTS

242. Due to the trust relationship between the United States and the Tribes, a significant number of Tribal programs, activities, and development projects involve federal funding or oversight. Therefore, where critical habitat is designated on an Indian Reservation, nearly all projects will have a Federal nexus for section 7 consultation.⁴³⁴ To estimate potential administrative impacts associated with these section 7 consultations, this analysis forecasts section 7 consultations based on discussions with the Tribes about future projects. Total baseline and incremental impacts are presented in Exhibit 8-6.

⁴³¹ Ibid.

⁴³² Personal communication with Ted Cordery, BLM, Arizona State Office, July 18, 2005.

⁴³³ Personal communication with Dee Randall, San Carlos Apache Tribe Natural Resources Department, June 16, 2005.

⁴³⁴ See, for example, Public comments of Susan B. Montgomery, Montgomery & Interpreter, plc, on behalf of the Yavapai-Apache Nation, December 27, 2010.

**EXHIBIT 8-6. SUMMARY OF QUANTIFIED INCREMENTAL AND BASELINE IMPACTS TO TRIBES
(2011\$, DISCOUNTED AT SEVEN PERCENT)**

UNIT	REACH	INCREMENTAL		BASELINE	
		PRESENT VALUE	ANNUALIZED	PRESENT VALUE	ANNUALIZED
1	Verde River	\$44,600	\$3,930	\$134,000	\$11,800
	Beaver and West Beaver Creek	\$0	\$0	\$0	\$0
2	White River	\$17,300	\$1,530	\$51,800	\$4,570
	East Fork White River	\$17,300	\$1,530	\$51,800	\$4,570
4	Bonita Creek	\$0	\$0	\$0	\$0
5	Eagle Creek	\$43,700	\$3,860	\$131,000	\$11,600
Total		\$123,000	\$10,800	\$368,000	\$32,500

Note: Totals may not sum due to rounding.

243. For the Yavapai-Apache Nation, we estimate four formal section 7 consultations in the next year associated with the Nation's CAP program, wastewater treatment facilities, construction of a shopping center, and construction of Tribal housing.⁴³⁵ We also forecast one informal consultation a year for the following nineteen years for continued housing construction or other projects that may be subject to section 7 consultation. Given the limited section 7 consultation history with the Nation for these species and because critical habitat has not been previously designated on the Nation's lands, it is difficult to forecast the exact number of section 7 consultations that may result from critical habitat designation. Therefore, this may overestimate the total number of future consultations for these activities. Total incremental impacts associated with section 7 consultation for the Yavapai-Apache are estimated at \$44,600 in present value terms, while total baseline impacts are estimated at \$134,000 in present value terms.
244. For the White Mountain Apache Tribe, we estimate one formal consultation in the next year associated with the construction of the dam on the North Fork White River, as well as one consultation related to the use of the Tribe's water rights for agricultural development. We also forecast the potential for one informal consultation a year for the following nineteen years for planned housing development or other projects that may be subject to section 7 consultation. Given the limited section 7 consultation history with the Tribe for these species and because critical habitat has not been previously designated on the Tribe's lands, it is difficult to forecast the exact number of section 7 consultations that may result from critical habitat designation. Therefore, this may overestimate the total number of future consultations for these activities. Total incremental impacts associated with section 7 consultation for the White Mountain Apache Tribe are estimated at \$34,600 in present value terms, while total baseline impacts are estimated at \$104,000 in present value terms.

⁴³⁵ Personal communication with Susan Montgomery and Robyn Interpreter, Montgomery & Interpreter, plc on behalf of the Yavapai-Apache Nation, on March 8, 2011.

245. For the San Carlos Apache Tribe, we forecast three formal consultations in the next year for the Tribe's water management, grazing, and fire management activities. We anticipate that two additional formal consultations for fire management associated with the Tribe's plans to conduct prescribed burns every ten years. Finally, similar to the other Tribes, we forecast one informal consultation a year for nineteen years related to other projects the Tribe may undertake on the Reservation. All of these consultations are assumed to occur on the Eagle Creek reach, as acreage surrounding this reach comprises nearly 99 percent of total proposed critical habitat on the Reservation. Given the limited section 7 consultation history with the Tribe for these species and because critical habitat has not been previously designated on the Tribe's lands, it is difficult to forecast the exact number of section 7 consultations that may result from critical habitat designation. Therefore, this may overestimate the total number of future consultations for these activities. In total, incremental impacts associated with section 7 consultations for the San Carlos Apache Tribe are estimated at \$43,700 in present value terms, and baseline impacts are estimated at \$131,000 in present value terms.

CHAPTER 9 | POTENTIAL ECONOMIC IMPACTS TO TRANSPORTATION ACTIVITIES

246. Road and bridge construction and maintenance can adversely affect spikedace and loach minnow habitat.⁴³⁶ The primary problem related to these activities is sedimentation. Specifically, road construction may contribute to watershed problems through direct soil disturbance. Road construction and maintenance may increase the sediments entering the stream through normal run-off.
247. This chapter considers the potential for road construction and maintenance activities to be affected by critical habitat designation for the spikedace and loach minnow. It first provides a summary of estimated impacts. The chapter then describes existing baseline protections, including Best Management Practices employed by the Arizona Department of Transportation. It then calculates anticipated baseline and incremental costs associated with transportation projects in critical habitat areas, and the administrative costs of section 7 consultation on these projects.

9.1 SUMMARY OF IMPACTS TO TRANSPORTATION ACTIVITIES

248. In total, incremental impacts to transportation projects are estimated to range from \$57,100 to \$779,000 over 20 years (or \$5,000 to \$68,700 on an annualized basis). This estimate includes conservation efforts associated with three road and bridge construction and maintenance projects, with project modification costs estimated at \$0 to \$722,000 over 20 years (or \$0 to \$63,700 on an annualized basis). Future administrative costs, associated with nine formal and three informal consultations, are estimated at \$57,100 over 20 years (\$5,000 on an annualized basis).
249. Baseline impacts to transportation activities are estimated at \$1.6 million over 20 years (\$139,000 on an annualized basis). Included in this total cost estimate are administrative costs, estimated at \$83,000 over 20 years (\$7,300 on an annualized basis). Exhibit 9-1 summarizes anticipated baseline and incremental costs related to transportation projects in spikedace and loach minnow critical habitat areas.

⁴³⁶ U.S. Fish and Wildlife Service. Proposed Rule to List the Spikedace and Loach Minnow as Endangered With Critical Habitat. (70 FR 75546) December 20, 2005.

**EXHIBIT 9-1. SUMMARY OF INCREMENTAL AND BASELINE IMPACTS TO TRANSPORTATION
ACTIVITIES BY REACH (2011\$, DISCOUNTED AT SEVEN PERCENT)**

UNIT	UNIT NAME	BASELINE		INCREMENTAL	
		PRESENT VALUE	ANNUALIZED	PRESENT VALUE	ANNUALIZED
1A	Verde River Mainstem	\$451,000	\$39,800	\$0 to \$8,500	\$0 to \$750
1B	Granite Creek	\$0	\$0	\$0	\$0
1C	Oak Creek	\$0	\$0	\$0	\$0
1D	Beaver and West Beaver Creek	\$0	\$0	\$0	\$0
1E	West Clear Creek	\$0	\$0	\$0 to \$150,000	\$0 to \$13,300
1F	Fossil Creek	\$0	\$0	\$0	\$0
2A	Tonto Creek	\$0	\$0	\$0 to \$226,000	\$0 to \$19,900
2B	Greenback Creek	\$0	\$0	\$0	\$0
2C	Rye Creek	\$0	\$0	\$0	\$0
2D	Spring Creek	\$0	\$0	\$0	\$0
2E	Rock Creek	\$0	\$0	\$0	\$0
2F	White River mainstem	\$0	\$0	\$0	\$0
2G	East Fork White River	\$0	\$0	\$0	\$0
2H	North Fork East Fork Black River	\$0	\$0	\$0	\$0
2I	East Fork Black River	\$0	\$0	\$0	\$0
2J	Boneyard Creek	\$0	\$0	\$0	\$0
2K	Coyote Creek	\$0	\$0	\$0	\$0
3A	San Pedro River	\$0	\$0	\$0 to \$376,000	\$0 to \$33,200
3B	Hot Springs Canyon	\$0	\$0	\$0	\$0
3C	Bass Canyon	\$0	\$0	\$0	\$0
3D	Redfield Canyon	\$0	\$0	\$0	\$0
3E	Aravaipa Creek	\$376,000	\$33,200	\$0 to \$4,920	\$0 to \$434
3F	Deer Creek	\$0	\$0	\$0	\$0
3G	Turkey Creek	\$0	\$0	\$0	\$0
4	Bonita Creek mainstem	\$0	\$0	\$0	\$0
5	Eagle Creek mainstem	\$0	\$0	\$0	\$0
6A	San Francisco River	\$300,000	\$26,500	\$0 to \$5,670	\$0 to \$500
6B	Tularosa River	\$0	\$0	\$0	\$0
6C	Negrito Creek	\$0	\$0	\$0	\$0
6D	Whitewater Creek	\$0	\$0	\$0	\$0
7A	Blue River	\$0	\$0	\$0	\$0
7B	Campbell Blue Creek	\$0	\$0	\$0	\$0
7C	Dry Blue Creek	\$0	\$0	\$0	\$0
7D	Little Blue Creek	\$0	\$0	\$0	\$0
7E	Pace Creek	\$0	\$0	\$0	\$0
7F	Frieborn Creek	\$0	\$0	\$0	\$0

UNIT	UNIT NAME	BASELINE		INCREMENTAL	
		PRESENT VALUE	ANNUALIZED	PRESENT VALUE	ANNUALIZED
8A	Gila River	\$451,000	\$39,800	\$0 to \$8,500	\$0 to \$750
8B	West Fork Gila River	\$0	\$0	\$0	\$0
8C	Middle Fork Gila River	\$0	\$0	\$0	\$0
8D	East Fork Gila River	\$0	\$0	\$0	\$0
8E	Mangas Creek	\$0	\$0	\$0	\$0
9	Bear Creek	\$0	\$0	\$0	\$0
	Total	\$1,577,000	\$139,000	\$0 to \$779,000	\$0 to \$68,700

Note: Totals may not sum due to rounding.

9.2 EXISTING BASELINE PROTECTIONS

250. When conducting construction and maintenance projects, the Arizona Department of Transportation (ADOT) employs Best Management Practices (BMPs) to avoid several detrimental impacts of transportation activity. Of particular concern are:

- The introduction pollutants from the construction process as well as increased runoff due to impervious surfaces;
- Streambank erosion leading to increased sedimentation;
- Changes to flow rates caused by changes in drainage, particularly stormwater drainage; and
- Impacts to wildlife areas, sensitive water bodies, and protected areas.⁴³⁷

251. In order to mitigate such impacts, the ADOT has prescribed BMPs used in the design of and after the completion of construction. They include:

- Minimization of impermeable surfaces;
- Preserve existing vegetation and re-establish vegetation to disturbed soils in order to prevent erosion;
- Mitigate increased runoff flows with the use of concentrated flow structures;
- The use of synthetic erosion control measures, such as decomposed granite cover, erosion control blankets, impervious cover, retaining wall, and riprap; and
- Maintain water quality using various natural and man-made methods of filtration.⁴³⁸

These BMPs are intended to address the threats associated with transportation activity outlined by the Service in the Proposed Rule, including changes to the channel gradient

⁴³⁷ ADOT Post-Construction Best Management Practices Manual for Highway Design and Construction, 2009. Accessed at http://www2.azdot.gov/ADOT_and/Storm_Water/PDF/adot_post_construction_bmp_manual.pdf on March 11, 2011.

⁴³⁸ Ibid.

and substrate composition, as well as reduced habitat availability.⁴³⁹ In addition to general BMPs listed in the ADOT Post-Construction Best Management Practices Manual, past section 7 consultations have outlined a number of conservation measures for transportation activity within critical habitat. These measures are summarized in Exhibit 9-2.

EXHIBIT 9-2. POTENTIAL BASELINE IMPACTS TO TRANSPORTATION PROJECTS ASSOCIATED WITH SPIKEDACE AND LOACH MINNOW CRITICAL HABITAT

UNIT	STREAM REACH	ROAD	PLANNED PROJECT
Unit 1	Verde River	State Route 89A	1 maintenance project over 20 years
		State Route 260	1 maintenance project over 20 years
		Interstate 17	1 maintenance project over 20 years
Unit 3	Aravaipa Creek	State Route 77	Bridge Replacement to be completed by 2015
Unit 6	San Francisco River	US Highway 180	1 maintenance project over 20 years
		US Highway 180	1 maintenance project over 20 years
Unit 8	Gila River	US Highway 180	1 maintenance project over 20 years
		State Route 92	1 maintenance project over 20 years
		State Route 211	1 maintenance project over 20 years
Source: Personal communication with Justin White, statewide biologist for ADOT, on February 23, 2011. Note: Totals may not sum due to rounding.			

