APPENDIX D

U.S. FISH AND WILDLIFE SERVICE CONCURRENCE LETTER

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region

IN REPLY REFER TO:
FWS/R6
ES

MAILING ADDRESS:
P.O. Box 25486, DFC
Denver, Colorado 80225-0486

STREET LOCATION:
134 Union Boulevard
Lakewood, Colorado 80228-1807

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Memorandum

To: Field Manager, Bureau of Land Management, Pinedale, Wyoming
Attention: Priscilla Mecham

From: ACTING Regional Director, Region 6
U.S. Fish and Wildlife Service
Denver, Colorado

Subject: Final Biological Opinion for the Jonah Infill Drilling Project, Sublette County, Wyoming

In accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), and the Interagency Cooperation Regulations (50 CFR 402), this document transmits the U.S. Fish and Wildlife Service's (USFWS) biological opinion based on our review of the proposed Jonah Infill Drilling Project (Project) located in Sublette County, Wyoming, and its effects on the endangered Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), bonytail (*Gila elegans*), and razorback sucker (*Xyrauchen texanus*) and their critical habitats. Your October 25, 2005, correspondence requesting initiation of formal consultation was received on October 28, 2005.

This biological opinion is based primarily on our review of the information in your request letter and supplemental information regarding the proposed actions and the estimated average annual water depletion. A complete administrative record of this consultation is on file at the USFWS Wyoming Field Office. Copies of this opinion should be provided to the applicant because the USFWS has incorporated reasonable and prudent alternatives that should be included as conditions of any authorization issued by the Bureau of Land Management (BLM) for this Project.

With respect to critical habitat, this biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Jonah Infill Drilling Project Area currently encompasses approximately 30,500 acres located in portions of Townships 28 and 29 North, Ranges 107 through 109 West, in Sublette County approximately 32 miles southeast of Pinedale and 28 miles northwest of Farson, Wyoming. There are 501 producing and shut-in natural gas wells within the Project Area as well as extensive infrastructure including roads and pipelines for natural gas production.

The proposed expansion of the existing Project includes drilling up to 3,100 new wells and 16,200 acres of new surface disturbance over the next 12.4 years. This proposed expansion includes--a minimum of 64 well pads per 640-acre section; downhole well spacing from 1 bottomhole every 5 acres to one bottomhole every 40 acres; 465 miles of new resource roads with associated pipelines; 8 miles of new collector/local roads; 41 acres of new surface disturbance for ancillary facilities; and 100 acres of new surface disturbance for exploration of other geologic formations. A total of 12,400 acre-feet of water from the Green River Basin in Wyoming will be used for well drilling, hydrostatic testing of pipelines, and dust abatement associated with this proposed expansion of the Jonah Infill Drilling Project.

An additional component of the proposed Jonah Infill Drilling Project is the Bird to Opal III compressor station and pipeline. There will be one 36-inch diameter pipeline that will be 17 miles long and two segments of 24-inch diameter pipeline that will be 51 miles long. Hydrostatic testing of these pipelines will require a total of 16.2 acre-feet of water from the Green River Basin in Wyoming.

Habitat reclamation for areas disturbed by the proposed Project is described in the Jonah Gas Field Native Habitat Surface Reclamation Project Plan. This reclamation plan will characterize the physical and biological nature of the Jonah field's soils and vegetation to be used in design site goals and prescriptions for reclamation. Six treatments have been identified for experimental vegetation plantings. Approximately 67 acre-feet of water from the Green River Basin will be used to hold topsoil in place and to provide moisture for planting and seed germination.

Consequently, the revised Jonah Infill Drilling Project and associated Project components as described above will result in a total depletion to the Green River Basin in Wyoming of 12,483 acre-feet over the 12.4 year life of the project. The average annual depletion over the life of the project is 1,006.7 acre-feet.

Our regulations define the action area as all areas directly or indirectly affected by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The subject Project water depletion would result in a loss of water from the point of removal within the Green River Basin in Wyoming, continuing downstream to the confluence with the Colorado River, and downstream to Lake Powell. Therefore, the action area designation begins at the water removal location as described above downstream to Lake Powell.

STATUS OF THE SPECIES AND CRITICAL HABITAT

COLORADO PIKEMINNOW

Species Description

The Colorado pikeminnow is the largest cyprinid fish (minnow family) native to North America and evolved as the main predator in the Colorado River system. It is an elongated pike-like fish that during predevelopment times may have grown as large as 6 feet in length and weighed nearly 100 pounds (Behnke and Benson 1983). Today, Colorado pikeminnow rarely exceed 3 feet in length or weigh more than 18 pounds; such fish are estimated to be 45 to 55 years old (Osmundson et al. 1997). The mouth of this species is large and nearly horizontal with long slender pharyngeal teeth (located in the throat), adapted for grasping and holding prey. The diet of Colorado pikeminnow longer than 3 or 4 inches consists almost entirely of other fishes (Vanicek and Kramer 1969). Males become sexually mature earlier and at a smaller size than do females, though all are mature by about age 7 and 20 inches in length (Vanicek and Kramer 1969; Seethaler 1978; Hamman 1981). Adults are strongly countershaded with a dark, olive back, and a white belly. Young are silvery and usually have a dark, wedge-shaped spot at the base of the caudal fin.

Status and Distribution

Based on early fish collection records, archaeological finds, and other observations, the Colorado pikeminnow was once found throughout warmwater reaches of the entire Colorado River Basin down to the Gulf of California, and including reaches of the upper Colorado River and its major tributaries, the Green River and its major tributaries, and the Gila River system in Arizona (Seethaler 1978). Colorado pikeminnow apparently were never found in colder, headwater areas. Seethaler (1978) indicated that the species was abundant in suitable habitat throughout the entire Colorado River Basin prior to the 1850s. No historic records exist that would indicate how far upstream Colorado pikeminnow once occurred in the Colorado River. The only reliable account of the species occurring upstream of the Price Stubb Dam near Palisade, Colorado, is from a USFWS biologist who reports having captured Colorado pikeminnow in Plateau Creek approximately 2-3 miles upstream from the Colorado River confluence while angling there around 1960 (Osmundson 2001).

By the 1970s, Colorado pikeminnow were extirpated from the entire lower basin (downstream of Glen Canyon Dam) and from portions of the upper basin of the Colorado River as a result of major alterations to the riverine environment. Having lost 75 to 80 percent of its former range (Miller 1961; Moyle 1976; Tyus 1991; Osmundson and Burnham 1998), the Colorado pikeminnow was federally listed as an endangered species in 1967 (32 FR 4001).

Colorado pikeminnow are presently restricted to the Upper Colorado River Basin and inhabit warmwater reaches of the Colorado, Green, and San Juan Rivers and associated tributaries. The species inhabits about 350 miles of the mainstem Green River from its confluence with the Colorado River upstream to the mouth of the Yampa River. In the Yampa River, its range extends upstream an additional 160 miles. Colorado pikeminnow also occur in the lowermost

104 miles of the White River, another tributary to the Green River. In the mainstem Colorado River, distribution of the species extends 201 miles upstream from the upper end of Lake Powell to Palisade, Colorado (Tyus 1982).

Colorado pikeminnow are found in the Gunnison River as far upstream as the Hartland Diversion Dam, which is a barrier to upstream fish passage, located approximately 57 miles upstream of the Redlands Diversion Dam (Burdick 1995). Colorado pikeminnow use most of the Gunnsion River between the Redlands Diversion and the Hartland Diversion (Burdick 1995). A suspected spawning area was located between river mile 32 and 33 (Burdick 1995; McAda 2003). Colorado pikeminnow larvae were collected in the Gunnison River in 1995 and 1996 (Anderson 1999). Collection of larval fish provides evidence of spawning, but does not locate specific spawning locations.

Osmundson and Burnham (1998) summarized the status and trend of the Colorado River population of Colorado pikeminnow. They found that numbers were low but new individuals were actively recruiting to the adult population, and recruitment largely occurs in pulses from infrequent strong year classes. These investigators concluded that low adult numbers and infrequent pulsed recruitment make this population vulnerable to extirpation over time from both natural fluctuations in numbers as well as from continued changes in habitat.

Threats

Major declines in Colorado pikeminnow populations occurred during the dam-building era of the 1930s through the 1960s. Behnke and Benson (1983) summarized the decline of the natural ecosystem, pointing out that dams, impoundments, and water use practices drastically modified the river's natural hydrology and channel characteristics throughout the Colorado River Basin. Dams on the mainstem broke the natural continuum of the river ecosystem into a series of disjunct segments, blocking native fish migrations, reducing temperatures downstream of dams, creating lacustrine habitat, and providing conditions that allowed competitive and predatory nonnative fishes to thrive both within the impounded reservoirs and in the modified river segments that connect them. The highly modified flow regime in the lower basin coupled with the introduction of nonnative fishes decimated populations of native fish.

Major declines of native fishes first occurred in the lower basin where large dams were constructed from the 1930s through the 1960s. In the upper basin, the following major dams were not constructed until the 1960s--Glen Canyon Dam on the mainstem Colorado River, Flaming Gorge Dam on the Green River, Navajo Dam on the San Juan River, and the Aspinall Unit Dams on the Gunnison River. To date, some native fish populations in the Upper Basin have managed to persist, while others have become nearly extirpated. River segments where native fish have declined more slowly than in other areas are those where the hydrologic regime most closely resembles the natural condition, where adequate habitat for all life phases still exists, and where migration corridors are unblocked and allow connectivity among life phases.

The Redlands Diversion Dam restricted upstream travel of Colorado pikeminnow in the lower Gunnison River between 1917 and 1996. A small remnant population persisted upstream of the dam. Five adult Colorado pikeminnow were captured in the Gunnison River between 1992 and 1994 (Burdick 1995). Earlier studies captured four adult Colorado pikeminnow in the Gunnison

River between river mile 22.1 and 31.4 (Valdez et al. 1982a). In 1996 the fish ladder was constructed around the Redlands Diversion Dam, and 62 Colorado pikeminnow have ascended the fish ladder. In addition, 1,050 Colorado pikeminnow (150-300 millimeters long) were stocked in the Gunnison River at Delta in 2003.

In the mainstem Colorado River, the magnitude of spring flows has declined by 30 to 45 percent since the early part of the century (Osmundson and Kaeding 1991; Van Steeter 1996; Pitlick et al. 1999). Such flow reduction negatively affects Colorado pikeminnow in four ways-- 1) reducing the river's ability to build and clean cobble bars for spawning; 2) reducing the dilution effect for waterborne contaminants from urban and agricultural sources that may interfere with reproductive success; 3) reducing the connectivity of main-channel and bottomland habitats needed for habitat diversity and productivity; and 4) providing a more benign environment for nonnative fish and invasive nonnative, bank-stabilizing shrubs (salt cedar) to persist and flourish (Osmundson and Burnham 1998). In general, the existing habitat has been modified to the extent that it impairs essential behavior patterns, such as breeding, feeding, and sheltering.

