Chapter 6 LITTLE COLORADO RIVER WATERSHED

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LOWER LITTLE COLORADO RIVER SUB-WATERSHED

JACKS CANYON COMPLEX

Physical Geographic Description

There are five reservoirs that make up the Jacks Canyon Complex: Soldiers Lake, Soldiers Annex Lake, Long Lake, Tremaine Lake, and Hay Lake (Figure 1). These lakes are interconnected by a complex series of irrigation canals and ditches (Figure 2, and Figure 3). The Jacks Canyon Complex of lakes is connected through a ditch system designed to catch runoff during periodic precipitation events, to store water for irrigation, and to water livestock. The approximately 40,000 acre drainage ranges in elevation from 8,532 feet at the top of Hutch Mountain to approximately 6,662 feet at the bottom of Hay Lake. Conveyance canals capture water from Sawmill Wash and transport water to the various lakes, dependant on need.

The canal system within the entire Jacks Canyon Complex was designed for water retention. Hay Lake is the downstream-most lake and only fills after all of the other lakes in this complex have been filled. Since 1991, Hay Lake has never been observed to spill into Jacks Canyon, including the wet years of 1993 and 2005. Chavez Pass Ditch can only receive outflow from a manually operated gate at the base of the dam on Soldiers Annex Lake, or from outflow from Long Lake, which has no record of ever spilling. In the unlikely event that water should spill, the distance to the LCR is approximately 50 miles through intermittent Diablo Canyon, and an additional 50 miles of intermittent stream before encountering any listed species or critical habitats within the LCR. A more detailed description is found under the Jacks Canyon Complex analysis section. The Jacks Canyon Complex is most likely a closed system because it has not been known to spill for nearly 20 years; however, it will be analyzed as an open system.

Hay Lake is part of the complex of reservoirs; however, the lake is not managed for fish nor proposed for stocking under this consultation.

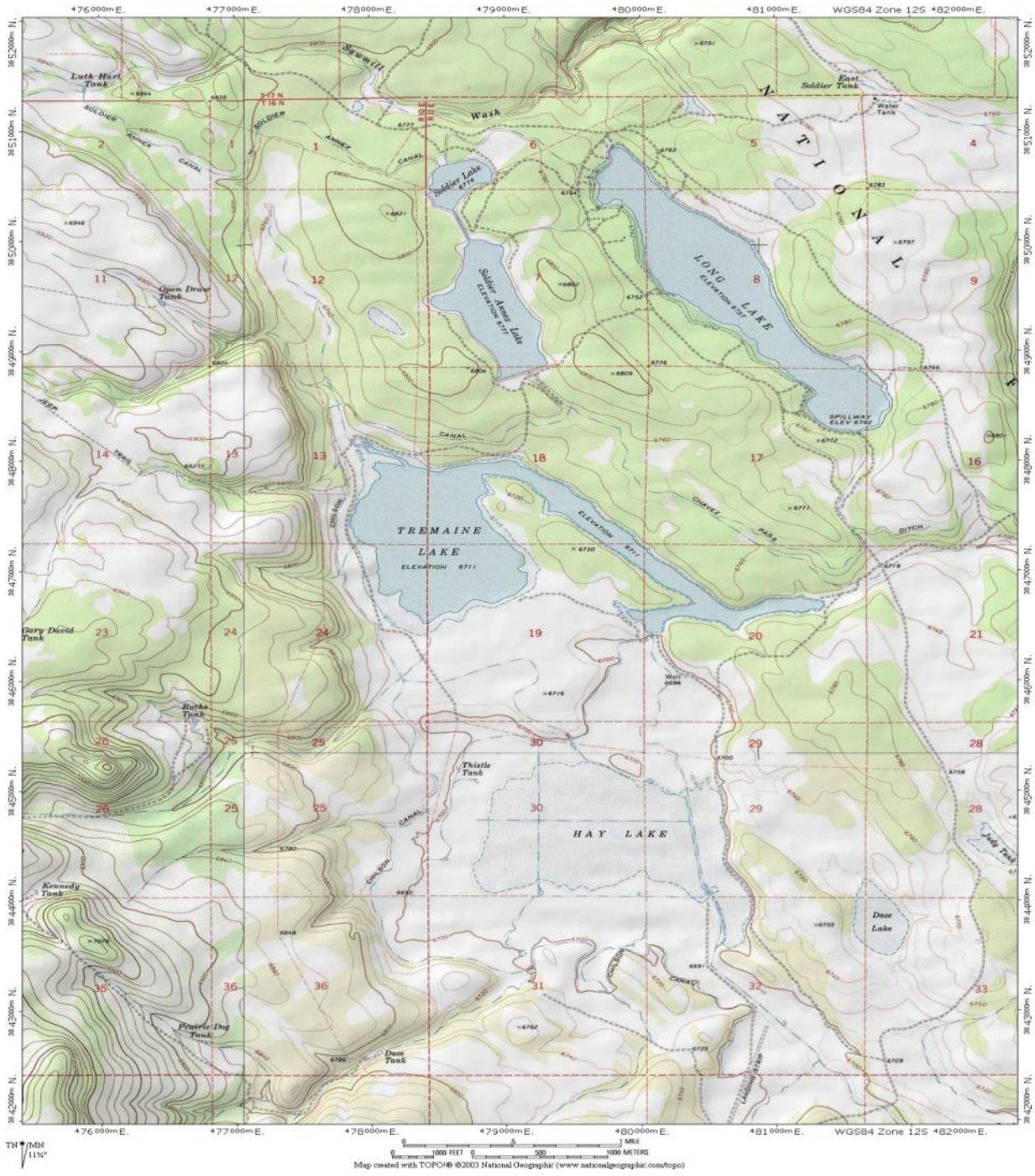

Figure 1. Jacks Canyon Complex topographic representation

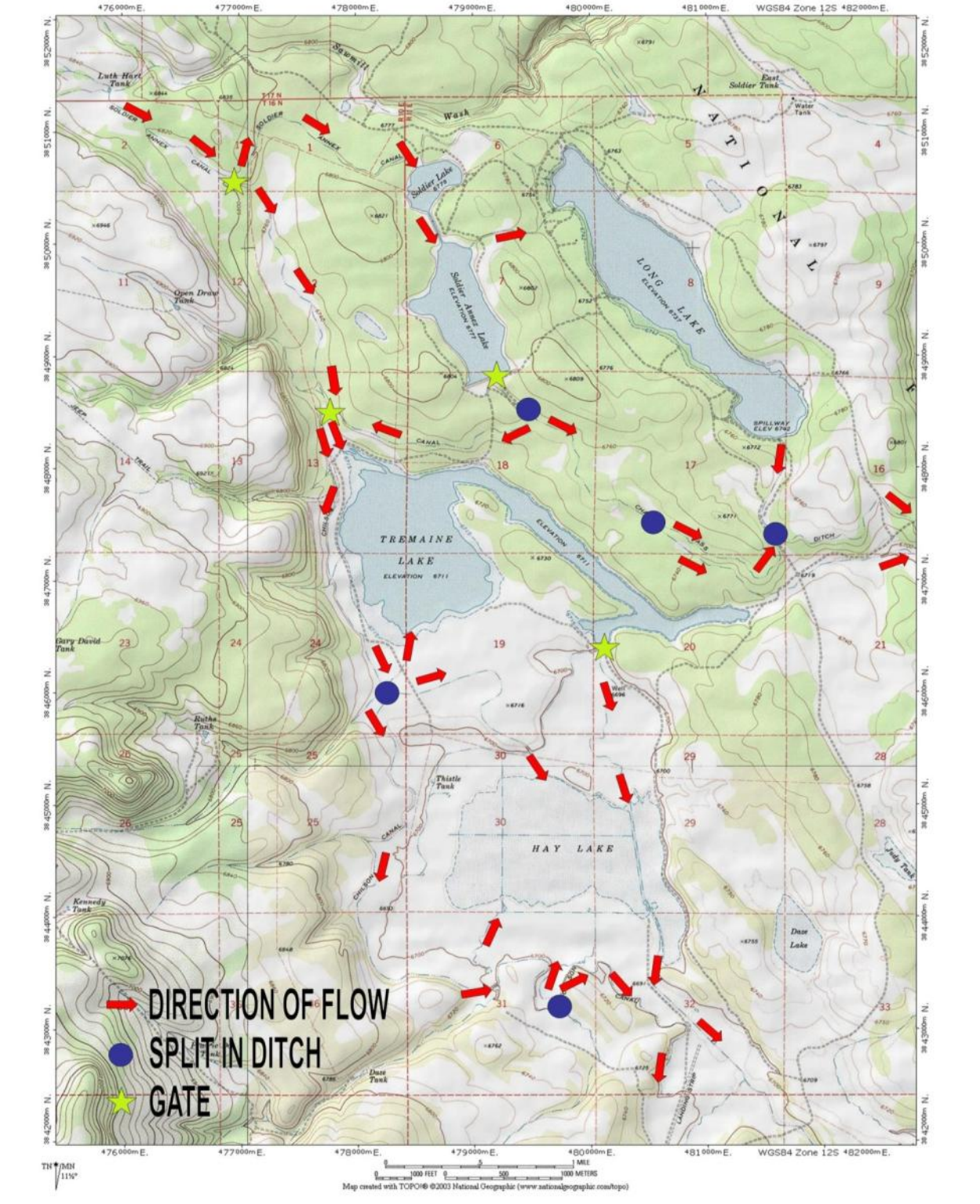

Figure 2. Jacks Canyon Complex direction of water flow via ditch systems.

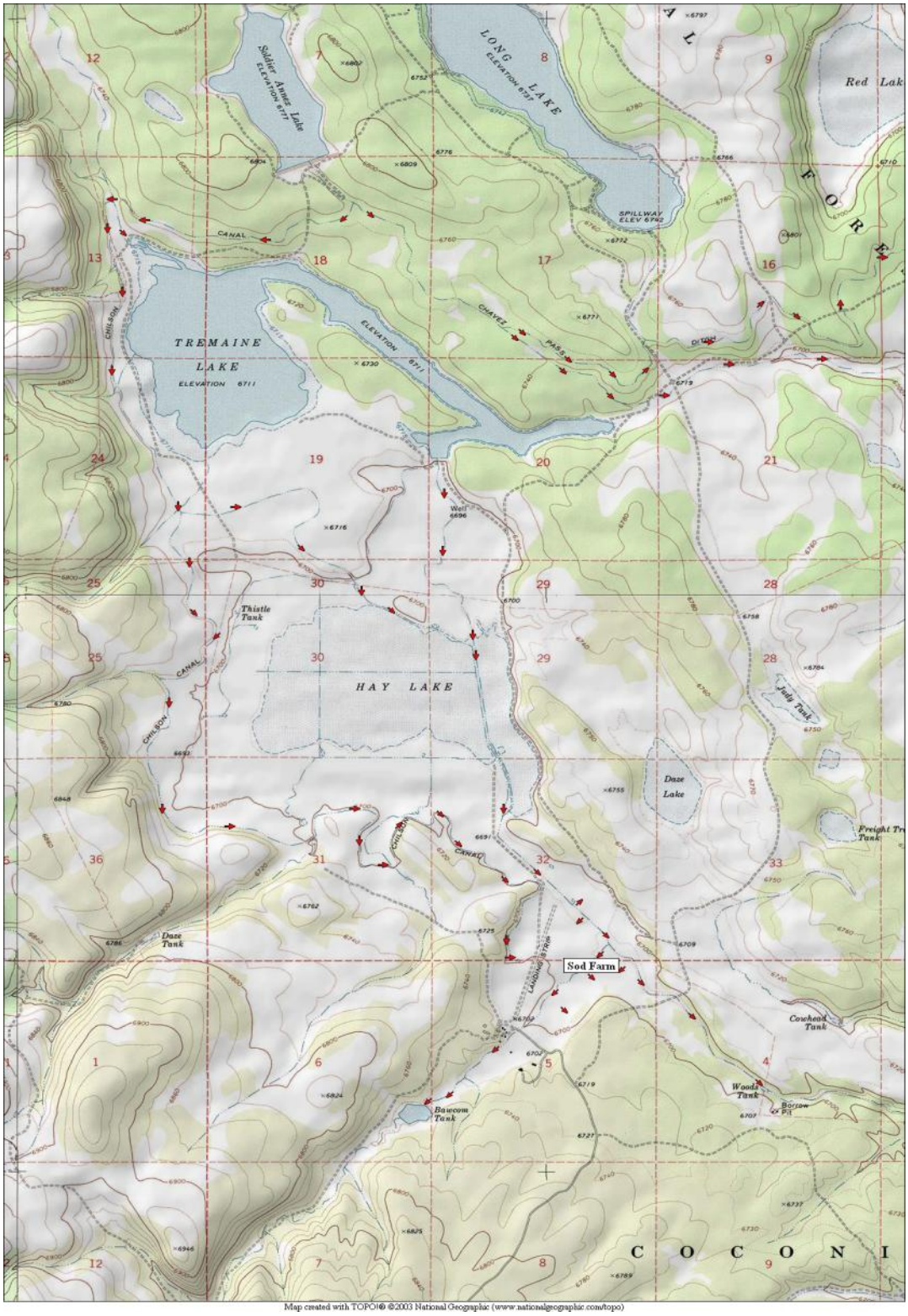

Figure 3. Chilson Canal Hay Lake side water flow direction (small red arrows)

Soldiers Lake

Site Description

Soldiers Lake is the furthest upstream of the series of 5 lakes in the Jacks Canyon Complex. Located in the southern portion of Coconino County, Soldiers Lake sits at an elevation of 6,778 feet. Soldiers Lake is located approximately 70 miles from the communities of Flagstaff and Payson, and approximately 45 miles from the city of Winslow. The lake sits exclusively on Coconino National Forest land, with primary water rights owned by the Hay Lake Ranch. Soldiers Lake is approximately 30 surface acres in size, approximately 40 surface acres when fully watered, and has an average depth of approximately eight feet, with a maximum depth of approximately 15 feet when fully watered. The lake receives runoff from the Sawmill Wash and surrounding drainages via Soldiers Annex Canal, which originates at Luth Hart Tank in the Diablo Canyon drainage. This canal can be diverted to supply water to either Soldiers Lake or to Tremaine Lake via the Chilson Canal.

Management of Water Body

Lake management historically included both warm and cold-water species (Table 1). The lake currently holds self sustaining populations of largemouth bass, bluegill, channel catfish, walleye, golden shiner, and northern pike. Current stocking clearance includes rainbow trout, channel catfish, bluegill, and largemouth bass. Overall fish numbers are low in Soldiers Lake, but overall fish size is large. Brown trout were last stocked in 1992 and warm water fishes in 1993-1994.

Table 1. Soldiers Lake Stocking History

Fish Species	First Year	Last Year	Num. of Stockings	Num. of Fish Stocked
Northern Pike	1965	1965	1	1,000
Channel Catfish	1957	1994	18	31,814
Bluegill	1937	1993	3	11,500
Largemouth Bass	1937	1993	4	12,574
Rainbow Trout	1935	1979	29	105,116
Black Crappie	1937	1937	1	300
Redear	1991	1991	2	3,000
Brown Trout	1962	1992	7	51,750
Walleye	1984	1984	1	126,000
Totals			66	343,054

The primary management would be for a self sustaining, naturally reproducing warm water fishery consisting of bluegill, channel catfish, largemouth bass and yellow perch. Secondary management is for a put-and-take cold water rainbow trout fishery. Warm water stockings have been primarily of fingerling-sized fish ranging from 20 to 10,000 fish, with no more than two

stockings in any given year. Cold water stockings have been primarily of catchable and sub-catchable sized fish, but have included fingerling stockings when there is opportunity for their survival and growth. Cold water stockings have ranged from 125 to 20,000 fish in any given year. Yellow perch has not previously been stocked by the Department (Table 2), is not currently present in Soldier's Lake or the drainage, but is present elsewhere in the Little Colorado River watershed in Upper and Lower Lake Mary, Rainbow Lake, River Reservoir and Becker Lake.

Table 2. Summary of all known yellow perch stockings in the Little Colorado River drainage of Arizona.

Lake Stocked	First year stocked	Last year Stocked	Num of Stockings	Number stocked
Lyman Reservoir	1979	1979	1	100000
Marshall Lake	1941	1966	2	717
Mormon Lake	1965	1993	12	39922
Morton Lake	1989	1989	1	80000
Ned Lake	1980	1980	1	112

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, yellow perch and bluegill for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times per year, but typically in spring and fall. Rainbow trout numbers would be from 0-25,000 fish annually.

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchables), and yellow perch (fry/fingerlings, sub-catchables) may be stocked as to augment the warm water fishery, or to reestablish the fishery after a catastrophic event. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Soldiers Lake receives runoff from Sawmill Wash and surrounding drainages via Soldiers Annex Canal. Runoff typically occurs during the spring months from snowmelt, but occasional heavy precipitation events at other times of year result in runoff through Sawmill Wash. Soldiers Annex Canal originates at Luth Hart Tank, from which the canal travels approximately 0.9 miles to a two-way board gate. From this gate, flow can either continue down Soldiers Annex Canal approximately 1.34 miles into the north end of Soldiers Lake, or head south approximately 1.5 miles to a split in the ditch where flow either heads west and south into Chilson Canal or south approximately 0.25 miles into Tremaine Lake. In the event of flooding, water from Soldiers Lake

will travel through a short 200 meter earthen ditch into Soldiers Annex Lake. For a further discussion of connectivity, see the complex analysis section.

There is no record of Soldiers Lake going completely dry; however, lake levels do fluctuate throughout the year due to frequent winds and porous soil, which are characteristic of this series of lakes.

Fish Movement

Fish in Soldiers Lake could potentially travel upstream in Soldiers Annex Canal on the north end of Soldiers Lake for approximately 1.34 miles until reaching the two-way board gate. Upstream movement of fish either ends at the gate if it is closed, or they could be diverted back downstream from the two-way board gate toward Chilson Canal and Tremaine Lake via a cut-off canal, or if open, they could continue up Soldiers Annex Canal approximately 0.9 miles into Luth Hart Tank. Further movement of fish upstream from Luth Hart Tank would terminate in the headwaters of the drainage. In the event of flooding, fish could also travel through a short 200 meter earthen ditch downstream into Soldiers Annex Lake. Movement of fish out of this lake into the upstream canal system is expected to be extremely difficult and not very likely to occur.

Community Description

Soldiers Lake is inhabited by a non-native, self sustaining, warm water fish community. The 2008 survey data (Table 3) indicated a small, low abundance, self-sustaining population of larger, therefore older, warm water sport fish. Four six panel gill nets were set for approximately 15 to 16 hours, according to the Department sampling protocol. Walleye, bluegill, channel catfish, and largemouth bass were collected during the survey. In 2009, survey data indicated larger numbers of shiner, pike and walleye in larger size ranges (Table 4). In addition, a small yet stable population of predominately adult golden shiner provides a forage fish for the warm water predatory species. Crayfish were also observed and present during the survey. A 2006 creel census recorded a total of four fish harvested by anglers: two channel catfish, one northern pike, and one largemouth bass. A total of seven anglers were interviewed at Soldiers Lake during the 2006 creel season, indicating current angler use of the lake is extremely low.

The lake provides little cover for juvenile fish to escape predation. The majority of the cover in the lake resides on the southern shoreline in the form of submerged junipers that have lost their needles.

Table 3. Soldiers Lake 2008 Sampling

Species	Num. of Fish Collected	Size Range (mm)
Northern Pike	0	N/A

Largemouth Bass	1	415
Bluegill	1	247
Walleye	3	259-405
Channel Catfish	4	541-687
Golden Shiner	0	N/A
Crayfish	None recorded	N/A

Table 4. Soldiers Lake 2009 Sampling

Species	Num. of Fish Collected	Size Range (mm)
Northern Pike	14	270-530
Largemouth Bass	1	405
Bluegill	2	225-236
Walleye	8	294-480
Channel Catfish	1	665
Golden Shiner	13	92-120
Crayfish	Visual observation	N/A

Consultation Species, Critical Habitat & Potential Impacts
Chiricahua and northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked areas and fish movement potential up or downstream to areas where frogs may occur. Additional consultation species are discussed in the Jack's Canyon Complex Analysis. Potential impacts from the proposed action to candidate and listed species are described below.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog
Local Analysis: Although Soldiers Lake and the Jacks Canyon buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Soldiers Lake is low. There are no historical records for

Chiricahua leopard frogs from Soldiers Lake or within the buffered stocking complex. Five sites have each been surveyed once within the buffered stocking complex; one in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). No Chiricahua leopard frogs were observed during these surveys. The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Coconino National Forest). In addition, crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Soldiers Lake is low, because there are no records for Chiricahua leopard frogs in the drainages into which fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although Soldiers Lake and the Jacks Canyon buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Soldiers Lake is low. There are no historical records for northern leopard frogs from Soldiers Lake (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There is a 1972 northern leopard frog record from Dave's Tank, which is approximately 7.5 miles west of the complex if you measure through the drainage; there have been no subsequent surveys at this site (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any northern leopard frogs (based on data provided by the Coconino National Forest). The negative results of these surveys indicate that it is not likely that northern leopard frogs occupy Soldiers Lake, Dave's Tank, or the area within the buffered stocking complex (Figure 4). Furthermore, crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Soldiers Lake is low. There are no recent historical records for frogs in these drainages (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

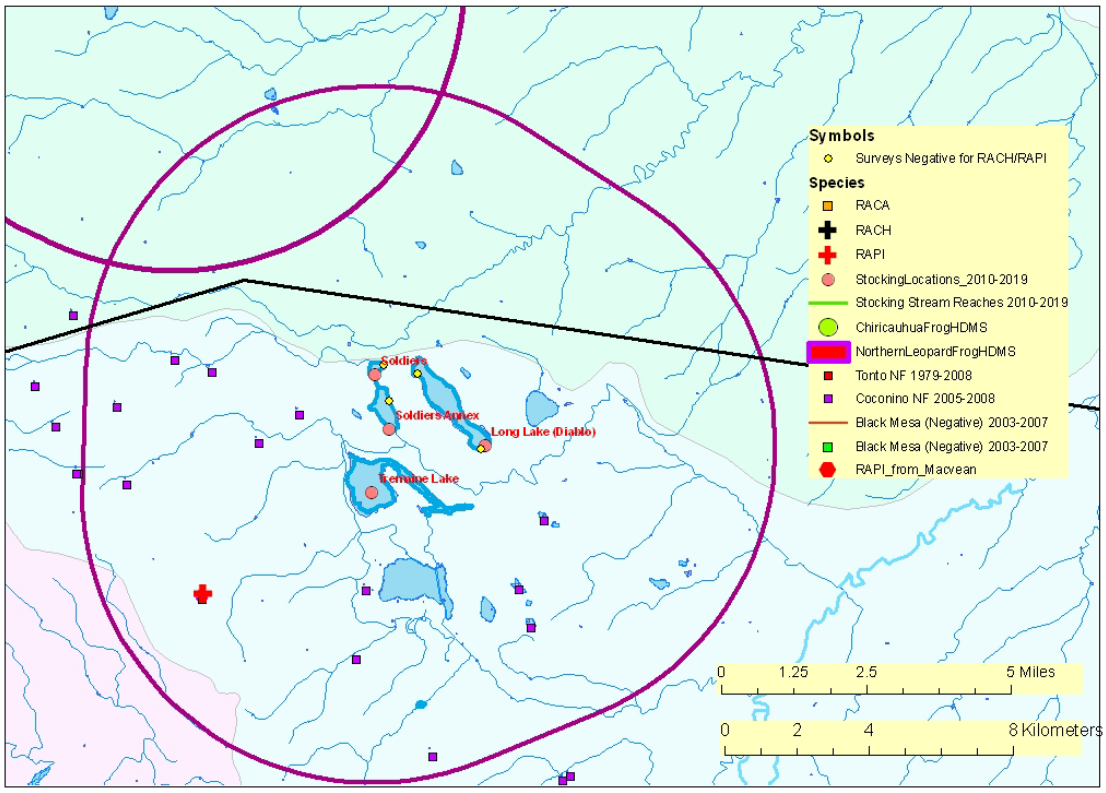

Figure 4. Map of Jacks Canyon buffered stocking complex.

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Soldiers Annex Lake

Site Description

Soldiers Annex Lake is approximately 90 surface acres in size, approximately 147 surface acres when fully watered, and is located in the southern portion of Coconino County on the Bar T Bar Ranch, at an elevation of 6,777 feet. Soldiers Annex Lake has an average depth of approximately 5 feet, with approximately a 30 foot maximum depth when fully watered. Soldiers Annex Lake is located approximately 70 miles from the communities of Flagstaff and Payson, and approximately 45 miles from the city of Winslow. This lake is directly connected to Soldiers Lake by a short 200 meter earthen ditch.

Management of Water Body

Lake management historically included both warm and cold-water species (Table 5). Since 1994, no fish have been stocked into Soldiers Annex Lake. The lake currently holds self sustaining populations of largemouth bass, bluegill, channel catfish, walleye, and northern pike. Overall fish numbers are low in Soldiers Annex Lake, but overall fish size is large. Soldiers Annex Lake is currently cleared for the stocking of rainbow trout; however, rainbow trout have not been stocked since 1980.

The stocking regime covered by the period of this consultation would allow Soldiers Annex Lake to be managed as a cold water (rainbow trout) and warm water (bluegill, channel catfish, largemouth bass, and yellow perch) fishery. Fish would be stocked from the department hatchery system or private vendors.

Table 5. Soldiers Annex Lake Stocking History

Fish Species	First Year	Last Year	Num. of Stockings	Num. of Fish Stocked
Redear Sunfish	1991	1991	2	3,000
Channel Catfish	1957	1994	11	22,098
Bluegill	1993	1993	1	4,000
Largemouth Bass	1956	1993	3	12,724
Rainbow Trout	1968	1980	7	55,500
Walleye	1984	1984	1	252,000
Tadpoles	1968	1968	1	500
Totals			26	349,822

Primary management is for is a self sustaining, naturally reproducing warm water fishery featuring largemouth bass, bluegill, and channel catfish. Secondary management is for put-and-take, cold water rainbow trout fishery. Warm water stockings have been primarily of fingerling sized fish ranging from 20 to 252,000 fish, with no more than three stockings in any given year. Cold water stockings have been primarily of catchable and sub-catchable sized fish, but have included fingerling stockings when there is opportunity for their survival and growth. Cold water stockings have ranged from 500 to 10,000 fish in any given year, and would typically occur in spring and fall, however, may occur year round as water level, water quality and fish availability permit. Yellow perch has not previously been stocked by the Department (Table 2), is not currently present in Soldier's Lake or the drainage, but is present elsewhere in the Little Colorado River watershed in Upper and Lower Lake Mary, Rainbow Lake, River Reservoir and Becker Lake.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, yellow perch, and bluegill, for the period covered by this consultation.

Catchable rainbow trout would be stocked multiple times per year, but typically in spring and fall. Rainbow trout numbers would be from 0-25,000 fish annually.

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchable) and yellow perch (fry/fingerlings, sub-catchables) may be stocked as needed to augment the warm water fishery, or to reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity
Soldiers Annex Lake only receives water when Soldiers Lake receives enough water to spill during snow melt and runoff season. In the event that Soldiers Annex Lake in turn fills and spills, outflow can either travel through a earthen ditch on the east side of the lake into Long Lake, or through a gate at the base of the dam, which must be manually opened on the south side of the lake, into the Chavez Pass Ditch system. Once water enters the Chavez Pass ditch system, water can be diverted manually into Tremaine Lake or into Hay Lake. During dry cycles Soldiers Annex Lake does not spill into Long Lake. There is no record of Soldiers Annex Lake going completely dry; however, lake levels do fluctuate throughout the year. The frequent winds and porous soil, which are characteristic of this series of reservoirs, cause lake levels to fluctuate throughout the year. For a further discussion of connectivity, see the Complex Analysis section.

Fish Movement
See the Soldiers Lake section for potential upstream fish movements. In the event of flooding, fish from Soldiers Annex Lake can either swim through a ditch on the east side of the lake approximately 0.6 miles into Long Lake, or through a gate at the base of the dam, which must be manually opened on the south side of the lake into the Chavez Pass Ditch system. This gate acts as a barrier to fish passage if left closed. Fish can travel down the Chavez Pass Ditch approximately 0.28 miles to the confluence with the Chilson Canal. From the confluence, fish could travel west and south into Chilson Canal or south approximately 0.25 miles into Tremaine Lake. For potential further downstream fish movements, see the Jacks Canyon Complex Analysis.

Community Description
Soldiers Annex Lake is inhabited by a self sustaining warm water community of non-native fishes. The most recent survey data indicate a small, low abundance, self sustaining population of predominately larger, therefore older, warm water sport fish (Table 6). Five 6 panel gill nets were set for approximately 15 to 16 hours, according to the Department sampling protocol. Northern pike, walleye, bluegill, channel catfish, and largemouth bass were collected during the

survey. In addition, a stable population of golden shiner provides a forage fish for the warm water predatory species. Crayfish were also observed and present during the survey. No amphibians were observed.

The lake provides little cover for juvenile fish to escape predation. The majority of the cover in the lake is in the form of aquatic vegetation located on the north end of the lake near the inflow from Soldiers Lake.

Table 6. Soldiers Annex Lake 2009 Gill Netting Sampling

Species	Num. of Fish Collected	Size Range (mm)
Northern Pike	8	398-631
Largemouth Bass	1	179
Bluegill	2	208-210
Walleye	19	332-492
Channel Catfish	4	503-611
Golden Shiner	75	92-165
Crayfish	Visually Observed	N/A

Consultation Species, Critical Habitat & Potential Impacts
Chiricahua and northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked areas and fish movement potential up or downstream to areas where frogs may occur (Figure 4). Additional consultation species are discussed in the Jack's Canyon Complex Analysis.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog

Local Analysis: Although Soldiers Annex Lake and the Jacks Canyon buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Soldiers Annex Lake is low. There are no historical records for Chiricahua leopard frogs from Soldiers Annex Lake or within the buffered stocking complex (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). No Chiricahua leopard frogs were observed during these surveys. The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Coconino National Forest). In addition, crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Soldiers Annex Lake is low, because there are no records for Chiricahua leopard frogs in the drainages into which fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although Soldiers Annex Lake and the Jacks Canyon buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Soldiers Annex Lake is low. There are no historical records for northern leopard frogs from Soldiers Annex Lake. Five sites have each been surveyed once within the buffered stocking complex; one in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There is a 1972 northern leopard frog record from Dave's Tank, which is approximately 7.5 miles west of the complex if you measure through the drainage; there have been no subsequent surveys at this site (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any northern leopard frogs (based on data provided by the Coconino National Forest). It is not likely that northern leopard frogs occupy Soldiers Annex Lake, Dave's Tank, or the area within the buffered stocking complex. Crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Soldiers Annex Lake is low. There are no recent historical records for frogs in these drainages (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Tremaine Lake

Site Description

Located in the southern portion of Coconino County, Tremaine Lake is located approximately 70 miles from the communities of Flagstaff and Payson, and is approximately 45 miles from the city of Winslow. The lake sits exclusively on Coconino National Forest land off of Forest Service road 82 at an elevation of 6,737 feet. This relatively large lake, on average covering approximately 350 surface acres with approximately 544 surface acres when fully watered, and about 8.20 miles of shoreline, would be an ideal place for a fishery that can be managed in isolation from fish in the three adjacent lakes. Tremaine Lake has an average depth of 3 to 5 feet, with a 12 to 15 foot maximum depth around the dam. The lake is primarily used as an irrigation source, and can be subject to wide fluctuations in level as water demands for irrigation are met.

Management of Water Body

No fish have been stocked by the Department into Tremaine Lake, nor does the Department currently manage a fishery at Tremaine Lake. Current fish management is listed as “no intent to stock”. The lake currently holds self sustaining populations of illegally introduced common carp, green sunfish, bullhead catfish, and golden shiner.