9.3 CONSERVATION EFFORTS FOR SPIKEDACE AND LOACH MINNOW

252. The Service has conducted approximately 12 formal consultations on transportation-related projects related to spikedace and loach minnow. Past consultations on transportation activities have primarily included bridge and road construction and maintenance projects. Exhibit 9-3 summarizes the project modifications that were included in these past consultations.

⁴³⁹ U.S. Fish and Wildlife Service. Endangered and Threatened Wildlife and Plants; Endangered Status and Designation of Critical Habitat for Spikedace and Loach Minnow; Proposed Rule. Published in the Federal Register on October 28, 2010, 75 FR 66482.

EXHIBIT 9-3. SPIKEDACE AND LOACH MINNOW PROJECT MODIFICATIONS ASSOCIATED WITH TRANSPORTATION PROJECTS

Minimize Direct Mortality

- In addition to the provisions of the BMPs, all reasonable efforts shall be made to minimize activities within the wetted channel. (a, b, c, d)
- Except during emergency situations, all work requiring entry of vehicles or equipment into surface water will not be conducted during loach minnow spawning season. (a, b, c)
- All reasonable efforts shall be made to ensure that no pollutants enter surface waters during actions implementation. In addition, no toxic chemicals or vehicles shall be stored or deposited within the floodplain during or after construction. (a, b, c, d)

Minimize Loss and Alteration of Habitat

- All reasonable efforts shall be made to minimize damage to or loss of riparian vegetation. (a, b, c, d)
- Projects anticipated to take longer than one season to complete will require additional consultation with the Service. (a)
- Channel alteration and use of heavy equipment within the river channel and floodplain shall be limited to within 25 linear feet perpendicular to the centerline of the low-water crossing and existing roadbed. (b, d)
- Borrowing of gravel from tributary alluvial fans shall be done in a manner that generally retains the natural contours of the fans. (b)

Monitor Fish Communities and Habitat to Document Levels of Incidental Take

- All reasonable efforts shall be maintained to monitor for the presence of dead or dying fish in or within 500 yards downstream of the project areas. the Service shall be notified immediately by telephone upon detection of more than 20 dead or dying fish of any species. Operations must be stopped in the interim period between the notification and completion of a new consultation if it is determined that the impact of the additional taking will cause an irreversible and adverse impact to the loach minnow or their habitat. (a, b, c, d)

Maintain Complete and Accurate Records of Actions Which May Result in Incidental Take of Species and/or its Habitat

- A written report shall be submitted to the Service within 60 days of completion of project activities. The report shall document the project, as implemented, and shall include photographs of the project area before project initiation and after project completion. the report shall also include a discussion of compliance with the above terms and conditions. (c, d)

Sources:

- (a) "Normal and flood-related maintenance for Forest Road (FR) 281," 2-21-94-F-243.
- (b) "Re-initiation of biological opinion for State Route 260," 2-21-98-F-403R1.
- (c) "Biological opinion on design for a permanent low-water crossing on the Blue River," 2-21-00-F-364
- (d) "Emergency follow-up repair of flood damage to low-water ford crossings on Forest Road 475," 2-21-95-F-166

253. In past consultations on transportation projects that have involved the spikedace and loach minnow, project modifications for transportation projects have typically involved providing:

- Exclusionary netting;
- Monitoring;
- Water quality testing; and
- Reporting.

Costs of implementing these types of project modifications in the future are expected to vary depending on the scale of future projects. One estimate of the costs to implement these conservation efforts, based on past project modification costs incurred by ADOT for a bridge replacement project that affected the Little Colorado spinedace, is (\$250,000).⁴⁴⁰ Because the spinedace project was a bridge replacement, it may represent a high-end cost of project modifications likely to be taken by ADOT. ADOT notes that exclusionary netting and monitoring would be unnecessary for transportation projects in unoccupied spikedace and loach minnow critical habitat reaches.⁴⁴¹ The Service concurs with this statement.⁴⁴² Because these costs may comprise the majority of the costs described above, this analysis assumes that, under the low end scenario, project modification costs in unoccupied reaches could be zero. Under the high end scenario, the analysis assumes that incremental project modification costs could be \$250,000 per project. Under the baseline, the analysis assumes that \$250,000 in project modification costs will be incurred by future projects.

9.4 BASELINE IMPACTS TO TRANSPORTATION ACTIVITIES

254. As stated in the Chapter 2 of this analysis, the Service believes that recommendations to avoid adverse modification which are not duplicated by the need to prevent jeopardy will usually occur only in unoccupied critical habitat that is essential to the species' conservation.⁴⁴³ As such, this analysis assumes that consultations and anticipated conservation efforts that would be protective of spikedace and loach minnow critical habitat in occupied areas would already be expected to occur under the baseline.

⁴⁴⁰ Personal communication with Justin White, statewide biologist for the Arizona Department of Transportation, on February 23, 2011.

⁴⁴¹ Written communication with Justin White, Statewide Biologist for ADOT, on March 18, 2011.

⁴⁴² Written communication with Service, Arizona Ecological Services Field Office, April 6, 2011.

⁴⁴³ Ibid.

255. ADOT is currently planning one transportation project in occupied proposed critical habitat areas, on Aravaipa Creek, to be completed by 2015. In addition, nine roads cross occupied reaches.⁴⁴⁴ These nine roads include:
- State Route 89A (Unit 1 – Verde River)
 - State Route 260 (Unit 1 – Verde River)
 - Interstate 17 (Unit 1 – Verde River)
 - State Route 77 (Unit 3 – Aravaipa Creek)
 - US Highway 191 (Unit 6 – San Francisco River)
 - US Highway 180 (Unit 6 – San Francisco River)
 - US Highway 180 (Unit 8 – Gila River)
 - State Route 92 (Unit 8 – Gila River)
 - State Route 211 (Unit 8 – Gila River)
256. Although the State transportation agencies did not explicitly identify planned projects on these nine road segments, this analysis assumes that one maintenance project will be necessary over the next 20 years (2011-2030) for each, amounting to nine future formal consultations. Note that while project modification costs associated with future projects occurring in these reaches are considered baseline, section 7 consultations on these projects will result in some incremental administrative costs to consider adverse modification of critical habitat.
257. Project modification costs associated with the planned construction at Aravaipa Creek and nine maintenances projects (one at each of the crossings listed above) are estimated at \$1.6 million assuming a discount rate of seven percent (\$139,000 on an annualized basis) over 20 years.

9.4.1 BASELINE ADMINISTRATIVE COSTS

258. Because of uncertainty about future new construction projects, it is difficult to forecast the number and location of transportation projects that may be subject to section 7 consultation. This analysis assumes that one maintenance project will be necessary over the next 20 years (2011-2030) for each major road crossing, amounting to 9 formal consultations.
259. In addition to consultation related to these nine crossings, we forecast one baseline informal consultation associated with currently planned construction on Aravaipa Creek within the next five years. In total, baseline administrative costs for transportation activities are estimated at \$83,000 over 20 years, or \$7,300 on an annualized basis, assuming a seven percent discount rate.

⁴⁴⁴ Road crossings considered in the analysis included Interstate Highways, US Highways, and State Routes that fall within the Arizona and New Mexico State Transportation System, as well as primary roads in Apache-Sitgreaves National Forest.

9.5 INCREMENTAL IMPACTS TO TRANSPORTATION ACTIVITIES

260. Currently, ADOT has indicated that construction projects are planned on two unoccupied reaches within proposed critical habitat. These include:

- bridge replacement on the San Pedro River; and
- construction of a new bridge on Tonto Creek.

Major Arizona roads also cross unoccupied proposed critical habitat on West Clear Creek (State Route 260) and on the San Pedro River (State Route 92), but ADOT does not have current plans for construction projects associated with these crossings.⁴⁴⁵ Major roads crossing critical habitat reaches are expected to undergo some level of maintenance activity that could necessitate section 7 consultation sometime over the next 20 years. Thus, this analysis assumes that one maintenance project, precipitating formal consultation, will be required on each of these two crossings over the next 20 years.

261. In New Mexico, State Route 180 crosses Whitewater Creek in Catron County. NMDOT has stated that the existing regulatory restrictions and environmental review processes already required for projects falling within these riparian areas make NMDOT District 1 reluctant to pursue preventative maintenance activities (or other major construction activities) in those areas. Only in the event of a bridge becoming so deficient that it presents a danger to the traveling public or in response to an emergency (i.e., a road or bridge washes out) would NMDOT District 1 likely undertake projects in areas of critical habitat.⁴⁴⁶ Thus, we note that critical habitat may have an influence on the priority of transportation projects for repair in New Mexico.

EXHIBIT 9-4. POTENTIAL INCREMENTAL CONSERVATION EFFORTS RELATED TO TRANSPORTATION PROJECTS ASSOCIATED WITH SPIKEDACE AND LOACH MINNOW CRITICAL HABITAT

UNIT	STREAM REACH	ROAD	PLANNED PROJECT	FUTURE COSTS (7% DISCOUNT RATE)
Unit 1	West Clear Creek	State Route 260	1 maintenance project over 20 years	\$0- \$142,000
Unit 2	Tonto Creek	Unknown Gila County Road	New Bridge Construction	\$0- \$219,000
Unit 3	San Pedro River	State Route 90	Bridge Replacement	\$0- \$219,000
	San Pedro River	State Route 92	1 maintenance project over 20 years	\$0- \$142,000
Total				\$0- \$722,000

⁴⁴⁵ Personal communication with Justin White, statewide biologist for the Arizona Department of Transportation, on February 23, 2011.

⁴⁴⁶ Written communication with Rand Morgan, Environmental Analyst for the New Mexico Department of Transportation. Received February 21, 2006.

262. In addition to project modification costs, the analysis estimates incremental administrative costs associated with section 7 consultation for transportation activities. The nine roads discussed in Section 9.3 of this report cross occupied reaches, thus any project modification costs associated with future projects occurring in these reaches are considered baseline. However, section 7 consultations on these projects will result in some incremental administrative costs to consider adverse modification.
263. In addition to these nine crossings, we forecast two formal consultations on West Clear Creek and the San Pedro River and three informal consultations associated with currently planned construction on Tonto Creek, Aravaipa Creek, and the San Pedro River within the next five years. In total, incremental administrative costs for transportation activities are estimated at \$57,100 over 20 years, or \$5,000 on an annualized basis.

CHAPTER 10 | POTENTIAL ECONOMIC IMPACTS TO FIRE MANAGEMENT ACTIVITIES

264. This chapter provides an analysis of the potential for critical habitat designation to result in incremental economic impacts to fire management activities. We first provide a summary of incremental costs to fire management activities, followed by an overview of the baseline state of spikedace and loach minnow conservation activities. The chapter then considers the potential for critical habitat to result in incremental changes to fire management, which includes administrative costs associated with section 7 consultations on grazing.
265. There is little debate that there is a high risk of catastrophic wildfire in many areas of the Southwest. According to the Southwest Forest Health and Wildfire Prevention Act of 2003, 39 million acres of National Forest land in the interior west are at high risk of catastrophic wildfire.⁴⁴⁷ In addition, the frequency and intensity of catastrophic wildfire has been increasing over time. The average size of wildfires has been increasing since 1960, and particularly since the 1970s. Reportedly, the average size of a wildfire since the 1970s is double the average size of a wildfire in the 1940s to 1960s.⁴⁴⁸
266. The primary contributor to the recent increases in wildland fire and intensity is widely believed to be the long-standing practice of fire suppression by USFS and other land management agencies. Logging practices and grazing activities also exacerbate impacts on the natural fire regime. These practices resulted in a reduction in the frequency of low-intensity fires that historically removed fuels from the forest floor. As a result, the number of “stand-replacing,” high-intensity fires has increased.⁴⁴⁹
267. With the increase in stand-replacing fires has come increasing damage to private property. For example, the 2000 Cerro Grande Fire in New Mexico burned 47,650 acres, including the destruction of 235 structures and part of Los Alamos National Laboratory.⁴⁵⁰ The 468,638-acre Rodeo-Chediski fire of 2002 ranks as Arizona’s second most expensive disaster ever, with insurance companies paying out over \$102 million for

⁴⁴⁷ H.R. 2696, July 10, 2003.

⁴⁴⁸ “Wildfire history and ecology,” <http://www.cpluhna.nau.edu/Biota/wildfire.htm>, accessed February 17, 2004. National Interagency Fire Center, Wildlands Fire Statistics, 1960-2002, www.nifc.gov/stats/wildlandfirestats.html, accessed February 16, 2004.