Nonnative fishes compete with native fishes in several ways. The capacity of a particular area to support aquatic life is limited by physical habitat conditions. Increasing the number of species in an area usually results in a smaller population of most species. The size of each species population is controlled by the ability of each life stage to compete for space and food resources and to avoid predation. Some nonnative fishes' life stages appear to have a greater ability to compete for space and food and to avoid predation in the existing altered habitat than do some native fishes' life stages.

Nonnative fishes are often stocked in and enter rivers from off-channel impoundments. The periodic introduction of these nonnative fishes into a river allows them to bypass limitations to reproduction, growth, or survival that they might encounter in the river. Consequently, populations of nonnative fishes in the river are enhanced. Endangered and other native species in the river experience greater competition and predation as a result.

Life History

The life-history phases that appear to be most critical for the Colorado pikeminnow include spawning, egg hatching, development of larvae, and the first year of life. These phases of Colorado pikeminnow development are tied closely to specific habitat requirements. Natural spawning of Colorado pikeminnow is initiated on the descending limb of the annual hydrograph as water temperatures approach or exceed 20°C (Vanicek and Kramer 1969; Hamman 1981; Haynes et al. 1984; Tyus 1990; McAda and Kaeding 1991). Temperature at initiation of spawning varies somewhat by river--in the Green River, spawning begins as temperatures exceed 20-23°C; in the Yampa River, 16-23°C (Bestgen et al. 1998); in the Colorado River, 18-22°C (McAda and Kaeding 1991). Spawning, both in the hatchery and under natural riverine conditions, generally occurs in a 2-month timeframe between late June and late August. However, in the natural system, sustained high flows during wet years may suppress river temperatures and extend spawning into September (McAda and Kaeding 1991). Conversely, during low flow years, when the water warms earlier, spawning may commence in mid-June.

Temperature has an effect on egg development and hatching success. In the laboratory, egg development was tested at five temperatures and hatching success was found to be highest at 20°C, lower at 25°C, and mortality was 100 percent at 5, 10, 15, and 30°C. In addition, larval abnormalities were twice as high at 25°C than at 20°C (Marsh 1985).

Experimental tests of temperature preference of yearling (Black and Bulkley 1985a) and adult (Bulkley et al. 1981) Colorado pikeminnow indicated that 25°C was the most preferred temperature for both life phases. Additional experiments indicated that optimum growth of yearling Colorado pikeminnow also occurs at temperatures near 25°C (Black and Bulkley 1985b). Although no such tests were conducted using adults, the tests with yearlings supported the conclusions of Jobling (1981) that the final thermal preferendum provides a good indication of optimum growth temperature, i.e., 25°C.

Most information on Colorado pikeminnow reproduction was gathered from spawning sites on the lower 20 miles of the Yampa River and in Gray Canyon on the Green River (Tyus and McAda 1984; Tyus 1985; Wick et al. 1985; Tyus 1990). Colorado pikeminnow spawn after peak runoff subsides and is probably triggered by several interacting variables such as photoperiod, temperature, flow level, and perhaps substrate characteristics. Spawning generally occurs from late June to mid-August with peak activity occurring when water temperatures are between 18 and 23°C (Haynes et al. 1984; Archer et al. 1985; Tyus 1990; Bestgen et al. 1998).

Spawning has been confirmed in the Colorado River by the presence of Colorado pikeminnow larvae in all years sampled. Larvae are distributed throughout the river although most have been found downstream of Grand Junction (McAda and Kaeding 1991; Osmundson and Burnham 1998). Aggregations of ripe adults have been found near Clifton and Grand Junction, Colorado, and near the Colorado-Utah State line (Osmundson and Kaeding 1989; McAda and Kaeding 1991; USFWS unpublished data). Suitable spawning habitat (defined below) in the Colorado River near Cataract Canyon, Professor Valley, and upstream from the Dolores River confluence indicates spawning may occur in or near these areas as well (Archer et al. 1985; Valdez 1990).

Known spawning sites in the Yampa River are characterized by riffles or shallow runs with well-washed coarse substrate (cobble containing relatively deep interstitial voids (for egg deposition) in association with deep pools or areas of slow laminar flow used as staging areas by adults (Lamarra et al. 1985; Tyus 1990). Recent investigations at a spawning site in the San Juan River by Bliesner and Lamarra (1995) and at one in the upper Colorado River (USFWS unpublished data) indicate a similar association of habitats. The most unique feature at the sites actually used for spawning, in comparison with otherwise similar sites nearby, is the degree of looseness of the cobble substrate and the depth to which the rocks are devoid of fine sediments; this appears consistent at the sites in all three rivers (Lamarra et al. 1985; Bliesner and Lamarra 1995).

Habitat Use and Preferences

Clean cobble substrates that provide interstitial spaces for eggs are necessary for spawning and egg incubation (Tyus and Karp 1989). Several studies on the cobble cleaning process have been conducted at a known spawning location in Yampa Canyon. O'Brien (1984) studied the hydraulic and sediment transport dynamics of the cobble bar within the Yampa River spawning site and duplicated some of its characteristics in a laboratory flume study. O'Brien (1984) concluded that incipient motion of the cobble bed is required to clean cobbles for spawning and estimated that this takes discharges of about 21,500 cfs. However, Harvey et al. (1993) concluded that because flows required for incipient motion of bed material are rare (20-year return period event) and spawning occurs annually, another process must be cleaning the cobbles. Their study found that in Yampa Canyon recessional flows routinely dissect gravel bars and thereby produce tertiary bars of clean cobble at the base of the riffles. These tertiary bars are used by Colorado pikeminnow for spawning. The importance of high magnitude, low frequency discharges is in forming and maintaining the midchannel bars. Dissection of bars without redeposition by high magnitude flows would lead to conditions where spawning habitat is no longer available (Harvey et al. 1993).

It is unknown whether tertiary bars similar to those used for Colorado pikeminnow spawning in Yampa Canyon are available in the 15-mile reach of the Colorado River. There, significant motion of bed material occurs at near bankfull discharge of 22,000 cfs (Van Steeter 1996). These flows occur on average once in 4 years. Van Steeter (1996) concluded that flows of this magnitude are important because they generally remove fine sediment from the gravel matrix which maintains the invertebrate community and cleans spawning substrate.

Although the location of spawning areas in the Colorado River is not as defined as in the Yampa River, the annual presence of larvae and young-of-the-year downstream of the Walker Wildlife Area, in the Loma to Black Rocks reach and near the confluence of the Dolores River, demonstrates that spawning occurs every year. Osmundson and Kaeding (1989, 1991) reported that water temperatures in the Grand Junction area were suitable for Colorado pikeminnow spawning. In 1986, a year of high runoff, suitable temperatures for spawning (20°C) occurred in mid-August; in 1989, a year of low runoff, the mean temperature reached 20°C during the last week of June. Tyus (1990) demonstrated that Colorado pikeminnow often migrate considerable distances to spawn in the Green and Yampa Rivers, and similar though more limited movement has been noted in the mainstem Colorado River (McAda and Kaeding 1991).

Collections of larvae and young-of-the-year downstream of known spawning sites in the Green and Yampa Rivers indicate that downstream drift of larval Colorado pikeminnow occurs following hatching (Haynes et al. 1984; Nesler et al. 1988; Tyus 1990, Tyus and Haines 1991). During their first year of life, Colorado pikeminnow prefer warm, turbid, relatively deep (averaging 1.3 feet) backwater areas of zero velocity (Tyus and Haines 1991). After about 1 year, young are rarely found in such habitats, though juveniles and subadults are often located in large deep backwaters during spring runoff (USFWS, unpublished data; Osmundson and Burnham 1998).

Larval Colorado pikeminnow have been collected in the Gunnison River upstream and downstream of the Redlands Diversion Dam (Anderson 1999; Osmundson and Burnham 1998). Burdick (1997) reports that the capture of larval Colorado pikeminnow in 1995 and 1996 upstream of the Redlands Diversion Dam coupled with aggregations of radio-tagged adult fish during the spawning season confirms that spawning occurs upstream of the dam.

Information on radio-tagged adult Colorado pikeminnow during fall suggests that fish seek out deep water areas in the Colorado River (Miller et al. 1982; Osmundson and Kaeding 1989), as do many other riverine species. River pools, runs, and other deep water areas, especially in upstream reaches, are important winter habitats for Colorado pikeminnow (Osmundson et al. 1995).

Very little information is available on the influence of turbidity on the endangered Colorado River fishes. Osmundson and Kaeding (1989) found that turbidity allows use of relatively shallow habitats ostensibly by providing adults with needed cover; this allows foraging and resting in areas otherwise exposed to avian or land predators. Tyus and Haines (1991) found that young Colorado pikeminnow in the Green River preferred backwaters that were turbid. Clear conditions in these shallow waters might expose young fish to predation from wading birds or introduced sight-feeding, piscivorous fish. It is unknown whether the river was as turbid in the past as it is today. For now, it is assumed that these endemic fishes evolved under natural conditions of high turbidity; therefore, the retention of these highly turbid conditions is probably an important factor in maintaining the ability of these fish to compete with nonnatives that may not have evolved under similar conditions.

Population Dynamics

Osmundson (2002) investigated population dynamics of Colorado pikeminnow from 1991 to 2000. These years were divided into two study periods--1991 to 1994 and 1998 to 2000. The results of the investigation found that annual estimates of whole-river (the Colorado River from the confluence with the Green River upstream to the Price-Stubb Dam, including the lower 2.3 miles of the Gunnison River downstream of the Redlands Diversion Dam) population size (all fish $\geq$ 250 mm) averaged 582 fish during the earlier study period and 742 fish during the more recent study period. This represents a 27 percent increase based on these estimates. Estimates of adult fish ($\geq$ 500 mm) averaged 362 during the earlier study period and 490 during the more recent study period, representing a 35 percent increase in adult fish.

Colorado pikeminnow reproduce each year; however, strong year classes that recruit fish to the adult population are relatively rare (Osmundson and Burnham 1998). A distinct increase of subadult fish was found below Moab in 1991 and within a few years these fish were distributed throughout the Colorado River. Osmundson and Burnham (1998) concluded that these fish were the result of one or more strong year classes produced during the mid-1980s. McAda and Ryel (1999) have identified another strong year class that occurred in 1996. In both cases, the common hydrologic conditions that led to successful reproduction and first year survival was a spring and summer of moderately high flows following a year of exceptionally high-flood flows (McAda and Ryel 1999).