Proposed Action

The Department proposes to stock channel catfish, largemouth bass, redear sunfish, and bluegill, for the period covered by this consultation

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), redear sunfish (fingerlings, sub-catchables), and bluegill (fingerlings, sub-catchables) may be stocked as needed to augment the warm water fishery, or to reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Tremaine Lake only receives water from various splits in the Chilson Canal, which includes flow from the Soldier Annex Canal as described in the Soldier Lake description or from outflow at the base of Soldiers Annex Lake. A complex of conveyance canals that capture water from Sawmill Wash on the Diablo Canyon drainage feed Tremaine Lake. Using the isolated ditch from Sawmill Wash, the lake can potentially be isolated from the rest of the lakes in the complex. A manually operated gate at the base of the dam on Tremaine Lake can allow flow to travel about 1.12 miles (1,795 meters) into Hay Lake. This is the only potential outflow for Tremaine Lake.

Fish Movement

See the Soldiers Lake and Soldiers Annex Lake sections for potential upstream fish movements. During wet climactic cycles or when irrigation and ditch systems are being utilized there is a potential for fish to move out of Tremaine Lake and into the Chilson Canal system. From here

fish can potentially move into the upper drainage and dead end at any number of tanks upstream, or move into Soldiers Lake. Conditions would have to be ideal with the gates opened in the correct orientation and direction to allow fish movement.

During wet climactic cycles or when irrigation and ditch systems are being used there is potential for fish to move out of Tremaine Lake downstream into Hay Lake. All outflow from Tremaine Lake ends up in Hay Lake. For potential further downstream fish movements, see the Jacks Canyon Complex Analysis.

Community Description
Tremaine Lake is inhabited by an abundant, illegally introduced, self-sustaining warm water community of non-native fishes (Table 7). Two 6 panel gill nets were set for approximately 15 to 16 hours, according to the Department sampling protocol. Common carp, green sunfish, bullhead catfish, and golden shiner were collected during the survey. Crayfish were also observed and present during the survey. No amphibians were observed. Of the 99 common carp collected, 90 were “mirror carp,” or carp with unusually large scales laid down in a sporadic pattern.

Table 7. Tremaine Lake 2009 Sampling

Species	Num. of Fish Collected	Size Range (mm)
Common Carp	99	159-407
Green Sunfish	17	66-181
Bullhead Catfish	3	174-253
Golden Shiner	5	171

Consultation Species, Critical Habitat & Potential Impacts
Chiricahua and northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen

or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog

Local Analysis: Although Tremaine Lake and the Jacks Canyon buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Tremaine Lake is low. There are no historical records for Chiricahua leopard frogs from Tremaine Lake or within the buffered stocking complex (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). No Chiricahua leopard frogs were observed during these surveys. The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Coconino National Forest). In addition, crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Tremaine Lake is because there are no records for Chiricahua leopard frogs in the drainages into which fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although Tremaine Lake and the Jacks Canyon buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Tremaine Lake is low. There are no historical records for northern leopard frogs from Tremaine Lake (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There is a 1972 northern leopard frog record from Dave's Tank which is approximately 7.5 miles west of the complex if you measure through the drainage; there have been no subsequent surveys at this site (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any northern leopard frogs (based on data provided by the Coconino National Forest). It is not likely that northern leopard frogs occupy Tremaine Lake, Dave's Tank, or the area within the buffered stocking complex and crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm at Tremaine Lake is low. There

are no recent historical records for northern leopard frogs in these drainages (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Long Lake

Site Description

Long Lake was constructed in the early 1940's through the alteration of a wet meadow. Long Lake is located in the southern portion of Coconino County approximately 70 miles from the communities of Flagstaff and Payson, and approximately 45 miles from Winslow. The lake sits exclusively on Coconino National Forest land at an elevation of 6,737 feet, with a spillway elevation of 6,760 feet. Long Lake on average covers 268 surface acres with 372 surface acres when fully watered, and it requires approximately 417 surface acres to reach an elevation to spill. Long lake has an average depth of 5 feet with a 25 foot maximum depth when fully watered. Long Lake is prone to low water levels and drying during drought conditions. From 1999 –2004 the state suffered drought conditions, causing many of the lakes in Northern Arizona to become susceptible to poor water quality and in some cases to completely dry up. In 2003, Long Lake suffered poor water quality causing a fish kill, and in late summer of 2004 completely dewatered.

Management of Water Body

Long Lake is currently managed as a put-grow-and-take rainbow trout fishery. The Department stocks between 0-20,000 catchable rainbow trout between the months of March through May. In addition, variable numbers of fingerling rainbow trout are stocked when available in the fall and spring.

Stocking activities permitted by this consultation would satisfy the support expressed by the public to stock rainbow trout, largemouth bass, bluegill, and channel catfish back into Long Lake. In the Department's Region II 2003 fisheries questionnaire, 86% of the 678 total respondents supported the restocking of this species mix into the lake once it refills. In addition, 46.8% of the total respondents supported "adding walleye to the species mix".

Lake management historically included both warm and cold-water species (Table 8); since 1992 only rainbow trout have been stocked. Long Lake is currently cleared for the stocking of rainbow trout, channel catfish, walleye, largemouth bass, bluegill, and yellow perch.

Table 8. Long Lake Stocking History

Fish Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Northern Pike	1965	1967	3	66,000
Channel Catfish	1965	1992	16	152,100
Bluegill	1941	1993	6	49,835
Largemouth Bass	1941	1975	10	146,837
Rainbow Trout	1965	2009	123	2,934,407

Black Crappie	1988	1988	1	172
Brook Trout	1976	1976	1	2,000
Brown Trout	1982	1985	3	127,750
Walleye	1982	1985	3	1,880,000
Tadpoles	1967	1967	1	8,125
Totals			167	5,367,226

Primary management is for a put-grow-and-take rainbow trout fishery. Cold water species are primarily stocked multiple times per season in the spring and fall with 0-20,000 stocked annually. Occasional summer stockings occur when lake levels and water quality permit.

Secondary management is for a naturally reproducing, self sustaining warm water fishery featuring largemouth bass, bluegill, walleye, yellow perch, and channel catfish.

Warm water species are not currently stocked into Long Lake and are a small by-product of fish movement from upstream Soldiers Lake and Soldiers Lake Annex. No warm water species have been stocked in Long Lake since 1993. Yellow perch has not previously been stocked by the Department (Table 2), is not currently present in Soldier's Lake or the drainage, but is present elsewhere in the Little Colorado River watershed in Upper and Lower Lake Mary, Rainbow Lake, River Reservoir and Becker Lake.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, walleye, yellow perch, and bluegill for the period covered by this consultation.

Rainbow trout (fingerlings, sub-catchable, catchable) would be stocked multiple times annually, but stocking will most likely occur in the spring. Numbers of trout to be stocked would be 0 to 20,000 catchables, variable numbers of sub-catchables, and variable numbers of fingerlings; not to exceed a total of 480,000 fish annually.

Largemouth bass (fingerlings, sub-catchables, catchables), channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchables), walleye (sac fry, fingerlings), and yellow perch (fry/fingerlings, sub-catchables) may be stocked as needed to augment the warm water fishery, or reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Long Lake is fed by a complex of conveyance canals transporting water from Soldier Lake and Soldier Annex Lake. Long Lake normally only receives water from these two sources and only

after both of them have filled completely. However, during heavy precipitation events, water from Soldiers Annex Lake will connect to Long Lake rather than overflow anywhere else. The primary source of inflow for the Jacks Canyon Complex is from annual snowmelt during the spring months. Although there is no record to date of Long Lake spilling, if it did spill, water leaving the lake would flow into Chavez Pass Ditch at the SE end and then through a series of small cattle tank and splits in the ditch system, ending up at Diablo Canyon, 56 miles from the confluence with the LCR. See the Jacks Canyon Complex Analysis for a more detailed description of the Chavez Pass Ditch system.

Fish Movement

See the Soldiers Lake and Soldiers Annex Lake sections for potential upstream fish movements. There is a potential for fish from Long Lake to travel up the 0.6 mile dirt ditch on the west side of Long Lake into Soldiers Lake Annex during precipitation events significant enough to cause Soldiers Lake Annex to fill. In order for Soldiers Lake Annex to fill, Soldiers Lake must also receive enough inflow to fill. Conversely, fish from Soldiers Lake and Soldiers Annex Lake can also move into Long Lake during heavy precipitation events. The “dam” or embankment on the downstream (northwest) end of Long Lake is an effective fish barrier for the movement of fish into Diablo Canyon. If the lake were to fill completely, the designed spillway at the SE end of the lake would spill into the Chaves Pass Ditch (Figure 5). However, this has never been known to occur. Additionally, there is no controlled outflow or release from Long Lake. For potential further downstream fish movements, see the Jacks Canyon Complex Analysis.

Community Description

The aquatic community of Long Lake can vary based on water levels and water quality of the lake. During wet cycles the fish community may include rainbow trout (when stocked), northern pike, largemouth bass, bluegill, walleye, and golden shiner. During drought cycles when water levels are low, and pH and temperatures are high, a warm water mix of species may be found. These warm water species are those that establish after moving downstream from Soldiers and Soldiers Lake Annex during cycles that are sufficiently wet enough to cause them to spill. Depending on the year, these species may become self sustaining until drought conditions cause the lake to dry, or until a fish kill occurs due to high temperatures, high pH levels, or low oxygen levels. Long Lake has periods where it is fishless due to drying and or poor water quality.

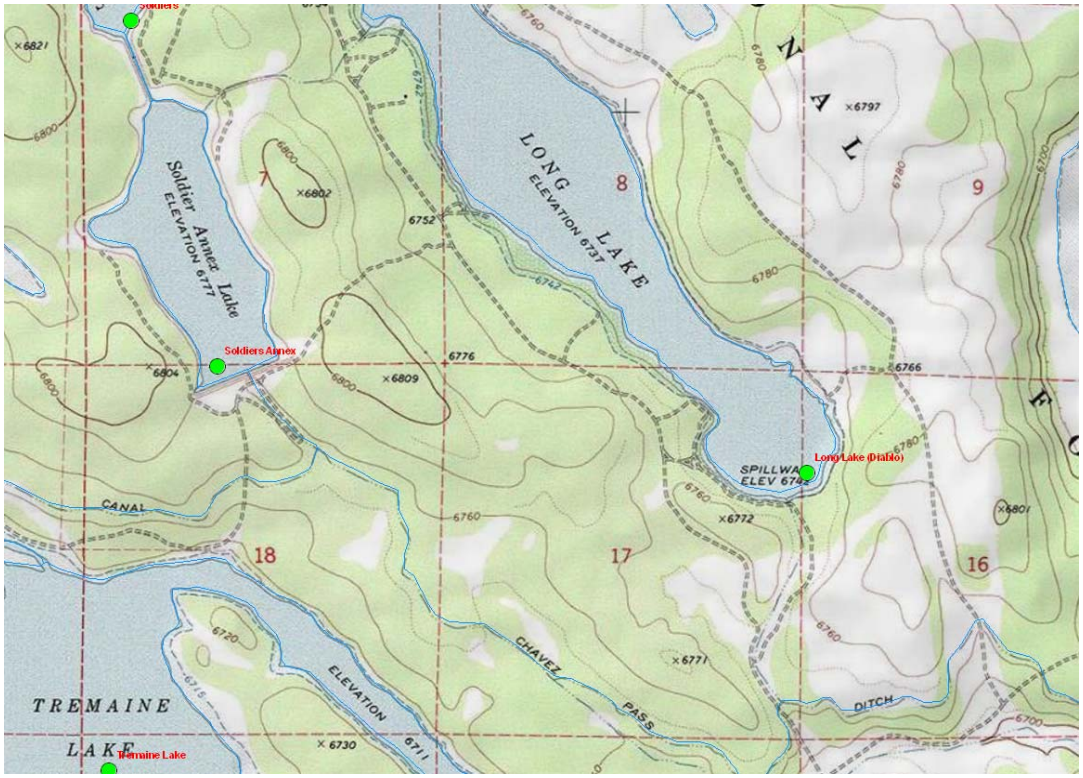

Figure 5. Close-up of Long Lake spillway and connection to Chaves Pass Ditch.

The most recent survey data of Long Lake indicate a mix of cold and warm water species (Table 9). Stocked rainbow trout were collected in addition to an abundant self-sustaining fathead minnow and golden shiner population, with a few adult northern pike and walleye present.

Table 9. Long Lake 2009 Sampling

Species	Num. of Fish Collected	Size Range (mm)
Northern Pike	5	345-480
Largemouth Bass	0	N/A
Bluegill	0	N/A
Walleye	2	306-580
Channel Catfish	0	N/A
Golden Shiner	(only 1 measured many observed)	126

Crayfish	Many collected in gill nets. None counted	N/A
Rainbow trout	13	323-483

According to the Department's 2006 Long Lake Fish Report (Rinker et al. 2006), stocked rainbow trout made up the majority of the fish collected during gill netting surveys, with 223 trout caught, with a small subsample of 42 northern pike caught, representing several size classes ranging from 294 to 662 mm total length. These data support the cycle of a fish community of stocked trout and warm water fish that flush in from above impoundments.

Consultation Species, Critical Habitat & Potential Impacts
Chiricahua and northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog
Local Analysis: Although Long Lake and the Jacks Canyon buffered stocking complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in Long Lake is low. There are no historical records for Chiricahua leopard frogs from Long Lake or within the buffered stocking complex. Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). No Chiricahua leopard frogs were observed during these surveys. The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Coconino National Forest). In addition, crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm is low, because there are no records for Chiricahua leopard frogs in the drainages into which fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although Long Lake and the Jacks Canyon buffered stocking complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in Long Lake is low. There are no historical records for northern leopard frogs from Long Lake. Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (Figure 4, AGFD Riparian Herpetofauna Database). There is a 1972 northern leopard frog record from Dave's Tank, which is approximately 7.5 miles west of the complex if you measure through the drainage; there have been no subsequent surveys at this site (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any northern leopard frogs (based on data provided by the Coconino National Forest). It is not likely that northern leopard frogs occupy Long Lake, Dave's Tank, or the area within the buffered stocking complex and crayfish have been documented at the lake, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or a breached berm is low. There are no recent historical records for frogs in these drainages (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

JACKS CANYON COMPLEX ANALYSIS

From 1999 –2004 the state suffered drought conditions, causing many of the lakes in Northern Arizona to become susceptible to poor water quality and in some cases to completely dry up. In 2003, Long Lake suffered poor water quality causing a fish kill, and in late summer of 2004 completely dewatered. The geology/soil type of the Jacks Canyon Complex is such that water seeps into the soil more quickly than in some other areas, leaving the soil dry. The windy conditions in this area also add to the evaporation of water resources.

Water Distribution/Connectivity

The Jacks Canyon Complex receives water primarily from Sawmill Wash via Soldiers Annex Canal during snowmelt runoff during the spring months of the year. Some spring snowmelt enters the complex from the surrounding drainage on the west and southwest side of the complex of reservoirs from a 40,000 acre drainage area. Once water is in the complex, it is diverted through a complex system of canals and ditches controlled by various manual gates, to supply water to stock tanks and retain water in agricultural fields.

There are two potential outflows from the Jacks Canyon Complex to the LCR: Jacks Canyon from Hay Lake, and Chavez Pass Ditch from Soldiers Annex Lake and Long Lake. Hay Lake was constructed for the sole purpose of water retention and only fills after all of the other lakes in this complex have filled. If water were to leave Hay Lake it would flow in the form of sheet runoff through a series of active agricultural fields prior to reaching an unnamed tributary to Jacks Canyon. Since 1991, Hay Lake has never been observed to spill into Jacks Canyon, including the wet years of 1993 and 2005. Chavez Pass Ditch can only receive outflow from a manually operated gate at the base of the dam on Soldiers Annex Lake, over its spillway or from outflow from Long Lake.

All tributaries are typically dry, only contributing flow to the canal system during snow melt or significant precipitation events. The irrigation and canal system is controlled by the Hay Lake Ranch. They limit flows through the Chavez Ditch System, according to irrigation and livestock needs and to fill all tanks along the system before water is released to Diablo Canyon.

Based on the description of the complex water conveyance system involved with the water management of these lakes, the distance to any listed fish species or critical habitat, and the absence of records documenting spill events, this complex of lakes is likely a closed system, However, because the potential does exist for fish escapement through the Chavez Pass Ditch in extreme and rare precipitation events, analysis of downstream impacts is also included.

Fish Movement

The upstream movement of fish from the complex can travel up the Soldiers Annex Canal to a manually operated gate. From this gate fish could travel into Luth Hart Tank and potentially up into the head waters of these drainages. Similarly, fish could travel up the various tributaries from Tremaine and/or Hay Lake up into the headwaters of the drainage.

The downstream movement of fish from the complex would be 5 miles through Chavez Pass Ditch to Lute Hart Tank where the ditch ends then heads east about 1.63 miles to a series of four tanks known as Perkins Tanks. The outflow from Perkins Tanks continues down the ditch about 0.52 miles to Red Tank. From Red Tank it is about 1.59 miles to a split in the ditch where an unnamed ditch travels north. The unnamed drainage travels about 0.43 miles to Pat Duke Tank. The ditch continues about 1.67 miles to the first of two tanks known as Twin Tanks. It is about 0.16 miles from the first tank to the second tank. From the second tank it is about 0.76 miles to Goslin Tank. The outflow from Goslin Tank terminates about 2.91 miles at Dog Valley Wash, which travels 4.4 miles west into Diablo Canyon. Diablo Canyon flow 46.02 miles before meeting up with the LCR. From this confluence of the LCR and Canyon Diablo, an additional 50+ miles of intermittent stream exist before reaching occupied habitat for humpback chub and critical habitat.

From the confluence of the Chavez Pass Ditch and Soldiers Annex Canal, fish can access Chavez Pass Ditch traveling 1.03 miles to a split in the ditch where an unnamed side channel travels about 2.41 miles and terminates at Antelope Tank. From where the unnamed side channel splits toward Antelope Tank, Chavez Pass Ditch continues about 0.95 miles to a split where the outflow from Long Lake enters the Chavez Pass Ditch system. Chavez Pass Ditch from where the outflow of Long Lake travels about 6.83 miles to a split in the ditch, where an unnamed drainage travels to the north. The unnamed drainage travels north about 1.92 miles to Bypass Tank. From Bypass Tank the unnamed drainage flows about 1.66 miles to Melbourne Dam. From Melbourne Dam it travels about 1.95 miles to Horse Pasture Tank. From there it travels about 0.80 miles to Mud Tank. The outflow from Mud Tank travels about 1.78 miles to where it drops into Diablo Canyon. Diablo Canyon meanders for about 55.98 miles to the confluence with the LCR.

From where the unnamed drainage splits off of Chavez Pass Ditch and heads North, Chavez Pass Ditch continues northeast about 3.15 miles (5,074 meters) to 14 Inch Tank. It is about 1.53 miles from 14 Inch Tank to New Tank. The outflow from New Tank travels about 1.04 miles to Upper Dog Valley Tank. Chavez Pass Ditch continues about 1.13 miles to Broken Dam Tank in Dog Valley Wash. Dog Valley Wash travels 6.1 miles west into Diablo Canyon and Diablo Canyon flows 46.02 miles before meeting up with the LCR.

Hay Lake is a fifth lake in this complex and although it is not a proposed stocking location, it plays an important role in preventing water or stocked fish from reaching sensitive habitats downstream in Jacks Canyon. Hay Lake is dry in most years, but when full it covers approximately 480 surface acres in size. Hay Lake has not been known to spill, but in the unlikely event that it did, it would flow down an unnamed drainage that runs about 10.01 miles to Jacks Canyon. Jacks Canyon is about 49 miles to its confluence with the LCR. There are about 35.5 miles of ephemeral/intermittent channel that separate the site and the LCR.

Based on these complicated connections, and the lack of recorded spills from Hay Lake and Long Lake, it is extremely unlikely that fish from the Jacks Canyon Complex would reach Diablo Canyon, let alone travel to the LCR.

Community Description

Soldiers Lake, Soldiers Annex Lake, and Long Lake are all interconnected and can potentially have the same aquatic community during wet climactic cycles. At any given time the aquatic community of these three lakes may contain largemouth bass, walleye, rainbow trout, bluegill, channel catfish, northern pike, golden shiner, and crayfish. The aquatic community of Tremaine Lake is currently different than the other three reservoirs in the system, except for golden shiner and crayfish. Common carp, bullhead catfish, and green sunfish all currently inhabit Tremaine Lake.

The aquatic community of Tremaine Lake remains different from both Soldiers Lake and Soldiers Annex Lake despite the potential upstream connection to them via Soldiers Annex Canal and through the Chilson Canal and Chavez Pass Ditch to the base of Soldiers Annex Lake. It is suspected that the aquatic community in Tremaine Lake is the result of illegal fish stocking of "mirror carp" and other species (see Tremaine Lake site analysis). This suggests that the gate system on Soldiers Annex Canal into Soldiers Lake, and the gate at the base of Soldiers Annex Lake Dam are sufficient barriers to fish movement into and out of Tremaine Lake.

Consultation Species, Critical Habitat & Potential Impacts
The Jacks Canyon Complex is most likely a closed system because it has not been known to spill for nearly 20 years; however it will be analyzed as an open system. Potential impacts from the proposed action to candidate and listed species are described below, and in the Lower LCR Complex Analysis Section for possible connection through the Chavez Pass Ditch to Canyon Diablo.

Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.). Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua leopard frog
Local Analysis: Although the lakes in the Jacks Canyon Complex are within the historical range of the Chiricahua leopard frog, the likelihood that Chiricahua leopard frogs could be exposed to fish stocked in these lakes is low. There are no historical records for Chiricahua leopard frogs from the lakes or within the buffered stocking complex. Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). No Chiricahua leopard frogs were observed during these surveys. The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any Chiricahua leopard frogs (based on data provided by the Coconino National Forest). In addition, crayfish have been documented at some of the lakes, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that Chiricahua leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or breached berms is low because there are

no records for Chiricahua leopard frogs in the drainages into which fish could disperse (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Northern Leopard Frog

Local Analysis: Although the lakes in the Jacks Canyon Complex are within the historical range of the northern leopard frog, the likelihood that northern leopard frogs could be exposed to fish stocked in these lakes is low. There are no historical records for northern leopard frogs from the Lakes (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). Five sites have each been surveyed once within the buffered stocking complex; 1 in 1972 and the rest in 1992 (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There is a 1972 northern leopard frog record from Dave's Tank, which is approximately 7.5 miles west of the complex if you measure through the drainage; there have been no subsequent surveys at this site (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Coconino National Forest surveyed 16 sites between 2006 and 2007 and did not observe any northern leopard frogs (based on data provided by the Coconino National Forest). It is not likely that northern leopard frogs occupy any of the lakes, Dave's Tank, or the areas within the buffered stocking complex and crayfish have been documented at some of the lakes, making it less suitable leopard frog habitat.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing stocked fish due to an extreme storm event or breached berms is low. There are no recent historical records for frogs in these drainages (AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.).

Humpback Chub and Critical Habitat

Suitable and designated critical habitat for the humpback chub occurs at the confluence of the Little Colorado and Colorado Rivers. Refer to the Lower LCR complex analysis which describes the potential impacts and analysis to the humpback chub under the extremely unlikely event that stocked fish in this complex are able to escape and move through the complex and extensive ditch and tank system to reach Canyon Diablo. However, the likelihood of fish from this complex ever reaching the LCR is extremely remote due to the distance, water conditions, water management regime imposed on the system by the Hay Lake Ranch and multiple falls on the LCR as described later.

CANYON DIABLO COMPLEX DESCRIPTION

PHYSICAL GEOGRAPHIC DESCRIPTION

Drainage area and elevations

The Canyon Diablo Complex is located in the southwest quadrant of the Little Colorado River (LCR) Watershed (Figure 6). The Canyon Diablo Complex is approximately 1,205 square miles in size, and ranges in elevation from 8,200 feet near the top of Rio de Flag, to 4,685 feet where it

connects into the LCR approximately 5.5 miles downstream from Corn Creek Wash, near the termination of State Highway 99 at Sunrise, Arizona.

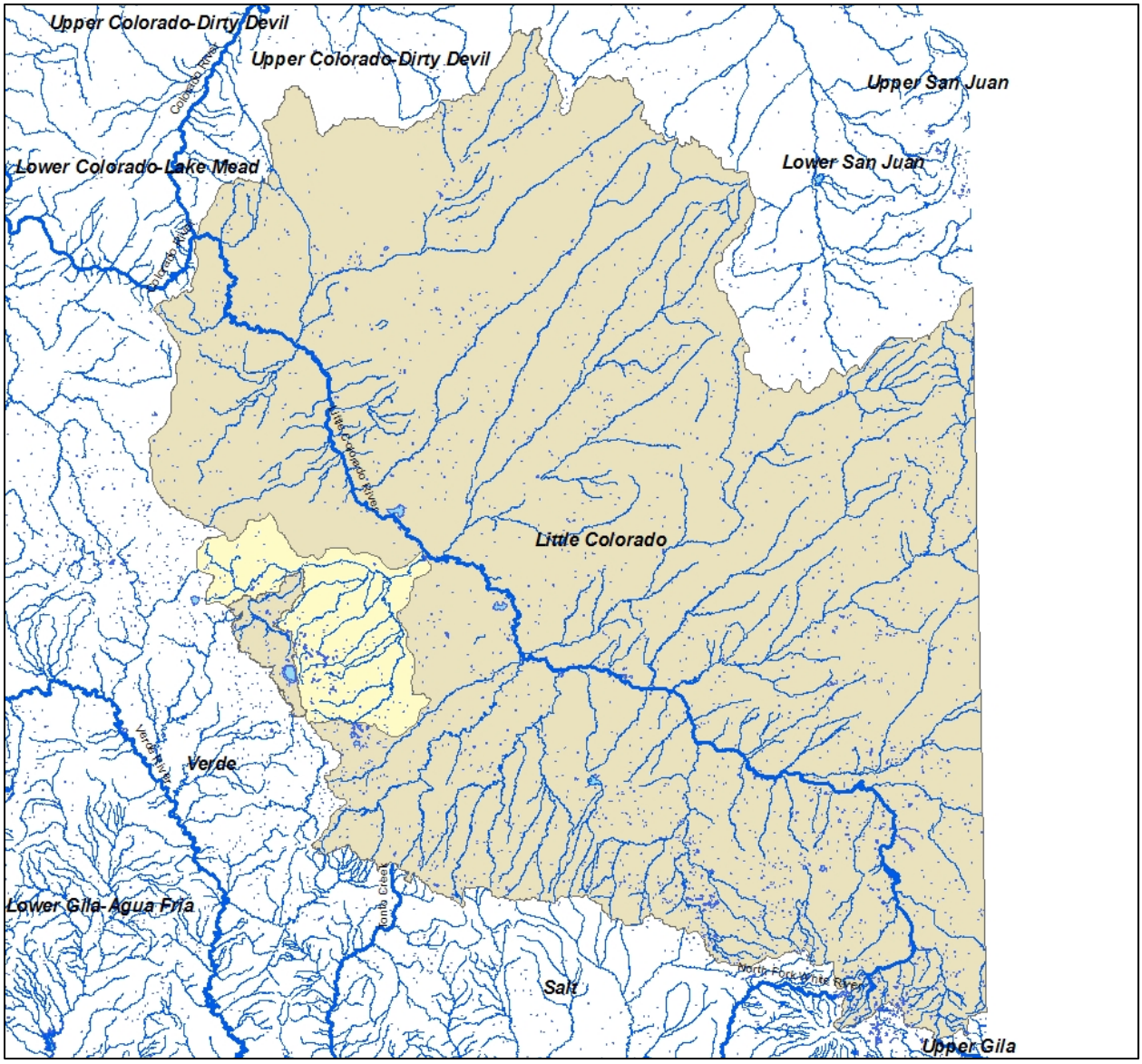

Figure 6. Location of the Canyon Diablo Complex (shaded yellow) in relation to the LCR watershed (shaded brown).

The Canyon Diablo Complex consists of six reservoirs that are managed for sport fisheries. The reservoirs are essentially comprised of three sub-watersheds: Kinnikinick Canyon, Coconino Lake/Ashurst Lake, and Rio de Flag (Figure 7). There are no known USGS flow gauging stations within this watershed complex.

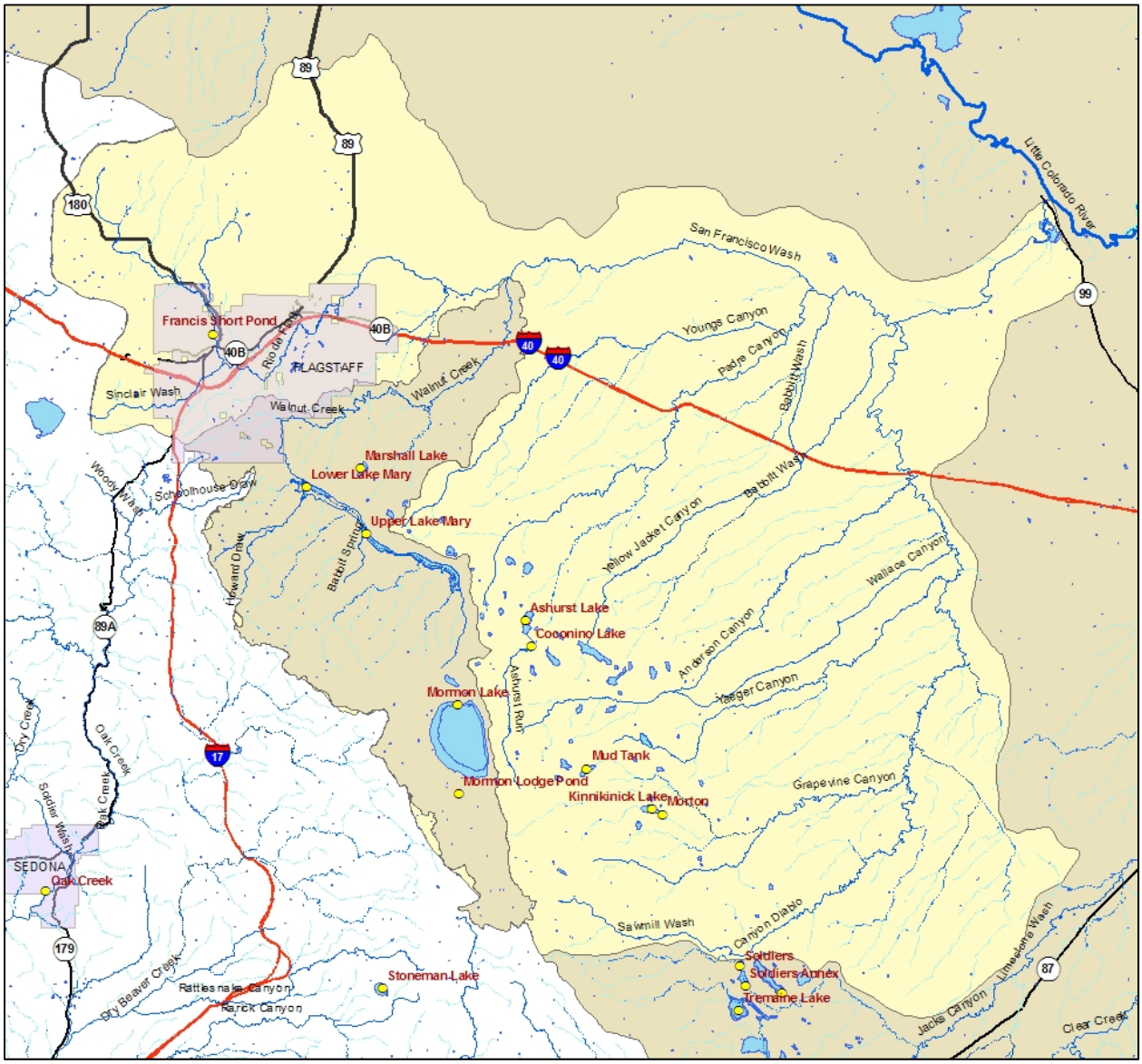

Figure 7. Canyon Diablo Complex (yellow) located within the Little Colorado River watershed; municipal areas are shaded in purple. The Walnut Creek sub-drainage stocking sites are considered closed and do not connect with the Canyon Diablo drainage.