⁴⁴⁹ *Ibid.*

⁴⁵⁰ National Interagency Fire Center, Historical Wildland Fire Statistics, www.nifc.gov/stats/historicalstats.html, accessed February 16, 2004.

the destruction of 426 structures (including 250 homes).⁴⁵¹ The Wallow Fire of 2011 surpassed the total acreage burned in the Rodeo-Chediski fire. The Wallow fire burned through the Black River area, including North Fork East Fork Black River, East Fork Black River, Coyote Creek, and Boneyard Creek, which are proposed as critical habitat for loach minnow. Numerous residences and commercial structures were destroyed in the fire; however final numbers were not yet available at time of publication of this report. As a result of the increased risk and cost of catastrophic wildfires, both the public and the land management agencies have an interest in implementing fuel reduction and fire management efforts. Fire management activities may impact the spikedeace and loach minnow and proposed critical habitat areas. Various agencies and private parties may conduct fire management activities within proposed critical habitat.

10.1 BACKGROUND AND SUMMARY OF PAST FIRE MANAGEMENT IMPACTS

268. Spikedace and loach minnow conservation activities have had limited impacts on fire management activities in the past. Four consultations on fire management have been completed to date that addressed spikedace and loach minnow. The first consultation was the BLM Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management.⁴⁵² The second was completed for prescribed burning efforts on the Robinson Mesa Prescribed Fire project.⁴⁵³ A third consultation with the USFS, the Nutrioso Wildland Urban Interface Fuels Reduction Project, resulted in no further conservation measures. The analysis assumes one emergency section 7 consultation was performed in response to 2011 wildfires in Coronado National Forests in Unit 3.⁴⁵⁴ Conservation efforts outlined in these consultations for the spikedace and loach minnow are described in Exhibit 10-1.
269. During the Three-Forks fire in Apache-Sitgreaves National Forest in 2004, the Forest Service considered evacuation of spikedace and loach minnow. However, upon finding two fish, it was determined that the best course of action for the local population was to return the fish to the stream channel rather than risk harm or loss of species through transportation, quarantine, and holding.⁴⁵⁵ There have been no previous spikedace or loach minnow evacuations at Prescott or Gila National Forests.⁴⁵⁶

⁴⁵¹ Wichner, David. "Rodeo-Chediski Costs Rank 2nd," *Arizona Daily Star*, July 16, 2002.

⁴⁵² U.S. Fish and Wildlife Service. Biological and Conference Opinion for the BLM Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management. September 3, 2004.

⁴⁵³ U.S. Fish and Wildlife Service. Formal Conference on the Robinson Mesa Prescribed Fire Project on the Clifton Ranger District of the Apache-Sitgreaves National Forests. October 5, 1999.

⁴⁵⁴ Public comments of Mary E. Darling on behalf of the City of Sierra Vista, Cochise County and the Coalition of Arizona and New Mexico Counties. "Comments on the Draft Economic Analysis and Draft Environmental Assessment on the Proposed Designation of Critical Habitat for Spikedace and Loach Minnow," submitted November 3, 2011.

⁴⁵⁵ Written communication with William Wall, Aquatic Ecologist/Fisheries Biologist, Alpine and Clifton Ranger Districts in Apache-Sitgreaves National Forest. Received 2/21/06.

⁴⁵⁶ Personal communication with Albert Sillas, Fisheries Biologist, Prescott National Forest on 2/10/6; written communication with Jerry Monzingo, Biologist, Gila National Forest. Received 1/31/06.

EXHIBIT 10-1. CONSERVATION ACTIVITIES FOR FIRE MANAGEMENT ASSOCIATED WITH THE SPIKEDACE AND LOACH MINNOW

CONSULTATION	PROJECT MODIFICATIONS
BLM Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management	Collect and salvage fish if incidental take is likely to occur.
	Monitor the effects of fire suppression.
	Annually report monitoring efforts.
Robinson Mesa Prescribed Fire Project on the Clifton Ranger District of the Apache-Sitgreaves National Forests	Minimize the potential for sedimentation and toxic ash to reach Eagle Creek by lining felled pine structures perpendicular to the canyon.
	Document the effectiveness of the pine structures using photo points.
Nutrioso Wildland Urban Interface Fuels Reduction Project, Fire Control (Reinitiated)	Recommendations from the 2005 consultation included minimization of sedimentation in Boneyard Creek. The 2006 reinitiation prescribed no further conservation measures.
<p>Source:</p> <p>U.S. Fish and Wildlife Service. Biological and Conference Opinion for the BLM Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management. September 3, 2004.</p> <p>U.S. Fish and Wildlife Service. Formal Conference on the Robinson Mesa Prescribed Fire Project on the Clifton Ranger District of the Apache-Sitgreaves National Forests. October 5, 1999.</p> <p>U.S. Fish and Wildlife Service. Formal Consultation and Conferencing on the Nutrioso Wildland Urban Interface Fuels Reduction Project. June 5, 2006.</p>	

10.2 SUMMARY OF BASELINE FIRE MANAGEMENT IMPACTS

270. In spikedace and loach minnow proposed critical habitat areas, and in many areas across the U.S., the USDA and the Department of the Interior are jointly implementing what is known as the “National Fire Plan,” which grew out of a report to the President called *Managing the Impacts of Wildfire on Communities and the Environment: A Report to the President in Response to the Wildfires of 2000*. The National Fire Plan calls for a substantial increase in the number of forested acres treated annually to reduce hazardous fuels. Under the plan, WUI areas are defined by each agency “where human life, property, and natural resources are in imminent danger from catastrophic wildfire.”⁴⁵⁷ WUI generally include areas where houses meet or intermingle with undeveloped wildland vegetation. This makes the WUI a focal area for human-environment conflicts such as wildland fires.⁴⁵⁸
271. This analysis relies on data developed by the University of Wisconsin that integrates U.S. Census and USGS National Land Cover Data to map WUI areas according to the Federal

⁴⁵⁷ USFS 2001. Biological Opinion on the AUSFS Proposed Wildland/Urban Interface (WUI) Fuel treatments in New Mexico and Arizona and their effects on listed and proposed species in accordance with section 7 of the Endangered Species Act, Service, April 2001.

⁴⁵⁸ “The Wildland-Urban Interface,” University of Wisconsin, Department of Forest Ecology & Management, Spatial analysis for conservation and sustainability (SILVIS) Lab, Online at: http://silvis.forest.wisc.edu/projects/WUI_Main.asp. Accessed on November 30, 2004.

Register definition of WUI (Federal Register 66:751, 2001).⁴⁵⁹ WUI areas are composed of both “interface” and “intermix” communities. In both communities, housing must meet or exceed a minimum density of one structure per 40 acres. Intermix communities are places where housing and vegetation intermingle. Intermix areas are characterized by continuous wildland vegetation and more than 50 percent vegetation. Interface communities are areas with housing in the “vicinity” of contiguous vegetation, that is, areas with less than 50 percent vegetation but within 1.5 miles of an area over 1,325 acres (500 ha) that is more than 75 percent vegetated. The California Fire Alliance defines “vicinity” as all areas within 1.5 miles of wildland vegetation, roughly the distance that firebrands can be carried from a wildland fire to the roof of a house. Including interface communities captures those homes that are at risk of being burned in a wildland fire, regardless of whether or not the homes sit within the forest area.⁴⁶⁰

272. Based on an analysis of the WUI data, overlap of the proposed critical habitat with WUI areas is limited. Approximately 6,500 acres of WUI areas fall within the proposed critical habitat across four proposed critical habitat units and twelve stream reaches.⁴⁶¹ These 6,500 WUI acres comprise only 15 percent of the total acres proposed as critical habitat and only 0.07 percent and 0.3 percent of the areas identified as potential WUI areas in New Mexico and Arizona, respectively. The number of acres that overlap WUI areas is presented by unit in Exhibit 10-2.
273. As part of the National Fire Plan effort, Action Agencies published new regulations for implementing section 7 consultation requirements in December 2003. These regulations provide an alternative process that “eliminates the need to conduct informal consultation and eliminates the need to provide written concurrence” from the Service for those National Fire Plan actions that the Action Agency determines are “not likely to adversely affect (NLAA) any listed species or its designated critical habitat.”
274. Perhaps the most costly effects on fire management activities would be borne by agencies if they attempt to protect spikedace and loach minnow populations from an ongoing wildfire. Because these efforts would be intended to protect the species rather than their habitat, such impacts would be considered baseline.

⁴⁵⁹ Ibid. The Service notes that the Forest Service has also developed a WUI layer for both Arizona and New Mexico; however, because this layer only includes Forest Service lands, this analysis uses the more inclusive layer developed by the University of Wisconsin.

⁴⁶⁰ Ibid.

⁴⁶¹ In estimating the WUI areas that overlap with the proposed critical habitat, this analysis excluded the following non-WUI areas: wildland intermix, uninhabited with vegetation, uninhabited and no vegetation, wildland with no vegetation, low density with no vegetation, medium density with no vegetation, and high density with no vegetation.

EXHIBIT 10-2. WILDLAND URBAN INTERFACE AREAS IN PROPOSED CRITICAL HABITAT

UNIT	STREAM REACH	OVERLAP WITH WUI (ACRES)
1	Verde River	176
2	East Fork Black River	582
	Boneyard Creek	15
	Coyote Creek	1
6	Tularosa River	1,222
	San Francisco River	2,332
	Negrito Creek	103
	Whitewater Creek	83
8	West Fork Gila	574
	Middle Fork Gila River	139
	Gila River	515
	East Fork Gila River	773
Total		6,514
Source: University of Wisconsin, Department of Forest Ecology & Management, Spatial analysis for conservation and sustainability (SILVIS) Lab, Online at: http://silvis.forest.wisc.edu/projects/WUI_Main.asp		

275. In the past, Federal and State agencies have made several attempts to evacuate other native fish populations when a fire was expected to destroy habitat on public lands.⁴⁶² However, as stated above, no previous evacuations of spikedace and loach minnow populations due to fire threat have been undertaken.⁴⁶³ The cost of an evacuation will vary depending on the urgency of the evacuation (this can affect the number of staff required) and remoteness of the area (this can affect the transport method used--trucks, mules, or helicopters), and is estimated to range from \$2,000 to \$5,000.⁴⁶⁴ After a wildfire moves through an area, the affected native fish population must be reestablished. Depending on the severity of the fire, it can take several months to years for the habitat to be restored.⁴⁶⁵ Holding native fish in captivity and reestablishment is assumed to cost approximately \$40,000 per effort, but this cost could vary widely depending on the extent of damage

⁴⁶² Personal communication with Ron Maes, US Forest Service Region 3, July 18, 2005. Personal communication with Jerry Monzingo, Fisheries Biologist, Gila National Forest, US Forest Service, June 9, 2005.

⁴⁶³ An evacuation was considered following the 3 Forks Fire in Apache-Sitgreaves National Forest, but was abandoned when only two fish were found. Per email from William Wall, Aquatic Ecologist/Fisheries Biologist, Alpine and Clifton Ranger Districts in Apache-Sitgreaves National Forest. Received 2/21/06.

⁴⁶⁴ Evacuating a population is least expensive using a mule or a truck and most expensive using a helicopter.

⁴⁶⁵ Written communication with William Wall, Aquatic Ecologist/Fisheries Biologist, Alpine and Clifton Ranger Districts in Apache-Sitgreaves National Forest. Received 2/21/06.

that occurs to the habitat and the length of time that the fish must be held.⁴⁶⁶ Therefore, the total costs of spikedace and loach minnow evacuation and reestablishment in the event of a wildfire are estimated to be approximately \$42,000 to \$45,000. However, due to the difficulty in predicting the locations of future catastrophic wildfires, this analysis does not assign evacuation and reestablishment costs to stream reaches within the proposed critical habitat.

276. Although project modification costs are not assigned in this analysis, administrative costs are. Because of uncertainty about the location and timing of additional section 7 consultations for wildfire management activities, we estimate future administrative costs based on past consultation history. Three section 7 consultations have occurred within proposed critical habitat in the last 20 years. One of these was a statewide fire management plan, for which reoccurrence of consultation is unlikely. The other consultations, on Eagle Creek and North Fork East Fork Black River, consisted of fire control projects, which indicate the potential for further consultation. Therefore, we forecast one section 7 consultation on each of these reaches over the next 20 years. Baseline administrative costs associated with these consultations are estimated at \$17,000 over 20 years (\$1,500 on an annualized basis), assuming a seven percent discount rate.

10.3 SUMMARY OF INCREMENTAL FIRE MANAGEMENT IMPACTS

277. As discussed above, efforts to evacuate and then re-establish spikedace and loach minnow populations during and after a fire are considered baseline. Therefore, expected incremental impacts on fire management activities are expected only to include administrative costs related to section 7 consultation on fire management plans on Eagle Creek and North Fork East Fork Black River. Therefore, we forecast one section 7 consultation on each of these reaches over the next 20 years. Assuming a seven percent discount rate, the incremental portion of administrative costs associated with these consultations is estimated at \$14,200 over the next 20 years (\$1,250 on an annualized basis).