Critical Habitat

Critical habitat for the Colorado pikeminnow was designated in 1994 within the 100-year floodplain of the Colorado pikeminnow's historical range in the following area of the upper Colorado River (59 FR 13374). Colorado pikeminnow now only occur in the upper Colorado

River basin (upstream of Lee Ferry just below the Glen Canyon Dam). Most of Lake Powell is not suitable habitat for Colorado pikeminnow and is not designated critical habitat. The total designated miles is 1,148 and represents 29 percent of the historical habitat for the species:

> Moffat County, Colorado. The Yampa River and its 100-year floodplain from the State Highway 394 bridge in T. 6 N., R. 91 W., section 1 (6th Principal Meridian) to the confluence with the Green River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian).
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> Uintah, Carbon, Grand, Emery, Wayne, and San Juan Counties, Utah; and Moffat County, Colorado. The Green River and its 100-year floodplain from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to the confluence with the Colorado River in T. 30 S., R. 19 E., section 7 (Salt Lake Meridian).
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> Rio Blanco County, Colorado; and Uintah County, Utah. The White River and its 100-year floodplain from Rio Blanco Lake Dam in T. 1 N., R. 96 W., section 6 (6th Principal Meridian) to the confluence with the Green River in T. 9 S., R. 20 E., section 4 (Salt Lake Meridian).
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> Delta and Mesa Counties, Colorado. The Gunnison River and its 100-year floodplain from the confluence with the Uncompahgre River in T. 15 S., R. 96 W., section 11 (6th Principal Meridian) to the confluence with the Colorado River in T. 1 S., R. 1 W., section 22 (Ute Meridian).
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> Mesa and Garfield Counties, Colorado; and Grand, San Juan, Wayne, and Garfield Counties, Utah. The Colorado River and its 100-year floodplain from the Colorado River Bridge at exit 90 north off Interstate 70 in T. 6 S., R. 93 W., section 16 (6th Principal Meridian) to North Wash, including the Dirty Devil arm of Lake Powell up to the full pool elevation, in T. 33 S., R. 14 E., section 29 (Salt Lake Meridian).
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> San Juan County, New Mexico; and San Juan County, Utah. The San Juan River and its 100-year floodplain from the State Route 371 Bridge in T. 29 N., R. 13 W., section 17 (New Mexico Meridian) to Neskahai Canyon in the San Juan arm of Lake Powell in T. 41 S., R. 11 E., section 26 (Salt Lake Meridian) up to the full pool elevation.

The final critical habitat rule identified water, physical habitat, and the biological environment as the Primary Constituent Elements (PCEs) of critical habitat. The water PCE was further described as including a quantity of water of sufficient quality (i.e., temperature, dissolved oxygen, lack of contaminants, nutrients, turbidity, etc.) that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable by fish for use in spawning, nursery, feeding, and rearing, or serve as corridors between these areas. In addition to river channels, these areas also include bottom lands, side channels, secondary channels, oxbows, backwaters, and other areas in the 100-year floodplain, which when inundated provide access to spawning, nursery, feeding, and rearing habitats. The biological environment PCE includes food supply predation, and competition. Food supply is a function of nutrient supply, productivity, and availability to each life stage of the species. Predation and competition, although considered normal components of this environment, are out of balance due to introduced nonnative fish species in many areas.

PRIMARY CONSTITUENT ELEMENT - WATER

The status of water quantity includes all historical depletions in the Upper Basin, depletions resulting from projects, which have previously undergone section 7 consultation, and depletions resulting from projects contemporaneous with this consultation. Since 1988, the USFWS has consulted on 152 projects with a potential to deplete a total of 1,729,060 acre-feet in the entire Upper Colorado River Basin, of which 1,507,202 acre-feet are historic depletions. According to the Colorado River Compact of 1922, the total flow from the Upper Colorado River Basin is approximately 16 million acre-feet in an average year. Therefore, withdrawals of approximately 11 percent of the average flow has been covered in previous biological opinions.

The status of water quality in critical habitat includes concerns regarding the following contaminants--heavy metals, selenium, salts, PAHs, and pesticides. Selenium is of particular concern because of its documented effects on fish (and wildlife) reproduction. Many chemical, physical, and biological factors affect the toxicity of environmental contaminants to biological organisms. Chemical and physical factors include contaminant type, chemical species or form, pH, water temperature, dissolved oxygen, hardness, salinity, and multiple-chemical exposure (antagonism and synergism). Duration of exposure, quantity of contaminant, and exposure pathways from the environment to the organism also affect toxicity. Some trace elements are beneficial to organisms at low concentrations but may be toxic at higher concentrations. Biological and physiological factors affecting toxicity include species, age, sex, and health of the organism.

Selenium concentrations can be elevated in areas where irrigation occurs on soils which are derived from or which overlie Upper Cretaceous marine sediments. Percolation of irrigation water through these soils and sediments leaches selenium into receiving waters. Other sources of selenium include powerplant fly ash and oil refineries. Water depletions, by reducing dilution effects, have increased the concentrations of selenium and other contaminants. In 1995, Colorado's Water Quality Control Commission reduced the chronic selenium standard from 17 μg/L to 5 μg/L. The USFWS recommended the level be lowered to 2 μg/L.

PRIMARY CONSTITUENT ELEMENT - PHYSICAL HABITAT

Physical habitat of the Colorado River in the action area has been greatly altered by changes in the timing and volume of flows, bank stabilization, diking, and diversion dams. Barriers to fish movement have been identified as a factor in the decline of the endangered fishes because they block migration routes and prevent fish from reaching spawning grounds and other important habitat. As an example, the Redlands Diversion Dam has been in place since 1918 and completely blocked upstream fish movement until 1996 when a fish ladder was installed. Large quantities of water are diverted into the Redlands Water and Power Company's Canal for power production and irrigation. Large diversions are known to divert many species of fish into canals, including the Colorado River endangered fishes (Burdick 2003). Once fish enter the Redlands

Canal, they likely enter the power turbines and are injured or killed. Fish also could be lost in the electric pumps, during canal dewatering, or transported through ditches to irrigated fields. Fish have likely been lost in the Redlands Water and Power Company's Canal since 1918.

In addition to blocking native fish migrations, dams have reduced downstream temperatures and created lacustrine habitats that provided conditions that allowed competitive and predatory nonnative fishes to thrive both within the impounded reservoirs and in the modified river segments that connect them. The highly modified flow regimes coupled with the introduction of nonnative fishes decimated populations of native fish.

Water depletions, by affecting the quantity and timing of flows, have reduced the ability of the river to create and maintain habitats and have reduced the frequency and duration of availability of certain habitats.

The formation of a variety of channel habitats, including gravel/cobble bars and substrates used by Colorado pikeminnow for spawning, is essential to ensure the availability of the range of habitats required by all endangered fish life stages to fulfill daily requirements (foraging, resting, spawning, avoiding predation, etc.) under various flow conditions. The number and distribution of these channel habitats can be described as channel habitat complexity, diversity, or heterogeneity. Osmundson and Kaeding (1991) found that adult Colorado pikeminnow in the Grand Valley prefer river segments with a complex morphometry to those that are simple. Some important physical habitats, such as inundated floodplain depressions, are located outside the channel. Floodplain depressions are principally derived from abandoned main channels, side-channels, backwaters, and meander cutoffs.

The creation of complex channel habitat and the formation and eventual abandonment of channel features from which floodplain depressions are formed occur primarily during spring runoff when flows are of sufficient size and duration to cause major changes in channel morphology through significant erosion and deposition of bed and bank materials. The reduction in the magnitude, duration, and frequency of high spring flows has slowed the rate at which channel morphology changes. Consequently, the creation of complex channel habitat and floodplain depressions has slowed. The placement of riprap and other bank stabilization measures and the construction of dikes and levees impede changes in channel morphology and contribute to the slowed creation of complex channel habitat. In addition, the construction of dikes and levees reduces existing channel habitat complexity by causing channelization of the river. Dikes and levees also isolate existing floodplain depressions from the channel during high flows. The slowed creation of complex channel habitats and new floodplain depressions, the reduction of existing channel habitat complexity, and the isolation of existing floodplain depressions have acted to reduce the quantity and quality of important habitat for endangered fishes.

Backwaters, a habitat component of the physical habitat PCE, are essential for various life stages of endangered fish. Backwaters are damaged by the deposition of fine sediments which reduces their depth and consequently their duration and frequency of inundation. Gravel and cobble substrates, used by pikeminnow for spawning, are damaged by the infiltration of fine sediments. The establishment of vegetation on backwater sediments and on bars further reduces the value of these habitats for endangered fishes. Furthermore, higher flows are required to flush sediments from vegetated backwaters than from unvegetated ones. Osmundson and Kaeding (1991) reported observations that, on the 15-mile reach during the drought years of 1988 to 1990, backwaters were filling in with silt and spring flows were not sufficient to flush out the fine sediment. Also, they reported that tamarisk colonized sand and cobble bars. Therefore, the lower frequency of high water years decreases the frequency at which silt and sand is flushed from backwaters, fine sediments are flushed from gravel/cobble substrates, and vegetation is scoured from backwaters and bars. Flow recommendations recently developed for the Gunnison River (McAda 2003) are intended to restore and maintain in-channel critical habitats used by all life stages--1) spawning areas for adults; 2) spring, summer, autumn, and winter habitats used by subadults and adults; and 3) nursery areas used by larvae, young-of-year, and juveniles.

Summer (August-October) Habitats--Osmundson et al. (1995) reported that, in the 15-mile reach, availability of habitats did not differ significantly between periods of moderate flows and low flows. Though absolute area of habitat decreases with declining flows, relative area or percent composition of habitat types changes little. However, pikeminnow habitat use patterns did change. The fish used a greater variety of habitats during moderate flows than during low flows. During moderate flows, the fish used primarily backwaters, eddies, and pools. During low flows, the fish used slow and fast runs almost exclusively. The change in habitat use without a corresponding change in relative habitat availability indicates that other factors also influence habitat selection. These factors could include changes in quality of physical habitat features such as diversity, depth, dissolved oxygen, etc., or changes in biotic interactions. Osmundson et al. (1995) interpreted the pikeminnow behavioral changes as reflective of suboptimal conditions; the behavioral changes demonstrate the ability of the species to modify their habitat use patterns to temporarily cope with adverse conditions and do not demonstrate habitat preferences under optimum conditions.

Winter (November-March) Habitats--Osmundson et al. (1995) reported that, in the 15-mile reach, flows during the winter are usually moderate because no water is diverted for irrigation and because additional water is released through upstream dams to increase reservoir storage capacity in anticipation of spring runoff. The relative availability of slow runs and riffles during the winter was very similar to their availability during summer. As in the summer, backwaters, eddies, and pools were the preferred types of habitat in the winter. However, whereas eddies were most preferred in summer, pools were most preferred in winter. Adult pikeminnow used fewer habitat types overall during winter than during summer. Although fast runs and riffles were used during the summer, they were not used during the winter. The colder water temperatures in winter which cause lower metabolic rates may account for the avoidance of high velocity sites. Absolute area of pools increases as flows decrease and slow runs lose velocity. Because Osmundson et al. (1995) did not sample low flows in the winter, they could not determine if pools would still be preferred in the winter at lower flows.