The Kinnikinick Canyon sub-watershed consists of Kinnikinick Lake, Morton Lake, and Mud Lake (Figure 8). Kinnikinick Lake is located on the southern end of the complex and receives its water primarily from spring runoff from the surrounding area on Anderson Mesa via a ditch system. When Kinnikinick spills it fills Morton Lake, which is located directly downstream of Kinnikinick dam, and eventually drains into Kinnikinick Canyon. Mud Lake is located north of Kinnikinick Lake and just west of the road to Kinnikinick. Mud Lake fills from spring runoff from Anderson Mesa and when it spills, it spills through a poorly defined channel into Kinnikinick Canyon.

Kinnikinick Canyon eventually flows into Grapevine Canyon approximately five miles to the southeast of Morton Lake, and then Grapevine Canyon eventually ties into Diablo Canyon.

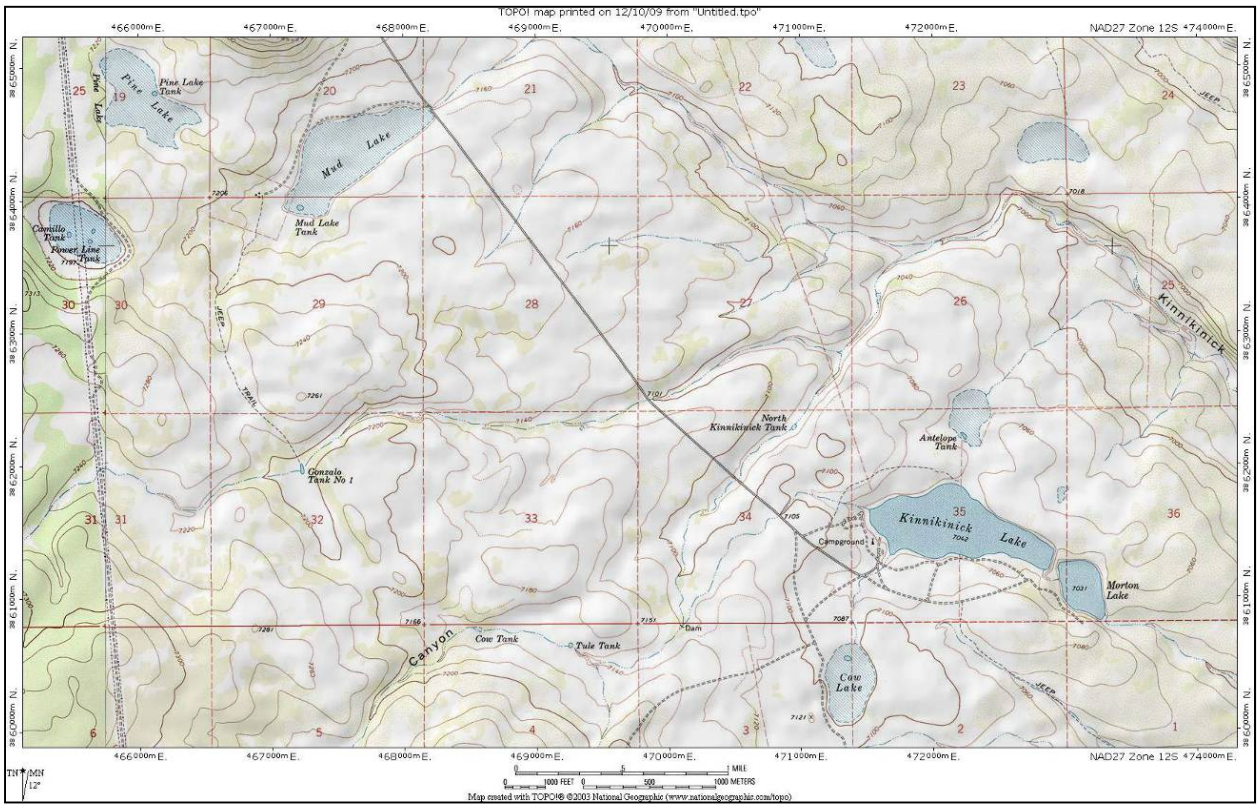

Figure 8. Topographic map indicating the location of Kinnikinick, Morton, and Mud lakes in Kinnikinick Canyon.

Coconino Lake collects water during spring runoff from a ditch system located in Ashurst Run (Figure 9); water from Coconino Lake flows north about ½ mile down a ditch to fill Ashurst Lake. Flow in the ditch is controlled by a head gate located at Coconino Dam. When Coconino Lake and Ashurst Lake spill they flow via a ditch system into Breezy Lake, a large wet meadow with no observed outlet; it is therefore considered a closed system.

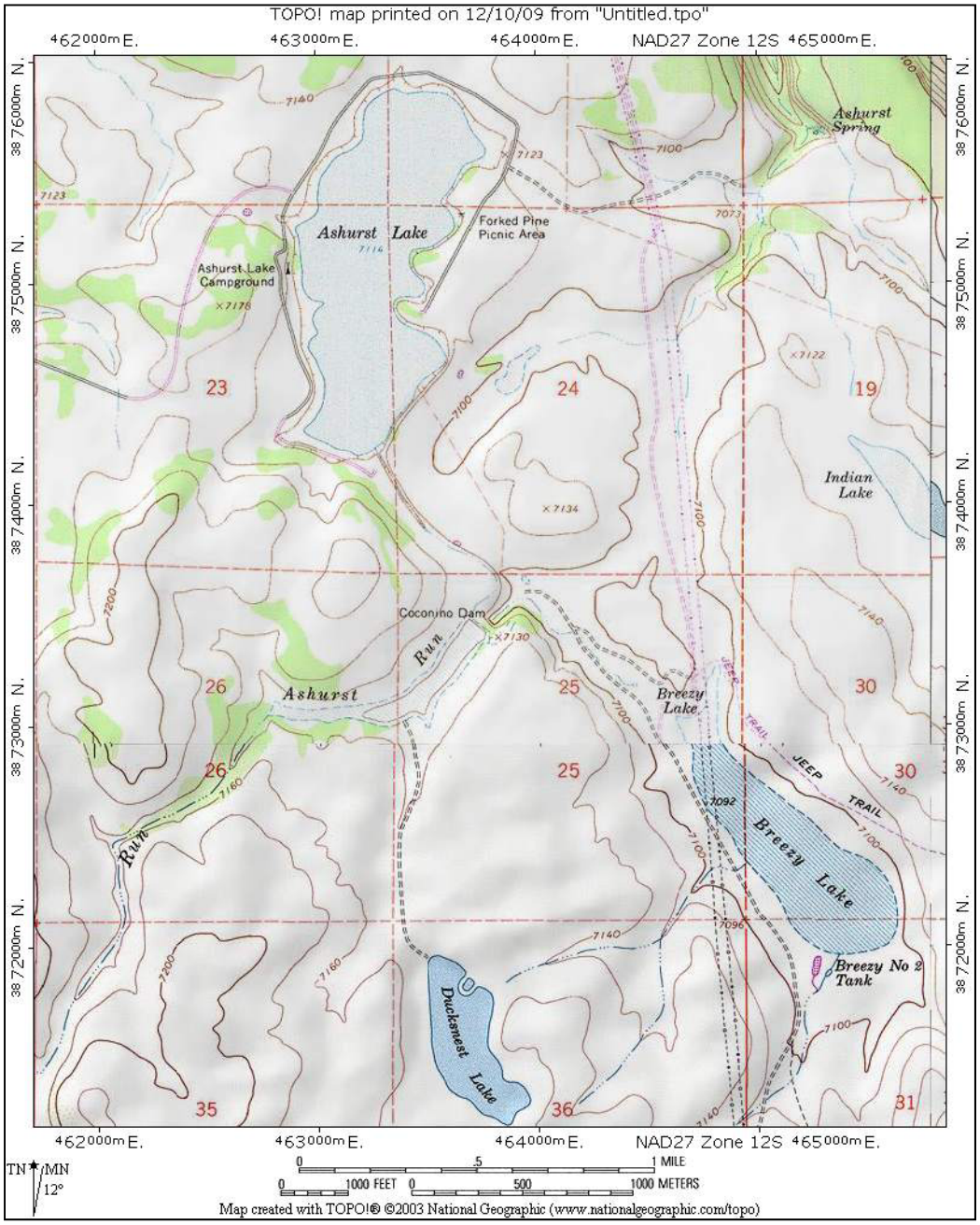

Figure 9. Topographic map indicating the Ashurst Run ditch system.

Frances Short pond sits in the Rio de Flag drainage within the city of Flagstaff. This pond captures runoff from the San Francisco Peaks, Elden Mountain, and A-1 Mountain sub-drainages north of Flagstaff. The Rio de Flag also collects drainage water from the City of Flagstaff downstream of Frances Short Pond. Any runoff from Frances Short Pond must travel approximately 40 miles through ephemeral washes, 26 culverts under roadways, over a single

roadway, through nine ponds, and across a golf course before it enters Diablo Canyon. Diablo Canyon is connected to the Lower LCR approximately 128 miles from the confluence of the LCR and the Colorado River.

Kinnikinick Lake

Site Description

Kinnikinick Lake is located approximately 9.7 miles off of Forest Highway #3 on Forest Service Road 82 in the Coconino National Forest, about 40 miles southeast of Flagstaff. The dam was built in 1954 and is fed by annual runoff from a 26,500 acre watershed on Anderson Mesa. Kinnikinick Lake sits at an elevation of 7,042 feet, has an average depth of 14 feet and a maximum depth of 22 feet, and encompasses 160 surface acres at maximum capacity (Figure 10; Figure 11). There is a Forest Service campground on the lake with 13 single unit campsites with tables, fire rings, cooking grills, and vault-type toilets. There is a gravel boat ramp located on the north end of the lake.

Figure 10 . Image of Kinnikinick and Morton lakes located within the Canyon Diablo drainage (©2009 ESRI, i-cubed, GeoEye).

Figure 11. Photo of Kinnikinick Lake located within the Canyon Diablo drainage.

Management of Water Body

Kinnikinick Lake has been stocked dating back to 1936 and managed as a put-and-take rainbow trout fishery, and a put-grow-and-take brown trout and channel catfish fishery. In 1993 stocking of brown trout was halted, but was restarted in 2007. The emphasis listed in the "Integrated Fisheries Management Plan for the LCR Watershed" for Kinnikinick Lake is for sport fish management with a desired concept of Intensive Use Fishery (Young et al. 2001).

The primary fishery for Kinnikinick Lake is an intensive use coldwater put-and-take rainbow trout fishery and a put-grow-and-take brown trout fishery. Secondary Management is a channel catfish fishery (Table 10). Brook trout, cutthroat trout and Arctic grayling may be stocked opportunistically provide additional angling opportunity depending on fish availability.

Table 10. Stocking History for Kinnikinick Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked

Arctic grayling	1940	1940	2	6,050
Bluegill	1936	1936	1	9,000
Brook trout	1978	2007	6	45,000
Brown trout	1973	2009	35	211,737
Channel catfish	1970	2001	18	69,361
Cutthroat trout	1946	1991	11	796,450
Largemouth bass	1936	1936	1	950
Rainbow trout	1936	2009	359	2,416,220
Total			433	3,554,768

Proposed Action

The Department proposes to stock rainbow trout, brown trout, channel catfish, brook trout, cutthroat trout, and arctic grayling for the period covered by this consultation.

Catchable and sub-catchable rainbow trout will be stocked multiple times each year from March-November; numbers of rainbow trout stocked may be from 0 – 50,000 annually.

Catchable, sub-catchable, fingerling sized brown trout will be stocked multiple times from September-November each year; numbers of brown trout stocked may be from 0-20,000 annually.

Catchable and sub-catchable channel catfish will be stocked from April – November; numbers of channel catfish stocked may be from 0-2,000 annually.

Catchable, sub-catchable, and fingerling brook trout may be stocked multiple times each year from April – November; numbers stocked may be from 0-50,000 annually.

Catchable, sub-catchable and fingerling cutthroat trout may be stocked multiple times each year from April – November; numbers stocked may be from 0-50,000 annually.

Catchable, sub-catchable and fingerling Arctic grayling may be stocked multiple times each year from March-November; numbers stocked may be from 0-50,000 annually.

Water Distribution / Connectivity

As mentioned above, Kinnikinick Lake is fed by annual runoff from Anderson Mesa via a first-order ephemeral stream with no known tanks or ponds. Kinnikinick Lake spills on the average twice every ten years and drains over the spillway into Morton Lake. According to Arizona Department of Water Resources (ADWR), the Kinnikinick spillway measures 860 feet long and 20.5 feet in height; thus flooding spillway events are broad and shallow.

Morton Lake has a maximum depth of 18 feet and on average covers 10 surface acres when it receives water. Morton Lake has a maximum surface area of 28.2 acres when full. Morton Lake fills and spills on average once every ten years.

Drainage from Morton Lake travels 1.77 miles down an unnamed ephemeral drainage into Kinnikinick Canyon. From Kinnikinick Canyon, ephemeral flows run 3.16 miles to Grapevine Canyon, and thereafter runs ephemerally through Grapevine Canyon 10.62 miles before connecting with Diablo Canyon. Ephemeral Diablo Canyon meanders for 49.10 miles before meeting up with the LCR.

Kinnikinick Canyon, Grapevine Canyon, and Diablo Canyon are dry except during runoff events. Diablo canyon meets with the ephemeral Lower LCR approximately 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Fish Movement
During wet years when reservoirs fill completely, fish can travel downstream from Kinnikinick Lake over the Kinnikinick spillway into Morton Reservoir, which has happened an average of twice every ten years; Morton Lake spills once every ten years on average.

Below Morton Lake there are no identified perennial sections of creek (GIS data), nor tanks or ponds where fish could seek refuge through stochastic events. There are no USGS stream gauges along this route and therefore nothing to suggest that fish could potentially reach the Lower LCR via traveling approximately 65 miles of ephemeral flow.

Community Description
Rainbow trout, brown trout, brook trout, golden shiner, fathead minnow and channel catfish are currently present in the lake (Table 11, Table 12 and Table 13). Based on stocking data and limited information from sampling data, channel catfish appear to be sustaining themselves as indicated through a variety in lengths, albeit at low numbers. The rainbow trout are presumed to be holdovers from numerous stocking events, but given a far narrower range in total lengths, it is unlikely they are capable of reproducing and recruiting in this lentic environment.

Table 11. 2004 Kinnikinick Lake gill net survey.

Species	Num.	Percent of Catch	Catch per Net Hour
Channel Catfish	60	80	.69

Rainbow Trout	14	18.7	.16
Golden Shiner	1	1.3	.01
Total	75	100	.86

Table 12. 2008 Kinnikinick Reservoir electrofishing data.

Species	Num.	Catch/Min	%of Total	Mean TL (mm)	Min-Max TL (mm)	Max WT (g)
Rainbow Trout	38	0.50	2.55	247.26	213-278	254
Channel Catfish	7	0.09	0.47	358.86	260-478	1,204
Golden Shiner	1,441	18.84	96.71	-	-	
Fathead Minnow	4	0.05	0.27	-	-	
TOTALS	1,490	-	-	-	-	

TOTAL EFFORT 4,590 SECONDS (76.50 MINUTES).

Table 13. 2009 Kinnikinick electrofishing data.

Species	Num.
Channel Catfish	3
Rainbow Trout	5
Golden Shiner	Not counted but present
Fathead Minnow	20
Brown Trout	1

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to humpback chub will be covered in the Lower LCR analysis.

Northern Leopard Frog

Local Analysis: Kinnikinick Lake and the Canyon Diablo buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Kinnikinick Lake or other stocking sites within the complex is high. There are historical records for northern leopard frogs from 2 sites in the complex; Ashurst Lake (1972), and Mormon Lake (1970) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 24 surveys at 17 sites within the Canyon Diablo buffered stocking complex from 1970 to 2000 (Figure 12; HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 3 sites within the buffered stocking complex regularly from 2005-2009 and has confirmed that northern leopard frogs occupy all 3 sites; Hennsey/Wallace Lake, VJ Tank, and Flying M Tank (Ashurst Run).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Kinnikinick Lake or Canyon Diablo buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

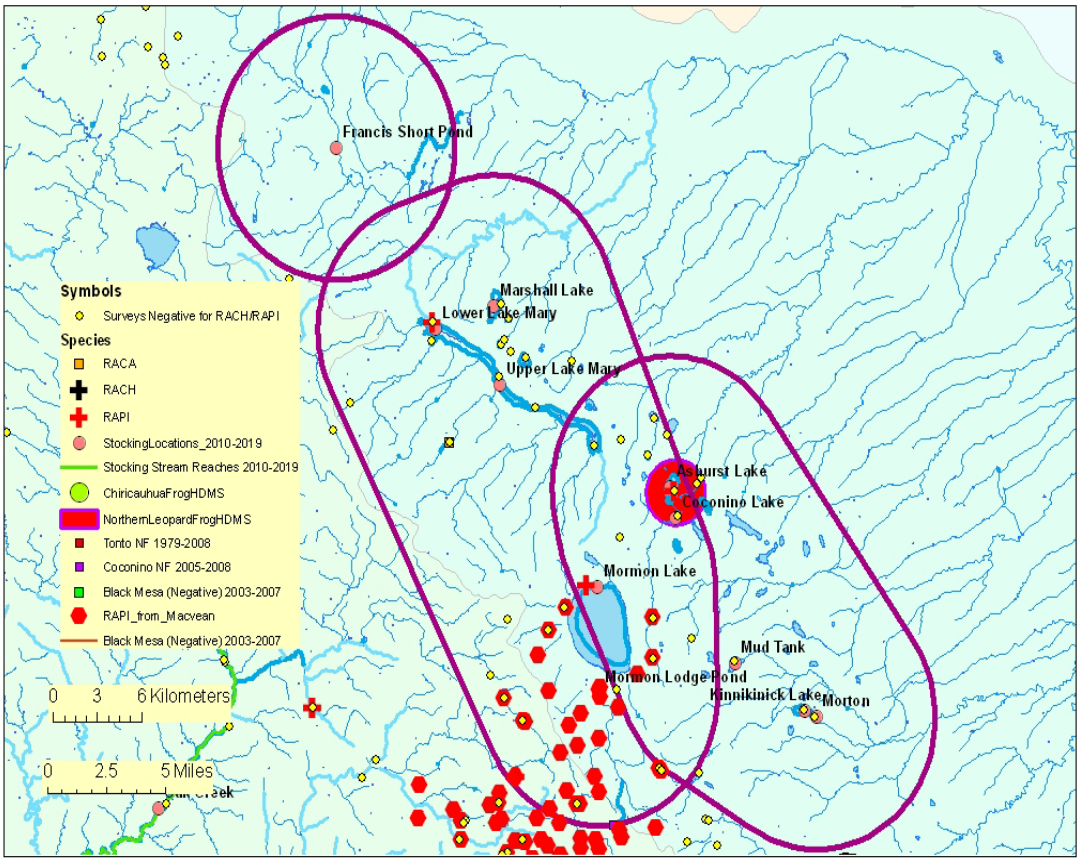

Figure 12. Map of Canyon Diablo buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and intermittent). A black line represents a Chiricahua leopard frog Recovery Unit boundary. The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Morton Lake

Site Description

Morton Lake is located on the Coconino National Forest directly downstream of the Kinnikinick Dam, about 40 miles southeast of Flagstaff (Figure 10; Figure 13). It has a maximum depth of 18 feet and an average surface area of 10 acres when it receives water from Kinnikinick Lake. Morton Lake spills on average once every ten years. Kinnikinick Lake is the only source of water for Morton Lake except for sheet flow run-off from the surrounding slopes.

Figure 13. Photo of Morton Lake.

Management of Water Body

The emphasis listed in the "Integrated Fisheries Management Plan for the LCR Watershed" for Morton Lake is for sport fish management with a desired concept of Intensive Use Fishery (Young et al. 2001). Primary fishery management is a coldwater put and take rainbow trout fishery. Secondary fishery management is a channel catfish fishery (Table 14).

Table 14. Stocking history for Morton Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brook Trout	1977	1977	1	5,000
Brown Trout	1992	1994	3	8,271
Rainbow Trout	1976	1998	10	14,053
Yellow Perch	1989	1989	1	80,000

Total	26	394,822

Proposed Action
Stock rainbow trout and channel catfish are proposed for the period covered by this consultation.

Catchable rainbow trout may be stocked multiple times each year from March-November; numbers of rainbow trout stocked may be from 0 – 5,000 annually.

Sub-catchable channel catfish may be stocked multiple times each year from September-November; numbers of channel catfish stocked may be from 0-2000 annually.

Water Distribution/Connectivity
Drainage from Morton Lake travels 1.77 miles down an unnamed ephemeral course into Kinnikinick Canyon. Figure 14 depicts the Morton Lake spillway. Kinnikinick Canyon is ephemeral and meanders 3.16 miles to Grapevine Canyon. Grapevine Canyon is ephemeral and can run 10.62 miles before connecting with Diablo Canyon. Diablo Canyon is ephemeral and winds for 49.10 miles before meeting up with the LCR.

Kinnikinick Canyon, Grapevine Canyon, and Diablo Canyon are dry except during runoff events. Diablo canyon meets with the ephemeral Lower LCR approximately 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Figure 14. Photo of Morton Lake spillway.

Fish Movement

Due to the dam, there is no upstream movement of fish from Morton Lake to Kinnikinick Lake. If Morton Lake fills and spills, the water drains downstream through almost 65 miles of ephemeral canyons. As mentioned above, there are no identified perennial sections of creek, nor tanks or ponds where fish could seek refuge through stochastic events. There are no USGS stream gauges along this route and therefore nothing to suggest that fish could potentially reach the Lower LCR via traveling approximately 65 miles of ephemeral flow to enter the ephemeral portion of the Lower LCR 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Community Description

No fish surveys have been conducted on Morton Lake since 1991. The lake was dry from 2001-2005. However because Kinnikinick Lake spills into Morton Lake, any of the species found in Kinnikinick Lake can be found in Morton Lake when it has water, including rainbow trout, brown trout, brook trout, golden shiner, fathead minnow, and channel catfish.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to humpback chub will be covered in the Lower LCR analysis.

Northern Leopard Frog

Local Analysis: Morton Lake and the Canyon Diablo buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Morton Lake or other stocking sites within the complex is high. There are historical records for northern leopard frogs from 2 sites in the complex; Ashurst Lake (1972), and Mormon Lake (1970) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 24 surveys at 17 sites within the Canyon Diablo buffered stocking complex from 1970 to 2000 (Figure 12, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 3 sites within the buffered stocking complex regularly from 2005-2009 and has confirmed that northern leopard frogs occupy all 3 sites; Hennsey/Wallace Lake, VJ Tank, and Flying M Tank (Ashurst Run).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Morton Lake or Canyon Diablo buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Mud Lake

Site Description

Mud Lake is a 7 acre tank located on the Coconino National forest about 35 miles southeast of Flagstaff and approximately 3 miles northwest of Kinnikinick Lake on Forest Road 82 (Figure

15). Spring runoff from Anderson Mesa fills Mud Lake and it spills through a culvert under the FR82 at the outlet and down a shallow channel into Kinnikinick Canyon.

Figure 15. Image of Mud Lake downstream from Kinnikinick and Morton lakes, located within the Canyon Diablo drainage (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Mud Lake has historically been stocked with rainbow trout, brown trout and channel catfish during wet years (Table 15). Mud Lake was last stocked in 1998 during a wet cycle, at which time it was managed as an intensive use water. The emphasis listed in the "Integrated Fisheries Management Plan for the LCR Watershed" is for sport fish management with a desired concept

of warm water fishery (Young et al. 2001). Current management is for an intensive use rainbow trout and channel catfish fishery when the lake has enough water to support fish.

Table 15. Stocking history for Mud Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1992	1994	3	14,000
Channel catfish	1988	1998	7	4,900
Rainbow trout	1970	1973	2	7,500
Total			12	26,400

Proposed Action
The Department proposes to stock rainbow trout and channel catfish for the period covered by this consultation.

Catchable rainbow trout may be stocked multiple times from April-November each year, when conditions allow; numbers of rainbow trout stocked may be from 0-5,000 annually.

Catchable channel catfish will be stocked each year from April – November, when conditions allow; numbers of channel catfish stocked may be from 0-1,000 annually.

Water Distribution/Connectivity
Mud Lake is reduced to a small stock tank found on its western edge over most years. During wet years the lake fills and can periodically support fish. The stock tank went dry during 2001-2002.

When Mud Lake spills it travels 3.5 miles down an unnamed shallow drainage to Kinnikinick Canyon. It then flows down Kinnikinick Canyon 7 miles to Grapevine Canyon. Grapevine Canyon is ephemeral and meanders 10.62 miles before connecting with Diablo Canyon. Diablo Canyon is ephemeral and meanders for 49.10 miles before meeting up with the LCR. Kinnikinick Canyon, Grapevine Canyon, and Diablo Canyon are dry except during runoff events. Diablo Canyon meets with the ephemeral Lower LCR 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Fish Movement
If Mud Lake fills and spills, the water travels downstream through the almost 70 miles of ephemeral canyons. There are no identified perennial sections of creek (GIS data), nor tanks or

ponds where fish could seek refuge through stochastic events. There are no USGS stream gauges along this route and therefore nothing to suggest that fish could potentially reach the Lower LCR via traveling approximately 70 miles of ephemeral drainages.

Community Description
Mud Lake has not been stocked by the Department since it went dry in 2001-2002. No surveys have been conducted at Mud Lake.

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to humpback chub will be covered in the Lower LCR analysis.

Northern Leopard Frog
Local Analysis: Mud Lake and the Canyon Diablo buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Mud Lake or other stocking sites within the complex is high. There are historical records for northern leopard frogs from 2 these sites in the complex; Ashurst Lake (1972), and Mormon Lake (1970), although there are no historical records for northern leopard frogs from Mud Lake (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 24 surveys at 17 sites within the Canyon Diablo buffered stocking complex from 1970 to 2000 (Figure 12, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 3 sites within the buffered stocking complex regularly from 2005-2009 and has confirmed that northern leopard frogs occupy all 3 sites; Hennsey/Wallace Lake, VJ Tank, and Flying M Tank (Ashurst Run).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Mud Lake or Canyon Diablo buffered stocking complex is low. There are no historical records for northern leopard frogs where stocked fish are able to disperse outside of the buffered stocking complex.

Coconino Lake

Site Description

Coconino Lake is located about 20 miles southeast of Flagstaff in the Coconino National Forest on Anderson Mesa, at an elevation of 7,130 feet. The lake is approximately ½ mile south of Ashurst Lake and is accessible by a very rough dirt road that follows the ditch from Coconino Lake to Ashurst Lake. On average the lake covers 5 surface acres, 31 surface acres when fully watered, and has an average depth of 7 feet with a 30 foot maximum depth when fully watered (Figure 16). The lake collects water from a portion of Ashurst Run, with a total drainage area of 6,464 acres. No perennial stream input or outflow exists.

Figure 16. Image of Coconino Lake located within the Canyon Diablo drainage (©2009 ESRI, i-cubed, GeoEye).

Management of Water Body

Prior to the mid 1990's, the lake was managed as a put grow and take rainbow trout fishery and was known for producing large trout (Table 16). The reservoir has been actively managed as a trout fishery but still supports an illegally stocked northern pike fishery. The emphasis listed in the "Integrated Fisheries Management Plan for the LCR Watershed" for Coconino Lake is for sport fish management with a desired concept of intensive use fishery (Young et al. 2001). If the lake is renovated to remove northern pike, or goes dry, the proposed management is to remain a put-grow-and-take trout fishery for rainbow trout and brown trout. Brook trout, cutthroat trout

and Arctic grayling may be stocked opportunistically provide additional angling opportunity depending on fish availability.

Table 16. Stocking history for Coconino Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1992	1992	1	1,000
Cutthroat trout	1991	1992	2	23,000
Rainbow trout	1956	2003	60	131,986
Total			63	155,986

Proposed Action

The proposed action is to stock rainbow trout, brown trout, brook trout, cutthroat trout, and arctic grayling for the period covered by this consultation.

Catchable and sub-catchable rainbow trout will be stocked multiple times each year from March-November; numbers of rainbow trout stocked may be from 0 – 5,000 annually.

Catchable, sub-catchable, and fingerling brown trout, brook trout, cutthroat trout, and arctic grayling may be stocked each year from March-November: numbers stocked may be from 0-5,000 of each species annually.

Water Distribution/Connectivity

Coconino Lake receives most of its water as runoff from Ashurst Run. Two stock tanks/wet meadows in the upper part of Ashurst Run, Flying M Tank and VJ Tank, may connect to Ashurst Run during high flow events.

Coconino Lake is connected to Ashurst Lake via a ditch (Figure 9; Figure 17; Figure 18). Runoff between Coconino and Ashurst is controlled through a valve at Coconino Lake (Figure 19). The Department opens this valve during usually during March to April to fill Ashurst Lake. During most years, all of the runoff from Coconino Lake goes to Ashurst Lake. During wet periods when Ashurst Lake is full, runoff from Coconino Lake runs into the closed Breezy Lake, and a large meadow (Figure 20; Figure 21; Figure 22). There is no record of Breezy Lake or this meadow spilling. Ashurst Lake also spills into Breezy Lake and the meadow during wet years (see photos in Ashurst Lake section). Therefore, this system is considered closed.

Figure 17. Photo of the ditch between Ashurst and Coconino lakes.

Figure 18. Photo of the ditch between Ashurst and Coconino lakes showing water flowing into the south end of Ashurst Lake.

Figure 19. Photo of the runoff control valve at Coconino Lake through which water is released downstream to Ashurst Lake. The Department typically opens this valve during March to April to fill Ashurst Lake.

Figure 20. Photo of the Coconino Reservoir spillway when Ashurst Lake is full and Coconino spills instead into Breezy Lake.

Figure 21. Photo of the ditch through which water spills and flows from Coconino Lake and Breezy Lake.

Figure 22. Photo of water flows into Breezy Lake (visible at top of photo) from Coconino Reservoir.

Fish Movement

Fish from Coconino Lake may be able to move from the reservoir into Ashurst Run and the two upstream stock tanks, VJ Tank and Flying M Tank, during high flow events. However, the only fish collected from these tanks is fathead minnow. No stocked fish from downstream have been found in the upstream tanks. Fish from Coconino Lake can move into Ashurst Lake when the ditch between the lakes is flowing, and can also spill into Breezy Lake.

Community Description

According to anglers, northern pike are present in Coconino Lake. No fish surveys have been conducted. VJ and Flying M tanks contain fathead minnows. They have also supported northern leopard frogs in the past (Table 17). During leopard frog surveys 2000-2009, no fish were collected, but anecdotal observations indicate only fathead minnows are present (S. MacVean pers. comm.).

Table 17. Leopard frog survey history in tanks located upstream from Coconino Lake in Ashurst Run.

Site Name	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Flying M Tank	NS[1]	NS	NS	NS	NS	0	0	NS	1	0
VJ Tank	NS	NS	NS		NS	0	0	NS	1	NS

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level. Coconino Lake is a closed system to downstream fish movement, so fish stocked into Coconino Lake will not move into listed fish habitat.