⁴⁶⁶ This analysis assumes the costs holding a spikedace or loach minnow in captivity and reestablishing the population is similar to reestablishing a population (\$40,000). Written communication from Ted Cordery, Endangered Species Coordinator, Arizona State Office, Bureau of Land Management, July 20, 2005.

CHAPTER 11 | ECONOMIC BENEFITS

11.1 INTRODUCTION

278. The primary intended benefit of critical habitat is to support the conservation of threatened and endangered species, such as the spikedace and loach minnow. Thus, attempts to develop monetary estimates of the benefits of this proposed critical habitat designation would focus on the public's willingness to pay to achieve the conservation benefits to the spikedace and loach minnow expected to result from this designation.
279. Quantification and monetization of species conservation benefits requires information on the incremental change in the probability of spikedace and loach minnow conservation that is expected to result from the designation. No studies are known to exist that provide such information for this species. Even if this information existed, the published valuation literature does not support monetization of incremental changes in the conservation potential of this species.
280. Numerous published studies estimate individuals' willingness to pay to protect endangered species. The economic values reported in these studies reflect various groupings of benefit categories (including both use and non-use values). For example, these studies assess public willingness-to-pay for wildlife-viewing opportunities, the possibility of seeing or experiencing the species in the future, the assurance that the species will exist for future generations, and simply knowing a species exists, among other values. Unfortunately, this literature addresses a relatively narrow range of species and circumstances compared to the hundreds of species and habitats that are the focus of the Act. Specifically, existing studies focus almost exclusively on large mammal, bird, and fish species, and generally do not report values for incremental changes in species conservation potential.
281. Other benefits may also be achieved through designation of critical habitat. For example, the public may hold a value for habitat conservation, beyond its willingness to pay for conservation of a specific species. Studies have been done that estimate the public's willingness to pay to preserve wilderness areas, for wildlife management and preservation programs, and for wildlife protection in general. These studies address categories of benefits (e.g., ecosystem integrity) that may be similar to the types of benefits provided by critical habitat, but do not provide values that can be used to establish the incremental values associated with this proposed critical habitat designation (i.e., the ecosystem and species protection measures considered in these studies are too dissimilar from the habitat protection benefits that may be afforded by this designation).
282. Similarly, economists have conducted research on the economic value of open space. Open space can provide aesthetic benefits, with subsequent positive impacts on property

values in the surrounding community. In particular, some studies have examined the potential increase in property values associated with stream habitat. For example, Streiner and Loomis estimate the value of urban stream habitat improvements in northern California, where value is measured in terms of increased property values, and find values amounting to three to 15 percent increases in property values, depending upon the nature of stream corridor changes and how the various amenity values are “bundled.”⁴⁶⁷ In another study, Colby and Wishart estimated the value to property arising from proximity to open space provided by streambeds, arroyos, and dry washes in the city of Tucson, Arizona. The authors found that existence of permanent easements and other policies to protect these areas increased the property values of homes within one-half mile of the streambed by an average of five percent.⁴⁶⁸

283. While the quality of the habitat may be improved as a result of this designation in some areas, the degree to which such improvements may occur, and the extent to which critical habitat can be attributed as the cause, is unknown. Further, the existing literature was developed in other contexts, and thus transfer of those estimates to the current critical habitat context may not be appropriate. Thus, the Service has decided not to include such estimates in the Economic Analysis. The remainder of this chapter includes a qualitative benefits discussion, summarizing the conservation efforts described in Chapters 3 through 10 of this report and linking them with potential categories of economic benefit that may derive from their implementation.

11.2 POTENTIAL BENEFITS OF SPIKEDACE AND LOACH MINNOW CONSERVATION

284. This section describes the categories of benefits potentially resulting from spikedace and loach minnow conservation efforts within proposed critical habitat. Exhibit 11-1 summarizes potential benefits associated with the specific spikedace and loach minnow conservation efforts described in Chapters 3 through 10 of this report. The first column lists the economic activity; the second column lists the conservation effort(s) associated with that activity. The third column identifies potential categories of benefits that may derive from implementation of these conservation efforts. A description of these categories of benefit is provided below. The final columns of the exhibit identify whether baseline or incremental benefits may occur. Whether the benefits deriving from the conservation efforts are baseline or incremental depends on the reason for implementing the effort. The baseline or incremental status of the conservation effort summarized in the exhibit is as described for each activity in Chapters 3 through 10 of this report.

⁴⁶⁷ Streiner, Carol, and John B. Loomis, October 1995, “Estimating the Benefits of Urban Stream Restoration Using the Hedonic Price Method,” *Rivers*, Vol. 5, No. 4, pp. 267-278.

⁴⁶⁸ Colby, B., and S. Wishart, January 2002, “Riparian Areas Generate Property Value Premium for Landowners,” Department of Agricultural and Resource Economics, University of Arizona, Tucson. Wu, Junjie, Richard Adams, and Andrew Plantinga, February 2004, “Amenities in an Urban Equilibrium Model: Residential Development in Portland, Oregon,” *Land Economics*, Vol. 80, No. 1, pp. 19-32; Mahan, Brent L., Steven Polasky, and Richard M. Adams, February 2000, “Valuing Urban Wetlands: A Property Price Approach,” *Land Economics*, Vol. 76, No. 1, pp. 100-113; Mooney, 1997, “A Cost Effectiveness Analysis of Actions to Reduce Stream Temperature: A Case Study of the Mohawk Watershed,” Ph.D. Dissertation, Department of Agricultural and Resource Economics, Oregon State University.

285. The categories of economic benefits that may derive from the spikedace and loach minnow conservation efforts described in this report include:
- **Improved water quality:** Managing economic activities that occur adjacent to riparian and aquatic habitats may improve water quality by reducing chemical runoff, erosion, and sedimentation. Water quality improvements may in turn have human health and human use (e.g., recreation) benefits, and may reduce the costs of future stream restoration/maintenance activities.
 - **Increased river flows through historical channel of river:** Modification of the timing of flows and releases from dams and impoundments within the study area may allow for more habitat for multiple species to flourish there, including other fish species. These improved flows may therefore result in an improved recreational experience in some reaches, resulting in an increasing demand for sportfishing and other river-based recreation.
 - **Property value benefits:** Open space or decreased density of residential or commercial development resulting from spikedace and loach minnow conservation may increase adjacent or nearby property values.
 - **Aesthetic benefits:** Social welfare gains may be associated with enhanced aesthetic quality of habitat. Preferences for aesthetic improvements may be measured through increased willingness-to-pay to visit a habitat region for recreation or increased visitation.
 - **Educational benefits:** Surveying of project areas for the spikedace and loach minnow confers educational benefits in that more is known about the species and where populations exist. This knowledge could help direct future conservation efforts.
286. In addition to these categories of potential benefit, all of the conservation efforts described in Exhibit 11-1 are related to the broader conservation and recovery of the species. For example, monitoring and surveying for the species is undertaken to better understand the effects of projects on species, and to therefore inform the avoidance or minimization of those effects. All conservation efforts therefore relate to the maintenance or enhancement of the use and non-use value (e.g., existence value) that the public may hold specifically for the species. Further, many of the conservation efforts undertaken for the spikedace and loach minnow may also result in improvements to ecosystem health that are shared by other, coexisting species. The maintenance or enhancement of use and non-use values for these other species, or for biodiversity in general, may also result from these spikedace and loach minnow conservation efforts.

EXHIBIT 11-1. SPIKEDACE AND LOACH MINNOW CONSERVATION EFFORTS AND POTENTIAL ASSOCIATED ANCILLARY BENEFITS (IN ADDITION TO DIRECT SPECIES CONSERVATION AND RECOVERY BENEFITS)

ECONOMIC ACTIVITY	CONSERVATION EFFORT	POTENTIAL ECONOMIC BENEFITS	BASELINE BENEFIT	INCREMENTAL BENEFIT
Water Management	Limits on groundwater pumping	Increased river flow through historic channel, improved water quality, property value benefits, aesthetic benefits	Yes	Yes
Grazing	Riparian fencing	Improved water quality	Yes	No
	Reductions in grazing activity	Improved water quality	Yes	Yes
Mining	Potential for reduced water diversion	Increased river flow through historic channel, improved water quality, aesthetic benefits	(Potential)	(Potential)
Species Management and Recreation	Cessation of non-native sportfish stocking	Increased biodiversity	Yes	Yes
	Non-native fish removal	Improved habitat quality	Yes	Yes
	Survey and monitoring	Educational benefits, improved scientific knowledge	Yes	Yes
	Species repatriation	N/A*	No	No
Development	Habitat restoration	Increased water quality	Yes	Yes
	Land set-aside/off-site conservation	Aesthetic benefits—due to open space preservation	Yes	Yes
Tribal Activities	Potential for reduced water diversion	Increased river flow through historic channel, improved water quality, aesthetic benefits	(Potential)	(Potential)
Transportation	Surveys and monitoring	Educational benefits	Yes	Yes
	Sediment control measures	Improved water quality	Yes	Yes
Fire Management	None identified	N/A*	No	No
<p>Note:</p> <p>* As discussed in greater detail in the text, all conservation efforts are intended to provide conservation and recovery benefits to the species itself. This table focuses on the potential for other, ancillary benefits to accrue over and above the conservation and recovery benefits that are the primary goal of the listed conservation efforts.</p>				

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APPENDIX A | SMALL BUSINESS AND ENERGY IMPACTS ANALYSES

287. This appendix considers the extent to which incremental impacts from critical habitat designation may be borne by small entities and the energy industry. The analysis presented in Section A.1 is conducted pursuant to the Regulatory Flexibility Act (RFA) as amended by the Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996. The energy analysis in Section A.2 is conducted pursuant to Executive Order No. 13211.
288. The analyses of impacts to small entities and the energy industry rely on the estimated incremental impacts resulting from the proposed critical habitat designation. The incremental impacts of the rulemaking are most relevant for the small business and energy impacts analyses because they reflect costs that may be avoided or reduced based on decisions regarding the composition of the final rule.

A.1 SBREFA ANALYSIS

289. When a Federal agency proposes regulations, the RFA requires the agency to prepare and make available for public comment an analysis that describes the effect of the rule on small entities (i.e., small businesses, small organizations, and small government jurisdictions as defined by the RFA).⁴⁶⁹ No initial regulatory flexibility analysis is required if the head of an agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. SBREFA amended the RFA to require Federal agencies to provide a statement of the factual basis for certifying that a rule will not have significant economic impact on a substantial number of small entities. To assist in this process, this appendix provides a screening level analysis of the potential for spikedace and loach minnow critical habitat to affect small entities.
290. To ensure broad consideration of impacts on small entities, the Service has prepared this small business analysis without first making the threshold determination in the proposed rule regarding whether the proposed critical habitat designation could be certified as not having a significant economic impact on a substantial number of small entities. This small business analysis will therefore inform the Service's threshold determination.

⁴⁶⁹ 5 U.S.C. § 601 et seq.

A.1.1 SUMMARY OF IMPACTS TO SMALL ENTITIES

291. This screening analysis is based on the estimated incremental impacts associated with the proposed rulemaking.⁴⁷⁰ As discussed in Chapters 3 through 10 of this analysis, activities that may be affected by the designation include water management, grazing, mining, species management and recreational fishing, development, Tribal activities, transportation, and fire management.
292. Small entities may participate in section 7 consultation as a third party (the primary consulting parties being the Service and the Federal action agency). It is therefore possible that the small entities may spend additional time considering critical habitat during section 7 consultation for the spikedace and loach minnow. These incremental administrative impacts to third parties are also considered in this analysis. Additional incremental costs of consultation that would be borne by the Federal action agency and the Service are not relevant to this screening analysis as these entities (Federal agencies) are not small.
293. Of the activities described in Chapter 3 through 10 of this analysis, incremental impacts are not anticipated to impact small entities for five of these activities for the following reasons:
- *Mining*: Chapter 5 of this analysis discusses the potential for spikedace and loach minnow critical habitat to affect mining activities. As discussed in the chapter, no incremental impacts to mining activities are forecast. Moreover, Freeport McMoRan, the mining company with activities in the vicinity of critical habitat, is not a small entity.
 - *Species management*: Chapter 6 of this analysis presents the potential incremental costs of species management activities such as non-native fish removal. As USBR, BLM, USFS, the Service, and State game and fish departments are expected to bear these costs, no impacts on small entities are anticipated for this category. The welfare losses associated with potential reductions in recreational fishing may be borne by individuals that are not legally considered to be businesses.
 - *Tribes*: Chapter 8 of this analysis details the potential incremental impacts of critical habitat designation on the San Carlos Apache Tribe, White Mountain Apache Tribe, and the Yavapai-Apache Nation. The EPA has stated that, "for the purposes of the RFA, States and Tribal governments are not considered small governments but rather as independent sovereigns."⁴⁷¹ Tribal businesses, like other businesses, can be considered small entities under RFA/SBREFA if they

⁴⁷⁰ As discussed in greater detail in Chapter 2, determination of baseline and incremental impacts depends on whether the area is considered occupied.

