Upalco Unit Replacement Project

Central Utah Water Conservancy District

Draft Environmental Impact Statement

December 1996

December 27, 1996

Dear Reviewer:

This Draft Environmental Impact Statement (Draft EIS) on the proposed Upalco Unit/Uinta Basin Replacement Project was filed with the U.S. Environmental Protection Agency (EPA) on December 27, 1996, and is submitted here for your review and comment. The purpose of this public review is to receive your comments on the information presented in the Draft EIS. A Final EIS will be prepared considering the comments received and will be sent to those who have commented on the Draft EIS or who request a copy. The Final EIS may only include errata sheets and responses to comments; therefore, you should retain your copy of the Draft EIS.

Please submit your written comments so that they are received by March 4, 1997. Comments received by this date will be responded to in the Final EIS. Please make your comments as specific as possible and provide rationale or data to support your position. Comments will be most helpful if they address the inadequacies or inaccuracies in the impact analysis or methodologies used or if they identify new impacts or recommend reasonable new alternatives or mitigation measures that may have been overlooked.

Written comments on the Draft EIS should be addressed to:

R. Terry Holzworth, UBRP Project Manager
Central Utah Water Conservancy District
355 West 1300 South
Orem, UT 84058-7303

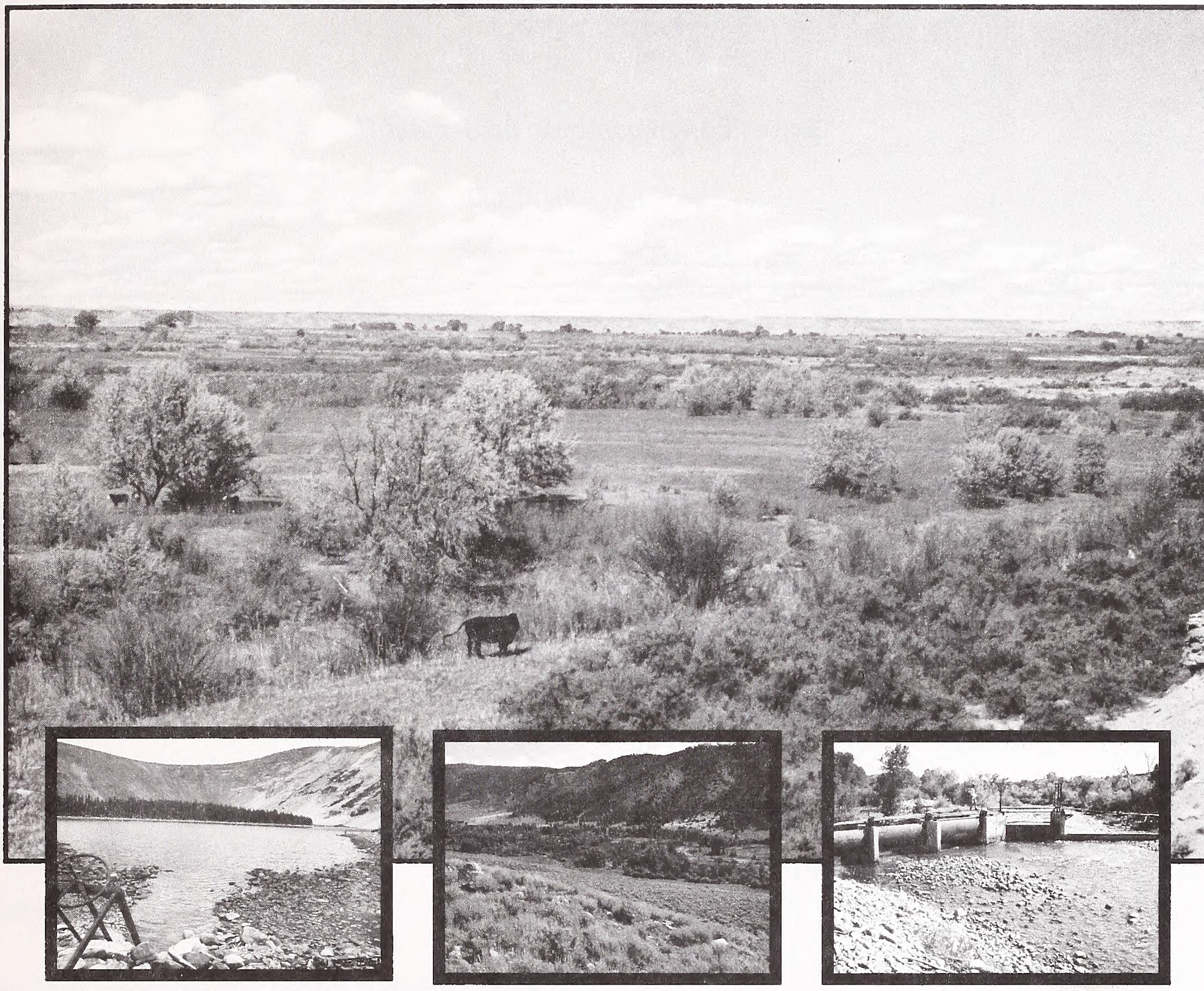
Comments on the Draft EIS may also be presented verbally or submitted in writing at a public hearing. Public hearings have been scheduled for Wednesday, February 5, 1997, at 6:00 p.m. in the Altamont High School Auditorium, Highway 87 (north side), Altamont, Utah; Thursday, February 6, 1997, at 6:00 p.m. in the Salt Lake County Commission Chambers, Room N1100, 2001 South State, Salt Lake City, Utah; and Tuesday, February 11, 1997, at 1:00 p.m. in the Ute Tribal Auditorium, Tribal Headquarters, Fort Duchesne, Utah. If you wish to give testimony at a hearing, please fill out a Public Hearings Registration Form (included at the end of the Draft EIS) and return it to our Orem office (listed on the form and above).

This Draft EIS contains information summarized from the following draft Technical Reports: Aquatic Resources, Cultural Resources, Water Resources, Wetland/Riparian Resources, Threatened and Endangered Species, Environmental Contaminants, and Wildlife Resources. Please send Public Hearings Registration Forms and/or requests for copies of the Technical Reports or Draft EIS to: Nancy Hardman, CUWCD, 355 West 1300 South, Orem, UT 84058-7303, Phone (801) 226-7187, Fax (801) 226-7150.

Sincerely,

R. T. Holzworth

R. Terry Holzworth, UBRP Project Manager
Central Utah Water Conservancy District



Upalco Unit Replacement Project

Central Utah Water Conservancy District (lead agency)
U.S. Department of the Interior (joint-lead agency)

Draft Environmental Impact Statement

CUP
CENTRAL UTAH WATER CONSERVANCY DISTRICT
COMPLETION ACT

December 1996

Cover Sheet

Upalco Unit Replacement Project

(X) Draft   ( ) Final

Joint Lead Agencies

Central Utah Water Conservancy District
U.S. Department of the Interior

Cooperating Agencies

U.S. Bureau of Indian Affairs
U.S. Department of Army, Corps of Engineers
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Department of Agriculture, Forest Service
U.S. Department of Agriculture, Natural Resources Conservation Service
Ute Indian Tribe

Counties that Could be Affected

Duchesne and Uintah, Utah

Abstract

This Draft Environmental Impact Statement (Draft EIS) covers the federally proposed Upalco Unit/Uinta Basin Replacement Project in Duchesne and Uintah counties, Utah. There is a need to manage the water supply within the Upalco Unit to develop resources of the Ute Indian Tribe of the Uintah and Ouray Reservation, provide early and late season irrigation water, provide municipal water supplies, and provide water and facilities for environmental and recreation purposes. The Proposed Action (Talmage) and its alternatives (Cow Canyon, Crystal Ranch, Twin Pots) would meet these needs to varying degrees by providing water storage, improved distribution of water, water conservation, municipal and industrial water, instream flows, fish and wildlife enhancements, and recreation development. The No Action Alternative would not meet any of these needs. Major environmental issues involve the following resource topics: sociocultural, socioeconomics, agriculture, water and water quality, aquatics, wetlands, wildlife, threatened and endangered species, cultural, recreation, and visual.

Other Requirements Served

This Draft EIS is intended to serve other environmental review and consultation requirements pursuant to 40 CFR 1502.25(a).

Draft EIS Contact

Comments on this Draft EIS should be directed to:

R. Terry Holzworth, UBRP Project Manager
Central Utah Water Conservancy District
355 West 1300 South
Orem, Utah 84058-7303

Date Draft EIS Made Available to EPA and the Public:

December 27, 1997

Date by Which Comments on the Draft EIS Must be Received to be Considered in the Preparation of the Final EIS:

March 4, 1997

U.S. Department of the Interior

Draft
Environmental Impact Statement
on the
Upalco Unit Replacement Project

Prepared by
Central Utah Water Conservancy District
December 1996

Don A. Christiansen, General Manager
Central Utah Water Conservancy District

Ronald Johnston, CUPCA Program Director
U.S. Department of the Interior

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Summary

The following sections summarize each chapter of the Upalco Unit Replacement Project Draft Environmental Impact Statement (Draft EIS). This summary provides a general overview of project purpose and need, describes the Proposed Action and alternatives, discusses major impact conclusions and compares major impact differences for key resources between the Proposed Action and alternatives, and lists key coordination and consultation activities. This summary also describes the Preferred Alternative and key resource issues raised during public scoping.

S.1 Chapter 1—General Overview

S.1.1 Introduction

The Upalco Unit Replacement Project consists of a proposal to construct a combination of features that will develop water supplies for the Upalco Unit of the Central Utah Project (CUP) in the Uinta Basin of northeastern Utah. The features include water storage reservoirs, improved diversion and distribution of water, water conservation, stabilization of high mountain lakes, instream flows, fish and wildlife mitigation and enhancements, recreation developments, and land retirement.

This project responds to Public Law 102-575, Reclamation Projects Authorization and Adjustment Act of 1992, which was signed by the President on October 30, 1992. Titles II through VI, known as the Central Utah Project Completion Act (CUPCA), transferred the responsibility for completing the CUP from the U.S. Bureau of Reclamation (USBR) to the Central Utah Water Conservancy District (CUWCD).

S.1.2 Purpose and Need

There is a need to manage the water supply within the Upalco Unit to develop resources of the Ute Indian Tribe of the Uintah and Ouray Reservation, provide early and late season irrigation water, provide municipal water supplies, and provide water and facilities for environmental and recreation purposes. The Proposed Action and its alternatives seek to meet these needs by providing water storage, improved distribution of water, water conservation, municipal and industrial water, instream flows, fish and wildlife enhancements, and recreation developments.

The purposes of the Proposed Action and alternatives are as follows:

- To assist the Ute Tribe in the management and use of its water resources
- To deliver water to match agricultural plant consumptive use and instream flow needs
- To facilitate improved water resource management in the Uinta Basin
- To minimize impacts of irrigation operation of high mountain lakes on wilderness values
- To facilitate water conservation in the Uinta Basin
- To provide 3,000 acre-feet of water per year to the City of Roosevelt for municipal and industrial use
- To protect and enhance environmental, fish and wildlife, and recreation resources

S.2 Chapter 2—Description of the Proposed Action and Alternatives

S.2.1 Proposed Action—Talmage

Map 2-1 (see Chapter 2 of the Draft EIS) shows the locations of specific features of the Proposed Action. Table 2-1 (see Chapter 2) lists specific features of the Proposed Action and each action alternative. Project features of the Proposed Action are summarized below.

S.2.1.1 Dams and Reservoirs

Crystal Ranch Dam and Reservoir would be constructed on the Yellowstone River, and the existing offstream Big Sand Wash Dam and Reservoir would be enlarged. The water storage capability and water supply regulation of these reservoirs would increase the amount and delivery of the available surface water supply for irrigation to better match crop irrigation requirements. For Indian (1861) water rights, average annual irrigation water supplies would increase from 42,093 acre-feet under baseline (existing) conditions to 51,323 acre-feet with the project, an increase of 9,230 acre-feet. For secondary water rights, average annual irrigation water supplies would increase from 95,301 acre-feet under baseline conditions to 105,579 acre-feet with the project, an increase of 10,278 acre-feet. Dam and reservoir operations would also provide minimum instream flows in selected reaches of the Yellowstone and Lake Fork Rivers, 3,000 acre-feet of municipal and industrial water for the City of Roosevelt each year, and reservoir conservation pools for successful over-winter fish survival.

Crystal Ranch Reservoir would have a total active storage capacity of 24,000 acre-feet and be located on Tribal, National Forest, and private lands. Reservoir storage space allocations would include 9,550 acre-feet for use by the Ute Tribe, 2,400 acre-feet for the conservation pool, 2,500 acre-feet for high mountain lakes storage replacement, 150 acre-feet for non-Indian-owned 1861 water-righted lands, and 9,400 acre-feet for secondary water-righted lands. During an average water year, reservoir elevation and storage would be highest in June and lowest in September; water levels would fluctuate 24 feet, remaining well above the conservation pool elevation. Minimum instream flow releases provided in the Yellowstone River would be 56 cubic feet per second (cfs) April through September and 24 cfs October through March. Normal project operation would provide the required minimum flows except for periods during very dry years.

Big Sand Wash Reservoir would be enlarged 9,000 acre-feet, raising its total active storage capacity to 21,000 acre-feet. The enlarged reservoir would be on private and State lands. Reservoir storage space allocations would include 1,200 acre-feet for the conservation pool, 3,000 acre-feet for City of Roosevelt municipal and industrial purposes, and 16,800 acre-feet (6,000 acre-feet more than currently available) for the Moon Lake Water Users Association. Water for the City of Roosevelt would be made available by exchanging 3,000 acre-feet from Big Sand Wash Reservoir with 3,000 acre-feet from the Uinta River. During an average water year, reservoir elevation and storage would be highest in April and lowest in August; water levels would fluctuate 74 feet but would remain well above the conservation pool elevation.

S.2.1.2 Diversion Dams

Five existing diversion structures would be replaced with new diversion dams, and one new diversion structure would be built. They include the Yellowstone Feeder/Payne diversion on the Yellowstone River and the U.S. Lake Fork, Boneta, "C" Canal, and South Boneta diversions and the new Big Sand Wash Feeder Pipeline diversion on the Lake Fork River. The new diversion dams would provide permanent structures and improved control of water diversions made for irrigated agriculture. Their permanent nature would reduce streambed disturbances presently resulting from the annual construction and/or maintenance of diversion dams. The diversion dams would be designed to provide upstream passage for juvenile and adult fish throughout the year. Fish screens would be provided at the canal inlet structures to prevent the movement of juvenile and adult fish from the river into irrigation canals.

S.2.1.3 Canal Rehabilitation

Seven canal laterals would be rehabilitated. They include Farnsworth Canal Laterals No. 1, No. 2, and No. 3, and the Ottosen, Blackburn, Anderson, and Tony Smith Laterals. Canal rehabilitation would consist of constructing pipelines primarily within existing canal right-of-ways. In total, 22.3 miles of pipeline would be placed in existing canals and 1.2 miles would be placed in new right-of-way. The Farnsworth Lateral No. 1 diversion and the first 2.7 miles of this lateral would be abandoned. Rehabilitation and abandonment of these unlined canal reaches would increase the project water supply by reducing the amount of water lost to evaporation, evapotranspiration, and canal seepage.

A wetland maintenance system would be designed to preserve 83 acres of wetlands that have developed along existing canals where there is a water source from canal leaks. The water for maintenance of wetlands would come from water savings realized as a result of canal rehabilitation and land retirement. Maintaining a sufficient water supply to wetlands and riparian areas dependent on canal seepage is a mitigation action required for canal rehabilitation.

S.2.1.4 Pipelines

The new Big Sand Wash Feeder Pipeline would deliver additional reregulated flows from the Lake Fork River to the enlarged Big Sand Wash Reservoir for irrigation delivery and for storage of municipal and industrial water for the City of Roosevelt. The new 39-inch-diameter pipeline would begin at the proposed Big Sand Wash Feeder Pipeline diversion structure on the Lake Fork River and extend 6.4 miles to the inlet structure at Big Sand Wash Reservoir.

S.2.1.5 High Mountain Lakes Stabilization

Ten high mountain lakes in the upper Yellowstone River watershed and within the High Uintas Wilderness (HUW) would be stabilized. They include Bluebell, Drift, Five Point, Superior, Milk, Farmers, East Timothy, White Miller, Deer, and Water Lily Lakes. These lakes were modified in the early to mid-1900s to store additional water during the winter and spring for subsequent release during the summer for irrigation. Stabilization of high mountain lakes would maintain constant lake water levels year-round. Consequently, streamflows originating in the upper watershed would be uncontrolled and follow natural runoff patterns; intrinsic and recreational values within the HUW would be enhanced; fish habitat and water quality would be improved; and impacts from annual dam maintenance operations in the wilderness area would be eliminated.

S.2.1.6 Fish and Wildlife

Fish- and wildlife-related activities would include five enhancements and five mitigation measures designed to replace, improve, and/or enhance fish and wildlife habitat affected by the project. The five fish and wildlife enhancements are summarized below.

- Stream improvement—A combination of instream fishery habitat improvement structures, bank stabilization structures, and riparian vegetation establishment would be implemented on 5 miles of the Lake Fork River and 2 miles of the Yellowstone River.

- Big game winter range improvement—New water sources would be provided and vegetation would be improved on the 11,500-acre Towanta Flats site and the 13,300-acre Monarch Bench site.

- Habitat acquisition—All or a portion of 15,480 acres in the Red Rocks area northwest of Farm Creek Pass (or equivalent habitat in the Duchesne River drainage) would be acquired and managed for wildlife values and riparian corridor protection.

- Clay Basin Settlement Pond fish enhancement—The pond would be deepened, fish habitat structures placed, and a flow of 3 cfs provided from May through October. Also, waterfowl habitat would be provided and angler access to the pond would be improved.

- Twin Pots Reservoir improvement—The existing Twin Pots Dam would be replaced with a new stabilized dam and reservoir with a total active storage capacity of 3,241 acre-feet. Reservoir water would provide long-term storage primarily for fish (recommended conservation pool depth of at least 15 feet) and wildlife enhancements and recreation activities, but it also may be used by the Ute Tribe for irrigation.

The five fish and wildlife mitigation measures are summarized below.

- Instream flows and fish habitat—Minimum instream flows would be provided for several affected reaches of the Yellowstone and Lake Fork Rivers downstream of Crystal Ranch Dam to maintain fish habitat and to prevent fish population limiting events that now occur during dry years and the nonirrigation season.

- Wildlife habitat/wetland mitigation—Strategies would be implemented to mitigate project-induced impacts on wildlife habitat. Habitat improvement and habitat development measures would be implemented on 1,367 acres while potential impacts on 83 acres on wetlands and riparian communities would be avoided.

- Fish stocking program—Crystal Ranch Reservoir would be stocked annually with fingerling trout (most likely rainbow trout or Colorado River cutthroat trout) and managed as a put-grow-and-take fishery. The Yellowstone/Lake Fork drainage downstream of Crystal Ranch Dam would be stocked appropriately.

- High mountain lakes fish habitat—Stabilization of high mountain lakes would encourage the growth of submerged aquatic plants around the lake perimeter, which would further stabilize shoreline sediments and provide fish habitat. Fish stocking programs would remain the same as at present.

- Fish passage—The new diversion dams would be designed to provide passage for juvenile and adult fish throughout the year.

S.2.1.7 Recreation Developments

Recreation developments would create and improve recreational facilities and opportunities. They would consist of minimum basic facilities for environmental protection, which includes the Crystal Ranch Campground recreation replacement and development, and enhancements, which include Forest Service (FS) campground upgrades. The new Crystal Ranch Campground would be on Tribal land about 2 miles downstream of the proposed Crystal Ranch Reservoir. It would have a day-use area with picnic tables, a toilet, and group and family camping areas. In addition, fish habitat improvement structures would be placed in the Yellowstone River adjacent to the new campground as part of the stream improvement program to improve the fishery and benefit anglers at the campground.

Project-associated visitation increases to Ashley National Forest campgrounds along or near the Lake Fork/Yellowstone Rivers may further tax already overextended FS facilities and personnel. Therefore, efforts to upgrade campgrounds may include the following: rebuild all units within each campground site to the latest standards; replace all toilets with two-unit brick buildings; construct new water systems; and reconstruct and surface interior campground roads and spurs.

S.2.1.8 Land Retirement

Water rights would be acquired on about 1,300 acres of currently irrigated, secondary water-righted lands, making available about 3,300 acre-feet of water that would become part of the project water supply. This would increase the amount of water available for project purposes, including irrigation, instream flows, and water quality improvement in the lower Lake Fork River.

S.2.2 Cow Canyon Alternative

Map 2-11 (see Chapter 2 of the Draft EIS) shows the locations of specific features of the Cow Canyon Alternative. Project features of this alternative are summarized below.

S.2.2.1 Dams and Reservoirs

Upper Yellowstone Dam and Reservoir would be constructed on the Yellowstone River and the existing offstream Big Sand Wash Dam and

Reservoir would be enlarged. The water storage capability and water supply regulation of these reservoirs would increase the amount and delivery of the available surface water supply for irrigation to better match crop irrigation requirements. For Indian (1861) water rights, average annual irrigation water supplies would increase from 42,093 acre-feet under baseline conditions to 51,273 acre-feet with the project, an increase of 9,180 acre-feet. For secondary water rights, average annual irrigation water supplies would increase from 95,301 acre-feet under baseline conditions to 105,529 acre-feet with the project, an increase of 10,238 acre-feet. Dam and reservoir operations would also provide minimum instream flows in selected reaches of the Yellowstone and Lake Fork Rivers, 3,000 acre-feet of municipal and industrial water for the City of Roosevelt each year, and reservoir conservation pools for successful over-winter fish survival.

Upper Yellowstone Reservoir would have a total active storage capacity of 25,000 acre-feet and be located on National Forest land. Reservoir storage space allocations would include 10,000 acre-feet for use by the Ute Tribe, 2,500 acre-feet for the conservation pool, 2,500 acre-feet for high mountain lakes storage replacement, 150 acre-feet for non-Indian-owned 1861 water-righted lands, and 9,850 acre-feet for secondary water-righted lands. During an average water year, reservoir elevation and storage would be highest in February and lowest in September; water levels would fluctuate 40 feet, remaining well above the conservation pool elevation. Minimum instream flow releases provided in the Yellowstone River would be 56 cfs April through September and 24 cfs October through March. Normal project operation would provide the required minimum flows except for periods during very dry years.

Big Sand Wash Reservoir would be enlarged 9,000 acre-feet with the storage allocated the same as described for the Proposed Action.

S.2.2.2 Diversion Dams

Diversion dams would be identical to the Proposed Action.

S.2.2.3 Pipelines

The Big Sand Wash Feeder Pipeline would be identical to the Proposed Action.

S.2.2.4 High Mountain Lakes Stabilization

High mountain lakes stabilization would be identical to the Proposed Action.

S.2.2.5 Fish and Wildlife

Fish- and wildlife-related activities would include two enhancements and five mitigation measures designed to replace, improve, and/or enhance fish and wildlife habitat affected by the project. The first fish and wildlife enhancement, stream improvement, is identical to the Proposed Action. The second enhancement, habitat acquisition, would consist of acquiring the 160-acre Fisher property, which is adjacent to the Lake Fork River and is an inholding within the Ashley National Forest. This property would be managed for wildlife purposes.

The same five mitigation measures described for the Proposed Action would be implemented under the Cow Canyon Alternative. Under this alternative, habitat improvement and habitat development measures would be implemented on 877 acres to mitigate project-induced impacts on wildlife habitat.

S.2.2.6 Recreation Developments

Recreation developments would create and improve recreational facilities and opportunities. They would consist of minimum basic facilities for environmental protection, which include the Bridge and Swift Creek Campgrounds recreation improvement, and enhancements, which include FS campground upgrades and Fish Creek Trail improvement. Bridge and Swift Creek Campgrounds would be improved by applying a hardened gravel surface to roads, installing a vault toilet at the Swift Creek Campground and Trailhead, and developing a trailhead at the Yellowstone All-Terrain Vehicle Trail. Fish Creek Trail improvement would consist of reconstructing 2 miles of existing FS trail and constructing 3.5 miles of new trail. The trail would have a 24-inch tread suitable for mountain bike use. The second recreation enhancement, FS campground upgrades, would be identical to the Proposed Action.

S.2.2.7 Land Retirement

Land retirement would be identical to the Proposed Action.

S.2.3 Crystal Ranch Alternative

Map 2-13 (see Chapter 2 of the Draft EIS) shows the locations of specific features of the Crystal Ranch Alternative. Project features of this alternative are summarized below.

S.2.3.1 Dams and Reservoirs

Crystal Ranch Dam and Reservoir would be constructed on the Yellowstone River. This reservoir's water storage capability and water supply regulation would increase the amount and delivery of the available surface water supply for irrigation to better match crop irrigation requirements. For Indian (1861) water rights, average annual irrigation water supplies would increase from 42,093 acre-feet under baseline conditions to 49,723 acre-feet with the project, an increase of 7,630 acre-feet. For secondary water rights, average annual irrigation water supplies would increase from 95,301 acre-feet under baseline conditions to 102,781 acre-feet with the project, an increase of 7,480 acre-feet. Dam and reservoir operation would also provide minimum instream flows in selected reaches of the Yellowstone and Lake Fork Rivers, 3,000 acre-feet of municipal and industrial water for the City of Roosevelt each year, and a reservoir conservation pool for successful over-winter fish survival.

Crystal Ranch Reservoir would have a total active storage capacity of 24,000 acre-feet and be located on Tribal, National Forest, and private lands, identical to the Proposed Action. Reservoir storage space allocations would include 9,550 acre-feet for use by the Ute Tribe, 2,400 acre-feet for the conservation pool, 2,500 acre-feet for high mountain lakes storage replacement, 150 acre-feet for non-Indian-owned 1861 water-righted lands, 6,400 acre-feet for secondary water-righted lands, and 3,000 acre-feet for City of Roosevelt municipal and industrial purposes. (Big Sand Wash Dam and Reservoir would not be enlarged under this alternative.) During an average water year, reservoir elevation and storage would be highest in June and lowest in September; water levels would fluctuate 40 feet but would remain well above the conservation pool elevation. Minimum instream flow releases provided in the Yellowstone River would be 56 cfs April through September and 24 cfs October through March. Normal project operation would provide the required minimum flows except for periods during very dry years.

S.2.3.2 Diversion Dams

Diversion dams and associated benefits would be identical to the Proposed Action except that the Big Sand Wash Feeder Pipeline diversion dam would not be constructed since Big Sand Wash Reservoir would not be enlarged.

S.2.3.3 Canal Rehabilitation

Farnsworth Canal Laterals No. 1, No. 2, and No. 3 would be rehabilitated. Rehabilitation procedures and benefits would be the same as described for the Proposed Action. A wetland maintenance system would be designed to preserve 80.4 acres of wetlands that have developed along existing canals where there is a water source from canal leaks.

S.2.3.4 High Mountain Lakes Stabilization

High mountain lakes stabilization would be identical to the Proposed Action.

S.2.3.5 Fish and Wildlife

Fish- and wildlife-related activities would include three enhancements and five mitigation measures designed to replace, improve, and/or enhance fish and wildlife habitat affected by the project. Two of the fish and wildlife enhancements, stream improvement and big game winter range improvement, are identical to the Proposed Action. The third enhancement, habitat acquisition, consists of acquiring the Red Rocks/Duchesne Drainage property (described under the Proposed Action) and the Fisher property (described under the Cow Canyon Alternative).

The same five mitigation measures described for the Proposed Action would be implemented under the Crystal Ranch Alternative. Under this alternative, habitat improvement and habitat development measures would be implemented on 1,212 acres to mitigate project-induced impacts on wildlife habitat; impacts on 80.4 acres of wetlands and riparian communities would be avoided.

S.2.3.6 Recreation Developments

Recreation developments would create and improve recreational facilities and opportunities. They would consist of two minimum basic facilities for environmental protection (Crystal Ranch Campground recreation replacement and development, Bridge Campground recreation improvement) and one enhancement (FS campground upgrades). Crystal Ranch Campground and FS campground upgrades would be identical to the Proposed Action while Bridge Campground would be identical to the Cow Canyon Alternative.

S.2.3.7 Land Retirement

Land retirement would be identical to the Proposed Action.

S.2.4 Twin Pots Alternative

Map 2-14 (see Chapter 2 of the Draft EIS) shows the locations of specific features of the Twin Pots Alternative. Project features of this alternative are summarized below.

S.2.4.1 Dams and Reservoirs

Big Sand Wash Dam and Reservoir would be enlarged 12,000 acre-feet, raising its total active storage capacity to 24,000 acre-feet. This reservoir's water storage capability and water supply regulation would increase the amount and delivery of the available surface water supply for irrigation to better match crop irrigation requirements. For Indian (1861) water rights, average annual irrigation water supplies would increase from 42,093 acre-feet under baseline conditions to 49,423 acre-feet with the project, an increase of 7,330 acre-feet. For secondary water rights, average annual irrigation water supplies would increase from 95,301 acre-feet under baseline conditions to 102,481 acre-feet with the project, an increase of 7,180 acre-feet. Dam and reservoir operation would also provide 3,000 acre-feet of municipal and industrial water for the City of Roosevelt each year and a reservoir conservation pool for successful over-winter fish survival.

Big Sand Wash Reservoir storage space allocations would include 1,200 acre-feet for the conservation pool, 3,000 acre-feet for City of Roosevelt municipal and industrial purposes, 6,500 acre-feet for high mountain lakes storage replacement, and 13,300 acre-feet (2,500 acre-feet more than currently available) for the Moon Lake Water Users Association. Water for the City of Roosevelt would be delivered from the reservoir to the City via the proposed Big Sand Wash-Roosevelt Pipeline. During an average water year, reservoir elevation and storage would be highest in April and lowest in September; water levels would fluctuate 71 feet but would remain well above the conservation pool elevation.

S.2.4.2 Diversion Dams

Diversion dams and associated benefits would be identical to the Proposed Action. In addition, a concrete diversion dam with fish passage capabilities and fish screens would be constructed on the Lake Fork River about 2.2 miles upstream of the county road that crosses the upper Lake Fork. This diversion dam would direct water to the proposed Lake Fork-Yellowstone Pipeline.

S.2.4.3 Canal Rehabilitation

Canal rehabilitation would be identical to the Crystal Ranch Alternative.

S.2.4.4 Pipelines

Three pipelines would be constructed under the Twin Pots Alternative. The Big Sand Wash Feeder

Pipeline would follow the same corridor as described for the Proposed Action, but it would have a pipeline diameter of 60 inches rather than 39 inches to accommodate filling the 12,000-acre-foot enlargement of Big Sand Wash Reservoir.

The new 24-inch-diameter Lake Fork-Yellowstone Pipeline would begin at the proposed Lake Fork-Yellowstone Pipeline diversion structure on the Lake Fork River and extend 3.6 miles to the Yellowstone River where it would discharge. Water discharged would meet replacement requirements in the Yellowstone River resulting from high mountain lakes stabilization. The new 15-inch-diameter Big Sand Wash-Roosevelt Pipeline would deliver water 15.4 miles from the enlarged Big Sand Wash Reservoir to the City of Roosevelt's existing distribution system.

S.2.4.5 High Mountain Lakes Stabilization

High mountain lakes stabilization would include the 10 lakes described under the Proposed Action, plus Brown Duck, Island, Kidney, and Clements Lakes in the upper Lake Fork River watershed that were modified in the 1920s for water storage. Benefits resulting from stabilizing these 14 lakes would be the same as described for the Proposed Action.

S.2.4.6 Fish and Wildlife

Fish- and wildlife-related activities would include three enhancements and three mitigation measures designed to replace, improve, and/or enhance fish and wildlife habitat affected by the project. The three fish and wildlife enhancements (big game winter range improvement, habitat acquisition of the Red Rocks/Duchesne Drainage property, and Twin Pots Reservoir improvement) are identical to the Proposed Action.

Three of the five mitigation measures described for the Proposed Action would be implemented. They include wildlife habitat/wetland mitigation, high mountain lakes fish habitat, and fish passage. Under the Twin Pots Alternative, habitat improvement and habitat development measures would be implemented on 298 acres to mitigate project-induced impacts on wildlife habitat; impacts on 80.4 acres of wetlands and riparian communities would be avoided.

S.2.4.7 Land Retirement

Land retirement would be identical to the Proposed Action.

S.2.5 No Action Alternative

In the No Action Alternative, none of the project features proposed in the Proposed Action or action alternatives would be constructed. Existing water supply conditions within the Upalco Unit would continue, and the needs and purposes of the project would remain unmet. Anticipated environmental impacts of the project would not occur, and proposed fish and wildlife enhancements, recreation developments, and mitigation measures would not be implemented.

Under the No Action Alternative, authorization to construct the Upalco Unit Replacement Project would terminate pursuant to provisions of Section 201(c) of the CUPCA. Authorization for construction of a Section 203 Project would continue for 5 years from the date of completion of the Feasibility Studies pursuant to Section 203(a) of the CUPCA. A separate EIS and National Environmental Policy Act (NEPA) compliance would be required.

S.3 Chapter 3—Affected Environment and Environmental Consequences

S.3.1 Issues of Concern

This section summarizes the major issues of concern identified by the public or agencies during scoping, or by the EIS team during the analysis. Following are the major issues of concern for each resource topic.

S.3.1.1 Sociocultural Resources

- Consistency of project features with traditional cultural values and desired lifestyles of Uinta Basin communities
- Potential for Tribal and non-Indian autonomy in project control and management
- Opportunities for economic growth provided by the project
- Potential project effects on the non-Indian agrarian lifestyle in the Uinta Basin
- Compatibility of recreational/environmental components of the project with non-Indian agrarian lifestyles

S.3.1.2 Socioeconomics

- Employment, population changes, and output/earnings associated directly and indirectly with project construction, operation, and maintenance
- Employment, population changes, and output/earnings resulting from project-associated changes in agriculture and recreation
- Earnings of outfitters and guides in the Uinta Basin
- Project effects on temporary and permanent housing in Altamont, Duchesne, Roosevelt, and Vernal
- Effects of project-associated changes in housing demand on housing prices
- Adequacy of existing infrastructure in the local impact area and on the Uintah and Ouray Reservation to meet project-associated demand during project construction, operation, and maintenance

S.3.1.3 Agriculture

- Irrigated crop yields, irrigated crop production, and the value of crop production predicted to occur as a result of the project

S.3.1.4 Water Resources and Hydrology

- The quantity and quality of water available for direct or indirect use determines its existing and future beneficial uses.
- There is concern that changes to and impacts on water quantity and quality will occur.
- All potential impacts on water quantity and quality must be accounted for, including modification of peak and low flows, and effects on groundwater recharge, floodplains, and downstream loading of salts and other contaminants.
- There is concern that each project feature, including dam and reservoir construction, canal rehabilitation, and water conservation measures, will affect site and local hydrology and the related environment.
- There is concern that the collective impacts of project features will impact downstream water resources and that modification of peak flows will impact the river ecosystem.
- Water conservation measures and systems, such as improved delivery systems, should be provided.
- There is a desire to decrease downstream salt loads.

S.3.1.5 Water Quality and Contaminants

- Project effects on water quality and contaminant levels and on bioaccumulation, risks to fish and wildlife, and beneficial use designations

S.3.1.6 Aquatic Resources

- Effects on fisheries of high mountain lakes/ outlet streams resulting from high mountain lakes stabilization

- Fish-rearing potential and adequate conservation pool size in proposed storage reservoirs

- Effects on instream flows, habitat for fish, and channel shaping flows from construction of project features

- Benefits associated with proposed instream and riparian habitat improvements

S.3.1.7 Wetland and Riparian Resources

- All impacts on wetland and riparian communities must be accounted for, including losses resulting from canal rehabilitation and water conservation measures.

- Impacts on wetland and riparian communities should be avoided where possible because of the difficulty and very high costs of replacing these resources.

- All impacts on wetland and riparian communities must be mitigated in-kind and as close to the impact site as possible.

- Mitigating impacts by restoring degraded wetland and riparian communities would require very large areas but has proven to be much more successful than creating new wetlands.

S.3.1.8 Wildlife Resources

- Loss of wetland, riparian, and upland wildlife habitat because of the project

- Loss of critical and normal big game winter range because of the project

- Project effects on raptors and sage grouse breeding complexes

S.3.1.9 Threatened and Endangered Species

- Project effects on federal endangered, threatened, candidate, and FS sensitive species and on designated critical habitat

S.3.1.10 Land Use Plans Conflict

- Potential conflicts with existing land use plans

S.3.1.11 Transportation

- Direct physical effects on roads in the affected area from the transport of heavy equipment and project construction materials

- Indirect physical effects on transportation systems in the affected area as a result of project driven changes in population, recreation visitation, etc.

- Potential traffic delays because of project construction activities

- Effects on existing levels of service on roads in the affected area during and after project construction

- Direct physical effects of permanent project features on the transportation resources of the affected area (e.g., inundation of roads, etc.)

S.3.1.12 Soils

- Disturbance of soils resulting from project construction activities and other factors may cause increased soil erosion.

- Alkalinity and minerals may build up in soils and cause reduced soil productivity.

S.3.1.13 Health and Safety

- Consequences of potential dam failure on individuals living in the area

- Conditions relating to the project features or area that would pose a greater than average risk of construction accidents

S.3.1.14 Cultural Resources

- Determine the extent and type of cultural resources in the project area and the probability of significant resources being impacted.

- Locate and record any potentially impacted prehistoric and historic sites and determine their eligibility to the National Register of Historic Places (NRHP).

- Locate the ethnographic, traditional, and religious use areas and determine their eligibility to the NRHP.

- Record the extent and significance of paleontological resources in the project area and determine their potential for being impacted.

S.3.1.15 Recreation Resources

- Determine whether existing recreation opportunities and facilities in the Uinta Basin would be protected and preserved both during and after project construction.

- Determine whether the project would provide new recreation opportunities and facilities within the Uinta Basin.

S.3.1.16 Wilderness Areas

- Project facilities or activities that may encroach into the High Uintas Wilderness

S.3.1.17 Visual Resources

- Compliance with FS Visual Quality Objectives in the Ashley National Forest (ANF)

- Project effects on visually important landmarks and other features outside the ANF, particularly on Tribal land

S.3.1.18 Mineral and Energy Resources

- Project effects on the existing and future production of mineral or energy resources in the area of influence

S.3.1.19 Air Quality

- Project effects potentially exceeding federal, state, and local air quality standards

S.3.1.20 Noise

- Potential temporary noise impacts related to project construction, operation, and maintenance

S.3.2 Major Impact Conclusions

Major impacts anticipated under the Proposed Action and each action alternative are summarized below by resource topic.

S.3.2.1 Sociocultural Resources

S.3.2.1.1 Proposed Action. This analysis addresses the unique facets of a society (its social and cultural resources, group identity, autonomy, folkways, lifestyle, and relationship to the environment) for Native Americans living on and adjacent to the Uintah and Ouray Reservation and the primarily Anglo-Saxon communities living near the Reservation. The analysis focuses on overall project effects on sociocultural resources and on project effects on resource control, economic development, and water uses from a sociocultural perspective.

Overall effects of the Proposed Action on sociocultural resources would be beneficial for the Ute Tribe and beneficial (+) for non-Indians. For the Ute Tribe, project effects would be beneficial for resource control, very beneficial for economic development, and adverse for water uses. For non-Indians, project effects would be beneficial for resource control and water uses and very beneficial for economic development.

S.3.2.1.2 Cow Canyon Alternative. Overall effects on sociocultural resources would be adverse (+) for the Ute Tribe and beneficial (-) for non-Indians. For the Ute Tribe, project effects would be very adverse for resource control, beneficial for economic development, and adverse for water uses. For non-Indians, project effects would be neutral for resource control and beneficial for economic development and water uses.

S.3.2.1.3 Crystal Ranch Alternative. Overall effects on sociocultural resources would be neutral (+) for the Ute Tribe and beneficial (-) for non-Indians. For the Ute Tribe, project effects would be beneficial for resource control and economic development and adverse for water uses. For non-Indians, project effects would be neutral for resource control and beneficial for economic development and water uses.

S.3.2.1.4 Twin Pots Alternative. Overall effects on sociocultural resources would be neutral (+) for the Ute Tribe and neutral (-) for non-Indians. For the Ute Tribe, project effects would be neutral for resource control and water uses and beneficial for economic development. For non-Indians, project effects would be neutral for resource control and economic development and adverse for water uses.

S.3.2.2 Socioeconomics

S.3.2.2.1 Proposed Action. Average monthly unemployment during the 7-year construction period would decline by about 5 percent in Duchesne County (creation of 66 new jobs) and Uintah County (42 new jobs) and by about 3 percent on the Uintah and Ouray Reservation (18 new jobs). Average annual earnings from project construction would be about $0.9 million for Ute Tribal members and increase by about $3.3 million in Duchesne County's construction sector. During project construction, population in the Uinta Basin would increase by 264 people; Roosevelt's public school enrollment (already high) would increase by up to 28 students; home and rental prices in Duchesne (12 additional families) and Altamont (2 additional families) would increase by more than 10 percent; and current levels of Uinta Basin law enforcement services may be inadequate, given anticipated population and traffic increases.

S.3.2.2.2 Cow Canyon Alternative. Average monthly unemployment during the 6-year construction period would decline by about 4 percent in Duchesne County (62 new jobs), 5 percent in Uintah County (48 new jobs), and 2 percent on the Uintah and Ouray Reservation (11 new jobs). Average annual earnings from project construction would be about $0.5 million for Ute Tribal members and increase by about $3.4 million in Duchesne County's construction sector. During project construction, population in the Uinta Basin would increase by 285 people; Roosevelt's public school enrollment (already high) would increase by up to 29 students; home and rental prices in Duchesne (12 additional families) and Altamont (2 additional families) would increase by more than 10 percent; and current levels of Uinta Basin law enforcement services may be inadequate, given anticipated population and traffic increases.

S.3.2.2.3 Crystal Ranch Alternative. Average monthly unemployment during the 7-year construction period would decline by about 5 percent in Duchesne County (65 new jobs) and Uintah County (37 new jobs) and by about 3 percent on the Uintah and Ouray Reservation (21 new jobs). Average annual earnings from project construction would be about $1.1 million for Ute Tribal members and increase by about $3.1 million in Duchesne County's construction sector. During project construction, population in the Uinta Basin would increase by 212 people; Roosevelt's public school enrollment (already high) would increase by up to 18 students; home and rental prices in Duchesne (12 additional families) and Altamont (2 additional families) would increase by more than 10 percent; and current levels of Uinta Basin law enforcement services may be inadequate, given anticipated population and traffic increases.