Northern Leopard Frog
Local Analysis: Coconino Lake and the Canyon Diablo buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Coconino Lake or other stocking sites within the complex is high. Although there are no historical records for northern leopard frogs from Coconino Lake, there are historical records for northern leopard frogs from 2 sites in the complex; Ashurst Lake (1972), and Mormon Lake (1970) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 24 surveys at 17 sites within the Canyon Diablo buffered stocking complex from 1970 to 2000 (Figure 12, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed the two sites upstream from these lakes

[1] NS=not sampled.

where fish can move regularly from 2005-2009 and has confirmed that northern leopard frogs occupied both sites in 2008; VJ Tank, and Flying M Tank (Ashurst Run).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Coconino Lake or Canyon Diablo buffered stocking complex is low. Coconino Lake is in a closed system and stocked fish are not able to disperse outside of the buffered stocking complex.

Ashurst Lake

Site Description

Ashurst Lake is located on the Coconino National Forest on Anderson Mesa about 20 miles south of Flagstaff. Ashurst Lake sits at an elevation of 7,110 feet about sea level and usually covers 161 surface acres, but expands to 229 surface acres when full, has an average depth of 10 feet, with a 25 foot maximum depth when full (Figure 23; Figure 24). Water enters the lake through a diversion canal from Coconino Lake along with the area surrounding the lake, with a total drainage area of 8,329 acres. The dam was constructed in 1955 and the lake was filled in 1962, with renovation efforts in 1976-77. Ashurst Lake has two Forest Service campgrounds as well as a public boat ramp.

Figure 23. Image of Ashurst Lake located within the Canyon Diablo drainage (©2009 ESRI, i-cubed, GeoEye).

Figure 24. Photo of Ashurst Lake located in the Canyon Diablo drainage.

Management of Water Body

Ashurst Lake was historically a put-grow-and-take rainbow trout fishery featuring the stocking of trout fingerlings (Table 18). Turbidity increased during the late 1960's and the growth rates of trout declined. The stocking of the lake changed from fingerling rainbow trout to catchable trout, and the current management is as a high intensity put-and-take rainbow trout fishery. In addition, fingerling and catchable channel catfish have been stocked opportunistically as fish were available. The emphasis listed in the "Integrated Fisheries Management Plan for the LCR Watershed" for Ashurst Lake is for sport fish management with a desired concept of intensive use fishery (Young et al. 2001).

The primary fishery management is high intensity cold water put-and-take rainbow trout fishery and a put-grow-and-take trout fishery; secondary management is a channel catfish fishery. Brook trout, brown trout, cutthroat trout and Arctic grayling may be stocked opportunistically to provide additional angling opportunity depending on fish availability.

Table 18. Stocking history for Ashurst Lake.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Arctic grayling	1969	1969	1	50,000
Black crappie	1937	1937	1	500
Bluegill	1935	1947	8	44,500
Bream	1937	1937	1	3,500
Brook trout	1964	1983	11	295,154
Brown trout	1949	1971	2	36,500
Channel catfish	1987	1988	2	6,000
Cutthroat trout	1943	1991	6	217,460
Kokanee	1960	1964	3	154,540
Largemouth bass	1937	1947	5	29,777
Rainbow trout	1944	2009	445	4,791,015
Smallmouth bass	1939	1939	1	390
Sunfish hybrid	1947	1947	1	10,224
Total			557	5,639,560

Proposed Action

The proposed action is to stock rainbow trout, brown trout, channel catfish, brook trout, cutthroat trout, and arctic grayling for the period covered by this consultation.

Catchable and sub-catchable rainbow trout will be stocked multiple times each year from March-November; numbers of rainbow trout stocked may be from 0 – 80,000 annually.

Catchable and sub-catchable channel catfish may be stocked each year from April – November; numbers of channel catfish stocked may be from 0-2,000 annually.

Catchable, sub-catchable, and fingerling brown trout may be stocked each year from March-November: numbers stocked may be from 0-50,000.

Catchable, sub-catchable, and fingerling brook trout may be stocked each year from March-November: numbers stocked may be from 0-50,000.

Catchable, sub-catchable, and fingerling cutthroat trout may be stocked each year from March-November: numbers stocked may be from 0-50,000.

Catchable, sub-catchable, and fingerling arctic grayling may be stocked each year from March-November: numbers stocked may be from 0-10,000.

Water Distribution / Connectivity

Water from runoff events in Ashurst Run flows into Coconino Lake where it can be diverted downstream in a ditch to Ashurst Lake. The gate on the dam at Coconino Lake can be manipulated to prevent flow from entering Ashurst Lake (Figure 19). If the gate at Coconino Lake is open when Ashurst Lake is full, Ashurst Lake can spill, which it did in 1995 and 2008. When Ashurst Lake spills, the water flows over the spillway to a ditch system that flows and collects in a low basin to the east of Ashurst Lake before flowing into Breezy Lake (Figure 9; Figure 25; Figure 26). Breezy Lake is a large meadow with no opportunity for flow to leave once it collects in the basin, making this a closed system.

Figure 25. Photo of Ashurst spillway; from this point water flows into Breezy Lake.

Figure 26. Photo of the basin behind Ashurst Lake; outflow from Ashurst travels through this basin towards the right side of the photo southeast to Breezy Lake.

Fish Movement

Fish from Ashurst Lake may be able to move upstream into Coconino Lake when the ditch between the lakes is flowing. Water and fish can spill into Breezy Lake as well, which is a closed system and goes dry most years.

Community Description

Surveys have not been conducted on Ashurst Lake since 1991. A creel census was conducted during 2009, and anglers reported catching rainbow trout, northern pike, and green sunfish. A large channel catfish was caught by an angler from Ashurst Lake and brought in to the Region II Game and Fish Office in 2008.

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked

and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level. Ashurst Lake is a closed system. Fish stocked into Ashurst Lake do not move into listed fish habitat.

Northern Leopard Frog

Local Analysis: Ashurst Lake and the Canyon Diablo buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Ashurst Lake or other stocking sites within the complex is high. In the buffered complex, there are historical records for northern leopard frogs from Ashurst Lake (1972) and Mormon Lake (1970) (HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There have been 24 surveys at 17 sites within the Canyon Diablo buffered stocking complex from 1970 to 2000 (Figure 12, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.) and northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 3 sites within the buffered stocking complex regularly from 2005-2009 and has confirmed that northern leopard frogs occupy all 3 sites; Hennsey/Wallace Lake, VJ Tank, and Flying M Tank (Ashurst Run).

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Ashurst Lake or Canyon Diablo buffered stocking complex is low. Ashurst Lake is in a closed system and stocked fish are not able to disperse outside of the buffered stocking complex.

Frances Short Pond

Site Description

In 1923 the City of Flagstaff constructed a dam in the Rio de Flag drainage to catch runoff from the San Francisco Peaks north of Flagstaff. The 2-acre pond, referred to as "the duck pond" by locals, was used primarily for recreation such as ice skating, swimming, and fishing. Over time the pond began to fill with sediment, and water was released through an outlet pipe during high flows.

During the spring of 1975 the U.S. Soil Conservation Service and students and teachers from Flagstaff Junior High School planned to utilize the pond as a wetland. The plan included constructing an island and planting aquatic vegetation to provide habitat for wildlife. In 1976 the pond became an outdoor study area for the adjacent schools (Figure 27; Figure 28). The Arizona

Bicentennial Commission recognized this outdoor study area as a Youth Bicentennial Project for the Flagstaff area, and in 1979 the Arizona State Parks Board placed the site on the Natural Area Register. In 1993 the duck pond was renamed after a Flagstaff Middle School teacher and City Council Member Frances Short.

In October of 2003 the Arizona Game and Fish Department Heritage fund provided a $30,000 grant to the City of Flagstaff and the Flagstaff Unified School District to restore Frances Short Pond. During the summer of 2005 restorations to the pond took place that included dredging the pond to increase storage capacity and to make it suitable for fish. Reclaimed water is used as a supplemental water source to maintain the pond water level year round.

Since 2005 management has been primarily for a “kids” oriented fishery focusing on the stocking of both cold and warm water species that are easy for kids to catch; for example, bluegill, channel catfish, and rainbow trout. Bag limits at the lake are similar to the Department’s Urban Program regulated waters, with limits of 4 trout, 4 channel catfish, 5 bluegill, and 2 largemouth bass with a minimum size of 13 inches. The pond is a very popular fishing and recreation area for the anglers and citizens of Flagstaff.

During the summers of 2008 and 2009 Frances Short Pond suffered partial fish kills due to high pH levels and/or low oxygen levels. To combat this problem the Department, in cooperation with the City of Flagstaff, funded installation of a solar powered aerator.

Frances Short Pond comprises approximately 2 acres and is located within the city limits of Flagstaff at Flagstaff High School, at an elevation of approximately 6,926 ft. Water enters the pond through annual snowmelt and runoff from the Rio de Flag drainage, capturing runoff from the San Francisco Peaks, Elden Mountain at Shultz Creek, and A-1 Mountain sub-drainages north of Flagstaff. The drainage area of the Rio de Flag upstream of Frances Short Pond is 30,000+ acres, including 3 mountains and five springs. Drainage elevation ranges from 12,200 feet at the top of Agassiz peak to 6,926 feet at Frances Short Pond.

Figure 27. Image of Frances Short Pond located within the Canyon Diablo drainage (©2009 ESRI, i-cubed, GeoEye).

Figure 28. Photo of Francis Short Pond located in the Canyon Diablo drainage.

Management of Water Body

Frances Short Pond is currently managed as both a cold and warm water fishery, featuring a high intensity put-and-take rainbow trout and channel catfish fishery (Table 19). The secondary fishery is a warm water fishery featuring bluegill, hybrid sunfish, and largemouth bass. The lake currently holds self sustaining, naturally reproducing populations of bluegill sunfish, and largemouth bass, as well as stocked rainbow trout and channel catfish. Future warm water fishery management will focus on maintaining largemouth bass, redear sunfish and bluegill sunfish; hybrid sunfish are not proposed for stocking.

Table 19. Stocking history for Frances Short Pond.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	2007	2009	3	1,138

Channel catfish	2006	2009	10	4,042
Largemouth bass	2008	2009	2	423
Rainbow trout	2006	2009	31	13,911
Hybrid sunfish	2007	2007	1	400
Total			47	19,914

A creel census was conducted from April to June of 2008. During that time an estimated 1,056 rainbow trout were harvested by anglers, compared to the 3,000 stocked, which is roughly 35%. Similarly, an estimated 4,773 rainbow trout were caught from April to June of 2008, which is 159% of the total stocked during that time period (Table 9), and 46% of the total rainbow trout stocked since the pond's initial stocking in 2006.

Of the anglers interviewed during the 2008 and 2009 creel, 99.91% were using bait; only 0.09% were fly fishers. Of the remaining 3,717 trout that were caught but not harvested from April to June of 2008, an estimated 483 trout were killed due to hooking mortality using an estimated minimum 13% hooking mortality. Of the initial 3,000 trout stocked from April to June of 2008, an estimated 1,539 trout were either harvested or killed due to hooking mortality, leaving an estimated 1,461 trout remaining.

During the April to June 2008 creel census, 818 channel catfish were harvested by anglers, compared to the 1,720 stocked, which translates to roughly a 48% harvest rate. Similarly, an estimated 1,062 channel catfish were caught from April to June of 2008 or 62% of the total stocked during that time period. Of the 1,062 channel catfish caught, 77% were harvested by anglers. All of the angler's interviewed were targeting specifically for channel catfish during the 2008 and 2009 creel census, and all were bait fishing. Of the remaining 244 channel catfish that were caught but not harvested from April to June of 2008, an estimated 32 were killed due to hooking mortality using the minimum 13% hooking mortality associated with bait fishing. Of the 1,720 channel catfish that were stocked from April to June of 2008, an estimated 850 channel catfish were either harvested or killed due to hooking mortality, leaving an estimated 870 channel catfish remaining.

In July 2008 the pond experienced a fish kill due to low oxygen levels. Due to poor angler use and lack of available fish, the creel survey was terminated at that time. The creel survey was reinitiated during October and November of 2008 when water quality permitted stocking of rainbow trout. During that time, 1,000 rainbow trout were stocked, and an estimated 120 rainbow trout were harvested. However, an estimated 1,436 trout were caught, or 144% of what was

stocked during October and November 2008. Of the estimated remaining 1,316 rainbow trout that were caught but not harvested from April to June of 2008, an estimated 171 trout were killed due to hooking mortality. Of the 1,000 rainbow trout that were stocked from October to November of 2008, an estimated 291 rainbow trout were either harvested or killed due to hooking mortality, leaving an estimated 709 rainbow trout remaining. No channel catfish were stocked or caught during this time period.

Stocking efforts for rainbow trout began again in March of 2009 and ended in June of 2009 due to poor water quality. Similarly, two channel catfish stockings occurred beginning in May of 2009 and ending in June. The pond suffered a fish kill in July of 2009 due to low oxygen levels.

A creel census was conducted during August and September of 2009. During that time an estimated 438 rainbow trout were harvested and 2,169 were caught by anglers, although no trout were stocked during this time period; however 2,145 trout were stocked from March to June of 2009. Of the 2,145 trout stocked in 2009, approximately 21% were harvested and 101% were caught; this indicates that many anglers practice catch and release. Of the estimated 1,731 rainbow trout that were caught but not harvested from August to September 2009, an estimated 225 were killed due to hooking mortality. Of the 2,145 trout that were stocked from March to June of 2009, an estimated 663 were harvested or killed by hooking mortality, leaving and estimated 1,482 rainbow trout remaining.

During August to September 2009, 113 channel catfish were harvested by anglers, compared to the 1,542 stocked from April to June of 2009, or roughly 7%. Similarly, an estimated 395, or 26%, channel catfish were caught of those stocked from April to June 2009. Of the remaining estimated 282 channel catfish that were caught but not harvested, an estimated 37 were killed due to hooking mortality. Of the 1,542 channel catfish that were stocked in April to June of 2009, roughly 150 were harvested or killed due to hooking mortality in August and September of 2009.

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, largemouth bass, bluegill sunfish and redear sunfish for the period covered by this consultation.

Catchable rainbow trout will be stocked each year from March to November and multiple times per season; numbers of rainbow trout stocked may be from 0 – 8,000 annually.

Catchable channel catfish will be stocked each year from April to July and multiple times per season; numbers of catchable channel catfish stocked may be from 0-2,500 annually.

Largemouth bass (fingerlings, sub-catchables, catchables) and bluegill (fingerlings, sub-catchables) may be stocked as needed at any time during the year and multiple times per season

to augment the fishery or to recover the fishery from catastrophic events. Numbers of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Redear sunfish (fingerlings and sub catchables) would be established; numbers and sizes of fish stocked for this purpose will be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

The Inner Basin of the San Francisco Peaks contains an aquifer that supplies much of the municipal water for the city of Flagstaff. Water is piped southward to the city from a series of wells tapping the basin's aquifer. Five springs contribute to snowmelt flow from the San Francisco Peaks: Chimney Spring, Little Leroux Spring, Big Leroux Spring, and Taylor Spring. Flow from Elden Mountain is drained via Schulz Creek and includes Onion Spring. Runoff from the north side of A-1 mountain ends up in the Rio de Flag. The Rio de Flag drainage typically runs during annual snowmelt from the surrounding areas, but can flow during significant precipitation events. Flow from this upper basin ends up in Frances Short Pond. Frances Short pond also periodically receives “high grade” Class A reclaimed water from city supplies to keep level of the pond up during dry periods.

According to GIS data, Flagstaff reservoirs reside east and west of Shultz creek, but dam height ranges from 15 to 23.8 feet. There may be extremely small pools of water upstream along the Rio de Flag, but there’s no opportunity for fish to escape the drainage.

Outflow from Frances Short Pond is typically in response to snowmelt runoff during the spring months. In the event of flooding, outflow from Frances Short Pond flows across the surface of Aztec road on the south side of the pond and travels approximately 1.65 miles down ephemeral Rio de Flag through the city of Flagstaff to the confluence of ephemeral Sinclair Wash. Flow through this section of the drainage is typically turbid and contains debris such as trash, sediment, gravel from snow removal efforts, oil and other automotive fluids.

From its confluence with Sinclair wash, Rio de Flag continues approximately 1.04 miles to a perennial pump back pond just north of Interstate 40, from the sewage treatment plant. From this pond intermittent flow travels approximately 0.31 miles under Interstate 40 to a small pond below a sewage sub-station. Rio de Flag continues approximately 2.60 miles to an approximately 2.36 acre perennial pond at the outflow of a sewage disposal center. From the sewage disposal pond it is approximately 0.36 miles down Rio de Flag to a series of two unnamed ephemeral ponds. From these unnamed ponds, Rio de Flag continues approximately 0.37 miles onto a golf course just north of Butler Avenue. Flow continues through the golf course 0.73 miles to an unnamed pond on the golf course. From the golf course pond outflow travels 1.12 miles to where outflow from a 1.88 acres unnamed pond travels approximately 200 meters into the Rio de Flag.

From the unnamed pond it is 0.77 miles to ephemeral Big Fill Lake that, when fully watered, impounds approximately 13.67 acres.

Outflow from Big Fill Lake travels approximately 0.07 miles to a second unnamed ephemeral reservoir that is approximately 5.42 acres when fully watered. From the second unnamed reservoir Rio de Flag continues approximately 8.21 miles to two small unnamed ephemeral tanks of less than 1 acre each. From these tanks the Rio de Flag continues approximately 0.09 miles to its confluence with ephemeral Wildcat Canyon at the head waters of ephemeral San Francisco Wash.

In all, outflow from Frances Short Pond to its confluence with San Francisco wash crosses 27 different road ways and the railroad three times; of these all but one pass under these travel routes through culverts. San Francisco Wash travels approximately 20.22 miles to its confluence with ephemeral Locust Canyon. San Francisco Wash continues approximately 1.17 miles to its confluence with ephemeral Padre Canyon. It is approximately 6.60 miles from this confluence down Padre Canyon to its confluence with ephemeral Diablo Canyon. From its confluence with Padre Canyon, Diablo Canyon is approximately 10.43 miles to an unnamed ephemeral reservoir. Outflow from this impoundment travels approximately 1.20 miles to the confluence with the LCR (see the Lower LCR Analysis).

Fish Movement

The upstream movement of fish from Frances Short Pond is possible during spring runoff and precipitation events significant enough to cause Rio de Flag to run. Fish moving upstream from the pond would encounter major roadways, including highway 180, and neighborhoods. Fish moving upstream could potentially take any number of side drainages before reaching any headwaters. It is unlikely that fish will be able to move upstream through the various obstacles through the typically dry channel and arrive at the headwaters of the drainage. Fish in the headwaters would not persist due to the typically dry nature of the drainage.

In the event of flooding water from Frances Short Pond could potentially travel across the surface of Aztec road (Figure 29 and Figure 30) on the south side of the pond and travel approximately 1.65 miles down ephemeral Rio de Flag through the city of Flagstaff under 19 roadways and one railroad to the confluence of ephemeral Sinclair Wash. It is highly unlikely that stocked fish would survive multiple road crossings and highly turbid runoff associated with annually snowmelt significant enough to cause Frances Short Pond to spill. Habitat conditions are extremely poor even if standing water develops along the way.

From its confluence with Sinclair wash, Rio de Flag continues approximately 1.04 miles to a perennial pump back pond just north of Interstate 40 from the sewage treatment plant. From this pond intermittent flow travels approximately 0.31 miles under Interstate 40 to a small pond below a sewage sub-station. Green sunfish and fathead minnow have been observed in this

stretch on the Rio de Flag (AGFD Region 2 personnel observations) although the source was unknown. From the small pond below the sewage station, fish could potentially travel down the Rio de Flag approximately 2.60 miles to an approximately 2.36 acre perennial pond at the outflow of a sewage disposal center. Once there, it is highly unlikely that fish could survive the harsh limnological conditions associated with the sewage disposal center.

There are no identified perennial sections of creek (GIS data), nor tanks or ponds where fish could seek refuge through stochastic events below the confluence with San Francisco Wash area. Also, there are no USGS stream gauges along this route and therefore nothing to suggest that fish could potentially reach the Lower LCR via traveling ephemeral drainages and enter the ephemeral portion of the Lower LCR 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Figure 29. Frances Short Pond Spillway.

Figure 30. Frances Short Pond Stocking Area.

Community Description

The current fish community of Frances Short Pond includes largemouth bass, bluegill, channel catfish, and rainbow trout. Hybrid sunfish were initially stocked into the pond in March of 2007, but none have been recorded during sampling or creel efforts since 2007. Northern pike were first collected in 2007, which the Department attempted to capture and remove through netting (Table 20). Pike were collected again in November of 2007 when a Flag Middle School class was conducting sampling efforts of the pond using a backpack electrofishing unit and trammel nets (Table 21). Since 2007 no northern pike have been reported or collected during creel or sampling efforts of the pond. Black crappie were first collected in the spring of 2008 by anglers but none were collected during creel or sampling in 2009. Frances Short Pond did suffer partial fish kills during the summers of 2008 and 2009.

Due to the intensive use (angler catch, harvest, and hooking mortality) and prevalent fish kills associated with Frances Short Pond (See Management of Water Body section) there is a minimal chance of long term fish survival in Frances Short Pond. Moreover, if fish escapement occurs from Frances Short Pond, a myriad of obstacles (road crossings, sewage treatment plants, golf courses, etc) and harsh environmental conditions (typically dry ephemeral drainages, waterfalls,

etc) likely limit fish survival downstream to the LCR (See above description in Water Distribution / Connectivity section).

Table 20. August 2007 Northern Pike Removal efforts.

Species	Num.	Length Range
Northern Pike	9	435-771
Rainbow trout	2	238-246

Table 21. Department sampling data from November 2007 at Frances Short Pond.

Species	Num.	% of Total	Mean Length	Min-Max Length	Mean Weight	Min-Max Weight
Northern Pike	1	1.67	87 cm	87 cm	6,804 g	6,804 g
Rainbow trout	9	15	23.6 cm	19-26.5 cm	149.33 g	45-215 g
Bluegill	50	83.33	7.2 cm	2.1-11.2 cm	6.46 g	0.1-24 g
TOTAL	60	100	-	-	-	-

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed below at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur. Potential impacts to humpback chub will be covered in the Lower LCR analysis.

Northern Leopard Frog

Local Analysis: Although the Frances Short Pond buffered stocking site is within the historical range of the northern leopard frog, the likelihood that frogs could be exposed to fish stocked in

Frances Short Pond is low. There are no historical records for northern leopard frogs from Frances Short Pond or within the 5 mile buffer around the stocking site; however, there have been no surveys in this area (Figure 12, HDMS, AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). The Frances Short Pond buffered stocking site has not been adequately surveyed to be able to determine whether northern leopard frogs occupy this area or not, but due to the urban environment and the presence of non-native fish, it is likely that northern leopard frogs do not occupy this area.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Frances Short Pond buffered stocking complex is low. There are records for northern leopard frogs from 1987 and 1992 at Veit Spring and Pond Lake, which is located in the headwaters of Rio de Flag. Although it is likely that northern leopard frogs occupy this site, it is not likely that dispersing fish could disperse that far upstream from the stocking location.

CANYON DIABLO COMPLEX ANALYSIS

The Canyon Diablo Complex consists of six reservoirs that are managed as sport fisheries. The reservoirs can be placed into three sub-watersheds: Kinnikinick Canyon sub-watershed, Coconino Lake/Ashurst Lake, and Rio de Flag.

The Kinnikinick Canyon sub-watershed consists of Kinnikinick Lake, Morton Lake, and Mud Lake. Kinnikinick Lake can spill into Morton Lake, and eventually into Kinnikinick Canyon. Mud Lake (Mud Lake) is north of Kinnikinick Lake and also flows into Kinnikinick Canyon. Kinnikinick Canyon can flow into Grapevine Canyon which then flows into Diablo Canyon.

Coconino Lake collects runoff from Ashurst Run, and when Coconino Lake and Ashurst Lake spill, they flow via a ditch system into Breezy Lake, a large wet meadow with no observed outlet. Thus, Coconino Lake and Ashurst Lake are within a closed system

Frances Short pond sits in the Rio de Flag drainage within the city of Flagstaff, and drainage passes down to San Francisco Wash approximately 50 miles of ephemeral drainage to Canyon Diablo and approximately 15 miles before entering the ephemeral Little Colorado River.

The Canyon Diablo Complex analysis consists of the brief segment of drainage from the confluence of Canyon Diablo and San Francisco Wash approximately 12 miles from the LCR.

Water Distribution / Connectivity

Kinnikinick Canyon, Grapevine Canyon, and Diablo Canyon are dry except during periodic flooding or runoff events, mostly in the spring due to snow melt.

Outflow from Frances Short Pond can travel down the Rio de Flag drainage to San Francisco Wash, and from there it travels to Padre Canyon to Diablo Canyon, and eventually into the LCR approximately 65 total miles from the outflow of Frances Short Pond.

The San Francisco Wash, Padre Canyon, Diablo Canyon, and the majority of the Rio de Flag drainage are ephemeral. A small section of the Rio De Flag drainage that flows downstream of the Flagstaff waste water treatment plant is perennial.

Within the Complex Analysis area, there are no known fish populations due to the ephemeral nature of the drainage.

Fish Movement
Fish from the Ashurst/Coconino Lake group cannot move downstream of Breezy Lake and cannot reach Diablo Canyon or the LCR. Fish may be able to move upstream of Coconino Lake into VJ Tank and Flying M Tank.

Fish from the Kinnikinick Canyon group could move downstream of the stocking sites into usually dry Kinnikinick Canyon and eventually into the LCR via usually dry Grapevine Canyon (10.6 miles) and usually dry Diablo Canyon (49.1 miles).

Runoff from Frances Short pond can travel approximately 40 miles through ephemeral washes, over a road, through 26 culverts under roadways, through nine ponds, and across a golf course before it enters Diablo Canyon. It is unlikely that fish survive the environmental conditions between Frances Short Pond and Canyon Diablo. Any fish that survive to the confluence of Diablo Canyon and the LCR could enter the ephemeral Lower LCR 114 miles upstream of Blue Springs (see Lower LCR Complex analysis).

Community Description
There are very few perennial waters where fish could reside after escapement from any of the waters in this complex; however, there is little data from drainages downstream of stocking sites. There is neither known listed nor candidate fish species in these reaches.

Because flooding events are relatively infrequent, and due to a gauntlet of ephemeral washes/tanks/roadways and other obstacles along the routes, uncertain habitat suitability for catfish, trout, and bluegill, the likelihood is extremely small that any fish (stocked or wild) could survive the extreme environmental conditions necessary to travel these ephemeral washes through Diablo Canyon and/or San Francisco Wash, and arrive at the confluence of Diablo Canyon and the LCR.

If any fish did survive, they could enter the Lower LCR 114 miles upstream of Blue Springs (see Lower LCR Complex analysis) which in itself is an ephemeral reach.

Consultation Species or Critical Habitat
There is no listed, candidate or proposed species occurrences within the Canyon Diablo drainage other than northern leopard frogs which is evaluated above at each site specific stocking location.

Potential impacts to humpback chub in the Little Colorado River are addressed in the Lower LCR analysis.

Northern Leopard Frog

See Local and Broad Scale analyses under each stocking location.

WALNUT CREEK COMPLEX DESCRIPTION

The Walnut Creek complex is composed of 4 lakes proposed for stocking (Figure 31). From south (upstream) to north (downstream) the lakes are Mormon Lodge Pond (located inside the Mormon Lake Basin), Upper Lake Mary, Marshall Lake, and Lower Lake Mary. Mormon Lake was originally proposed for stocking but has been removed from further consideration, although still depicted in the map. When Lower Lake Mary spills, the water flows down Walnut Canyon to Santa Fe Dam, where the flow stops and the water percolates into the ground. No water has been observed spilling from Santa Fe Dam, and this dam has been observed during wet periods including observation in 1993 during an extremely wet period with high runoff (S. Hedwall, FWS pers. com.). The entire Walnut Creek Complex is a closed system.

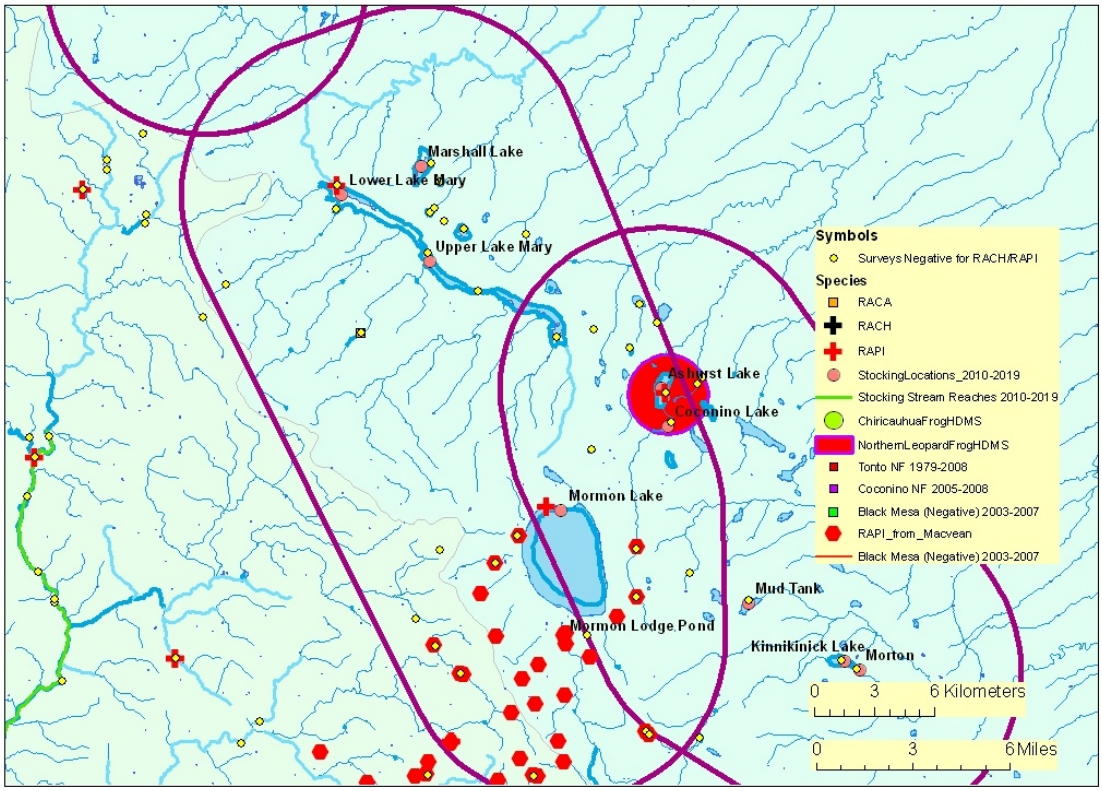

Figure 31. Map of Walnut Creek buffered stocking complex:

The purple line illustrates the 5 mile buffer surrounding a stocking site, stocking reach, or a group of stocking sites. Blue lines symbolize streams and rivers (both perennial and

intermittent). The background color represents the 8 digit Hydrologic Unit Code. Other data are described in the legend. (Note: HDMS data appear as buffered points and may appear larger than site records for other surveys).

Mormon Lodge Pond

Site Description

Mormon Lodge Pond is located about 40 miles southeast of Flagstaff next to the Mormon Lake Lodge in Mormon Lake Village. It is a small pond, and on average covers about 0.15 surface acres; it is located in the Mormon Lake basin just above Mormon Lake's high water mark (Figure 32), and is filled by runoff from the nearby area, water pumped from a nearby stock pond, and/or well water.

The pond is on private property owned by Forever Resort, but is managed as a fishery by the Department. When water levels and quality are sufficient to support fish, Mormon Lodge Pond is a popular fishing spot for local anglers and guests of the Mormon Lake Lodge Resort.