Spring (April-July) Habitats--Osmundson and Kaeding (1989) reported that pikeminnow use of low velocity habitats such as backwaters and flooded gravel pits is greatest during the spring runoff. It is believed that pikeminnow use these habitats during the runoff to escape the high velocity, low temperature flows of the main channel. Because backwaters, flooded gravel pits, and other low velocity habitats are considerably warmer than the main channel during the runoff, these habitats allow pikeminnow to extend their growing season substantially. The earlier warming of these habitats also may be important in enabling pikeminnow to reach spawning condition by the time flow and temperature in the main channel are optimum for spawning. Osmundson et al. (1995) reported that, in the 15-mile reach, the numbers of backwaters and flooded gravel pits increases with increasing spring flows. (Although the number of backwaters eventually decreases as increasing flows convert backwaters to side channels, the number of other low velocity habitats likely increases as increasing flows inundate additional bottomlands.) The decrease in the magnitude, duration, and frequency of high spring flows, then, decreases the quantity and the duration and frequency of availability of important low velocity, higher temperature habitat in the spring. These changes could be affecting pikeminnow growth and spawning success.

PRIMARY CONSTITUENT ELEMENT - BIOLOGICAL ENVIRONMENT

This PCE includes food supply and predation. As described in the species section above, predation and competition from nonnative fishes have been clearly implicated in the population reductions or elimination of native fishes in the Colorado River Basin (Dill 1944; Minckley and Deacon 1968; Joseph et al. 1977; Lanigan and Berry 1979; Behnke 1980; Meffe 1985; Osmundson and Kaeding 1989; Propst and Bestgen 1991; Rinne 1991). The modification of flow regimes, water temperatures, sediment levels, and other habitat conditions caused by water depletions has contributed to the establishment of nonnative fishes. During low water years, nonnative minnows capable of preying on or competing with larval endangered fishes greatly increase in numbers (Osmundson and Kaeding 1991). Thus, the biological environment PCE has been adversely affected by nonnative fishes.

Species/Critical Habitat Likely to be Affected

The Colorado pikeminnow and its critical habitat in the action area are likely to be adversely affected. The critical habitat includes the Green River and its 100-year floodplain from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to the confluence with the Colorado River in T. 30 S., R. 19 E., section 7 (Salt Lake Meridian), continuing to the Colorado River and its 100-year floodplain from the Colorado River Bridge at exit 90 north off Interstate 70 in T. 6 S., R. 93 W., section 16 (6th Principal Meridian) to North Wash, including the Dirty Devil arm of Lake Powell up to the full pool elevation, in T. 33 S., R. 14 E., section 29 (Salt Lake Meridian).

RAZORBACK SUCKER

Species Description

The razorback sucker, an endemic species unique to the Colorado River Basin, was historically abundant and widely distributed within warmwater reaches throughout the Colorado River Basin. The razorback sucker is the only sucker with an abrupt sharp-edged dorsal keel behind its head. It has a large fleshy subterminal mouth that is typical of most suckers. Adults often exceed 6 pounds in weight and 2 feet in length.

Historically, razorback suckers were found in the mainstem Colorado River and major tributaries in Arizona, California, Colorado, Nevada, New Mexico, Utah, Wyoming, and in Mexico (Ellis 1914; Minckley 1983). Bestgen (1990) reported that this species was once so numerous that it was commonly used as food by early settlers and, further, that commercially marketable quantities were caught in Arizona as recently as 1949. In the Upper Basin, razorback suckers were reported in the Green River to be very abundant near Green River, Utah, in the late 1800s (Jordan 1891). An account in Osmundson and Kaeding (1989) reported that residents living along the Colorado River near Clifton, Colorado, observed several thousand razorback suckers during spring runoff in the 1930s and early 1940s. In the San Juan River drainage, Platania and Young (1989) relayed historical accounts of razorback suckers ascending the Animas River to Durango, Colorado, around the turn of the century.

Status and Distribution

The current distribution and abundance of the razorback sucker have been significantly reduced throughout the Colorado River system, due to lack of recruitment to the adult population (Holden and Stalnaker 1975; McAda and Wydoski 1980; Minckley 1983; McAda 1987; Tyus 1987; Marsh and Minckley 1989). The only substantial population exists in Lake Mohave with an estimated population of 5,000 adult razorback suckers in 2005 (Burke 2005) down from an earlier estimate of 25,000 in 1995 (Minckley 1995) and 60,000 in 1991 (Minckley et al. 1991). They do not appear to be successfully recruiting. While limited numbers of razorback suckers persist in other locations in the lower Colorado River, they are considered rare or incidental and may be continuing to decline.

In the Upper Basin, above Glen Canyon Dam, razorback suckers are found in limited numbers in both lentic and lotic environments. The largest population of razorback suckers in the Upper Basin is found in the upper Green River and lower Yampa River (Tyus 1987). Lanigan and Tyus (1989) estimated that from 758 to 1,138 razorback suckers inhabit the upper Green River. Modde et al. (1996) report no significant decrease in the population between 1982 and 1992, and the continued presence of fish smaller than 480 mm during the study period suggest some level of recruitment. In the Colorado River, most razorback suckers occur in the Grand Valley area near Grand Junction, Colorado; however, they are increasingly rare. Osmundson and Kaeding (1991) report that the number of razorback sucker captures in the Grand Junction area has declined dramatically since 1974. In 1991 and 1992, 28 adult razorback suckers were collected from isolated ponds adjacent to the Colorado River near De Beque, Colorado (Burdick 1992). The last wild razorback sucker was caught in the Grand Valley area in 1995; however, stocked razorback suckers are now captured on a regular basis in the Grand Valley area during ongoing survey efforts (C. McAda, pers. comm. 2005). The existing habitat has been modified to the extent that it impairs essential behavior patterns, such as breeding, feeding, and sheltering.

Anecdotal information indicates razorback sucker were once common in the Gunnison River (Kidd 1977; Quartrone 1993), and two specimens from the 1940s are in the University of Michigan Museum of Zoology (Wiltzius 1978). One razorback sucker was collected near Delta in 1975 (Wilzius 1978) and three were collected in the vicinity in 1981 (Holden et al. 1981). No razorback suckers were collected during sampling by Valdez et al. (1982a) or Burdick (1995).

A stocking program was initiated by the Recovery Program and between April 1994 and October 2001, 18,423 juvenile, sub-adult, and adult razorback suckers were stocked in the Gunnison River and 31,531 juvenile, sub-adult, and adult razorback suckers were stocked in the Colorado River (Burdick 2001a). Razorback suckers were not stocked in the Gunnison River in

2002 or 2003 due to the low water conditions, which increase the chance of fish being lost in the unscreened Redlands Canal. The goal of the stocking program is to establish a self-sustaining population of 600 individuals between Hartland Diversion and Redlands Diversion. In 2001 and 2002, six razorback suckers used the Redlands fish ladder. Razorback suckers did not use the Redlands fish ladder in 2003. In 2002, eight larval razorback suckers were collected in the Gunnison River (Osmundson 2002b). These are the first larval razorbacks suckers collected from the Colorado or Gunnison Rivers and confirm that spawning is taking place in the Gunnison River.

A marked decline in populations of razorback suckers can be attributed to construction of dams and reservoirs, introduction of nonnative fishes, and removal of large quantities of water from the Colorado River system. Dams on the mainstem Colorado River and its major tributaries have segmented the river system, blocking migration routes. Dams also have drastically altered flows, temperatures, and channel geomorphology. These changes have modified habitats in many areas so that they are no longer suitable for breeding, feeding, or sheltering. Major changes in species composition have occurred due to the introduction of numerous nonnative fishes, many of which have thrived due to man-induced changes to the natural riverine system.

Razorback suckers are in imminent danger of extirpation in the wild. The razorback sucker was listed as endangered October 23, 1991 (56 FR 54957). As Bestgen (1990) pointed out:

> "Reasons for decline of most native fishes in the Colorado River Basin have been attributed to habitat loss due to construction of mainstream dams and subsequent interruption or alteration of natural flow and physio-chemical regimes, inundation of river reaches by reservoirs, channelization, water quality degradation, introduction of nonnative fish species and resulting competitive interactions or predation, and other man-induced disturbances (Miller 1961; Joseph et al. 1977; Behnke and Benson 1983; Carlson and Muth 1989; Tyus and Karp 1989). These factors are almost certainly not mutually exclusive; therefore it is often difficult to determine exact cause and effect relationships."

The virtual absence of any recruitment suggests a combination of biological, physical, and/or chemical factors that may be affecting the survival and recruitment of early life stages of razorback suckers. Within the Upper Basin, recovery efforts endorsed by the Recovery Program include the capture and removal of razorback suckers from all known locations for genetic analyses and development of discrete brood stocks if necessary. These measures have been undertaken to develop refugia populations of the razorback sucker from the same genetic parentage as their wild counterparts such that, if these fish are genetically unique by subbasin or individual population, then separate stocks will be available for future augmentation. Such augmentation may be a necessary step to prevent the extinction of razorback suckers in the Upper Basin.

Life History

McAda and Wydoski (1980) and Tyus (1987) reported springtime aggregations of razorback suckers in off-channel habitats and tributaries; such aggregations are believed to be associated with reproductive activities. Tyus and Karp (1990) and Osmundson and Kaeding (1991) reported off-channel habitats to be much warmer than the mainstem river and that razorback suckers presumably moved to these areas for feeding, resting, sexual maturation, spawning, and other activities associated with their reproductive cycle. Prior to construction of large mainstem dams and the suppression of spring-peak flows, low velocity, off-channel habitats (seasonally flooded bottomlands and shorelines) were commonly available throughout the Upper Basin (Tyus and Karp 1989; Osmundson and Kaeding 1991). Dams changed riverine ecosystems into lakes by impounding water, which eliminated these off-channel habitats in reservoirs. Reduction in spring-peak flows eliminates or reduces the frequency of inundation of off-channel habitats. The absence of these seasonally flooded riverine habitats is believed to be a limiting factor in the successful recruitment of razorback suckers in their native environment (Tyus and Karp 1989; Osmundson and Kaeding 1991). Wydoski and Wick (1998) identified starvation of larval razorback suckers due to low zooplankton densities in the main channel and loss of floodplain habitats which provide adequate zooplankton densities for larval food as one of the most important factors limiting recruitment.

While razorback suckers have never been directly observed spawning in turbid riverine environments within the Upper Basin, captures of ripe specimens, both males and females, have been recorded (Valdez et al. 1982b; McAda and Wydoski 1980; Tyus 1987; Osmundson and Kaeding 1989; Tyus and Karp 1989; Tyus and Karp 1990; Platania 1990; Osmundson and Kaeding 1991) in the Yampa, Green, Colorado, and San Juan Rivers. Sexually mature razorback suckers are generally collected on the ascending limb of the hydrograph from mid-April through June and are associated with coarse gravel substrates (depending on the specific location).