S.3.2.2.4 Twin Pots Alternative. Average monthly unemployment during the 5-year construction period would decline by about 4 percent in Duchesne County (50 new jobs), 3 percent in Uintah County (27 new jobs), and 1 percent on the Uintah and Ouray Reservation

(8 new jobs). Average annual earnings from project construction would be about $0.4 million for Ute Tribal members and increase by about $2.1 million in Duchesne County's construction sector. During project construction, population in the Uinta Basin would increase by 174 people; Roosevelt's public school enrollment (already high) would increase by up to 12 students; home and rental prices in Duchesne (12 additional families) and Altamont (2 additional families) would increase by more than 10 percent; and current levels of Uinta Basin law enforcement services may be inadequate, given anticipated population and traffic increases.

S.3.2.3 Agriculture

S.3.2.3.1 Proposed Action. The overall value of irrigated crop production would increase by about $1.5 million annually as a result of the project. Depending on the crop, production would increase between 10 and 12 percent in the Upalco Unit project area, between 5 and 12 percent in Duchesne and Uintah Counties combined, and from less than 1 to 2 percent on a statewide basis. These increases would represent significant beneficial impacts for the project area and the two counties but not for the state.

S.3.2.3.2 Cow Canyon Alternative. Increases in irrigated crop production and value would be the same as described for the Proposed Action.

S.3.2.3.3 Crystal Ranch Alternative. The overall value of irrigated crop production would increase by about $1.3 million annually under this alternative. Depending on the crop, production would increase between 8 and 10 percent in the project area, between 4 and 10 percent in Duchesne and Uintah Counties combined, and about 1 percent or less on a statewide basis. These increases would represent significant beneficial impacts for the project area and the two counties but not for the state.

S.3.2.3.4 Twin Pots Alternative. The overall value of irrigated crop production would increase by about $1.3 million annually under this alternative. Depending on the crop, production would increase between 8 and 10 percent in the project area, between 4 and 10 percent in Duchesne and Uintah Counties combined, and about 1 percent or less on a statewide basis. These increases would represent significant beneficial impacts for the project area and the two counties but not for the state.

S.3.2.4 Water Resources and Hydrology

S.3.2.4.1 Proposed Action. The project would result in changes in the quantity and timing of surface water flows, which would allow more water to be used for crop production, instream flows, and other project purposes. Water use changes (i.e., increased crop use, even water use throughout the growing season, and a 2- to 3-week extension in late season irrigation deliveries), and improved water management (i.e., water delivery matched to crop requirements and canals converted to pipelines) would decrease the amount of water leaving the Upalco Unit and Uinta Basin.

Under the Proposed Action, annual irrigation water supplies would increase by 9,230 acre-feet to a total of 51,323 acre-feet for Indian (1861) water rights and by 10,278 acre-feet to a total of 105,579 acre-feet for secondary water rights. Except for periods during very dry years, minimum instream flows would be provided in the Yellowstone River from Crystal Ranch Reservoir to the Yellowstone Feeder Canal at the rate of 24 cfs from October through March and 56 cfs from April through September, and from the Yellowstone Feeder Canal to the river's confluence with the Lake Fork River at the rate of 24 cfs from October through March and 38 cfs from April through September. Minimum instream flows in the Lake Fork River would be provided from the Yellowstone River confluence to the Big Sand Wash Feeder Pipeline diversion at the rate of 24 cfs from October through March and 72 cfs from April through September. Water leaving the Upalco Unit (outflow) would decrease by 38 percent (10,300 acre-feet) annually.

S.3.2.4.2 Cow Canyon Alternative. Benefits of more water available for crop production, instream flows, and other project purposes described for the Proposed Action would also occur under this alternative. For the Cow Canyon Alternative, annual irrigation water supplies would increase by 9,180 acre-feet to a total of 51,273 acre-feet for Indian (1861) water rights and by 10,238 acre-feet to a total of 105,529 acre-feet for secondary water rights. Minimum instream flows in the Yellowstone and Lake Fork Rivers would be the same as for the Proposed Action. Water leaving the Upalco Unit (outflow) would decrease by 38 percent (10,400 acre-feet) annually.

S.3.2.4.3 Crystal Ranch Alternative. Benefits of more water available for crop production, instream flows, and other project purposes described for the Proposed Action would also occur under this alternative. For the Crystal Ranch Alternative, annual irrigation water supplies would increase by 7,630 acre-feet to a total of 49,723 acre-feet for Indian (1861) water rights and by 7,480 acre-feet to a total of 102,781 acre-feet for secondary water rights. Minimum instream flows in the Yellowstone River from Crystal Ranch Dam to the Lake Fork River confluence would be the same as described for the Proposed Action. In the Lake Fork River, minimum flows would be provided from the Yellowstone River confluence down to the "C" Canal diversion at a rate of 24 cfs from October through March and 72 cfs from April through September. Water leaving the Upalco Unit (outflow) would decrease by 27 percent (7,300 acre-feet) annually.

S.3.2.4.4 Twin Pots Alternative. Benefits of more water available for crop production, instream flows, and other project purposes described for the Proposed Action would also occur under this alternative. For the Twin Pots Alternative, annual irrigation water supplies would increase by 7,330 acre-feet to a total of 49,423 acre-feet for Indian (1861) water rights and by 7,180 acre-feet to a total of 102,481 acre-feet for secondary water rights. Water leaving the Upalco Unit (outflow) would decrease by 25 percent (6,700 acre-feet) annually. No minimum instream flows would be provided under this alternative since no onstream reservoirs are proposed.

S.3.2.5 Water Quality and Contaminants

S.3.2.5.1 Proposed Action. Significant but localized adverse impacts on water quality would include potential occasional exceedances of agricultural water quality criteria for total dissolved solids (TDS) in localized areas near the lower Lake Fork River and the Duchesne River. These exceedances may result in slight localized restrictions on the use of this river water for irrigation. The project is not expected to cause any additional impairment of beneficial uses relative to fish and wildlife since no significant toxicological changes from baseline are expected. Project benefits would include salinity (salt load) reductions of 22 percent in the Lake Fork River near Myton and 0.1 percent in the Colorado River at Imperial Dam, settling of sediment and associated phosphorus and metals in constructed or enlarged reservoirs, and reduced shoreline erosion of high mountain lakes.

S.3.2.5.2 Cow Canyon Alternative. Adverse and beneficial project effects under the Cow Canyon Alternative would be the same as described for the Proposed Action.

S.3.2.5.3 Crystal Ranch Alternative. Project effects under this alternative would be essentially the same as described for the Proposed Action.

S.3.2.5.4 Twin Pots Alternative. Project effects under this alternative would be essentially the same as described for the Proposed Action.

S.3.2.6 Aquatic Resources

S.3.2.6.1 Proposed Action. Three largely separate fisheries would be affected by the project: high mountain lake, reservoir, and stream fisheries. Changes to high mountain lakes' fish populations would likely be positive but not significantly so. These lakes currently support good trout populations, comparable to other natural lakes in the High Uintas Wilderness. These fish populations would be no worse off under stabilized lake level conditions than they are at present.

The proposed Crystal Ranch Reservoir would provide year-round habitat for a new fishery that would not exist without the project. Although supported largely by stocking hatchery Colorado River cutthroat trout or rainbow trout, the reservoir fishery would very likely be popular with local anglers. Creation of this reservoir fishery would be at the expense of the existing stream fishery in the 2.6-mile reach of the Yellowstone River that would be inundated. The dam would also block upstream fish passage.

Stream fisheries (primarily trout) downstream of the proposed reservoir would be enhanced significantly by the following project features:

- Minimum flows during critical time periods would eliminate some of the flow-related "biological bottlenecks" that now limit fish populations.

- Upstream fish passage facilities would be constructed at all replaced and new diversion dams.

- Specific areas of streambank and channel disturbance in the Lake Fork and Yellowstone Rivers would be eliminated and riparian habitat would be improved.

- Improved flow measurement and control at diversion points would promote improved water management for instream flows and other flow-related fish and wildlife enhancements.

- Water released from Crystal Ranch Reservoir would be up to 10°F cooler during summer compared to existing conditions. This would maintain stream temperatures more within the preferred range of trout species occurring in the upper reaches of project-area streams.

- Water released from the reservoir would be slightly warmer in early winter, thus helping prevent the formation of frazil and anchor ice, which can be detrimental to fish and fish habitat.

- Two miles of "new" trout habitat would be created in the Lake Fork River below the "C" Canal diversion.

- Fish would be stocked, as appropriate, in the Yellowstone/Lake Fork drainage downstream of Crystal Ranch Dam.

Overall, because of reservoir formation and changes in the downstream flow regime, trout habitat during the critical low-flow period (September) in a normal water year would decrease slightly for fry and remain about the same or increase slightly for juveniles and adults compared to baseline conditions. In a dry water year, fry habitat would increase slightly while juvenile and adult habitat would increase by about 41 to 47 percent over baseline conditions.

Based on the winter habitat analysis, it can only be conservatively assumed that the loss of winter habitat in the middle Lake Fork River and the upper Yellowstone River has the potential to limit their respective trout populations. Many of the project features, such as stream habitat improvements, may provide additional winter habitat not accounted for in this analysis and could possibly offset projected habitat losses.

S.3.2.6.2 Cow Canyon Alternative. Total impacts and mitigation of the Cow Canyon Alternative on fisheries resources would be similar to those described for the Proposed Action except for the following:

- Development of year-round habitat and creation of a new reservoir trout fishery in the proposed Upper Yellowstone Reservoir

- Appropriate stocking of fish in the Yellowstone/Lake Fork drainage downstream of Upper Yellowstone Dam

- Inundation of 2 miles of the Yellowstone River, loss of the existing stream fishery in this reach, and blockage of upstream fish passage at the dam

Overall, because of reservoir formation and changes in the downstream flow regime, trout habitat during the critical low-flow period (September) in a normal water year would decrease slightly for fry and juveniles and increase slightly for adults compared to baseline conditions. In a dry water year, fry habitat would increase slightly while juvenile and adult habitat would increase by about 40 to 46 percent over baseline conditions. These changes, together with stream benefits listed above, would combine to improve overall conditions for stream fisheries under the Cow Canyon Alternative.

Impacts on winter habitat and mitigation for the Cow Canyon Alternative would be essentially the same as those described for the Proposed Action.

S.3.2.6.3 Crystal Ranch Alternative. Total impacts and mitigation of the Crystal Ranch Alternative on fisheries resources would be similar to those described for the Proposed Action, except no "new" trout habitat would be created below the "C" Canal diversion on the Lake Fork River.

Overall, because of reservoir formation and changes in the downstream flow regime, trout habitat during the critical low-flow period (September) in a normal water year would decrease slightly for fry, juveniles, and adults compared to baseline conditions. In a dry water year, fry habitat would decrease slightly while juvenile and adult habitat would increase by about 35 percent over baseline conditions. These changes and stream benefits listed above would combine to improve overall conditions for steam fisheries under the Crystal Ranch Alternative.

Impacts on winter habitat and mitigation for the Crystal Ranch Alternative would be essentially the same as those described for the Proposed Action.

S.3.2.6.4 Twin Pots Alternative. Total impacts and mitigation associated with the Twin Pots Alternative would be somewhat similar to those described for the Proposed Action, although no onstream reservoirs are proposed under this alternative. Total impacts and mitigation measures include the following:

- Improved high mountain lakes' and Twin Pots Reservoir fish populations and a higher-quality fishing experience because of lake and reservoir stabilization

- Elimination of some fisheries–limiting "biological bottlenecks" on the Lake Fork River through minimum flows

- Construction of upstream fish passage facilities, elimination of streambank and channel disturbance, and improved flow measurement and control at replaced and new diversion dams

- The creation of "new" trout habitat below the "C" Canal diversion on the Lake Fork River

The flow regime in the Lake Fork and lower Yellowstone Rivers would change slightly under the Twin Pots Alternative. Because of this, trout habitat during the critical low-flow period (September) in a normal water year would increase slightly for all lifestages compared to baseline conditions. In a dry water year, fry habitat would increase by about 10 percent while juvenile and adult habitat would increase by about 35 to 40 percent over baseline conditions.

Impacts on winter habitat for the Twin Pots Alternative would be essentially the same as those described for the Proposed Action.

S.3.2.7 Wetland and Riparian Resources

S.3.2.7.1 Proposed Action. Dams, reservoirs, and canal rehabilitation under the Proposed Action would impact 364 acres of wetland and riparian resources, 96 percent of which (349 acres) would be permanently lost. This represents a functional loss of approximately 1,097 Average Annual Habitat Units (AAHUs). Mitigation measures are expected to substantially offset these losses. An estimated 2,212 additional acres of wetlands and riparian communities that were not evaluated using the Habitat Evaluation Procedure (HEP) may also be permanently impacted by land retirement, reduced availability of secondary irrigation water, and irrigation of Tribal idle lands. Known and estimated total permanent losses of wetlands and riparian communities would be 2,561 acres. Proposed mitigation measures would result in a net loss of 1,429 acres of existing wetlands and riparian communities compared to known and estimated impacts. Other potential, currently unquantifiable impacts could occur because of changes in the timing and peak volume of downstream river discharge. Estimated and currently unquantifiable impacts would be monitored to determine mitigation requirements.

S.3.2.7.2 Cow Canyon Alternative. Approximately 109 acres of wetland and riparian habitat would be impacted by dams, reservoirs, and canals under the Cow Canyon Alternative, with all but 15 acres permanently lost. This portion of total losses represents approximately 167 AAHUs. Mitigation measures are expected to substantially offset these losses. Up to 2,201 additional acres of wetlands and riparian communities that were not evaluated using HEP may also be permanently impacted by land retirement, reduced availability of secondary irrigation water, and irrigation of Tribal idle lands. Known and estimated total permanent losses of wetlands and riparian communities would be 2,295 acres. Proposed mitigation measures to develop new or improve existing wetlands and riparian communities would result in a net loss of 1,690 acres of wetlands compared to known and estimated project impacts. Other potential, currently unquantifiable impacts could occur because of changes in the timing and peak volume of downstream river discharge. Estimated and currently unquantifiable impacts would be monitored to determine mitigation requirements.

S.3.2.7.3 Crystal Ranch Alternative. Dams, reservoirs, and canals for the Crystal Ranch Alternative would result in the permanent loss of 267 acres of wetland and riparian resources. This represents a functional loss of approximately 915 AAHUs. Mitigation measures are expected to substantially offset these losses. Up to 2,342 additional acres of wetlands and riparian communities that were not evaluated using HEP may also be permanently impacted by land retirement, reduced availability of secondary irrigation water, and irrigation of Tribal idle lands. Known and estimated total losses of wetlands and riparian communities would be 2,609 acres. Proposed mitigation measures would result in a net loss of 1,634 acres of existing wetlands and riparian communities compared to known and estimated impacts. Other potential, currently unquantifiable impacts could occur because of changes in the timing and peak volume of downstream river discharge. Estimated and currently unquantifiable impacts would be monitored to determine mitigation requirements.

S.3.2.7.4 Twin Pots Alternative. Dams, reservoirs, and canals would result in the permanent loss of 144 acres of wetlands and riparian areas under the Twin Pots Alternative with 66 percent of this area permanently affected. This represents a functional loss of approximately 144 AAHUs. Mitigation measures are expected to substantially offset these losses. Up to 2,330 additional acres of wetlands and riparian communities that were not evaluated using HEP may also be permanently impacted by land retirement, reduced availability of secondary irrigation water, and irrigation of Tribal idle lands. Known and estimated total losses of wetlands and riparian communities would be 2,421 acres. Proposed mitigation measures to develop new or improve existing wetlands and riparian communities would result in a net loss of 2,121 acres of wetlands compared to known and estimated project impacts. Other potential, currently unquantifiable impacts could occur because of delays in the timing of peak river flows. Estimated and currently unquantifiable impacts would be monitored to determine mitigation requirements.

S.3.2.8 Wildlife Resources

S.3.2.8.1 Proposed Action. Impacts on wetlands and riparian habitat were summarized in Section S.3.2.7.1. Dams, reservoirs, and canal rehabilitation under the Proposed Action would impact 753 acres of upland and open water habitat. This represents a functional loss of approximately 1,080 AAHUs. An estimated 817 additional acres of native upland communities, consisting of mostly sagebrush/grass that were not evaluated using HEP, would be permanently impacted by conversion of Tribal idle lands to irrigation. Known and estimated total permanent losses of uplands and open water habitat would be 1,570 acres. Critical deer and elk winter range and critical year-long moose range preferred habitat would be impacted by dam and reservoir construction. Mitigation measures for wildlife habitat and wetlands are described in Appendix B.

S.3.2.8.2 Cow Canyon Alternative. Impacts on wetlands and riparian habitat were summarized in Section S.3.2.7.2. Dams, reservoirs, and canal rehabilitation under the Cow Canyon Alternative would impact 644 acres of upland and open water habitat. This represents a functional loss of approximately 713 AAHUs. An estimated 817 additional acres of native upland communities, consisting of mostly sagebrush/grass that were not evaluated using HEP, would be permanently impacted by conversion of Tribal idle lands to irrigation. Known and estimated total permanent losses of upland and open water habitat would be 1,461 acres. Critical year-long moose range preferred habitat would be lost as a result of dam and reservoir construction. Mitigation measures for wildlife habitat and wetlands are described in Appendix B.

S.3.2.8.3 Crystal Ranch Alternative. Impacts on wetlands and riparian habitat were summarized in Section S.3.2.7.3. Dams, reservoirs, and canal rehabilitation under the Crystal Ranch Alternative would impact 355 acres of upland and open water habitat. This represents a functional loss of approximately 696 AAHUs. An estimated 817 additional acres of native upland communities, consisting of mostly sagebrush/grass that were not evaluated using HEP, would be permanently impacted by conversion of Tribal idle lands to irrigation. Known and estimated total permanent losses of upland and open water habitat would be 1,172 acres. Critical deer and elk winter range and critical year-long moose range would be impacted by dam and reservoir construction. Mitigation measures for wildlife habitat and wetlands are described in Appendix B.

S.3.2.8.4 Twin Pots Alternative. Impacts on wetlands and riparian habitat were summarized in Section S.3.2.7.4. Dams, reservoirs, and canal rehabilitation under the Twin Pots Alternative would impact 751 acres of upland and open water habitat. This represents a functional loss of approximately 402 AAHUs. An estimated 817 additional acres of native upland communities, consisting of mostly sagebrush/grass that were not evaluated using HEP, would be permanently impacted by conversion of Tribal idle lands to irrigation. Known and estimated total permanent losses of upland and open water habitat would be 1,568 acres. Two sage grouse leks within 0.75 mile of the Lake Fork-Yellowstone Pipeline could be abandoned because of pipeline construction. Mitigation measures for wildlife habitat and wetlands are described in Appendix B.

S.3.2.9 Threatened and Endangered Species

S.3.2.9.1 Proposed Action. Implementation of the Proposed Action generally would result in lower Duchesne River flows in the winter and higher flows in the spring and summer. Autumn flows would remain essentially the same. This flow regime would not be expected to adversely affect razorback sucker. The small flow increases and decreases in the Duchesne River (depending on month and water-year type) that would result from the project would not significantly change the current depleted flow condition nor contribute significant amounts of water toward endangered fish recovery. Increased water surface elevations in the middle reach of the Lake Fork River may inundate some individual Ute ladies'-tresses orchids. However, the overall effect of more water in the river, particularly in the dry-dammed lower reaches, should be beneficial to the orchid population as a whole. Potential habitat desiccation associated with reduction of secondary irrigation return flows and conversion of Tribal idle lands to irrigated lands might have adverse impacts on orchid populations not closely associated with riverine water. If spotted or Townsend's big-eared bat roost sites are located in reservoir inundation zones, they would be lost with project implementation. Bat roost sites might also be lost with conversion of Tribal idle land to irrigated land, particularly during conversion of forest riparian habitat.

S.3.2.9.2 Cow Canyon Alternative. Impacts of the Cow Canyon Alternative would be similar to those reported for the Proposed Action.

S.3.2.9.3 Crystal Ranch Alternative. Impacts of the Crystal Ranch Alternative on endangered, threatened, candidate, and FS sensitive species would be similar to those reported for the Proposed Action except for the following areas. Development of new Ute ladies'-tresses orchid habitat would be limited, maintenance of existing orchid habitat would be degraded, and no orchids would be inundated along the Lake Fork River.

S.3.2.9.4 Twin Pots Alternative. Impacts of the Twin Pots Alternative would be similar to those reported for the Proposed Action.

S.3.2.10 Land Use Plans Conflict

There would be no significant conflicts with land use plans under the Proposed Action or any of the alternatives because the increased recreation opportunities and enhanced agricultural efficiency would be consistent with county plans.

S.3.2.11 Transportation

S.3.2.11.1 Proposed Action. The level of service on U.S. 40, sections of State Secondary Route (SR) 87, and local roads would decline by one level during peak construction periods and peak commuting hours. Small vehicle traffic is not expected to conflict with project-associated truck traffic. There would be an estimated 3,990 annual truck round trips on U.S. 40.

S.3.2.11.2 Other Alternatives. The expected impacts of the other alternatives would be essentially the same as those of the Proposed Action. However, there would be fewer annual truck round trips on U.S. 40 (3,280 under the Cow Canyon Alternative; 2,555 under the Crystal Ranch Alternative; 2,925 under the Twin Pots Alternative).

S.3.2.12 Soils

S.3.2.12.1 Proposed Action. Under the Proposed Action, Crystal Ranch Reservoir would inundate 562 acres of land. The 9,000-acre-foot Big Sand Wash Reservoir enlargement would inundate an additional 282 acres of land. Significant impacts would include the loss of soil productivity for the life of the reservoirs. Soil productivity would also be lost at the sites of diversion dams.

S.3.2.12.2 Cow Canyon Alternative. Significant soil impacts under the Cow Canyon Alternative would be the same as described for the Proposed Action except that Upper Yellowstone Reservoir would inundate 361 acres of land and Crystal Ranch Reservoir would not be built.

S.3.2.12.3 Crystal Ranch Alternative. Significant soil impacts under the Crystal Ranch Alternative would be the same as described for the Proposed Action except that Big Sand Wash Reservoir would not be enlarged.

S.3.2.12.4 Twin Pots Alternative. Significant soil impacts under the Twin Pots Alternative would include inundation of 395 acres of land because of the 12,000-acre-foot Big Sand Wash Reservoir enlargement.

S.3.2.13 Health and Safety

S.3.2.13.1 Proposed Action. The presence of new and enlarged dams under the Proposed Action would increase the risk of loss of life from flooding if there was a dam failure. About 164 structures located primarily in and near Myton, Ouray, and Randlett could be impacted by dam failure. However, failure of new or enlarged dams would be extremely unlikely. Truck-related accidents on U.S. 40 are expected to increase by 28 percent during peak construction activity. This would amount to about two additional truck-related accidents during the construction period. Truck-related accidents on smaller roads and automobile accident rates would also increase, but no data are available to assess the magnitude of these changes.

S.3.2.13.2 Other Alternatives. Potential impacts for the other alternatives would generally be the same as described for the Proposed Action except that different numbers of structures could be impacted in the very unlikely event of a dam failure. Numbers of structures potentially at risk for the other alternatives are 171 for the Cow Canyon Alternative, 69 for the Crystal Ranch Alternative, and 95 for the Twin Pots Alternative.

S.3.2.14 Cultural Resources

S.3.2.14.1 Proposed Action. Six historic sites determined eligible for the NRHP would be adversely affected by construction of project features associated with the Proposed Action. They include the Crystal Ranch Homestead, site 42Dc364 (a small historic bridge and fence), site 42Dc1044, Water Lily Lake Dam, Milk Lake Dam, and Farmers Lake Tunnel. In addition, if East Timothy Lake Dam is determined eligible for the NRHP, it would be adversely affected. Two historic homes may be affected by construction of the Big Sand Wash Feeder Pipeline. Potential impacts on ethnographic resources include inundation of a free-flowing reach of the Yellowstone River that provides some fishing, and inundation of adjacent lands that provide habitat and migration corridors for deer and elk.

S.3.2.14.2 Cow Canyon Alternative. Five historic sites determined eligible for the NRHP would be adversely affected by construction of project features associated with the Cow Canyon Alternative. They include site 42Dc1044, Milk Lake Dam, Water Lily Lake Dam, Farmers Lake Tunnel, and the Yellowstone Hydroelectric Power Plant. In addition, if East Timothy Lake Dam and the two historic homes near the proposed Big Sand Wash Feeder Pipeline corridor are determined eligible for the NRHP, they would be adversely affected.

S.3.2.14.3 Crystal Ranch Alternative. Six historic sites determined eligible for the NRHP would be adversely affected by construction of project features associated with the Crystal Ranch Alternative. They include Milk Lake Dam, Water Lily Lake Dam, Farmers Lake Tunnel, the Crystal Ranch Homestead, site 42Dc364 (a small bridge and historic fence), and site 42Dc1044. In addition, if East Timothy Lake Dam is determined eligible for the NRHP, it would be adversely affected. Potential impacts on ethnographic resources include inundation of a free-flowing reach of the Yellowstone River that provides some fishing, and inundation of adjacent lands that provide habitat and migration corridors for deer and elk.

S.3.2.14.4 Twin Pots Alternative. Seven historic sites determined eligible for the NRHP would be adversely affected by construction of project features associated with the Twin Pots Alternative. They include the dams at Water Lily, Milk, Island, Kidney, and Clements Lakes, Farmers Lake Tunnel, and site 42Dc1044. East Timothy Lake Dam may also be adversely affected. Two historic homes may be affected by construction of the Big Sand Wash Feeder Pipeline. Ute Tribal members expressed concern that the Lake Fork-Yellowstone Pipeline not impact deer and elk migrations through this area to Towanta Flats, a major wintering ground and important hunting area.

S.3.2.15 Recreation Resources

S.3.2.15.1 Proposed Action. Implementation of the Proposed Action would result in the inundation of 2.6 miles of the Yellowstone River. However, it would also provide new recreational opportunities for individuals who would otherwise participate in outdoor recreation within the project area (helping to alleviate overcrowding at other sites) and lead to an increase in outdoor recreation participation within the Uinta Basin. The predicted net increase in recreation visitation in the Basin generated by significant project effects would be about 4,835 recreation visitor days (RVDs) annually. This should exceed 10 percent of current levels, a significant impact.

S.3.2.15.2 Cow Canyon Alternative. Implementation of the Cow Canyon Alternative would result in the inundation of 2.0 miles of the Yellowstone River. However, the predicted net increase in recreation visitation in the Basin generated by significant project effects would be about 4,615 RVDs annually, a significant impact.

S.3.2.15.3 Crystal Ranch Alternative. Implementation of the Crystal Ranch Alternative would inundate 2.6 miles of the Yellowstone River. However, the predicted net increase in recreation visitation in the Basin generated by significant project effects would be about 3,875 RVDs annually. This should exceed 10 percent of current levels, a significant impact.

S.3.2.15.4 Twin Pots Alternative. Stabilization of Twin Pots Reservoir would be expected to increase the annual number of visitors to the Uinta Basin by about 1,000 (spending about 450 RVDs). Therefore, this alternative does little to augment Indian-administered recreation facilities and would not significantly affect the recreation resources of the Basin.

S.3.2.16 Wilderness Areas

S.3.2.16.1 Proposed Action. There would be no significant adverse impacts on the wilderness as a result of high mountain lakes stabilization or reservoir construction. There would be some temporary noise increases during lakes stabilization. Project benefits would include improved wilderness values at 10 high mountain lakes.

S.3.2.16.2 Other Alternatives. Project effects would be the same as for the Proposed Action, except that wilderness values would be improved at 14 high mountain lakes under the Twin Pots Alternative.

S.3.2.17 Visual Resources

S.3.2.17.1 Proposed Action. Crystal Ranch Dam would be comprised of highly visible and accessible structures. The embankment, control tower, and spillway would have the most significant visual impact of all features comprising this alternative because they would dominate a landscape with few existing man-made structures. The intimate scale of the dense conifer and aspen woods surrounding the proposed dam and reservoir sites would be replaced by a large lake during winter and spring, but by large and unsightly areas of mud in late summer and fall. Both situations present focalizing elements that would not be overlooked by the average observer. There would be some exceedance of visual quality objectives on the Uintah and Ouray Reservation because of the presence of Crystal Ranch Dam and Reservoir.

S.3.2.17.2 Cow Canyon Alternative. Impacts of the Cow Canyon Alternative would generally be the same as described for the Proposed Action except that impacts would result from Upper Yellowstone Dam and Reservoir. There would be some exceedance of visual quality objectives of the Ashley National Forest because of the presence of Upper Yellowstone Dam and Reservoir.

S.3.2.17.3 Crystal Ranch Alternative. Impacts on visual quality under the Crystal Ranch Alternative would ostensibly be the same as those of the Proposed Action.

S.3.2.17.4 Twin Pots Alternative. Visual quality impacts of the Twin Pots Alternative would primarily be temporary, occurring during project construction. Following construction, the minimal impact of project features on the area's visual quality would not result in a change in visual quality objective classification.

S.3.2.18 Mineral and Energy Resources

S.3.2.18.1 Proposed Action. There would be no adverse impacts on known mineral and energy resources resulting from construction, operation, and maintenance activities associated with the Proposed Action. No known oil or gas wells would be taken out of production.

S.3.2.18.2 Cow Canyon Alternative. Adverse impacts on known mineral and energy resources resulting from construction, operation, and maintenance activities associated with the Cow Canyon Alternative would include the decommissioning of the Yellowstone Hydroelectric Power Plant. No known oil or gas wells would be taken out of production.

S.3.2.18.3 Crystal Ranch Alternative. There would be no adverse impacts on mineral and energy resources resulting from construction, operation, and maintenance of any of the Crystal Ranch Alternative project features. No known oil or gas wells would be taken out of production.

S.3.2.18.4 Twin Pots Alternative. There would be no adverse impacts on known mineral and energy resources resulting from construction, operation, and maintenance of any of the Twin Pots Alternative project features. No known oil or gas wells would be taken out of production.

S.3.2.19 Air Quality

Fugitive dust would be emitted during construction of project structures, operation of vehicles, and during burning operations to clear vegetation. Based on the extent and duration of planned construction activities, and the implementation of required mitigation measures, it is anticipated that no significant ambient air impacts would occur as a result of the Proposed Action or any of the alternatives. There would be no significant impacts on air quality during the operation and maintenance of project features for the Proposed Action or any of the alternatives.

S.3.2.20 Noise

There would be substantial increases in noise levels during construction but no long-term noise impacts are expected under the Proposed Action or any of the alternatives. Postconstruction operation and maintenance noise levels are expected to be no higher than preconstruction levels.

S.3.3 Preferred Alternative

In the Draft EIS, the Proposed Action is the same as the Preferred Alternative. The CUWCD Board of Directors adopted the Talmage Alternative as the Proposed Action on October 18, 1995.

The term "Preferred Alternative" is used in an EIS when the lead agencies' Preferred Alternative is different from the Proposed Action of a permit application from a non-agency entity. This situation does not exist in the EIS since the lead agencies control the planning process as opposed to a permitting role.

S.4 Chapter 4—Comparative Analysis of Impacts of the Proposed Action and Alternatives

Major differences between significant adverse impacts and benefits of the Proposed Action and action alternatives are summarized below.

S.4.1 Sociocultural Resources

Overall project effects on the Ute Tribe's sociocultural resources would range from beneficial under the Proposed Action to adverse (+) under the Cow Canyon Alternative. Overall project effects on the non-Indians' sociocultural resources would range from beneficial (+) under the Proposed Action to neutral (-) under the Twin Pots Alternative. Considered together, overall project effects on Tribal and non-Indian sociocultural resources would be most favorable under the Proposed Action and least favorable under the Twin Pots Alternative.

S.4.2 Socioeconomics

The Proposed Action and Cow Canyon and Crystal Ranch Alternatives would result in similar increases in construction sector earnings for Duchesne County; the increase for the Twin Pots Alternative would be less. The Proposed Action and Crystal Ranch Alternative would result in substantially greater total earnings for Ute Tribe members during the construction period than would the other alternatives. Roosevelt schools would have to accommodate more students: 28 for the Proposed Action, 29 for the Cow Canyon Alternative, 18 for the Crystal Ranch Alternative, and 12 for the Twin Pots Alternative.

S.4.3 Agriculture

The Proposed Action and Cow Canyon Alternative would result in the greatest potential increase in the value of agricultural production, and both would result in a greater than 10 percent increase in crop production within the Upalco Unit Replacement Project area. Potential increases in the annual value of agricultural production for the Crystal Ranch and Twin Pots Alternatives would be about $129,000 and $157,000 less, respectively, than the potential increases for the Proposed Action and the Cow Canyon Alternative, which are the same.

S.4.4 Water Resources and Hydrology

No significance criteria were developed for water resources and hydrology. Instead, results of the hydrologic analysis were used to determine direct, indirect, and/or total impacts on water quality, environmental contaminants, and biological resources (i.e., threatened and endangered species, wetland and riparian resources, aquatic resources, and wildlife resources). Refer to the above-mentioned resources to ascertain significant hydrologic effects of the Proposed Action and alternatives.

S.4.5 Water Quality and Contaminants

Significant but localized adverse impacts under the Proposed Action and each alternative would include potential occasional exceedances of agricultural water quality criteria for total dissolved solids (TDS) in localized areas near the lower Lake Fork River and the Duchesne River. These exceedances may result in slight localized restrictions on the use of this river water for irrigation. Project benefits under the Proposed Action and each alternative would include a salinity (salt load) reduction of 0.1 percent in the Colorado River at Imperial Dam, settling of sediment and associated phosphorus and metals in constructed or enlarged reservoirs, reduced shoreline erosion of high mountain lakes, and reestablishment of natural hydrographs in outlet streams of high mountain lakes that would be stabilized.

S.4.6 Aquatic Resources

Significant adverse impacts would include the inundation of 2.6 miles of the Yellowstone River under the Proposed Action and Crystal Ranch Alternative (2.0 miles would be inundated under the Cow Canyon Alternative), loss of the existing river fishery in these reaches, and blockage of upstream fish passage at the dams. There would be a reduction in trout habitat in some reaches of the Lake Fork and Yellowstone Rivers under the Proposed Action and each alternative. However, overall trout habitat would increase for all life stages in a dry water year (except under the Crystal Ranch Alternative) and for all or some life stages in a normal water year (except under the Cow Canyon and Crystal Ranch Alternatives). Examples of other project benefits to fish under the Proposed Action and each alternative would include stabilization of high mountain lakes, fish passage and fish screens at rehabilitated diversion dams, establishment or maintenance of conservation pools for fish in constructed and/or enlarged reservoirs, and improvement of instream flow regimes for trout.

S.4.7 Wetland and Riparian Resources

Known and estimated losses of wetland and riparian areas would include 2,561 acres for the Proposed Action, 2,295 acres for the Cow Canyon Alternative, 2,609 acres for the Crystal Ranch Alternative, and 2,421 acres for the Twin Pots Alternative. Mitigation measures include improving habitat values on existing wetlands and riparian areas as well as developing new areas. Considering all lands involved in mitigation and the known and estimated impacts, there would be net increases in wetland and riparian area acreage for the Proposed Action and Crystal Ranch Alternative and net losses in acreage for the Cow Canyon and Twin Pots Alternatives. Changes in peak flows and reduced summer flows would likely result in additional losses of wetlands on the Lake Fork River for the Crystal Ranch and Twin Pots Alternatives, respectively. Changes in the timing of peak flows would impact wetland and riparian communities for the Proposed Action and all alternatives.

S.4.8 Wildlife Resources

Comparative impacts on wetland and riparian wildlife habitat were described in Section S.4.7 above. The Proposed Action and Crystal Ranch Alternative would result in the loss of critical deer and elk winter range and critical year-long moose range; the Cow Canyon Alternative would result in the loss of critical year-long moose range. Loss of 817 acres of mostly sagebrush/grass during conversion of Tribal idle lands would be the same for the Proposed Action and each alternative. Substantial areas of native upland habitat would be converted to wetlands for mitigation for the Proposed Action and the Cow Canyon and Crystal Ranch Alternatives, with a large trade-off of upland habitat units for wetland habitat units. Two sage grouse leks may be abandoned because of pipeline construction under the Twin Pots Alternative.

S.4.9 Threatened and Endangered Species

The Proposed Action and alternatives would not be expected to adversely affect razorback sucker. The small flow increases and decreases in the Duchesne River (depending on month and water-year type) that would result from the project would not significantly change the current depleted flow condition nor contribute significant amounts of water toward endangered fish recovery. Project impacts on Ute ladies'-tresses would be the same for the Proposed Action, the Cow Canyon Alternative, and the Twin Pots Alternative. Impacts would include inundation of some Ute ladies'-tresses along the Lake Fork River. Potential habitat desiccation associated with a reduction of secondary irrigation return flows and conversion of Tribal idle lands to irrigated lands might have adverse impacts on populations of orchids not closely associated with riverine water. The Crystal Ranch Alternative would result in degradation of some Ute ladies'-tresses habitat because of changes in peak flows.

S.4.10 Land Use Plans Conflict

No significant conflicts with land use plans would result from the Proposed Action or alternatives.

S.4.11 Transportation

Significant adverse impacts would include a decline in the level of service on several major and many minor project area roads during construction. These impacts would be the same and slightly greater under the Proposed Action, Cow Canyon Alternative, and Crystal Ranch Alternative than under the Twin Pots Alternative. Peak annual truck round trips on U.S. Highway 40 would be highest under the Proposed Action (3,990 trips) and lowest under the Crystal Ranch Alternative (2,555 trips).

S.4.12 Soils

Significant adverse impacts would include the loss of productivity on 844 acres (Proposed Action), 643 acres (Cow Canyon Alternative), 562 acres (Crystal Ranch Alternative), and 395 acres (Twin Pots Alternative) because of dam and reservoir construction and/or enlargement. Loss of productivity on relatively small areas at each diversion dam would also be a significant impact.

S.4.13 Health and Safety

There would be an increased risk of loss of life from flooding caused by dam failure under the Proposed Action and each alternative, although it is extremely unlikely such an event would occur. The number of structures potentially affected by flooding total 164 under the Proposed Action, 171 under the Cow Canyon Alternative, 69 under the Crystal Ranch Alternative, and 95 under the Twin Pots Alternative. Improvements at Twin Pots Dam under the Proposed Action and Twin Pots Alternative would reduce the risk of loss of life caused by dam failure and flooding.

S.4.14 Cultural Resources

The number of known historic properties that would potentially be adversely affected total six each under the Proposed Action and Crystal Ranch Alternative, five under the Cow Canyon Alternative, and seven under the Twin Pots Alternative. These significant impacts would be mitigated by avoiding (if possible) or data recovery of the affected resources. Significant ethnographic impacts would occur under the Proposed Action and Crystal Ranch Alternative and consist of inundation of fishing areas on the Yellowstone River and adjacent lands used by deer and elk. These impacts would be unavoidable unless the Ute Tribe states otherwise and allows mitigation.

S.4.15 Recreation Resources

Significant adverse impacts would include the inundation of 2.6 miles of the Yellowstone River under the Proposed Action and Crystal Ranch Alternative and 2.0 miles of the Yellowstone River under the Cow Canyon Alternative. Evaluation of other significant impacts indicated that recreation visitor days spent on the Uintah and Ouray Reservation would increase by 4,835 under the Proposed Action, 4,615 under the Cow Canyon Alternative, 3,875 under the Crystal Ranch Alternative, and 450 under the Twin Pots Alternative.

S.4.16 Wilderness Areas

There would be no significant adverse impacts on the High Uintas Wilderness under the Proposed Action or any of the alternatives. Project benefits resulting from lake stabilization would include improved wilderness values at 10 high mountain lakes under the Proposed Action, Cow Canyon Alternative, and Crystal Ranch Alternative, and improved wilderness values at 14 high mountain lakes under the Twin Pots Alternative.

S.4.17 Visual Resources

Significant adverse impacts would include some exceedance of visual quality objectives because of construction and operation of Crystal Ranch Dam and Reservoir (Proposed Action, Crystal Ranch Alternative) on the Uintah and Ouray Reservation and Upper Yellowstone Dam and Reservoir (Cow Canyon Alternative) on the Ashley National Forest.

S.4.18 Mineral and Energy Resources

There would be a significant adverse impact on energy resources under the Cow Canyon Alternative from decommissioning the Yellowstone Hydroelectric Power Plant. No other significant adverse impacts would occur for the Proposed Action or any of the alternatives.

S.4.19 Air Quality

There would be no significant adverse impacts on air quality under the Proposed Action or any of the alternatives.

S.4.20 Noise

There would be no significant adverse noise impacts under the Proposed Action or any of the alternatives, although construction activities would substantially increase noise levels.

S.5 Chapter 5—Coordination and Consultation

The CUWCD conducted extensive coordination and consultation while preparing the Draft EIS and performing related environmental and planning studies. Pre-scoping and scoping consultations were held with the public, agencies, and organizations. Less formal consultations with agencies, organizations, and technical experts took place throughout the environmental analysis and preparation of the Draft EIS. Key coordination and consultation activities that occurred during project planning, the scoping process, EIS development, and Draft EIS coordination are summarized below.

S.5.1 Project Planning

Public input to the project began in mid-1991 with a random telephone survey within the project area to determine the level of public interest and support for the project. Survey results indicated a very high level of public desire for water development in the project area. In October 1991, field tours were conducted by the CUWCD and representatives from various agencies and interest groups to view locations of potential project features and general environmental conditions in the project area. Attending were members of the FS, U.S. Fish and Wildlife Service (FWS), U.S. Bureau of Indian Affairs (BIA), U.S. Army Corps of Engineers (COE), Utah Division of Wildlife Resources (Wildlife Resources), Ute Tribe, and Utah Outdoor Interests Coordinating Council (UOICC).

Very early in the CUPCA planning phase, the CUWCD arranged with key State and Federal agencies for representatives to be appointed for CUP coordination. The agencies had representatives duty stationed at the CUWCD's CUPCA office to facilitate coordination, and included FS, Wildlife Resources, and Natural Resources Conservation Service (NRCS) personnel.

Following the development of a public involvement program, the CUWCD organized a Planning Team to participate in project planning. All local, State, and Federal agencies with responsibilities related to the project were invited to serve on the Planning Team, along with members of interest groups (environmental, recreation, etc.), the Ute Tribe, water user companies and associations, the news media, and the general public. The Planning Team held its first meeting in December 1991 in Duchesne to introduce members to the project, planning process, and schedule. About 70 people were in attendance.