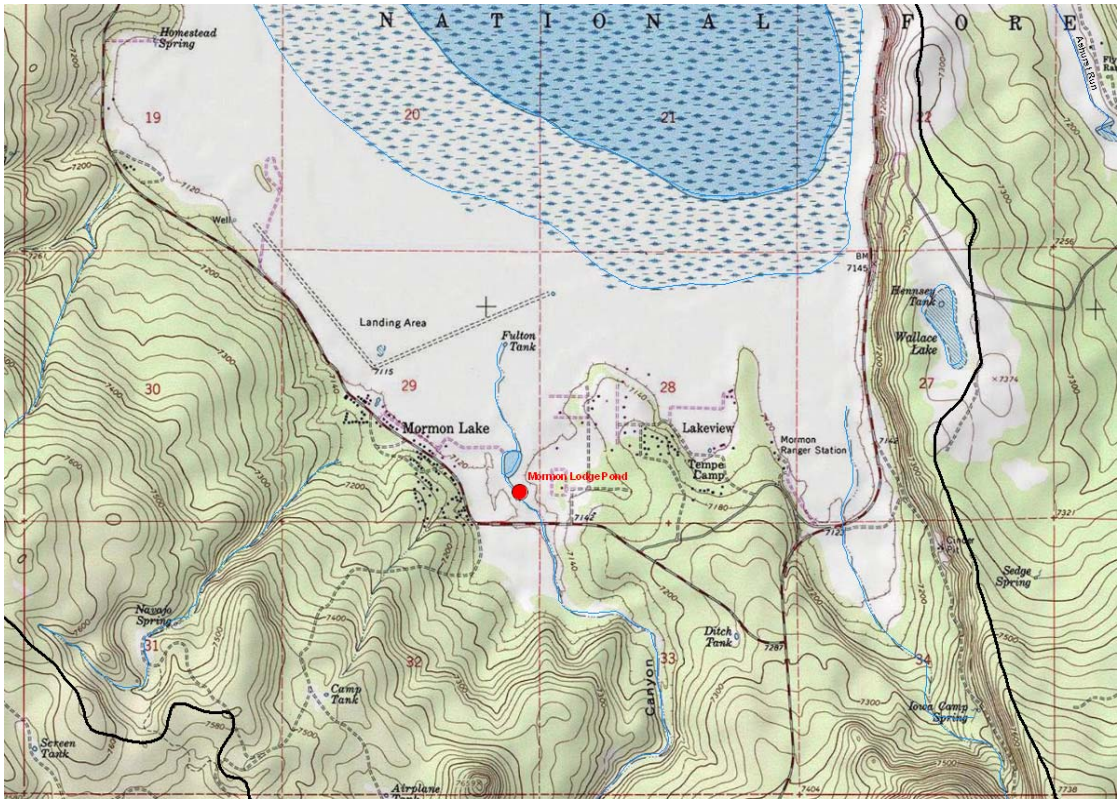

Figure 32. Mormon Lodge Pond topographic map.

Management of Water Body

Lake management emphasizes stocking of cold water species following precipitation events sufficient to support a fishery (Table 22). Mormon Lodge Pond is a popular fishing spot targeting cold water species. Rainbow trout are primarily stocked in the spring and early summer while temperatures and pH levels are sufficient to sustain trout. Stocking efforts typically end in June due to high pH and temperature levels. However this trout fishery can be marginal in some years, and the Department desires the ability to provide a secondary warm water fishery. The emphasis listed in the Integrated Fisheries Management Plan for the Little Colorado River Watershed (Young et al. 2001) for Mormon Lodge Pond is for sport fish management with a desired concept of Intensive Use Fishery.

Table 22. Mormon Lodge Pond Stocking History

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Brown trout	1992	1992	1	1,000
Cutthroat trout	1991	1992	2	23,000
Rainbow trout	1956	2008	83	142,736
Total			63	166,736

Proposed Action

The Department proposes to stock rainbow trout, bluegill sunfish and redear sunfish for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked each year from March to November; numbers of rainbow trout stocked may be from 0 – 4,500 annually.

Bluegill sunfish (fingerlings, sub-catchables), and redear sunfish (fingerlings, sub-catchables) are proposed for stocking as needed at any time during the year, and at multiple times per season for establishment of a new warm water fishery, to augment the fishery once started, or to reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Mormon Lodge Pond is within Mormon Lake Basin, and is filled by runoff from the area adjacent to the pond. It can also be filled by pumping water from a nearby stock pond or with well water. In the event of an overflow, the pond spills into Mormon Lake, which is a closed system.

Fish Movement

In the event of an overflow from Mormon Lodge Pond, fish would go to Mormon Lake. Because Mormon Lake does not spill the fish would go no further than the lake.

Community Description

Mormon Lodge Pond is currently stocked with rainbow trout. No fish surveys have been conducted at the pond, but anglers have not reported catching any species besides rainbow trout from the pond.

Consultation Species or Critical Habitat
Mormon Lodge Pond is a closed system with no opportunity for fish to escape and enter occupied fish habitat.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Leopard Frog
Local Analysis: Mormon Lodge Pond and the Walnut Creek buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Mormon Lodge Pond or other stocking sites within the complex is high. Although Mormon Lodge Pond is a closed system, there are occupied northern leopard frog sites in the area of Mormon Lodge Pond and within the Walnut Creek buffered stocking complex. There have been 48 surveys at 36 sites within the Walnut Creek buffered stocking complex from 1963 to 2000, with most surveys taking place between 1990 and 1993 (Figure 31; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There are historical records for northern leopard frogs from 4 of these sites; Lower Lake Mary (1963), Ashurst Lake (1972), Kelly Tank (1999 and 2000), and Mormon Lake (1970). Northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Lower Lake Mary (1990, 1991, and 1993) or Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 29 sites within the buffered stocking complex regularly from 2005-2009 and as of 2009, has confirmed 7 sites occupied by northern leopard frogs; Dairy Springs Tank, Hennsey/Wallace Lake, Fulton Canyon, New Tank (127/9472), Double Springs, Mint Springs, and Pierce Tank.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Walnut Creek buffered stocking complex is low. Stocked fish cannot disperse outside of the buffered stocking complex because Walnut Creek is a closed system and dries at Santa Fe Dam, which is within the Walnut Creek buffered stocking complex.

Marshall Lake

Site Description

Marshall Lake is located off of Forest Road 182 on the Coconino National Forest adjacent to Lower Lake Mary (Figure 34 and Figure 35), about 15 miles southeast of Flagstaff. Spring runoff from the surrounding basin fills the lake in wet years. When watered, the lake on average covers about 35 surface acres with a maximum observed capacity of 70 to 205 surface acres when fully watered. The lake sits at an elevation of 7,112 feet and has an average depth of about 7 feet, with a maximum depth of about 14 feet at full capacity.

There are a number of primitive campsites near the east side of the lake. A 10 horsepower maximum is the motor size restriction. The northwest side of the lake is closed to vehicular traffic to protect waterfowl nesting habitat. No toilets, tables, or drinking water is available. Camping next to the lake is not allowed, but camping is allowed on the other side of the road.

Figure 33. Marshall Lake

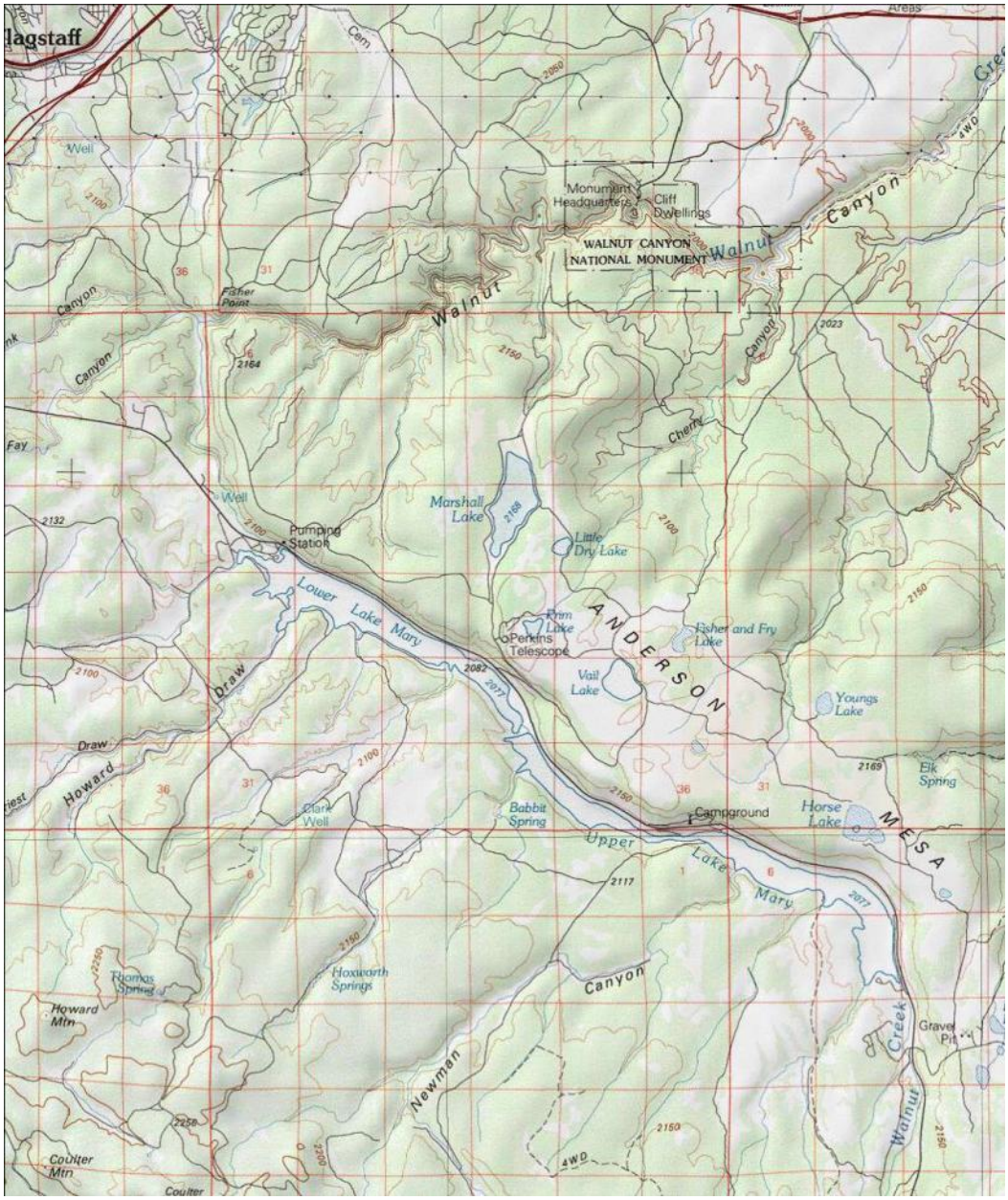

Figure 34. Upper and Lower Lake Mary and Marshall Lake

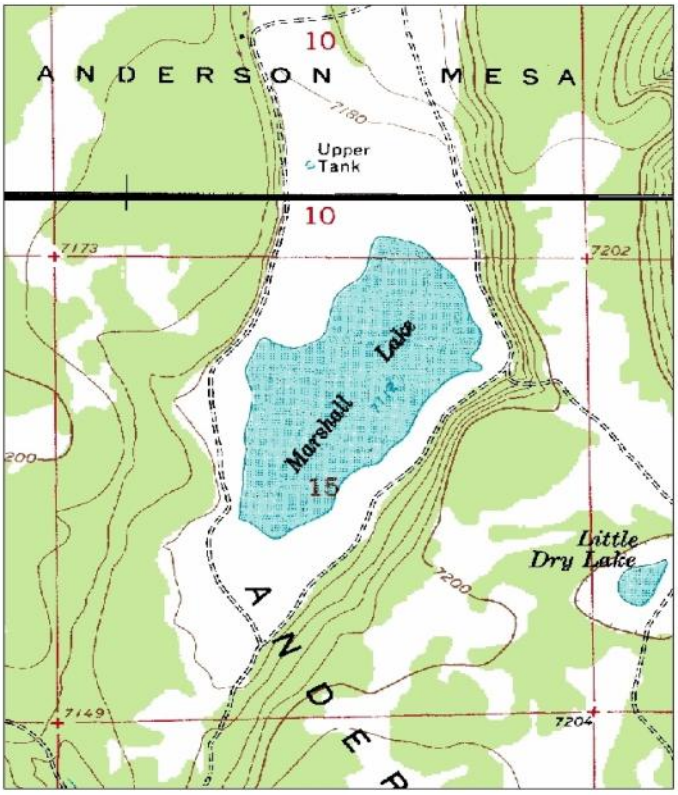

Figure 35. Marshall Lake topographic representation.

Management of Water Body

Historic lake management emphasized stocking of cold water species, with isolated yellow perch and channel catfish stockings following precipitation events sufficient to fill the lake adequately to support a fishery (Table 23). Over the years, Marshall Lake has been used as a temporary fishery relying on wet climactic cycles for water. Due to the large fluctuations in water level and lack of water permanence a new lake phenomenon occurs every time the lake refills. This situation creates a highly productive lake capable of producing large fish in a short amount of time. When full, the lake is a prime fly-fishing location. The emphasis listed in the Integrated Fisheries Management Plan for the Little Colorado River Watershed (Young et al. 2001) for Marshall Lake is for sport-fish management with a desired concept of a basic yield featured species fishery.

Proposed Action

The Department proposes to stock rainbow trout, brook trout, and Arctic grayling for the period covered by this consultation.

Catchable and sub-catchable rainbow trout would be stocked each year from March to November; numbers of rainbow trout stocked may be from 0 – 10,000 annually.

Fingerling brook trout would be stocked from March to June each year; numbers of brook trout stocked may be 0-1,000 annually.

Fingerling Arctic grayling would be stocked from March to June each year; numbers of brook trout stocked may be 0-1,000 annually.

Table 23. Marshall Lake Stocking History.

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Arctic grayling	1969	2008	2	5,500
Channel catfish	1994	1994	1	1,500
Rainbow trout	1968	2009	79	244,957
Tadpole	1968	1968	1	500
Brook trout	2008	2008	1	252
Yellow perch	1941	1966	2	717
Total			85	249,880

Water Distribution / Connectivity

Marshall Lake usually has some water in it after spring runoff, but only contains enough water to support fish during wet years. After very wet years, or if multiple wet years occur in succession, the lake will hold enough water to maintain a sport fishery over winter, but during most years the lake experiences winter kill. According to the topographic map for the area, Marshall Lake would have to reach a level approximately 20 feet above its maximum observed elevation to spill into Lower Lake Mary. The surface of Marshall Lake at its highest observed elevation is at about 7112 feet. In 1993, it was the wettest year in recent history with high runoff, and Marshal Lake did not cross the road that leads to a ranch on the north side of the Lake at an elevation of about 7115 feet. Marshall Lake is located in a deep basin with a small watershed. The hillside on the downstream side is steep, rocky and shows no evidence of water flow (Figure 36 and Figure 37). There is no evidence the Lake has reached the approximately 7130 foot elevation necessary to spill; therefore Marshall Lake is considered a closed system.

Figure 36. Down slope side of Marshall Lake to Lower Lake Mary (seen in the background).

Figure 37. Upstream view of drop towards Lower Lake Mary

Fish Movement
Marshall Lake is a closed system with no opportunity for fish to escape.

Community Description
Marshall Lake was dry in the fall of 2009.

Consultation Species or Critical Habitat
Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses

(resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Leopard Frog

Local Analysis: Marshall Lake and the Walnut Creek buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Marshall Lake or other stocking sites within the complex is high. Although Marshall Lake is a closed system, there are occupied northern leopard frog sites within the Walnut Creek buffered stocking complex. There have been 48 surveys at 36 sites within the Walnut Creek buffered stocking complex from 1963 to 2000, with most surveys taking place between 1990 and 1993 (Figure 31; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There are historical records for northern leopard frogs from 4 of these sites; Lower Lake Mary (1963), Ashurst Lake (1972), Kelly Tank (1999 and 2000), and Mormon Lake (1970). Northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Lower Lake Mary (1990, 1991, and 1993) or Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 29 sites within the buffered stocking complex regularly from 2005-2009 and as of 2009, has confirmed 7 sites occupied by northern leopard frogs; Dairy Springs Tank, Hennsey/Wallace Lake, Fulton Canyon, New Tank (127/9472), Double Springs, Mint Springs, and Pierce Tank.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Walnut Creek buffered stocking complex is low. Stocked fish cannot disperse outside of the buffered stocking complex because Walnut Creek is a closed system and dries at Santa Fe Dam, which is within the Walnut Creek buffered stocking complex.

Upper Lake Mary

Site Description

Upper Lake Mary is located in the Coconino National Forest about 15 miles southeast of Flagstaff (Figure 34). The dam was constructed in 1941 and raised higher in 1952. It impounds approximately 6 mi of Walnut Creek, with an average of 800 surface acres and a maximum of 1228 acres. Walnut Creek is an ephemeral system that drains approximately 33,000 acres from

an area north of Mormon Lake to the southern end of Upper Lake Mary and flows mainly during spring runoff. Other ephemeral drainages flow into the lake from the west and south during runoff events. Spills occurring from Upper Lake Mary drain directly into Lower Lake Mary.

Lake Mary Narrows Recreation Area provides excellent access facilities for disabled anglers by means of paved lakeshore ramps. Two developed campgrounds, Lake View and Pine Grove, are nearby. There are two paved boat ramps at the parking area near the dam, and a lakeside picnic area and another boat ramp at Lake Mary Narrows Recreation Area, in addition to its paved fishing access ramps.

Management of Water Body
Upper Lake Mary is managed primarily as a self-sustaining warm water fishery. It is secondarily managed as a put-and-take rainbow trout fishery and a put-grow-and-take fishery for brown trout and cutthroat trout (Table 24). The emphasis listed in the Integrated Fisheries Management Plan for the Little Colorado River Watershed (Young et al. 2001) for Upper Lake Mary is for sport fish management with a desired concept of warm water Fishery.

Table 24. Upper Lake Mary Stocking History

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Bluegill	1936	1951	7	56,380
Bream	1937	1937	2	4,500
Brown trout	1949	1974	18	431,109
Channel catfish	1968	2001	32	369,969
Coho salmon	1973	1973	2	40,000
Cutthroat trout	1966	1967	2	60,360
Fathead minnow	1978	1987	1	10,000
Largemouth bass	1935	1951	13	99,800
Kokanee	1962	1962	3	150,862
Northern pike	1969	1980	13	314,280
Rainbow trout	1947	2002	139	4,644,123
Redear sunfish	1951	1951	3	40,000
Smallmouth bass	1942	1942	1	14,000
Walleye	1975	1990	13	3,548,519
Yellow bass	1979	1979	1	102
Total			250	9,784,004

Proposed Action
Channel catfish, rainbow trout, brown trout, brook trout, cutthroat trout, bluegill sunfish, and redear sunfish are proposed for the period covered by this consultation.

Catchable, sub-catchable, and fingerling rainbow trout, would be stocked from March to November each year depending on suitable water levels and quality as well as fish availability;

numbers of trout would be up to 160,000 fish annually. The primary goal would be to stock rainbow trout, however if other species including brown trout, brook trout or cutthroat trout became available, they may be stocked opportunistically; no more than a total of 160,000 trout would be stocked annually.

Catchable and sub-catchable channel catfish would be stocked from April to July each year; numbers of catchable channel catfish stocked may be from 0-10,000 annually.

Channel catfish (fingerlings, sub-catchables), bluegill (fingerlings, sub-catchables), and redear sunfish (fingerlings, sub-catchables) may be stocked as needed to augment the warm water fishery, or to reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Walnut Creek is an ephemeral system that drains approximately 33,000 acres from an area north of Mormon Lake to the southern end of Upper Lake Mary, and flows mainly during spring runoff. Other ephemeral drainages flow into the lake from the west and south during runoff events. Spills occurring from Upper Lake Mary drain directly into Lower Lake Mary (Figure 38 and Figure 39).

Figure 38. Upper Lake Mary spillway

Figure 39. Downstream of Upper Lake Mary spillway looking at Lower Lake Mary

Fish Movement

The only fish movement occurring within the complex is the movement of fish over the spillway from Upper Lake Mary to Lower Lake Mary.

Community Description

Aquatic Species in Upper Lake Mary include bluegill, black crappie, channel catfish, yellow perch, walleye, yellow bass, northern pike, golden shiners, and fathead minnows according to the 2003 fish surveys and angler reports in Table 25 and Table 26 (Benedict et al. 2002[2]).

Table 25. Fish Sampled by Gillnetting in Upper Lake Mary June 2003

Species	Num. of fish	Catch per hour
Walleye	9	.084
Northern Pike	10	.093

[2] Report is Mis-titled. Work was actually conducted in June 2003.

Yellow Bass	4	.04
Black Crappie	1	.01
Channel Catfish	15	.14
Golden Shiner	33	.31

Table 26. Fish Sampled by Electrofishing in Upper Lake Mary June 2003

Species	Num. of fish	Catch per EFU (900 Seconds)
Walleye	7	.98
Northern Pike	3	.42
Yellow Bass	1	.14
Black Crappie	3	.42
Bluegill	1	.14
Yellow Perch	4	.56

Consultation Species or Critical Habitat
Upper Lake Mary spills into Lower Lake Mary, which is considered a closed system with no opportunity for fish to escape and enter occupied fish habitat (see Walnut Creek Complex Analysis).

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed at a local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Leopard Frog
Local Analysis: Upper Lake Mary and the Walnut Creek buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Upper Lake Mary or other stocking sites within the complex is high. Although

there are no historical records for northern leopard frogs from Upper Lake Mary itself, there are occupied northern leopard frog sites within the Walnut Creek buffered stocking complex. There have been 48 surveys at 36 sites within the Walnut Creek buffered stocking complex from 1963 to 2000, with most surveys taking place between 1990 and 1993 (Figure 31; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There are historical records for northern leopard frogs from 4 of these sites; Lower Lake Mary (1963), Ashurst Lake (1972), Kelly Tank (1999 and 2000), and Mormon Lake (1970). Northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Lower Lake Mary (1990, 1991, and 1993) or Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 29 sites within the buffered stocking complex regularly from 2005-2009 and as of 2009, has confirmed 7 sites occupied by northern leopard frogs; Dairy Springs Tank, Hennsey/Wallace Lake, Fulton Canyon, New Tank (127/9472), Double Springs, Mint Springs, and Pierce Tank.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Walnut Creek buffered stocking complex is low. Stocked fish cannot disperse outside of the buffered stocking complex because Walnut Creek is a closed system and dries at Santa Fe Dam, which is within the Walnut Creek buffered stocking complex.

Lower Lake Mary

Site Description

Lower Lake Mary is a 0-750 acre lake located on Walnut Creek, 10 miles southeast of Flagstaff (Figure 6). The dam was constructed in 1905. The lake receives runoff from several ephemeral drainages south and west of the lake and from Upper Lake Mary when it spills. During years when Upper Lake Mary spills (Figure 38 and Figure 39), the majority of the flow into the lake is from Upper Lake Mary.

Access to this lake is directly off Forest Highway 3 at the Lower Lake Mary Picnic Area and Boat Launch, which is only open during the summer. This day-use area is a great picnic location with of tables, and grills under ramadas.

Management of Water Body

Primary fishery is high intensity cold water put-and-take or put-grow-and-take rainbow trout fishery, depending on hatchery fish availably and watery quality and levels; the secondary management is for a warm water fishery (Table 27). Catchable, sub-catchable, and/or fingerling rainbow trout are stocked multiple times during the stocking season. The emphasis listed in the Integrated Fisheries Management Plan for the Little Colorado River Watershed (Young et al. 2001) for Lower Lake Mary is for sport fish management with a desired concept of warm water/intensive use fishery.

Table 27. Lower Lake Mary Stocking History

Species	First Year	Last Year	Num. of Stockings	Num. Stocked
Arctic grayling	1969	1969	1	50,000
Black crappie	1949	1959	4	1,989
Bluegill	1957	2008	9	34,474
Brown trout	1992	1992	1	522
Channel catfish	1957	2008	9	45,703
Largemouth bass	1948	1993	13	74,286
Northern pike	1965	1980	6	204,090
Rainbow trout	1966	2008	117	844,368
Redear sunfish	1991	1993	3	20,576
Total			163	1,276,008

Proposed Action

The Department proposes to stock rainbow trout, channel catfish, bluegill sunfish, and redear sunfish for the period covered by this consultation.

Catchable, sub-catchable, and fingerling rainbow trout would be stocked from March to November each year; numbers of rainbow trout stocked may be from 0 – 120,000 annually.

Catchable channel catfish would be stocked from April to July each year; numbers of catchable channel catfish stocked may be from 0-5,000 annually.

Channel catfish (fingerlings, sub-catchables), bluegill sunfish (fingerlings, sub-catchables), and redear sunfish (fingerlings, sub catchables) may be stocked as needed to augment the fishery, or to reestablish the fishery from catastrophic events. Numbers of fish stocked for this purpose would be determined according to stocking guidelines identified in the sport fish stocking protocol.

Water Distribution / Connectivity

Lower Lake Mary sits on a fault system that causes much of its water to leak into the ground. As a result, it is an ephemeral system that rarely maintains water more than one year, except in high water high runoff years. When Lower Lake Mary spills, the water flows down Walnut Canyon to Santa Fe Dam where the flow stops and the water percolates into the ground (see Walnut Creek Complex Analysis).

Fish Movement

The only fish movement occurring within the complex is the movement of fish over the spillway from Upper Lake Mary to Lower Lake Mary and the movement of fish downstream of Lower

Lake Mary in Walnut Creek during spills approximately 15 miles to Santa Fe Dam where Walnut Creek then goes dry.

Community Description
In years where water levels are high, Lower Lake Mary may support populations of stocked rainbow trout along with any of the species found in Upper Lake Mary that may have been spilled over the Upper Lake Mary Dam. In the fall of 2009, the lake was essentially dry and no fish were present.

The most recent sampling data from Lower Lake Mary indicated a rainbow trout fishery was present with northern pike also being abundant prior to the lake drying up in 2007 (Table 28). Golden shiners and one black crappie were also collected by that survey.

Table 28. Lower Lake Mary 2005 Electrofishing/Creel Data.

Species	Num. of Fish Collected	Size Range (mm)
Northern Pike	42	205-383
Golden Shiner	5	51-100
Rainbow trout	90	229-530
Black Crappie	1	57

Lower Lake Mary held water for 4 years between the Fall of 1992 and the Fall of 1996; electrofishing surveys were conducted in 1993, 1994 and 1995. Table 29 provides the results from those sampling events.

Table 29. Relative abundance of fish sampled by species using electrofishing 1993-1995 during high water years.

Year	Black Crappie	Northern Pike	Rainbow Trout	Bluegill	Other*
1993	56.3%	11.9%	7.9%	7.3%	16.%6
1994	24.1%	26.5%	19.3%	19.3%	10.8%
1995	31.9%	41.8%	2.2%	1.1%	23.1%

* Other species sampled included brown trout, redear sunfish, yellow perch, walleye, largemouth bass, and golden shiner.

Consultation Specie or Critical Habitat
Lower Lake Mary is a closed system with no opportunity for fish to escape and enter occupied fish habitat.

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Northern leopard frogs are analyzed at the local site and broad scale level due to the movement potential into the stocked area and fish movement potential up or downstream into areas where frogs may occur.

Northern Leopard Frog

Local Analysis: Lower Lake Mary and the Walnut Creek buffered stocking complex are within the historical range of the northern leopard frog and the likelihood that frogs could be exposed to fish stocked in Lower Lake Mary or other stocking sites within the complex is high. There is a historical record for northern leopard frogs from Lower Lake Mary from 1963. Although, northern leopard frogs were not observed during subsequent surveys at Lower Lake Mary (1990, 1991, and 1993), there are occupied northern leopard frog sites within the Walnut Creek buffered stocking complex. There have been 48 surveys at 36 sites within the Walnut Creek buffered stocking complex from 1963 to 2000, with most surveys taking place between 1990 and 1993 (Figure 31; AGFD Riparian Herpetofauna Database, M. Sredl pers. comm.). There are historical records for northern leopard frogs from 3 other sites; Ashurst Lake (1972), Kelly Tank (1999 and 2000), and Mormon Lake (1970). Northern leopard frogs were not observed by the Departments' Nongame personnel during subsequent surveys at Ashurst Lake (1988, 1990, 1991, 1993, and 1995). However, Susi MacVean (S. MacVean-unpublished data) has surveyed 29 sites within the buffered stocking complex regularly from 2005-2009 and as of 2009, has confirmed 7 sites occupied by northern leopard frogs; Dairy Springs Tank, Hennsey/Wallace Lake, Fulton Canyon, New Tank (127/9472), Double Springs, Mint Springs, and Pierce Tank.

Broad Scale Analysis: The likelihood that northern leopard frogs could be exposed to dispersing fish from the Walnut Creek buffered stocking complex is low. Stocked fish cannot disperse outside of the buffered stocking complex because Walnut Creek is a closed system and dries at Santa Fe Dam, which is within the Walnut Creek buffered stocking complex.

WALNUT CREEK COMPLEX ANALYSIS

Mormon Lodge Pond (located inside the Mormon Lake Basin), Upper Lake Mary, Marshall Lake, and Lower Lake Mary make up the Complex. Mormon Lodge Pond, and Marshall Lake are closed systems. Upper Lake Mary receives runoff from a 30,000 acre watershed north of the Mormon Lake Basin and spills directly into Lower Lake Mary. When Lower Lake Mary spills, the water flows down Walnut Canyon 15 miles to Santa Fe Dam, where the water is impounded and percolates into the ground.

Water Distribution / Connectivity

Mormon Lodge Pond is within a closed basin and does not connect to Walnut Creek. Marshall Lake is also within a closed basin. Spills from Upper Lake Mary drain into Lower Lake Mary; Lower Lake Mary occasionally spills down Walnut Canyon. Since 1991, Lower Lake Mary has spilled twice, including in 1993, during an extremely wet year with high runoff. Outflow from Lower Lake Mary spills about 0.18 miles down its spillway into Walnut Creek. The water then flows down Walnut Canyon to Santa Fe Dam located near the eastern edge of Walnut Canyon National Monument. The flow ends at Santa Fe Dam (Figure 40) where the water percolates into the ground because of a series of faults. (S. Hedwall, FWS pers. com.). No water has been observed spilling from Santa Fe Dam over recent years. The entire Walnut Creek Complex is a closed system.

Fish Movement

The only fish movement occurring within the complex is the movement of fish over the spillway from Upper Lake Mary to Lower Lake Mary and the movement of fish downstream of Lower Lake Mary in Walnut Creek during spills to Santa Fe Dam where Walnut Creek then goes dry.