The quantity and frequency of availability of inundated floodplain depressions used by razorback suckers for spawning is dependent on the magnitude and frequency of spring flows necessary to inundate these areas. The decrease in the magnitude and frequency of spring flows necessary to inundate floodplain depressions is believed to be largely responsible for poor razorback sucker spawning success.

Outside of the spawning season, adult razorback suckers occupy a variety of shoreline and main channel habitats including slow runs, shallow to deep pools, backwaters, eddies, and other relatively slow velocity areas associated with sand substrates (Tyus 1987; Tyus and Karp 1989; Osmundson and Kaeding 1989; Valdez and Masslich 1989; Tyus and Karp 1990; Osmundson and Kaeding 1991).

Habitat requirements of young and juvenile razorback suckers in the wild are not well known, particularly in native riverine environments. Prior to 1991, the last confirmed documentation of a razorback sucker juvenile in the Upper Basin was a capture in the Colorado River near Moab, Utah (Taba et al. 1965). In 1991, two early juvenile (36.6 and 39.3 mm TL) razorback suckers were collected in the lower Green River near Hell Roaring Canyon (Gutermuth et al. 1994). Juvenile razorback suckers have been collected in recent years from Old Charley Wash, a wetland adjacent to the Green River (Modde 1996). Between 1992 and 1995 larval razorback suckers were collected in the middle and lower Green River and within the Colorado River inflow to Lake Powell (Muth 1995). No young razorback suckers have been collected in recent times in the Colorado River.

Population Dynamics

Captures of razorback suckers in the upper Colorado River have been so low in recent years that estimating population size is not possible. Presumably, the numbers are very low due to the low capture rates and the extensive habitat modification described above.

Critical Habitat

Critical habitat was designated in 1994 within the 100-year floodplain of the razorback sucker's historical range in the following area of the upper Colorado River (59 FR 13374). The PCEs are the same as critical habitat for Colorado pikeminnow described previously, as is the status of the PCEs. We designated 15 reaches of the Colorado River system as critical habitat for the razorback sucker. These reaches total 1,724 miles as measured along the center line of the river within the subject reaches. The designation represents approximately 49 percent of the historical habitat for the species and includes reaches of the Green, Yampa, Duchesne, Colorado, White, Gunnison. and San Juan Rivers:

Moffat County, Colorado. The Yampa River and its 100-year floodplain from the mouth of Cross Mountain Canyon in T. 6 N., R. 98 W., section 23 (6th Principal Meridian) to the confluence with the Green River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian).

Uintah County, Utah; and Moffat County, Colorado. The Green River and its 100-year floodplain from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to Sand Wash in T. 11 S., R. 18 E., section 20 (6th Principal Meridian).

Uintah, Carbon, Grand, Emery, Wayne, and San Juan Counties, Utah. The Green River and its 100-year floodplain from Sand Wash at river mile 96 at T. 11 S., R. 18 E., section 20 (6th Principal Meridian) to the confluence with the Colorado River in T. 30 S., R. 19 E., section 7 (6th Principal Meridian).

Uintah County, Utah. The White River and its 100-year floodplain from the boundary of the Uintah and Ouray Indian Reservation at river mile 18 in T. 9 S., R. 22 E., section 21 (Salt Lake Meridian) to the confluence with the Green River in T. 9 S., R 20 E., section 4 (Salt Lake Meridian).

Uintah County, Utah. The Duchesne River and its 100-year floodplain from river mile 2.5 in T. 4 S., R. 3 E., section 30 (Salt Lake Meridian) to the confluence with the Green River in T. 5 S., R. 3 E., section 5 (Uintah Meridian).

Delta and Mesa Counties, Colorado. The Gunnison River and its 100-year floodplain from the confluence with the Uncompahgre River in T. 15 S., R. 96 W., section 11 (6th Principal Meridian) to Redlands Diversion Dam in T. 1 S., R. 1 W., section 27 (Ute Meridian).

Mesa and Garfield Counties, Colorado. The Colorado River and its 100-year floodplain from Colorado River Bridge at exit 90 north off Interstate 70 in T. 6 S., R. 93 W., section 16 (6th Principal Meridian) to Westwater Canyon in T. 20 S., R. 25 E., section 12 (Salt Lake Meridian) including the Gunnison River and its 100-year floodplain from the Redlands Diversion Dam in T. 1 S., R. 1 W., section 27 (Ute Meridian) to the confluence with the Colorado River in T. 1 S., R. 1 W., section 22 (Ute Meridian).

Grand, San Juan, Wayne, and Garfield Counties, Utah. The Colorado River and its 100-year floodplain from Westwater Canyon in T. 20 S., R. 25 E., section 12 (Salt Lake Meridian) to full pool elevation, upstream of North Wash, and including the Dirty Devil arm of Lake Powell in T. 33 S., R. 14 E., section 29 (Salt Lake Meridian).

San Juan County; and Utah, San Juan County, New Mexico. The San Juan River and its 100-year floodplain from the Hogback Diversion in T. 29 N., R. 16 W., section 9 (New Mexico Meridian) to the full pool elevation at the mouth of Neskahai Canyon on the San Juan arm of Lake Powell in T. 41 S., R. 11 E., section 26 (Salt Lake Meridian).

SPECIES/CRITICAL HABITAT LIKELY TO BE AFFECTED

The razorback sucker and its critical habitat, as described below, are likely to be adversely affected by the subject Project:

Uintah County, Utah; and Moffat County, Colorado. The Green River and its 100-year floodplain from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to Sand Wash in T. 11 S., R. 18 E., section 20 (6th Principal Meridian).

Uintah, Carbon, Grand, Emery, Wayne, and San Juan Counties, Utah. The Green River and its 100-year floodplain from Sand Wash at river mile 96 at T. 11 S., R. 18 E., section 20 (6th Principal Meridian) to the confluence with the Colorado River in T. 30 S., R. 19 E., section 7 (6th Principal Meridian).

Grand, San Juan, Wayne, and Garfield Counties, Utah. The Colorado River and its 100-year floodplain from the confluence with the Green River in T. 30 S., R. 19 E., section 7 (6th Principal Meridian) to full pool elevation, upstream of North Wash, and including the Dirty Devil arm of Lake Powell in T. 33 S., R. 14 E., section 29 (Salt Lake Meridian).

HUMPBACK CHUB

Species Description

The humpback chub is a medium-sized freshwater fish (less than 500 mm) of the minnow family. The adults have a pronounced dorsal hump, a narrow flattened head, a fleshy snout with an inferior-subterminal mouth, and small eyes. It has silvery sides with a brown or olive colored back.

The humpback chub is endemic to the Colorado River Basin and is part of a native fish fauna traced to the Miocene epoch in fossil records (Miller 1946; Minckley et al. 1986). Humpback chub remains have been dated to about 4000 B.C., but the fish was not described as a species until the 1940s (Miller 1946), presumably because of its restricted distribution in remote white water canyons (USFWS 1990b). Because of this, its original distribution is not known. The humpback chub was listed as endangered on March 11, 1967.

Status and Distribution

Until the 1950s, the humpback chub was known only from Grand Canyon. During surveys in the 1950s and 1960s humpback chub were found in the upper Green River including specimens from Echo Park, Island Park, and Swallow Canyon (Smith 1960; Vanicek et al. 1970). Individuals also were reported from the lower Yampa River (Holden and Stalnaker 1975), the White River in Utah (Sigler and Miller 1963), Desolation Canyon of the Green River (Holden and Stalnaker 1970), and the Colorado River near Moab (Sigler and Miller 1963).

Today the largest populations of this species occur in the Little Colorado and Colorado Rivers in the Grand Canyon, and in Black Rocks and Westwater Canyon in the upper Colorado River. Other populations have been reported in De Beque Canyon of the Colorado River, Desolation and Gray Canyons of the Green River, Yampa and Whirlpool Canyons in Dinosaur National Monument (USFWS 1990b). One individual was recently captured in the Gunnison River in a canyon-bound reach at river mile 22 (Burdick 1995).

In general, the existing habitat has been modified to the extent that it impairs essential behavior patterns, such as breeding, feeding, and sheltering.

Life History

Humpback chubs spawn soon after the highest spring flows when water temperatures approach 20°F (Kaeding et al. 1990; Karp and Tyus 1990; USFWS 1990b). The collection of ripe and spent fish indicated that spawning occurred in Black Rocks during June 2-15, 1980, at water temperatures of 11.5 to 16°C; in 1981, spawning occurred May 15-25, at water temperatures of 16 to 16.3°C (Valdez et al. 1982b). Humpback chub spawned in Black Rocks on the Colorado River in 1983 when maximum daily water temperatures were 12.6 to 17°C (Archer et al. 1985). In the Grand Canyon, humpback chub spawn in the spring between March and May in the Little Colorado River when water temperatures are between 16 and 22°C. Swimming abilities of young-of-the-year humpback chub were determined to be significantly reduced when laboratory water temperatures were reduced from 20 to 14°C. Many young-of-year humpback chub are displaced from the Little Colorado River into the mainstem by monsoonal floods from July through September (Valdez and Ryel 1995). Young humpback chub are found in low velocity shorelines and backwaters. Survival rates are extremely low and believed to be less than 1 in 1,000 to 2 years of age. Low water temperatures and predation are believed to be the primary factors. Valdez and Ryel (1995) estimated that 250,000 young humpback chub are consumed annually by brown trout, rainbow trout, and channel catfish.

Backwaters, eddies, and runs have been reported as common capture locations for young-of-year humpback chub (Valdez and Clemmer 1982). These data indicate that in Black Rocks and Westwater Canyon, young utilize shallow areas. Habitat suitability index curves developed by Valdez et al. (1990) indicate young-of-year prefer average depths of 2.1 feet with a maximum of 5.1 feet. Average velocities were reported at 0.2 feet per second.

Population Dynamics
The number of humpback in the Gunnison River is so low that it is not possible to do a population estimate.

Critical Habitat

Critical habitat was designated in 1994 within humpback chub historical range in the following sections of the upper Colorado River (59 FR 13374). The PCEs are the same as those described for the Colorado pikeminnow, as is the status of the PCEs. We designated seven reaches of the Colorado River system for a total of 379 miles as measured along the center line of the subject reaches. The designation represents approximately 28 percent of the historical habitat of the species and includes reaches in the Colorado, Green, and Yampa Rivers in the Upper Basin:

> Moffat County, Colorado. The Yampa River from the boundary of Dinosaur National Monument in T. 6 N., R. 99 W., section 27 (6th Principal Meridian) to the confluence with the Green River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian).
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> Uintah County; and Colorado, Moffat County, Utah. The Green River from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to the southern boundary of Dinosaur National Monument in T. 6 N., R. 24 E., section 30 (Salt Lake Meridian).
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> Uintah and Grand Counties, Utah. The Green River (Desolation and Gray Canyons) from Sumner's Amphitheater in T. 12 S., R. 18 E., section 5 (Salt Lake Meridian) to Swasey's Rapid in T. 20 S., R. 16 E., section 3 (Salt Lake Meridian).
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> Grand County; and Colorado, Mesa County, Utah. The Colorado River from Black Rocks in T. 10 S., R. 104 W., section 25 (6th Principal Meridian) to Fish Ford in T. 21 S., R. 24 E., section 35 (Salt Lake Meridian).
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> Garfield and San Juan Counties, Utah. The Colorado River from Brown Betty Rapid in T. 30 S., R. 18 E., section 34 (Salt Lake Meridian) to Imperial Canyon in T. 31 S., R. 17 E., section 28 (Salt Lake Meridian).