In January 1992, six public meetings were held to inform the public about the pending CUPCA legislation and to obtain public input on water needs and possible projects. Meetings were held in Altamont, Duchesne, Fort Duchesne, Roosevelt, Vernal, and Salt Lake City. Following these public meetings, the Planning Team held six meetings to begin planning the project. Tasks undertaken included consideration of physical, social, and economic conditions in the Uinta Basin relating to the project; identification of problems, needs, and opportunities relating to water development in the Basin; development of project goals and objectives; identification of general and site-specific project features that might meet the needs identified; and evaluation of the project features. An average of about 60 people attended each of these meetings, representing all of the groups identified above. Two additional public meetings were widely noticed and held in Duchesne on April 15 and in Salt Lake City on April 16, 1992, providing a presentation on the river operations and opportunity for questions and answers.

Beginning in September 1991, the CUWCD met monthly with members of the Duchesne County Water Resource Board at their scheduled Board meetings in Duchesne to inform the group of project status and to answer questions. The Board is appointed by the County Commissioners and is comprised of representatives of major irrigation companies and Basin representatives who serve on the CUWCD Board. Numerous additional meetings have been held throughout the project with irrigators and water-user groups in the Uinta Basin, including representatives from the Moon Lake, Dry Gulch, Farnsworth, and Whiterocks user groups, to inform them of project status and to answer questions.

The involvement of the Ute Tribe in the project has been essential. Two public meetings were held at Fort Duchesne during the planning period (January 28, 1992, and June 3, 1992), and an observer from the Tribe attended Planning Team meetings. The CUWCD communicated with the Tribal Business Council and Resource Officer during this time through letters and personal contacts to keep them informed of the project and to encourage their participation. Two meetings were held with the Tribal Council for that purpose in 1991. Monthly meetings were held with the Tribal Resource Officer to report on project status. Coordination also occurred with Tribal resource staff members and representatives of Federal agencies with trust responsibilities to the Tribe, such as the U.S. Department of the Interior (DOI), FWS, and BIA, to obtain information regarding resource needs and objectives.

The CUWCD has also supported the participation in project planning of other groups important to the project. The CUWCD funded the participation of representatives from the UOICC and the Ute Tribe to ensure their perspectives were heard and incorporated into project planning. The UOICC is an informal organization made up of representatives from the Sierra Club, Audubon Society, several chapters of Trout Unlimited, Salt Lake County Fish and Game Association, Sundance, Utah Rivers Council, and others.

S.5.2 Scoping Process

The Notice of Intent to prepare an EIS was published in December 1992. Public scoping meetings on the project were held at Altamont on January 20, 1993 (59 in attendance), Fort Duchesne on January 21 (44 in attendance), and Salt Lake City on January 28, 1993 (23 in attendance). The top five issues and concerns mentioned in the scoping meetings were, in descending order, project design, financing, relation of the project to the Ute Tribe, structure of project alternatives, and water rights. Details of these meetings are presented in two scoping documents.

A steering committee composed of 13 members of the Planning Team met during the summer of 1993 to develop project alternatives. The steering committee included representatives of agencies with responsibility for project area resources, including the FS, FWS, COE, NRCS, BIA, Wildlife Resources, and Water Resources. Other interests represented were the UOICC, water users, and the CUWCD.

A second series of public scoping meetings was held in October 1993 to present the project alternatives and obtain comments on alternatives and issues that should be studied in the Draft EIS. Meetings were held at Roosevelt on October 12 (64 in attendance), Salt Lake City on October 13 (26 in attendance), and Altamont on October 14 (33 in attendance). The top five issues and concerns mentioned in the scoping meetings were, in descending order, project design, relation of the project to the Ute Tribe, project control, cost/benefits, and water rights. Details of these meetings are presented in two scoping documents.

S.5.3 Coordination During Draft EIS Development

The Draft EIS has been developed through continued coordination efforts among the CUWCD project team, agencies, the Ute Tribe, and the Planning Team. Issues identified during scoping were incorporated into the Specialist Work Plans for collecting data to be analyzed in resource Technical Reports, which are the basis for preparing the Draft EIS. Participants on the Planning Team and the UOICC were provided with copies for review of the relevant draft Specialist Work Plans and Technical Reports for the Draft EIS. Their comments were received and incorporated into the final Specialist Work Plans and Technical Reports.

Weekly meetings with agency personnel located at CUP headquarters were held by the CUWCD during Draft EIS development. Monthly coordination meetings with a broader group of agencies occurred for project planning and scoping purposes and to guide fieldwork efforts associated with the environmental data collection and evaluation. Participating in these meetings were the DOI, U.S. Environmental Protection Agency (EPA), COE, FWS, Wildlife Resources, NRCS, FS, UOICC, and, later in the process, the Ute Tribe.

Technical committees were established during the Planning Team meetings to provide guidance on studies of terrestrial and aquatic biological resources. These committees were comprised of professional experts from State and Federal agencies, as well as the private sector. They provided input during technical committee meetings on the design of field studies and data collection and analysis methodologies, and they reviewed study findings.

Major coordination efforts with the Ute Tribe also occurred during this period. The Tribe hired a consultant to conduct Upalco Unit Draft EIS studies on the Reservation and appointed a Water Board to manage the work and coordinate with the CUWCD and its consultant. Following this action, a series of meetings was held by the Tribal Water Board and CUWCD to develop the project relationship and to define and coordinate the division of work between the consultants. Between November 1995 and June 1996, biweekly or monthly meetings were held with the Ute Tribe, their representatives, and DOI to discuss allocation of project water and the status of the planning effort.

More than 50 special purpose meetings were held by the project team with a number of agencies during Draft EIS development. Numerous meetings were also held with various interest groups during this period. Several additional meetings were held to inform and obtain input from the project Planning Team during Draft EIS development.

These occurred on April 26, 1994, and January 31, 1995.

Draft technical reports were subsequently prepared for seven resource areas (water, aquatics, wildlife, threatened and endangered species, wetlands/riparian, environmental contaminants, and cultural), then reviewed and commented on by agency representatives, the Ute Tribe and their representatives, and the UOICC. Review comments were received by the CUWCD during late 1995/early 1996. Where appropriate, these comments were addressed in revised technical reports, which form the basis of the respective resource areas addressed in the Draft EIS.

S.5.4 Draft EIS Coordination

A complete mailing list of all agencies, bureaus, organizations, groups, and individuals that will receive the Draft EIS is available upon request from:

Terry Holzworth, Project Manager
Central Utah Water Conservancy District
355 West 1300 South
Orem, Utah 84058-7303

Three public hearings will be held on the Draft EIS — in Fort Duchesne, Utah; in Salt Lake City, Utah; and in Altamont, Utah. Following are the hearing dates, times, and locations:

Altamont Draft EIS Hearing

Date: **Wednesday, February 5, 1997**
Time: **6:00 p.m.**
Location: **Altamont High School Auditorium**
Highway 87 (north side)
Altamont, Utah

Salt Lake City Draft EIS Hearing

Date: **Thursday, February 6, 1997**
Time:` **6:00 p.m.**
Location: **Salt Lake County Commission Chambers**
2001 S. State Rm N1100
Salt Lake City, Utah

Fort Duchesne Draft EIS Hearing

Date: **Tuesday, February 11, 1997**
Time: **1:00 p.m.**
Location: **Ute Tribal Auditorium**
Tribal Headquarters
Fort Duchesne, Utah

Chapter 1
General Overview

1.1 Introduction

This Draft Environmental Impact Statement (Draft EIS) was prepared pursuant to requirements of the National Environmental Policy Act (NEPA) for the Upalco Unit Replacement Project (hereafter referred to as the Upalco Unit) proposed by the Department of the Interior (DOI) and the Central Utah Water Conservancy District (CUWCD). This action consists of a proposal to construct a combination of features that will develop water supplies for the Upalco Unit of the Central Utah Project (CUP) in the Uinta Basin of northeastern Utah. The features include water storage reservoirs, improved diversion and distribution of water, water conservation, stabilization of high mountain lakes, instream flows, fish and wildlife mitigation and enhancements, recreation developments, and land retirement. Detailed descriptions of the Proposed Action and alternatives are provided in Chapter 2 of this Draft EIS. A similar, but independent, action is being planned for the Uintah Unit Replacement Project (hereafter referred to as the Uintah Unit) of the CUP, which is adjacent to the Upalco Unit and is the subject of another EIS being prepared concurrently.

This project responds to Public Law 102-575, Reclamation Projects Authorization and Adjustment Act of 1992, which was signed by the President on October 30, 1992. Titles II through VI, known as the Central Utah Project Completion Act (CUPCA), transferred the responsibility for completing the CUP from the U.S. Bureau of Reclamation (USBR) to the CUWCD.

The legislation designated the CUWCD as a Federal agency for the purposes of complying with the NEPA and other federal environmental statutes. In compliance with the CUPCA, the CUWCD on August 11, 1993, entered into an Agreement with the DOI "to provide for compliance with the provisions of the CUPCA." That Agreement authorized the CUWCD to enter into Cooperative Agreements and fund transfer agreements. The Agreement also established the CUWCD and Secretary of the Interior as joint lead agencies in the preparation of this Draft EIS.

The Upalco Unit will, in part, assist the Ute Indian Tribe of the Uintah and Ouray Reservation (Tribe) with the development and management of its water resources. The DOI and CUWCD have a trust responsibility to protect Tribal water resources and to assist the Tribe in developing and using its resources. This Draft EIS recognizes this trust responsibility as part of the development of the Proposed Action and alternatives.

1.2 Purpose and Need

1.2.1 Purposes of the Proposed Action

The purposes of the Proposed Action are as follows:

- To assist the Ute Indian Tribe in the management and use of its water resources
- To deliver water to match agricultural plant consumptive use and instream flow needs
- To facilitate improved water resource management in the Uinta Basin
- To minimize impacts of irrigation operation of high mountain lakes on wilderness values
- To facilitate water conservation in the Uinta Basin
- To provide 3,000 acre-feet of water per year to the City of Roosevelt for municipal and industrial use
- To protect and enhance environmental, fish and wildlife, and recreation resources

1.2.2 Need for the Proposed Action

There is a need to manage the water supply within the Upalco Unit to develop resources of the Ute Tribe, provide early and late season irrigation water, provide municipal water supplies, and provide water and facilities for environmental and recreation purposes. Each need is described below.

Tribal and non-Tribal irrigators in the Upalco Unit have a need to distribute runoff from the Uinta Mountains on a schedule that better matches the consumptive use of their crops. Because the Uinta Range has an east-west orientation, its extensive south-facing slopes are subject to rapid snowmelt during spring thaw. Figure 1-1 shows the relationship between runoff and consumptive use of crops. Runoff is insufficient in April and early May, overabundant in late May and June, and insufficient again in July, August, and September. There is also a need to attenuate the diurnal fluctuations at the diversion structures to improve regulation of water distributed for irrigation.

The City of Roosevelt is experiencing moderate, steady growth. City officials have requested that the project provide 3,000 acre-feet of water per year for municipal and industrial growth in the city. The City has developed all of the groundwater resources that can be practically used for this purpose. No sources of water are available except for the Upalco Unit. A detailed analysis of this need shows that water shortages would occur in summer months by the year 2000.

Early in this century, high mountain lakes in the upper portion of the Lake Fork and Yellowstone River drainages were dammed to provide late season irrigation flows. Since construction of the lakes, the High Uintas Wilderness was established. However, this designation provided for continued operation of the lakes. There is a need to return these lakes to natural levels to make them more compatible with wilderness values.

A number of environmental resource needs within the unit have been identified. These include instream flows and habitat, big game winter range, and recreation facilities. Fishery resources are depressed by widely fluctuating stream flows and recurring instream activities such as rebuilding irrigation diversions, channelization, and bank maintenance. In addition, Tribal cultural needs for live streams are not being met when stream channels are dry.

Much of the big game winter range includes agricultural land, which often results in depredation of crops. There is a need to reduce this conflict by providing improved natural winter range habitat, thereby minimizing big game dependence on agricultural lands. In addition, recreation facilities and related fisheries habitat are limited at existing water impoundments.

The Proposed Action and its alternatives seek to meet these needs and purposes by providing water storage, improved distribution of water, water conservation, municipal and industrial water, instream flows, fish and wildlife enhancements, and recreation developments.

1.3 History and Background

The origins of the Upalco Unit are traced to the Colorado River Compact of 1928 in which the states within the Colorado River Basin agreed to their share of the water produced by the Colorado River system. The mechanism to deliver Utah's share was provided by the Central Utah Project of the Colorado River Storage Project Act of 1956 (Public Law 84-485). This project consisted of six units that could be constructed and operated independently. Included among these was the Upalco Unit.

The Upalco Unit was intended to include construction of facilities to deliver supplemental water to 8,501 acres of Group 1 Indian land and 34,110 acres of non-Indian land. Group 1 lands are those irrigated lands for which a federal decree has been entered.

The Upalco Unit was indefinitely postponed after a Final EIS had been filed with the U.S. Environmental Protection Agency (EPA) in 1980 by the USBR because of rising construction costs and

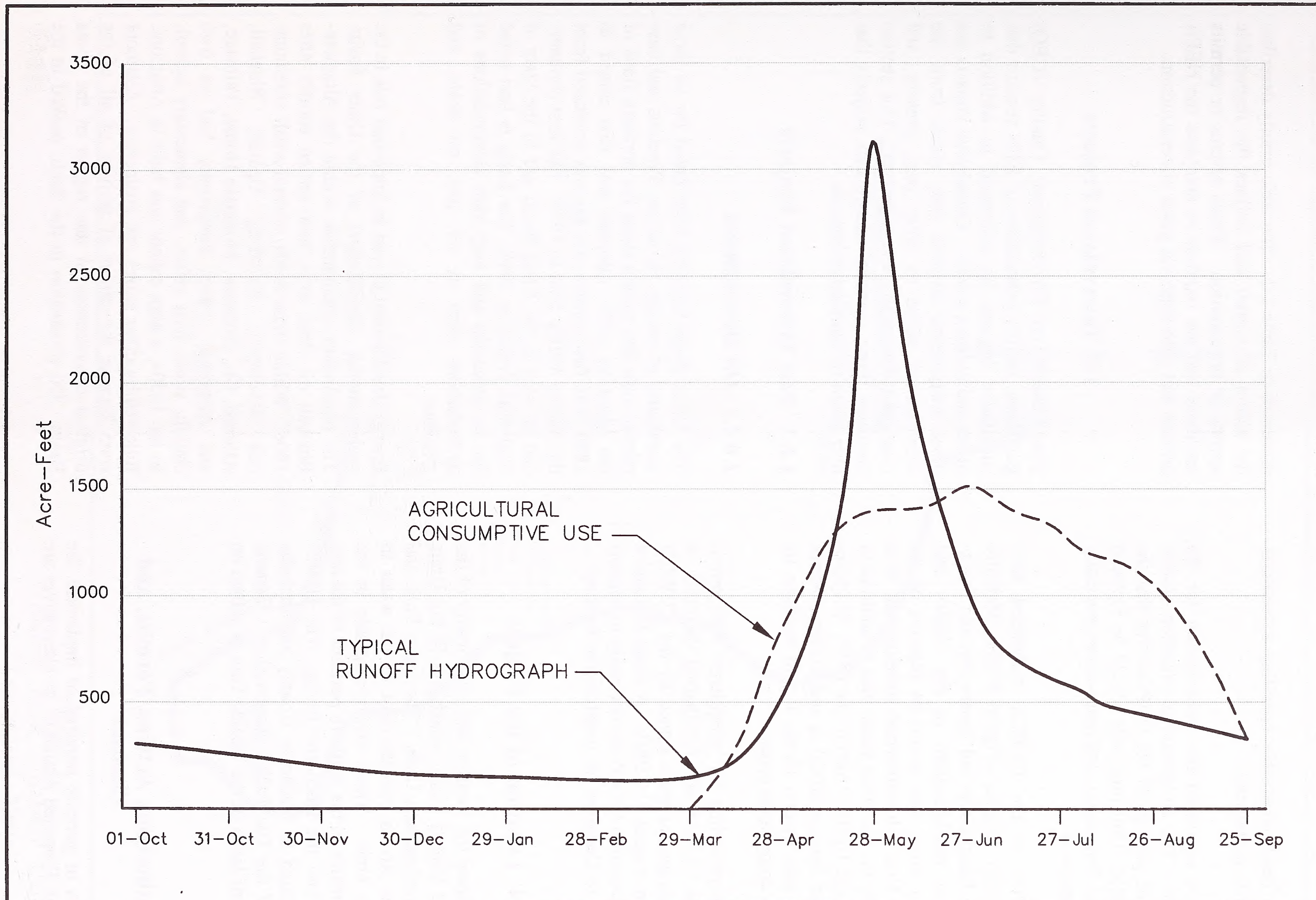


Figure 1-1
Upalco System Runoff Hydrograph and Consumptive Use

inability to reach acceptable operating agreements among project proponents.

The CUPCA continued the authorization for the Upalco Unit. The congressional direction associated with the passage of the CUPCA was that the original Upalco Unit proposals should be replaced with smaller, less costly, and more environmentally acceptable projects.

Section 203(a) of the CUPCA authorized four specific project features (Pigeon Water, McGuire Draw, Clay Basin Dams and Reservoirs, and Farnsworth Canal rehabilitation) in the Upalco and Uintah Unit areas that would be features of the Bonneville Unit. It authorized development of a water supply for the Uinta Basin area in addition to the Uintah and Upalco Units of the CUP. If implementation of Section 203(a) is undertaken without the Uintah and Upalco Units, it will undergo its own NEPA compliance process.

Agreements providing for compliance with provisions of the CUPCA and for sharing the costs of project development were signed by the CUWCD and DOI on August 11, 1993. A Final EIS and a Record of Decision (ROD) are necessary to support the request to Congress for construction funding.

1.4 Location of the Project

Map 1-1 shows the location and relationship of the Upalco and Uintah Units, which are in the Uinta Basin of northeastern Utah. The Lake Fork and Yellowstone Rivers provide most of the water in the Upalco Unit. These rivers originate in the Uinta Mountains in the northern portions of the unit and drain into the Duchesne River. The Upalco Unit is located in Duchesne County and includes portions of the Ute Indian Reservation. General ownership of lands in the Upalco Unit is shown on Map 1-2.

1.5 Authorizing Actions, Permits, and Licenses

The actions or permits required to implement the Upalco Unit Proposed Action or its alternatives are presented in Table 1-1. The table briefly describes the action or permit and defines the responsible agency or organization. These actions or permits are those that are required to complete the NEPA process and gain approval prior to construction.

1.6 Interrelated Projects

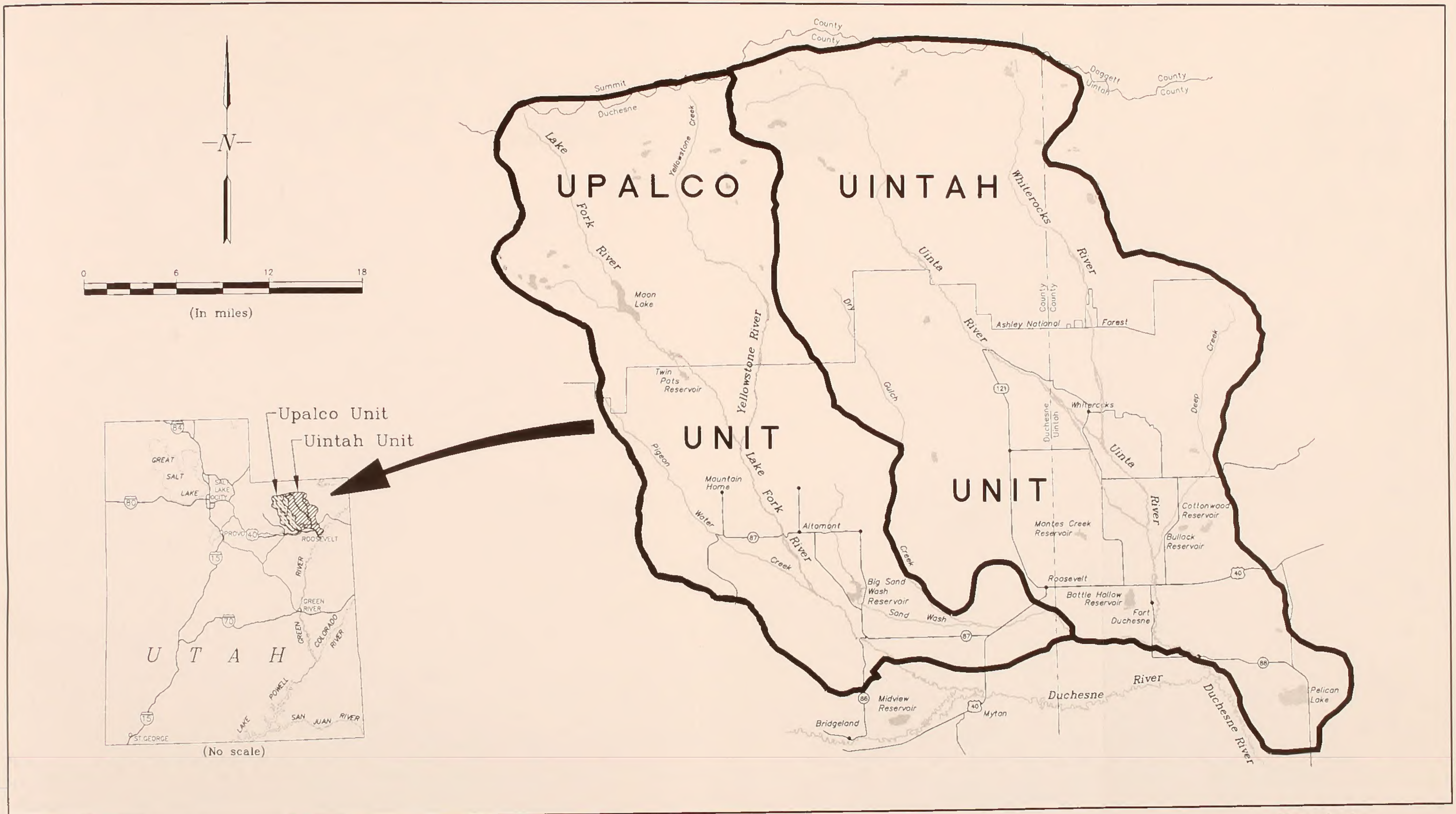
The Council on Environmental Quality (CEQ) guidelines for the preparation of EISs require that cumulative impacts be addressed in addition to direct and indirect effects. Cumulative impacts are those incremental impacts that result from the action when added to other past, present, and reasonably foreseeable future actions. This section discusses those potential interrelated projects that may result in cumulative impacts.

1.6.1 Past Interrelated Projects

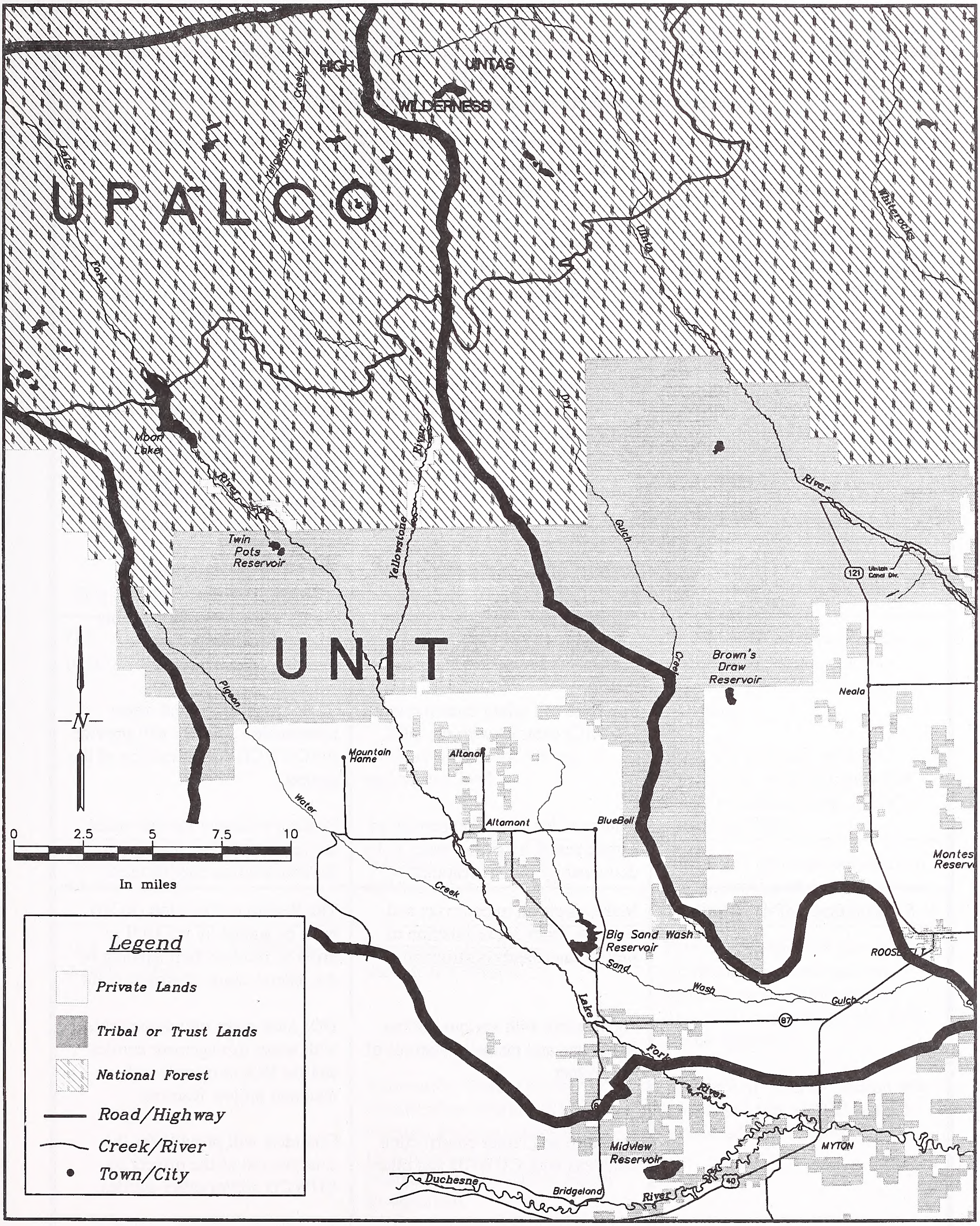
1.6.1.1 Oil Development

The Uinta Basin has long been noted for its large storehouse of energy resources. Precious and base metals were first mined along the northern flank of the Basin in 1887; gilsonite was first mined in 1889. The first commercial gas was produced from the Ashley Valley field in 1925. The first commercial oil well in the Uinta Basin and in the State of Utah was drilled in 1948. The Basin is best noted for its extensive and very rich accumulations of hydrocarbons such as oil, gas, oil shale, and gilsonite.

Energy development played an important role in the socioeconomic development of the Uinta Basin. The non-Indian communities within the Altamont-Bluebell oil field were first settled shortly after 1906. Within these fields, several small communities developed, including Upalco, Bluebell, Altonah, Mt. Emmons, Mountain Home, Talmage, and Altamont. Each community had its own church, store, post office, and elementary school. In the 1930s, a high school was built in Altamont, followed by other stores and businesses. Altamont soon became the center of activity of all of the original communities in this region of the Uinta Basin. Oil production in the Basin peaked in the



Map 1-1
Upalco and Uintah Units
Location Map



Map 1-2
Upalco Unit
General Land Ownership

Table 1-1
Upalco Unit Authorizing Actions, Permits, and Licenses

Page 1 of 5

Agency or Organization	Actions, Permits, and Licenses Required	Description
Federal Agencies		
Central Utah Water Conservancy District (CUWCD)	Approve the alternatives selected for construction	The CUWCD Board of Directors must recommend a Proposed Action to the Department of the Interior (DOI) for construction.
	Agreements with various entities to operate and maintain features of the alternative selected for construction	The CUWCD must enter into several agreements with existing water management companies, the Ute Indian Tribe, and the Bureau of Indian Affairs (BIA) to operate and maintain the features of the project to be constructed.
	Repayment contract with the DOI	The CUWCD must have an executed repayment contract with the DOI to cover reimbursable costs before construction is started.
	Drainage and minor construction (D&MC) contract with the DOI	Drainage facilities and minor construction contract will provide for CUWCD's construction of the project.
	Contracts for sale of 90 percent of supplemental irrigation water to be delivered by project features	Binding contracts for this water are required before any funding for construction may be used.
U.S. Department of the Interior (DOI)	Makes decision to construct and requests funds for acquisition of project lands and construction	The Record of Decision (ROD) must be signed by the DOI in order to provide their funding of the federal share of project costs.
	Agreements with various entities to operate and maintain features of the project	DOI must enter into agreements with water management entities and the BIA to operate and maintain project features.
	Drainage and minor construction contracts with CUWCD and others	Contracts will provide for the construction of the project by CUWCD and/or other entities.
	Certification of irrigability	The Secretary must certify the irrigability of lands receiving project water.

Table 1-1
Upalco Unit Authorizing Actions, Permits, and Licenses

Agency or Organization	Actions, Permits, and Licenses Required	Description
U.S. Fish and Wildlife Service (FWS)	Endangered Species Act (ESA) (Section 7 consultation)	Consultation under Section 7 of ESA is required to determine if the project will affect threatened or endangered species. FWS will prepare a Biological Opinion based on the CUWCD Biological Assessment.
	Fish and Wildlife Coordination Act (FWCA) Report	FWS must prepare a FWCA report that determines impacts on fish and wildlife and recommends ways to avoid or mitigate those impacts.
	Contaminant Prevention Plan (Section 205-CUPCA)	Approve a contaminant prevention plan if determined necessary.
U.S. Army Corps of Engineers (COE)	Permit pursuant to Section 404 of the Clean Water Act (CWA)	Will be required for excavation or discharge of fill material into waters of the U.S., including wetlands.
	Wetland delineation on non-agricultural land	COE will delineate on non-agricultural lands wetlands that are jurisdictional under Section 404 of the CWA.
Natural Resources Conservation Service (NRCS)	Wetlands delineation on agricultural lands	NRCS will delineate wetlands on agricultural lands under the Food Security Act (FSA).
U.S. Environmental Protection Agency (EPA)	Oversight authority for Section 404 Permits	EPA will review 404 permit applications and recommend approval or denial of permits. They have authority to veto COE permit approvals.
	Administers Water Quality Certification (Section 401) and National Pollutant Discharge Elimination System (NPDES) permits (Section 402) on Indian Reservations	EPA will provide all Section 401 certificates and NPDES permits associated with the project.

Table 1-1
Upalco Unit Authorizing Actions, Permits, and Licenses

Agency or Organization	Actions, Permits, and Licenses Required	Description
U.S. Forest Service (FS)	Special Use Permits	FS will need to issue special use permits for various features proposed under the Upalco Unit located on National Forest land. Termination of special use permits for high mountain lakes will be required if lakes are stabilized.
	Special waiver by the Regional Forester for certain work in wilderness areas	This will be needed if high mountain lake construction requires camps with more than 12 workers or 15 pack animals and/or uses mechanized/ motorized equipment.
U.S. Bureau of Indian Affairs (BIA)	Modification and Operation Agreements	Agreements with the BIA will be required by the DOI and CUWCD to modify water management facilities on Tribal lands. Agreements will also be required for BIA's operation and maintenance of new or modified water management facilities on Tribal lands.
	Permits and right-of-ways (ROWs) for use of Tribal lands	Issues formal permits and ROWs for use of Tribal lands as a Federal trust agency based on approval of Tribe Business Committee.
	Certification of Irrigability	BIA must certify irrigability of lands receiving project water.
State Agencies		
Division of State History, State Archaeologist and State Historical Preservation Officer (SHPO)	State Antiquities Permit Signatory to a Programmatic Agreement (PA) with the CUWCD, DOI, Ute Tribe, FS, and Advisory Council on Historic Preservation (ACHP) to guide future studies and mitigation	Approval of survey and excavation of cultural resources prior to construction. SHPO and the ACHP will determine if the proposed project will have an impact on culturally or historically sensitive sites listed, or if sites are eligible for listing on the National Register of Historic Places.

Table 1-1
Upalco Unit Authorizing Actions, Permits, and Licenses

Agency or Organization	Actions, Permits, and Licenses Required	Description
Utah Division of Wildlife Resources (Wildlife Resources)	Wildlife Resources has responsibility for management of fish and wildlife in the state outside of Indian Reservations and has concurrence responsibility for the FWCA Report	Wildlife Resources will comment on, and concur with FWS on, the FWCA Report. If they cannot concur, they may write their own FWCA Report.
Utah Division of Water Quality	Section 401 Water Quality Certificate (CWA)* Section 402 National Pollutant Discharge Elimination System (NPDES) permit (CWA)*	This agency must provide 401 Water Quality Certificates for applicable project features. This agency will also issue NPDES permits.
Utah Division of Water Rights	Approval of changes in diversions, new diversions, and issuance of stream alteration permits*	Each new or moved point of diversion must be approved by the Division of Water Rights. They also must issue a stream alteration permit for each feature affecting stream beds.
	Approval of transfer of water rights from the U.S. Bureau of Reclamation (USBR) to the CUWCD (does not include Indian water rights)	Water rights held by USBR for the Upalco Unit must be transferred to the CUWCD to operate the project.
	Approval of transfer of irrigation water rights in high mountain lakes to project reservoirs	Operation of the project will require the water rights to be moved to the facility in order for the lakes to be stabilized.
	Approve exchange agreements with water users	Exchange agreements will be required to facilitate project operation.
	Review plans and specifications for all dam construction	Plans for dams must be reviewed for safety considerations.
Utah Department of Transportation (UDOT)	Encroachment Permits	UDOT must issue permits to construct or modify project features on state highway ROWs.

*Only applies to features outside Indian Reservations.

Table 1-1
Upalco Unit Authorizing Actions, Permits, and Licenses

Agency or Organization	Actions, Permits, and Licenses Required	Description
Tribal and Other Agencies or Organizations		
Water User Associations and Irrigation Companies	Agreements to operate and maintain project features	Operation and maintenance of project-funded features will be carried out by operators of existing facilities through agreements with the DOI and CUWCD.
Ute Indian Tribe Business Committee	Approval of use of Tribal lands for project features Approval of access, ROWs, easement, or other uses of Tribal lands Agreements to operate and maintain fish and wildlife mitigation measures and enhancements and recreation developments on Tribal lands	The Tribe Business Committee must approve any project features on and access to Tribal lands. It also must be a signatory party to agreements to operate and maintain fish and wildlife and recreation developments on Tribal lands.
Duchesne County Government	Building Permits Permits to construct in county road ROWs	Duchesne County will need to issue building permits for each project feature and permits to construct in county road ROWs.

mid-1980s with approximately 18 million barrels produced in a year.

Today, oil wells and their attributed revenues are still a significant factor in the economy of the Uinta Basin. An oil refinery in Roosevelt is one of the major employers in the area. The Roosevelt Refinery processes crude oil from the Altamont and Bluebell fields and distributes products to major buyers in several states.

There are currently 923 active oil and gas wells in Duchesne County and 1,779 active oil and gas wells in Uintah County. From January 1996 through October 15, 1996, 68 new wells have been drilled in Duchesne County and 34 new wells have been drilled in Uintah County. Yearly oil production in Duchesne and Uintah Counties is roughly 9 million barrels, approximately half the amount produced during the mid-1980s. The industry appears to have stabilized in the past few years, with overall production remaining relatively constant.

1.6.1.2 Water Development

Numerous water projects have influenced the growth and quality of life in the Uinta Basin. Several Federal agencies, including the U.S. Forest Service (FS), the USBR, and the U.S. Indian Irrigation Service, have been involved in these water development projects. The importance of irrigation for the initial success and survival of communities in the Uinta Basin was well understood. A complex system of irrigation canals and reservoirs has been constructed and maintained for irrigation uses since the late 1800s.

The first decades of the twentieth century clearly demonstrated that the existing irrigation system was inadequate to meet the agricultural needs of all Uinta Basin farmers. Mormon farmers and the U.S. Indian Irrigation Service moved quickly to impound the mountain runoff that flowed through and out of the Basin each spring. The mountain waters were stored behind small earth-filled or masonry dams and then released during the hot growing season. The majority of dams allowed farming to continue through brief periods of drought while the larger structures facilitated further agricultural settlement in the Basin. Numerous dams and reservoirs were created in the early years, including Kidney Lake (1918), Island Lake (1919), Brown Duck Lake (1919), East Timothy Lake (1920), Water Lily Lake (1920), and Twin Pots (1921). Other high mountain lakes were also modified during the same time period, including White Miller, Deer, Farmers, Bluebell, Drift, Superior, Five Points, and Milk Lakes.

In the 1930s, interested irrigation companies joined together to raise capital for the Moon Lake Project and to form the Moon Lake Water Users Association. The project was needed to obtain 44,880 additional acre-feet of water supply. A dam on the south side of the lake was completed in 1937.

After these early years of water development, numerous other projects were added to the system to supplement the water supply in the Uinta Basin. Some of the more important projects include, but are not limited to, the following:

- Brough Reservoir
- Cottonwood Reservoir
- Big Sand Wash Reservoir
- Browns Draw
- Bonneville Unit Features (including Strawberry Aqueduct, Soldier Creek Reservoir, Upper Stillwater Reservoir, Starvation Reservoir, and Duchesne River Canal Rehabilitation)

1.6.1.3 Irrigation Development

During most of the past century, cropland was irrigated using the corrugation method, where furrows extend down slopes to carry water. On irrigated pasture, the free or wild flowing method of irrigation was commonly practiced. Using this technique, irrigation water was allowed to run over the same area of land for days at a time. These irrigation techniques were not water-efficient and tended to decrease the fertility of the soil while increasing the amount of salinity reaching surface water. In the last two decades, the Soil Conservation Service (SCS), now known as the Natural Resources Conservation Service (NRCS), has been working with farmers in the Uinta Basin to develop more efficient irrigation systems.

In 1980, the SCS began the Colorado River Salinity Control Program. The goal of the program was to reduce the salinity load from irrigation runoff returning to surface water by helping farmers install sprinkler and surface irrigation systems. The program has also increased crop yields over the years and improved overall farm efficiency. Since 1981, a total of 99,185 acres in Duchesne and Uintah Counties have benefited from the program with improved irrigation systems, the vast majority being wheel line sprinklers. NRCS estimates that the cumulative salt load reduction in these two counties is 86,000 tons per year.

This program is very popular and has a continual waiting list. During the past year (fiscal year 1996), a total of 4,336 acres were converted for 99 separate contracts or farmers. At the present time, the NRCS pays for 70 percent of the cost of the system; farmers pay 30 percent. NRCS develops a priority list based on lands that have the highest salinity problem and that will show the greatest cost benefit for removed salinity.

1.6.2 Future Interrelated Projects

An extensive survey was conducted to identify and determine the nature of other reasonably foreseeable projects potentially occurring within the Uinta Basin that could result in cumulative environmental impacts with projects proposed for the Upalco Unit. Table 1-2 summarizes the projects expected to occur in the Basin. Each project was evaluated to determine if it was sufficiently defined (i.e., reasonably foreseeable) to be relevant to potential impacts of the Upalco Unit; within the Upalco Unit area of influence; and of a magnitude that would result in a significant cumulative impact. The evaluation showed that only the Uintah Unit projects meet all these criteria. Therefore, potential cumulative impacts resulting from combinations of actions in the Upalco and Uintah Units are addressed in each resource area in Chapter 3.

1.7 Alternatives Considered but Eliminated from Detailed Analysis

This section discusses the features and alternatives considered but eliminated from further analysis. While a very wide range of features was considered by the Planning Team, they were reduced to a defined set of alternatives made up of interrelated features at the time of formal NEPA scoping. Planning Team members and objectives are described in Chapter 5. The discussion below assesses project refinements made after scoping was complete.

1.7.1 Features and Basis for Elimination or Addition

Table 1-3 shows the Upalco Unit project features proposed for construction, replacement, or modification that were eliminated or added during the project refinement phase following scoping. The table also indicates the general basis for eliminations or additions of features.

1.7.2 Alternatives Eliminated and Rationale

At the time of scoping, five action alternatives and a No Action Alternative were proposed in the Upalco Unit. As individual features proved infeasible during subsequent analysis, the interrelationships with other features within alternatives were affected. It was necessary then to reconfigure alternatives and, in some cases, rename them. The former Twin Pots Alternative became known as the Talmage Alternative and the Big Sand Wash Alternative became the Twin Pots Alternative. The South Clay Basin Alternative was eliminated because South Clay Basin Dam duplicated Big Sand Wash Enlargement and Talmage Dam proved infeasible.

Table 1-2
Uinta Basin Projects Considered for Cumulative Impact Analysis

Duchesne County Comprehensive Plan Amendment—Draft plan would provide direction on federal land policy issues within the county.

Gravity Sprinkler Irrigation Development (Colorado River Salinity Control Project)
Sand Wash Canal—400-acre conversion to sprinkler irrigation. Preliminary design has been completed. Construction unknown.

Dry Gulch Irrigation Company—1,800-acre conversion. Preliminary design has been completed. Construction possible in 1997.

Lower Pioneer Group—481-acre conversion. This project will connect to the USBR project and eliminate the open Pioneer Canal. Preliminary design has been completed.

Red Creek Reservoir Irrigation Company—This project would pipe a section of the canal.

Uteland Purdy Ditch Company—1,500-acre conversion on hold by USBR.

Fruitland Group—692-acre conversion. Preliminary design has been completed.

Lower Strawberry—576-acre conversion. Preliminary design has been completed. Construction possible in 1996.

Farm Creek Irrigation Company—2,100-acre conversion. Half of this has already been converted. Completion possible in 1996.

Wildlife Reserve Concept (near Myton)
Lands near the county line at Myton have been considered for use as a wildlife reserve to mitigate losses caused by past USBR projects.

Ute Tribe Development
Housing—Work on a $3.5 million single-family housing development is underway.

Whiterocks Road Improvement—This is the priority road improvement project on the reservation. It will require $3.2 million over the next 2 years (1996 and 1997).

Uintah Canyon Road Improvement—This project is currently secondary to the Whiterocks Road Improvement. Improvement consists of paving. The status is uncertain.

Independence Road Improvement—This is another secondary priority project to the Whiterocks Road Improvement. Status is uncertain.