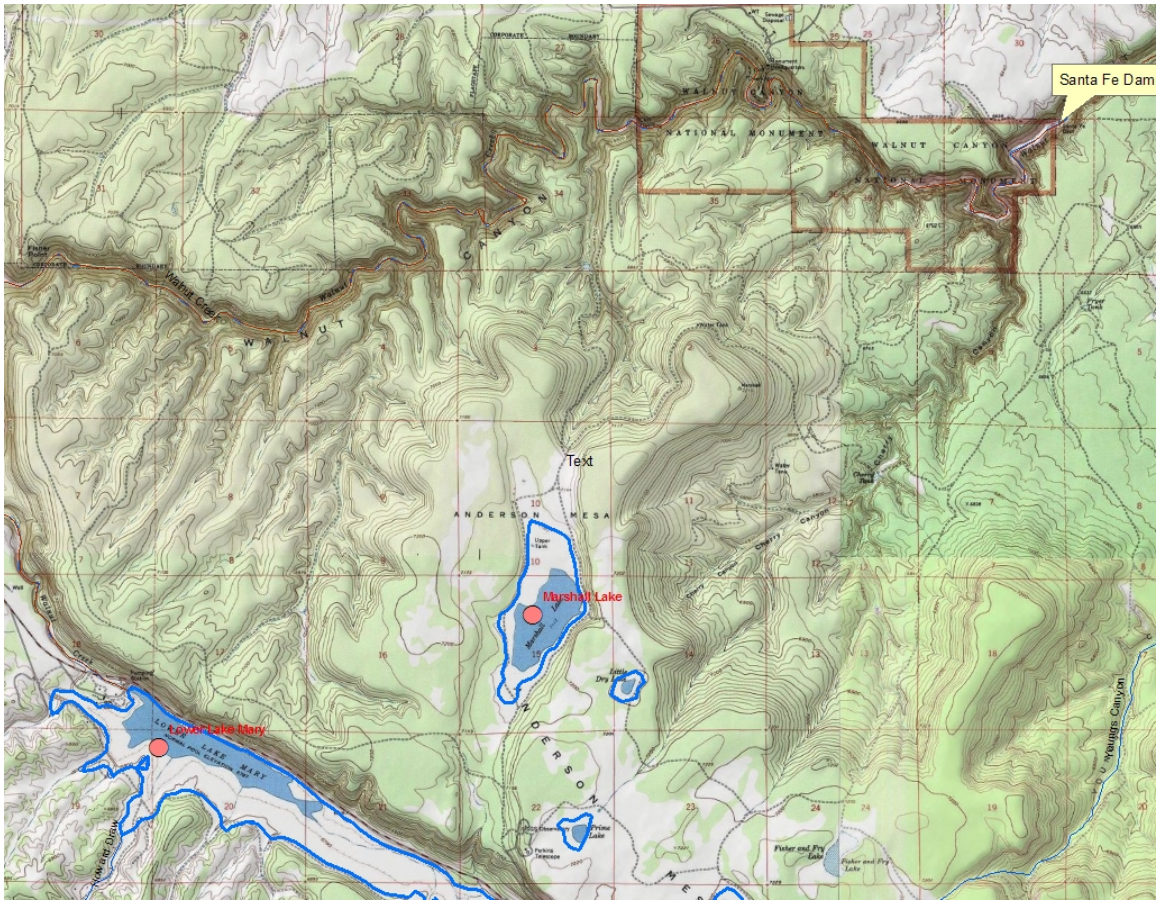

Figure 40. Santa Fe Dam location on Walnut Creek

Community Description

Aquatic Species in Walnut Creek complex include rainbow trout plus all of the species found in the only permanent water in the complex; bluegill, black crappie, channel catfish, yellow perch, walleye, yellow bass, northern pike, golden shiners and fathead minnows, along with the yellow bullhead found in the private pond near Double Springs Campground on the edge of Mormon Lake. Northern leopard frogs are currently found at Dairy Springs in the Mormon Lake Basin and outside of the complex on Anderson Mesa.

Consultation Species or Critical Habitat

The entire Walnut Creek Complex is considered a closed system, so there are no potential impacts to listed fish species.

Northern Leopard Frog

See Local and Broad Scale analyses under each stocking location.

LOWER LITTLE COLORADO RIVER ANALYSIS OF IMPACTS

Sub-Watershed Description

The Little Colorado River watershed covers approximately 21,706 mi^2 in northeastern and central Arizona and 5,337 mi^2 in northwestern New Mexico according to the NRCS National Watershed Boundary dataset. The perennial flows in the watershed occur in the upper 77.67 miles and lower 13.05 miles before joining the Colorado River (Benke and Cushing 2006). The Little Colorado River watershed consists of 47 reservoirs and 4 streams proposed for stocking. The Little Colorado River complex is separated into 9 drainages; from upstream to downstream they are as follows: West Fork Little Colorado River, Little Colorado River above Lyman Lake, Upper Little Colorado River, Schoen's Dam, White Mountain Lake, Chevelon Creek, Clear Creek, Jack's Canyon, and Canyon Diablo (Figure 41).

The West Fork Little Colorado River complex contains six lakes (White Mountain Reservoir, Lee Valley Lake, Mexican Hay Lake, River Reservoir, Bunch Reservoir, and Tunnel Reservoir) and two sections of stream (Little Colorado River at Greer and West Fork Little Colorado River at Sheep's crossing) that are proposed for stocking. Located in the eastern portion of the state this drainage collects run-off from Mt. Baldy and forms the uppermost headwaters of the Little Colorado River. Elevations of this drainage range from over 11,000 feet near the top of Mt. Baldy to 7,525 feet at its confluence with the Little Colorado River. The West Fork Little Colorado River drainage enters the Little Colorado River upstream of Lyman Lake. Proposed species for stocking include rainbow trout, apache trout, and arctic grayling.

The Little Colorado River above Lyman Lake complex contains six lakes (Pratt Lake, Carnero Lake, Hulsey Lake, Nelson Reservoir, Becker Lake, and Lyman Lake) that are proposed for stocking. This drainage drains downstream of the West Fork Little Colorado River drainage into Lyman Lake (an impoundment of the Little Colorado River itself). Rainbow trout, Apache trout, and Arctic grayling are proposed for stocking in this drainage.

The Upper Little Colorado River complex contains two lakes (Concho Lake and Little Ortega Lake) both of which are closed systems with no outlets or possibility of fish movement downstream. Proposed stocking includes rainbow trout, largemouth bass, bluegill, and channel catfish.

The Schoen's Dam complex contains six lakes (Woodland Lake, Mountain Recreation Complex, Rainbow Lake, Scott's Reservoir, Show Low Lake, and Fools Hollow Lake) and one stream (Show Low Creek) that are proposed for stocking. This drainage flows into Silver Creek and eventually into the Little Colorado River downstream of Lyman Lake. Rainbow trout, brook trout, cutthroat trout, Apache trout, channel catfish, bluegill, and largemouth bass are proposed for stocking.

The White Mountain complex contains four lakes (Sponseller Lake, Little Mormon Lake, Whipple Lake, Long Lake (Show Low) and one stream (Silver Creek) that are proposed for stocking. This drainage flows into White Mountain Reservoir (an impoundment of Silver Creek) at its downstream end. The confluence of Silver Creek and the Little Colorado River is downstream of Lyman Lake. Rainbow trout, Apache trout, and channel catfish are proposed for stocking.

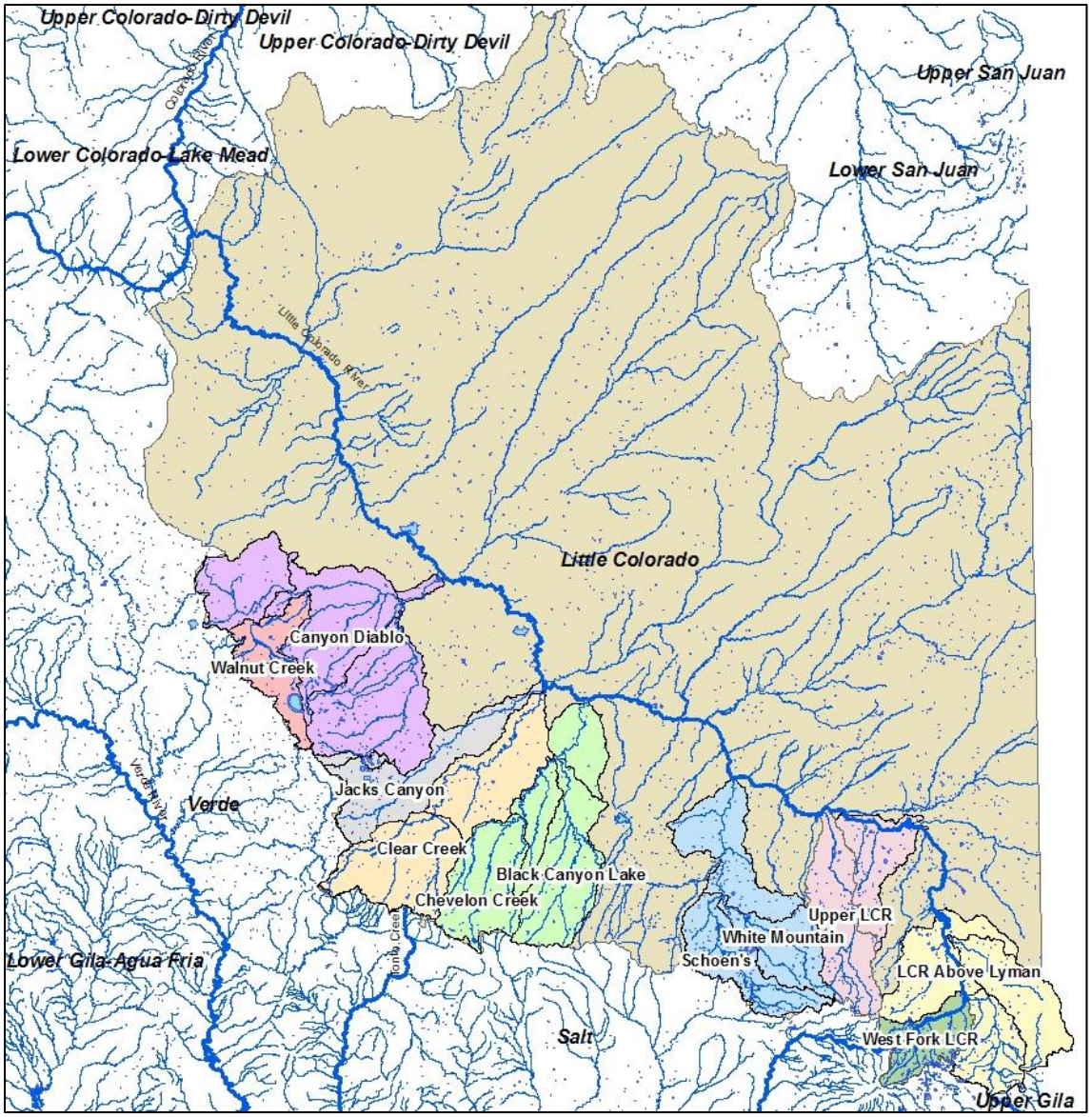

Figure 41. Map indicating the drainages of the Little Colorado River that contain complexes of waters (both lakes and stream reaches) proposed for stocking fish.

The Chevelon complex contains five lakes (Black Canyon, Long Tom, Willow Springs, Woods Canyon, and Chevelon Canyon Lake) that are proposed for stocking. The drainage flows into

Chevelon creek upstream of its confluence with the Little Colorado River. The Chevelon Creek confluence with the Little Colorado River is downstream of the confluence of Silver Creek and the Little Colorado River. Rainbow trout, brook trout, and Arctic grayling are proposed for stocking.

The Clear Creek complex contains four lakes (C.C. Cragin, Knoll Lake, Bear Canyon Lake, and Clear Creek Reservoir) that are proposed for stocking. Outflow from the entire drainage flows into Clear Creek Reservoir. Outflow from Clear Creek Reservoir connects with the Little Colorado River downstream of the Chevelon Creek Confluence. Rainbow trout and Arctic grayling are proposed for stocking.

The Jacks Canyon complex contains four lakes (Soldiers, Soldiers Annex, Long Lake, and Tremaine Lake) that are proposed for stocking. The entire drainage is a closed system with no possibility of fish movement or survival downstream. All water is retained within the drainage for irrigation and livestock watering needs. Rainbow trout, largemouth bass, channel catfish, bluegill sunfish, yellow perch, walleye and redear sunfish are proposed for stocking.

The Canyon Diablo complex contains eleven lakes that are proposed for stocking. Morton Lake, Kinnikinick Lake, Mud Lake flow into the LCR via Canyon Diablo and Frances Short Pond flows into San Francisco Wash before entering Canyon Diablo and finally the Little Colorado River. Ashurst and Coconino lakes are also a closed system with no possibility for fish movement downstream to Diablo Canyon. Mormon Lodge Pond, Upper Lake Mary, Lower Lake Mary, and Marshall Lake lie within the closed system of Walnut Canyon; flow goes subsurface below Santa Fe Dam, and there is no possibility for fish movement downstream. Of the lakes that are not within closed systems, rainbow trout, channel catfish, brown trout, brook trout, cutthroat trout, arctic grayling, bluegill sunfish, redear sunfish and largemouth bass are proposed for stocking.

Water Distribution/Connectivity

The Little Colorado River runs 573 km (356.05 miles) through northeastern Arizona from its headwaters in the West Fork LCR complex in the White Mountains of Arizona to its confluence with the Colorado River in Grand Canyon National Park (Figure 41). The Little Colorado River is ephemeral throughout most of its watershed. Exceptions include the headwaters and the final 13.05 miles of the river upstream from its confluence with the Colorado River. The final 13.05 miles) is fed by springs in redwall limestone, primarily Blue Springs, and provides base flow of approximately 198 ft^3/s (Minckley, 1990).

Since 1980, the U.S. Geological Survey has operated at least 17 flow gauges on tributaries and the main channel of the Little Colorado River between the dam at Lyman Lake and the Little Colorado River's confluence with the Colorado River. The dates the gauges have been operational varies, with some gauges (e.g., Clear Creek and Chevelon Creek) only being

operational for a short period of time while some of the main channel Little Colorado River gauges have been continuously operational. Complex relationships exist between bank storage, reservoir storage, water lost to seepage, unknown diversions, and unrecorded sources of water; and modeling the relationship between water sources and floods in the Lower Little Colorado River is not a simple additive process. The modeling process is also confounded by incomplete data sets and the large size of the watershed, and caution should be used when attempting to understand these relationships.

According to USGS 24K topographic maps, there are at least 30 large, named drainages that flow into the Little Colorado River between Lyman Lake and the Cameron gauge. Only five of those named drainages (Little Colorado River above Lyman Lake, Silver Creek, Chevelon Creek, Clear Creek, and Diablo Canyon) have locations that are being stocked, while 10 of those named drainages flow partially or completely through the Navajo Nation (Figure 42). Stocked drainages (at the 12-digit HUC level) comprise 1011 mi^2 which is 3.7% of the entire Little Colorado River watershed. Stocked drainages at the 10-digit HUC level comprise 4,582 mi^2 of watershed or 16.9% of the entire LCR watershed. Tribal ownership comprises 63.9 % of the land ownership within the Little Colorado River basin (ADWR 2009). Very little data exist regarding the current fishery management, historic fishery management or current distribution of native and non-native fishes within the majority of the Little Colorado River watershed that is managed by several Native American tribes.

Hydrograph data from the Cameron gauge (http://waterdata.usgs.gov/nwis/rt) along with available data from gauges on the Navajo Nation suggest that many floods recorded at Cameron originated on the Navajo Nation. Only two gauges (Moenkopi Wash, Dinnebito Wash) on the Navajo Nation have a long time series, and both appear to have contributed to recent floods (2001–2009, Figure 43). Moenkopi Wash and Dinnebito Wash are located downstream of Grand Falls and upstream of the gauging station at Cameron. It is suspected that Grand Falls is a natural barrier to downstream fish movement, although there is some evidence that fish may be able to pass over Grand Falls (Stone et al. 2007). When looking for sources of non-native fishes and without consideration of complicating factors of hydrology or biological limitations or distributions, logic would dictate that one should look to the closest and most proximal sources as having a higher likelihood of contribution non-native species in the lower Colorado River.

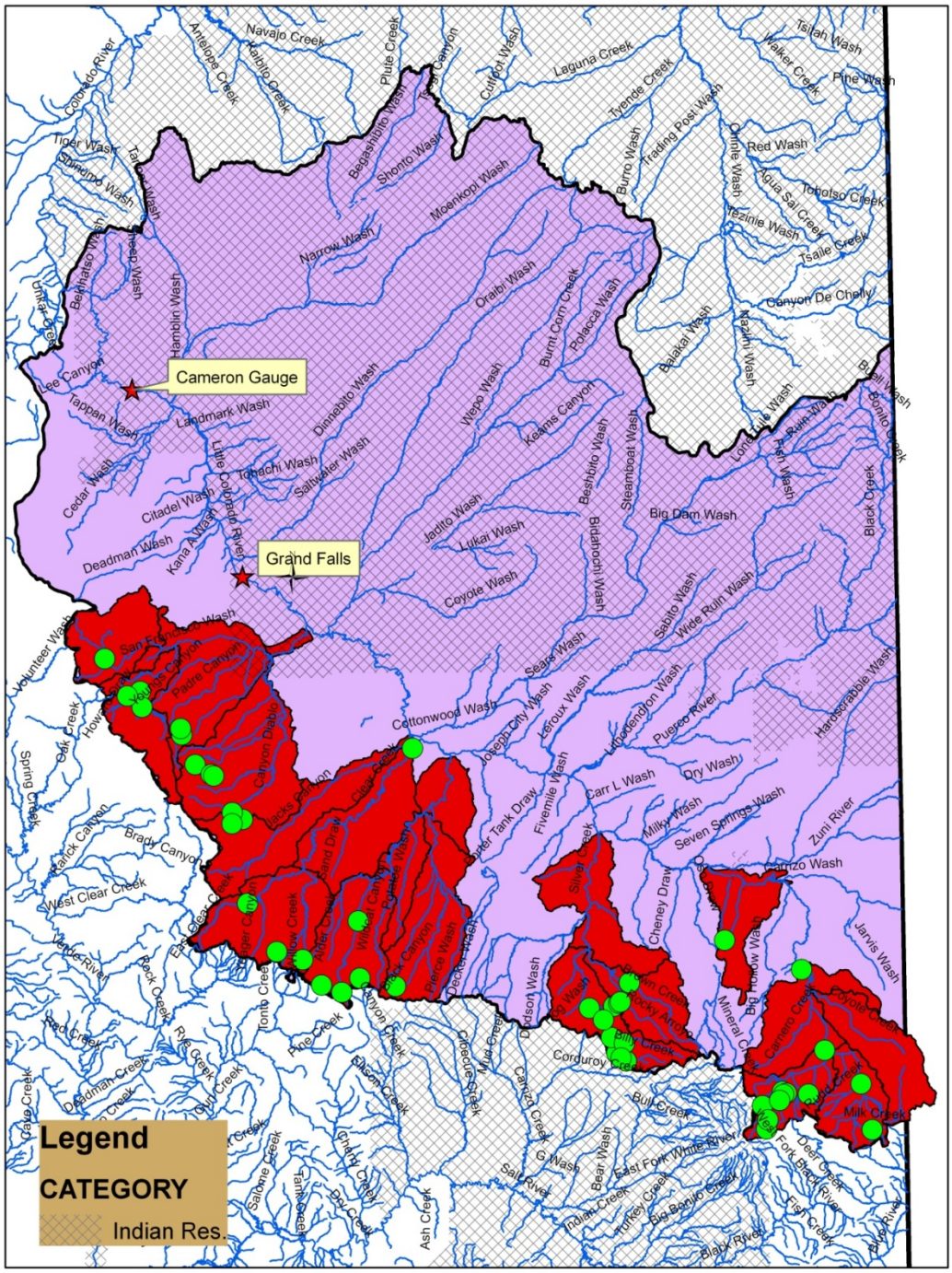

Figure 42. Little Colorado River watershed in Arizona.

Purple polygon is the LCR watershed; red polygons identify watersheds at a 10 digit HUC level containing the green dots which identify locations proposed for stocking. Crosshatch identifies Indian reservations.

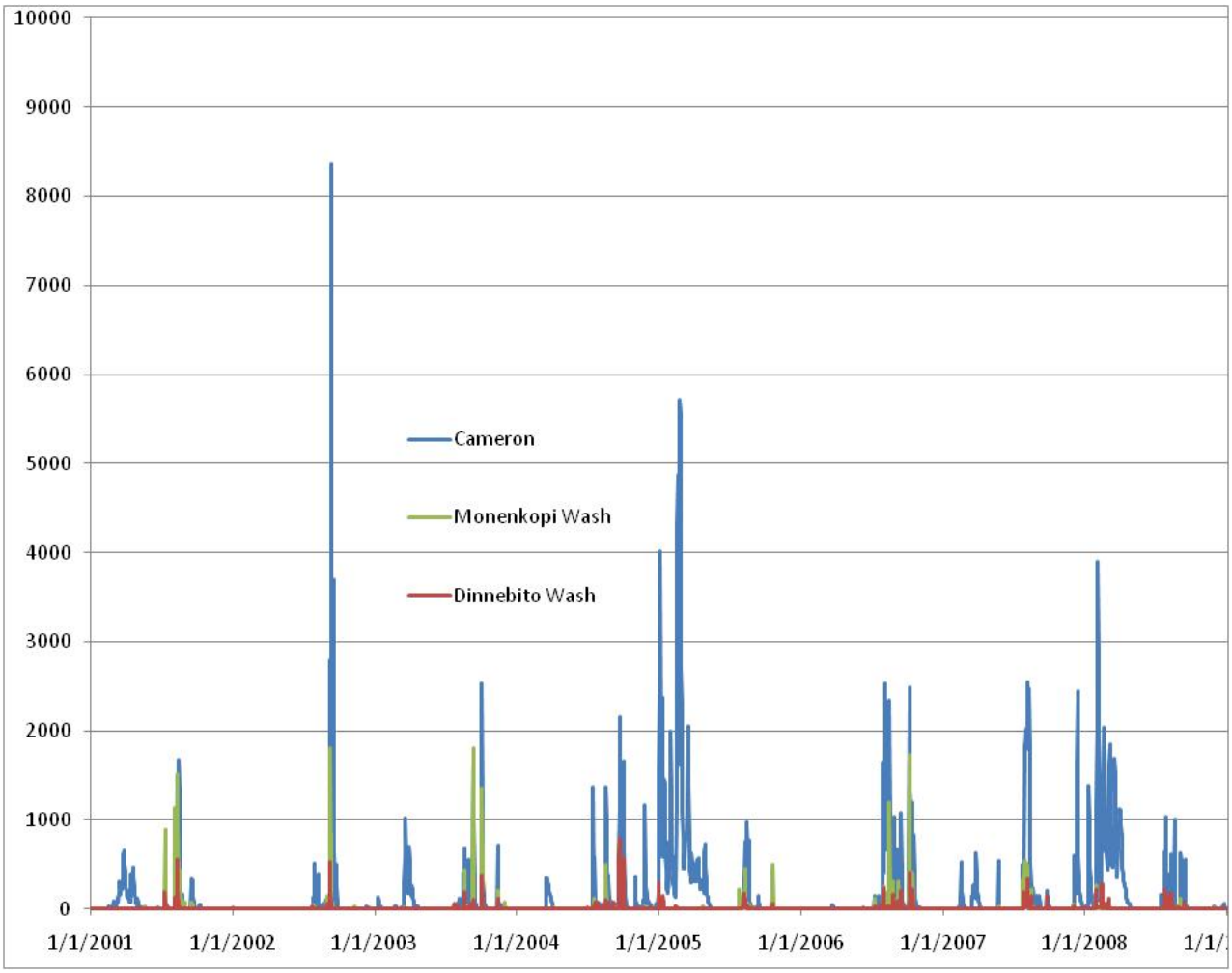

Figure 43. Flow data (cfs) from Cameron (Lower Little Colorado River main channel), Moenkopi Wash, and Dinnebito Wash (2001–2009.)

Moenkopi Wash and Dinnebito Wash are located 9 miles and 40.6 miles, respectively, upstream of Cameron.

Water Distribution/Connectivity Upstream of the Stocked Drainages

The West Fork Little Colorado River drainage consists of 5 main drainages (Hall Creek, West Fork Little Colorado River, Lee Valley Creek, East Fork Little Colorado River, and the South Fork Little Colorado River) forming the uppermost headwaters of the Little Colorado River. The West Fork Little Colorado River drainage is composed of 8 stocking sites in the headwaters of the Little Colorado River from upstream to downstream they are as follows Lee Valley Reservoir, Sheep's Crossing, Little Colorado in Greer, River Reservoir, Tunnel Reservoir, Bunch Reservoir, White Mountain Reservoir, and Mexican Hay Lake. Lyman Lake is approximately 27

miles downstream from the confluence of the South Fork Little Colorado River and the Little Colorado River (the downstream most outflow from the drainage).

The Little Colorado River above Lyman Lake drainage contains four stocking sites that can potentially make hydrologic connections to the Little Colorado River. These stocking sites from upstream to downstream most they are as follows Hulsey Lake, Nelson Reservoir, Becker Lake, and Lyman Lake. Lyman Lake sits at the downstream end of the drainage. From Lyman Lake the Little Colorado River has permanent flow for about 15 miles to the city of St. Johns then is mostly intermittent to Silver Creek approximately 80 miles downstream.

The Upper Little Colorado River drainage contains two proposed stocking sites. These sites, Little Ortega and Concho Lake, form two distinct areas due to their isolation. Little Ortega has no hydrologic connections to the Little Colorado River. Concho Lake is functionally a closed system with no possibility of fish escapement downstream.

The Schoen's Drainage contains 6 reservoirs and 1 section of creek that can potentially make hydrologic connections with the Little Colorado River. These stocking sites from upstream to downstream most are as follows Woodland Lake, Rainbow Lake, Scott's Reservoir, Show Low Lake, Show Low Creek, and Fools Hollow Lake. From the Confluence of Show Low Creek and Silver Creek it is about 30 + miles to the confluence of Silver Creek and the Little Colorado River.

The White Mountain Drainage contains one reservoir and one section of creek that can potentially make hydrologic connections to the Little Colorado River. These stocking sites from upstream to downstream most are as follows Little Mormon Lake and Silver Creek. Both of these stocking sites flow down to White Mountain Lake. From White Mountain Lake Silver Creek continues approximately 30 miles to its confluence with the Little Colorado River (43 miles upstream of the Chevelon confluence and 52 miles upstream of the Clear Creek Confluence).

The Chevelon drainage contains 5 reservoirs that can potentially make hydrologic connections to the Little Colorado River. From upstream to downstream they are as follows Willow Springs Lake, Woods Canyon Lake, Long Tom, Chevelon Canyon Lake, and Black Canyon Lake. Black Canyon Lake at the downstream end of the drainage spills to the West Fork of Black Canyon to Black Canyon to Chevelon Creek 13.5 miles upstream of the Little Colorado River and 47.9 miles downstream of Chevelon Canyon Lake. The confluence of Chevelon Canyon and the Little Colorado River is about 45 miles downstream from the confluence of Silver Creek and the Little Colorado River. Perennial flow continues from the confluence of Chevelon Creek and the Little Colorado River for 9.1 miles to the confluence with Clear Creek.

The Clear Creek drainage contains 4 reservoirs that can potentially make a hydrologic connection to the Little Colorado River. From upstream to downstream most they are as follows C.C. Cragin, Knoll Lake, Bear Canyon Lake, and Clear Creek Reservoir. Out flow from C.C. Cragin, Knoll Lake, and Bear Canyon Lake all end up in Clear Creek Reservoir. Outflow from Clear Creek Reservoir travels approximately 1.25 miles to the Little Colorado River which is about 80 miles upstream of Grand Falls on the Little Colorado River.

The Jacks Canyon complex likely is a closed system with very limited or no possibility for fish movement or survival downstream of the drainage as described in the complex analysis. The confluence of Jacks Canyon with the Little Colorado River is 1.6 miles downstream of the Clear Creek confluence.

The Diablo Canyon drainage contains four reservoirs that can potentially make hydrological connection with the Little Colorado River. From upstream to downstream most they are as follows Mud Lake, Kinnikinick Lake, Morton Lake, and Frances Short Pond. Diablo Canyon is connected to the Lower Little Colorado River approximately 128 miles from the confluence of the Little Colorado River and the Colorado River. Diablo canyon meets with the ephemeral Lower Little Colorado River approximately 24 miles upstream of Grand Falls and about 114 miles upstream of Blue Springs.

Fish Movement

Three of the 10 complexes proposed for stocking in this consultation in watersheds that flow into the Little Colorado River are closed systems and stocked fish exposure to the lower Little Colorado River will not occur. Only three of the remaining 7 complexes (Schoen's Dam, White Mountain and Canyon Diablo) are proposed for stocking fish species with biological life histories that allow for the potential for transport, exposure, and potential impacts to humpback chub in the lower LCR. These species include channel catfish, largemouth bass, redear sunfish, bluegill sunfish, rainbow trout and brown trout. Other species proposed for stocking in the watershed such as Apache trout, Arctic grayling or brook trout are either in closed systems or have never been detected in the intervening waterways or in the Little Colorado River.

Within the Schoen's Dam complex, six reservoirs are proposed for stocking one or more of these species: Woodland Lake, Rainbow Lake, Show Low Lake, Fools Hollow Lake, Scott's Reservoir, and Mountain Meadow Recreational Area (Table 36). Within the White Mountain Complex, four reservoirs and 1 stream reach are proposed for stocking, of these only Clear Creek and Little Mormon Lake are open systems, and only Little Mormon Lake is proposed to have channel catfish stocked.

Within the Canyon Diablo complex, four reservoirs are proposed for stocking one or more of these species: Mud Lake, Kinnikinick Lake, Morton Lake, and Frances Short Pond.

Much of the Little Colorado River Basin is periodically connected to the lower Little Colorado River through flooding. Any fish escaping stocked location would have to travel approximately 70 – 150 miles through heavily sediment-laden flood waters, over Grand Falls (191 ft tall), and over Chute falls to reach the occupied humpback chub habitat and critical habitat in the lower Little Colorado River and mainstem Colorado River.

Community Description
Lower Little Colorado River Fish Assemblage near the Confluence with the Colorado River.

The Little Colorado River between its confluence with the Colorado River and Atomizer Falls, 15.5 km (9.63 miles) upstream of the confluence, is home the largest spawning aggregation of the endangered humpback chub in the Grand Canyon (Figure 44). Because of the importance of this reach, it has likely been the most intensively sampled reach of river in the state over the past two decades, with intensive fish sampling occurring since 1977. Sampling data from the Little Colorado River in the Grand Canyon Monitoring and Research Center database spans from 1977 to 2008. The most intense sampling in the Little Colorado River did not begin until after 1990. Numerous (57,664) samples using multiple gears have been collected (Table 30 and Table 31). Since 1977, a total of 289,571 fish comprising 18 species have been captured in the lower Little Colorado River (Table 32 and Table 33).