⁴⁷¹ EPA. "Regulatory Flexibility Act/Small Business Regulatory Enforcement Fairness Act (RFA/SBREFA). What is a "small government?" Accessed at <http://www.epa.gov/sbrefa/government.htm> on August 10, 2005.

meet the requisite size standards.⁴⁷² As noted in Chapter 8, because Tribal governments generally have far fewer resources to draw from and often serve especially disadvantaged populations, impacts due to critical habitat designation may have a disproportionately negative effect on Tribes.

- *Transportation:* Chapter 9 of this analysis presents the potential incremental impacts to transportation activities. These impacts are expected to be borne by the USFS and State transportation departments. Therefore, no incremental impacts to small entities are anticipated.
- *Fire management activities:* Chapter 10 of this analysis discusses the potential for critical habitat to affect fire management activities; however, it does not estimate any incremental impacts associated with fire management beyond administrative costs.

294. Incremental impacts associated with the three remaining activities of water management, grazing, and development potentially may be borne by small entities. Exhibit A-1 describes the number of entities that may bear incremental impacts related to these activities. It presents the relevant small entity thresholds by North American Industry Classification System (NAICS) code, the total number of entities and small entities, and the estimated incremental impacts as a percentage of annual revenues.
295. As shown in Exhibit A-1, this analysis estimates that 84 small entities may be affected by this rule, each with estimated revenues ranging from \$750,000 to \$33.5 million per entity, depending on the industry affected. Depending on the activity, annualized impacts may represent between 0 percent and 0.5 percent of annual revenues. For development activities, potential impacts to small development firms may be overstated because some or all of the costs of spikedace and loach minnow conservation efforts to development activities may ultimately be borne by current landowners in the form of reduced land values. Many of these landowners may be individuals or families that are not legally considered to be businesses. No NAICS code exists for landowners, and the SBA does not provide a definition of a small landowner.

⁴⁷² The Small Business Size Regulations state that "Business concerns owned and controlled by Indian Tribes, Alaska Native Corporations (ANCs) organized pursuant to the Alaska Native Claims Settlement Act (43 U.S.C. 1601 *et seq.*), Native Hawaiian Organizations (NHOs), Community Development Corporations (CDCs) authorized by 42 U.S.C. 9805, or wholly-owned entities of Indian Tribes, ANCs, NHOs, or CDCs are not considered affiliates of such entities. Small Business Size Regulations, Title 13: Business Credit and Assistance, Chapter I: Small Business Administration, Part 121: Small Business Size Regulations.

EXHIBIT A-1. SUMMARY OF UPPER-BOUND POTENTIAL IMPACTS ON SMALL ENTITIES

ACTIVITY	INDUSTRY (NAICS CODES)	SMALL ENTITY SIZE STANDARD	TOTAL NUMBER OF ENTITIES	NUMBER OF SMALL ENTITIES	NUMBER OF AFFECTED SMALL ENTITIES ¹	ANNUALIZED INCREMENTAL ECONOMIC IMPACTS TO SMALL BUSINESSES (7%)	IMPACTS AS % OF ANNUAL REVENUES ²
Water Management and Agriculture	Cotton Farming (111920)	\$750,000	61	50	47	\$125,000 to \$252,000; or \$3,250 to \$6,125 per entity ³	0.20% to 0.36%
	Hay Farming (111940)		11	11			
	Cotton Ginning (115111)	\$7.0 million	14	11			
	Food manufacturing (311)	500 employees	226	201			
Grazing	Beef Cattle Ranching and Farming (112111)	\$750,000	147	136	33	\$77,900 to \$147,000; or \$1,640 to \$3,130 per entity	0.26% to 0.50%
Development	New Single-Family Housing Construction (236115)	\$33.5 million	3,818	3,789	4	\$0 to \$71,300; or \$0 to \$17,800 per entity	0% to 0.28%
	New Multifamily Housing Construction (236116)		309	304			
	New Housing Operative Builders (236117)		66	59			
	Land Subdivision (237210)	\$7.0 million	480	450			

Notes:

- To estimate the number of affected small entities, this analysis assumes one small entity per forecast section 7 consultation.
- Annual revenues are estimated using Risk Management Association (RMA), *Annual Statement Studies: Financial Ratio Benchmarks 2010 to 2011*, 2010. For each NAICS code, RMA provides the net sales and the number of entities falling within several sales categories: \$0 to \$500,000, \$500,000 to \$2 million, \$2 to \$10 million, or \$10 to \$50 million. Based on the number of entities and total net sales falling within each sales category, we developed an estimate of average net sales (revenues) per small entity. Specifically, the analysis averages data for the sales categories at or below the small business threshold for each industry.
- Note, estimated impacts include conservation costs that may be borne by Fort Huachuca, which is not a small entity.

Source: Dialog search of File 516, Dun and Bradstreet, "Duns Market Identifiers," on March 4, 2011.

A.1.2 DETAILED ANALYSIS OF IMPACTS TO SMALL BUSINESSES

296. This analysis is intended to improve the Service's understanding of the potential effects of the proposed rule on small entities and to identify opportunities to minimize these impacts in the final rulemaking. The Act requires the Service to designate critical habitat for threatened and endangered species to the maximum extent prudent and determinable. Section 4(b)(2) of the Act requires that the Service designate critical habitat "on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impacts, of specifying any particular area as critical habitat." This section grants the Secretary [of the Interior] discretion to exclude any area from critical habitat if (s)he determines "the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat". However, the Secretary may not exclude an area if it "will result in the extinction of the species."
297. Three types of small entities are defined in the RFA:
- **Small Business** - Section 601(3) of the RFA defines a small business as having the same meaning as small business concern under section 3 of the Small Business Act. This includes any firm that is independently owned and operated and is not dominant in its field of operation. The SBA has developed size standards to carry out the purposes of the Small Business Act, and those size standards can be found in 13 CFR 121.201. The size standards are matched to NAICS industries. The SBA definition of a small business applies to a firm's parent company and all affiliates as a single entity.
 - **Small Governmental Jurisdiction** - Section 601(5) defines small governmental jurisdictions as governments of cities, counties, towns, townships, villages, school districts, or special districts with a population of less than 50,000. Special districts may include those servicing irrigation, ports, parks and recreation, sanitation, drainage, soil and water conservation, road assessment, etc. When counties have populations greater than 50,000, those municipalities of fewer than 50,000 can be identified using population reports. Other types of small government entities are not as easily identified under this standard, as they are not typically classified by population.
 - **Small Organization** - Section 601(4) defines a small organization as any not-for-profit enterprise that is independently owned and operated and not dominant in its field. Small organizations may include private hospitals, educational institutions, irrigation districts, public utilities, agricultural co-ops, etc.
298. The courts have held that the RFA/SBREFEA requires Federal agencies to perform a regulatory flexibility analysis of forecast impacts to small entities that are directly regulated. In the case of *Mid-Tex Electric Cooperative, Inc., v. Federal Energy Regulatory Commission (FERC)*, FERC proposed regulations affecting the manner in which generating utilities incorporated construction work in progress in their rates. The

generating utilities that expected to be regulated were large businesses; however, their customers -- transmitting utilities such as electric cooperatives -- included numerous small entities. In this case, the court agreed that FERC simply authorized large electric generators to pass these costs through to their transmitting and retail utility customers, and FERC could therefore certify that small entities were not directly impacted within the definition of the RFA.⁵⁴⁸

299. Similarly, *American Trucking Associations, Inc. v. Environmental Protection Agency* (EPA) addressed a rulemaking in which EPA established a primary national ambient air quality standard for ozone and particulate matter.⁵⁴⁹ The basis of EPA's RFA/SBREFEA certification was that this standard did not directly regulate small entities; instead, small entities were indirectly regulated through the implementation of state plans that incorporated the standards. The court found that, while EPA imposed regulation on states, it did not have authority under this rule to impose regulations directly on small entities and therefore small entities were not directly impacted within the definition of the RFA.
300. The SBA in its guidance on how to comply with the RFA recognizes that consideration of indirectly affected small entities is not required by the RFA, but encourages agencies to perform a regulatory flexibility analysis even when the impacts of its regulation are indirect.⁵⁵⁰ "If an agency can accomplish its statutory mission in a more cost-effective manner, the Office of Advocacy [of the SBA] believes that it is good public policy to do so. The only way an agency can determine this is if it does not certify regulations that it knows will have a significant impact on small entities even if the small entities are regulated by a delegation of authority from the Federal agency to some other governing body."⁵⁵¹
301. The regulatory mechanism through which critical habitat protections are enforced is section 7 of the Act, which directly regulates only those activities carried out, funded, or permitted by a Federal agency. By definition, Federal agencies are not considered small entities, although the activities they may fund or permit may be proposed or carried out by small entities. Given the SBA guidance described above, this analysis considers the extent to which this designation could potentially affect small entities, regardless of whether these entities would be directly regulated by the Service through the proposed rule or by a delegation of impact from the directly regulated entity.
302. This screening analysis focuses on small entities that may bear the incremental impacts of this rulemaking quantified in Chapters 3 through 10 of this economic analysis. Small entities also may participate in section 7 consultation as a third party (the primary consulting parties being the Service and the Federal action agency). It is therefore possible that the small entities may spend additional time considering critical habitat

⁵⁴⁸ 773 F. 2d 327 (D.C. Cir. 1985).

⁵⁴⁹ 175 F. 3d 1027, 1044 (D.C. Cir. 1999).

⁵⁵⁰ Small Business Administration, Office of Advocacy. May 2003. A Guide for Government Agencies: How to Comply with the Regulatory Flexibility Act, pg. 20.

⁵⁵¹ *Ibid.*, pg. 21.

during section 7 consultation for the spokedace and loach minnow. Additional incremental costs of consultation that would be borne by the Federal action agency and the Service are not relevant to this screening analysis as these entities (Federal agencies) are not small.

303. As described above and detailed in Chapters 3 through 10 of this report, estimated incremental costs that may be borne by small entities consist of impacts to water management, development, and grazing activities, as well as incremental administrative costs. These potential impacts are described in greater detail below.
- **Water Management.** Potential incremental costs to water management activities that may be borne by small entities are estimated at \$155,000 to \$282,000 on an annualized basis (discounted at seven percent) over the next 20 years. These impacts consist largely of monitoring and consultation costs, as well as some lost agricultural land value, and do not include potential unquantified impacts associated with water management at Fort Huachuca (as discussed in Chapter 3). Assuming approximately 47 entities undergo section 7 consultation and all of these entities are small, annualized impacts per small entity are expected to range from 0.20 to 0.36 percent of annual revenues.
 - **Grazing.** Incremental costs to small grazing entities are estimated at \$77,900 to \$147,000 on an annualized basis. Assuming that 33 entities undergo section 7 consultation and all of these entities are small, annualized impacts per small entity are expected to range from 0.26 to 0.50 percent of annual revenues.⁵⁵² This estimate assumes all costs are borne by grazing permittees, while in fact some of these costs may be shouldered by Federal agencies (administrative costs and fencing construction costs). Nonetheless, although the percent revenue effect appears small, recent public comments expressed the concern that each addition of a species and/or critical habitat area takes its toll on the economic viability of ranching and that this cumulative impact is important to consider. One commenter was concerned that a single additional restriction or requirement that decreases the profitability of an operation could be the one that causes the operator to go out of business.⁵⁵³
 - **Residential and Commercial Development.** Potential incremental impacts to small development firms are estimated to range from \$0 to \$71,000 on an annualized basis using a seven percent discount rate. Assuming that impacts are borne by four small entities (equivalent to the number of forecast section 7 consultations), annualized impacts are estimated to range from 0 to 0.28 percent of annual revenues.⁵⁵⁴

⁵⁵² Annual revenues are estimated using Risk Management Association (RMA), *Annual Statement Studies: Financial Ratio Benchmarks 2010 to 2011*, 2010.

⁵⁵³ Public comments of Patrick Bray, Arizona Cattle Growers' Association, November 2, 2011. Public comments of Jim and Clarice Holder, July 6, 2006.

⁵⁵⁴ Annual revenues are estimated using Risk Management Association (RMA), *Annual Statement Studies: Financial Ratio Benchmarks 2010 to 2011*, 2010.