SPECIES/CRITICAL HABITAT LIKELY TO BE AFFECTED

The humpback chub and its critical habitat, as described below, are likely to be adversely affected by the subject Project. Although the Project depletion does not occur within the designated critical habitat for the humpback chub, the depletion would adversely affect critical habitat by reducing the amount of water flowing into designated critical habitat:

Uintah County; and Colorado, Moffat County, Utah. The Green River from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to the southern boundary of Dinosaur National Monument in T. 6 N., R. 24 E., section 30 (Salt Lake Meridian).

Uintah and Grand Counties, Utah. The Green River (Desolation and Gray Canyons) from Sumner's Amphitheater in T. 12 S., R. 18 E., section 5 (Salt Lake Meridian) to Swasey's Rapid in T. 20 S., R. 16 E., section 3 (Salt Lake Meridian).

Garfield and San Juan Counties, Utah. The Colorado River from Brown Betty Rapid in T. 30 S., R. 18 E., section 34 (Salt Lake Meridian) to Imperial Canyon in T. 31 S., R. 17 E., section 28 (Salt Lake Meridian).

BONYTAIL

Species Description

Bonytail are medium-sized (less than 600 mm) fish in the minnow family. Adult bonytail are gray or olive colored on the back with silvery sides and a white belly. The adult bonytail has an elongated body with a long, thin caudal peduncle.

Status and Distribution

The bonytail is the rarest native fish in the Colorado River. It was listed as endangered on April 23, 1980. Formerly reported as widespread and abundant in mainstem rivers (Jordan and Evermann 1896), its populations have been greatly reduced. The fish is presently represented in the wild by a low number of old adult fish in Lake Mohave and perhaps other lower basin reservoirs (USFWS 1990a). The last known riverine area where bonytail were common was the Green River in Dinosaur National Monument, where Vanicek (1967) and Holden and Stalnaker (1970) collected 91 specimens during 1962-1966. From 1977 to 1983, no bonytail were collected from the Colorado or Gunnison Rivers in Colorado or Utah (Wick et al. 1979, 1981; Valdez et al. 1982b; Miller et al. 1984). However, in 1984, a single bonytail was collected from Black Rocks on the Colorado River (Kaeding et al. 1986). Several suspected bonytail were captured in Cataract Canyon in 1985-1987 (Valdez 1990). In 2003 one formerly stocked bonytail was captured in the Redlands fish ladder and released upstream. This is the first record of a bonytail in the Gunnison River.

The existing habitat has been modified to the extent that it impairs essential behavior patterns, such as breeding, feeding, and sheltering.

Life History

The bonytail is considered a species that is adapted to mainstem rivers, where it has been observed in pools and eddies (Vanicek 1967; Minckley 1973). Spawning of bonytail has never been observed in a river, but ripe fish were collected in Dinosaur National Monument during late June and early July suggesting that spawning occurred at water temperatures of about 18°C (Vanicek and Kramer 1969).

Population Dynamics

The number of bonytail in the upper Colorado River and its tributaries is so low that it is not possible to do a population estimate.

Critical Habitat

Critical habitat was designated in 1994 within the bonytail's historical range in the following sections of the upper Colorado River (59 FR 13374). The PCEs are the same as those described for the Colorado pikeminnow, as is the status of the PCEs. We designated seven reaches of the Colorado River system as critical habitat for the bonytail chub. These reaches total 312 miles as measured along the center line of the subject reaches, representing approximately 14 percent of the historical habitat of the species. Critical habitat includes portions of the Colorado, Green, and Yampa Rivers in the Upper Basin:

> Moffat County, Colorado. The Yampa River from the boundary of Dinosaur National Monument in T. 6 N., R. 99 W., section 27 (6th Principal Meridian) to the confluence with the Green River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian).
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> Uintah County; and Colorado, Moffat County, Utah. The Green River from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to the boundary of Dinosaur National Monument in T. 6 N., R. 24 E., section 30 (Salt Lake Meridian).
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> Uintah and Grand Counties, Utah. The Green River (Desolation and Gray Canyons) from Sumner's Amphitheater in T. 12 S., R. 18 E., section 5 (Salt Lake Meridian) to Swasey's Rapid (river mile 12) in T. 20 S., R. 16 E., section 3 (Salt Lake Meridian).
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> Grand County, Utah; and Mesa County, Colorado. The Colorado River from Black Rocks (river mile 137) in T. 10 S., R. 104 W., section 25 (6th Principal Meridian) to Fish Ford in T. 21 S., R. 24 E., section 35 (Salt Lake Meridian).
>
> Garfield and San Juan Counties, Utah. The Colorado River from Brown Betty Rapid in T. 30 S., R. 18 E., section 34 (Salt Lake Meridian) to Imperial Canyon in T. 31 S., R. 17 E., section 28 (Salt Lake Meridian).

SPECIES/CRITICAL HABITAT LIKELY TO BE AFFECTED

The bonytail and its critical habitat, as described below, are likely to be adversely affected by the subject Project. Although the Project depletion does not occur within the designated critical habitat for the bonytail, the depletion would adversely affect critical habitat by reducing the amount of water flowing into designated critical habitat.

> Uintah County; and Colorado, Moffat County, Utah. The Green River from the confluence with the Yampa River in T. 7 N., R. 103 W., section 28 (6th Principal Meridian) to the boundary of Dinosaur National Monument in T. 6 N., R. 24 E., section 30 (Salt Lake Meridian).

Uintah and Grand Counties, Utah. The Green River (Desolation and Gray Canyons) from Sumner's Amphitheater in T. 12 S., R. 18 E., section 5 (Salt Lake Meridian) to Swasey's Rapid (river mile 12) in T. 20 S., R. 16 E., section 3 (Salt Lake Meridian).

Garfield and San Juan Counties, Utah. The Colorado River from Brown Betty Rapid in T. 30 S., R. 18 E., section 34 (Salt Lake Meridian) to Imperial Canyon in T. 31 S., R. 17 E., section 28 (Salt Lake Meridian).

ENVIRONMENTAL BASELINE

The environmental baseline includes the past and present impacts of all Federal, State, and private actions and other human activities in the action area; the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal section 7 consultation; and the impact of State or private actions contemporaneous with the consultation process.

In formulating this opinion, the USFWS considered adverse and beneficial effects likely to result from cumulative effects of future State and private activities that are reasonably certain to occur within the Project area, along with the direct and indirect effects of the Project and impacts from actions that are part of the environmental baseline (50 CFR 402.02 and 402.14 (g)(3)).

Because of the widespread effects of the Project on downstream areas and the large size of the action area, the environmental baseline for the four listed fish is roughly the same as the status as described above. Therefore, we are not repeating that information in this section.

FACTORS AFFECTING THE SPECIES ENVIRONMENT WITHIN THE ACTION AREA

The action area includes critical habitat for Colorado pikeminnow, razorback sucker, humpback chub, and bonytail on the Green River from the confluence of the Yampa River to the confluence with the Colorado River and downstream to Lake Powell.

Critical Habitat - Green River

Critical habitat on the Green River historically experienced high spring turbid flows and low flows throughout the rest of the year. High spring flows create and maintain the braided channels that provide a variety of important habitats. Impoundments and diversions have reduced peak discharges in various river reaches throughout the Upper Colorado River Basin since pioneer settlement of the basin, while increasing base flows in other reaches. Important spawning and nursery habitats for the razorback sucker and the Colorado pikeminnow are found along the Green River below the confluence with the Yampa River. While flows and sediment transport in the Green River have been significantly altered by the operation of Flaming Gorge Dam, the influence of the Yampa and Little Snake Rivers' more natural hydrograph partially ameliorates these adverse effects to the riverine environment of the Green River below the Yampa River confluence.

PRIMARY CONSTITUENT ELEMENT - WATER

Alteration of the natural hydrology of the action area due to existing water development projects constitute the most significant existing factor affecting the species and critical habitat. Existing projects have reduced the magnitude and frequency of peak flows, augmented summer base flows, and lowered average water temperatures in the Green River. These projects have reduced the amount and quality of spawning and nursery habitat, changed environmental cues necessary for the initiation of spawning behavior, and favored non-native fish species in the Green River. Quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species has been substantially altered.

PRIMARY CONSTITUENT ELEMENT - PHYSICAL HABITAT

The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. Storage and diversion of water tends to reduce the peak flows, altering processes that trigger spawning behavior, maintain spawning gravels, backwaters and floodplain connectivity to the river. Reduced sediment load and associated channel changes in the Green River due to the closure of Flaming Gorge Reservoir have been documented at Jensen, Utah. Further reductions in sediment supply to the Green River may lead to reductions in the active channel width and nursery habitat for larval fish.

Historically, floodplain habitats inundated and connected to the main channel by overbank flooding during spring-runoff discharges would have been available as nursery areas for young razorback suckers in the Green River. Tyus and Karp (1990) associated low recruitment with reductions in floodplain inundation since 1962 (closure of Flaming Gorge Dam), and Modde et al. (1996) associated years of high spring discharge and floodplain inundation in the middle Green River (1983, 1984, and 1986) with subsequent suspected recruitment of young adult razorback suckers.

PRIMARY CONSTITUENT ELEMENT - BIOLOGICAL ENVIRONMENT

Oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation and competition are important elements of the biological environment. Reduction of peak flow and augmentation of summer base flows also affects the biological environment by favoring nonnative predators and competitors better adapted to more stable hydrology and reducing autochthonous nutrient inputs from floodplain habitats.

Some scientists believe (Tyus and Saunders 1996) that changes in the biological community as a result of fish introductions may currently be the most significant threat to the native fish fauna of the Colorado River Basin. The impoundment of tributaries and mainstem waters has resulted in the stocking of a number of nonnative sport and bait fishes for use by local residents and visitors to the basin. While the acceptance of these fishes has been generally favorable by the public, their presence has led to predation, competition and the general demise of native fishes (Tyus and Saunders 1996). The stocking of nonnative warm water fishes such as channel catfish, smallmouth bass, and northern pike have resulted in the continuing high probability of predation on soft-rayed native fishes. Red shiners, for example, have been documented as preying on larval suckers, including razorbacks (Rupert et. al. 1993; Modde and Irving 1997). Other exotics such as sand shiner and fathead minnow compete for food and space in remaining habitats.