Fish Hatchery—A fish hatchery at the Youth Camp/Big Springs area has been proposed under CUPCA mitigation 313(c).

Leland Bench Oilfield Development Project—A NEPA Scoping Announcement has been circulated for this development of 625 oil wells at 40-acre spacing on 25,000 acres located 35 miles southwest of Vernal.

Utah Reclamation, Mitigation, and Conservation Commission
Strawberry Aqueduct and Collection System of the Bonneville Unit—Aquatic mitigation plan for the Strawberry and Duschene River drainages.

U.S. Forest Service
Yellowstone Hydroelectric—A cooperative effort with Moon Lake Electric Cooperative to dredge the existing reservoir on this hydro project. Dredging was completed in 1995. Improvements to Reservoir Campground to be completed.

Table 1-2
Uinta Basin Projects Considered for Cumulative Impact Analysis

Revision of Ashley Forest Resource Management Plan—Although scheduled for revision, this plan is not expected to be revised until clear direction is provided.

High Uintas Wilderness Limits of Acceptable Change—A citizens committee is working to define acceptable limits of change within the wilderness area. Draft EIS released for review and comment.

Utah Department of Transportation
State Route 35 Wolf Creek Road—Involves reconstruction of road, some on new alignments, by FHWA across Forest Service land. Last portion of four sections scheduled for fiscal 1997.

Oil and Gas Well Development (future wells)
About the same number of oil and gas wells are expected to be drilled in Duchesne and Uintah Counties in the next several years as in the past year. From January through mid-October 1996, 68 wells were drilled in Duchesne County and 34 in Uintah County.

Central Utah Project Water Conservation Credit Projects
Brown & Broadhead Ditch Piping—Pipe the Brown (approximately 2 miles) and Broadhead (approximately 2.4 miles) Canals. Feasibility of combining the two canals into one pipeline will be considered.

Farm Creek Irrigation—Convert from open canal to piped pressure irrigation systems. Conserved water is proposed to remain in the Duchesne River.

Rhoades Flood to Sprinkler Conversion—On-farm improvement, converting from flood to sprinkler irrigation systems. Project includes pressurized supply line.

Altamont Town Irrigation Project—Secondary irrigation system for Altamont residents, includes replacing approximately 12,000 feet of open ditch with a pipeline.

Duchesne City Instream Flow Project and East Duchesne Culinary Water Improvement District Instream Flow Project—The DOI has agreed to credit these entities for 275 and 70 acre-feet of water to be conserved, respectively. The agreement is thought to be for a 5-year period before contract renewal. Water is assumed to be put back into the Duchesne River.

Central Utah Water Conservancy District/Department of the Interior Uintah Unit Replacement Project—Major water development project consisting of water storage, water distribution, recreation, and environmental features.

U.S. Bureau of Reclamation
Uinta River—Land acquisition for the CUP Mitigation Commission—retirement of lands for water rights.

Land Acquisition for Fisherman Access—Seventy to 85 percent of the land has already been acquired.

Strawberry River and West Fork of the Duchesne River—Section 8 stream rehabilitation.

Rock Creek below Upper Stillwater Dam—Wetlands mitigation for CUP Mitigation Commission.

SEED Project—Drilling at Moon Lake Dam to determine safety.

Green River—Recovery Implementation Program (RIP)
- Study Green and Colorado Rivers
- Flooded Bottomlands Program
- Hatchery Propagation
- Middle Green River Selenium Study

Table 1-3
Upalco Unit Project Features Eliminated or Added

Features Eliminated	**Basis**
Talmage Dam	Insufficient economic benefits and engineering infeasibility
Clay Basin Reservoir	Engineering infeasibility (replaced by South Clay Basin Dam)
South Clay Basin Dam	Replaced by Big Sand Wash Dam and Reservoir Enlargement
Pigeon Water Reservoir	Replaced by Big Sand Wash Dam and Reservoir Enlargement
Moon Lake Channel Dredging	Filling and distribution problems; limited water supply benefit
Gravity Pressure Irrigation	Insufficient economic benefit
Dry Gulch No. 1 Canal and Diversion Dam	Unacceptable loss of wetlands
Farnsworth Canal	Unacceptable loss of wetlands
U.S. Lake Fork Canal	Unacceptable loss of wetlands
Yellowstone Feeder Canal	Unacceptable loss of wetlands
Farnsworth Diversion Dam	Insufficient flows for fish passage
Purdy Diversion Dam	Insufficient flows for fish passage
Uteland Diversion Dam	Insufficient flows for fish passage
Red Cap Diversion Dam	Insufficient flows for fish passage
Hamilton-Knudsen Diversion Dam	Insufficient flows for fish passage
Features Added	
Farnsworth Canal Laterals	Replacement for Farnsworth Canal
Farnsworth Lateral No. 1	
Farnsworth Lateral No. 2	
Farnsworth Lateral No. 3	
Ottosen Lateral	
Blackburn Lateral	
Anderson Lateral	
Tony Smith Lateral	
Lake Fork-Yellowstone Pipeline	Improved water supply for Moon Lake Water Users Association
Big Sand Wash Reservoir–Roosevelt Pipeline	Requested by City of Roosevelt

Chapter 2
Description of the Proposed Action and Alternatives

2.1 Overview of the Proposed Action and Alternatives

This chapter of the Draft Environmental Impact Statement (EIS) addresses the Proposed Action and four alternatives for the Upalco Unit Replacement Project (hereafter referred to as the Upalco Unit). They are as follows:

- Proposed Action – Talmage
- Cow Canyon Alternative
- Crystal Ranch Alternative
- Twin Pots Alternative
- No Action Alternative

The Proposed Action and each action alternative are a combination of features that work together as a unit. The features are generally addressed according to the following:

- Dams and Reservoirs
- Diversion Dams
- Canal Rehabilitation
- Pipelines
- High Mountain Lakes Stabilization
- Fish and Wildlife
- Recreation Developments
- Land Retirement

The exceptions are the Cow Canyon Alternative, which proposes no canal rehabilitation; the Crystal Ranch Alternative, which proposes no new pipelines; and the Twin Pots Alternative, which proposes no recreation developments. Table 2-1 lists specific features for the Proposed Action and each action alternative.

Functions of the project features are as follows:

- Dams and Reservoirs – Water storage capability and water supply regulation would primarily increase the amount and delivery of the available surface water supply for irrigation. Increased water supplies stored in Upalco Unit reservoirs would also be used for municipal and industrial water, minimum instream flows, fish and wildlife, and other project purposes.

  Dam and reservoir operations would meet demands of Tribal and secondary water users and their storage and diversion water rights and would also provide minimum instream flows in selected stream reaches. Normal project operation would provide the required minimum flows except for periods during very dry years. Reservoir conservation pools would provide habitat for successful over-winter fish survival.

- Diversion Dams – Replacement and new diversion dams would improve the control of water diversions made for irrigated agriculture. In addition, this project feature would reduce streambed disturbances resulting from the annual construction and/or maintenance of diversion dams and would provide for fish passage.

- Canal Rehabilitation – Rehabilitation and abandonment of selected unlined canal reaches would increase the project water supply by reducing the amount of water lost to evaporation, evapotranspiration, and canal seepage losses. In addition, maintaining a sufficient water supply to wetlands and riparian areas dependent on canal seepage is a mitigation action required by this project feature.

- Pipelines – An example of a pipeline is the construction of the Big Sand Wash Feeder Pipeline to redirect instream flows to an enlarged Big Sand Wash Reservoir for irrigation delivery and for storage of municipal and industrial water for the City of Roosevelt.

Table 2-1
Project Features and Mitigation Measures Associated with the Proposed Action and Alternatives

Proposed Action–Talmage	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Dams and Reservoirs			
Crystal Ranch (new) Big Sand Wash Enlargement	Upper Yellowstone (new) Big Sand Wash Enlargement	Crystal Ranch (new)	Big Sand Wash Enlargement
Replacement and New Diversion Dams			
Yellowstone Feeder/Payne U.S. Lake Fork Boneta "C" Canal South Boneta Big Sand Wash Feeder (new)	Yellowstone Feeder/Payne U.S. Lake Fork Boneta "C" Canal South Boneta Big Sand Wash Feeder (new)	Yellowstone Feeder/Payne U.S. Lake Fork Boneta "C" Canal South Boneta	Yellowstone Feeder/Payne U.S. Lake Fork Boneta "C" Canal South Boneta Big Sand Wash Feeder (new) Lake Fork-Yellowstone (new)
Rehabilitate Canals			
Farnsworth Lateral No. 1* Farnsworth Lateral No. 2 Farnsworth Lateral No. 3 Ottosen Lateral Blackburn Lateral Anderson Lateral Tony Smith Lateral	None	Farnsworth Lateral No. 1* Farnsworth Lateral No. 2 Farnsworth Lateral No. 3	Farnsworth Lateral No. 1* Farnsworth Lateral No. 2 Farnsworth Lateral No. 3
Pipelines			
Big Sand Wash Feeder	Big Sand Wash Feeder	None	Big Sand Wash Feeder Lake Fork-Yellowstone Big Sand Wash-Roosevelt
High Mountain Lakes Stabilization			
Bluebell Drift Five Point Superior Milk Farmers East Timothy White Miller Deer Water Lily	Bluebell Drift Five Point Superior Milk Farmers East Timothy White Miller Deer Water Lily	Bluebell Drift Five Point Superior Milk Farmers East Timothy White Miller Deer Water Lily	Bluebell Drift Five Point Superior Milk Farmers East Timothy White Miller Deer Water Lily Brown Duck Island Kidney Clements
Fish and Wildlife			
Mitigation: Instream Flows and Fish Habitat Wildlife Habitat/Wetland Mitigation at Brotherson, Clay Basin, Lake Fork, and canals Fish Stocking at Crystal Ranch Reservoir	**Mitigation:** Instream Flows and Fish Habitat Wildlife Habitat/Wetland Mitigation at Clay Basin and Lake Fork Fish Stocking at Upper Yellowstone Reservoir	**Mitigation:** Instream Flows and Fish Habitat Wildlife Habitat/Wetland Mitigation at Brotherson, Lake Fork, and canals Fish Stocking at Crystal Ranch Reservoir	**Mitigation:** Wildlife Habitat/Wetland Mitigation at Evans and Clay Basin

Table 2-1
Project Features and Mitigation Measures Associated with the Proposed Action and Alternatives

Proposed Action–Talmage	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Fish and Wildlife (continued)			
Mitigation (continued): High Mountain Lakes Fish Habitat Fish Passage	**Mitigation (continued):** High Mountain Lakes Fish Habitat Fish Passage	**Mitigation (continued):** High Mountain Lakes Fish Habitat Fish Passage	**Mitigation (continued):** High Mountain Lakes Fish Habitat Fish Passage
Enhancement: Stream Improvement Lake Fork River (5 Miles in 18-mile Reach) Yellowstone River (2 Miles in 4.5-mile Reach)	**Enhancement:** Stream Improvement Lake Fork River (5 Miles in 18-mile Reach) Yellowstone River (2 Miles in 4.5-mile Reach)	**Enhancement:** Stream Improvement Lake Fork River (5 Miles in 18-mile Reach) Yellowstone River (2 Miles in 4.5-mile Reach)	**Enhancement:**
Big Game Winter Range Improvement Towanta Flats (11,500-acre site) Monarch Bench (13,300-acre site)		Big Game Winter Range Improvement Towanta Flats (11,500-acre site) Monarch Bench (13,300-acre site)	Big Game Winter Range Improvement Towanta Flats (11,500-acre site) Monarch Bench (13,300-acre site)
Habitat Acquisition Red Rocks/Duchesne Drainage Property	Habitat Acquisition Fisher Property (160 acres)	Habitat Acquisition Fisher Property (160 acres) Red Rocks/Duchesne Drainage Property	Habitat Acquisition Red Rocks/Duchesne Drainage Property
Clay Basin Settlement Pond Fish Enhancement			
Twin Pots Reservoir Improvement			Twin Pots Reservoir Improvement
Recreation Developments			
Minimum Basic Facilities for Environmental Protection: Crystal Ranch Campground Recreation Replacement and Development (new)	**Minimum Basic Facilities for Environmental Protection:** Bridge and Swift Creek Campgrounds Recreation Improvement	**Minimum Basic Facilities for Environmental Protection:** Crystal Ranch Campground Recreation Replacement and Development (new) Bridge Campground Recreation Improvement	**Minimum Basic Facilities for Environmental Protection:** None
Enhancement: Forest Service Campground Upgrades	**Enhancement:** Forest Service Campground Upgrades	**Enhancement:** Forest Service Campground Upgrades	**Enhancement:** None
	Fish Creek Trail Improvement		
Land Retirement			
Land Retirement (1,300 acres)	Land Retirement (1,300 acres)	Land Retirement (1,300 acres)	Land Retirement (1,300 acres)

*Includes abandonment of 2.7 miles of lateral.

- High Mountain Lakes Stabilization – Stabilization of high mountain lakes would maintain constant lake water levels year-round. Consequently, streamflows originating in the upper watershed would be uncontrolled and follow natural runoff patterns; intrinsic and recreational values within the High Uintas Wilderness would be enhanced; fish habitat and water quality would be improved; and impacts from annual dam maintenance operations in the wilderness area would be eliminated.

- Fish and Wildlife – Mitigation and enhancement features of the project would replace, improve, and/or enhance fish and wildlife habitat affected by the project. Examples include, but are not limited to, providing a fish conservation pool in Crystal Ranch Reservoir, providing minimum instream flows in selected river reaches, acquiring wildlife habitat, improving big game winter range, installing stream improvement structures, providing fish screen and fish passage facilities at diversion dams, and stabilized high mountain lakes.

- Recreation Developments – Examples include construction of a new campground on Tribal land and campground upgrades on National Forest land to create and improve recreational facilities and opportunities.

- Land Retirement – The retirement of selected farmlands from irrigated agriculture and the purchase of associated water rights would increase the amount of project water available for project purposes, including irrigation, instream flows, and water quality improvement in the lower Lake Fork River.

Project features are described below and are based on feasibility designs. The designs of the Proposed Action features will be finalized during the construction phase of the project but are not expected to change substantially. The feasibility designs provide a sufficient basis for the environmental impact analysis contained in this Draft EIS.

Fish and wildlife mitigation and enhancement features and recreation minimum basic facilities and enhancements associated with the Proposed Action and each action alternative are also listed in Table 2-1. These measures are described for the Proposed Action and each action alternative.

2.2 Proposed Action – Talmage

2.2.1 General Description

Map 2-1 shows the locations of specific features of the Proposed Action. Detailed descriptions of facilities, construction procedures, and operation and maintenance procedures are presented below. Table 2-2 contains supporting reference information for the following text and lists land ownership; entities responsible for land acquisition, project construction, and operation and maintenance; and future land access for Proposed Action project features.

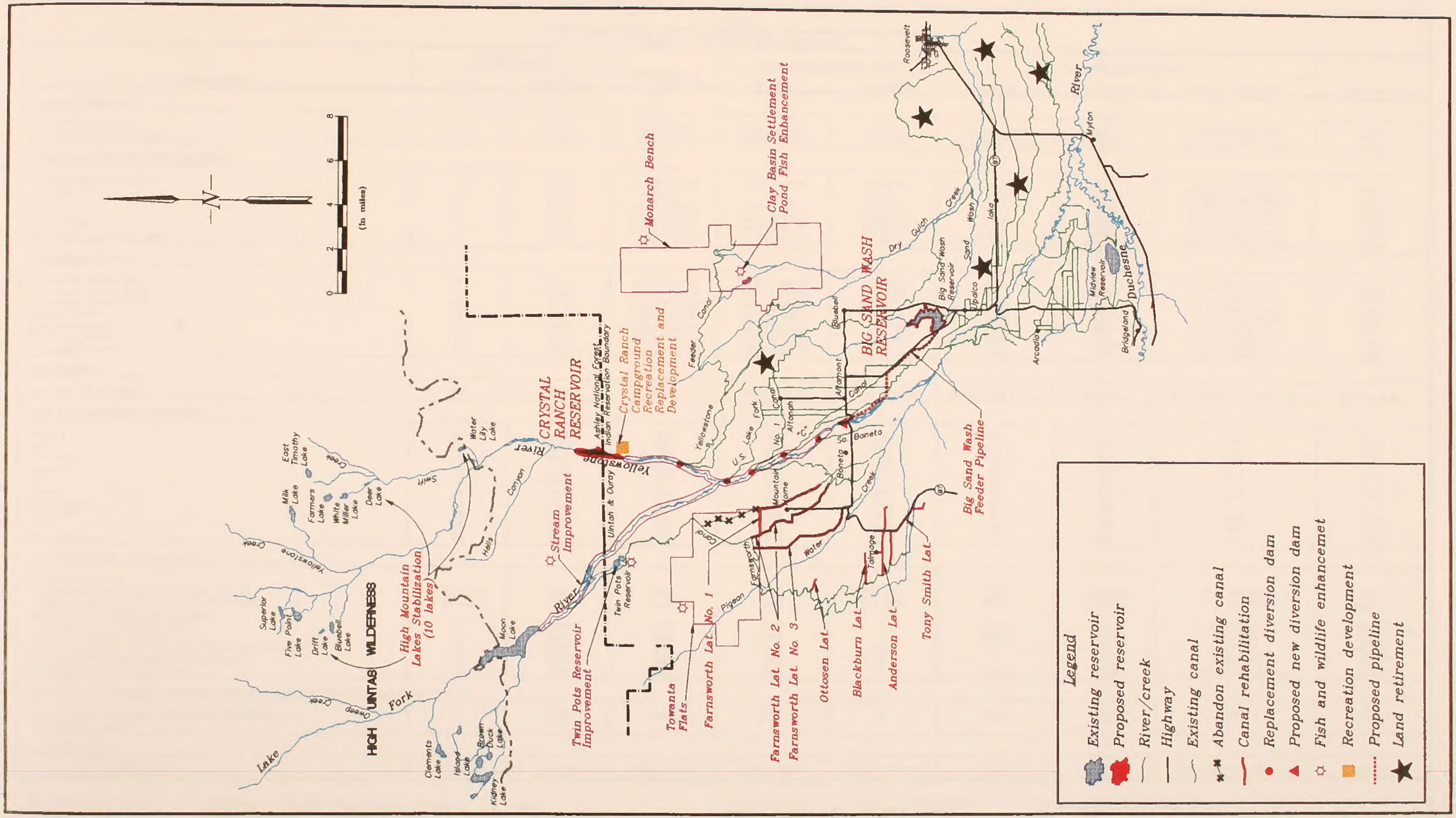
2.2.2 Physical Features and Other Characteristics

2.2.2.1 Dams and Reservoirs

Dam and reservoir facilities under the Proposed Action would include construction of Crystal Ranch Dam and Reservoir and enlargement of Big Sand Wash Dam and Reservoir.

2.2.2.1.1 Crystal Ranch Dam and Reservoir. The proposed Crystal Ranch Dam and Reservoir would be on the Yellowstone River approximately 4 miles upstream from the confluence of the Yellowstone and Lake Fork Rivers (see Map 2-1). The reservoir would be on Tribal, National Forest, and private lands.

2.2.2.1.1.1 Description of Facilities. Crystal Ranch Dam would be 180 feet high with a crest length of 1,450 feet. It would form a reservoir 2.5 miles long with a surface area of 524 acres. Map 2-2 shows the locations of proposed physical features and facilities. Table 2-3 provides details of the dam and reservoir.



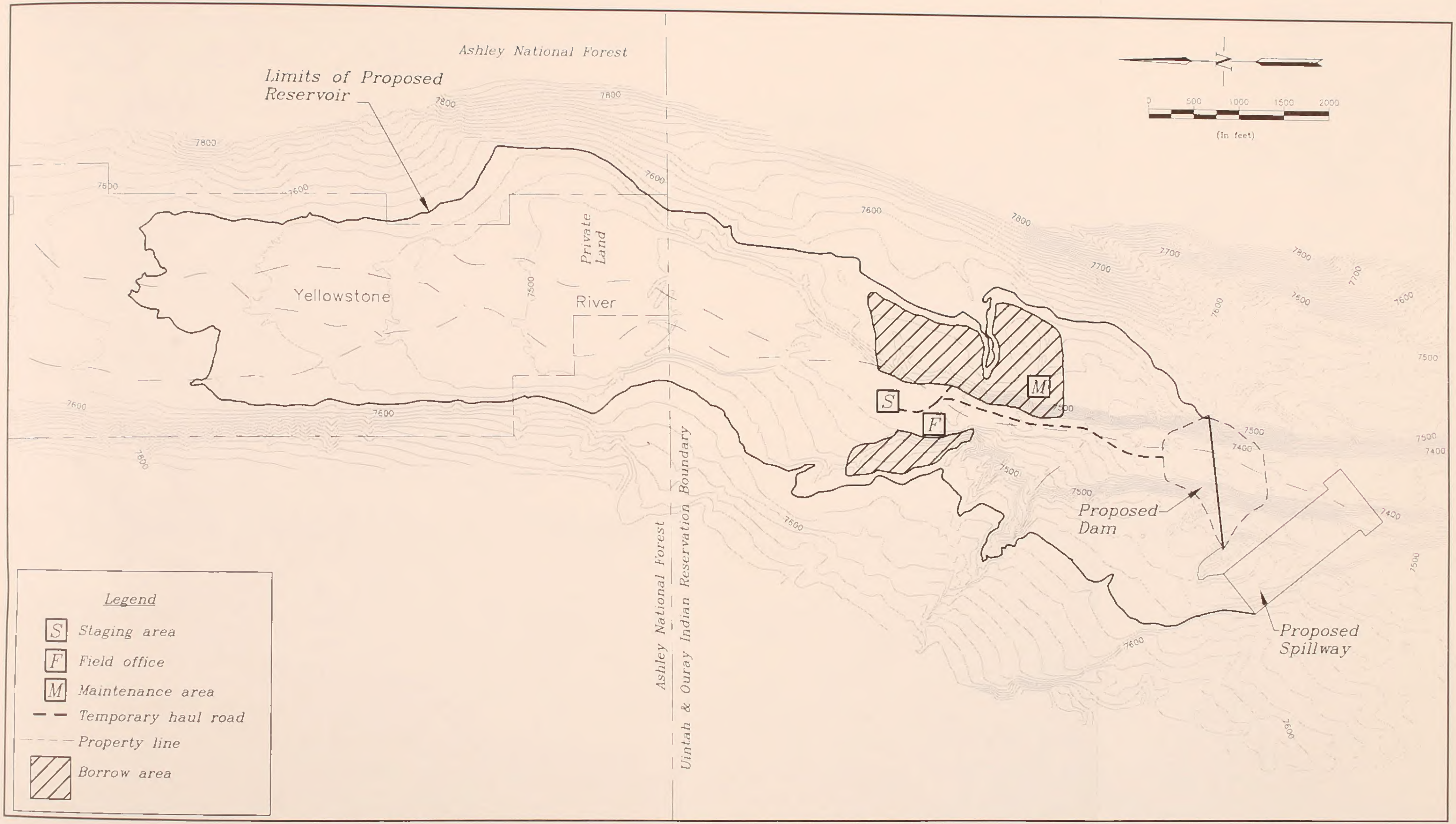
Map 2–1
Upalco Unit
Proposed Action–Talmage

Table 2-2
Entities Responsible for Acquisition, Construction, and Operation and Maintenance of Features of the Proposed Action–Upalco Unit

Project Feature	Land Ownership		Management of Land Acquisition	Construction or Implementation		Operation and Maintenance			Land Access
	Present	Post Project		Funding	Management	Funding	Management	Agreement Signatories	
Dams and Reservoirs									
Crystal Ranch (new)	T,P,FS	DOI[a]	DOI,CUWCD	DOI,CUWCD	DOI	DOI,CUWCD	BIA	T,BIA,CUWCD,DOI	ALL,T[b]
Big Sand Wash Enlargement	P,S	MLWUA	DOI,CUWCD	DOI,CUWCD	CUWCD	CUWCD,MLWUA	MLWUA	MLWUA,CUWCD,DOI	ALL
Replacement and New Diversion Dams									
Yellowstone Feeder/Payne	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
U.S. Lake Fork	T	DOI	DOI	DOI	DOI	SAP	SAP	SAP,BIA,CUWCD,DOI	SAP
Boneta	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
"C" Canal	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
South Boneta	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Big Sand Wash Feeder (new)	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	CUWCD,MLWUA	MLWUA	MLWUA,CUWCD,DOI	SAP
Rehabilitate Canals									
Farnsworth Lateral No. 1	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Farnsworth Lateral No. 2	T,P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Farnsworth Lateral No. 3	T,P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Ottosen Lateral	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Blackburn Lateral	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Anderson Lateral	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Tony Smith Lateral	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
New Pipelines									
Big Sand Wash Feeder	T,P	DOI	DOI,CUWCD	DOI,CUWCD	DOI,CUWCD	CUWCD,MLWUA,P	MLWUA	T,P,MLWUA,CUWCD,DOI	SAP,MLWUA
High Mountain Lakes Stabilization									
Bluebell	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Drift	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Five Point	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Superior	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Milk	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Farmers	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
East Timothy	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
White Miller	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Deer	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Water Lily	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Fish and Wildlife: Enhancements									
Stream Improvement									
Lake Fork River (5 Miles in 18-mile Reach)	T or S or P	SAP	DOI	DOI	T or DOI	DOI	T or WR	T or WR,DOI	ALL,T[b]
Yellowstone River (2 Miles in 4.5-mile Reach)	T or S or P	SAP	DOI	DOI	T or DOI	DOI	T or WR	T or WR,DOI	ALL,T[b]
Big Game Winter Range Improvement									
Towanta Flats (11,500-acre Site)	T	SAP	DOI	DOI	T	T,BIA	T	T,DOI,BIA	ALL,T[b]
Monarch Bench (13,300-acre Site)	T	SAP	DOI	DOI	T	T,BIA	T	T,DOI,BIA	ALL,T[b]
Habitat Acquisition: Red Rocks/Duchesne Drainage Property	P	DOI[a]	DOI	DOI	DOI	T	T	T,DOI,BIA	ALL,T[b]
Clay Basin Settlement Pond Fish Enhancement	T	DOI	DOI	DOI	T	T	T	T,DOI,BIA	ALL,T[b]
Twin Pots Reservoir Improvement	T	DOI	DOI	DOI	T	T,BIA	T,BIA	T,DOI,BIA,MLWUA	ALL,T[b]
Recreation Developments: Minimum Basic Facilities for Environmental Protection									
Crystal Ranch Campground Recreation Replacement and Development (new)	T	DOI	DOI	DOI	T	DOI	T,BIA	T,DOI,BIA	ALL,T[b]
Land Retirement									
Land Retirement (1,300 acres)	P	T,P,DOI[c]	DOI,CUWCD	DOI,CUWCD	DOI,CUWCD	P,DOI	T,P,DOI	T,DOI,CUWCD,FWS,WR	SAP,ALL

Notes:
SAP = Same as present
T = Tribe
BIA = Bureau of Indian Affairs
MLWUA = Moon Lake Water Users Association
ALL = Tribal and non-Tribal public
S = State of Utah
P = Private
FS = U.S. Forest Service
DOI = Department of the Interior
CUWCD = Central Utah Water Conservancy District
NA = Not applicable
WR = Utah Division of Wildlife Resources
FWS = U.S. Fish and Wildlife Service

[a]Held as trust lands for the Ute Indian Tribe.
[b]Access to all publics, but a Tribal permit may be required.
[c]Some may be water rights only.



Map 2–2
Proposed Action–Talmage
Physical Features and
Construction Requirements
Crystal Ranch Dam and Reservoir

Table 2-3
Physical Features and Facilities for Crystal Ranch Dam and Reservoir

Dam	
Location	Yellowstone River
Type	Zoned earth and rock fill
Structural height (feet)	180
Crest elevation (feet msl)	7,570
Crest length (feet)	1,450
Crest width (feet)	30
Spillway	
Type	Concrete overflow chute
Crest elevation (feet msl)	7,552
Crest length (feet)	420
Chute length (feet)	1,523
Chute width (feet)	420
Probable Maximum Flood Design Capacity (cfs)	47,100
Intake Structure	
Type	Single, low level
Intake elevation (feet msl)	7,420
Outlet Works	
Conduit type	Steel encased in concrete
Conduit diameter (inches)	72
Conduit length (feet)	976
Minimum discharge (cfs)	5
Maximum discharge (cfs)	1,270
Control gate type	Howell-Bunger
Probable Maximum Flood (cfs)	55,000
Storage (acre-feet)	
Inactive (dead) pool	200
Conservation pool	2,400
Active pool	21,600
Total active	24,000
Reservoir (at full pool)	
Elevation (feet msl)	7,552
Length (miles)	2.5
Surface area (acres)	524
Shoreline length (miles)	6
Maximum depth (feet)	148
Mean depth (feet)	36
Conservation Pool Maximum Depth (feet)	72
Drainage Area (square miles)	134

2.2.2.1.1.2 Dam and Reservoir Operations. Based on the 64-year analysis period (1930-1993), the average flow of water entering Crystal Ranch Reservoir (reservoir inflow) would range from 50 cubic feet per second (cfs) in February to 479 cfs in June. Reservoir inflow would peak with snowmelt and decline rapidly in mid-summer. The overall average inflow would be 141 cfs.

Figure 2-1 shows estimated end-of-month water surface elevation and storage in the proposed Crystal Ranch Reservoir for wet, average, and dry years based on the 64-year analysis period. Average year data are an average of all 64 years during the analysis period. Wet year data are an average of the 4 wettest years by volume (1941, 1944, 1965, 1983), and dry year data are an average of the 4 driest years by volume (1934, 1977, 1988, 1989) during the analysis period.

During an average water year, Crystal Ranch Reservoir elevation and storage would be highest in June and lowest in September (Figure 2-1). Both would increase very gradually from October (the start of the calendar water year) through March, then remain about the same through June, reflecting storage of Yellowstone River water during the nonirrigation season and the occurrence of peak runoff in June. Reservoir elevation and storage would decline through September. Based on end-of-month operations data, reservoir water levels during an average water year would fluctuate only 24 feet and would be considerably above the 2,400-acre-foot conservation pool elevation of 7,476 feet, but levels would not reach full pool elevation of 7,552 feet.

Crystal Ranch Reservoir would have 9,550 acre-feet of storage space allocated for use by the Ute Tribe. The model used to forecast reservoir operations and future river reach flows was based on the assumption that Tribal water would not be retained in storage but would be delivered downstream during the irrigation season according to crop demand on Indian-owned, Indian water-righted lands. It would also be used to irrigate Tribal lands that are now idle. Other reservoir storage space allocations would include 2,400 acre-feet for the conservation pool, 2,500 acre-feet for high mountain lakes storage replacement, 150 acre-feet for non-Indian-owned 1861 water-righted lands, and 9,400 acre-feet for secondary water-righted lands. In addition to these space allocations, a 200-acre-foot dead pool would be located below the intake structure.

Water would be released from Crystal Ranch Reservoir to better match crop irrigation requirements and downstream water rights. The distribution of project water is discussed in Section 2.2.3, and future stream flows are shown in Table 2-15. Water would also be released or allowed to flow through year-round to provide minimum instream flows for fish. Minimum flow releases provided in the Yellowstone River would be 24 cfs October through March and 56 cfs April through September. Minimum flows during the nonirrigation season would be provided by a separate conduit through the dam that comes off the main outlet.

In times of extreme water shortage, when these minimum fish flows cannot be achieved without jeopardizing established water rights (drier than 1934 or when reservoir inflow is below the minimum flow), instream flows would be provided only to the extent necessary to ensure fish survival, as determined by the U.S. Fish and Wildlife Service (FWS) and Ute Tribe, unless reservoir releases are made by separate agreement with an entity willing to release their water for instream flows. During wetter than dry winters, instream flows would be increased above the winter (October through March) minimum fish flow release. To ensure that these additional flows would be available for instream uses, a forecasting procedure and mechanism to implement changes in wintertime releases, when possible, would be established by the Central Utah Water Conservancy District (CUWCD) in consultation with the FWS, Ute Tribe, U.S. Bureau of Indian Affairs (BIA), Utah Division of Wildlife Resources (Wildlife Resources), State Engineer, and potentially affected water users. These entities would develop an instream flow agreement that stipulates agreed-upon minimum flows and describes the procedure and mechanism for implementing flow changes. Further details on minimum instream flows are provided in Chapter 3, Section 3.6 Water Resources and Hydrology and Section 3.8 Aquatic Resources of this Draft EIS.

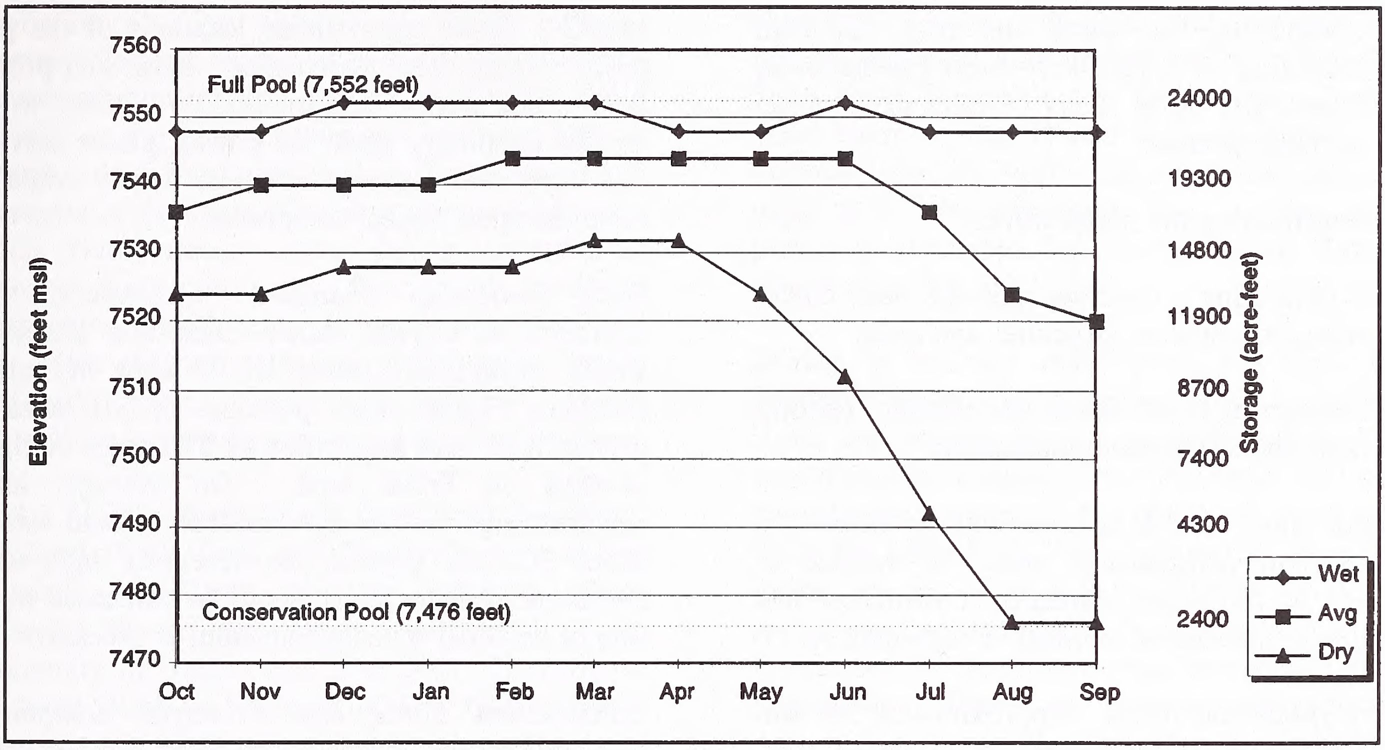


Figure 2-1
Average, Wet, and Dry Year End-of-Month Elevation and Storage for Crystal Ranch Reservoir (Proposed Action)

Major maintenance needs at the dam would be met on a scheduled and as-needed basis. There would be periodic inspections of inlet works, outlet works, conduits, sub-drainage facilities, and overflow and energy dissipation structures. Regular monitoring would be performed for water levels in piezometers, excessive movement, and excessive seepage, both within and downstream from the dam. Periodic maintenance would include exercising valves and/or gates, cleaning trash racks, and ensuring the integrity of embankment, earthwork, riprap, and/or erosion-protection structures, as necessary.

*2.2.2.1.1.3 **Construction Requirements**.* Construction activities would be localized and occur primarily in and near the reservoir pool. Primary impact-causing activities in the reservoir area would include the following:

- Installing a field office, temporary electrical power, phone service, and water and sanitary facilities
- Constructing temporary haul roads
- Preparing borrow areas for material extraction and processing
- Operating rock crushers and sorters in the staging area for aggregate sizing
- Constructing and using settling ponds for cleaning fines from crushed aggregate
- Stockpiling and mixing aggregate in the staging area
- Constructing a cofferdam and river diversion facilities
- Excavating the dam foundation and installing a cutoff trench and drainage system
- Installing a grout curtain and upstream blanket of impervious materials to control foundation seepage

- Constructing an earth and rock fill dam consisting of a relatively impermeable core, filters, and outer shells of random fill from the borrow areas

- Constructing the outlet works

- Constructing a concrete spillway weir, chute, energy-dissipation structure, and dikes

- Conducting construction site cleanup, restoration, and revegetation operations

Potential short- and long-term impacts from dam and reservoir construction would be avoided or reduced by following standard construction and operating requirements outlined in Appendix A.

Borrow (Material) Areas. Approximately 3.8 million cubic yards of earth materials would be excavated for processing and sorting. Two borrow areas of 40 and 9 acres have been identified in the reservoir pool area. Map 2-2 shows the general location of the proposed borrow areas. The borrow areas should provide all needed grades of suitable earth materials for dam and dike construction and for concrete aggregate. If needed, additional riprap materials are located near the town of Vernal, approximately 60 miles from the dam site. Borrow materials not used would be regraded within the reservoir borrow areas. A natural layer of armor rock would form on the surface of glacial deposits after the fines have been removed by several years of reservoir water fluctuations.

Staging Areas and Support Facilities. Borrow materials would be processed and sorted in a 10-acre staging area between the two borrow areas. Staging area operations would include rock crushing, screening, sorting, and stockpiling; mixing aggregate; and storing construction materials and equipment. Processed materials would be hauled in scrapers or large dump trucks to the construction site. Approximately 1 mile of temporary haul road would be constructed to connect the borrow and staging areas to existing roads and to provide access to the dam site (see Map 2-2).

Map 2-2 shows approximate locations of the proposed staging area, maintenance areas, and project field office during construction. Utilities would include temporary electrical power, phone service, and water and sanitary facilities, which would be removed upon project completion.

Land Ownership Changes. Construction and operation of Crystal Ranch Dam and Reservoir would require withdrawal of 97 acres of federal (National Forest) land, purchase of 310 acres of private land, and acquisition of 570 acres of right-of-ways on Tribal land. On average, lands acquired adjacent to the reservoir would extend about 300 feet beyond the reservoir high-water elevation. Private lands would be purchased in fee title or acquired by condemnation, if necessary.

Construction Force and Principal Equipment. Construction of Crystal Ranch Dam and Reservoir would extend over a 5-year period. The number of workers required per month would vary between 3 and 144, while the total labor effort would be approximately 540,000 hours.

Personnel requirements would include the owner's management and engineering staff, a resident engineer, and the contractors' field staff, including equipment operators, carpenters, steel workers, surveyors, truck drivers, and laborers. Local personnel would be used to staff the project, although some personnel may be required from nearby communities and outside the local area.

The number of pieces and types of equipment required for construction would vary depending on the stage of the project and specific operations in progress. Motorized equipment would use an estimated 2.24 million gallons of petroleum products (diesel, gasoline, and grease). Most motorized equipment would be diesel-powered except for light utility trucks.

Construction of Crystal Ranch Dam would begin in the first year and be completed in the fifth year of the overall 7-year construction period for the Proposed Action. The first year's construction activities on the dam would primarily consist of dam foundation preparation and grouting and installation of river diversion facilities. Partial reservoir clearing for facilities would occur during the second construction season and work would continue on the grout curtain and upstream blanket through the third season. Excavation and placement of dam embankment materials for Crystal Ranch Dam would occur during construction seasons three through five, and spillway construction would occur during seasons four and five. Most reservoir clearing would occur during the fourth season. Work on the dam embankment and spillway would be completed by the fifth year.

2.2.2.1.2 Big Sand Wash Dam and Reservoir. Big Sand Wash Dam and Reservoir are existing offstream facilities located between State Highways 87 and 199, about 1 mile north of the community of Upalco (see Map 2-1). They are on Big Sand Wash, a tributary of Dry Gulch Creek. The reservoir's primary water supply is the Lake Fork River approximately 7 miles to the northwest via the "C" Canal. The enlarged reservoir would be on private and state lands.

2.2.2.1.2.1 Description of Facilities. Big Sand Wash Dam would be raised 21 feet to a height of 131 feet with a crest elevation of 5,913 feet. The two east dikes would be combined, and the west dike would be replaced with a roller-compacted concrete (RCC) embankment. Table 2-4 summarizes the physical features and facilities associated with the existing 12,000-acre-foot reservoir and proposed 9,000-acre-foot enlargement of Big Sand Wash Dam and Reservoir. Map 2-3 shows the locations of proposed modifications to the dam.

2.2.2.1.2.2 Dam and Reservoir Operations. The reservoir's primary water supply would come from the Lake Fork River via the "C" Canal and the proposed Big Sand Wash Feeder Pipeline. A small amount of runoff would come from the 11.3-square-mile Big Sand Wash watershed upstream of the dam. Based on the 64-year analysis period (1930 to 1993), the average flow of water diverted into Big Sand Wash Reservoir (reservoir inflow) would range from 35 cfs in March to 188 cfs in June. The overall average inflow would be 75 cfs.

Figure 2-2 shows estimated end-of-month water surface elevation and storage in the enlarged Big Sand Wash Reservoir for wet, average, and dry years based on the 64-year analysis period. Wet, average, and dry year estimates were determined using data from the same years of the analysis period as described for Crystal Ranch Reservoir (see Section 2.2.2.1.1.2).

During an average water year, Big Sand Wash Reservoir elevation and storage would be highest in April and lowest in August (Figure 2-2). Both would steadily increase from September (the end of the calendar water year) through April as diversions from the Lake Fork River are stored for delivery during the irrigation season. Reservoir elevation and storage would decline through August as water is released for irrigation, then increase slightly in September. Based on end-of-month operations data, reservoir water levels during an average water year would fluctuate 74 feet and would be well above the 1,200-acre-foot conservation pool elevation of 5,794 feet, but levels would not reach full pool elevation of 5,905 feet.