A.2 POTENTIAL IMPACTS TO THE ENERGY INDUSTRY

304. Pursuant to Executive Order No. 13211, “Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use,” issued May 18, 2001, Federal agencies must prepare and submit a “Statement of Energy Effects” for all “significant energy actions.” The purpose of this requirement is to ensure that all Federal agencies “appropriately weigh and consider the effects of the Federal Government’s regulations on the supply, distribution, and use of energy.”⁵⁵⁵
305. The Office of Management and Budget provides guidance for implementing this Executive Order, outlining nine outcomes that may constitute “a significant adverse effect” when compared with the regulatory action under consideration:
- Reductions in crude oil supply in excess of 10,000 barrels per day (bbls);
 - Reductions in fuel production in excess of 4,000 barrels per day;
 - Reductions in coal production in excess of 5 million tons per year;
 - Reductions in natural gas production in excess of 25 million Mcf per year;
 - Reductions in electricity production in excess of 1 billion kilowatts-hours per year or in excess of 500 megawatts of installed capacity;
 - Increases in energy use required by the regulatory action that exceed the thresholds above;
 - Increases in the cost of energy production in excess of one percent;
 - Increases in the cost of energy distribution in excess of one percent; or
 - Other similarly adverse outcomes.⁵⁵⁶
306. As none of these criteria is relevant to this analysis, energy-related impacts associated with spikedace and loach minnow conservation activities within the proposed critical habitat are not expected.

⁵⁵⁵ Memorandum For Heads of Executive Department Agencies, and Independent Regulatory Agencies, Guidance For Implementing E.O. 13211, M-01-27, Office of Management and Budget, July 13, 2001, <http://www.whitehouse.gov/omb/memoranda/m01-27.html>.

⁵⁵⁶ Ibid.

APPENDIX B | SENSITIVITY OF RESULTS TO DISCOUNT RATE

307. This appendix summarizes the costs of spikedace and loach minnow conservation quantified in Chapters 3 through 10 of this report. It presents impacts assuming an alternative real discount rate of three percent (the main text of the report assumes a real discount rate of seven percent).⁵⁵⁷

EXHIBIT B-1. SUMMARY OF INCREMENTAL IMPACTS TO WATER MANAGEMENT ACTIVITIES BY REACH (2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$7,370	\$7,370	\$481	\$481
	Granite Creek	\$54,200	\$54,200	\$3,540	\$3,540
	Oak Creek	\$0	\$17,100	\$0	\$1,110
	Beaver and Wet Beaver Creek	\$0	\$14,400	\$0	\$942
	West Clear Creek	\$22,100	\$42,700	\$1,440	\$2,790
	Fossil Creek	\$0	\$0	\$0	\$0
2	Tonto Creek	\$0	\$25,800	\$0	\$1,690
	Greenback Creek	\$0	\$0	\$0	\$0
	Rye Creek	\$0	\$0	\$0	\$0
	Spring Creek	\$0	\$0	\$0	\$0
	Rock Creek	\$0	\$0	\$0	\$0
	White River	\$0	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0	\$0
	North Fork East Fork Black River	\$0	\$0	\$0	\$0
	East Fork Black River	\$0	\$0	\$0	\$0
	Boneyard Creek	\$0	\$0	\$0	\$0
Coyote Creek	\$0	\$0	\$0	\$0	
3	San Pedro River	\$2,040,000	\$3,800,000	\$133,000	\$248,000

⁵⁵⁷ A more detailed discussion of how to calculate present and annualized values, as well as the relevant discount rates, is provided in Chapter 2 of this report.

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
	Hot Springs Canyon	\$7,370	\$7,370	\$481	\$481
	Bass Canyon	\$0	\$0	\$0	\$0
	Redfield Canyon	\$0	\$0	\$0	\$0
	Aravaipa Creek	\$7,370	\$7,370	\$481	\$481
	Deer Creek	\$7,370	\$7,370	\$481	\$481
	Turkey Creek	\$7,370	\$7,370	\$481	\$481
4	Bonita Creek	\$7,370	\$7,370	\$481	\$481
5	Eagle Creek	\$0	\$0	\$0	\$0
6	San Francisco River	\$29,400	\$29,400	\$1,920	\$1,920
	Tularosa River	\$0	\$0	\$0	\$0
	Negrito Creek	\$0	\$0	\$0	\$0
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$7,370	\$7,370	\$481	\$481
	Campbell Blue Creek	\$0	\$0	\$0	\$0
	Dry Blue Creek	\$0	\$0	\$0	\$0
	Little Blue Creek	\$0	\$0	\$0	\$0
	Pace Creek	\$0	\$0	\$0	\$0
	Frieborn Creek	\$0	\$0	\$0	\$0
8	Gila River	\$7,370	\$7,370	\$481	\$481
	West Fork Gila River	\$0	\$0	\$0	\$0
	Middle Fork Gila River	\$0	\$0	\$0	\$0
	East Fork Gila River	\$0	\$0	\$0	\$0
	Mangas Creek	\$0	\$0	\$0	\$0
	Bear Creek	\$0	\$0	\$0	\$0
Total		\$2,200,000	\$4,040,000	\$144,000	\$264,000
Note: Totals may not sum due to rounding.					

EXHIBIT B-2. SUMMARY OF BASELINE IMPACTS TO WATER MANAGEMENT ACTIVITIES BY REACH
(2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$2,590,000	\$3,920,000	\$169,000	\$256,000
	Granite Creek	\$0	\$0	\$0	\$0
	Oak Creek	\$0	\$0	\$0	\$0
	Beaver and Wet Beaver Creek	\$0	\$0	\$0	\$0
	West Clear Creek	\$0	\$0	\$0	\$0
	Fossil Creek	\$0	\$0	\$0	\$0
2	Tonto Creek	\$0	\$0	\$0	\$0
	Greenback Creek	\$0	\$0	\$0	\$0
	Rye Creek	\$0	\$0	\$0	\$0
	Spring Creek	\$0	\$0	\$0	\$0
	Rock Creek	\$0	\$0	\$0	\$0
	White River	\$0	\$34,700	\$0	\$2,260
	East Fork White River	\$0	\$81,600	\$0	\$5,320
	North Fork East Fork Black River	\$0	\$0	\$0	\$0
	East Fork Black River	\$0	\$0	\$0	\$0
	Boneyard Creek	\$0	\$0	\$0	\$0
	Coyote Creek	\$0	\$0	\$0	\$0
3	San Pedro River	\$67,200,000	\$67,200,000	\$4,380,000	\$4,380,000
	Hot Springs Canyon	\$22,100	\$22,100	\$1,440	\$1,440
	Bass Canyon	\$0	\$0	\$0	\$0
	Redfield Canyon	\$0	\$46,500	\$0	\$3,030
	Aravaipa Creek	\$22,100	\$676,000	\$1,440	\$44,100
	Deer Creek	\$22,100	\$22,100	\$1,440	\$1,440
	Turkey Creek	\$22,100	\$22,100	\$1,440	\$1,440
4	Bonita Creek	\$22,100	\$22,100	\$1,440	\$1,440
5	Eagle Creek	\$0	\$0	\$0	\$0
6	San Francisco River	\$22,100	\$41,800	\$1,440	\$2,730
	Tularosa River	\$0	\$0	\$0	\$0
	Negrato Creek	\$0	\$0	\$0	\$0
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$22,100	\$22,100	\$1,440	\$1,440
	Campbell Blue Creek	\$0	\$0	\$0	\$0
	Dry Blue Creek	\$0	\$0	\$0	\$0
	Little Blue Creek	\$0	\$0	\$0	\$0
	Pace Creek	\$0	\$0	\$0	\$0

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
	Frieborn Creek	\$0	\$0	\$0	\$0
8	Gila River	\$22,100	\$1,070,000	\$1,440	\$69,600
	West Fork Gila River	\$0	\$11,600	\$0	\$757
	Middle Fork Gila River	\$0	\$0	\$0	\$0
	East Fork Gila River	\$0	\$0	\$0	\$0
	Mangas Creek	\$0	\$0	\$0	\$0
	Bear Creek	\$0	\$0	\$0	\$0
Total		\$69,900,000	\$73,200,000	\$4,560,000	\$4,770,000
Note: Totals may not sum due to rounding.					

EXHIBIT B-3. SUMMARY OF INCREMENTAL IMPACTS TO GRAZING ACTIVITIES BY REACH (2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$18,700	\$18,700	\$1,220	\$1,220
	Granite Creek	\$0	\$0	\$0	\$0
	Oak Creek	\$0	\$0	\$0	\$0
	Beaver and Wet Beaver Creek	\$0	\$0	\$0	\$0
	West Clear Creek	\$0	\$0	\$0	\$0
	Fossil Creek	\$820	\$820	\$54	\$54
2	Tonto Creek	\$15,600	\$15,600	\$1,020	\$1,020
	Greenback Creek	\$4,920	\$4,920	\$321	\$321
	Rye Creek	\$931	\$931	\$61	\$61
	Spring Creek	\$8,880	\$8,880	\$580	\$580
	Rock Creek	\$1,870	\$1,870	\$122	\$122
	White River	\$0	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0	\$0
	North Fork East Fork Black River	\$776	\$776	\$51	\$51
	East Fork Black River	\$6,250	\$6,250	\$408	\$408
	Boneyard Creek	\$760	\$760	\$50	\$50
	Coyote Creek	\$370	\$370	\$24	\$24
3	San Pedro River	\$34,300	\$51,400	\$2,240	\$3,360
	Hot Springs Canyon	\$2,070	\$2,070	\$135	\$135
	Bass Canyon	\$1,810	\$1,810	\$118	\$118
	Redfield Canyon	\$2,460	\$2,460	\$160	\$160
	Aravaipa Creek	\$2,960	\$2,960	\$193	\$193
	Deer Creek	\$400	\$400	\$26	\$26
	Turkey Creek	\$472	\$472	\$31	\$31
4	Bonita Creek	\$2,590	\$2,590	\$169	\$169
5	Eagle Creek	\$8,230	\$8,230	\$537	\$537
6	San Francisco River	\$123,000	\$241,000	\$8,050	\$15,700
	Tularosa River	\$3,260	\$3,260	\$213	\$213
	Negrito Creek	\$743	\$743	\$49	\$49
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$8,870	\$8,870	\$579	\$579
	Campbell Blue Creek	\$1,350	\$1,350	\$88	\$88
	Dry Blue Creek	\$517	\$517	\$34	\$34
	Little Blue Creek	\$0	\$0	\$0	\$0

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
	Pace Creek	\$136	\$136	\$9	\$9
	Frieborn Creek	\$193	\$193	\$13	\$13
8	Gila River	\$584,000	\$1,240,000	\$38,100	\$81,100
	West Fork Gila River	\$1,410	\$1,410	\$92	\$92
	Middle Fork Gila River	\$2,090	\$2,090	\$136	\$136
	East Fork Gila River	\$4,590	\$4,590	\$300	\$300
	Mangas Creek	\$127,000	\$274,000	\$8,290	\$17,900
	Bear Creek	\$3,420	\$3,420	\$223	\$223
Total		\$976,000	\$1,920,000	\$63,700	\$125,000
Note: Totals may not sum due to rounding.					

EXHIBIT B-4. SUMMARY OF BASELINE IMPACTS TO GRAZING ACTIVITIES BY REACH (2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$388,000	\$1,400,000	\$25,300	\$91,600
	Granite Creek	\$0	\$0	\$0	\$0
	Oak Creek	\$0	\$0	\$0	\$0
	Beaver and Wet Beaver Creek	\$0	\$0	\$0	\$0
	West Clear Creek	\$0	\$0	\$0	\$0
	Fossil Creek	\$28,100	\$106,000	\$1,830	\$6,940
2	Tonto Creek	\$163,000	\$660,000	\$10,600	\$43,100
	Greenback Creek	\$51,300	\$208,000	\$3,350	\$13,600
	Rye Creek	\$9,700	\$39,300	\$633	\$2,570
	Spring Creek	\$75,900	\$308,000	\$4,960	\$20,100
	Rock Creek	\$16,500	\$67,000	\$1,080	\$4,370
	White River	\$0	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0	\$0
	North Fork East Fork Black River	\$26,600	\$101,000	\$1,730	\$6,570
	East Fork Black River	\$65,100	\$264,000	\$4,250	\$17,200
	Boneyard Creek	\$7,910	\$32,100	\$516	\$2,090
	Coyote Creek	\$10,900	\$40,800	\$712	\$2,670
3	San Pedro River	\$0	\$0	\$0	\$0
	Hot Springs Canyon	\$6,220	\$6,220	\$406	\$406
	Bass Canyon	\$0	\$0	\$0	\$0
	Redfield Canyon	\$7,370	\$7,370	\$481	\$481
	Aravaipa Creek	\$129,000	\$497,000	\$8,440	\$32,400
	Deer Creek	\$13,700	\$51,900	\$894	\$3,390
	Turkey Creek	\$16,200	\$61,200	\$1,050	\$3,990
4	Bonita Creek	\$88,600	\$335,000	\$5,780	\$21,900
5	Eagle Creek	\$101,000	\$333,000	\$6,570	\$21,700
6	San Francisco River	\$441,000	\$1,590,000	\$28,800	\$104,000
	Tularosa River	\$98,600	\$370,000	\$6,430	\$24,100
	Negrito Creek	\$20,100	\$74,800	\$1,310	\$4,880
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$59,800	\$161,000	\$3,900	\$10,500
	Campbell Blue Creek	\$38,700	\$144,000	\$2,520	\$9,420
	Dry Blue Creek	\$17,700	\$67,100	\$1,160	\$4,380
	Little Blue Creek	\$0	\$0	\$0	\$0
	Pace Creek	\$4,650	\$17,600	\$303	\$1,150
	Frieborn Creek	\$6,600	\$25,000	\$431	\$1,630

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
8	Gila River	\$543,000	\$2,040,000	\$35,500	\$133,000
	West Fork Gila River	\$9,530	\$25,700	\$622	\$1,680
	Middle Fork Gila River	\$6,480	\$7,160	\$423	\$467
	East Fork Gila River	\$157,000	\$595,000	\$10,300	\$38,800
	Mangas Creek	\$4,640	\$9,740	\$303	\$636
	Bear Creek	\$117,000	\$444,000	\$7,650	\$29,000
Total		\$2,730,000	\$10,100,000	\$178,000	\$658,000
Note: Totals may not sum due to rounding.					