As reported by the Interagency Aquatic Nuisance Species Task Force (Aquatic Nuisance Species Task Force 1994), introductions of nonnative species into aquatic habitats has become problematic worldwide. Not unique to the Colorado River system, the threat that nonnative fishes pose to native fishes, particularly when coupled with significant changes to the physical environment, is hastening the decline of native species.

Tyus and Saunders (1996) reported species commonly identified as adversely affecting native fish populations nationwide are centrarchids such as largemouth bass (*Micropterus salmoides*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), crappie (*Pomoxis* spp.), and smallmouth bass (*Micropterus dolomieu*). The second most cited group are from the family Ictaluridae, which includes channel catfish (*Ictalurus punctatus*), and bullheads (*Ameiurus* spp.). Other species such as red shiner (*Cyprinella lutrensis*) and fathead minnow (*Pimephales promelas*) also have been identified as problematic to Colorado River endangered fishes. All of these species currently inhabit the Colorado River Basin.

Since the late 1800s, over 40 species of nonnative fishes have been stocked (primarily to enhance recreational fishing opportunities) or accidentally introduced to the Upper Colorado River Basin, including the Little Snake River Basin. Many of these fishes have established resident populations because of alteration of stream flows and resultant changes in physical aquatic habitats favorable to their existence. Many of these fishes are reproducing naturally and, in some cases, out-reproducing native fishes. Presently, two-thirds of the fish species in the Colorado River system are nonnative. Nonnative fishes continue to invade endangered fish habitats through introductions, escapement, and range expansions. Some exotics are stocked in basin rivers mostly for sport fishing purposes, while other exotics are removed when encountered but still represent a major detriment to the 14 native fishes still residing in the basin.

Stocking of cold water sport fishes such as trout do not appear to have a dramatic effect on native fish populations, primarily because their habitats do not overlap significantly and they are less voracious than other warm water exotics such as bass, pike, and catfish. Recovery Implementation Program participants have concluded that continued stocking of trout does not represent any long-term threat to listed fishes. However, stocking of warm water fishes will be controlled and intensively monitored to ensure that physical barriers or other behavioral limitations will reduce the likelihood of interspecific competition and/or predation. On September 5, 1996, a stocking policy was completed by the three Upper Basin States and the USFWS to establish procedures for stocking fish within the Upper Colorado River Basin.

Critical Habitat - Colorado River from Green River Confluence to Lake Powell

Historically, the Colorado River produced high spring turbid flows that maintained critical habitat by inundating floodplains, maintaining side channels, and creating backwaters. Between the confluence with the Green River and Lake Powell the Colorado River flows through Cataract Canyon where the river cuts deeply through steep canyons and talus slopes and has deep swift runs, major rapids, large eddies, and pools. Large angular rock and steep gradient have created approximately 13 miles of rapids before the river flows into the upper end of Lake Powell where it resembles a large, deep, slow-flowing river with high sandstone walls.

Major habitat change occurred in Cataract Canyon when Lake Powell was formed by the closure of Glen Canyon Dam in 1963. Lake Powell now inundates the lower end of Cataract Canyon where there is a transition zone between riverine and lacustrine habitat. Prior to inundation by Lake Powell, Cataract Canyon's steep gradient and large rapids comprised a 35-mile reach. Except for changes in water quantity and historic flow regime, the physical habitat in portions of Cataract Canyon above Lake Powell remains largely unmodified.

PRIMARY CONSTITUENT ELEMENT - WATER

Like the Green River, the quantity of water in the Colorado River has been reduced by water development projects. Any water depletions in the Green River will adversely affect the Colorado River critical habitat below the confluence through Cataract Canyon. Flow regimes have been altered significantly in the Colorado River by numerous upstream reservoirs and water projects, many of which transport large volumes of water out of the Colorado River Basin.

Elevated selenium concentrations associated with irrigation drainwater were found in the Colorado River during NIWQP investigations (Butler et al. 1994, 1996; Butler and Osmundson 2000). These elevated selenium concentrations still occur in water, sediment, and biota, and continue to pose a risk to this PCE. Studies show that selenium concentrations in water and fish tissue are related to flows; the lower the flows the higher the selenium concentrations (Osmundson et al. 2000).

PRIMARY CONSTITUENT ELEMENT - PHYSICAL HABITAT

Westwater and Cataract canyons provide movement and migration corridors between the other relatively flat water habitats. Floodplain habitats between the canyons provide warm water, low velocity, feeding and nursery habitats. Many backwaters between Westwater Canyon and Lake Powell provide nursery habitat. Cataract Canyon provides deep eddies and pools, with swift currents and larger boulders identified as preferred habitat of humback chub (USFWS 1990b).

PRIMARY CONSTITUENT ELEMENT - BIOLOGICAL ENVIRONMENT

This PCE is impaired by the presence of nonnative fishes common in this reach of the Colorado River. Nonnative fishes occupy the same backwaters that are very important for young Colorado pikeminnow and razorback sucker. Largemouth bass (*Micropterus salmoides*) and green sunfish (*Lepomis cyanella*) are the most common large-bodied fishes that occupy backwater habitats year-round (Osmundson 2003). The three most common small-bodies fishes found in backwaters are fathead minnow, sand shiner, and red shiner, comprising 80 to 100 percent of the fish found in Colorado River backwaters (McAda 1987).

The critical habitat units within the action area have been identified in the recovery goals for each of the four endangered fish species (USFWS 2002a, b, c, d) as essential for the conservation of the species. Colorado pikeminnow is a wide ranging species sometimes migrating extensive distances to carry out life history functions. The action area encompasses a large area of razorback sucker critical habitat. Critical habitat for humpback chub and bonytail are limited to shorter reaches of the Colorado River within critical habitat for Colorado pikeminnow and razorback sucker. These shorter reaches include unique habitats required for humpback chub and bonytail that are found in only a few other places in the Colorado River Basin.

EFFECTS OF THE ACTION

Effects to Endangered Species

The Project would adversely affect Colorado pikeminnow, razorback sucker, bonytail, and humpback chub by reducing the amount of water in the river system upon which they depend by up to 1,006.7 acre-feet/year. The effects to all four species primarily result from the effects of the action upon their habitats. In general, the proposed action would adversely affect the four listed fish by reducing the amount of water available to them, increasing the likelihood of water quality issues, increasing their vulnerability to predation, and reducing their breeding opportunities by shrinking the amount of breeding habitat within their range.

Removing 1,006.7 acre-feet of water per year from the Green and Colorado Rivers would change the natural hydrological regime that creates and maintains important fish habitats, such as spawning habitats, and reduces the frequency and duration of availability of these habitats of the four endangered fish. The reduction of available habitats will directly affect individuals of all four species by decreasing reproductive potential and foraging and sheltering opportunities. Many of the habitats required for breeding become severely diminished when flows are reduced. As a result, individual fish within the action area may not be able to find a place to breed, or will deposit eggs in less than optimal habitats more prone to failure or predation. In addition, reduction in flow rates lessens the ability of the river to inundate bottomland, a source of nutrient supply for fish productivity. Water depletions also exacerbate competition and predation by nonnative fishes by altering flow and temperature regimes that favor nonnatives.

The proposed depletion would affect the water quality in the action area by increasing concentrations of heavy metals, selenium, salts, pesticides, and other contaminants. Increases in water depletions will cause associated reductions in assimilative capacity and dilution potential for any contaminants that enter the Green and Colorado Rivers. The Project's depletion would cause a proportionate decrease in dilution, which in turn would cause a proportionate increase in heavy metal, selenium, salts, pesticides, and other contaminant concentrations in the Colorado River to Lake Powell. An increase in contaminant concentrations in the river would likely result in an increase in the bioaccumulation of these contaminants in the food chain which could adversely affect the endangered fishes, particularly the predatory Colorado pikeminnow.

Selenium is of particular concern due to its effects on fish reproduction and its tendency to concentrate in low velocity areas that are important habitats for Colorado pikeminnow and razorback suckers.

The proposed Project would adversely affect the four listed fish by resulting in a reduction of water and concomitant effects to habitat. This reduction would contribute to the cumulative reduction in high spring flows, which are essential for creating and maintaining complex channel geomorphology and suitable spawning substrates, creating and providing access to off-channel habitats, and possibly stimulating Colorado pikeminnow spawning migrations. Adequate summer and winter flows are important for providing a sufficient quantity of preferred habitats for a duration and at a frequency necessary to support all life stages of viable populations of all endangered fishes. To the extent that the Project will reduce flows, the ability of the river to provide these functions will be reduced. This reduction of water affects habitat availability and habitat quality.

To the extent that it would reduce flows and contribute to further habitat alteration, the Project would contribute to an increase in nonnative fish populations. The modification of flow regimes, water temperatures, sediment levels, and other habitat conditions caused by water depletions has contributed to the establishment of nonnative fishes. Endangered fishes within the action area would experience increased competition and predation as a result.

Effects to Critical Habitat

All four of the listed Colorado River fish require the same PCEs essential for their survival. Therefore, we are combining our analysis of all four species into one section. Because the amount of designated critical habitat varies for each of the four species, the amount of habitat will vary; however, the effects would be the same for all critical habitat within the action area.

Water, physical habitat, and the biological environment are the PCEs of critical habitat. This includes a quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species. The physical habitat includes areas of the Colorado River system that are inhabited or potentially habitable for use in spawning and feeding, as a nursery, or serve as corridors between these areas. In addition, oxbows, backwaters, and other areas in the 100-year floodplain, when inundated, provide access to spawning, nursery, feeding, and rearing habitats. Food supply, predation, and competition are important elements of the biological environment.

PRIMARY CONSTITUENT ELEMENT - WATER

The Project would deplete up to 1,006.7 acre-feet of water per year from the Colorado River Basin. Removing water from the river system changes the natural hydrological regime that creates and maintains important fish habitats, such as spawning habitats, and reduces the frequency and duration of availability of these habitats of the four endangered fish. In addition, reduction in flow rates lessens the ability of the river to inundate bottomland, a source of nutrient supply for fish productivity and important nursery habitat for razorback sucker. Water depletions change flow and temperature regimes that favor nonnative fish adding to competition and predation by these nonnative fishes as discussed above.

Changes in water quantity would affect water quality, which is a PCE of critical habitat. Contaminants enter the Colorado River from various point and nonpoint sources, resulting in increased concentrations of heavy metals, selenium, salts, pesticides, and other contaminants. Increases in water depletions will cause associated reductions in assimilative capacity and dilution potential for any contaminants that enter critical habitat in the Green and Colorado Rivers.