Under the Proposed Action, Big Sand Wash Reservoir storage space allocations would include 1,200 acre-feet for the conservation pool, 3,500 acre-feet for City of Roosevelt municipal and industrial purposes, and 16,300 acre-feet (5,500 acre-feet more than currently available) for the Moon Lake Water Users Association. In addition to these space allocations, a 21-acre-foot dead pool would be located below the intake structure. Municipal and industrial water for the City of Roosevelt would be stored in the enlarged Big Sand Wash Reservoir and made available by an exchange with secondary water right water stored in Crystal Ranch Reservoir. The water would be delivered to Brown's Draw Reservoir via the Yellowstone Feeder Canal. Such an exchange would be limited to a maximum of 3,000 acre-feet during any particular year from October 1 through September 30. This exchange is discussed further in Chapter 3, Section 3.6 Water Resources and Hydrology of this Draft EIS.

Major maintenance needs at the dam would be met on a scheduled and as-needed basis, the same as

Table 2-4
Physical Features and Facilities for the Existing and 9,000-acre-foot Enlarged Big Sand Wash Dam and Reservoir
Proposed Action

Page 1 of 2

Features	Existing	Enlarged
Dam		
Location	Big Sand Wash	Big Sand Wash
Type	Zoned earth and rock fill	Zoned earth and rock fill
Structural height (feet)	110	131
Crest elevation (feet msl)	5,892	5,913
Crest length (feet)	795	879
Crest width (feet)	25	25
East Dikes		
Type	Earth fill	Earth fill
Structural height (feet)	18	35
Crest elevation (feet msl)	5,892	5,913
Crest length (feet)	1,890	2,775
Crest width (feet)	16	20
West Dike		
Type	Earth fill	Roller-compacted concrete
Structural height (feet)	29	43
Crest elevation (feet msl)	5,892	5,913
Crest length (feet)	1,315	3,520
Crest width (feet)	16	20
Spillway		
Type	Unlined channel	Unlined channel
Crest elevation (feet msl)	5,885	5,905
Crest length (feet)	60	60
Unlined channel length (feet)	700	780
Probable Maximum Flood Design Capacity (cfs)	3,500	3,500
Intake Structure		
Type	Single, low level	Single, low level
Intake elevation (feet msl)	5,782	5,782
Outlet Works		
Conduit type	Reinforced concrete	Steel encased in concrete
Conduit diameter (inches)	40	36
Conduit length (feet)	536	335 (additional)
Maximum discharge (cfs)	200	250
Control gate type	Tandem gate valves	Tandem gate valves
Probable Maximum Flood (cfs)	18,000	18,000
Storage (acre-feet)		
Inactive (dead) pool	21	21
Conservation pool	1,200	1,200
Active pool	10,800	19,800
Total active	12,000	21,000

Table 2-4
Physical Features and Facilities for the Existing and 9,000-acre-foot Enlarged Big Sand Wash Dam and Reservoir
Proposed Action

Page 2 of 2

Features	Existing	Enlarged
Reservoir (at full pool)		
Elevation (feet msl)	5,885	5,905
Length (miles)	1.6	2.3
Surface area (acres)	393	537
Shoreline length (miles)	7	11
Maximum depth (feet)	103	123
Mean depth (feet)	30	35
Conservation Pool Maximum Depth (feet)	12	12
Drainage Area (square miles)	11.3	11.3

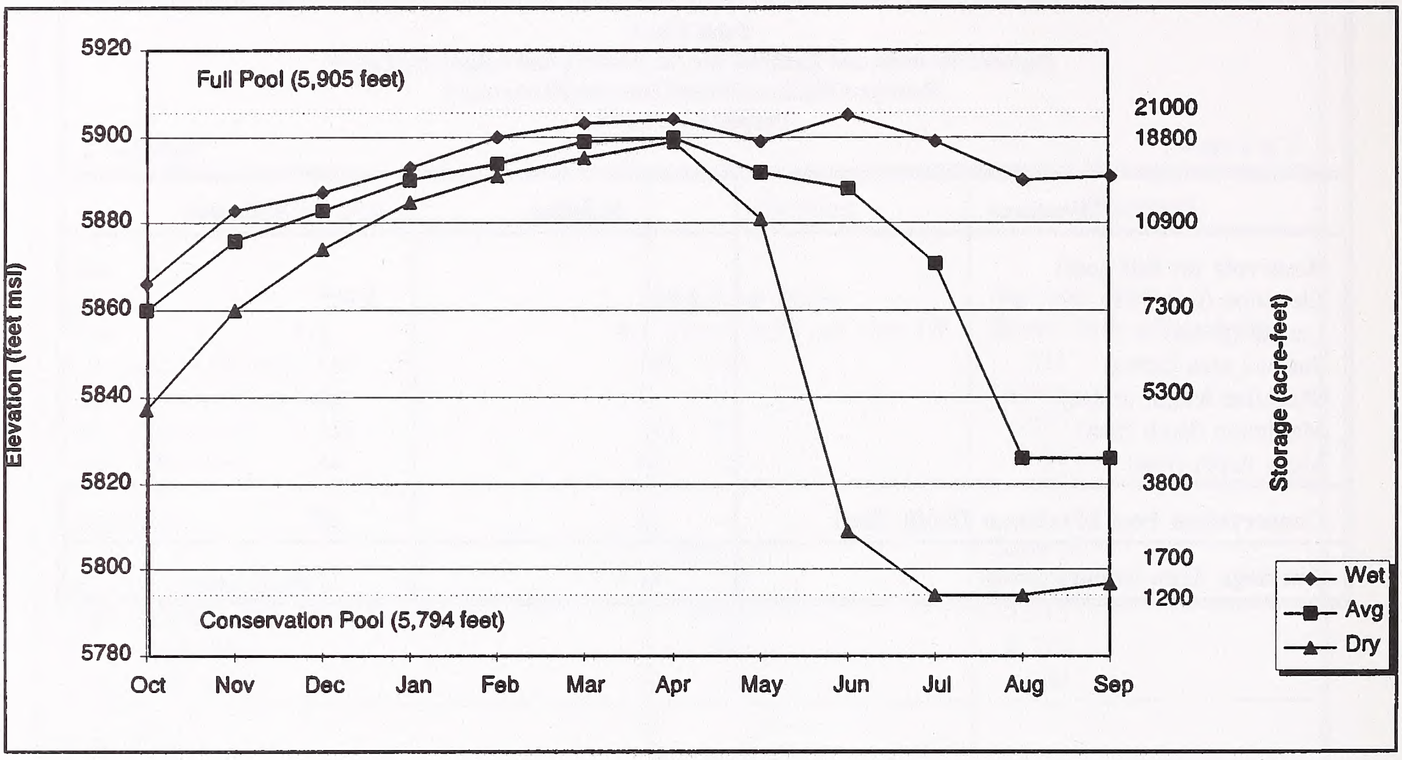
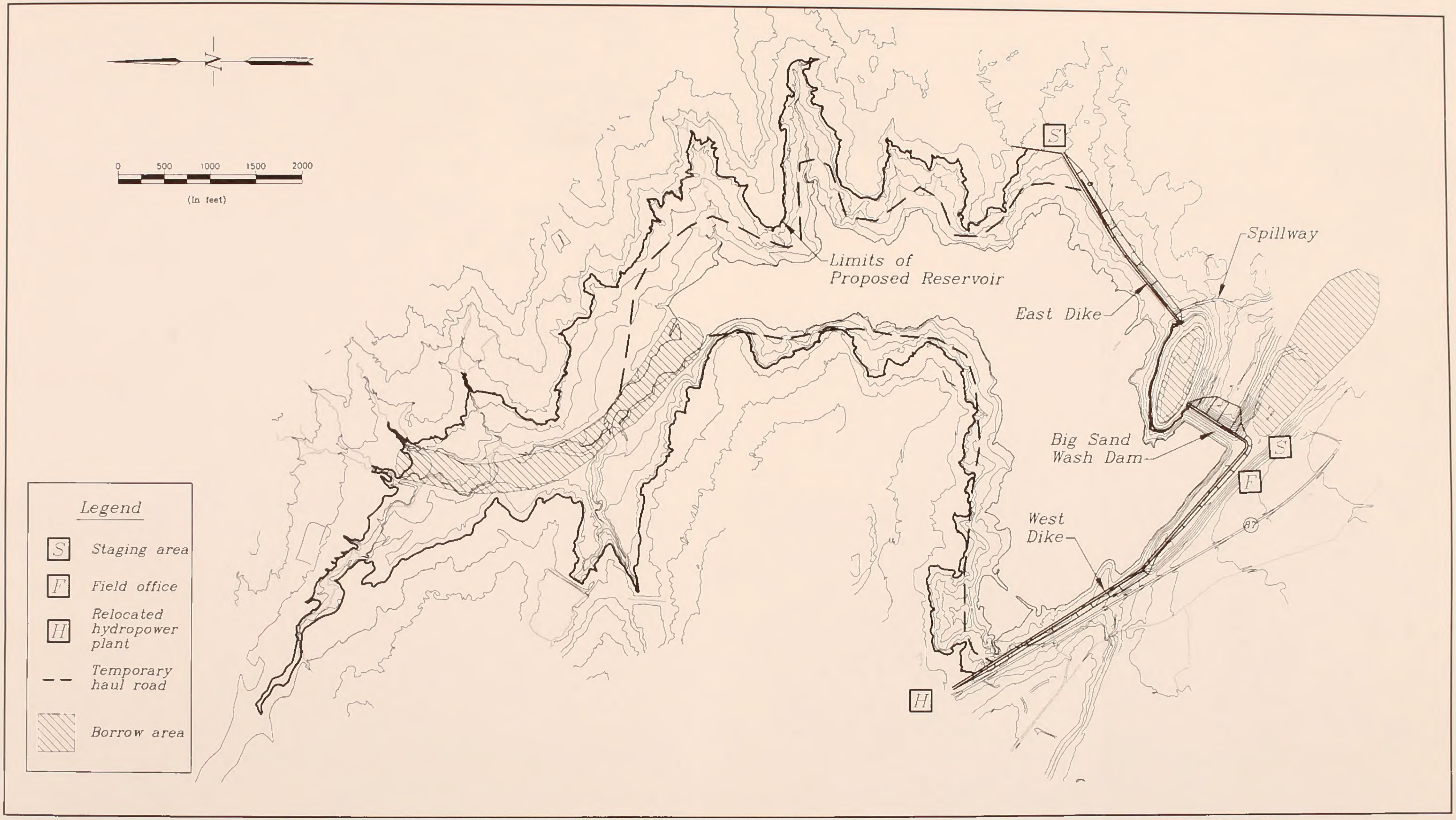


Figure 2-2
Average, Wet, and Dry Year End-of-Month Elevation and Storage for 9,000-acre-foot Enlarged Big Sand Wash Reservoir (Proposed Action)

described for Crystal Ranch Dam (see Section 2.2.2.1.1.2).

2.2.2.1.2.3 Construction Requirements. Construction activities would be localized and occur primarily in and near the reservoir pool. Primary activities that could cause impacts would include the following:

- Installing a field office, temporary electrical power, phone service, and water and sanitary facilities
- Constructing temporary haul roads
- Preparing borrow areas for material extraction and processing
- Operating rock crushers and sorters in staging or borrow areas for aggregate sizing
- Operating a batch plant for RCC processing in staging areas
- Constructing and using settling ponds for cleaning fines from crushed aggregate
- Stockpiling and mixing aggregate in staging areas
- Grouting the dam foundation and abutments
- Placing additional earth fill on the existing dam and installing riprap, filters, and drains
- Placing additional earth fill on the combined east dikes
- Excavating the existing west dike and replacing it with RCC
- Extending and installing a steel liner in the existing outlet conduit
- Extending the existing access shaft to the tandem gate valves
- Constructing a new concrete spillway weir



Map 2-3
Proposed Action–Talmage
Physical Features and Construction Requirements, Big Sand Wash Dam and Reservoir Enlargement (9,000 ac–ft)

- Salvaging and relocating an existing 1,600-kilowatt (kW) hydroelectric power plant

- Conducting construction site cleanup, restoration, and revegetation operations

Potential short- and long-term impacts from dam and reservoir construction would be avoided or reduced by following standard construction and operating requirements outlined in Appendix A.

Borrow (Material) Areas. Approximately 780,000 cubic yards of earth materials would be excavated for processing and sorting. Three borrow areas totaling 62 acres have been identified, including 32 acres outside the enlarged reservoir pool area. Map 2-3 shows the general location of the proposed borrow areas.

Materials excavated from the borrow areas would be processed onsite. Borrow area operations would include rock crushing, screening, and stockpiling. Processed materials would be hauled in scrapers or large dump trucks to the construction site. Water would be added to the material to improve compaction before being placed on the embankments and spread in lifts with dozers, graders, and rollers.

After borrow materials have been removed, the borrow areas would be resloped to facilitate good drainage and erosion control. Borrow materials not used would be regraded within the borrow areas. For borrow areas outside the enlarged reservoir pool area, site restoration would include grading and scarifying the soil surface for seedbed preparation and revegetation. Within the reservoir pool, a natural layer of armor rock would form on the surface of glacial deposits after the fines have been removed by several years of reservoir water fluctuations.

Staging Areas and Support Facilities. Construction operations would require two staging areas of about 5 acres each. They would be used for operating a batch plant for RCC processing, constructing and using settling ponds for cleaning fines from crushed aggregate, stockpiling and mixing aggregate, and storing other construction materials. Approximately 2.5 miles of temporary haul roads would be constructed to connect the borrow and staging areas to the Big Sand Wash Dam site and dikes. They would connect to existing roads in the area to provide access to the proposed construction sites.

A project field office and small maintenance yard would be located adjacent to the staging area just downstream of the dam's right (southern) abutment. Utilities required at the field office would include temporary electrical power, phone service, and water and sanitary facilities. These support facilities and utilities would be removed or incorporated into a permanent operation and maintenance facility upon project completion. Map 2-3 shows the approximate locations of the proposed staging areas and field office/maintenance site required during construction.

Relocations. An existing 1,600-kW hydroelectric power plant, located at the northwestern end of Big Sand Wash Reservoir and operated by the Moon Lake Electric Cooperative, would be inundated by the proposed reservoir enlargement. Under the Proposed Action, the 1,600-kW generator and related equipment used in the existing power plant would be salvaged and moved to a new powerhouse. Transmission lines would be relocated to serve the new facility.

The replacement powerhouse would be east of State Highway 87 on a 4-acre site 0.25 mile northwest of the existing power plant site (see Map 2-3). Water for the new powerhouse would be supplied through a penstock bifurcated to the proposed Big Sand Wash Feeder Pipeline. The penstock would be designed and constructed to meet the size and generating capacity limits of the existing 1,600-kW generating unit. Water discharged from the powerhouse would enter Big Sand Wash Reservoir.

Land Ownership Changes. The enlargement and operation of Big Sand Wash Dam and Reservoir would require acquisition of 98 acres of state land and 340 acres of private land. These lands would be acquired in fee in the name of the Moon Lake Water Users Association. On average, lands acquired adjacent to the reservoir would extend about 300 feet beyond the reservoir high-water elevation.

Construction Force and Principal Equipment. Enlargement of Big Sand Wash Dam and Reservoir would begin in March in the third year of the 7-year construction period for the Proposed Action and extend over a 13-month construction period. The number of workers required per month would vary between 10 and 68, while the total labor effort would be approximately 75,000 hours.

Personnel requirements and labor pool sources would be the same as described for Crystal Ranch Dam and Reservoir (see Section 2.2.2.1.1.3).

The number of pieces and types of equipment required for construction would vary depending on the stage of the project and specific operations in progress. Motorized equipment would use an estimated 320,000 gallons of petroleum products (diesel, gasoline, and grease). Most motorized equipment would be diesel-powered except for light utility trucks.

2.2.2.2 Diversion Dams

Five existing diversion structures would be replaced with new diversion dams and one new diversion structure would be built. Map 2-1 shows their locations. They include the Yellowstone Feeder/Payne diversion on the Yellowstone River and the U.S. Lake Fork, Boneta, "C" Canal, and South Boneta diversions and Big Sand Wash Feeder Pipeline diversion on the Lake Fork River. Figure 2-3 shows the design of a typical diversion dam, which is described below. However, the potential for incorporating a natural rock weir, or a similar design that promotes upstream fish passage past the diversion dam, would be evaluated during final project design. Fish screens would be provided at the canal inlet structure to prevent juvenile and adult fish from entering the canals.

2.2.2.2.1 Description of Facilities. Table 2-5 lists physical characteristics of the proposed diversion dams. The final design and dimensions of diversion structure facilities would be modified, as necessary, to conform to site-specific conditions, including environmental constraints, at each diversion dam location.

The new diversion dams would provide permanent structures for diverting water from the rivers. The new structures would be located upstream of the existing structures. The existing canals, and in some instances existing riverside channels, would be extended upstream to connect them with the new canal inlets. The exact locations of the new diversion structures would depend on local site conditions and would be determined during final project design.

Upstream control weirs on the new diversion dams would create stable water surfaces for delivering water to the irrigation canals. The canal inlet structures would consist of gates that would regulate the volume of water entering the irrigation canals. Table 2-5 shows the number of gates at each new canal inlet structure, which would vary depending on the volume of water required in the canals and inlet structure width. The canal inlets would be oriented 90 degrees to the main river channel and would have fish screens to prevent the diversion of juvenile and adult fish from the river into irrigation canals.

The diversion dams would be designed to provide upstream passage for juvenile and adult fish throughout the year. Anticipated fish passage flows would vary between the minimum October through March low flow of 24 cfs and the average flood flow of 1,025 cfs on the Lake Fork River and between 24 cfs and 1,294 cfs, respectively, on the Yellowstone River. The fish passage flows used in preliminary design varied from the 7-day average low flow of 24 cfs to the average flood flow of 1,025 cfs on the Lake Fork River, and from the 7-day average low flow of 32 cfs to the average flood flow of 1,294 cfs on the Yellowstone River. Two weirs below the upstream control weirs would create a series of steps over which fish could pass.

2.2.2.2.2 Construction Procedures.

Construction Facilities. Each diversion dam site would require a staging area of approximately 1.5 acres. The staging areas would be fenced and

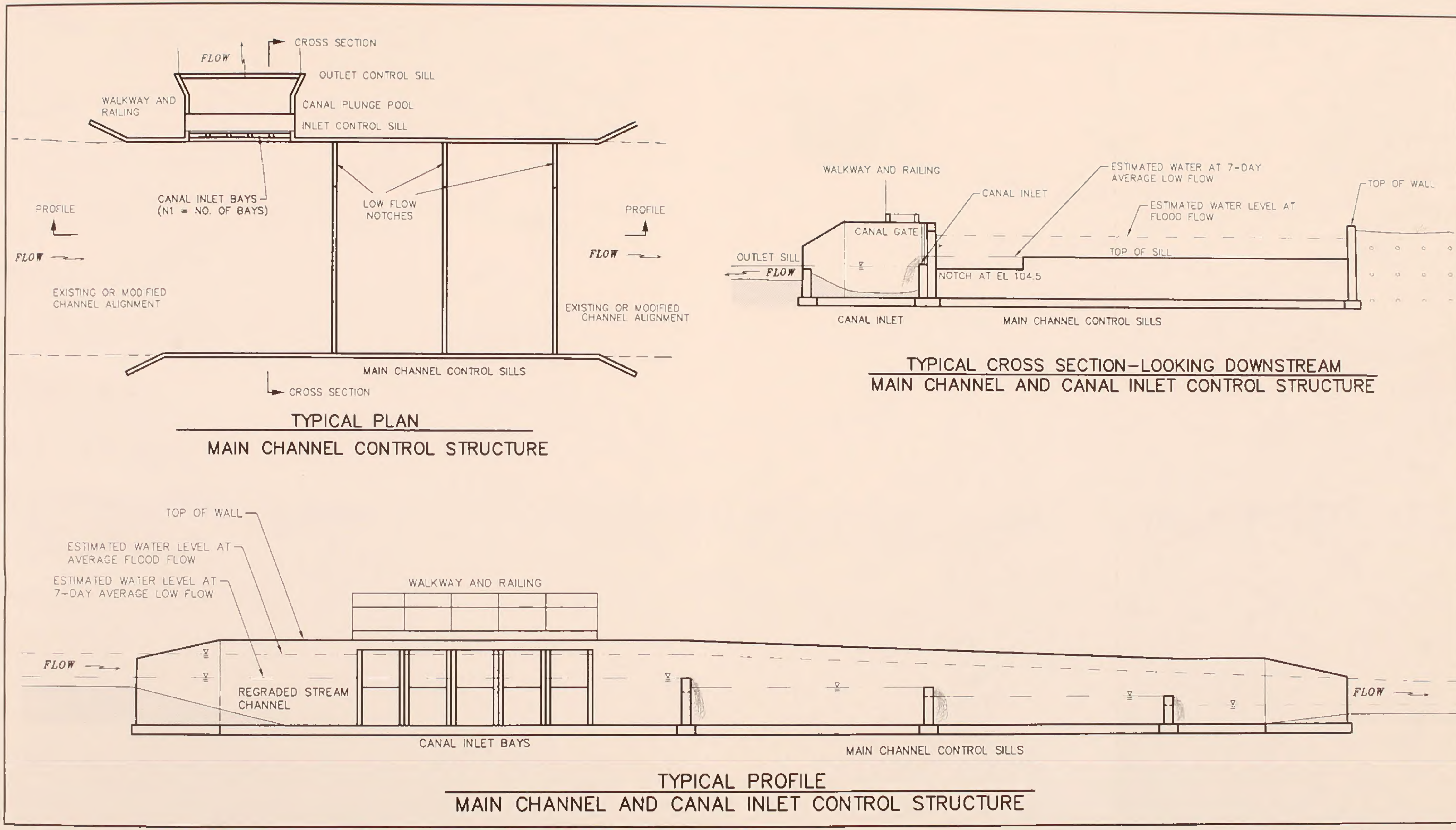


Figure 2-3
Typical Diversion Dam

Table 2-5
Characteristics of Diversion Dams Associated with the Proposed Action and Alternatives

	Yellowstone Feeder/Payne[a]	U.S. Lake Fork[a]	Boneta[a]	"C" Canal[a]	South Boneta[a]	Big Sand Wash Feeder[b]	Lake Fork-Yellowstone[c]
Diversion Flows							
Seasonal Average (cfs)	100	85	15	40	3	100	25
Capacity (cfs)	200	230	25	400	10	100	25
Main Channel Structure							
Length (feet)	130	150	130	400	110	130	120
Width (feet)	90	50	40	40	40	40	40
Canal Inlet Structure							
Width (feet)	44	44	14	54	4	24	14
Number of gates	9	9	3	11	1	5	3
Concrete							
Volume (cu yd)	600	465	350	400	325	350	325
Number of truckloads	60	47	35	45	33	35	33
New Access Roads	No	No	Yes	No	Yes	Yes	Yes
Length (feet)	--	--	4,500	--	2,400	4,000	400
Width (feet)	--	--	20	--	20	20	20
Surface	--	--	Gravel	--	Gravel	Gravel	Gravel
Nature	--	--	Permanent	--	Permanent	Permanent	Permanent
Disturbed Lands							
Temporary (acres)	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Permanent (acres)	0.9	1.1	3.7	0.5	1.6	1.8	0.2

[a]Replaced under the Proposed Action and Cow Canyon, Crystal Ranch, and Twin Pots Alternatives.
[b]Built under the Proposed Action and Cow Canyon and Twin Pots Alternatives.
[c]Built under the Twin Pots Alternative.

contain a field office and supply area. They would be located near the riverbank but not within wetlands, riparian communities, or areas occupied by the Ute ladies'-tresses orchid, by any other federally listed threatened or endangered species, or by any state or Forest Service (FS) sensitive species. The exact location would be coordinated with the agency administering land on which the staging area would be located.

Access Roads. Permanent, gravel-surfaced access roads would be constructed. Table 2-5 provides their dimensions. Contractors would be required to maintain site access roads, which would include blading and dust control as needed. Permanent easements would be acquired for portions of access roads crossing private or Tribal property.

Construction activities would require building temporary access roads leading from the site access roads into the river channels. To the extent possible, temporary access roads and diversion structures would be located to minimize disturbing native vegetation, especially wetlands and riparian areas.

Construction Areas and Activities. Diversion dam construction areas would be located in the river channels and along riverbanks, varying from 0.7 to 1.1 acres. Widths would extend approximately 30 feet past each end of the outside walls of the main channel structures. Lengths would extend from about 100 feet upstream to 100 feet downstream of the main channel structures. Construction areas would also include the space within 50 feet of the canal gates. To the extent possible, diversion structures would be installed to minimize disturbing native vegetation, especially wetlands and riparian areas.

Construction areas for new canal and channel sections that would connect existing canals with new canal inlets would vary in size from about 0.3 to 1.1 acres. Construction area sizes would vary by site, depending on the required lengths of the new canal and channel sections and the widths of the existing canals and channels. Excavated material would be disposed of at approved landfills. Permanent easements would be acquired for those portions of new canal and channel sections crossing private property.

Concrete used to construct diversion dams would be placed during low river flow periods (August through November). Concrete would be placed on one side of the river first, while water is diverted to the other side. A coffer dike or sheetpile wall would separate the construction area from the side of the river used to convey river flow. After half of the diversion structure is constructed, river flow would be diverted over the newly built concrete section. A coffer dike would be constructed to separate river flow from the construction area on the other side of the river where the rest of the concrete would be placed. Diversion gates would be installed using backhoes, where necessary.

Concrete would be hauled from Vernal, Roosevelt, or Duchesne. No site batch plant would be required. It may be possible to pour concrete from the permanent access roads along the riverbanks at sites with smaller-sized structures. Existing structures would be removed and disposed of at approved landfill sites after completion of the new diversion structures.

Table 2-5 shows the estimated sizes of areas that would be temporarily and permanently disturbed at each diversion dam site. A total of 11.4 acres would be temporarily disturbed and 9.6 acres would be permanently disturbed by the six diversion dams under the Proposed Action. These lands would be acquired under temporary and permanent easements, purchased, or acquired by condemnation, if necessary. Areas of permanent disturbance would include new, permanent access roads and new canal and river channel sections. Areas of temporary disturbance would include cleared riverbanks, temporary access roads down riverbanks, and staging areas, all of which would be reclaimed and revegetated. Riverbanks would be reshaped and revegetated with riparian vegetation, and staging areas would be revegetated to the vegetation type present prior to construction unless the original vegetation type was composed of noxious or undesirable plants. Riparian vegetation would be replanted in areas from which it was removed. Riverbanks would also be reshaped and revegetated after the removal of existing diversion structures to prevent river channel or bank erosion. Upstream ends of the old canals (between the old inlet structures and the confluences with the new canal extensions) would be backfilled and compacted. The upstream end of the old side channel at the Boneta site (between the old side channel inlet structure and the confluence with the new side channel extension) would also be backfilled and compacted. This would prevent high river flows from overtopping the banks and entering sections of old canals and side channels no longer in use. Short- and long-term impacts from diversion dam activities would be avoided or reduced by following standard construction and operating requirements contained in Appendix A.

Schedule, Personnel, and Equipment. Construction time for each diversion structure would average 2.5 months, excluding mobilization time for the contractor. Construction would occur during the nonirrigation season. The contractor's field crew would typically consist of 5 to 20 workers (averaging 7), including foremen, equipment operators, carpenters, steel workers, surveyors, quality control personnel, truck drivers, and laborers. The project would use local workers where possible.

Equipment required for the project would consist of one or two D-9 dozers, front-end loaders, backhoes, concrete pumper trucks, and graders. A fleet of 4 to 10 trucks would haul concrete to the job site.

2.2.2.2.3 Operation and Maintenance Procedures. Operation of the new diversion structures would provide water to irrigation canals during the irrigation season. Maintenance procedures would consist of routine (at least monthly) visits to the diversion structures during the irrigation season. Inspections would be more frequent during periods of high river flow. Debris that accumulates on trashracks, fish screens, and in the series of fish passage weirs would be removed and temporarily disposed of in non-wetland areas adjacent to the diversion structures. Accumulated debris removed from the river would be hauled to an approved landfill disposal site at the end of each irrigation season.

2.2.2.3 Canal Rehabilitation

Seven canal laterals would be rehabilitated under the Proposed Action. They include Farnsworth Canal Laterals No. 1, No. 2, and No. 3, and the Ottosen, Blackburn, Anderson, and Tony Smith Laterals. Map 2-1 shows their locations.

2.2.2.3.1 Description of Facilities. Canal rehabilitation would consist of constructing pipelines primarily within existing canal right-of-ways. Turnouts would be provided in the new pipelines at all existing canal turnouts and where necessary to maintain existing or newly developed riparian areas and wetlands. Table 2-6 lists physical characteristics and land requirements for each proposed pipeline associated with canal rehabilitation. Pipeline diameters would vary between 8 and 33 inches and carry up to 39 cfs. The Farnsworth Lateral No. 1 diversion and the first 2.7 miles of Lateral No. 1 would be abandoned. In total, 22.3 miles of pipeline would be placed in existing canals and 1.2 miles in new right-of-way.

Wetland Maintenance Systems. Numerous wetlands and riparian communities have developed along existing canals where there is a water source from canal leaks. Existing wet meadows, emergent wetlands, and shrub riparian areas larger than 5 acres, and existing forested riparian areas larger than 2.5 acres, as well as certain smaller wetland complexes, would be preserved after canal rehabilitation by providing alternative water sources. These alternative water sources would consist of pipeline turnouts and wetland irrigation systems designed to avoid impacts on wetlands and riparian communities. Table 2-7 lists the canals that meet these criteria, number of sites, and acres of wetlands that would be preserved along those canals proposed for rehabilitation. Under the Proposed Action, a total of 83 acres of wetlands would be preserved. Preserved wetlands would be acquired under a permanent easement, purchased, or acquired by condemnation, if necessary, from private owners. Preserved wetlands on Tribal land would be acquired through an agreement with the Tribe and BIA.

Table 2-6 Canal Rehabilitation Pipeline Characteristics for the Proposed Action			
Pipeline	Pipeline Length (miles)	Land Requirements	
		Temporary Easement (acres)	Permanent Easement (acres)
Farnsworth Lateral No. 1	4.8	11.3	14.4
Farnsworth Lateral No. 2	4.8	14.4	14.4
Farnsworth Lateral No. 3	5.9	14.4	17.8
Ottosen Lateral	5.9	1.9	1.9
Blackburn Lateral	1.4	4.3	4.3
Anderson Lateral	3.4	10.4	10.4
Tony Smith Lateral	3.7	11.2	11.2

Table 2-7 Wetlands Preservation along Rehabilitated Canals in the Proposed Action		
Canal Segment	Number of Preservation Sites	Acres Preserved
Farnsworth Lateral No. 1		
CM 0.0-1.0	2	8.9
CM 1.0-2.0	3	18.8
CM 2.0-3.0	2	5.8
Farnsworth Lateral No. 2		
CM 0.0-1.0	0	0
CM 1.0-2.0	3	12.5
Farnsworth Lateral No. 3		
CM 0.0-1.0	0	0
CM 1.0-2.0	1	8.4
CM 2.0-3.0	3	9.1
CM 3.0-4.0	3	1.4
CM 4.0-5.0	2	4.2
CM 5.0-6.0	3	11.2
Blackburn Lateral		
CM 0.0-1.0	1	2.7
Total	23	83.0

CM = canal mile.

The systems would provide adequate water to fully maintain suitable soil moisture conditions for wetlands and riparian communities for the life of the project. This water would come from water savings realized as a result of canal rehabilitation and land retirement. Because of their remote locations, the wetland irrigation systems must be very reliable, efficient, and economical, and require minimal maintenance. Figure 2-4 depicts a typical wetland irrigation system that would be constructed at pipeline turnouts.

2.2.2.3.2 Construction Procedures. Pipe is expected to be aluminum, concrete cylinder, or concrete-mortar-lined and coated-steel. Laying lengths would be approximately 8 or 10 feet for larger pipe (greater than 30-inch diameter) and 20 feet for smaller pipe (less than 30-inch diameter). The construction zone for pipeline installation would be 50 feet wide (142.6 acres total) and consist of a 25-foot-wide temporary easement and a 25-foot-wide permanent easement. The 71.3 acres associated with the temporary easement would be reclaimed, while the 71.3 acres associated with the permanent easement would be required for road access and would not be reclaimed to their original condition (Table 2-6).

Trenches excavated within the existing canals would be deep enough to maintain approximately 3 feet of cover over the top of the pipe. Other steps in the process would include placement of bedding material, installation of pipe, pressure testing, and final backfilling using material excavated from the canal bottoms. It is anticipated that the trenches would be filled in to match the contours of the existing ground.

Turnouts from canals and pipelines would be constructed at the site of each wetland and riparian area to be maintained. Turnouts would include screened weir boxes and would be constructed in place using concrete with metal screens. Water application would be controlled by a solar-powered surge valve installed below the weir box. Main water distribution lines would be aluminum. These would be partially buried where wetlands and riparian areas are adjacent to the canal or pipeline and would be buried when the areas are more distant from the canal or pipeline. Lateral pipelines would consist of gated aluminum pipe also partially buried. Pipeline placement would be designed on a site-by-site basis to avoid removal of trees greater than 3 inches in diameter and mature shrubs, and would minimize removal of other trees and shrubs to the greatest extent possible. Aluminum pipe would be of a thickness able to withstand trampling by livestock in unfenced areas on Tribal lands. A four-strand barb wire fence that is approved by Wildlife Resources and capable of excluding livestock would be constructed around the perimeter of each wetland maintenance area on non-Tribal lands.

Schedule, Personnel, and Equipment. Table 2-8 lists the equipment and estimated work force that would be required to install each of the proposed pipelines associated with canal rehabilitation.

2.2.2.3.3 Operation and Maintenance Procedures.

Canal Rehabilitation Pipelines. The new pipelines would require very little maintenance. They would be inspected annually to ensure the corrosion protection system is operating properly (if one is required based on the design soils report) and to detect any obvious signs of pipeline leakage. Suspicious areas would be marked and monitored more frequently or excavated and repaired. Excavation would only occur when the pipeline is not in service. Pipeline interiors would be inspected at least once every 5 years for corrosion and to determine if sediment needs to be removed.

Wetland Maintenance System. Wetland maintenance along proposed pipelines would include maintaining the surrounding, protective fences and irrigation systems in good operating condition. It would also include monitoring for and providing project water at a frequency and duration suitable for the site, soil conditions, and irrigation system design once the system becomes operational. Maintenance of wetlands generally requires about 4.5 acre-feet of water per acre. The 83 acres of preserved wetlands would require about 374 acre-feet of water annually. Operation and maintenance of the wetland maintenance system would be funded

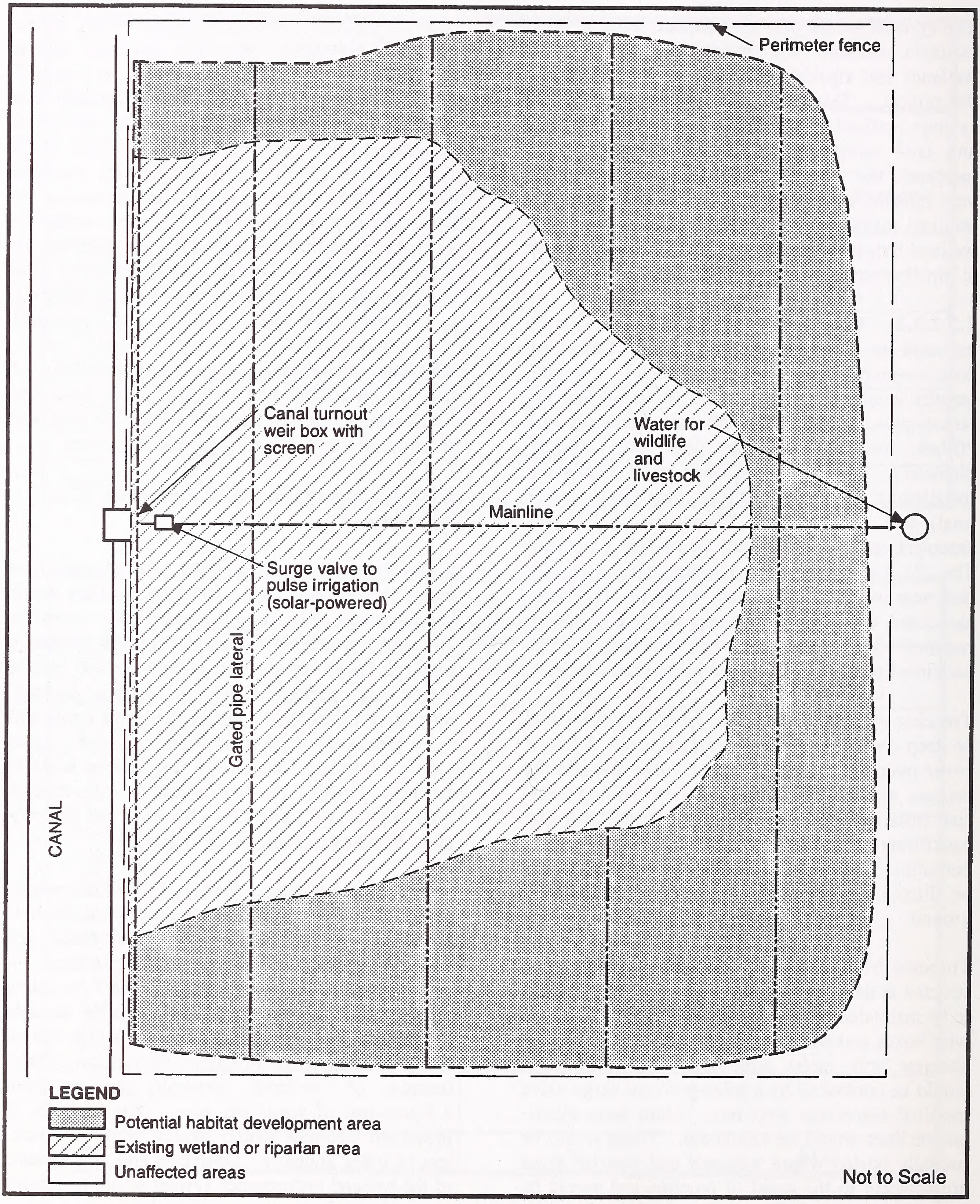


Figure 2-4
Wetland and Riparian Habitat Avoidance, Improvement, and Development Concept

Table 2-8
Equipment, Personnel, Staging Areas, and Seasons Required to Construct Canal Rehabilitation Pipelines for the Proposed Action[a]

Pipeline	Excavator	Loader Backhoe	Compactor	Miscellaneous Equipment	Dump Truck	Operators and Laborers	Project Manager	Staging Areas[b]	Construction Seasons[c]
Farnsworth Lateral No. 1	1	1	1	2	1	11	1	2	1
Farnsworth Lateral No. 2	1	1	1	2	1	11	1	2	1
Farnsworth Lateral No. 3	1	1	1	2	1	11	1	2	1
Ottosen Lateral	0	1	1	2	1	8	1	1	1
Blackburn Lateral	0	1	1	2	1	8	1	1	1
Anderson Lateral	0	1	1	2	1	8	1	1	1
Tony Smith Lateral	0	1	1	2	1	8	1	1	1

[a]Activities include clearing and grubbing, excavation, pipe installation, backfilling, and compaction. The above does not include transportation of the pipe and equipment to the job site and staging areas. Operators and laborers category includes operators and general support labor not required for any one piece of equipment but required to complete a successful project.
[b]Minimum number of contractor staging areas that would be required.
[c]One construction season = 3-month period in spring or fall.

by the DOI. This system has been used successfully in the artificial irrigation of wetlands in the Western United States and is described in detail in Section 4 Mitigation Plan of the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g).

2.2.2.4 Pipelines

The Proposed Action includes the new Big Sand Wash Feeder Pipeline. This pipeline would deliver additional water to the enlarged Big Sand Wash Reservoir.

2.2.2.4.1 Description of Facilities. The location of the Big Sand Wash Feeder Pipeline is shown on Map 2-1. The new 39-inch-diameter pipeline would begin at the proposed Big Sand Wash Feeder Pipeline diversion structure on the Lake Fork River and extend 6.4 miles to the inlet structure at Big Sand Wash Reservoir. Turnouts may be installed at the crossings with the Lake Fork and "C" Canals.

2.2.2.4.2 Construction Procedures. Construction procedures for the proposed Big Sand Wash Feeder Pipeline would be the same as described for pipelines that would be constructed as part of canal rehabilitation (see Section 2.2.2.3). For the Big Sand Wash Feeder Pipeline, the top 12 inches of soils would be stockpiled after removal from the area of pipeline trench excavation. These soils would subsequently be replaced as the final layer of native materials during trench backfilling. Where wetlands or riparian areas occur in the right-of-way, final backfilling in pipeline trenches would include the use of impervious materials as well as the use of cut-off collars, or other appropriate methods determined during final design, to prevent the pipeline trench from acting as a conduit and draining water from wetlands and riparian areas. The upper 12 to 18 inches of stockpiled soil removed from these areas would be replaced and comprise the top layer of backfill. Preproject contours and elevations also would be reestablished over the pipeline trench. Pipeline construction through wetlands and riparian communities is detailed in Appendix A.

Approximately 38.4 acres of land would be required to construct the Big Sand Wash Feeder Pipeline (50-foot-wide construction zone). (Ownership of the 38.4 acres is listed in Tables 2-16 and 2-17.) Disturbed land would be reclaimed following construction. It is anticipated that staging areas would be located at each end of the pipeline route and at the junction of the pipeline and Highway 87 right-of-way. Two construction seasons, with minimal activity during winter, would be required to build the Big Sand Wash Feeder Pipeline. Table 2-9 lists personnel and equipment that would be required for pipeline construction.

2.2.2.4.3 Operation and Maintenance Procedures. These procedures for the Big Sand Wash Feeder Pipeline would be the same as described for pipelines associated with canal rehabilitation (see Section 2.2.2.3). The design flow of the Big Sand Wash Feeder Pipeline would be 84 cfs.

2.2.2.5 High Mountain Lakes Stabilization

2.2.2.5.1 Description of Facilities. Ten high mountain lakes would be stabilized under the Proposed Action. Map 2-1 shows the locations of these lakes in the High Uintas Wilderness. Table 2-10 presents historical data on the modified lakes.