EXHIBIT B-5. SUMMARY OF INCREMENTAL IMPACTS TO SPECIES MANAGEMENT AND RECREATIONAL ACTIVITIES BY REACH (2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$6,840	\$6,840	\$446	\$446
	Granite Creek	\$14,200	\$14,200	\$923	\$923
	Oak Creek	\$1,590	\$1,590	\$104	\$104
	Beaver and West Beaver Creek	\$1,590	\$1,590	\$104	\$104
	West Clear Creek	\$1,590	\$1,590	\$104	\$104
	Fossil Creek	\$0	\$0	\$0	\$0
2	Tonto Creek	\$15,700	\$15,700	\$1,030	\$1,030
	Greenback Creek	\$0	\$0	\$0	\$0
	Rye Creek	\$0	\$0	\$0	\$0
	Spring Creek	\$31,700	\$31,700	\$2,070	\$2,070
	Rock Creek	\$15,700	\$15,700	\$1,030	\$1,030
	White River	\$0	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0	\$0
	North Fork East Fork Black River	\$0	\$0	\$0	\$0
	East Fork Black River	\$1,590	\$1,590	\$104	\$104
	Boneyard Creek	\$0	\$0	\$0	\$0
	Coyote Creek	\$0	\$0	\$0	\$0
3	San Pedro River	\$0	\$0	\$0	\$0
	Hot Springs Canyon	\$0	\$0	\$0	\$0
	Bass Canyon	\$0	\$0	\$0	\$0
	Redfield Canyon	\$12,300	\$12,300	\$800	\$800
	Aravaipa Creek	\$0	\$0	\$0	\$0
	Deer Creek	\$0	\$0	\$0	\$0
	Turkey Creek	\$0	\$0	\$0	\$0
4	Bonita Creek	\$5,000	\$5,000	\$326	\$326
5	Eagle Creek	\$0	\$0	\$0	\$0
6	San Francisco River	\$0	\$0	\$0	\$0
	Tularosa River	\$0	\$0	\$0	\$0
	Negrito Creek	\$0	\$0	\$0	\$0
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$12,100	\$12,100	\$790	\$790
	Campbell Blue Creek	\$0	\$0	\$0	\$0
	Dry Blue Creek	\$0	\$0	\$0	\$0
	Little Blue Creek	\$0	\$0	\$0	\$0
	Pace Creek	\$0	\$0	\$0	\$0

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
	Frieborn Creek	\$0	\$0	\$0	\$0
8	Gila River	\$5,000	\$5,000	\$326	\$326
	West Fork Gila River	\$0	\$0	\$0	\$0
	Middle Fork Gila River	\$0	\$0	\$0	\$0
	East Fork Gila River	\$0	\$0	\$0	\$0
	Mangas Creek	\$0	\$0	\$0	\$0
	Bear Creek	\$0	\$0	\$0	\$0
Total		\$125,000	\$125,000	\$8,150	\$8,150
Note: Totals may not sum due to rounding.					

EXHIBIT B-6. SUMMARY OF BASELINE IMPACTS TO SPECIES MANAGEMENT AND RECREATIONAL ACTIVITIES BY REACH (2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$9,290,000	\$28,800,000	\$625,000	\$1,900,000
	Granite Creek	\$55,800	\$55,800	\$3,640	\$3,640
	Oak Creek	\$0	\$0	\$0	\$0
	Beaver and West Beaver Creek	\$0	\$0	\$0	\$0
	West Clear Creek	\$0	\$0	\$0	\$0
	Fossil Creek	\$82,800	\$82,800	\$5,400	\$5,400
2	Tonto Creek	\$943,000	\$1,890,000	\$61,600	\$123,000
	Greenback Creek	\$0	\$0	\$0	\$0
	Rye Creek	\$0	\$0	\$0	\$0
	Spring Creek	\$963,000	\$1,880,000	\$69,200	\$129,000
	Rock Creek	\$13,700	\$13,700	\$896	\$896
	White River	\$0	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0	\$0
	North Fork East Fork Black River	\$49,500	\$49,500	\$3,230	\$3,230
	East Fork Black River	\$37,700	\$37,700	\$2,460	\$2,460
	Boneyard Creek	\$14,200	\$14,200	\$923	\$923
	Coyote Creek	\$0	\$0	\$0	\$0
3	San Pedro River	\$0	\$0	\$0	\$0
	Hot Springs Canyon	\$27,600	\$27,600	\$1,800	\$1,800
	Bass Canyon	\$0	\$0	\$0	\$0
	Redfield Canyon	\$1,050,000	\$2,040,000	\$103,000	\$167,000
	Aravaipa Creek	\$0	\$0	\$0	\$0
	Deer Creek	\$0	\$0	\$0	\$0
	Turkey Creek	\$0	\$0	\$0	\$0
4	Bonita Creek	\$85,800	\$85,800	\$19,600	\$19,600
5	Eagle Creek	\$9,430	\$9,430	\$616	\$616
6	San Francisco River	\$118,000	\$199,000	\$7,690	\$13,000
	Tularosa River	\$91,900	\$130,000	\$6,000	\$8,500
	Negrito Creek	\$0	\$0	\$0	\$0
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$6,980,000	\$6,980,000	\$489,000	\$489,000
	Campbell Blue Creek	\$4,720	\$4,720	\$308	\$308
	Dry Blue Creek	\$0	\$0	\$0	\$0
	Little Blue Creek	\$4,720	\$4,720	\$308	\$308
	Pace Creek	\$0	\$0	\$0	\$0

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
	Frieborn Creek	\$0	\$0	\$0	\$0
8	Gila River	\$383,000	\$536,000	\$39,000	\$49,000
	West Fork Gila River	\$91,900	\$130,000	\$6,000	\$8,500
	Middle Fork Gila River	\$91,900	\$130,000	\$6,000	\$8,500
	East Fork Gila River	\$91,900	\$130,000	\$6,000	\$8,500
	Mangas Creek	\$0	\$0	\$0	\$0
	Bear Creek	\$0	\$0	\$0	\$0
Total		\$20,500,000	\$43,200,000	\$1,460,000	\$2,940,000
Note: Totals may not sum due to rounding.					

EXHIBIT B-7. SUMMARY OF INCREMENTAL IMPACTS TO RESIDENTIAL AND COMMERCIAL DEVELOPMENT BY REACH (2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$0	\$3,830	\$0	\$250
	Oak Creek	\$0	\$798,000	\$0	\$52,100
	Beaver and Wet Beaver Creek	\$0	\$290,000	\$0	\$19,000
Total		\$0	\$1,090,000	\$0	\$71,300
Note: Totals may not sum due to rounding.					

EXHIBIT B-8. SUMMARY OF BASELINE IMPACTS TO RESIDENTIAL AND COMMERCIAL DEVELOPMENT BY REACH (2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$0	\$1,110,000	\$0	\$83,200
Total		\$0	\$1,110,000	\$0	\$83,200
Note: Totals may not sum due to rounding.					

EXHIBIT B-9. SUMMARY OF INCREMENTAL IMPACTS TO TRIBAL ACTIVITIES BY REACH (2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$54,100	\$54,100	\$3,530	\$3,530
	Beaver and Wet Beaver Creek	\$0	\$0	\$0	\$0
2	White River	\$22,000	\$22,000	\$1,440	\$1,440
	East Fork White River	\$22,000	\$22,000	\$1,440	\$1,440
4	Bonita Creek	\$0	\$0	\$0	\$0
5	Eagle Creek	\$55,800	\$55,800	\$3,640	\$3,640
Total		\$154,000	\$154,000	\$10,000	\$10,000
Note: Totals may not sum due to rounding.					

EXHIBIT B-10. SUMMARY OF BASELINE IMPACTS TO TRIBAL ACTIVITIES BY REACH (2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$162,000	\$162,000	\$10,600	\$10,600
	Beaver and Wet Beaver Creek	\$0	\$0	\$0	\$0
2	White River	\$66,100	\$66,100	\$4,310	\$4,310
	East Fork White River	\$66,100	\$66,100	\$4,310	\$4,310
4	Bonita Creek	\$0	\$0	\$0	\$0
5	Eagle Creek	\$167,000	\$167,000	\$10,900	\$10,900
Total		\$461,000	\$461,000	\$30,100	\$30,100
Note: Totals may not sum due to rounding.					

EXHIBIT B-11. SUMMARY OF INCREMENTAL IMPACTS TO TRANSPORTATION ACTIVITIES BY REACH
(2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$11,500	\$11,500	\$750	\$750
	Granite Creek	\$0	\$0	\$0	\$0
	Oak Creek	\$0	\$0	\$0	\$0
	Beaver and West Beaver Creek	\$0	\$0	\$0	\$0
	West Clear Creek	\$11,500	\$203,000	\$750	\$13,300
	Fossil Creek	\$0	\$0	\$0	\$0
2	Tonto Creek	\$6,730	\$243,000	\$439	\$15,800
	Greenback Creek	\$0	\$0	\$0	\$0
	Rye Creek	\$0	\$0	\$0	\$0
	Spring Creek	\$0	\$0	\$0	\$0
	Rock Creek	\$0	\$0	\$0	\$0
	White River	\$0	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0	\$0
	North Fork East Fork Black River	\$0	\$0	\$0	\$0
	East Fork Black River	\$0	\$0	\$0	\$0
	Boneyard Creek	\$0	\$0	\$0	\$0
	Coyote Creek	\$0	\$0	\$0	\$0
3	San Pedro River	\$18,200	\$446,000	\$1,190	\$29,100
	Hot Springs Canyon	\$0	\$0	\$0	\$0
	Bass Canyon	\$0	\$0	\$0	\$0
	Redfield Canyon	\$0	\$0	\$0	\$0
	Aravaipa Creek	\$6,080	\$6,080	\$397	\$397
	Deer Creek	\$0	\$0	\$0	\$0
	Turkey Creek	\$0	\$0	\$0	\$0
4	Bonita Creek	\$0	\$0	\$0	\$0
5	Eagle Creek	\$0	\$0	\$0	\$0
6	San Francisco River	\$7,660	\$7,660	\$500	\$500
	Tularosa River	\$0	\$0	\$0	\$0
	Negrito Creek	\$0	\$0	\$0	\$0
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$0	\$0	\$0	\$0
	Campbell Blue Creek	\$0	\$0	\$0	\$0
	Dry Blue Creek	\$0	\$0	\$0	\$0
	Little Blue Creek	\$0	\$0	\$0	\$0
	Pace Creek	\$0	\$0	\$0	\$0
	Frieborn Creek	\$0	\$0	\$0	\$0

UNIT	REACH	PRESENT VALUE		ANNUALIZED	
		LOW	HIGH	LOW	HIGH
8	Gila River	\$11,500	\$11,500	\$750	\$750
	West Fork Gila River	\$0	\$0	\$0	\$0
	Middle Fork Gila River	\$0	\$0	\$0	\$0
	East Fork Gila River	\$0	\$0	\$0	\$0
	Mangas Creek	\$0	\$0	\$0	\$0
	Bear Creek	\$0	\$0	\$0	\$0
	Total	\$73,200	\$928,000	\$4,770	\$60,600