The Project's depletion would cause a proportionate decrease in dilution, which in turn would cause a proportionate increase in heavy metal, selenium, salts, pesticides, and other contaminant concentrations in the Colorado River to Lake Powell. An increase in contaminant concentrations in the river would likely result in an increase in the bioaccumulation of these contaminants in the food chain which could adversely affect the endangered fishes, particularly the predatory Colorado pikeminnow. Selenium is of particular concern due to its effects on fish reproduction and its tendency to concentrate in low velocity areas that are important habitats for Colorado pikeminnow and razorback suckers.

PRIMARY CONSTITUENT ELEMENT - PHYSICAL HABITAT

The proposed Project would affect the physical condition of habitat for the four listed fish by resulting in a reduction of water. This reduction would contribute to the cumulative reduction in high spring flows, which are essential for creating and maintaining complex channel geomorphology and suitable spawning substrates, creating and providing access to off-channel habitats, and possibly stimulating Colorado pikeminnow spawning migrations. Adequate summer and winter flows are important for providing a sufficient quantity of preferred habitats for a duration and at a frequency necessary to support all life stages of viable populations of all endangered fishes. To the extent that the Project will reduce flows, the ability of the river to provide these functions will be reduced. This reduction of water affects habitat availability and habitat quality.

PRIMARY CONSTITUENT ELEMENT - BIOLOGICAL ENVIRONMENT

To the extent that it would reduce flows and contribute to further habitat alteration, the Project would contribute to an increase in nonnative fish populations. The modification of flow regimes, water temperatures, sediment levels, and other habitat conditions caused by water depletions has contributed to the establishment of nonnative fishes. Endangered fishes within the action area would experience increased competition and predation as a result.

CUMMULATIVE EFFECTS

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. The USFWS is not aware of any future non-Federal actions not included in this action under consultation that are reasonably certain to occur in the action area.

CONCLUSION

Based upon the best scientific and commercial information that is currently available, it is the USFWS's biological opinion that the water depletions associated with the Jonah Infill Drilling Project, as described herein, are likely to jeopardize the continued existence of the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker because the listed fish are harmed from the reduction of water in their habitats resulting from the Project in the following manner:

1) Individuals using habitats diminished by the proposed water depletions could be more susceptible to predation and competition from nonnative fish;

2) Individuals may be unable to breed because reduced flows would impact habitat formulation and maintenance.

Based upon the best scientific and commercial information that is currently available, it is the USFWS's biological opinion that the water depletions associated with the Jonah Infill Drilling Project, as described herein, are likely to result in adverse modification of critical habitat for the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker because the PCEs and the functioning of the critical habitat units would be altered in the following manner:

1) Water, a PCE, would be affected by further reducing the flows in critical habitat that are needed for endangered fishes breeding, feeding and sheltering. Reduction in flows also would affect water quality by reducing dilution of contaminants.

2) Physical habitat, a PCE, would be affected by reduction in flows by reducing important habitat such as spawning bars, backwaters, and inundated floodplains.

3) Biological environment, a PCE, would be affected by the increase in nonnative fishes due to altered flow regimes.

The USFWS has developed a reasonable and prudent alternative to avoid the likelihood of jeopardy to the endangered fishes and destruction or adverse modification of their critical habitat.

REASONABLE AND PRUDENT ALTERNATIVE

Regulations (50 CFR 402.02) implementing section 7 of the ESA define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that--1) can be implemented in a manner consistent with the intended purpose of the action; 2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; 3) are economically and technologically feasible; and 4) would, the USFWS believes, avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

On January 21-22, 1988, the Secretary of the Department of the Interior; the Governors of Wyoming, Colorado, and Utah; and the Administrator of the Western Area Power Administration were cosigners of a Cooperative Agreement to implement the "Recovery

Implementation Program for Endangered Fish Species in the Upper Colorado River Basin" (USFWS 1987). In 2001, the Recovery Program was extended until September 30, 2013. An objective of the Recovery Program was to recover the listed species while providing for new water development in the Upper Basin.

In order to further define and clarify processes outlined in sections 4.1.5, 4.1.6, and 5.3.4 of the Recovery Program, a section 7 Agreement (Agreement) and a Recovery Implementation Program Recovery Action Plan (Plan) was developed (USFWS 1993). The Agreement establishes a framework for conducting all future section 7 consultations on depletion impacts related to new projects and all impacts associated with historic projects in the Upper Basin. Procedures outlined in the Agreement will be used to determine if sufficient progress is being accomplished in the recovery of the endangered fishes to enable the Recovery Program to serve as a reasonable and prudent alternative to avoid jeopardy. The Plan was finalized on October 15, 1993, and has been reviewed and updated annually.

In accordance with the Agreement, the USFWS assesses the impacts of projects that require section 7 consultation and determine if progress toward recovery has been sufficient for the Recovery Program to serve as a reasonable and prudent alternative. If sufficient progress is being achieved, biological opinions are written to identify activities and accomplishments of the Recovery Program that support it as a reasonable and prudent alternative. If sufficient progress in the recovery of the endangered fishes has not been achieved by the Recovery Program, actions from the Plan are identified which must be completed to avoid jeopardy to the endangered fishes. For historic projects, these actions serve as the reasonable and prudent alternative as long as they are completed according to the schedule identified in the Plan. For new projects, these actions serve as the reasonable and prudent alternative so long as they are completed before the impact of the Project occurs. The Jonah Infill Drilling Project is considered a new project.

In determining if sufficient progress has been achieved, the USFWS considers--a) actions which result in a measurable population response, a measurable improvement in habitat for the fishes, legal protection of flows needed for recovery, or a reduction in the threat of immediate extinction; b) status of fish populations; c) adequacy of flows; and, d) magnitude of the Project impact. In addition, the USFWS considers support activities (funding, research, information, and education, etc.) of the Recovery Program if they help achieve a measurable population response, a measurable improvement in habitat for the fishes, legal protection of flows needed for recovery, or a reduction in the threat of immediate extinction. The USFWS evaluates progress separately for the Colorado River and Green River subbasins; however, it gives due consideration to progress throughout the Upper Basin in evaluating progress toward recovery.

The following excerpts summarize portions of the Recovery Program that address depletion impacts, section 7 consultation, and Project proponent responsibilities:

> "All future section 7 consultations completed after approval and implementation of this program (establishment of the Implementation Committee, provision of congressional funding, and initiation of the elements) will result in a one-time contribution to be paid to the USFWS by water project proponents in the amount of $10.00 per acre-foot based on the average annual depletion of the project . . . This figure will be adjusted annually for inflation [the current figure is $16.67 per acre-foot] . . . Concurrently with the completion of the Federal action which initiated the consultation, e.g., . . . issuance of a 404 permit, 10 percent of the total contribution will be provided. The balance . . . will be . . . due at the time the construction commences . . . ."

It is important to note that these provisions of the Recovery Program were based on appropriate legal protection of the instream flow needs of the endangered Colorado River fishes. The Recovery Program further states:

> ". . . it is necessary to protect and manage sufficient habitat to support self-sustaining populations of these species. One way to accomplish this is to provide long term protection of the habitat by acquiring or appropriating water rights to ensure instream flows. Since this program sets in place a mechanism and a commitment to assure that the instream flows are protected under State law, the USFWS will consider these elements under section 7 consultation as offsetting project depletion impacts."

Thus, the USFWS has determined that depletion impacts, which the USFWS has consistently maintained are likely to jeopardize the listed fishes, can be offset by--a) the water Project proponent's one-time contribution to the Recovery Program in the amount of $16.67 per acre-foot of the Project's average annual depletion; b) appropriate legal protection of instream flows pursuant to State law; and, c) accomplishment of activities necessary to recover the endangered fishes as specified under the Plan. The USFWS believes it is essential that protection of instream flows proceed expeditiously, before significant additional water depletions occur.

With respect to (a) above (i.e., depletion charge), the applicant will make a one-time payment which has been calculated by multiplying the Project's average annual depletion (acre-feet) by the depletion charge in effect at the time payment is made. For Fiscal Year 2006 (October 1, 2005, to September 30, 2006), the depletion charge is $16.67 per acre-foot for the average annual depletion which equals a total payment of $16,781.69 for this Project. The USFWS will notify the applicant of any change in the depletion charge by September 1 of each year. Ten percent of the total contribution $1,678.16, or total payment, will be provided to the USFWS's designated agent, the National Fish and Wildlife Foundation (Foundation), at the time of issuance of the Federal approvals from BLM. The balance will be due at the time the construction commences. The payment will be included by the BLM as a permit stipulation. The amount payable will be adjusted annually for inflation on October 1 of each year based on the Composite Consumer Price Index. Fifty percent of the funds will be used for acquisition of water rights to meet the instream flow needs of the endangered fishes (unless otherwise recommended by the Implementation Committee); the balance will be used to support other recovery activities for the Colorado River endangered fishes. All payments should be made to the Foundation:

Rebecca Kramer, Special Funds Program Coordinator
National Fish and Wildlife Foundation
28 Second Street, 6th Floor
San Francisco, California 94105

Each payment is to be accompanied by a cover letter that identifies the Project and biological opinion that requires the payment, the amount of payment enclosed, check number, and any special conditions identified in the biological opinion relative to disbursement or use of the funds (there are none in this instance). A copy of the cover letter and of the check is to be sent directly to the USFWS field office that issued the biological opinion. The cover letter shall identify the name and address of the payor, the name and address of the Federal Agency responsible for authorizing the Project, and the address of the USFWS office issuing the biological opinion. This information will be used by the Foundation to notify the payor, the lead Federal agency, and the USFWS that payment has been received. The Foundation is to send notices of receipt to these entities within 5 working days of its receipt of payment.

INCIDENTAL TAKE STATEMENT

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

Colorado pikeminnow, humpback chub, bonytail, and razorback sucker are harmed from the reduction of water in their habitats resulting from the Project in the following manner-- 1) individuals using habitats diminished by the proposed water depletions could be more susceptible to predation and competition from nonnative fish; 2) habitat conditions may be rendered unsuitable for breeding because reduced flows would impact habitat formulation and maintenance as described in the biological opinion.

Estimating the number of individuals of these species that would be taken as a result of water depletions is difficult to quantify for the following reasons--(1) determining whether an individual forwent breeding as a result of water depletions versus natural causes would be extremely difficult to determine; (2) finding a dead or injured listed fish would be difficult, due to the large size of the Project area and because carcasses are subject to scavenging; (3) natural fluctuations in river flows and species abundance may mask Project effects, and (4) effects that reduce fecundity are difficult to quantify. Estimating the number of individuals of the four listed fishes that could be taken by the water depletions addressed in this biological opinion is not possible. However, the implementation of the Recovery Program is intended to minimize impacts of water depletions and, therefore, the reasonable and prudent alternatives outlined in the biological opinion also will serve as reasonable and prudent measures for minimizing the take that results from the 1,006.7 acre-feet/year water depletion. Any amount of water withdrawal above this level would exceed the anticipated level of incidental take.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the request. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if-- 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; 3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the action.

Thank you for your cooperation in the formulation of this biological opinion and your interest in conserving endangered species.

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