Table 2-11 presents proposed future characteristics of these 10 lakes. Figure 2-5 shows the concepts of lake stabilization, which would generally consist of removing a portion of the dam embankment to the stabilized level (breach height and length) and plugging the outlet pipe. Existing spillways would be left in place for emergency purposes. The proposed stabilized level is based on the Utah Division of Water Rights Dam Safety Classification of "No Hazard." This classification means that no operation or maintenance of the facility would be required once the stabilization construction was completed. It also means that the downstream effects of dam failure on a stabilized lake would be no more serious than the occurrence of a 100-year natural flood event for that lake's drainage basin. Whatever minimum liability that may remain would be assumed by the FS upon cancellation of the special use permits for these dams.

Table 2-9
Equipment, Personnel, and Seasons Required to Construct Pipelines for the Proposed Action and Alternatives[a]

Pipeline	150 T Crane	Excavator	Loader	Compactor Backhoe	Miscellaneous	Dump Truck	Operators and Laborers	Project Manager	Construction Seasons
Big Sand Wash Feeder[b]	●	1	1	1	3	2	27	1	2
Lake Fork-Yellowstone[c]	0	1	1	1	3	2	24	1	1
Big Sand Wash-Roosevelt[c]	0	2	2	2	2	1	20	1	1

[a]Activities include clearing and grubbing, excavation, pipe installation, backfilling, and compaction. The above does not include transportation of the pipe and equipment to the job site and staging areas. Operators and laborers category includes operators and general support labor not required for any one piece of equipment but required to complete a successful project.
[b]Built under the Proposed Action and Cow Canyon and Twin Pots Alternatives.
[c]Built under the Twin Pots Alternative.

Table 2-10 Existing Characteristics of High Mountain Lakes Proposed for Stabilization under the Proposed Action							
	Existing Dam						
Lake	Year Constructed	Mechanized Equipment Used?	Hydraulic Height (ft)	Crest Length (ft)	Lake Storage Volume (ac-ft)*	Trench Depth (ft)	Lake Surface Area (ac)
Bluebell	1926	No	7.1	230	235	0	58
Drift	1928	No	11.4	215	160	6.9	31
Five Point	1929/1941	No	12.3	908	160	6.9	23
Superior	1933	No	16.2	205	300	7.9	40
Milk	1937	No	9.3	222	160	1.4	23
Farmers	1931	No	NA	NA	3,765	NA	50
East Timothy	1931/51	Yes	31.8	1391	600	6.9	43
White Miller	1926	No	2.4	NA	239	0	20
Deer	1931	No	16.3	158	115	4.3	11
Water Lily	1940	No	6.2	85	115	0	15

*Calculated from data provided by the State of Utah Division of Water Rights.
NA = Not applicable.

Table 2-11 Future Characteristics of High Mountain Lakes Following Stabilization under the Proposed Action						
	Stabilized Dam			Water Surface Elevation		
Lake	Breach Height (ft)	Breach Length (ft)	Surface Area (ac)	Natural (ft)	Existing (ft)	Stabilized (ft)
Bluebell	3	25	52	10,887	10,891	10,990
Drift	3	25	18	11,060	11,066	11,064
Five Point	8	25	37	10,970	11,002	10,999
Superior	8	25	22	11,160	11,165	11,160
Milk	11	25	15	10,970	10,983	10,970
Farmers	NA	NA	47	10,975	10,983	10,975
East Timothy	20	25	24	10,970	11,005	10,990
White Miller	2	25	18	10,975	10,983	10,978
Deer	12	25	6	10,236	10,245	10,236
Water Lily	6	25	12	9,346	9,346	9,346

NA = The outlet tunnel would be plugged with concrete.

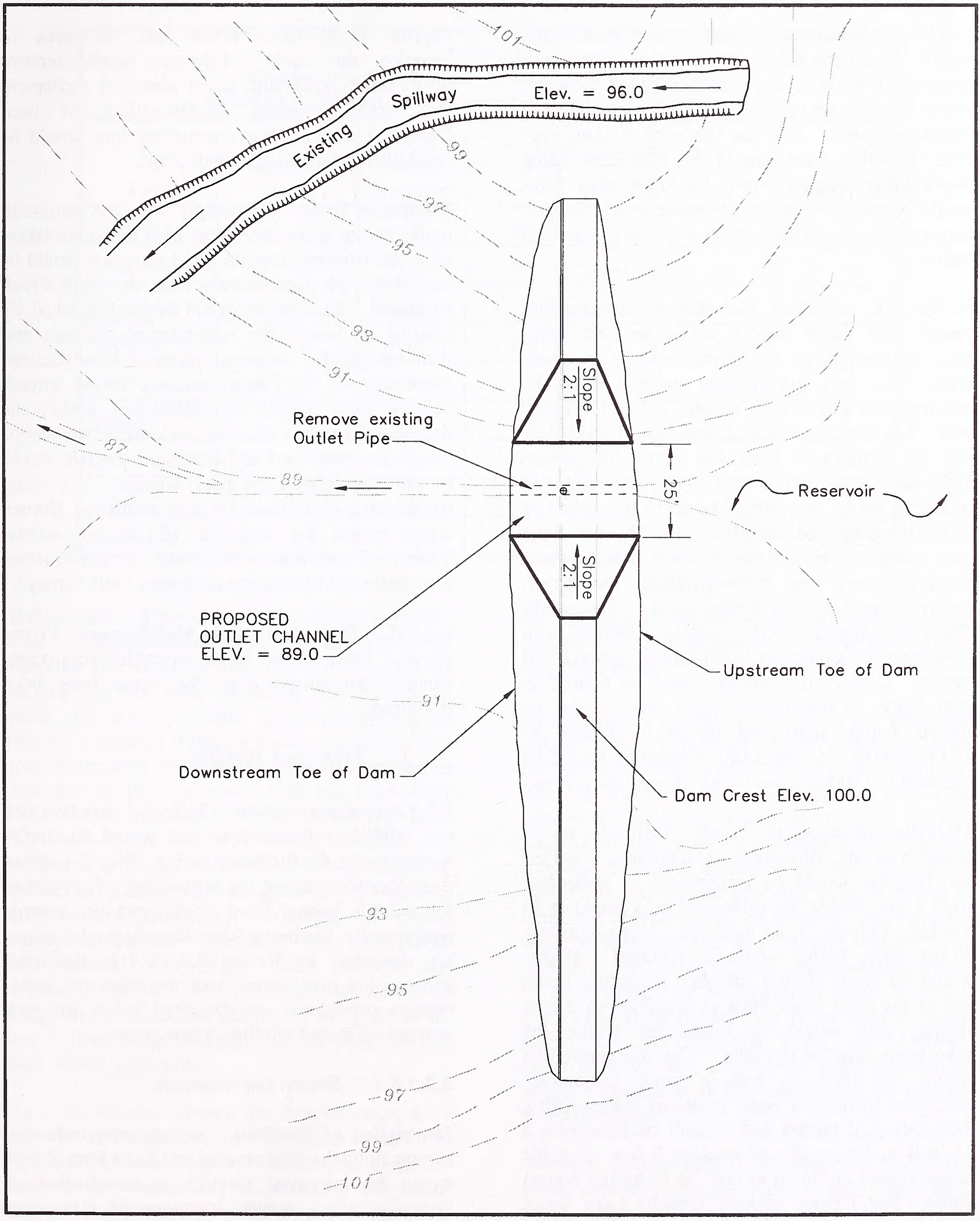


Figure 2-5
Typical Stabilization
of High Mountain Lake Dams

2.2.2.5.2 Construction Procedures. Construction would be accomplished using either motorized/ mechanical tools or the minimum tools concept, which is based on criteria in the FS minimum tool evaluation guide. For the Proposed Action, only East Timothy Lake would be stabilized using motorized/mechanical tools; the other nine lakes would be stabilized using minimum tools. General construction procedures at all lakes are described below.

In the fall preceding the summer construction season, the outlet works would be left open, allowing the lake to be drawn down to its lowest level. The dam embankment material would be removed and spread over an area within the reservoir. The removed material would be placed below the old high-water level but above the future high-water level of the stabilized lake. Any old concrete would be buried beneath the substrate below the stabilized waterline. Finally, the outlet gate would be closed, the conduit plugged with concrete, and the gate-operating mechanism removed from the wilderness area. The newly constructed breach outlet would be stabilized with impermeable membranes, filter fabric, gabions, and riprap. Construction crews would be housed in wall tents. Construction camp sites would be spaced 1 mile apart and would be limited to 12 individuals. Construction equipment would be confined to staging areas within the reservoir area.

Motorized/Mechanical Tools. Utilizing mechanized methods, all equipment, materials, supplies, and laborers would be transported by helicopter from a site outside the wilderness area boundary to the East Timothy Lake dam site. Approximately 50 helicopter flights would be required. Flights would be made during off-peak recreation hours and as far away from trails as possible. A 2-acre staging area would be established within the drawdown zone of the lake. The equipment that would be lifted in with a large "Skycrane" helicopter includes a small front-end loader with a 1/3-cubic-yard bucket and a small backhoe with a 16-inch-bucket capable of reaching 7 feet. Portable toilets would be flown in and out to handle human waste. Stabilization of East Timothy Lake would require 18 laborers at two camps near the lake and require 14,987 labor hours and 40 weeks to complete the work. Laborers would remove 4,983 cubic yards with seven pieces of equipment that would consume 24,850 gallons of fuel. Disturbed areas in the construction zone would be rehabilitated following construction.

Minimum Tools. To comply with the minimum tools concept at the nine other high mountain lakes, all tools, laborers, supplies, and materials would be hauled in with pack animals from the Swift Creek Trailhead. Excavation would be accomplished by blasting to loosen the embankment material and then loading the loosened material into buckets, wheelbarrows, or Fresno scrapers to be spread. Staging areas would be established within the drawdown zone of the lake. Construction camps would be established and temporary corrals would be built to contain the pack animals. No camp would have more than 15 pack animals. Human waste would be disposed of in pit toilets. Table 2-12 presents a summary of construction requirements utilizing the minimum tools concept.

2.2.2.5.3 Operation and Maintenance Procedures. There would be no operation or maintenance requirements after the dams have been stabilized.

2.2.2.6 Fish and Wildlife

2.2.2.6.1 Enhancement. Table 2-1 lists five fish and wildlife enhancements that would be implemented under the Proposed Action. Map 2-1 shows their locations except for acquisition of properties for wildlife habitat (Red Rocks area or, alternatively, in the Duchesne River drainage). Locations are described in Section 2.2.2.6.1.3. Facilities, construction procedures, and operation and maintenance procedures are described below for each proposed fish and wildlife enhancement.

2.2.2.6.1.1 Stream Improvement.

Description of Facilities. Aquatic and terrestrial habitat along the Yellowstone and Lake Fork Rivers would be improved through a combination of instream fishery habitat improvement structures, bank stabilization structures, and riparian vegetation

Table 2-12
Construction Requirements for the Stabilization of High Mountain Lakes under the Proposed Action Using Minimum Tools

Lake	Material Removed (cu yd)	No. of Laborers Required	Labor		No. of Camps	No. of Pack Trips
			Hours	Weeks		
Bluebell	21	10	392	1	1	3
Drift	28	10	392	1	1	3
Five Point	92	18	1,456	2	2	6
Superior	69	10	1,120	2	2	6
Milk	38	15	616	1	2	3
Farmers	0	12	480	1	1	3
White Miller	10	3	112	1	1	3
Deer	202	15	3,080	5	2	15
Water Lily	25	10	392	1	1	3

establishment. Most of these improvements would focus on bank stabilization and riparian vegetation. Although the exact location of each structure or planting has not been identified, the reaches in which this activity would occur are shown on Map 2-1. Reaches include 4.5 miles of the Yellowstone River from below the proposed Crystal Ranch Dam site to its confluence with the Lake Fork River and 18 miles of the Lake Fork River from the Moon Lake outlet to 7 miles below its confluence with the Yellowstone River. Existing recreational plunge pools along the rivers would be protected and preserved. Concepts for stream improvements are described by ECOTONE Environmental Consulting, Inc. (1995c) and summarized below. Any additional state-of-the-art design and construction techniques available at the time of final design and construction would also be used, where applicable.

The river reaches chosen for improvement were based on an analysis of the operational river flows expected under the Proposed Action and an assessment of the viability of constructing and maintaining improvements under project operating conditions. Using the Tennant method of fish habitat analysis, the end points demarcate the river reaches for which the project could reliably provide minimum flows.

Approximately 5 miles on the Lake Fork River and 2 miles on the Yellowstone River within the above delineated reaches would actually be improved. The selection of specific sub-reaches and sites to be improved would be based on a more detailed analysis of the river environment during design. The improvements described in this section are conceptual and will be modified in final design to minimize operation and maintenance requirements while maintaining fish and wildlife values. The objectives and design of these improvements would be accomplished as a cooperative effort, with the Ute Tribe taking the lead on Tribal land and with participation from the BIA, FWS, and CUWCD. Some other agency, such as the Utah Division of Wildlife Resources or FS, would take the lead on non-Tribal land.

Instream fishery habitat improvement structures would consist of boulder clusters and vortex rock weirs. Bank stabilization structures would include tree revetments, bank barbs, bioengineered erosion control blankets, hard structures such as logs and rocks for armoring streambanks, and vegetation plantings. Vegetation plantings would utilize a variety of techniques that employ woody and herbaceous vegetation (stem cuttings, sapling cuttings, and root wads).

Twelve boulder clusters would be placed in a 2,000-foot reach of the Lake Fork River adjacent to the existing Lake Fork Ponds Campground. Twelve boulder clusters would also be placed in a 1,500-foot reach of the Yellowstone River adjacent to the proposed Crystal Ranch Campground Recreation Replacement and Development (see Section 2.2.2.7.1.1). Approximately four boulders, at least 24 to 36 inches in diameter, would be placed in each boulder cluster to provide cover, habitat diversity, and resting places for fish. In addition, approximately seven vortex weirs would be placed in the Lake Fork and Yellowstone Rivers at the same locations as the boulder clusters. Each weir would consist of a string of boulders arching upstream to provide instream cover, deepen feeding areas, and provide holding cover at high flows for fish. Design would be based on ecologically sound state-of-the-art principles at the time of final design.

Tree revetments, bank barbs, and riparian vegetation would be used to stabilize sloughing and actively eroding banks along straight river reaches and on the outside banks of channel meanders. Long river reaches that have been severely damaged by artificial channelization and subsequent upstream and downstream erosion would be high-priority areas.

Stream channel improvements on the Yellowstone River and on the Lake Fork River downstream of its confluence with the Yellowstone River would require minimum stream flows to achieve fishery and recreation benefits expected from this work. The project water supply and operation have been developed on the basis that minimum flows would be available in the improved stream reaches at all times. Normal project operation would provide the required minimum flows except for portions of very dry years. Stream channel improvements in the Lake Fork River just downstream of Moon Lake would be protected from damaging peak flows because of flood control at Moon Lake Dam; however, minimum flows cannot be guaranteed in this particular stream reach.

Construction Procedures. Boulders in each boulder cluster would be placed no closer than one times their diameter to the bank and two to three diameters between each boulder. A backhoe or trackhoe would be used to dig a trench one-third to one-half the diameter of the boulder and an articulated bucket would be used to place the boulder in the trench.

To construct the vortex weirs, a trench at least one and one-half to two boulder widths deep would be excavated across the channel during low flow using a trackhoe. Rocks would be placed within the trench to form a foundation (footer rocks) and boulders would be placed on top of, and keyed into, the footer rocks. A trackhoe or backhoe with an articulated bucket would be used to place the rocks. Rocks and boulders would come from an approved quarry. The ends of the weir should be slightly higher than the middle of the weir, and the middle would be upstream of the ends. Boulders used in the vortex weirs and boulder clusters described above must be sufficiently sized to resist the tractive forces of flood events (on the order of 1,000 to 1,500 cfs) to avoid movement and translocation. They should also be angular or flat-surfaced on one side to help prevent them from being rolled down the river during high flows.

Bank stabilization structures (tree revetments and bank barbs) would be constructed from materials obtained from impacted areas (e.g., reservoir sites) or onsite. Mature, green Engelmann spruce or lodgepole pine at least 50 feet tall, preferably with many branches, would be used for the revetments. The trees would be placed along the bank with their tops facing downstream. Four-foot lengths of 0.75-inch rebar would be used to anchor the trees into the bank. Successive trees would be overlapped by at least 50 percent along the bank. Trees with root wads from within reservoir clearing zones that meet stream improvement and bank stabilization criteria would be stockpiled for use. Secondarily, trees would come from the local river corridor, but only if needed.

To construct the bank barbs, a trench with a width one-third to one-half the diameter of boulders to be placed in the trench would be excavated outward and upgradient into the stream. The largest boulders would be placed in the trench to form an anchor and then smaller boulders would be keyed in on top.

A variety of techniques would be used to revegetate eroded or channelized river reaches. Eroded, vertical banks would first be dressed back at a slope no greater than 3:1. Willow cuttings would be laid from the stream elevation to the top of the bank and then covered with 4 to 6 inches of soil. Root and shoot growth would occur along the length of the cutting. The new cuttings must be protected from erosive water forces until the plants become established using logs, willow root wads, bundles of live willows (facines), bank barbs, and/or vortex weirs. All cottonwood, red-ozier dogwood, alder, birch, and willow cuttings, root wads, and conifers for revetments would be collected from the reservoir inundation area to the extent practicable. Excavators equipped with an opposable thumb would be used to remove plant material, place it on flatbed trucks for transport, then replant the material. Seeding, mulch, or erosion blankets may be needed in some areas to stabilize the soil and reduce erosion. Jute erosion blankets are preferred over synthetic materials.

Operation and Maintenance Procedures. Monitoring of the bank stabilization structures and riparian vegetation plantings would be needed to ensure that restoration proceeds according to plan. Annual monitoring for at least 3 years would be required to measure plant establishment success and growth. Additional mulch, seeding, or planting may be required if erosion is not controlled adequately, or if plant establishment and growth fall below standards set during final project design.

2.2.2.6.1.2 Big Game Winter Range Improvement.

Description of Facilities. Big game winter range on the 11,500-acre Towanta Flats site and the 13,300-acre Monarch Bench site would be improved. New water sources would be provided by building guzzlers and constructing small dikes on natural drainages on both sites and by installing pipes from the Farnsworth Canal to watering tanks and troughs on the Towanta Flats site. The watering troughs would not be placed within 2 miles of a sage grouse lek site. Vegetation on Towanta Flats and Monarch Bench would be improved by seeding browse, forb, and grass mixtures over existing vegetation, the extent of which would be determined during final project design. Small, narrow openings with irregular borders may be developed in extensive pinyon/juniper stands on both sites through carefully controlled firewood cutting. Individual trees would be left scattered throughout. Development of new roads on both sites would be limited to those needed for construction, operation, and maintenance of proposed facilities. Unneeded existing two-track roads would be obliterated and revegetated. Maps 2-4 and 2-5 depict key features of these improvements on Monarch Bench and Towanta Flats, respectively. Big game winter range improvements are described in detail by ECOTONE Environmental Consulting, Inc. (1995a).

Construction Procedures. Construction would be limited to building guzzlers, small dikes, and troughs with associated piping. Some existing roads would be obliterated. Small firewood sales may be permitted in areas where small openings are needed.

Operation and Maintenance Procedures. Range condition, vegetation response to treatments, and the numbers and types of wildlife using the Towanta Flats and Monarch Bench sites would be monitored annually. Some minor annual maintenance of water catchment dikes, guzzlers, and water troughs may be needed.

2.2.2.6.1.3 Habitat Acquisition.

Description of Facilities. The Red Rocks property shown on Map 2-6 includes riparian habitat and extensive big game habitat. Wildlife habitat acquired would include all or a portion of 15,480 acres in the Red Rocks area northwest of Farm Creek Pass. It would include the confluence of the west and north forks of the Duchesne River, bordering Ashley National Forest to the north. The Red Rocks property would include conifer and deciduous forest, upland aspens, juniper, sagebrush/grass, and shrub/forest riparian communities. The property would include prime big game winter and year-round range.

Other properties in the Duchesne River drainage that would provide equivalent habitat and serve as prime big game winter range would be considered for purchase. Alternative acreage could be adjacent to other public land, the Ashley National Forest, or Ute Tribal lands managed for big game habitat.

The purpose of the Red Rocks/Duchesne Drainage properties acquisition is to manage areas of critical high value or substantial big game range for wildlife values and to protect the riparian corridor.

Construction Procedures. Fences would be installed as required for wildlife habitat management.

Operation and Maintenance Procedures. Fences, if installed, would be maintained periodically.

2.2.2.6.1.4 Clay Basin Settlement Pond Fish Enhancement.

Description of Facilities. Clay Basin Pond would be deepened and fish cover structures installed to enhance fish habitat. A fishing pier would be installed on the south end of the pond. Material removed would be hauled to a site directly north of Clay Basin and used to develop a sediment settling pond. This settling pond would also provide habitat for waterfowl. Additional material removed would be used to level picnic sites and improve parking on the west side of Clay Basin Pond. Up to 3 cfs of Tribal water would be committed to Clay Basin Pond from May through October. Flow-through minimum flows would be piped a sufficient distance to keep livestock away from the pond. Short-duration higher flows would be spilled into a natural channel. If it appears cattle would disturb Clay Basin Pond or the settling pond, their banks would be fenced.

Construction Procedures. Clay Basin Pond would be drained, dried for 4 to 6 months, then deepened on the north and east ends using a bulldozer. Some dredging would also occur on the west side of the pond just south of the parking area to enhance shore anglers' accessibility to open water. Heavy equipment would be used to remove approximately 1,000 cubic yards of sediment. The aeration line and diffusers would be replaced, and the fish cover structures, fishing pier, and 2-inch-diameter water line would be installed, primarily by hand.

Operation and Maintenance Procedures. Clay Basin Pond would be maintained at present water levels and inspected periodically for sediment accumulation. The pond would have a flow-through of up to 3 cfs from May through October.

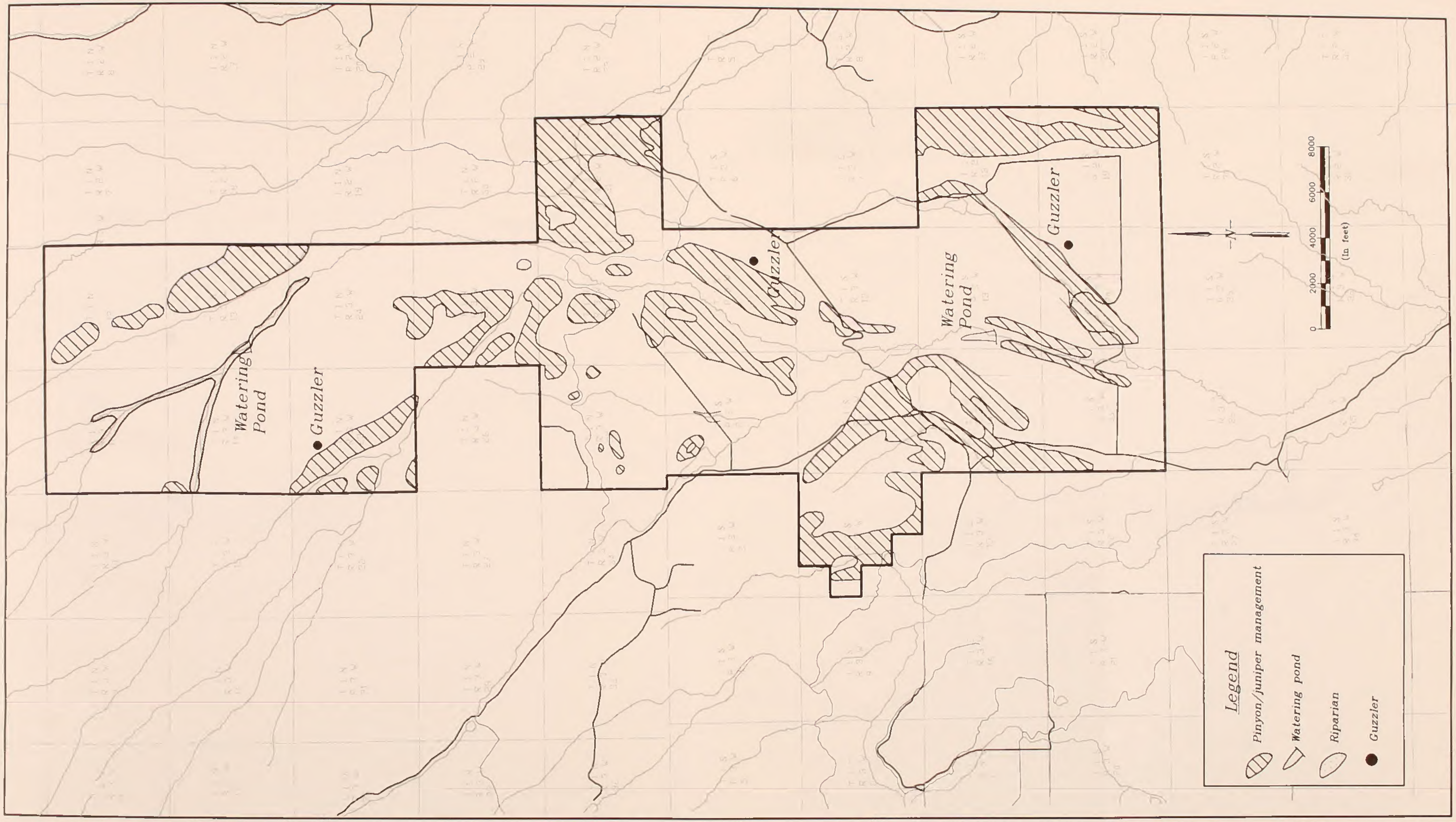
2.2.2.6.1.5 Twin Pots Reservoir Improvement.

Description of Facilities. Twin Pots Dam and Reservoir are located offstream on an unnamed channel just west of the Lake Fork River (see Map 2-1). Under the Proposed Action, the existing Twin Pots Dam would be removed and replaced with a new dam at the same location. It would provide long-term reservoir storage primarily for fish and wildlife enhancements and for recreation activities. The existing facilities are marginally suitable for these uses. Water stored in Twin Pots Reservoir also may be used by the Ute Tribe for irrigation. Conservation pool maximum depth for fish would vary from 38 feet at full pool to a lesser maximum conservation pool depth, which should be at least 15 feet.

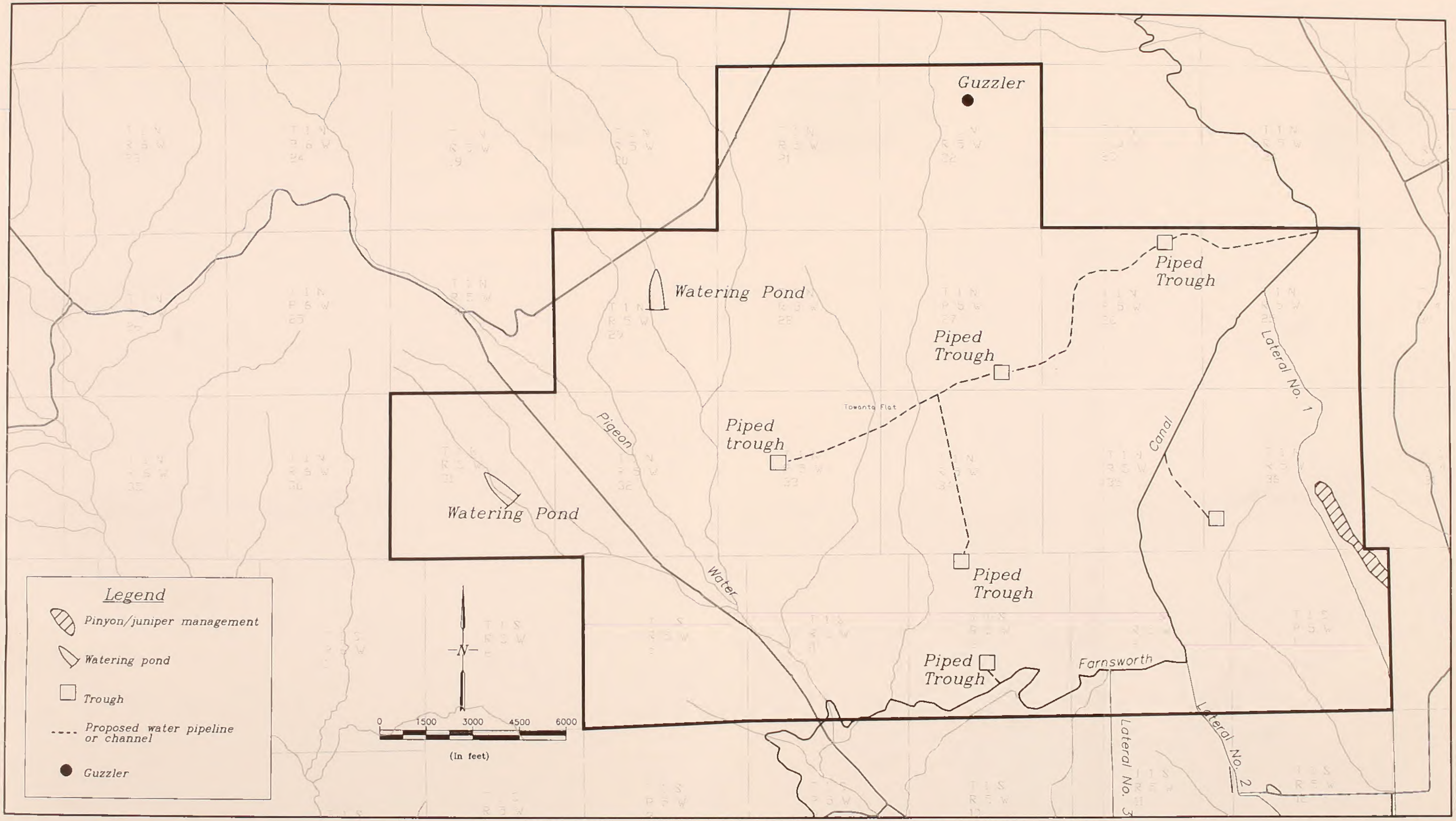
The replacement dam would be a zoned earth and rock fill structure approximately 34 feet high, with a crest elevation of 7,635 feet, a crest length of 500 feet, and a crest width of 20 feet. Table 2-13 summarizes the physical features and facilities proposed for Twin Pots Dam and Reservoir. Map 2-7 shows the locations of these facilities.

Construction Procedures.

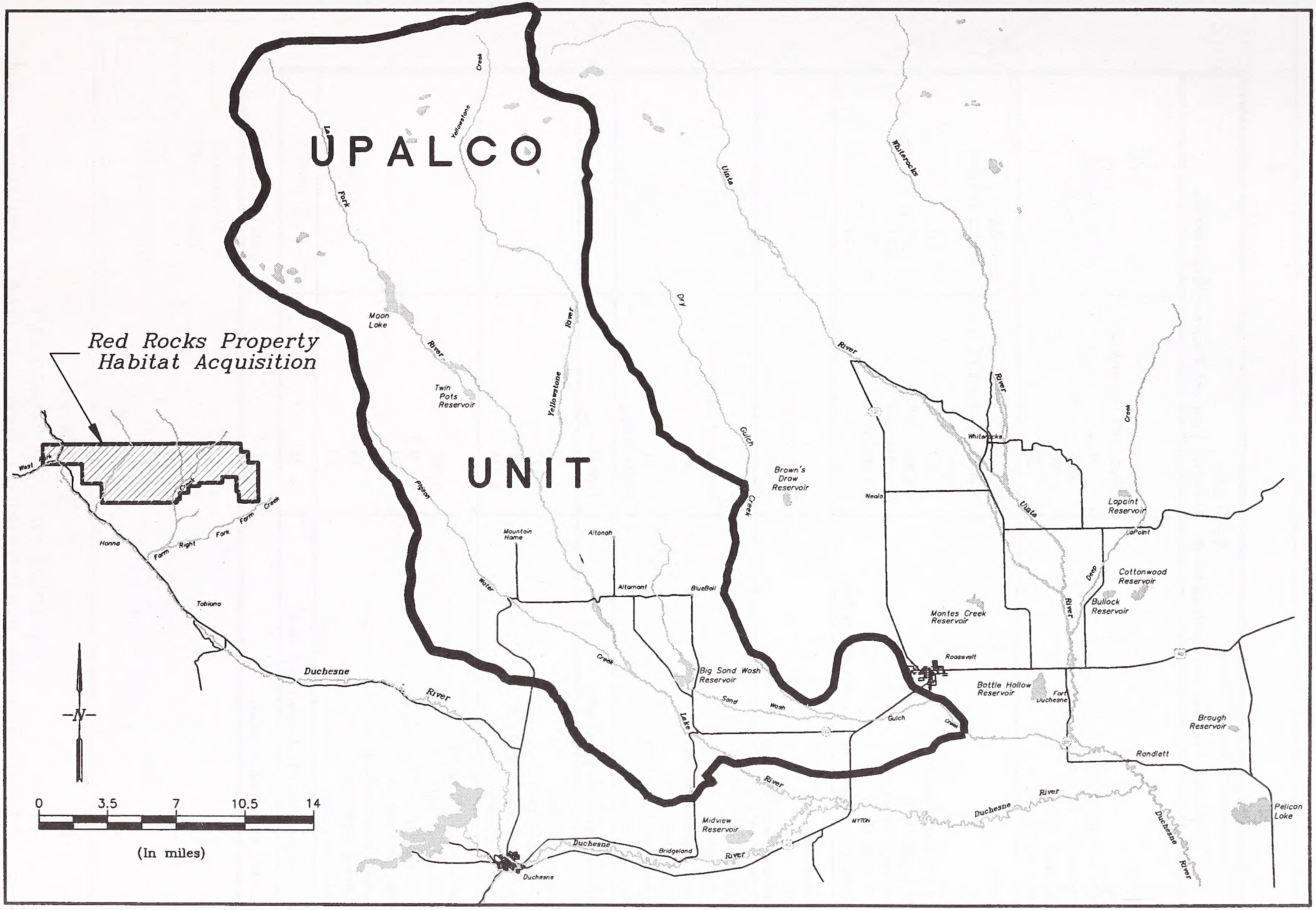
Twin Pots Dam Stabilization. Construction activities would be localized and occur primarily in and near the reservoir pool. Primary activities in the reservoir area that would cause impacts would be similar to those described for enlargement of Big



Map 2-4
Proposed Action–Talmage
Key Features of Big Game
Winter Range Improvement
Monarch Bench



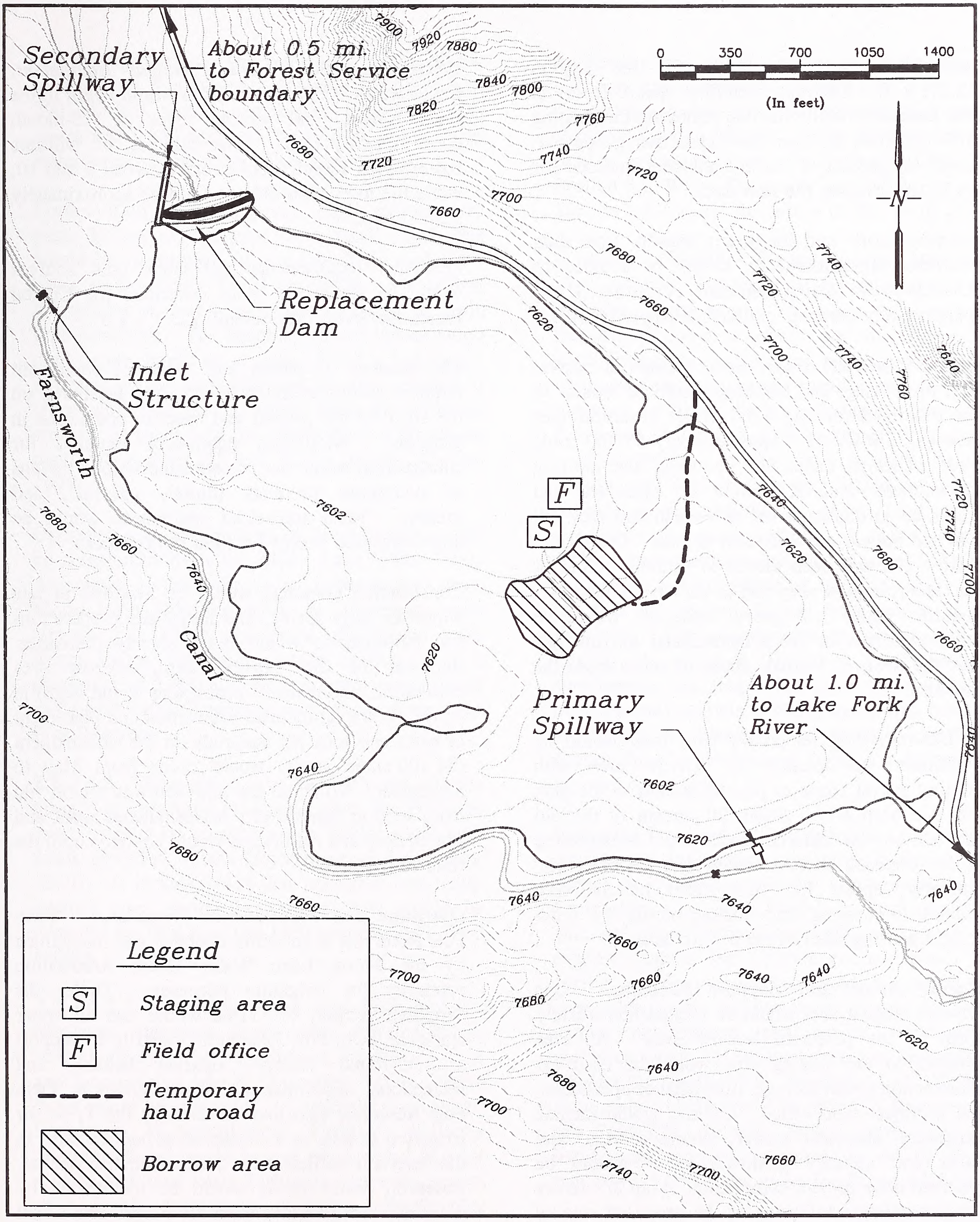
Map 2-5
Proposed Action–Talmage
Key Features of Big Game
Winter Range Improvement
Towanta Flats



Map 2–6
Proposed Action–Talmage
Red Rocks Property
Acquisition

Table 2-13
Physical Features and Facilities for the Twin Pots Dam and Reservoir Replacement

Dam		
Location	Offstream	
Type	Zoned earth and rock fill	
Structural height (feet)	34	
Crest elevation (feet msl)	7,635	
Crest length (feet)	500	
Crest width (feet)	20	
Spillway	**Primary**	**Secondary**
Type	12-inch-diameter PVC pipe	Concrete overflow
Crest elevation (feet msl)	7,629	7,630
Crest length (feet)	Not applicable	25
Chute length (feet)	Not applicable	240
Chute width (feet)	Not applicable	25
Probable Maximum Flood Design Capacity (cfs)	3	370
Intake Structure		
Type	Single, low level	
Intake elevation (feet msl)	7,606	
Outlet Works		
Conduit type	Reinforced concrete	
Conduit diameter (inches)	21	
Conduit length (feet)	250	
Maximum discharge (cfs)	41	
Control gate type	Simple sliding	
Probable Maximum Flood (cfs)	11,900	
Storage (acre-feet)		
Inactive (dead) pool	527	
Conservation (active) pool	3,241	
Total active	3,241	
Reservoir (at full pool)		
Elevation (feet msl)	7,630	
Length (miles)	0.9	
Surface area (acres)	194	
Shoreline length (miles)	2.5	
Maximum depth (feet)	38	
Mean depth (feet)	19	
Conservation Pool Maximum Depth (feet)	38	
Drainage Area (square miles)	0.5	



Map 2-7
Proposed Action–Talmage
Physical Features and Construction Requirements
Twin Pots Dam and Reservoir

Sand Wash Dam and Reservoir (see Section 2.2.2.1.2.3). Additional activities specific to Twin Pots Reservoir would include removing the existing earth and rock fill dam and reprocessing approximately 80 percent of the embankment material for use in constructing the new dam.

Potential short- and long-term impacts from dam and reservoir construction would be avoided or reduced by following standard construction and operating requirements outlined in Appendix A.

Borrow (Material) Areas. Borrow material excavation, processing, and handling would be similar to that described for Big Sand Wash Reservoir (see Section 2.2.2.1.2.3). Approximately 57,700 cubic yards of earth materials, including the existing embankment material, would be excavated and processed to construct the new earth and rock fill dam and impervious upstream blanket. One 5-acre borrow area has been identified near the center of the reservoir pool area and is shown on Map 2-7. Required riprap and gravel materials would be acquired offsite or from commercial borrow pits near the town of Vernal, about 65 miles from the dam site.

A 0.25-mile-long temporary haul road would be constructed to connect the borrow area with existing gravel roads to provide access to the dam site (see Map 2-7). About 20 percent of the old dam and borrow material spoils would be deposited in the proposed borrow area within the reservoir. Similarly, spoils left over from borrow area material processing and sorting would be redeposited and regraded in the borrow area.

Staging Areas and Support Facilities. One 0.5-acre staging area would be located immediately north of the proposed borrow area. An area adjacent to the staging area would be used for construction trailer storage, maintenance operations, and a project field office. Utilities would include temporary electrical power, phone service, and water and sanitary facilities, which would be removed after project completion. Map 2-7 shows the approximate locations of the proposed staging area and field office required during construction.

Construction Force and Principal Equipment. Replacement of Twin Pots Dam would begin in the early spring and extend over a 15-month construction period. The number of workers required per month would vary between 2 and 10, while the total labor effort would be approximately 9,500 hours.

Personnel requirements and labor pool sources would be similar to those described for Crystal Ranch Reservoir (see Section 2.2.2.1.1.3).

The number of pieces and types of equipment required for construction would vary depending on the stage of the project and specific operations in progress. Motorized equipment required for construction would use an estimated 46,600 gallons of petroleum products (diesel, gasoline, and grease). Most motorized equipment would be diesel-powered except for light utility trucks.

Construction contracts would be awarded in late winter or early spring, and initial site preparations and mobilization would begin shortly thereafter. Removal of the existing dam, borrow area excavation, and material processing would begin in April. Work on the dam foundation and placement of earth and rock fill materials on the embankment (34,100 cubic yards) would occur from May to September. Work on the new spillway would run from June to September. Miscellaneous work and site cleanup and restoration would continue until the following March.