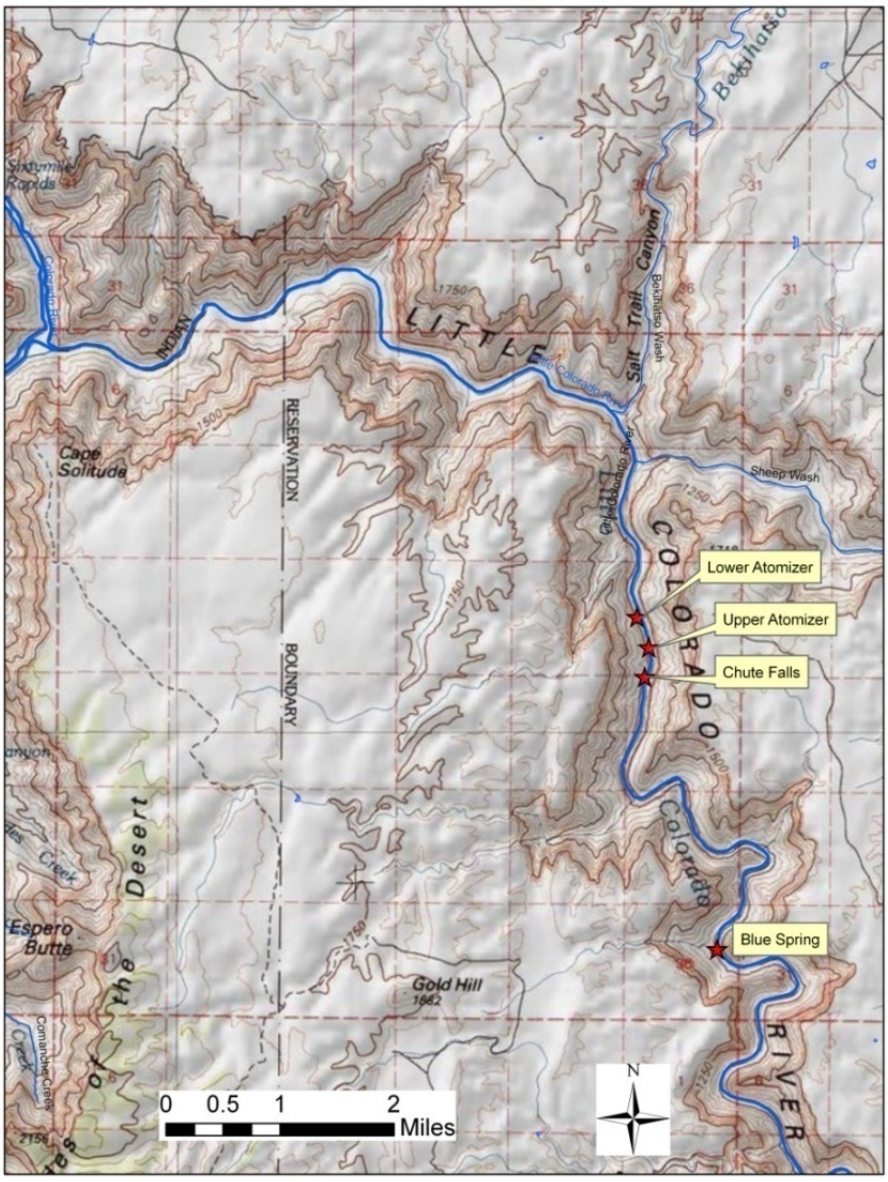

Figure 44. Lower Little Colorado River showing perennial reach from Blue Spring to the Colorado River.

Table 30. Summary of Gear used by year in the Lower Little Colorado River (1977-2008). Codes defined in Table 31.

	AHP	AN	BL	BS	DH	DIP	EL	GFH	HB	HL	HN	HND	HS	HS2	HS4	HW	LS	LT	MB	MH	MHS	MT	SEN	SG	SS	TD	TK	TL	TM	TN	TRA	total
1977											1																					1
1978		1		9			1				1						2													2		16
1979				1													3													4		8
1980											3											66			136	207						412
1981		1									6											161			191	192						551
1984																									33	7						40
1985		4				3					3														6	11						27
1986		7				10																			5	14						36
1987											142														34	85						261
1988		3		30		18					399																			179		629
1989		2				4					454														9	177						646
1990		6		50		5					356						7					88								72		584
1991	1066	15		9	12	88				87	1519	1	3				2			138		278	53		159					111	207	3748
1992	2231	1				146					792									689		521	56		401		1	1		2	194	5035
1993	2002	10	11	3		1734					1200							102		1400		832	128	2	161					5	141	7731
1994	2037	10	1			1023					945						5		1	903		406	43		246						103	5723
1995	1200	11									788							156		383		32			222			16			55	2863
1996				8							750									364		439		2	2			4				1569
1997				3							753									183		371							15	1		1326
1998	69			3				586			431	2								349		217	26					7		8	1	1699
1999	134							497												415		487	12				6	1			4	1556
2000												1	2680							20		22	6				6	1				2736
2001	8								1058				1278			7				300							6	58				2715
2002								376	1801				335	36	17					181	180											2926
2003								479	126				1995																		2	2602
2004		2						299	133				2162																			2596
2005								269	170				1800								360											2599
2006								312	183				2067																			2562
2007		1						269	300				2160																			2730
2008								274	368				1095																			1737
																															Total samples	57664

Table 31. Gear codes used on Table 1.

GEAR_TYPE	DESCRIPTION
AN	Angling
AQ	Aquarium net
BI	Bi-directional Trap Net - In
BL	Bag seine, large, 30' X 6' X 1/4" (1/8" bag mesh)
BO	Bi-directional Trap Net - Out
BP	Backpack electrofishing
BS	Bag seine, small, 15' X 6' X 1/8" (1/32" bag mesh)
BX	Bag Seine, Very Large, 100' x 8' x 1/8"
DH	D-Hoop Net
DIP	Dip net, unspecified
DNL	Dip net, Large Mesh, 3/16"
DNS	Dip net, small mesh, 1/16"
DR	Drift net, invert
DT	Trammel Net, Drifting, Unspecified
EL	Electrofishing
FR	Frame net
GF	Gill net, floated, record area sampled
GFH	Hoop net, AGF, large, 3' diameter, 1/4" mesh
GM	Gill net, 100' X 6' X 2"
GN	Gill Net, Unspecified
GP	Gill net, 100' X 6' X 1.5"
GX	Gill net, 100' experimental
GY	Gill net, 50' X 6' X 1.5"
GZ	Gill net, 60' experimental
HB	Hoop Net, Baited
HDL	Hydrolab
HDLL	Hydrolab with logger
HL	Hoop net, large, 4' diameter
HM	Hoop net, medium, 3' diameter
HM2	Hoop net, medium, 3' diameter, 2" square mesh
HM3	Hoop net, medium, 3' diameter, 3" square mesh
HN	Hoop net, 3' X 5' X 3/8" X 40' Without Wings
HND	Hand trap
HS	Hoop net, small, 2' diameter
HS2	Hoop net, small, 20" diameter, 2" square mesh
HS4	Hoop net, small, "Miller net turtle trap", 3' diameter, 4" square mesh
HW	Hoop Net, With 40' Wings, 3' x 5' x 3/8"

ICM	ICM meter
KS	Kick screen
KSE	Kick seine, 3' X 3' X 1/32"
LL	Long line (traught line)
LS	Seine, Larval
LT	Light Trap, Larval
MB	Minnow Trap, Baited
MG	Minnow Trap, Ganged
MH	Mini-hoop net, 50cm X 4' X 3/8"
MHS	Mini-hoop Net, Bait in Dennis Stone's Socks
MN	Minnow Trap
MT	Minnow trap
PP	Dip Net, Larval
SA	Seine, 10' X 3' X 1/8"
SB	Seine, 30' X 4' X 1/4"
SC	Seine, 15' X 4' X 1/8"
SEN	Seine, unspecified
SG	Seine, 30' X 5' X 1/4"
SL	Straight Seine, Large, 30' X 6' X 1/16"
SLT	Slat trap, square, Mississippi style 48" long, 24" x 1/5" openings
SPG	Spear Gun
SS	Straight Seine, Small, 15' X 4' X 1/8"
ST	Trammel Net, Used as Seine
SU	Surber
SX	Straight Seine, Very Large, 50' x 6' x 1/16"
T50	Trammel net, 50' X 6' , unknown mesh
T75	Trammel net, 75' X 6' , unknown mesh
TD	Trammel Net, Drifted
TF	Trammel net, floated, record area sampled
TK	Trammel net, 75' X 6' X 1" X 12"
TL	Trammel net, 75' X 6' X 1.5" X 12"
TM	Trammel net, 50' X 6' X 1" X 12"
TN	Trammel net, 50' X 6' X 1.5" X 12"
TRA	Trammel Net, Unspecified
TRN	USFWS transect
TS	Trammel Net (set)
TW	Trammel net, 75' X 6' X 0.5" X 10"
TY	Trammel net, TK with attached floats
TZ	Trammel net, TL with attached floats

Table 32. Species and number of fish captured by year in the Little Colorado River 1977-2008 (codes defined in Table 33).

	BBH	BHS	BNT	CCF	CRP	FHM	FMS	FRH	GSF	GSH	HBC	PKF	RBS	RBT	RGK	RSH	SPD	STB	SUC	TAD	YBH
1977											6										
1978				1	18		14				707										
1979					1		2				59			1							
1980	3	270		9	10	164	36				1174	3					2008		465		
1981	3	540		6	3	1195	80				1069	159					2092		382		
1984	1	12		6	16	1	253				610						5				
1985		595		35	3	4	227				398			4			7		1		
1986		149		12	4	1	228				682			1			6		1		
1987		106		15	15	1	207			1	684			6			146				
1988		172		20	3	12	232				1091			4			285				
1989		427		86	2	32	343				2075		1	4		2	502		3		
1990		280	2	20	345	25	346	1			1811	185	5	6			669	1	8	29	
1991	3	2101	3	146	54	46	1182		1		11056	11	3	48			5903		300		2
1992	3	1560	2	85	69	122	827	12			9652	30	3	10			3480		1		3
1993		3716	2	29	87	95	1686				20919	3	7	77			9141		59		1
1994	4	3120	3	64	45	793	1642		1		13810	4	8	43	1		4686		2		3
1995	3	1083	2	46	22	197	1004				4694	6	15	30			1374		145		9
1996		987		10	109	1898	331				592	107		11		51	1358		2		
1997		54		14	76	1185	157				253	549		3		121	451	1			1
1998	5	118		27	48	206	93				1205	18		17		70	533				1
1999		165		16	21	45	205				784	9		13		222	1043				4
2000	3	589		30	89	517	77				1901	8		21		46	1266				54
2001	28	338		34	98	1927	996		1		7492	11		12		131	2318				58
2002	21	1818		20	279	944	1206				9141	8	1	13		45	3227				36
2003	33	959		42	343	425	909		1		4155	19		3		199	5149				29
2004	66	916		33	43	786	689		1		7507	103		12		169	13161				
2005	77	501		43	220	425	332		1		4984			1			13919				
2006	147	1578	1	27	155	4021	697		2		6986	11		1		50	10428				
2007	149	4251		21	67	440	1329	1	1		7105	31		1		41	5272				
2008	52	3400		11	2	209	958				4915	2					3610				

Total fish 289571

Table 33. Species codes used on Table 32.

SPECIES_CODE	COMMON_NAME	GENUS	SPECIES
BHS	BLUEHEAD SUCKER	CATOSTOMUS	DISCOBOLUS
BBH	BROWN NULLHEAD	AMEIURUS	MELAS
BNT	BROWN TROUT	SALMO	TRUTTA
CCF	CHANNEL CATFISH	ICTALURUS	PUNCTATUS
CRP	COMMON CARP	CYPRINUS	CARPIO
FHM	FATHEAD MINNOW	PIMEPHALES	PROMELAS
FMS	FLANNELMOUTH SUCKER	CATOSTOMUS	LATIPINNIS
FRH	FLANNELMOUTH/RAZORBACK HYBRID		
GSF	GREEN SUNFISH	LEPOMIS	CYANELLUS
GSH	GOLDEN SHINER	NOTEMIGONUS	CRYSOLEUCAS
HBC	HUMPBACK CHUB	GILA	CYPHA
PKF	PLAINS KILLIFISH	ZEBRINUS	FUNDULUS
RBS	RAZORBACK SUCKER	XYRAUCHEN	TEXANUS
RBT	RAINBOW TROUT	ONCORHYNCHUS	MYKISS
RGK	RIO GRANDE KILLIFISH		
RSH	RED SHINER	CYPRINELLA	LUTRENSIS
SPD	SPECKLED DACE	RHINICHTHYS	OSCULUS
STB	STRIPED BASS	MORONE	SAXATILIS
SUC	UNIDENTIFIED SUCKER	N/A	N/A
TAD	TADPOLE		
YBH	YELLOW BULLHEAD	AMEIURUS	NATALIS

Fish Assemblages in the Colorado River (Glen and Grand Canyons)

The confluence of the Little Colorado River and Colorado Rivers is 76 miles downstream of Glen Canyon Dam. The intentional and unintentional stocking of nonnative fish in the Colorado River began long before the 1900s, and the ratio of non-natives to natives was high before the construction of Glen Canyon Dam (USGS 2005). It is likely that channel catfish was the most abundant species in the Colorado River within Glen and Grand Canyons prior to the construction and filling of Glen Canyon Dam. The Grand Canyon Monitoring and Research Center maintains a database of fish observations in the Colorado River spanning the years 1978–2008. Multiple gears types have been utilized to capture 195,146 fish comprising 36 species (Table 34 and Table 35).

Table 34. Species and number captured by year in the Colorado River from 1978–2008 (species codes defined in Table 35).

	SPECIES_CODES																	
Year	BBH	BGS	BHS	BKC	BKT	BNT	CCF	CRP	CTT	FHM	FMS	FRH	GSF	GSH	HBC	LMB	MOS	PKF
1978		1	17		19	6	16	508			54		1			2		
1979																		
1980			41		7	1		64	6	106	16				72			
1981	1		158		6	5		101	7	589	144				326			4
1984			9		121	64	11	549	1	129	311				42			
1985			354		150	240	13	911	2	3688	784			4	421	2		3
1986			107		41	115	6	431	1	277	358			1	3			
1987			134		35	1		8		398	104				196			
1988			197		228			52		117	358			2	16			
1989			292		8			1		180	137				5			
1990			15		41	45	18	120		56	45				106			21
1991	2		230		3	612	54	937		392	871	2			1042			29
1992	3	22	493	2	10	599	103	991		2911	1478	2	2		1191	23	10	52
1993	3	2	2747	3	3	303	169	473		2911	2944	1	6	1	7701	12	24	17
1994			2231		1	4		25		6405	938		1		1329			61
1995		2	325	3	1	20	195	377		3523	723		6		718	31	12	97
1996			339			15	2	81		3204	736		4		594			135
1997			11			20	2	62		492	537				118			50
1998			42			131		32		263	481		1		345			8
1999			20			95	3	42		57	106				303			2
2000	2		2716			1535	25	669		7428	2986		2		337	8		39
2001	2		58			328	21	63		15	496				443			
2002	3		90			645	31	393		356	1324				222			311
2003	2		342			929	23	664		940	2599		1		1130			230
2004	57		450			732	41	466		1556	3642		2		2085			368
2005	103		2117			290	63	492		2994	6266		1		3412			88
2006	119	1	2429			101	169	843		3995	7298		5		1960		217	449
2007	28		1068			68	6	128		1390	1678		2		586			164
2008			157			6		2		654	348				3			8

	SPECIES_CODES (continued from previous page)																		
Year	**RBT**	**RGK**	**RSH**	**RSS**	**RTC**	**SHR**	**SMB**	**SPD**	**STB**	**SUC**	**TFS**	**TRT**	**UID**	**UIF**	**UIS**	**UTC**	**WAL**	**YBH**	**TOTAL**
1978	378																		624
1979	2																		0
1980	88							6											319
1981	180		10					70		386			3						1810
1984	2520							30	2		1								1270
1985	8181							805		2		1				1		2	7383
1986	4208							151		7									1498
1987	625							778										1	1655
1988	3975							639	1	5									1615
1989	508							264		33									920
1990	4317							38	1	14		3	1						524
1991	7494							1409	18	191			118				1		5911
1992	5342		425					1300	17	341	61		68				2		10106
1993	6071		127					4366	63	1080	7		2408						25371
1994	3840							1774	3	37			1						12810
1995	3292		495	1	2			1985	80	11	18		4						8629
1996	6460		21					1845	1	12								1	6990
1997	4641		20					86											1398
1998	4549		43					397					1					1	1745
1999	4030		11					89										1	729
2000	13025	1	51					5784	17	110			4						21714
2001	9119		3					7	2										1438
2002	7032		28					1527	4	8			1					1	4944
2003	17260		17					1614	2	679			2					12	9186
2004	13114		24					4319	1	107			4	1				5	13860
2005	7442		276			1	5	3733	59	43	1			1	79			9	20033
2006	4217		858				3	3797	137	19				18	40		1		22459
2007	2796		18					2372		1			1		6		3		7519
2008	1234		8					1350							149		1		2686
																		Total	195146

Table 35. Species codes used on Table 34.

SPECIES_CODE	COMMON_NAME	GENUS	SPECIES
BGS	BLUEGILL	LEPOMIS	MACROCHIRUS
BHS	BLUEHEAD SUCKER	CATOSTOMUS	DISCOBOLUS
BKC	BLACK CRAPPIE	POMOXIS	NIGROMACULATUS
BKT	BROOK TROUT	SALVELINUS	FONTINALIS
BNT	BROWN TROUT	SALMO	TRUTTA
BTC	BONYTAIL CHUB	GILA	ELEGANS
CCF	CHANNEL CATFISH	ICTALURUS	PUNCTATUS
CRA	CRAYFISH	N/A	N/A
CRP	COMMON CARP	CYPRINUS	CARPIO
CSF	COLORADO SQUAWFISH	PTYCHOCHEILUS	LUCIUS
CUT	CUTTHROAT TROUT	ONCORHYNCHUS	CLARKI
FHM	FATHEAD MINNOW	PIMEPHALES	PROMELAS
FMS	FLANNELMOUTH SUCKER	CATOSTOMUS	LATIPINNIS
FRH	FLANNELMOUTH/RAZORBACK HYBRID		
GSF	GREEN SUNFISH	LEPOMIS	CYANELLUS
GSH	GOLDEN SHINER	NOTEMIGONUS	CRYSOLEUCAS
HBC	HUMPBACK CHUB	GILA	CYPHA
LMB	LARGEMOUTH BASS	MICROPTERUS	SALMOIDES
MOS	MOSQUITO FISH	GAMBUSIA	AFFINIS
NOP	NORTHERN PIKE		
PKF	PLAINS KILLIFISH	ZEBRINUS	FUNDULUS
RBS	RAZORBACK SUCKER	XYRAUCHEN	TEXANUS
RBT	RAINBOW TROUT	ONCORHYNCHUS	MYKISS
RCH	RAINBOW/CUTTHROAT HYBRID	ONCORHYNCHUS	MYKISS/CLARKI
RGK	RIO GRANDE KILLIFISH		
RSH	RED SHINER	CYPRINELLA	LUTRENSIS
RTC	ROUNDTAIL CHUB	GILA	ROBUSTA
SDS	SAND SHINER		
SHR	SHINER	CYPRINELLA	LUTRENSIS
SMB	SMALLMOUTH BASS	MICROPTERUS	DOLOMIEU
SPD	SPECKLED DACE	RHINICHTHYS	OSCULUS
STB	STRIPED BASS	MORONE	SAXATILIS
SUC	UNIDENTIFIED SUCKER	N/A	N/A
TAD	TADPOLE		
TFS	THREADFIN SHAD	DOROSOMA	PETENENSE
USU	UTAH SUCKER	CATOSTOMUS	ARDENS
UTC	UTAH CHUB		
VRC	VIRGIN RIVER CHUB	GILA	SEMINUDA
VSD	VIRGIN SPINEDACE	LEPIDOMEDA	MOLLISPINIS
WAL	WALLEYE		
WOU	WOUNDFIN	PLAGOPTERUS	ARGENTISSIMUS
WSU	WHITE SUCKER	CATOSTOMUS	COMMERSONII
YBH	YELLOW BULLHEAD	AMEIURUS	NATALIS
YPE	YELLOW PERCH	PERCA	FLAESCENS

Consultation Species or Critical Habitat

Potential impacts from the proposed action to candidate and listed species are described below. Please refer to Chapter 4 for a detailed description of the nature of the impacts (which may include predation, competition for space and food, and hybridization etc.).Subsequent responses (resulting from the frequency, magnitude and duration of the impacts) between proposed stocked and candidate and listed species, and any site or complex factors that provide context for determining the meaningfulness of the impacts, are discussed below. Impacts from the proposed action resulting from angler related recreation and/or potential introduction of disease, pathogen or invasive species are evaluated at a broad scale for the entire action area and are described in Chapter 4. If potential impacts specific to a stocking site or complex have been identified they are discussed below.

Chiricahua and northern leopard frog effects analysis was provided for both the site specific and broad-scale analysis within each complex analysis previously and will not be discussed in this section because there is no likelihood for their occurrence in the lower portion of the Little Colorado River.

Humpback Chub and Critical Habitat

The Little Colorado River between its confluence with the Colorado River and Atomizer Falls, 15.5 km (9.63 miles) upstream of the confluence, is critical habitat for the largest spawning aggregation of the endangered humpback chub in the Grand Canyon. Because of the importance of this reach, intensive fish sampling has occurred for over three decades in this reach. Humpback chub have been documented historically in the LCR below Atomizer and Chute falls. More recently, translocations of young chub and natural movement of marked chub have resulted in their occurrence above Chute Falls.

Critical habitat is designated in the Colorado River from Nautiloid Canyon to Granite Park in the Grand Canyon. Critical Habitat is designated in the Little Colorado River from river mile 8 (below Atomizer Falls) downstream to the confluence with the Colorado River. Known constituent elements include water, physical habitat, and biological environment as required for each particular life stage for each species. Biological environment is the only aspect of Critical Habitat with potential to be affected.

Potential impacts

The stocking of the proposed 12 non-native species within the Little Colorado River Basin has coincided with intensive sampling of the Lower Colorado River since 1977. Data from these efforts provide no evidence that stocked species have survived and been transported into humpback chub critical habitat. While possible, it is unlikely that these species survive the violent turbid floods and immense drop at Grand Falls. If humpback chub in the lower Little Colorado River or the Colorado River were exposed to fish stocked upstream in the Little

Colorado River watershed potential impacts could include predation of on small size classes of humpback chub and competition of all size classes of humpback chub with adult stocked fish and any progeny of stocked fish.

Although the proposed species have been stocked in the Little Colorado River Basin for over three decades during which the lower Little Colorado River has been intensely sampled, there is no evidence of movement of the 12 proposed stocked fish species from the 47 reservoirs and 4 streams to the Lower Little Colorado River downstream of Grand Falls. Of the 12 species proposed for stocking in the Little Colorado River watershed, only 6 species (channel catfish, largemouth bass, bluegill, redear sunfish, rainbow trout and brown trout) are stocked in the drainages where escapement is a likely possibility (Table 36).

Any stocked fish surviving the approximately 70–150 mile journey from stocked locations to the lower Little Colorado River would be subject to heavily sediment-laden floods and the drop over Grand Falls (191 ft. tall). It is unlikely that any salmonids, bluegill sunfish, redear sunfish, or largemouth bass could survive the journey, and it is likely that few if any channel catfish survive.

Table 36. Stocking complex summary information. Proposed fish species with biological life histories that may have a higher potential for transport, exposure, and potential impacts to humpback chub in the lower LCR are highlighted.

Stocking Complex	Number of waters	Species Proposed for Stocking	Connectivity	Reservoirs with proposed species of concern
West Fork LCR Complex	6 reservoirs + 2 stream reaches	ONAP, ONMY, THAR	Open	
LCR above Lyman Complex	6 reservoirs	ONAP, ONMY, THAR	Open	
Upper LCR Complex	2 reservoirs	ONMY, MISA, LEMA, ICPU	Closed system	
Schoen's Dam Complex (proposed stocking locations in Schoen's and White Mountain complexes both flow into Silver Creek)	6 reservoirs + 1 stream reach	ONMY, ONCL, SAFO, LEMA, ONAP, ICPU, MISA	Open	**Woodland:** ICPU, LEMA, ONMY **Rainbow:** ONMY, ICPU, LEMA, (MISA - protocol/catastrophic) **Show Low:** ONMY, SAFO, ONCL, ONAP, ICPU, (LEMA - protocol/catastrophic) **Fools Hollow:** ONMY, ONAP, ONCL, SAFO, ICPU Scott's Reservoir: ONMY, ICPU, LEMA Show Low Creek : ONMY Mountain Meadow : ONMY, LEMA
White Mountain Complex (proposed stocking locations in Schoen's and White Mountain complexes both flow into Silver Creek)	4 reservoirs + 1 stream	ONMY, ONAP, ICPU	3/5 closed (Only Little Mormon Lake & Silver Creek are open)	Little Mormon Lake: ICPU Silver Creek: ONAP, ONMY
Chevelon Creek Complex & Black Canyon Lake	5 reservoirs	ONMY, SAFO, THAR	Open	
Clear Creek Complex &	4 reservoirs	ONMY, THAR	Open	

Stocking Complex	Number of waters	Species Proposed for Stocking	Connectivity	Reservoirs with proposed species of concern
Clear Creek Reservoir				
Jacks Canyon Complex	4 reservoirs	ONMY, MISA, ICPU, LEMA, PEFL, SAVI, LEMI	Most likely a Closed system	
Canyon Diablo Complex	6 reservoirs	ONMY, ICPU, SATR, SAFO, THAR, ONCL, LEMA, LEMI, MISA	2/6 closed (only Ashurst / Coconino lakes are closed)	**Mud Lake:** ONMY, ICPU **Kinnikinick Lake:** ONMY, ICPU, SATR, SAFO, THAR, ONCL **Morton:** ONMY, ICPU **Frances Short:** ONMY, ICPU, LEMA, LEMI, MISA
Walnut Creek Complex (Walnut Creek is a closed system within the Canyon Diablo Complex)	5 reservoirs	ONMY, SAFO, THAR, ICPU, MISA, PEFL, LEMA, LEMI, SATR	Closed system	

Stone et al. (2007) describes the presence of red shiners, common carp, and black bullheads just downstream of Grand Falls and suggests that they originated from upstream. The interpretation of these data were based on the assumption that Atomizer and Chute falls were sufficient drops to act as upstream fish barriers. Since the time of that publication, five marked humpback chub have traveled upstream over these suspected fish barriers (Stone et al., 2009b). While some of the non-native species documented in the area above and below Chute Falls by Stone et al. (2007) may have originated from upstream and survived transport over the falls, it is also possible that they originated from downstream locations. Stone et al. (2007) did not find any of the 11 species proposed for stocking in the upstream watershed near Grand Falls when sampled in 2005. However, channel catfish and rainbow trout were known to occur above Chute Falls from prior surveys. It is possible that the catfish or rainbow trout moved downstream from stocked locations or remnant reproducing populations in the watershed, but equally possible that they came from known existing populations in the Little Colorado River by migrating over Chute Falls. Channel catfish might have migrated upstream over Chute Falls similar to the way the marked humpback were able. With respect to rainbow trout, it is possible they moved downstream over Chute Falls, but also possible that they have routinely migrated upstream over Chute Falls or come from rainbow trout lakes on the Navajo Reservation that join the LCR below Grand Falls where they would not have to traverse that 190 foot drop.

Stone et al. (2007) report on pools surveyed above and below Grand Falls in June and July of 2005 following flood flows during the previous winter. That report mentioned Clear Creek Reservoir (127 km upstream of Grand Falls) and Chevelon Creek (141 km above the falls) as presumably the closest sources of non-native fishes. Furthermore, of the 6 species stocked into open systems in this watershed, none were found by Stone et al. (2007) immediately above or below Grand Falls, and only 2, channel catfish and rainbow trout were found further downstream but above Chute Falls (presumably in the perennial reach between Blue Spring and Chute Falls). However, that report failed to identify other sources of non-native fishes downstream of Grand Falls such as those found in Moenkopi Wash watershed. On the Navajo Reservation, two lakes, White Mesa Lake and Cow Springs Lake are located approximately 88 km from the confluence of Moenkopi Wash and the Little Colorado River, entering the LCR downstream from Grand Falls. According to the Navajo Nation website, these lakes offered fishing opportunities for stocked rainbow trout and channel catfish as recently as 2009 and likely harbor other non-native fish species.

Only 3 of the 12 species proposed for stocking in this basin have been captured in the Lower Little Colorado River since 1977, these include rainbow trout, channel catfish, and brown trout. A self-sustaining population for each of these three species is found within the main channel of the Colorado River with easy access to occupied and critical habitat for humpback chub in the lower LCR up to and including Atomizer Falls. These self-sustaining populations are described below.

Rainbow trout

Rainbow trout have been stocked in the Grand Canyon since around 1930. Immediately after Lake Powell filled, rainbow trout were stocked below Glen Canyon Dam. Self-sustaining populations of rainbow trout persist throughout Glen, Marble, and Grand Canyons, and rainbow trout are most densely populated upstream of the confluence of the Colorado and Little Colorado Rivers (River Mile 61, Figure 45). Rainbow trout have been captured throughout the 15.5-km (9.63 mile) reach of the Lower Little Colorado River and were most frequently captured near its confluence with the Colorado River. Length histograms of rainbow trout provide no evidence of young rainbow trout in the Little Colorado River (Figure 46), suggesting there is no local recruitment or a self-sustaining population of rainbow trout in the Little Colorado River. It is most likely that all rainbow trout in the Little Colorado River originate from the self-sustaining population in the main channel of the Colorado River, which has both adult and young rainbow trout (Figure 47) because it is closer in proximity than locations proposed for trout stocking upstream in the Little Colorado River watershed, and has a constant connectivity to the Little Colorado River.

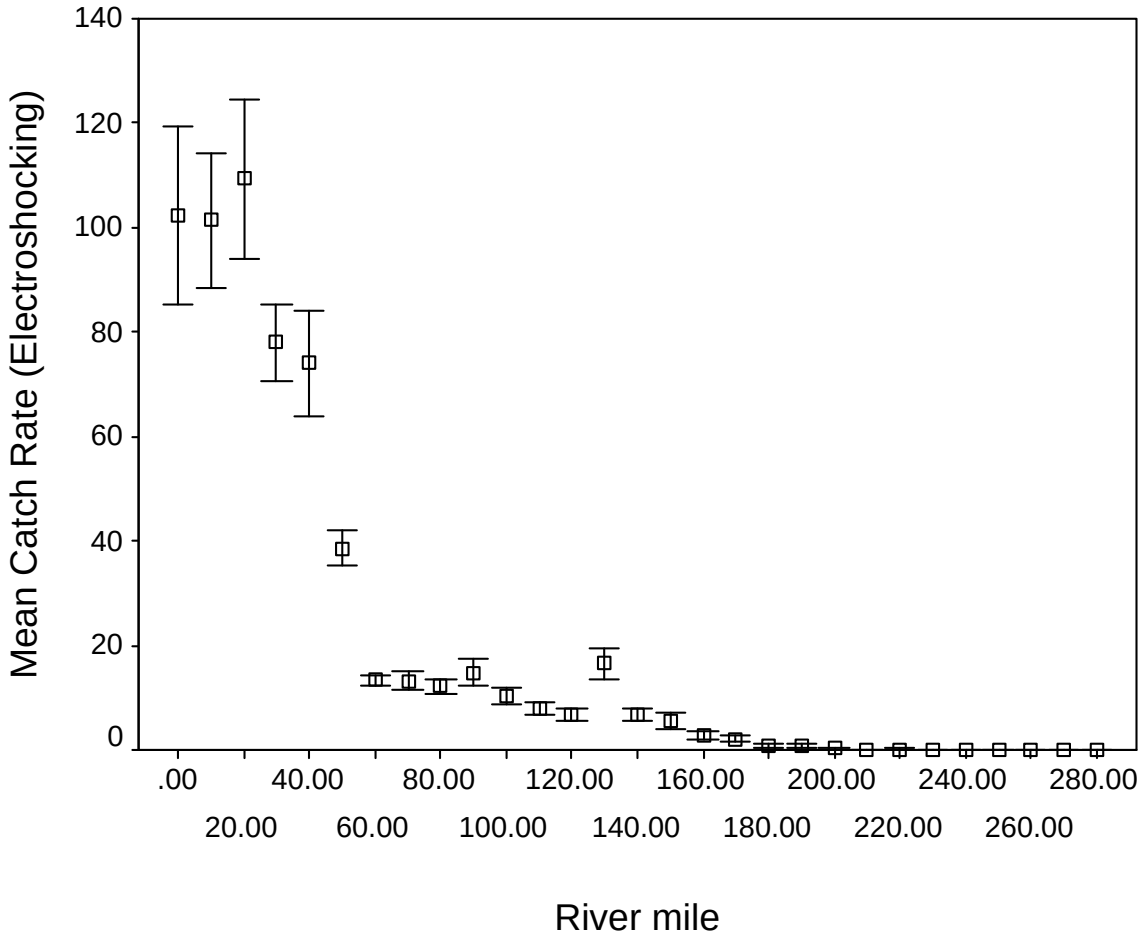

Figure 45. Rainbow trout mean catch per unit effort (electroshocking, fish/hour, 95% CI) by river mile in the Colorado River (Lees Ferry to Lake Mead 1991–2008). The Little Colorado River is located at river mile 61.