EXHIBIT B-12. SUMMARY OF BASELINE IMPACTS TO TRANSPORTATION ACTIVITIES BY REACH
(2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED	
		LOW	HIGH	LOW	HIGH
1	Verde River	\$609,000	\$609,000	\$39,800	\$39,800
	Granite Creek	\$0	\$0	\$0	\$0
	Oak Creek	\$0	\$0	\$0	\$0
	Beaver and West Beaver Creek	\$0	\$0	\$0	\$0
	West Clear Creek	\$0	\$0	\$0	\$0
	Fossil Creek	\$0	\$0	\$0	\$0
2	Tonto Creek	\$0	\$0	\$0	\$0
	Greenback Creek	\$0	\$0	\$0	\$0
	Rye Creek	\$0	\$0	\$0	\$0
	Spring Creek	\$0	\$0	\$0	\$0
	Rock Creek	\$0	\$0	\$0	\$0
	White River	\$0	\$0	\$0	\$0
	East Fork White River	\$0	\$0	\$0	\$0
	North Fork East Fork Black River	\$0	\$0	\$0	\$0
	East Fork Black River	\$0	\$0	\$0	\$0
	Boneyard Creek	\$0	\$0	\$0	\$0
Coyote Creek	\$0	\$0	\$0	\$0	
3	San Pedro River	\$0	\$0	\$0	\$0
	Hot Springs Canyon	\$0	\$0	\$0	\$0
	Bass Canyon	\$0	\$0	\$0	\$0
	Redfield Canyon	\$0	\$0	\$0	\$0
	Aravaipa Creek	\$446,000	\$446,000	\$29,100	\$29,100
	Deer Creek	\$0	\$0	\$0	\$0
	Turkey Creek	\$0	\$0	\$0	\$0

UNIT	REACH	PRESENT VALUE		ANNUALIZED	
		LOW	HIGH	LOW	HIGH
4	Bonita Creek	\$0	\$0	\$0	\$0
5	Eagle Creek	\$0	\$0	\$0	\$0
6	San Francisco River	\$406,000	\$406,000	\$26,500	\$26,500
	Tularosa River	\$0	\$0	\$0	\$0
	Negrito Creek	\$0	\$0	\$0	\$0
	Whitewater Creek	\$0	\$0	\$0	\$0
7	Blue River	\$0	\$0	\$0	\$0
	Campbell Blue Creek	\$0	\$0	\$0	\$0
	Dry Blue Creek	\$0	\$0	\$0	\$0
	Little Blue Creek	\$0	\$0	\$0	\$0
	Pace Creek	\$0	\$0	\$0	\$0
	Frieborn Creek	\$0	\$0	\$0	\$0
8	Gila River	\$609,000	\$609,000	\$39,800	\$39,800
	West Fork Gila River	\$0	\$0	\$0	\$0
	Middle Fork Gila River	\$0	\$0	\$0	\$0
	East Fork Gila River	\$0	\$0	\$0	\$0
	Mangas Creek	\$0	\$0	\$0	\$0
	Bear Creek	\$0	\$0	\$0	\$0
Total		\$2,070,000	\$2,070,000	\$135,000	\$135,000

EXHIBIT B-13. SUMMARY OF INCREMENTAL IMPACTS TO FIRE MANAGEMENT ACTIVITIES BY REACH (2011\$)

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
2	North Fork East Fork Black River	\$3,830	\$3,830	\$250	\$250
3	San Pedro River	\$11,500	\$11,500	\$750	\$750
5	Eagle Creek	\$3,830	\$3,830	\$250	\$250
Total		\$19,200	\$19,200	\$1,250	\$1,250
Note: Totals may not sum due to rounding.					

**EXHIBIT B-14. SUMMARY OF BASLINE IMPACTS TO FIRE MANAGEMENT ACTIVITIES BY REACH
(2011\$)**

UNIT	REACH	PRESENT VALUE		ANNUALIZED COSTS	
		LOW	HIGH	LOW	HIGH
2	North Fork East Fork Black River	\$11,500	\$11,500	\$750	\$750
5	Eagle Creek	\$11,500	\$11,500	\$750	\$750
Total		\$23,000	\$23,000	\$1,500	\$1,500
Note: Totals may not sum due to rounding.					

APPENDIX C | INCREMENTAL MEMORANDUM



United States Department of the Interior
U.S. Fish and Wildlife Service
Arizona Ecological Services Office
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 242-0210 Fax: (602) 242-2513



In reply refer to:

AESO/SE

January 7, 2011

Ms. Leslie K. Genova, Senior Associate
Industrial Economics, Incorporated
2067 Massachusetts Avenue
Cambridge, Massachusetts 02176

Dear Ms. Genova:

Subject: Incremental Effects Review for the Economic Analysis of the Proposed Rule to Designate Critical Habitat for Spikedace and Loach Minnow

Our preliminary assessment of the habitats needed for conservation of loach minnow and spikedace attempts to provide geographic distribution across the ranges of the species, represent the full range of habitat and environmental variability the species have occupied, and preserve existing genetic diversity. In total, we are proposing 1,168 km (726 mi) of streams as critical habitat for spikedace, and 1,141 km (709 mi) of streams as critical habitat for loach minnow. Of this total mileage, 874 km (543 mi) of streams are overlapping (*i.e.*, proposed for designation for both species), as identified in the proposed rule (75 FR 66482; October 28, 2010). The critical habitat areas constitute our current best assessment of areas that meet the definition of critical habitat for spikedace and loach minnow. The eight units we propose as critical habitat occur in portions of the Verde River and its tributaries; the Salt River and its tributaries; the San Pedro River and its tributaries; Bonita Creek; Eagle Creek; the San Francisco River and its tributaries; the Blue River and its tributaries; and the Gila River and its tributaries.

When consulting under section 7 of the Endangered Species Act in designated critical habitat, independent analyses are conducted for jeopardy and adverse modification. According to the Director's Memorandum of December 9, 2004, the analysis of "destruction or adverse modification of designated critical habitat" considers whether critical habitat would remain functional to serve the intended conservation role for the species. Jeopardy occurs when an action is reasonably expected, directly or indirectly, to diminish a species' numbers, reproduction, or distribution so that the likelihood of survival and recovery in the wild is appreciably reduced (50 CFR 402.02).

Jeopardy and adverse modification are not equivalent standards; however, the outcome of section 7 consultations under these standards may be similar in some cases. Alterations of occupied habitat that diminish the value of the habitat (e.g., changes to habitat for any of their life stages, decreases or changes to the aquatic insect food base, increases in pollutants, alteration of flow

Ms. Leslie K. Genova, Senior Associate

patterns or amount of flow, or increases in the number of nonnative aquatic species) would result in adverse modification if the effect is severe enough to render the habitat incapable of providing its intended conservation function. If the action would also affect the remaining populations, population size, reproduction, and recruitment to the extent that the likelihood of survival in the wild is appreciably reduced, a jeopardy determination would also result. Because the ability of these species to exist is very closely tied to the quality of their habitats, significant alterations of their occupied habitat may result in jeopardy as well as adverse modification. Therefore, we anticipate that section 7 consultation analyses may follow two scenarios: 1) no difference between recommendations to avoid jeopardy or adverse modification in occupied areas of critical habitat; or 2) recommendations to avoid adverse modification which are not duplicated by the need to prevent jeopardy will usually occur only in unoccupied critical habitat that is essential to the species' conservation.

For occupied habitat, proposed actions that would adversely affect the physical and biological features (PBFs) in the designated critical habitat would usually result in sufficient harm or harassment to constitute jeopardy to the species. For example, an instream road construction activity that would disturb substrates and water quality to such an extent that critical habitat would be adversely modified, would also usually result in a large enough loss of egg masses or adult fish to result in a jeopardy determination. As such, project modifications that minimize effects to the spinedace and loach minnow (such as limiting heavy equipment use in the channel to prevent compaction of substrates and excessive sedimentation) would also minimize effects to the PBFs associated with designated critical habitat. Accordingly, in occupied critical habitat it would be rare that an analysis would identify a difference between measures needed to avoid the destruction or adverse modification of critical habitat and measures needed to avoid jeopardizing the species. Absent reasonably foreseeable economic impacts that are distinctly attributable to the critical habitat portion of the analysis, economic impacts from conservation efforts that avoid adverse modification of critical habitat coincidental to avoid jeopardizing the species would generally be coextensive with the impacts of spinedace and loach minnow listing and within the regulatory baseline. Therefore, we do not anticipate significant incremental effects in regard to developing and implementing conservation actions in currently occupied critical habitat for spinedace and loach minnow, although we acknowledge that this could occur.

For unoccupied habitat, adverse modification would occur when the proposed action would remove the ability of the critical habitat to remain functional to serve the intended conservation role for the species. As identified in the proposed rule for spinedace and loach minnow, the intended conservation role of the habitat is to serve as an extension of habitat in the unit and expand the geographic distribution of the population, as the current geographic distribution is reduced to 10 to 20 percent of historical range and existing habitat is insufficient to recover the species. Therefore, proposed actions that significantly decrease expansion areas, reduce the ability of the species to expand within its historical range, or preclude the ability of the fish to connect to occupied areas could result in a determination of adverse modification. We anticipate that the majority of incremental effects will occur in unoccupied habitat as, without the critical habitat designation, no consultation would have occurred based on occupancy alone.

Listed below are activities that may result in adverse effects to unoccupied spinedace and loach minnow critical habitat such that affected stream segments would not be sufficiently capable of

Ms. Leslie K. Genova, Senior Associate

providing the necessary conditions to support re-occupancy of the area. However, we note that the activities listed may be able to be modified by measures which would sufficiently offset the potential adverse effects so that the value of the habitat for its intended conservation function is not appreciably reduced. The occurrence of the actions described below will not always result in adverse modification of critical habitat if the available mitigation can reduce the impacts of these actions on the habitat.

(1) Actions that would appreciably diminish flows within the active stream channel.

Such activities could include, but are not limited to: water diversions, channelization, construction of barriers or impediments within the active river channel, construction of permanent or temporary diversion structures, and groundwater pumping within aquifers associated with the river. These actions could affect water depth, velocity, and flow pattern, all of which are essential to the different life stages of spikedeace or loach minnow.

(2) Actions that significantly alter the water chemistry of the active channel. Such activities could include, but are not limited to: release of chemicals, biological pollutants, or other substances into the surface water or connected groundwater at a point source or by dispersed release (nonpoint source); and storage of chemicals or pollutants that can be transmitted, via surface water, groundwater, or air into critical habitat. These actions can affect water chemistry, and in turn the prey base of spikedeace and loach minnow.

(3) Actions that would significantly increase sediment deposition within a stream channel. Such activities could include, but are not limited to: livestock overgrazing, road construction, commercial or urban development, channel alteration, timber harvest, ORV use, recreational use, or other watershed and floodplain disturbances. These activities could adversely affect reproduction of the species by preventing hatching of eggs, or by eliminating suitable habitat for egg placement by loach minnow. In addition, excessive levels of sedimentation can make it difficult for these species to locate prey.

(4) Actions that result in the introduction, spread, or augmentation of nonnative aquatic species in unoccupied stream segments or in stream segments that are hydrologically connected to occupied stream segments, even if those segments are occasionally intermittent, or introduction of other species in these locations that compete with or prey on spikedeace or loach minnow. Possible actions could include, but are not limited to: introduction of parasites or disease, stocking of nonnative fishes, stocking of nonnative amphibians, or other related actions. These activities can affect the growth, reproduction, and survival of spikedeace and loach minnow.

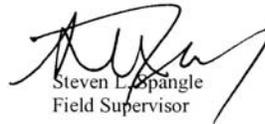
(5) Actions that would significantly alter channel morphology. Such activities could include, but are not limited to: channelization, impoundment, road and bridge construction, mining, dredging, and destruction of riparian vegetation. These activities may lead to changes in water flows and levels that would preclude occupancy by spikedeace or loach minnow. These actions can also lead to increased sedimentation and degradation in water quality to levels that are beyond the tolerances of spikedeace and loach minnow.

Ms. Leslie K. Genova, Senior Associate

All administrative economic impacts associated with reinitiating section 7 consultation as a result of a new critical habitat designation, whether occupied or not, would appropriately be considered an incremental effect of the designation. For a new section 7 consultation in occupied areas, the jeopardy analysis and the adverse modification analysis would be analyzed separately. Costs associated with the jeopardy analysis would be in the baseline, and the costs associated with the adverse modification analysis would be attributable to the designation. In consultations involving unoccupied critical habitat, there may be incremental project modification costs that would be attributable to the designation of critical habitat and add to incremental administrative costs. In these cases, we believe a reasonable method to determine the potential incremental economic impacts of these activities would be to assume that if activities with a Federal nexus would alter the PBFs to an extent that appreciably reduces the conservation value of critical habitat for spikedace or loach minnow, the costs associated with conservation measures implemented to mitigate those impacts would be attributable to critical habitat designation. In cases where we determine that an adverse modification finding may be likely, we will work with the Federal agency involved to identify reasonable and prudent alternatives that would eliminate or reduce those impacts to a point where adverse modification is no longer likely. The resulting project modifications would appropriately be considered an incremental cost of the critical habitat designation.

Thank you for your continued coordination. If you have any questions, please contact Mary Richardson (x242) or Debra Bills (x239) of my staff.

Sincerely,



Steven L. Spangle
Field Supervisor

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