Operation and Maintenance Procedures. Twin Pots Reservoir is currently operated and maintained by the Moon Lake Water Users Association primarily for irrigation purposes. Under the Proposed Action, the Tribe would use all water stored in Twin Pots Reservoir primarily to support a year-round fishery, riparian habitat, and recreational opportunities. Water stored in Twin Pots Reservoir also may be used by the Tribe for irrigation as long as a conservation pool remains in the reservoir sufficient for year-round fish habitat. Reservoir water levels would be maintained by diverting enough water from the Farnsworth Canal during the irrigation season (April through September) to compensate for reservoir evaporation and seepage losses. The annual diversion requirement would total about 1,840 acre-feet, of which 390 acre-feet would compensate for evaporation losses and 1,450 acre-feet for seepage losses. This water would come from Tribal water rights.

Conservation pool maximum depth would vary from 38 feet at full pool to a lesser depth that would be determined by the Ute Tribe and FWS based on balancing Tribal irrigation needs against the quality of year-round fishery desired in Twin Pots Reservoir. The lesser maximum conservation pool depth should be at least 15 feet. Experience indicates winter fish-kills are usually avoided if lakes with little or no water input via tributary streams or springs in the winter have a maximum depth of at least 15 feet during winter (Crosby 1995).

Operation and maintenance of the reservoir would be transferred from the Moon Lake Water Users Association to the Tribe. Also, in those years when Moon Lake fills and spills in accordance with current (per 1996) operations, the Moon Lake Water Users Association would receive up to a maximum of 2,000 acre-feet of Tribal water stored in Crystal Ranch Reservoir by exchange from Twin Pots Reservoir.

2.2.2.6.2 Mitigation. The five fish and wildlife mitigation measures associated with the Proposed Action would be constructed or implemented with funds provided by the Department of the Interior (DOI). It is anticipated that operation and maintenance costs would be minimal and would be provided by DOI pursuant to agreements with local entities.

2.2.2.6.2.1 Instream Flows and Fish Habitat. Minimum instream flows were developed for several affected river reaches in the Upalco Unit and incorporated into the Proposed Action, where flows could be controlled, to maintain fish habitat. Simulation of hydrological conditions indicates minimum flows would be met or exceeded in most months and most years during the irrigation season as a direct consequence of water deliveries for irrigation. Because minimum flows are especially a concern during dry years and in late summer, minimum flows would also be provided to prevent fish population-limiting events that now occur during dry years and the nonirrigation season (October through March). More detailed information on minimum flows is provided in Chapter 3, Section 3.6 Water Resources and Hydrology and Section 3.8 Aquatic Resources of this Draft EIS.

2.2.2.6.2.2 Wildlife Habitat/Wetland Mitigation. The wildlife habitat/wetland mitigation plan involves implementing a series of strategies intended to avoid, wherever possible, impacts on wildlife, and to mitigate for reductions in habitat value and losses that would result from unavoidable impacts. Three distinct strategies have been developed to mitigate project-induced impacts on wildlife habitat. The first strategy involves avoiding potential impacts on wetland and riparian habitats along rehabilitated canals (wetland and riparian habitat preservation). A second strategy (habitat improvement) involves measures designed to increase habitat values of existing cover types, but does not involve changes from one cover type to another. Habitat improvement measures include fencing to exclude livestock and selective supplemental planting. The third strategy (habitat development) consists of changing an area from one cover type to another, and usually involves a change from upland cover types to wetland and riparian cover types.

Under the Proposed Action, mitigation measures to compensate for impacts on wildlife habitat that cannot be avoided would be implemented at the Brotherson, Clay Basin, and Lake Fork mitigation sites and along portions of rehabilitated canals that support wetland and riparian communities. The current vegetation cover types and the area of each type, along with the proposed acreage on which habitat development and habitat improvement measures would be implemented, are discussed in Chapter 3, Section 3.9 Wetland and Riparian Resources and Section 3.10 Wildlife Resources of this Draft EIS. In total, habitat improvement and habitat development measures would be implemented on 1,367 acres under the Proposed Action.

The Wetland/Riparian Resource Technical Report (CH2M HILL/Horrocks 1996f) includes detailed information showing locations of wetland/riparian communities along canals that are currently supported by natural springs/seeps and canal leakage. Existing wet meadows, emergent wetlands, and shrub riparian areas larger than 5 acres, and existing forested riparian areas larger than 2.5 acres, as well as certain smaller wetland complexes, would be preserved after canal rehabilitation.

Under the Proposed Action, a total of 83 acres of wetland and riparian communities would be preserved. Since wetland maintenance in the project area generally requires about 4.5 acre-feet of water per acre, the 83 acres of preserved wetlands would require about 374 acre-feet of water annually. This water would come from water savings realized as a result of canal rehabilitation and land retirement. Wetland maintenance systems installed under the Proposed Action would consist of pipeline turnouts and wetland irrigation systems designed to avoid impacts on these wetland/riparian communities.

2.2.2.6.2.3 Fish Stocking Program. The proposed Crystal Ranch Reservoir would provide year-round habitat for a reservoir fishery that would not exist without the project. Although the new reservoir fishery would be supported largely by stocking hatchery trout, the fishery would likely be popular with local anglers. However, a 2.6-mile reach of the Yellowstone River would be inundated and upstream fish passage blocked at the dam.

The proposed Crystal Ranch Reservoir would be stocked annually with fingerling trout and managed as a put-grow-and-take fishery. Rainbow trout (*Oncorhynchus mykiss*) or Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) would most likely be stocked in the reservoir. Based on Wildlife Resources guidelines, approximately 157,000 fingerlings would be stocked during the first year and 52,000 to 105,000 fingerlings would be stocked each year thereafter. The Ute Indian Tribe Fish and Wildlife Department and the FWS would be responsible for establishing final fish stocking rates for reservoirs (or portions thereof) within Tribal jurisdiction. Wildlife Resources would establish final fish stocking rates for reservoirs (or portions thereof) outside Tribal jurisdiction. Natural survival of stocked trout should exceed 50 percent based on studies in similar reservoirs. In addition, appropriate stocking of the Yellowstone/Lake Fork drainage downstream of Crystal Ranch Dam would be included in this program. The initial stockings would be a project cost, and annual stockings thereafter would be funded through DOI annual budgets.

2.2.2.6.2.4 High Mountain Lakes Fish Habitat. Ten high mountain lakes currently used for seasonal irrigation water storage and delivery would be stabilized under the Proposed Action. To increase storage capacity, these high mountain lakes were originally modified by excavating the natural lake outlets and constructing low earthen dams. Consequently, lake water levels now fluctuate from above, and in most cases, to below the original "natural" lake elevation as water is released for irrigation purposes. Under the Proposed Action, the outlet pipes would be plugged and water surface elevations stabilized at levels zero to 5 feet above the natural lake level. This would encourage the growth of submerged aquatic plants around the lake perimeter, which would further stabilize shoreline sediments and provide fish habitat. Fish stocking programs would remain the same as at present.

2.2.2.6.2.5 Fish Passage. Five existing diversion structures would be replaced with new diversion dams, and one new diversion structure would be built. These diversion dams would be designed to provide passage for juvenile and adult fish throughout the year as described in Section 2.2.2.2.

2.2.2.7 Recreation Developments

2.2.2.7.1 Minimum Basic Facilities for Environmental Protection.

2.2.2.7.1.1 Crystal Ranch Campground Recreation Replacement and Development.

Description of Facilities. This new campground would be located approximately 2 miles downstream of the proposed Crystal Ranch Reservoir. It would be accessed from the Crystal Ranch Road by about 1 mile of existing and new graveled road.

The new campground would have a day-use area with picnic tables, a toilet, and group and family camping areas. The group area would accommodate up to 25 persons and would have picnic tables and fire rings. In addition, fish habitat improvement structures discussed in Section 2.2.2.6.1.1 would be placed in the Yellowstone River adjacent to the new campground to improve the fishery and benefit anglers at the campground. Map 2-8 shows the concept plan and key features for the new campground, which are described in detail by ECOTONE Environmental Consulting, Inc. (1995b).

Construction Procedures. A grader, backhoes, bulldozers, and dump trucks would be required to develop this new site. Roads, campground loops, and parking lots would be graded and graveled. Picnic tables, fire rings, and toilets would be manufactured offsite and placed onsite by hand. Fish habitat structures would be built onsite and placed in the river by hand to the extent practicable.

Operation and Maintenance Procedures. Roads and parking lots would be maintained annually. Trash collection and toilet maintenance would occur periodically at the camping and picnic areas. A recreation guard would visit the site regularly. Fish habitat structures would be inspected annually.

2.2.2.7.2 Enhancement.

2.2.2.7.2.1 Forest Service Campground Upgrades. Current funding and personnel shortages have made it difficult for the FS to implement the much needed repairs and improvements at many of their Ashley National Forest facilities (e.g., campgrounds). Project-associated visitation increases to the National Forest along or near the Lake Fork/Yellowstone Rivers may further tax already overextended facilities and personnel. Therefore, efforts to minimize impacts of the project may include the following measures:

1. Rebuild all units within each campground site to latest standards. This includes replacing tables, fire rings, surfacing around units, and meeting accessibility requirements according to the Universal Accessibility Design Guide.

2. Replace all toilets with fully accessible, odor-free, two-unit brick buildings (meeting Americans with Disabilities Act regulations).

3. Construct new water systems, consisting of distribution lines, hydrants, disinfectant systems, and contact/storage tanks.

4. Reconstruct and surface interior campground roads and spurs.

The campground upgrades would be completed by the FS.

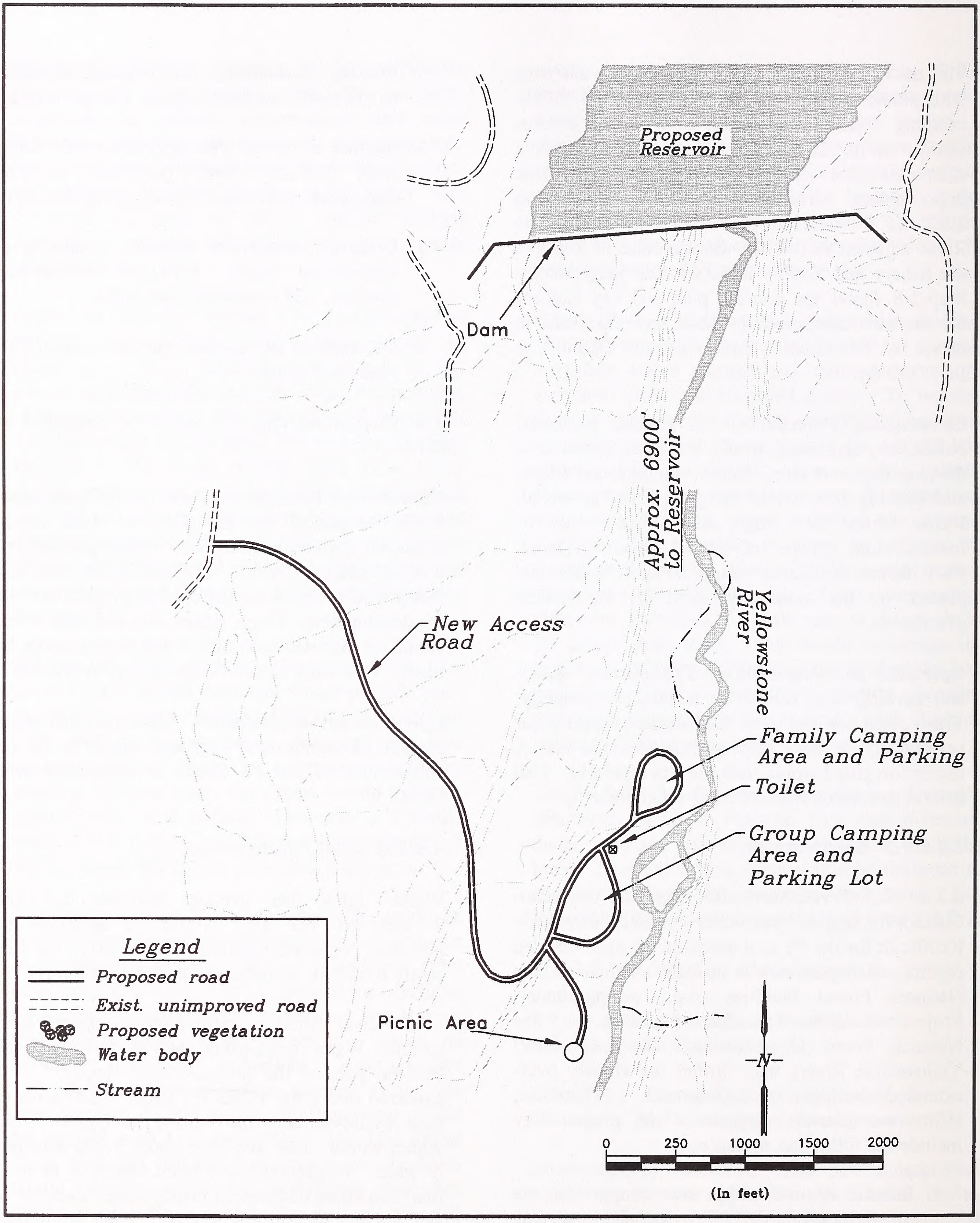
Construction Procedures. New and existing roads would be graded and graveled, as would campground loops and parking lots. Some grading and clearing using a grader, backhoes, bulldozers, and dump trucks would be required to prepare the site for development. Picnic tables, fire pits, and toilets would be manufactured offsite and placed onsite by hand. This work would be completed by the FS.

Operation and Maintenance. Operation and maintenance of campground upgrades would be the responsibility of the FS under an agreement with DOI.

2.2.2.8 Land Retirement

Water rights that average between 2.3 and 2.7 acre-feet per acre would be acquired by purchase, or condemnation if necessary, on currently irrigated, secondary water-righted lands.

These lands would be retired from irrigated agriculture. Water rights would then be transferred and become part of the project water supply. It is expected that water rights for about 1,300 acres of land would be acquired within the Upalco Unit, which would make available about 3,300 acre-feet of water. In general, these lands would be in areas that contribute disproportionately large amounts of salt loading to regional waters. Their retirement from irrigated agriculture would therefore provide



Map 2-8
Proposed Action–Talmage
Concept Plan for the
Crystal Ranch Campground

an additional water quality benefit to the Colorado River system.

The land remaining after acquisition may be disposed of, retained by public resource management agencies for wildlife habitat, or retained by the United States in trust for the Ute Tribe. Retired lands remaining in public ownership would be transferred to the appropriate Federal or State agency, or the Ute Tribe, for resource management after the water rights have been moved off the land through change applications. The determination of which management entity would manage a particular retired land parcel and how that parcel would be managed would be based on consultation among the CUWCD, DOI, FWS, Ute Tribe, and Wildlife Resources. An example of one potential management strategy would be to leave enough water on a retired land parcel to serve as mitigation for wildlife habitat or wetland purposes.

2.2.3 Delivery of Project Water

This section describes where and how much project water would be delivered and future flows in various reaches of the Lake Fork and Yellowstone Rivers.

2.2.3.1 Distribution of Water

Under the Proposed Action, lands currently being irrigated (except for retired lands and USBR Class 6W [non-arable but irrigated with certificated water rights] lands) and Tribal lands with an 1861 water right are candidate lands to receive project water. Water would also be delivered to the City of Roosevelt for municipal and industrial use. Map 2-9 shows the presently irrigated lands within the project service area of the Upalco Unit.

Candidate project lands consist of 15,070 acres of land with an 1861 water right and 44,410 acres of secondary water-righted lands. Of the 15,070 acres of water-righted lands, 1,039 acres are not presently being irrigated and are fallow or idle. Idle lands are defined as those lands that are Indian-owned, Indian-water-righted lands with an 1861 reserved water right that are currently fallow or idle. The idle lands located within the Uintah Indian Irrigation Project have been certified to Congress as irrigable lands. These lands have a reserved water right that can be exercised by the Tribe at any time. Some have been previously irrigated and all can be irrigated without the construction of the Proposed Action or additional diversion facilities. Therefore, irrigation water deliveries to these idle lands have been included in the evaluation of the Proposed Action and are discussed in relevant resource sections in Chapter 3 of this Draft EIS.

Table 2-14 presents the amount of water that is currently being diverted to project service area lands. It also shows the increased water deliveries to project lands that would result from the project. The project would help match water supply with water rights. The Proposed Action would increase the frequency of providing a full water supply, and late season water deliveries would be extended 2 to 3 weeks.

The Proposed Action would also deliver 3,000 acre-feet of water to the City of Roosevelt for municipal and industrial use through a series of exchanges described in Section 2.2.2.1.2.2.

2.2.3.2 Stream Flow Regime

Development of project features under the Proposed Action would affect the amount and timing of flows in reaches of the Lake Fork and Yellowstone Rivers. Map 2-10 shows the location of these river reaches. Table 2-15 shows future wet, average, and dry year flows with the project based on the water budget model. The wet year is an average of the 4 wettest years by volume (1941, 1944, 1965, and 1983); the dry year is an average of the 4 driest years by volume (1934, 1977, 1988, and 1989); and the average year is the average of all 64 years in the analysis period (1930-1993). Further details on stream flow regime are presented in Chapter 3, Section 3.6 Water Resources and Hydrology of this Draft EIS.

Table 2-14 Irrigation Water Supplies under Baseline Conditions and with the Proposed Action			
	Supply (acre-feet)		
Water Rights	Baseline	With Project	Change
Indian (1861)	42,093	51,323	9,230
Secondary	95,301	105,579	10,278

2.2.4 Summary of Project Detail

This section summarizes the amount of land to be impacted, the amount of acquisition, and the construction schedule for the Proposed Action. Table 2-16 summarizes the amount of land to be temporarily and permanently disturbed and is based on previous discussions of project feature disturbances. Table 2-17 shows the amount of land acquisition by ownership. Acquired land includes withdrawals (federal land), purchase or condemnation, and easements (temporary and permanent). Construction of recreation developments on National Forest land would be done under permits with the FS. The summary of construction schedules for all project features and mitigation measures is presented in Figure 2-6.

2.3 Cow Canyon Alternative

2.3.1 General Description

Specific features of the Cow Canyon Alternative and their locations are shown on Map 2-11 and listed in Table 2-1. Fish and wildlife mitigation and recreation development enhancements are also listed in Table 2-1 and discussed below. Table 2-18 contains supporting reference information for the following text and lists land ownership; entities responsible for land acquisition, project construction, and operation and maintenance; and future land access for each project feature. Detailed descriptions of facilities, construction procedures, and operation and maintenance procedures are presented below.

2.3.2 Physical Features and Other Characteristics

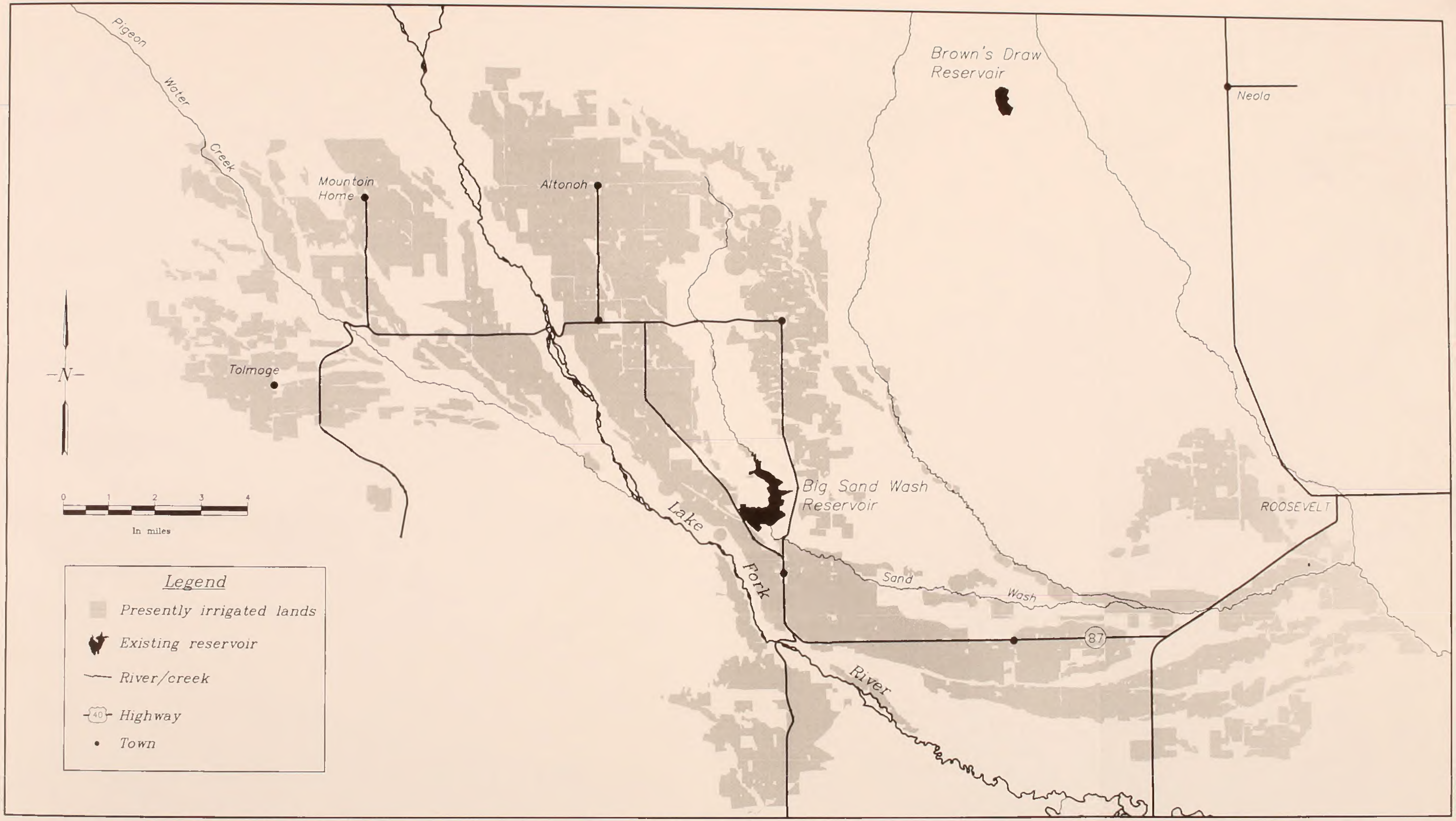
2.3.2.1 Dams and Reservoirs

Dam and reservoir facilities under the Cow Canyon Alternative would include construction of Upper Yellowstone Dam and Reservoir and enlargement of Big Sand Wash Dam and Reservoir.

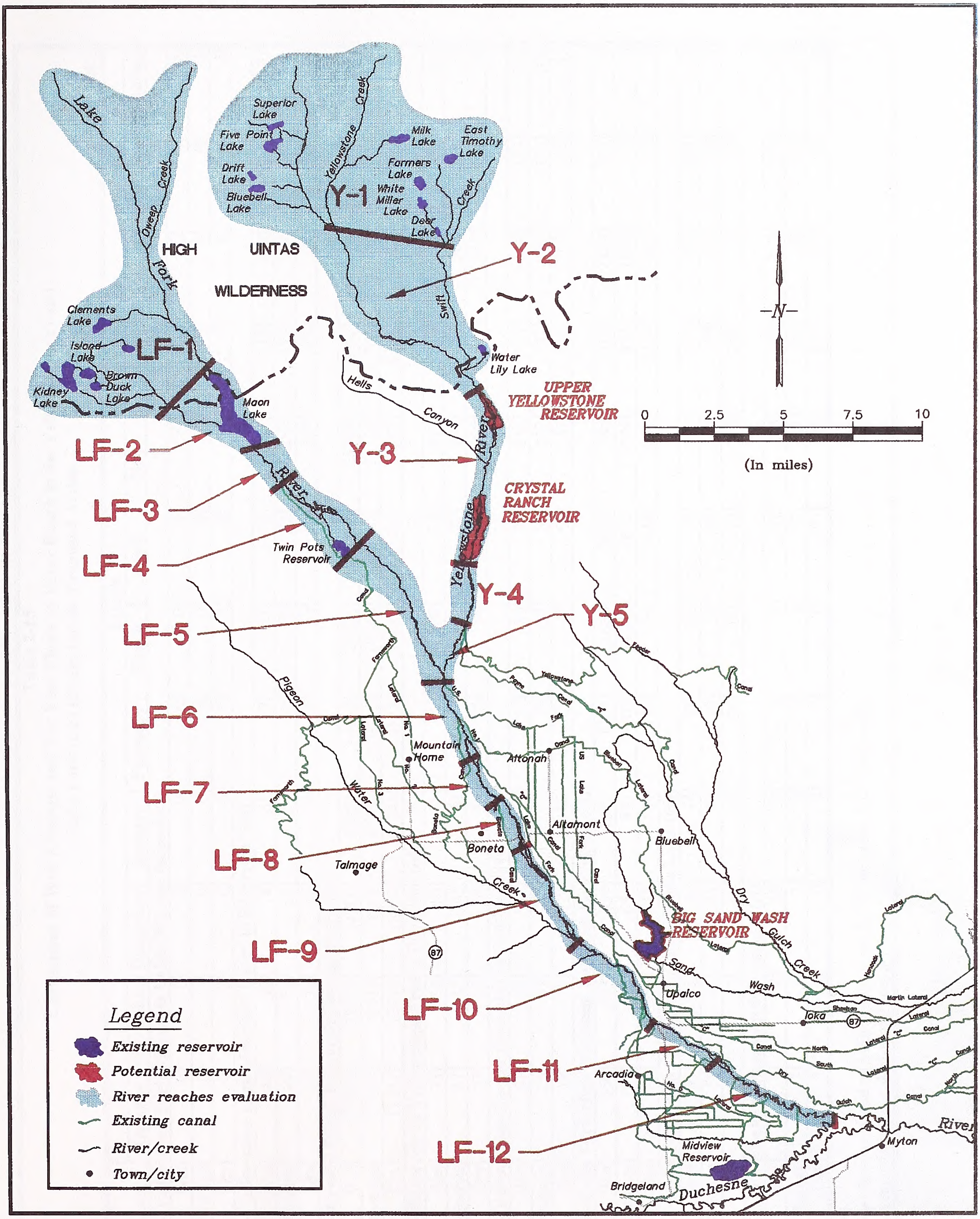
2.3.2.1.1 Upper Yellowstone Dam and Reservoir. Upper Yellowstone Dam and Reservoir would be constructed on the Yellowstone River approximately 1,600 feet upstream from the Yellowstone Ranch and about 2.4 miles downstream from the confluence of Swift Creek and the Yellowstone River (see Map 2-11). The reservoir would be on National Forest land.

2.3.2.1.1.1 Description of Facilities. Upper Yellowstone Dam would be a zoned earth and rock fill structure approximately 210 feet high with a crest elevation of 8,010 feet, a crest length of 2,600 feet, and a crest width of 25 feet. Map 2-12 shows the locations of proposed physical features and facilities. Table 2-19 summarizes the physical features and facilities proposed for Upper Yellowstone Dam and Reservoir.

2.3.2.1.1.2 Dam and Reservoir Operations. The Yellowstone River watershed above the Upper Yellowstone Dam site drains about 110 square miles. Based on the 64-year analysis period (1930-1993), the average flow of water entering Upper Yellowstone Reservoir (reservoir inflow) would range from 50 cfs in February to 479 cfs in June. Reservoir inflow would peak with snowmelt



Map 2-9
Upalco Unit
Presently Irrigated Lands



Map 2-10
Upalco Unit
Location of River Reaches Evaluation

Table 2-15
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Proposed Action

Reach	Month											
	October	November	December	January	February	March	April	May	June	July	August	September
Y-1--Yellowstone High Mountain Lakes Storage (acre-feet)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Y-2--Yellowstone High Mountain Lakes to Reservoir (cfs)*												
Wet	146	43	74	63	57	61	75	411	818	458	236	157
Average	99	74	61	54	50	55	82	297	479	106	343	111
Dry	67	52	45	43	38	33	82	169	172	41	82	60
Y-3--Crystal Ranch Reservoir Storage (acre-feet)												
Wet	21884	23618	24000	24000	24000	24000	23856	23701	24000	23820	23270	22547
Average	17258	18511	19266	19794	20195	20666	20185	20312	21704	16659	12919	11929
Dry	12551	13323	13843	14248	14533	15049	15164	12398	8954	4588	2400	2400
Y-4--Reservoir to Yellowstone Feeder Diversion (cfs)												
Wet	73	58	56	58	57	60	76	313	810	457	242	167
Average	47	45	45	43	41	45	87	288	347	200	200	125
Dry	27	36	36	35	35	33	75	200	215	147	118	60
Y-5--Yellowstone Feeder Diversion to Confluence (cfs)												
Wet	57	58	36	55	57	33	54	242	674	358	193	151
Average	28	47	34	40	33	33	63	243	347	192	139	100
Dry	47	47	21	28	27	27	60	147	154	106	99	53
LF-1--Lake Fork High Mountain Lakes Storage (acre-feet)												
Wet	356	593	830	1067	1304	1660	2075	385	4859	2483	147	0
Average	297	475	653	831	1009	1306	1662	3444	891	1009	0	0
Dry	237	356	475	594	713	951	1248	3030	4218	1545	0	0
LF-2--Lake Fork High Mountain Lakes to Moon Lake (cfs)*												
Wet	91	58	43	34	28	28	42	303	810	411	154	99
Average	58	43	34	36	27	28	57	312	550	200	99	71
Dry	40	35	28	26	28	38	72	243	248	74	50	41
LF-3--Moon Lake to Farnsworth Diversion (cfs)												
Wet	1	7	16	12	0	0	82	243	674	462	267	151
Average	1	3	3	3	2	2	82	261	433	348	236	119
Dry	1	0	0	0	0	0	97	246	296	173	96	40

Notes:
*These data are based on information from the Rivermaster and Dam tender.
All storage data are end-of-month values.

Table 2-15
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Proposed Action

Reach	Month											
	October	November	December	January	February	March	April	May	June	July	August	September
LF-4--Farnsworth Diversion to Rowley Ditch Diversion (cfs)												
Wet	0	0	13	12	3	7	65	139	539	327	159	94
Average	1	2	3	2	2	3	66	150	303	224	150	80
Dry	0	3	0	0	3	0	71	113	185	132	79	48
LF-5--Rowley Ditch Diversion to Confluence (cfs)												
Wet	10	10	26	22	10	17	75	139	539	337	169	104
Average	11	12	13	12	12	13	76	169	313	234	169	48
Dry	10	10	10	10	10	13	81	153	185	132	95	48
LF-6--Confluence to "C" Canal Diversion (cfs)												
Wet	65	67	70	80	76	54	83	205	987	454	175	155
Average	43	52	50	56	53	46	46	191	418	192	128	106
Dry	37	37	37	10	15	41	95	103	119	116	46	73
LF-7--"C" Canal Diversion to South Boneta Diversion (cfs)												
Wet	65	67	70	80	76	54	78	191	970	437	161	147
Average	43	52	50	56	53	46	87	177	401	176	116	104
Dry	37	37	37	10	45	41	82	46	103	108	95	72
LF-8--South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion (cfs)												
Wet	65	67	70	80	76	50	78	187	966	132	157	145
Average	43	52	50	56	53	38	46	173	396	171	113	48
Dry	37	37	37	10	15	38	41	46	99	106	95	72
LF-9--Big Sand Wash Feeder Pipeline Diversion to Purdy Ditch Diversion (cfs)												
Wet	3	3	15	10	38	38	33	56	706	262	57	53
Average	7	10	15	10	13	26	38	72	217	68	46	22
Dry	3	3	2	3	3	12	22	46	10	38	41	17
LF-10--Purdy Ditch Diversion to Red Cap Diversion (cfs)												
Wet	3	3	15	10	31	38	32	45	693	248	46	48
Average	7	10	15	10	10	26	2	82	204	55	38	48
Dry	3	3	2	3	3	12	19	29	10	33	26	48
LF-11--Red Cap Diversion to Hamilton-Knudsen Diversion (cfs)												
Wet	3	3	15	10	31	38	26	22	659	216	22	37
Average	7	10	15	10	13	26	24	38	172	24	8	9
Dry	3	3	2	3	3	12	45	7	7	7	7	7
LF-12--Hamilton-Knudsen Diversion to Duchesne River (cfs)												
Wet	3	3	15	46	31	38	26	22	657	215	22	37
Average	7	10	15	10	10	26	24	38	172	24	8	9
Dry	3	3	2	3	3	12	15	7	7	7	7	7

Notes:
*These data are based on information from the Rivermaster and Dam tender.
All storage data are end-of-month values.

Figure 2-6
Construction Schedule for the Proposed Action

Year 1

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Crystal Ranch Dam			35	50	50	50	59	59	59	3		
Big Sand Wash Dam												
Diversion Dams												
Rehabilitate Canals												
Pipelines						20	30	30	30	30	30	30
Fish and Wildlife and Recreation Developments												
Total Workers	0	0	35	50	50	70	89	89	89	33	30	30

Year 2

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Crystal Ranch Dam				82	82	82	82	82	82	82	5	
Big Sand Wash Dam												
Diversion Dams			7	7	7					7	7	7
Rehabilitate Canals												
Pipelines	30	30	12	12	12	24	30	30	30	22		
Fish and Wildlife and Recreation Developments												
Total Workers	30	30	19	101	101	106	112	112	112	111	12	7

Year 3

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Crystal Ranch Dam				144	144	144	144	144	144	144	5	
Big Sand Wash Dam			20	40	68	63	54	54	28	28	20	15
Diversion Dams			7	7	7					7	7	7
Rehabilitate Canals												
Pipelines												
Fish and Wildlife and Recreation Developments							2	2	2	2	6	8
Total Workers	0	0	27	191	219	207	200	200	174	181	38	30

Year 4

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Crystal Ranch Dam				115	115	115	115	115	115	115	5	
Big Sand Wash Dam	10	10	20									
Diversion Dams			7	7	7					7	7	7
Rehabilitate Canals			23	23	23							
Pipelines												
Fish and Wildlife and Recreation Developments	10	8	8	6	2							
Total Workers	20	18	58	151	147	115	115	115	115	122	12	7

Year 5

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Crystal Ranch Dam			35	50	50	50	59	59	59	3		
Big Sand Wash Dam												
Diversion Dams												
Rehabilitate Canals		23	23	23	10							
Pipelines												
High Mountain Lakes												
Fish and Wildlife and Recreation Developments								15	25	30	25	10
Total Workers	0	23	58	73	60	50	59	74	84	33	25	10

Year 6

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Crystal Ranch Dam												
Big Sand Wash Dam												
Diversion Dams												
Rehabilitate Canals			23	23	23					23	23	23
Pipelines												
High Mountain Lakes				30	30	30	30	21				
Fish and Wildlife and Recreation Developments	10	10	10		12	12	12	12				
Total Workers	10	10	33	53	65	42	42	33	0	23	23	23

Year 7

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Crystal Ranch Dam												
Big Sand Wash Dam												
Diversion Dams												
Rehabilitate Canals			23	23	23					23	23	23
Pipelines												
High Mountain Lakes				18	18	18	18	18				
Fish and Wildlife and Recreation Developments												
Total Workers	0	0	23	41	41	18	18	18	0	23	23	23

Estimated average number of workers per month shown above shaded areas.

Table 2-16 **Amount of Tribal and Non-Tribal Land to be Temporarily Disturbed and Restored or Permanently Encumbered by Project Features of the Proposed Action**						
Project Features	**Acres Temporarily Disturbed and Restored**			**Acres Permanently Encumbered[a]**		
	Tribal	**Non-Tribal**	**Total**	**Tribal**	**Non-Tribal**	**Total**
Dams and Reservoirs						
Crystal Ranch	0	0	0	329	233	562
Big Sand Wash	0	34	34	0	340	340
Diversion Dams	1.9	9.5	11.4	1.1	8.5	9.6
Canal Rehabilitation	1.9	69.4	71.3	1.9	152.4	154.3
Pipelines	4.2	15.0	19.2	4.2	15.0	19.2
Fish and Wildlife: Enhancements[b]	17.5	0	17.5	13.8	0	13.8
Recreation Developments	0	0	0	4.0	0	4.0

[a]Encumbered includes land whose use is limited by permanent acquisition such as ownership, right-of-ways, or easements.
[b]Some small portion of stream improvements may not be on Tribal land, but this will not be determined until final project design.

Table 2-17 **Amount of Land Acquisition (Acres) by Ownership for Project Features of the Proposed Action**					
Project Features	**Ownership**				
	Federal	**State**	**Tribal**	**Private**	**Total**
Dams and Reservoirs					
Crystal Ranch	97	0	570	310	977
Big Sand Wash	0	98	0	340	438
Diversion Dams	0	0	3	18	21
Canal Rehabilitation	0	0	4.0	221.8	225.6
Pipelines	0	0	8.4	30.0	38.4
Fish and Wildlife: Enhancements*	0	0	22.8	0	22.8
Recreation Developments	0	0	4.0	0	4.0
Land Retirement	0	0	0	1,300	1,300

*In addition, all or a portion of 15,480 acres of privately owned Red Rocks/Duchesne Drainage property would be acquired.

and decline rapidly in mid-summer. The overall average inflow would be 141 cfs.

Figure 2-7 shows estimated end-of-month water surface elevation and storage in the proposed Upper Yellowstone Reservoir for wet, average, and dry years based on the 64-year analysis period. Wet, average, and dry year estimates were determined using data from the same years of the analysis period as described for Crystal Ranch Reservoir under the Proposed Action (see Section 2.2.2.1.1.2).

During an average water year, Upper Yellowstone Reservoir elevation and storage would be highest in February and lowest in September (Figure 2-7). Both would increase abruptly in October (the start of the calendar water year), then remain about the same through March. Reservoir elevation and storage would decline slightly through June, when peak runoff on the Yellowstone River occurs, and continue to decline through September. Based on end-of-month operations data, reservoir water levels during an average water year would fluctuate 40 feet and would be well above the 2,500-acre-foot conservation pool elevation of 7,877 feet, but levels would not reach full pool elevation of 7,996 feet.

Upper Yellowstone Reservoir would have 10,000 acre-feet of storage space allocated for use by the Ute Tribe. The model used to forecast reservoir operations and future river reach flows was based on the assumption that Tribal water would not be retained in storage but would be delivered downstream during the irrigation season according to crop demand on Indian-owned, Indian water-righted lands. It would also be used to irrigate Tribal lands that are now idle. Other reservoir storage space allocations would include 2,500 acre-feet for the conservation pool, 2,500 acre-feet for high mountain lakes storage replacement, 150 acre-feet for non-Indian-owned 1861 water-righted lands, and 9,850 acre-feet for secondary water-righted lands. In addition to these space allocations, a 200-acre-foot dead pool would be located below the intake structure.