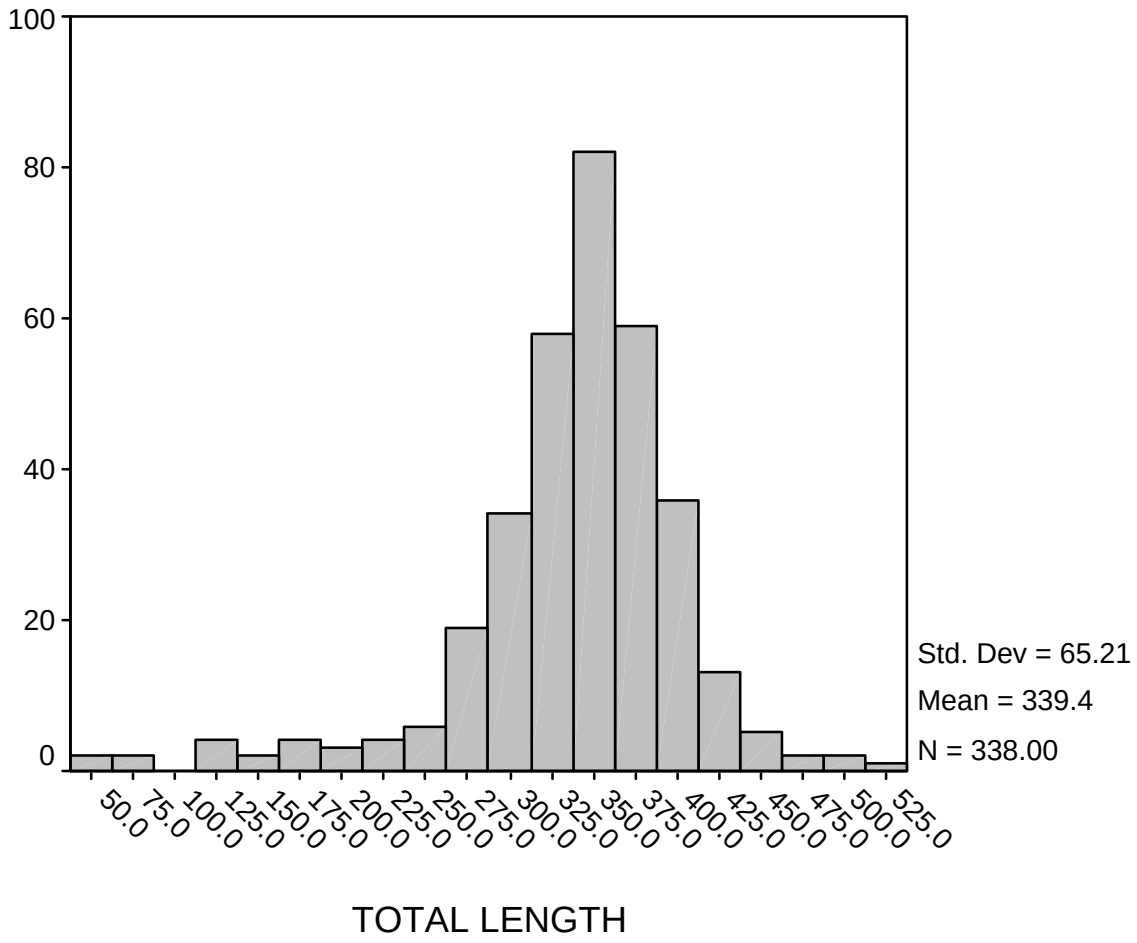

Figure 46. Length distribution of rainbow trout captured in the Lower Little Colorado River (1977–2008). The y-axis is the number of fish captured, and Total Length is measured in mm.

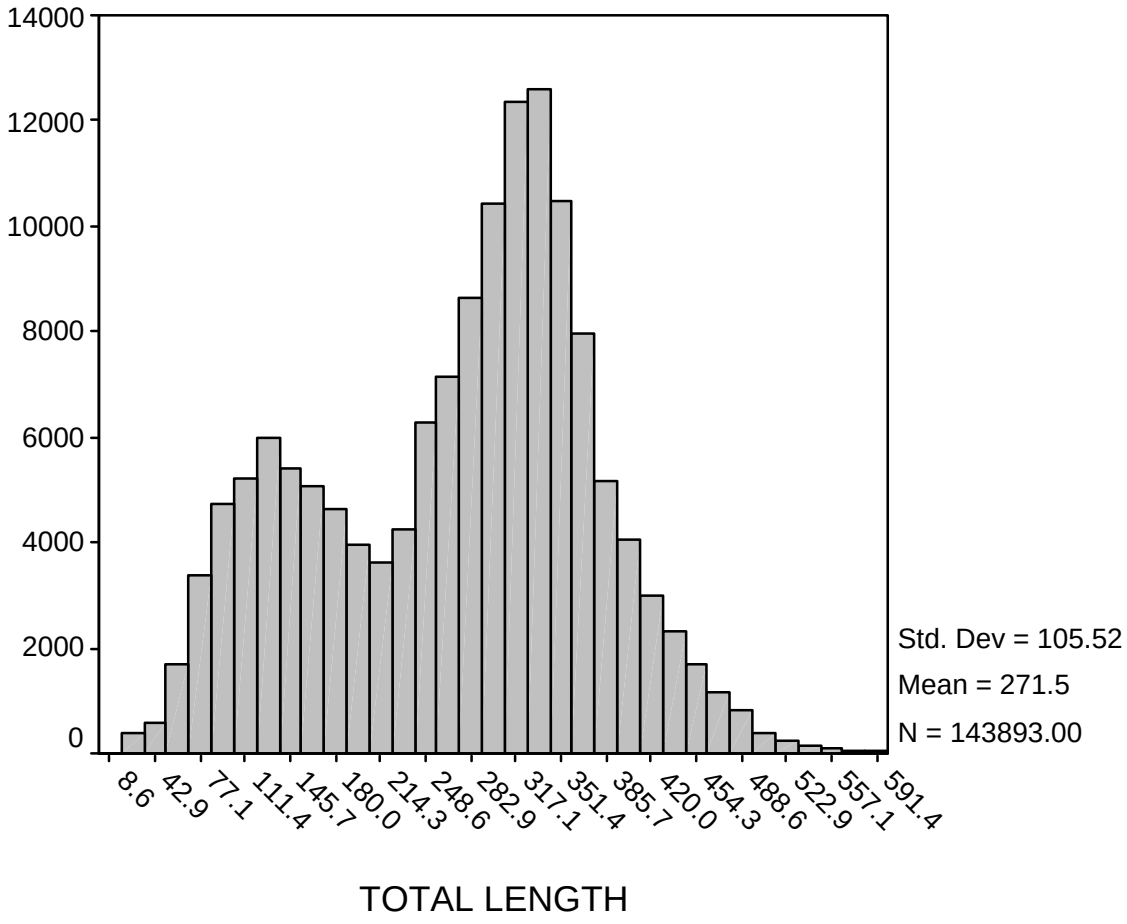

Figure 47. Length distribution of rainbow trout captured in the Colorado River (Lees Ferry to Lake Mead, 1991–2008). The y-axis is the number of fish captured, and Total Length is measured in mm.

Brown trout

Few brown trout have been captured in the Little Colorado River, and all but three of these were captured near the confluence of the Little Colorado and Colorado Rivers (Figure 48). Only one brown trout has been captured in the LCR since 1995. Brown trout were first stocked near Bright Angel Creek in 1923. Brown trout continue to be most densely populated in the Colorado River near Bright Angel Creek (River Mile 85, Figure 49). This area is located only 24 miles downstream of the confluence of the Colorado and Little Colorado Rivers, and it is likely that the few brown trout captured in the Little Colorado River originated in the main channel of the Colorado River or in Bright Angel Creek. Only one location not considered a closed system is proposed for stocking brown trout upstream in the little Colorado River watershed; Kinnikinick Lake in the Canyon Diablo drainage.

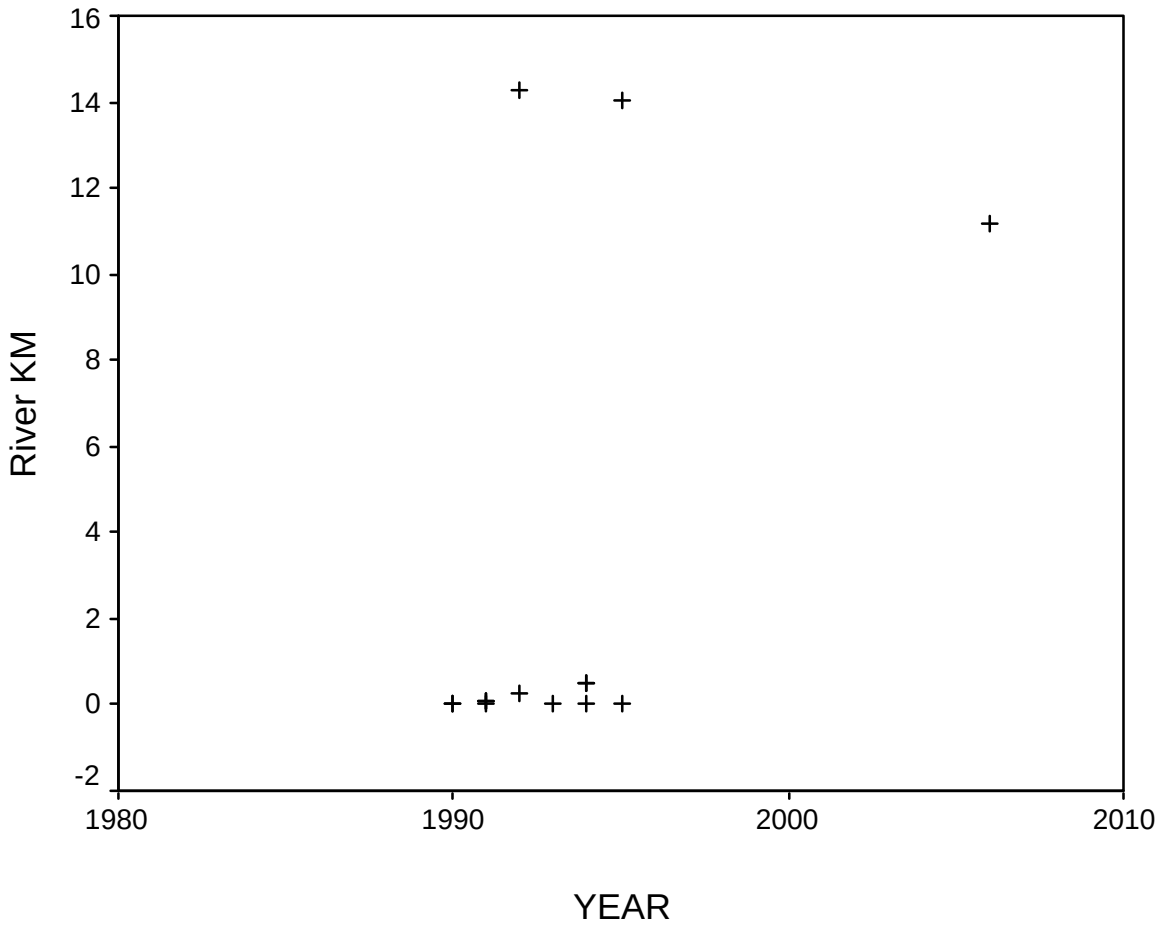

Figure 48. Distribution of brown trout captured in the Lower Little Colorado River. River KM 0 is the confluence of the Little Colorado and Colorado Rivers and River KM15.5 is at Atomizer Falls (1977-2008).

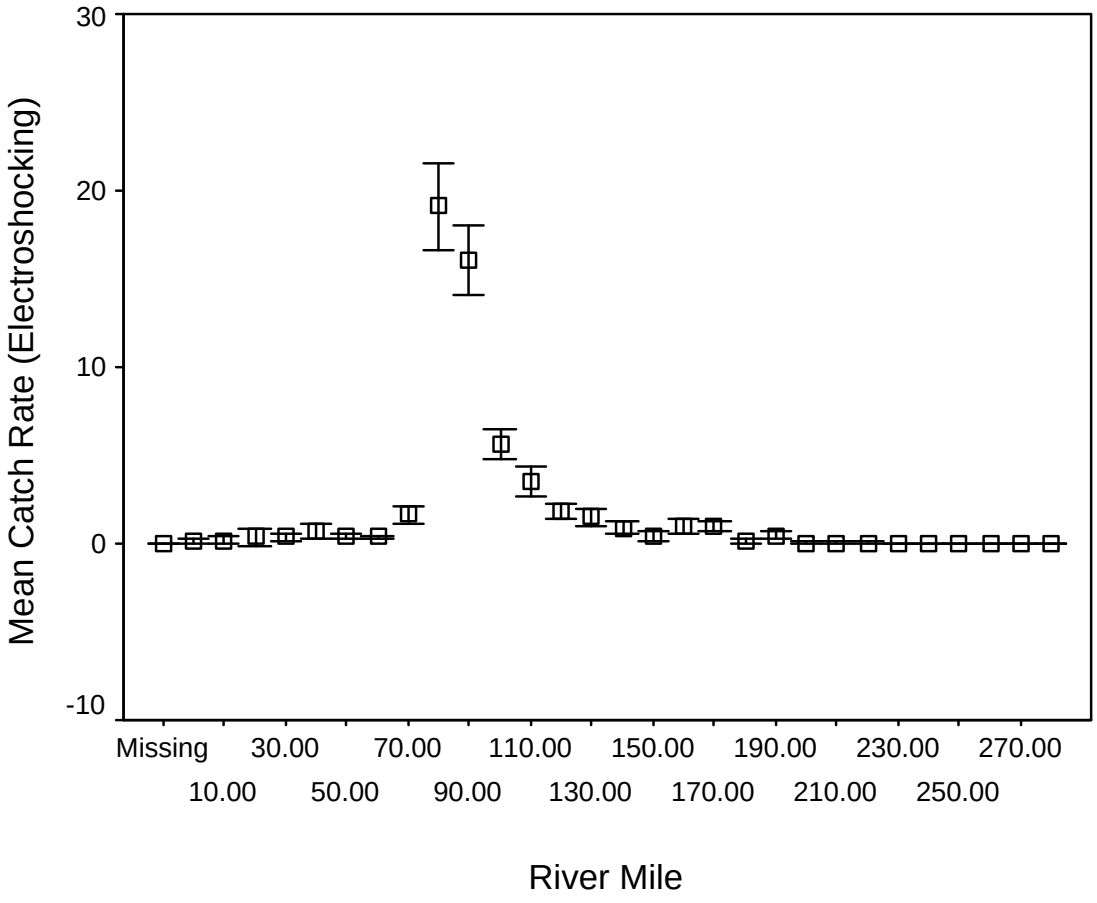

Figure 49. Brown trout mean catch per unit effort (electroshocking, fish/hour, 95% CI) by river mile in the Colorado River (Lees Ferry to Lake Mead, 1991-2008).

Bright Angel Creek is located near river mile 85 and the confluence of the Colorado and Little Colorado Rivers is located near river mile 61.

Channel Catfish

Channel catfish were likely one of the most abundant species in the Grand Canyon prior to the construction of Glen Canyon Dam. Over recent years, surveys suggest that channel catfish occur in relatively high abundances only in the Little Colorado River and downstream of river mile 170 in the Colorado River (Figure 50). Catfish have persisted in the Little Colorado River since at least the late 1970s and have been captured throughout the Little Colorado River from its confluence with the Colorado River to Atomizer Falls (Figure 51). Multiple cohorts have been witnessed over the years (Figure 52), suggesting that the Little Colorado River supports a self-sustaining population of channel catfish (Figure 53). It is likely that few if any channel catfish survive the floods and falls from the Upper and Middle Little Colorado River into the Lower

Little Colorado River. The self-sustaining population of channel catfish within the Lower Little Colorado River confounds any attempts to discern the presence or potential of downstream movement from our stocked location to the Lower Little Colorado River.

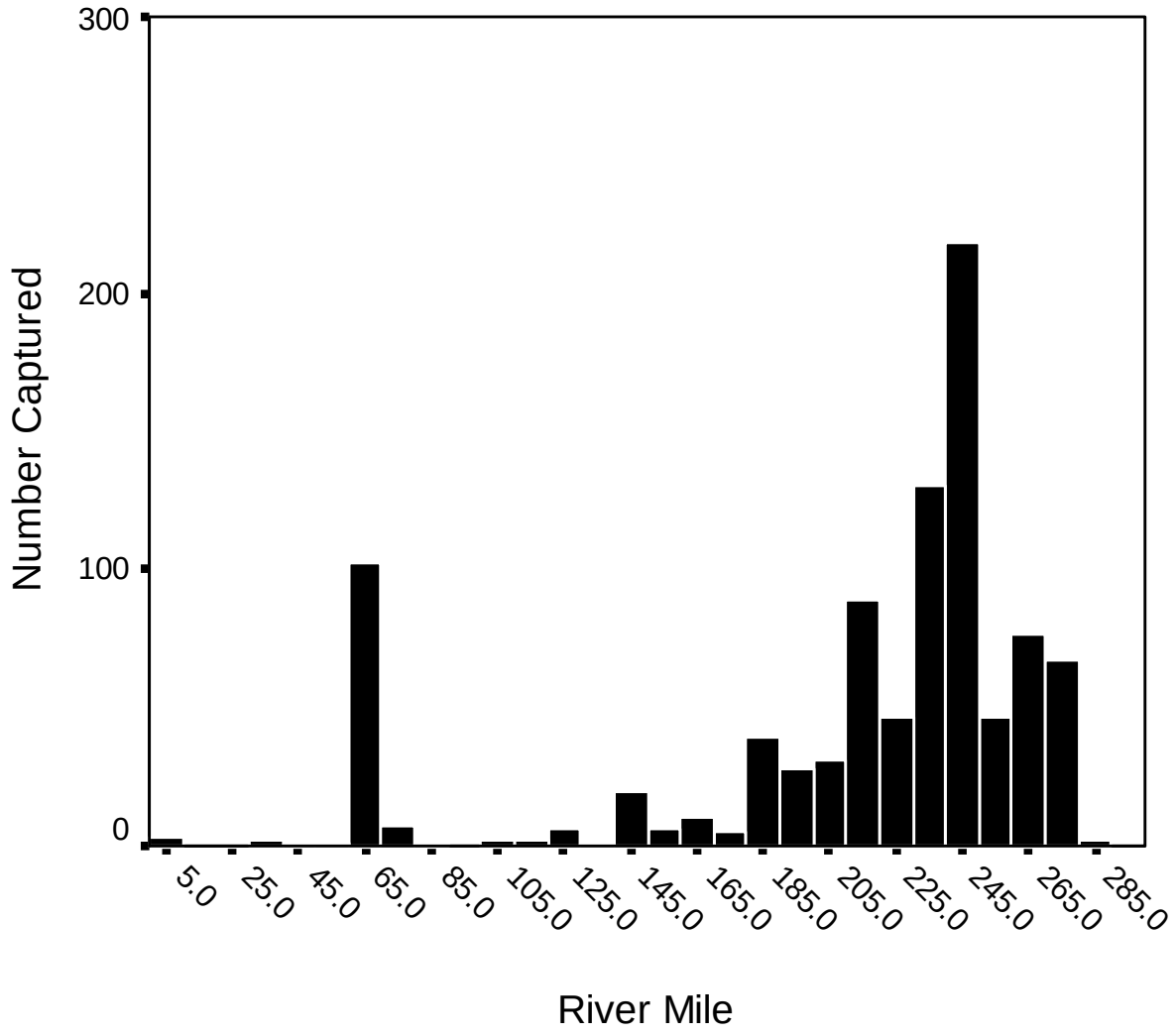

Figure 50. Total number of channel catfish captured in the Colorado River (Grand Canyon, 1998-2008)

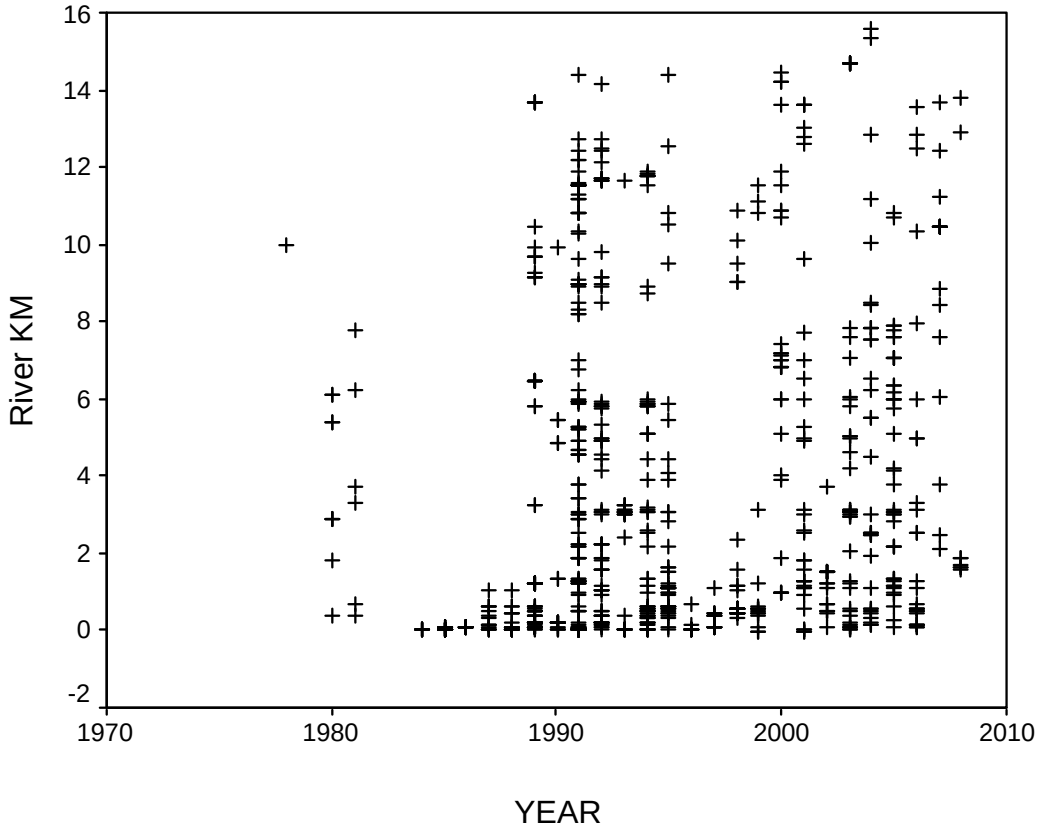

Figure 51. Distribution of channel catfish captured in the Lower Little Colorado River. River KM 0 is the confluence of the Little Colorado and Colorado Rivers and river KM 15.5 is at Atomizer Falls (1977-2008).

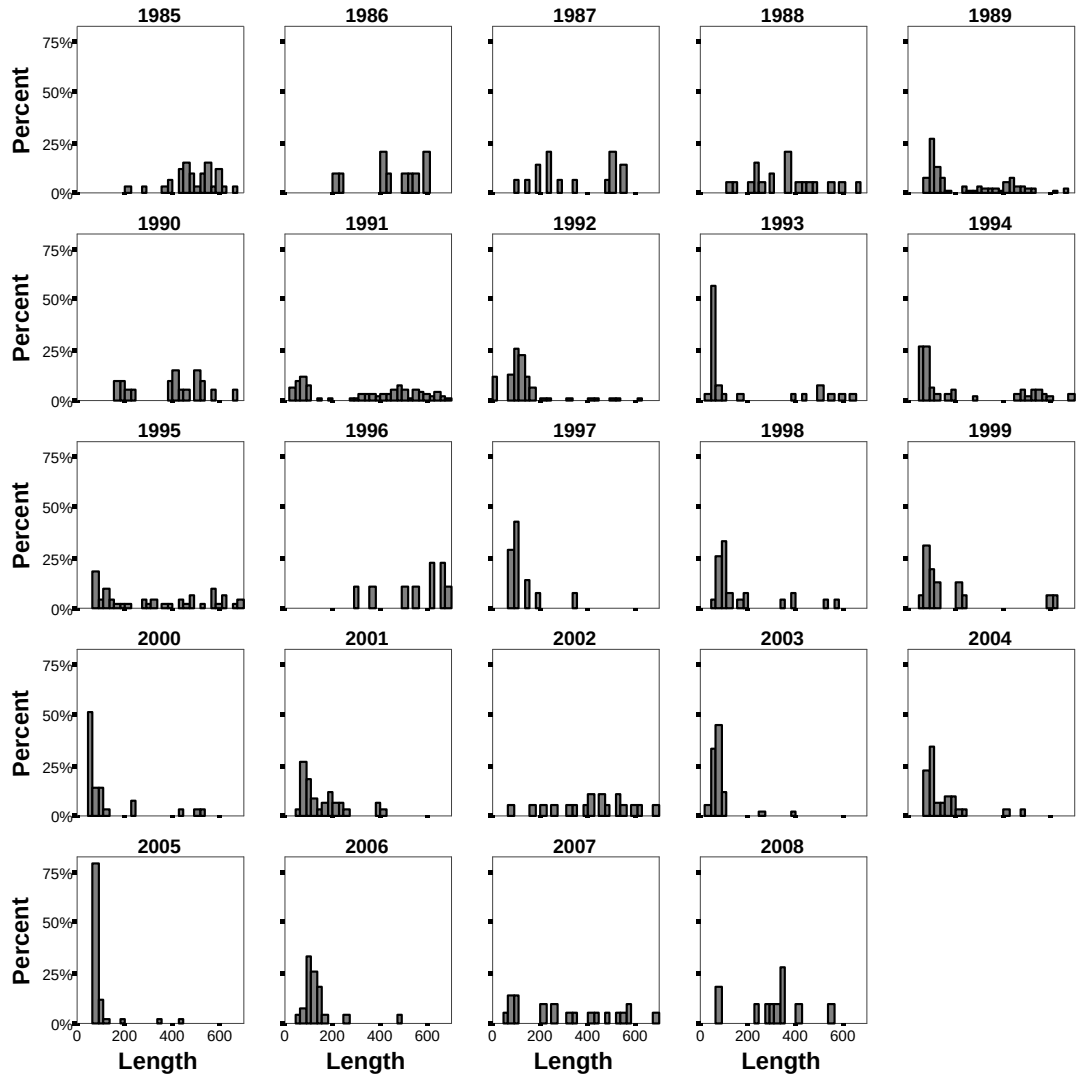

Figure 52. Length distribution of channel catfish captured in the Lower Little Colorado River by year (1985–2008).

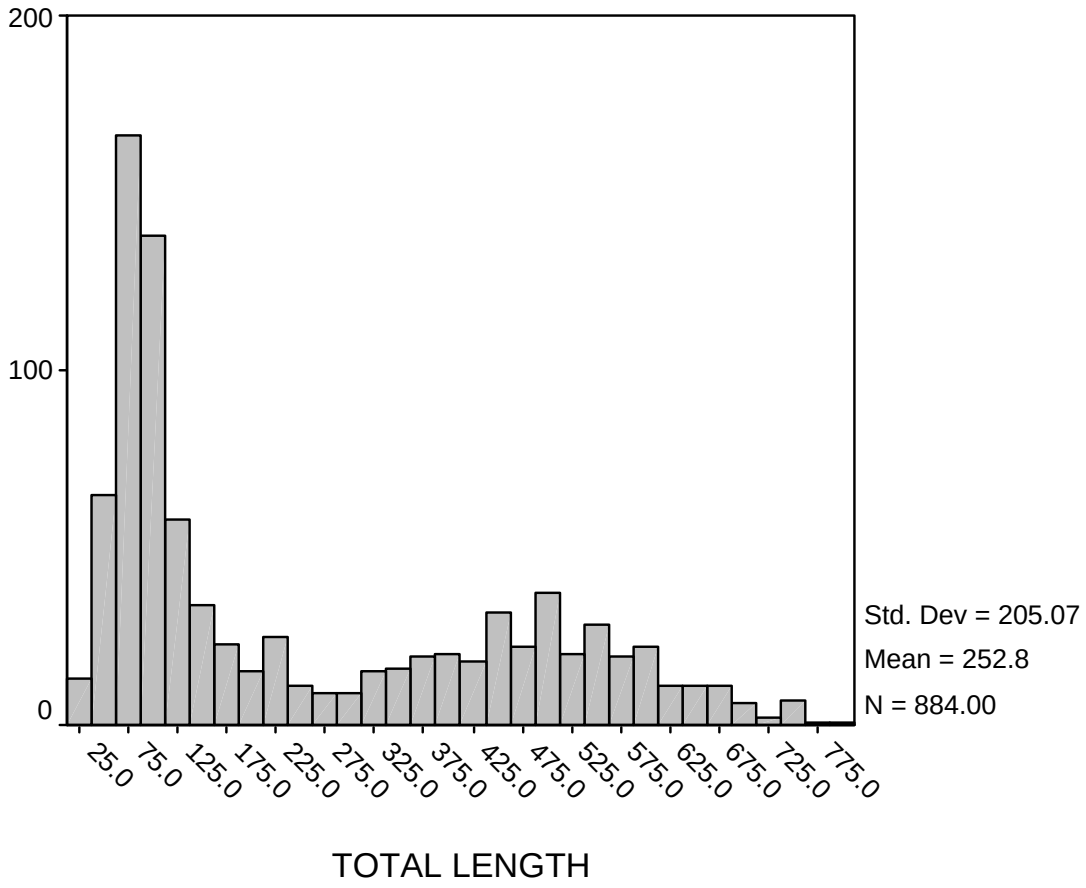

Figure 53. Length distribution of channel catfish captured in the Lower Little Colorado River (1977–2008).The y-axis is the number of fish captured, and Total Length is measured in mm.

Bluegill, Largemouth bass and Redear Sunfish

No bluegill, largemouth bass or redear sunfish have been captured in the lower Little Colorado River during intensive sampling over the past 32 years (Table 32). Nine sunfish have been captured in the lower Little Colorado River since 1977 and all have been identified as green sunfish. Green sunfish are not proposed for stocking by Arizona Game and Fish Department. It is unknown if green sunfish survive Grand Falls. No green sunfish have been captured immediately below Grand Falls (Stone et al., 2007). The green sunfish captured in the lower Little Colorado River may have originated from the main channel of the Colorado River. Green sunfish have been captured just downstream of Glen Canyon Dam over recent years (A. Makinster, pers. comm.) and have been documented in the Colorado River since 1978 (Table 34). Green sunfish may also have originated from watersheds within the Navajo Nation that spill into the Little Colorado River downstream of Grand Falls. Although green sunfish are numerous and

distributed throughout the Little Colorado River watershed, neither green sunfish nor the other centrarchid species have established populations in the lower Little Colorado River.

Critical Habitat

When Critical Habitat was designated for humpback chub, the Colorado River and lower Little Colorado River were already occupied by numerous species of non-native predatory and competitive fish species. The potential for transport of additional non-native fishes stocked in the upstream watershed might result in an immeasurable and incremental increase in the adverse effect to critical habitat that predation and competition impart. The potential for transport of parasites or pathogens that might affect humpback chub from the proposed stocking action in the watershed into critical habitat is similarly possible, but less likely to be measurable because the species proposed for stocking do not generally harbor the same or similar organisms as humpback chub because they are not cyprinids. Additionally, it would be impossible to determine if the occurrence of a new parasite or pathogen resulted from the existing baseline non-native or native fish assemblages or from the incremental and immeasurable effect of movement of stocked fish species. Potential increase in incidence or infestation rate of an existing parasite or pathogen is equally impossible to attribute to the stocking program as opposed to in situ increase from habitat or other environmental factors.