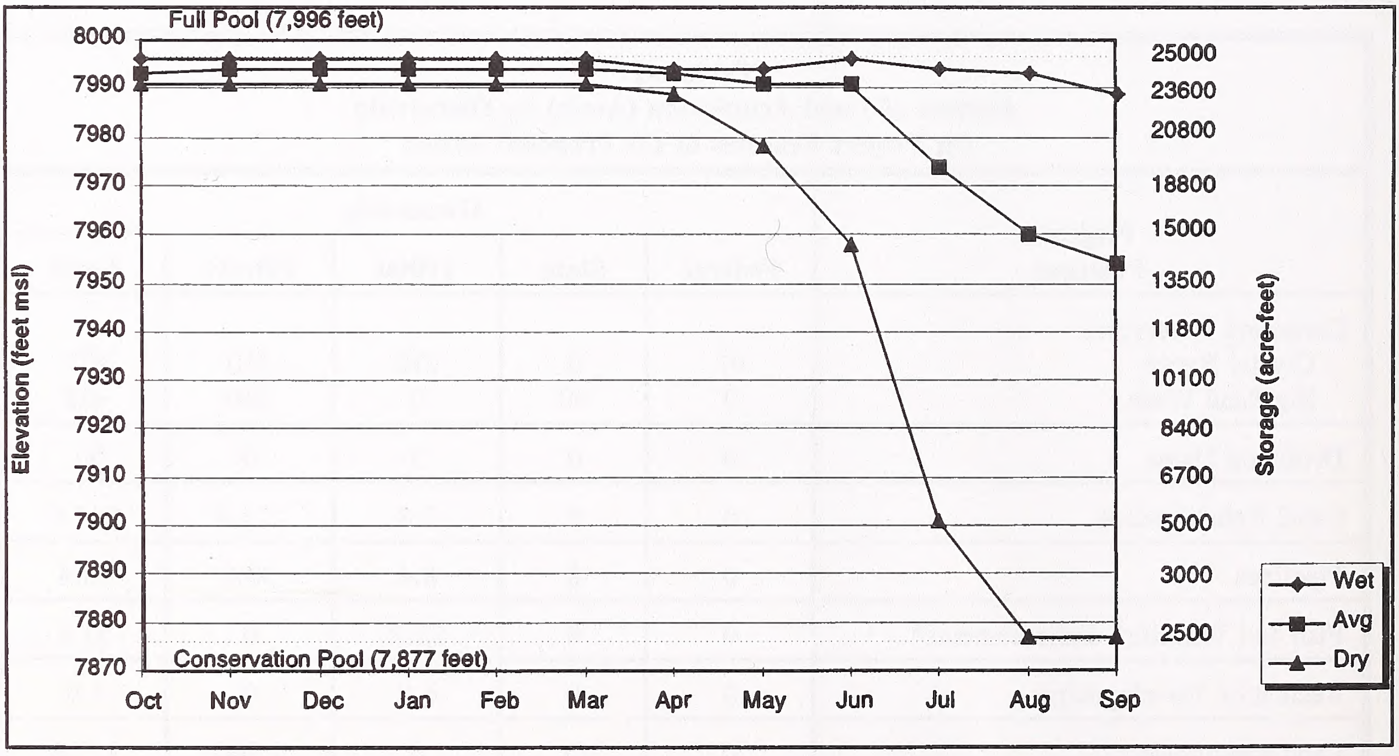
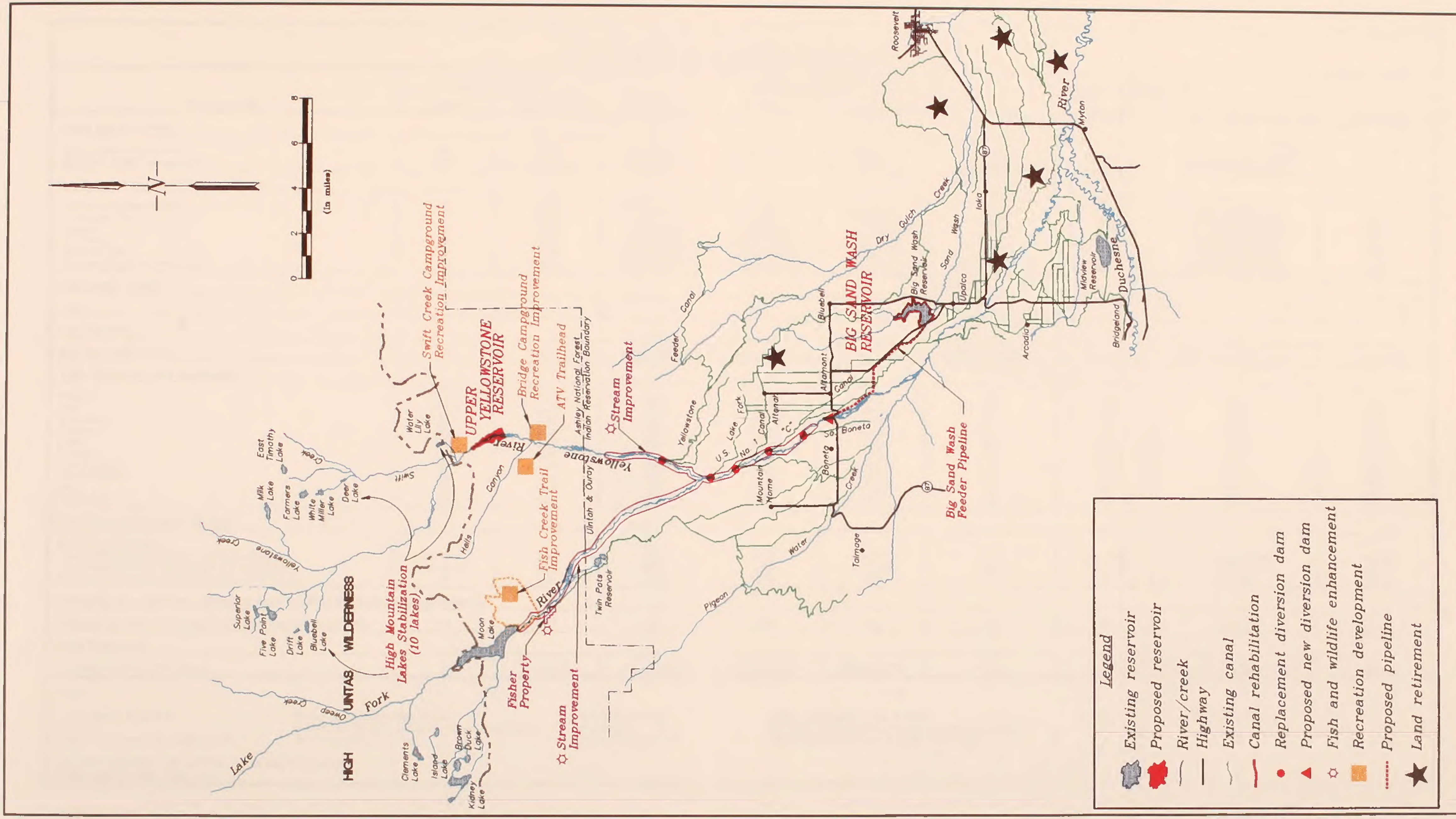


Figure 2-7
Average, Wet, and Dry Year End-of-Month Elevation and Storage for Upper Yellowstone Reservoir (Cow Canyon Alternative)



Map 2-11
Upalco Unit
Cow Canyon Alternative

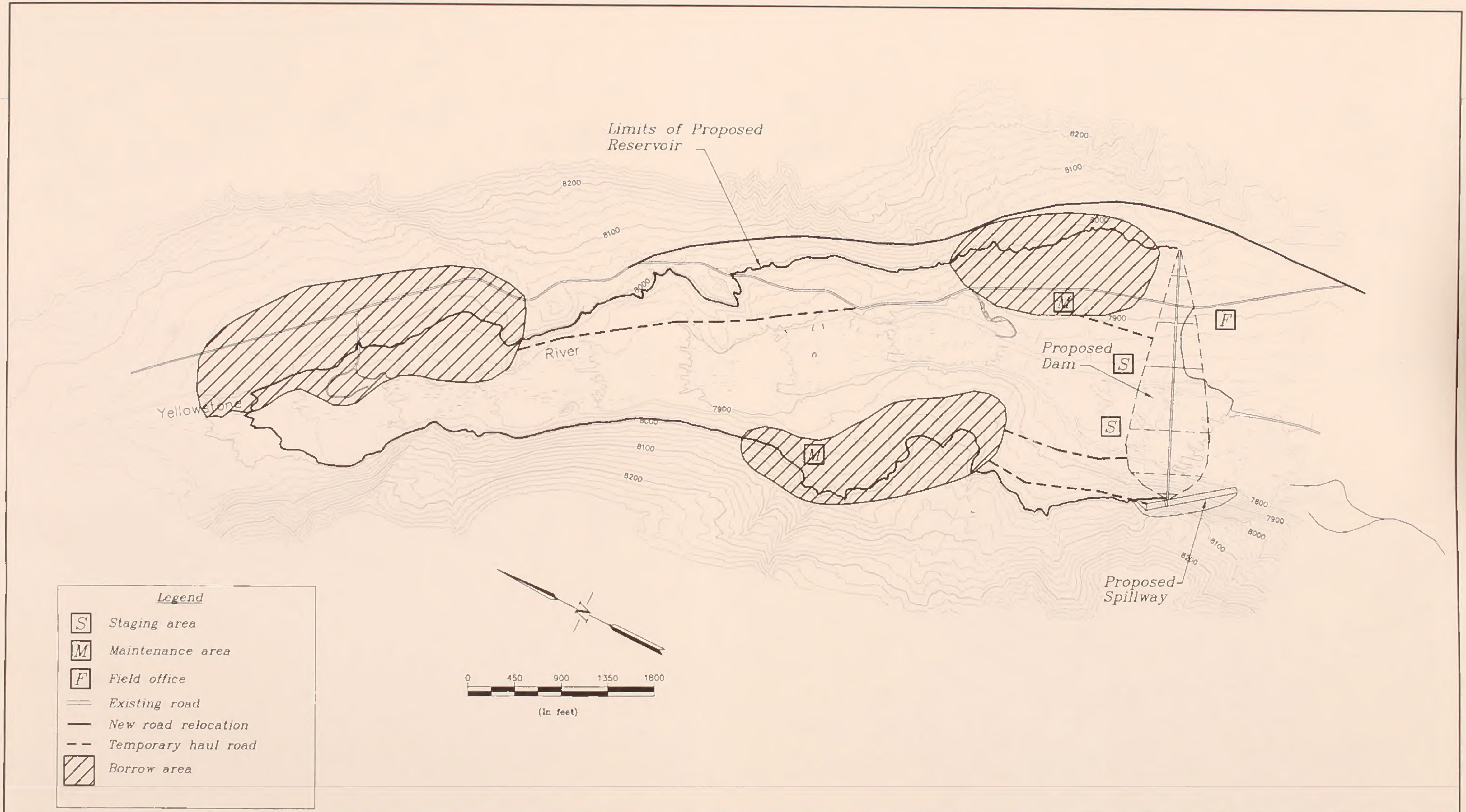
Table 2-18
Entities Responsible for Acquisition, Construction, and Operation and Maintenance of Features of the Cow Canyon Alternative–Upalco Unit

Project Feature	Land Ownership		Management of Land Acquisition	Construction or Implementation		Operation and Maintenance			Land Access
	Present	Post Project		Funding	Management	Funding	Management	Agreement Signatories	
Dams and Reservoirs									
Upper Yellowstone (new)	FS	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	CUWCD	MLWUA	MLWUA,CUWCD,DOI	ALL
Big Sand Wash Enlargement	P,S	MLWUA	DOI,CUWCD	DOI,CUWCD	CUWCD	CUWCD,MLWUA	MLWUA	MLWUA,CUWCD,DOI	ALL
Replacement and New Diversion Dams									
Yellowstone Feeder/Payne	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
U.S. Lake Fork	T	DOI	DOI	DOI	DOI	SAP	SAP	SAP,BIA,CUWCD,DOI	SAP
Boneta	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
"C" Canal	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
South Boneta	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Big Sand Wash Feeder (new)	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	CUWCD,MLWUA	MLWUA	MLWUA,CUWCD,DOI	SAP
Rehabilitate Canals									
None									
New Pipelines									
Big Sand Wash Feeder	T,P	DOI	DOI,CUWCD	DOI,CUWCD	DOI,CUWCD	CUWCD,MLWUA,P	MLWUA	T,P,MLWUA,CUWCD,DOI	SAP,MLWUA
High Mountain Lakes Stabilization									
Bluebell	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Drift	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Five Point	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Superior	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Milk	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Farmers	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
East Timothy	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
White Miller	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Deer	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Water Lily	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Fish and Wildlife: Enhancements									
Stream Improvement									
Lake Fork River (5 Miles in 18-mile Reach)	T or S or P	SAP	DOI	DOI	T or DOI	DOI	T or WR	T or WR, DOI	ALL,T[a]
Yellowstone River (2 Miles in 4.5-mile Reach)	T or S or P	SAP	DOI	DOI	T or DOI	DOI	T or WR	T or WR, DOI	ALL,T[a]
Habitat Acquisition: Fisher Property (160 acres)	P	FS	DOI	DOI	DOI	FS	FS	DOI,FS	ALL
Recreation Developments: Minimum Basic Facilities for Environmental Protection									
Bridge and Swift Creek Campgrounds Recreation Improvement	FS	SAP	NA	DOI	FS	FS	FS	DOI,FS	ALL
Land Retirement									
Land Retirement (1,300 acres)	P	T,P,DOI[b]	DOI,CUWCD	DOI,CUWCD	DOI,CUWCD	P,DOI	T,P,DOI	T,DOI,CUWCD,FWS,WR	SAP,ALL

Notes:

SAP = Same as present
T = Tribe
ALL = Tribal and non-Tribal public
BIA = Bureau of Indian Affairs
MLWUA = Moon Lake Water Users Association
FS = U.S. Forest Service
S = State of Utah
P = Private
NA = Not applicable
DOI = Department of the Interior
CUWCD = Central Utah Water Conservancy District
WR = Utah Division of Wildlife Resources
FWS = U.S. Fish and Wildlife Service

[a]Access to all publics, but a Tribal permit may be required.
[b]Some may be water rights only.



Map 2-12
Cow Canyon Alternative
Physical Features and
Construction Requirements
Upper Yellowstone Dam and Reservoir

Table 2-19
Physical Features and Facilities for Upper Yellowstone Dam and Reservoir

Dam	
Location	Yellowstone River
Type	Zoned earth and rock fill
Structural height (feet)	210
Crest elevation (feet msl)	8,010
Crest length (feet)	2,600
Crest width (feet)	25
Spillway	
Type	Concrete side channel
Crest elevation (feet msl)	7,996
Crest length (feet)	220
Chute length (feet)	500
Chute width (feet)	60
Probable Maximum Flood Design Capacity (cfs)	30,000
Intake Structure	
Type	Single, low-level
Intake elevation (feet msl)	7,820
Outlet Works	
Conduit type	Steel encased in concrete
Conduit diameter (inches)	72
Conduit length (feet)	1,000
Minimum discharge (cfs)	5
Maximum discharge (cfs)	650
Control gate type	Howell-Bunger
Probable Maximum Flood (cfs)	57,700
Storage (acre-feet)	
Inactive (dead) pool	200
Conservation pool	2,500
Active pool	22,500
Total active	25,000
Reservoir (at full pool)	
Elevation (feet msl)	7,996
Length (miles)	1.7
Surface area (acres)	334
Shoreline length (miles)	4
Maximum depth (feet)	195
Mean depth (feet)	75
Conservation Pool Maximum Depth (feet)	76
Drainage Area (square miles)	110

Water would be released from Upper Yellowstone Reservoir to match crop irrigation requirements and downstream water rights. The distribution of project water is discussed in Section 2.3.3, and future stream flows are shown in Table 2-20. Water would also be released or allowed to flow through year-round to provide minimum instream flows for fish. Minimum flow releases provided in the Yellowstone River would be 24 cfs October through March and 56 cfs April through September. Minimum flows during the nonirrigation season would be provided by a separate conduit through the dam that comes off the main outlet.

In times of extreme water shortage, when these minimum fish flows cannot be achieved without jeopardizing established water rights (drier than 1934 or when reservoir inflow is below the minimum flow), instream flows would be provided only to the extent necessary to ensure fish survival, as determined by the FWS and Ute Tribe, unless reservoir releases are made by separate agreement with an entity willing to release their water for instream flows. During wetter than dry winters, instream flows would be increased above the winter (October through March) minimum fish flow release. To ensure that these additional flows would be available for instream uses, a forecasting procedure and mechanism to implement changes in wintertime releases, when possible, would be established by the CUWCD in consultation with the FWS, Ute Tribe, BIA, Wildlife Resources, State Engineer, and potentially affected water users. These entities would develop an instream flow agreement that stipulates agreed-upon minimum flows and describes the procedure and mechanism for implementing flow changes. Further details on minimum instream flows are provided in Chapter 3, Section 3.6 Water Resources and Hydrology and Section 3.8 Aquatic Resources of this Draft EIS.

Major maintenance needs at the dam would be met on a scheduled and as-needed basis, the same as described for Crystal Ranch Dam under the Proposed Action (see Section 2.2.2.1.1.2).

*2.3.2.1.1.3 **Construction Requirements**.* Construction activities would be localized and occur primarily in and near the reservoir pool. Primary impact-causing activities in the reservoir area would generally be the same as those described for Crystal Ranch Reservoir under the Proposed Action (see Section 2.2.2.1.1.3).

Potential short- and long-term impacts from dam and reservoir construction would be avoided or reduced by following standard construction and operating requirements outlined in Appendix A.

Borrow (Material) Areas. Approximately 6 million cubic yards of earth materials would be excavated for processing and sorting. Three borrow areas totaling about 140 acres have been identified on the east and west side of the valley upstream of the dam, of which 70 acres would be outside the reservoir pool area. Map 2-12 shows the general location of the proposed borrow areas.

Materials excavated from the borrow areas would be processed and handled onsite as described for the Proposed Action. Approximately 1.8 miles of temporary haul roads would be constructed to connect the borrow areas to the dam site (see Map 2-12). Borrow materials not used would be regraded within the borrow areas. Site restoration for borrow areas above the reservoir high-water elevation would include grading to facilitate good drainage and erosion control, and scarifying the soil surface for seedbed preparation and revegetation.

Each borrow area would contain maintenance yard facilities, including shops for servicing and maintaining construction equipment. Routine servicing, such as changing oil and greasing equipment, would be done on location, while major maintenance work would be done at the maintenance yard.

Staging Areas and Support Facilities. Two staging areas totaling about 10 acres each would be required to support construction operations. They would be in the valley bottom on the east and west sides of the river just upstream from the dam embankment. An area west of the FS access road immediately downstream of the dam site would be used as a project field office for the contractor and engineer and as a temporary camp with support facilities for workers from outside the local area.

Utilities required would include temporary electrical power, phone service, and water and sanitary facilities. These support facilities would be removed or incorporated into a permanent operation and maintenance facility upon project completion. Map 2-12 shows the approximate locations of the proposed staging areas and field office site.

Relocations. Five facilities in the reservoir area would be relocated, replaced, or decommissioned because of reservoir inundation. These include the FS Reservoir and Riverview Campgrounds, the Upper Country Water District's Cow Canyon water supply, a portion of the FS access road along the Yellowstone River, and Moon Lake Electric Company's diversion dam and power plant.

Two springs in Cow Canyon provide water for the Upper Country Water District. The upper spring (at elevation 8,100 feet) is the main water supply, with the lower spring (at elevation 7,920 feet) serving as a backup. A 12-inch pipeline conveys about 1.8 cfs (1.2 million gallons per day) of water down the Yellowstone Valley to the Water District's service area.

The Upper Country Water District supply would be replaced with an identical amount of water from Upper Yellowstone Reservoir. Water would be treated in a packaged water treatment plant immediately below the dam in a previously disturbed area. Water for the treatment plant would be delivered through a 12-inch conduit and regulating valve through the dam. Water from the plant would be distributed to the Water District's service area via the existing 12-inch supply pipeline. Costs for the treatment plant would be part of the project. The plant would be operated and maintained by the Upper Country Water District under an agreement with the CUWCD and DOI.

Approximately 1.8 miles of the existing road along the Yellowstone River would be relocated east of the reservoir pool area, starting near the construction field office site and ending just upstream of the northeast borrow area (see Map 2-12). Road relocation would be completed to FS standards before starting work on the dam embankment.

The Moon Lake Electric Company operates a diversion dam constructed of timber and concrete on the Yellowstone River about 1,500 feet upstream from the Upper Yellowstone Dam site. A 48-inch steel penstock conveys water from the diversion dam to a 900-kW powerhouse about 2.5 miles downstream of the dam site. The diversion dam and power plant would be purchased, decommissioned, and water previously diverted to the power plant would be left in the Yellowstone River.

Land Ownership Changes. Construction and operation of Upper Yellowstone Dam and Reservoir would require withdrawal of approximately 533 acres of federal (National Forest) land by the DOI. On average, lands acquired adjacent to the reservoir would extend about 300 feet beyond the reservoir high-water elevation.

Construction Force and Principal Equipment. Construction of Upper Yellowstone Dam and Reservoir would extend over a 4-year period, beginning in the first year of the 6-year construction period for the Cow Canyon Alternative. The number of workers required per month would vary between 20 and 139, while the total labor effort would be approximately 500,000 hours.

Personnel requirements and labor pool sources would generally be the same as previously described for Crystal Ranch Dam and Reservoir under the Proposed Action (see Section 2.2.2.1.1.3).

The number of pieces and types of equipment required for construction would vary depending on the stage of the project and specific operations in progress. Motorized equipment would use an estimated 2.5 million gallons of petroleum products (diesel, gasoline, and grease). Most motorized equipment would be diesel-powered except for light utility trucks.

Construction contracts would be awarded in December, and initial preparations and mobilization would begin shortly thereafter. The first year's activities would consist of partial reservoir clearing, installing river diversion facilities, road relocation, and constructing the dam foundation, cutoff trench, and borrow area facilities. The second construction season would include the start of dam and spillway construction and completion of reservoir clearing. The third and fourth seasons would include construction of the intake structure and completion of the dam and spillway by October, followed by miscellaneous work, site cleanup, and site restoration.

2.3.2.1.2 Big Sand Wash Dam and Reservoir. Big Sand Wash Dam and Reservoir would be enlarged and the storage allocated as described under the Proposed Action. By raising Big Sand Wash Dam 21 feet, the active storage capacity of Big Sand Wash Reservoir would be increased by 9,000 acre-feet. A detailed description of the Big Sand Wash Dam and Reservoir enlargement is provided in Section 2.2.2.1.2. Construction would begin in the third year of the 6-year construction period of the Cow Canyon Alternative. Operation of Big Sand Wash Dam and Reservoir is described below since it would differ slightly from the operation described under the Proposed Action.

2.3.2.1.2.1 Dam and Reservoir Operations. The reservoir's primary water supply would come from the Lake Fork River via the "C" Canal and the proposed Big Sand Wash Feeder Pipeline. A small amount of runoff would come from the 11.3-square-mile Big Sand Wash watershed upstream of the dam. Based on the 64-year analysis period (1930-1993), the average flow of water diverted into Big Sand Wash Reservoir (reservoir inflow) would range from 30 cfs in March to 189 cfs in June. The overall average inflow would be 78 cfs.

Figure 2-8 shows estimated end-of-month water surface elevation and storage in the enlarged Big Sand Wash Reservoir for wet, average, and dry years based on the 64-year analysis period. Wet, average, and dry year estimates were determined using data from the same years of the analysis period as described for Crystal Ranch Reservoir under the Proposed Action (see Section 2.2.2.1.1.2).

During an average water year, Big Sand Wash Reservoir elevation and storage would be highest in April and lowest in August (Figure 2-8). Both would steadily increase from September (the end of the calendar water year) through April as diversions from the Lake Fork River are stored for delivery during the irrigation season. Reservoir elevation and storage would decline through August as water

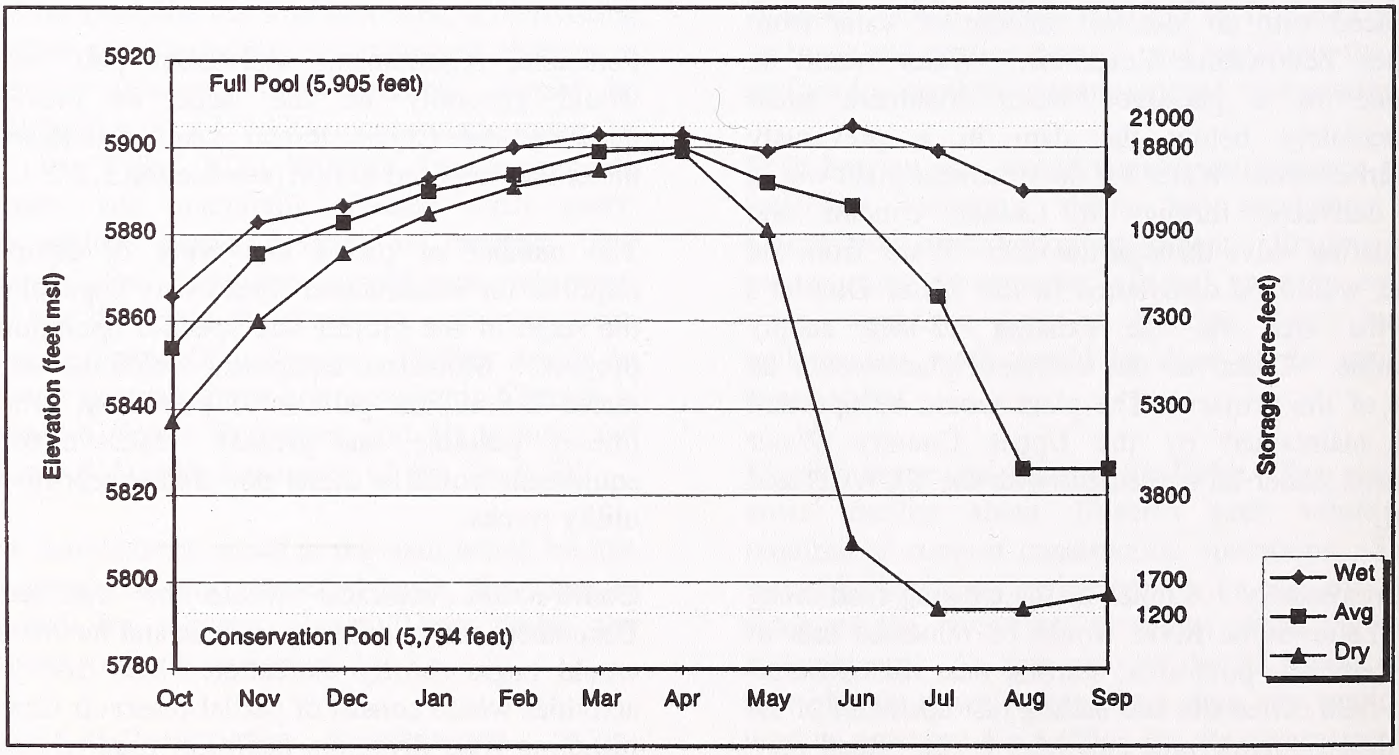


Figure 2-8
Average, Wet, and Dry Year End-of-Month Elevation and Storage for 9,000-acre-foot Enlarged Big Sand Wash Reservoir (Cow Canyon Alternative)

is released for irrigation, then increase slightly in September. Based on end-of-month operations data, reservoir water levels during an average water year would fluctuate 74 feet and would remain above the 1,200-acre-foot conservation pool elevation of 5,794 feet, but levels would not reach full pool elevation of 5,905 feet.

Other aspects of Big Sand Wash Dam and Reservoir operation and maintenance requirements would be the same as described for the Proposed Action (see Section 2.2.2.1.2). Major maintenance needs at the dam would be met on a scheduled and as-needed basis, also the same as described for the Proposed Action.

2.3.2.2 Diversion Dams

Diversion dams associated with the Cow Canyon Alternative would be identical to the Proposed Action (see Section 2.2.2.2).

2.3.2.3 Pipelines

The proposed Big Sand Wash Feeder Pipeline would be identical to the Proposed Action (see Section 2.2.2.4).

2.3.2.4 High Mountain Lakes Stabilization

High mountain lakes stabilization under the Cow Canyon Alternative would be identical to the Proposed Action (see Section 2.2.2.5).

2.3.2.5 Fish and Wildlife

2.3.2.5.1 Enhancement. Two fish and wildlife enhancements (Stream Improvement, Habitat Acquisition Fisher Property) would be implemented under the Cow Canyon Alternative. Map 2-11 shows their locations. Stream Improvement under the Cow Canyon Alternative would be identical to the Proposed Action (see Section 2.2.2.6.1.1). Facilities, construction procedures, and operation and maintenance procedures for Habitat Acquisition are described below.

2.3.2.5.1.1 Habitat Acquisition.

Description of Facilities. Approximately 160 acres of land (the Fisher property) adjacent to the Lake Fork River would be acquired by purchase, or condemnation if necessary, and transferred to the FS. The property, upstream of the Uintah and Ouray Indian Reservation, is an inholding within the Ashley National Forest and contains several old cabins, riparian habitat, and big game winter range. It also supports cattle grazing and some parts are being subdivided. The FS believes this trend would continue, resulting in wildlife habitat losses. The property would be fenced to exclude cattle and would be managed for wildlife purposes.

Construction Procedures. A fence would be built around the property.

Operation and Maintenance Procedures. The fence would be maintained periodically.

2.3.2.5.2 Mitigation. The five fish and wildlife mitigation measures associated with the Cow Canyon Alternative would be the same as described for the Proposed Action (see Section 2.2.2.6.2) except for differences noted below. The source of funds for construction or implementation, as well as operation and maintenance, of mitigation measures would also be the same as described for the Proposed Action.

2.3.2.5.2.1 Wildlife Habitat/Wetland Mitigation. Under the Cow Canyon Alternative, mitigation measures to compensate for impacts on wildlife habitat that cannot be avoided would be implemented at the Clay Basin and Lake Fork mitigation sites. The current vegetation cover types and the area of each type, along with the proposed acreage on which habitat development and habitat improvement measures would be implemented, are discussed in Chapter 3, Section 3.9 Wetland and Riparian Resources and Section 3.10 Wildlife Resources of this Draft EIS. In total, habitat improvement and habitat development measures would be implemented on 877 acres.

2.3.2.5.2.2 Fish Stocking Program. The proposed Upper Yellowstone Reservoir would provide year-round habitat for a reservoir fishery that would not exist without the project. The new reservoir fishery would be supported largely by stocking hatchery trout and would likely be popular with local anglers. However, a 2.0-mile reach of the Yellowstone River would be inundated and upstream fish passage would be blocked at the dam.

The proposed Upper Yellowstone Reservoir would be stocked annually with fingerling trout (perhaps rainbow trout or Colorado River cutthroat trout) and managed as a put-grow-and-take fishery. Based on Wildlife Resources guidelines, approximately 100,000 fingerlings would be stocked during the first year and 33,500 to 67,000 fingerlings would be stocked each year thereafter. Natural survival of stocked trout should exceed 50 percent based on studies in similar reservoirs. In addition, appropriate stocking of the Yellowstone/Lake Fork drainage downstream of Upper Yellowstone Dam would be included in this program. The initial stockings would be a project cost, and annual stockings thereafter would be funded through DOI annual budgets.

2.3.2.6 Recreation Developments

2.3.2.6.1 Minimum Basic Facilities for Environmental Protection.

2.3.2.6.1.1 Bridge and Swift Creek Campgrounds Recreation Improvement.

Description of Facilities. Improvements proposed for this project, whose location is shown on Map 2-11, include applying a hardened gravel surface to roads within the FS Bridge and Swift Creek Campgrounds; installing a vault toilet at the Swift Creek Campground and Trailhead; and developing a trailhead at the Yellowstone All-Terrain Vehicle (ATV) Trail. The ATV Trailhead would be on Forest Road 227, about 0.5 mile north of the intersection with Forest Road 119. It would include a hardened parking lot for 17 vehicles and their trailers, 6 camping spaces with tables and fire rings, and a vault toilet.

Construction Procedures. Hardening roads in the campgrounds would include grading the road surface, hauling and spreading gravel, spraying a gravel binder, and rolling the gravel surface smooth.

A vault toilet would be installed at the Swift Creek Campground and Trailhead.

Development of the ATV Trailhead would include the following tasks: 1) reconstruct approximately 0.5 mile of Forest Road 227 for upgraded access; 2) build a parking lot to hold 17 vehicles and trailers, which would involve removing 250 cubic yards of borrow, grading the surface, and applying gravel; 3) build a short trail to connect the parking lot with new camping spaces; 4) install 65 feet of pipe arch culvert (21 inches by 15 inches) to redirect runoff; 5) construct six campsites, each containing a picnic table and fire ring; 6) place 50 rock barriers to prevent vehicles from entering sensitive areas; and 7) construct a Sawtooth-type vault toilet. Equipment would include bulldozers, backhoes, graders, and gravel trucks. Campsite construction would be done by hand.

Operation and Maintenance Procedures. Ruts or holes that develop in the hardened road surfaces would be repaired. The loop road at the Swift Creek Campground and Trailhead would be repaired as needed. The new vault toilet would be maintained and resupplied consistent with current campground operation.

The ATV parking lot and the trail to the campground and campground facilities would be maintained periodically. Garbage would be removed, the toilet cleaned, and supplies replaced regularly.

2.3.2.6.2 Enhancement. Two recreation development enhancements would be implemented under the Cow Canyon Alternative. The first, Forest Service Campground Upgrades, was described under the Proposed Action (see Section 2.2.2.7.2.1). The second, Fish Creek Trail Recreation Improvement, is described below.

2.3.2.6.2.1 Fish Creek Trail Recreation Improvement.

Description of Facilities. Approximately 2 miles of existing FS trail leading from the Moon Lake spillway up Fish Creek to the top of Lake Fork Mountain would be reconstructed. A new trail would be constructed from the top of Lake Fork Mountain down Raspberry Draw to the Lake Fork River, then up the Lake Fork River to the Moon Lake spillway. The new trail section would be about 3.5 miles long and include a footbridge over the Lake Fork River. The trail would also have a 24-inch tread for mountain bike use.

Construction Procedures. Trail construction tasks would include cutting trees and brush, building a 24-inch tread, building a rock wall, placing water bars, and installing the footbridge. Equipment would include shovels, pulaskies, rock bars, sledge hammers, chain saws, and pickup trucks.

Operation and Maintenance Procedures. The trail would be kept clear of brush and logs and repaired from erosion or rockfall damage.

2.3.2.7 Land Retirement

The land retirement program described for the Proposed Action (see Section 2.2.2.8) also applies to this alternative.

2.3.3 Delivery of Project Water

The general discussion of delivery of project water under the Proposed Action (see Section 2.2.3) also applies to the Cow Canyon Alternative. Table 2-20 shows the amount of water that would be delivered under this alternative and the increased water deliveries. Table 2-21 shows future wet, average, and dry year flows in river reaches under the Cow Canyon Alternative. Further details on stream flow regime are presented in Chapter 3, Section 3.6 Water Resources and Hydrology of this Draft EIS.

2.3.4 Summary of Project Detail

This section summarizes the amount of land to be impacted, the amount of acquisition, and the construction schedule for the Cow Canyon Alternative. Table 2-22 summarizes the amount of land to be temporarily and permanently disturbed and is based on previous discussions of project feature disturbances. Table 2-23 shows the amount of land acquisition by ownership. Acquired land includes withdrawals (federal land), purchase or condemnation, and easements (temporary and permanent). Construction of recreation developments on National Forest land would be done under permits with the FS. The summary of construction schedules for all project features and mitigation measures is presented in Figure 2-9.

2.4 Crystal Ranch Alternative

2.4.1 General Description

Specific features of the Crystal Ranch Alternative and their locations are shown on Map 2-13 and listed in Table 2-1. Fish and wildlife mitigation and recreation development enhancements are also listed in Table 2-1 and discussed below. Table 2-24 contains supporting reference information for the following text and lists land ownership; entities responsible for land acquisition, project construction

Table 2-20
Irrigation Water Supplies under Baseline Conditions and with the Cow Canyon Alternative

Water Rights	Supply (acre-feet)		
	Baseline	With Project	Change
Indian (1861)	42,093	51,273	9,180
Secondary	95,301	105,529	10,238

Table 2-21
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Cow Canyon Alternative

Reach	Month											
	October	November	December	January	February	March	April	May	June	July	August	September
Y-1--Yellowstone High Mountain Lakes Storage (acre-feet)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Y-2--Yellowstone High Mountain Lakes to Reservoir (cfs)*												
Wet	146	93	74	63	57	61	75	311	819	458	246	157
Average	98	74	61	154	56	55	82	297	479	186	140	111
Dry	67	52	45	44	40	44	82	169	172	44	82	60
Y-3--Upper Yellowstone Reservoir Storage (acre-feet)												
Wet	25000	25000	25000	25000	25000	25000	24839	24685	25000	24809	24218	23473
Average	24361	24567	24707	24824	24897	24843	24258	23669	23911	19408	15001	13511
Dry	23728	23804	23846	23856	23860	23907	23416	20325	14711	5115	2500	2500
Y-4--Reservoir to Yellowstone Feeder Diversion (cfs)												
Wet	71	57	55	54	57	60	78	313	811	458	243	169
Average	47	35	44	44	44	44	87	297	447	272	202	127
Dry	27	36	44	45	45	44	75	200	215	149	122	60
Y-5--Yellowstone Feeder Diversion to Confluence (cfs)												
Wet	53	51	44	44	57	37	56	242	674	359	202	152
Average	32	39	37	44	44	35	64	208	138	193	142	101
Dry	27	27	27	45	45	40	52	138	136	136	101	53
LF-1--Lake Fork High Mountain Lakes Storage (acre-feet)												
Wet	356	594	830	1067	1304	1660	2075	385	4859	2483	107	0
Average	297	475	653	831	1009	1306	1662	3444	891	1889	0	0
Dry	237	356	475	594	713	951	1248	3030	4218	1545	0	0
LF-2--Lake Fork High Mountain Lakes to Moon Lake (cfs)*												
Wet	91	58	44	44	28	28	42	303	819	411	154	99
Average	58	43	44	40	27	28	57	312	550	200	99	71
Dry	40	45	28	28	28	40	72	213	248	73	56	41
LF-3--Moon Lake to Farnsworth Diversion (cfs)												
Wet	1	7	16	12	0	8	91	241	676	461	265	150
Average	1	3	[illegible]	3	2	[illegible]	82	200	435	347	235	119
Dry	1	0	0	0	0	0	87	246	295	175	98	30
LF-4--Farnsworth Diversion to Rowley Ditch Diversion (cfs)												
Wet	0	6	16	12	0	7	64	138	544	326	156	93
Average	1	2	[illegible]	2	2	[illegible]	65	458	385	223	140	80
Dry	0	0	0	0	0	0	70	142	184	135	81	39

Notes:
*These data are based on information from the Rivermaster and Dam tender.
All storage data are end-of-month values.

Table 2-21
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Cow Canyon Alternative

Reach	Month											
	October	November	December	January	February	March	April	May	June	July	August	September
LF-5--Rowley Ditch Diversion to Confluence (cfs)												
Wet	10	10	26	22	19	37	74	148	554	336	160	103
Average	11	12	13	12	12	13	75	168	315	233	159	90
Dry	10	10	10	10	10	40	40	152	194	45	91	49
LF-6--Confluence to "C" Canal Diversion (cfs)												
Wet	63	67	70	70	76	55	43	204	993	454	175	154
Average	33	52	50	55	53	48	90	189	419	194	128	106
Dry	37	37	37	10	45	40	45	103	419	419	101	73
LF-7--"C" Canal Diversion to South Boneta Diversion (cfs)												
Wet	63	67	70	76	76	55	40	194	976	436	160	147
Average	33	52	50	55	53	48	10	176	402	177	117	106
Dry	37	37	37	10	45	10	82	89	103	111	90	72
LF-8--South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion (cfs)												
Wet	63	67	70	76	76	55	74	186	972	432	157	145
Average	43	52	50	55	53	48	45	172	398	172	113	99
Dry	37	37	37	10	45	40	11	48	90	139	90	72
LF-9--Big Sand Wash Feeder Pipeline Diversion to Purdy Ditch Diversion (cfs)												
Wet	3	3	33	36	31	48	45	52	712	262	57	52
Average	7	10	31	48	48	26	40	72	216	68	50	22
Dry	3	3	2	3	4	11	23	40	48	31	31	47
LF-10--Purdy Ditch Diversion to Red Cap Diversion (cfs)												
Wet	3	3	33	36	11	48	32	11	698	249	10	47
Average	7	10	10	48	48	26	27	62	205	55	10	18
Dry	3	3	2	4	4	11	19	25	37	43	26	13
LF-11--Red Cap Diversion to Hamilton-Knudsen Diversion (cfs)												
Wet	3	3	33	10	11	48	27	10	665	216	22	36
Average	7	10	10	10	48	26	23	48	174	25	8	9
Dry	3	3	2	3	4	31	15	7	7	7	7	7
LF-12--Hamilton-Knudsen Diversion to Duchesne River (cfs)												
Wet	3	3	33	10	31	48	27	48	662	215	22	36
Average	7	10	10	10	19	26	23	48	174	23	8	9
Dry	3	3	2	3	4	11	15	7	7	7	7	7

Notes:
*These data are based on information from the Rivermaster and Dam tender.
All storage data are end-of-month values.

Table 2-22
Amount of Tribal and Non-Tribal Land to be Temporarily Disturbed and Restored or Permanently Encumbered by Project Features of the Cow Canyon Alternative

Project Features	Acres Temporarily Disturbed and Restored			Acres Permanently Encumbered[a]		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Dams and Reservoirs						
Upper Yellowstone	0	23	23	0	361	361
Big Sand Wash	0	34	34	0	340	340
Diversion Dams	1.9	9.5	11.4	1.1	8.5	9.6
Pipelines	4.2	15.0	19.2	4.2	15.0	19.2
Fish and Wildlife: Enhancements[b]	8.5	0	8.5	0	0	0
Recreation Developments	0	0	0	0	1.8	1.8

[a]Encumbered includes land whose use is limited by permanent acquisition such as ownership, right-of-ways, or easements.
[b]Some small portion of stream improvements may not be on Tribal land, but this will not be determined until final project design.

Table 2-23
Amount of Land Acquisition (Acres) by Ownership for Project Features of the Cow Canyon Alternative

Project Features	Ownership				
	Federal	State	Tribal	Private	Total
Dams and Reservoirs					
Upper Yellowstone	533	0	0	0	533
Big Sand Wash	0	98	0	340	438
Diversion Dams	0	0	[illegible]	18	21
Pipelines	0	0	8.4	30.0	38.4
Fish and Wildlife: Enhancements	0	0	0	160	160
Recreation Developments	0	0	0	0	0
Land Retirement	0	0	0	1,300	1,300

Figure 2-9
Construction Schedule for the Cow Canyon Alternative

Feature	Year 1												Year 2											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Upper Yellowstone Dam			20	81	81	92	82	81	81	77	20				20	88	88	100	90	90	88	80	20	
Big Sand Wash Dam																								
Diversion Dams																								
Pipelines						20	30	30	30	30	30	30	30	30	12	12	12	24	30	30	30	22		
Fish and Wildlife and Recreation Developments																	8	8	8					
Total Workers	0	0	20	81	81	112	112	111	111	107	50	30	30	30	32	100	108	132	128	120	118	102	20	0

Feature	Year 3												Year 4											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Upper Yellowstone Dam			30	139	139	139	139	139	139	139	30				20	81	81	92	82	81	81	77	20	
Big Sand Wash Dam			20	40	68	63	64	64	28	28	20	15	10	10										
Diversion Dams			7	7	7					7	7	7			7	7	7					7	7	7
Pipelines																								
Fish and Wildlife and Recreation Developments																								
Total Workers	0	0	57	186	214	202	203	203	167	174	57	22	10	10	27	88	88	92	82	81	81	84	27	7

Feature	Year 5												Year 6											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Upper Yellowstone Dam																								
Big Sand Wash Dam																								
Diversion Dams			7	7	7					7	7	7												
Pipelines																								
High Mountain Lakes				30	30	30	30	18								18	18	18	18	18				
Fish and Wildlife and Recreation Developments								15	25	30	25	10	10	10	10									
Total Workers	0	0	7	37	37	30	30	33	25	37	32	17	10	10	10	18	18	18	18	18	0	0	0	0

Estimated average number of workers per month shown above shaded areas.

and operation and maintenance; and future land access for each project feature. Detailed descriptions of facilities, construction procedures, and operation and maintenance procedures are presented below.

2.4.2 Physical Features and Other Characteristics

2.4.2.1 Dams and Reservoirs

Dam and reservoir facilities under the Crystal Ranch Alternative would include construction of Crystal Ranch Dam and Reservoir.

2.4.2.1.1 Crystal Ranch Dam and Reservoir. Physical features, facilities, and construction requirements associated with Crystal Ranch Dam and Reservoir would be the same as the Proposed Action (see Section 2.2.2.1.1). Operation of Crystal Ranch Dam and Reservoir is described below. It would differ from the operation described under the Proposed Action because Big Sand Wash Reservoir would not be enlarged.

2.4.2.1.1.1 Dam and Reservoir Operations. The Yellowstone River watershed above the Crystal Ranch Dam site drains about 134 square miles. Based on the 64-year analysis period (1930-1993), the average flow of water entering Crystal Ranch Reservoir (reservoir inflow) would range from 50 cfs in February to 479 cfs in June. Reservoir inflow would peak with snowmelt and decline rapidly in mid-summer. The overall average inflow would be 141 cfs.

Figure 2-10 shows estimated end-of-month water surface elevation and storage in the proposed Crystal Ranch Reservoir during wet, average, and dry years based on the 64-year analysis period. Wet, average, and dry year estimates were determined using data from the same years of the analysis period as described for Crystal Ranch Reservoir under the Proposed Action (see Section 2.2.2.1.1.2).

During an average water year, Crystal Ranch Reservoir elevation and storage would be highest in June and lowest in September (Figure 2-10). Both would increase from October (the start of the

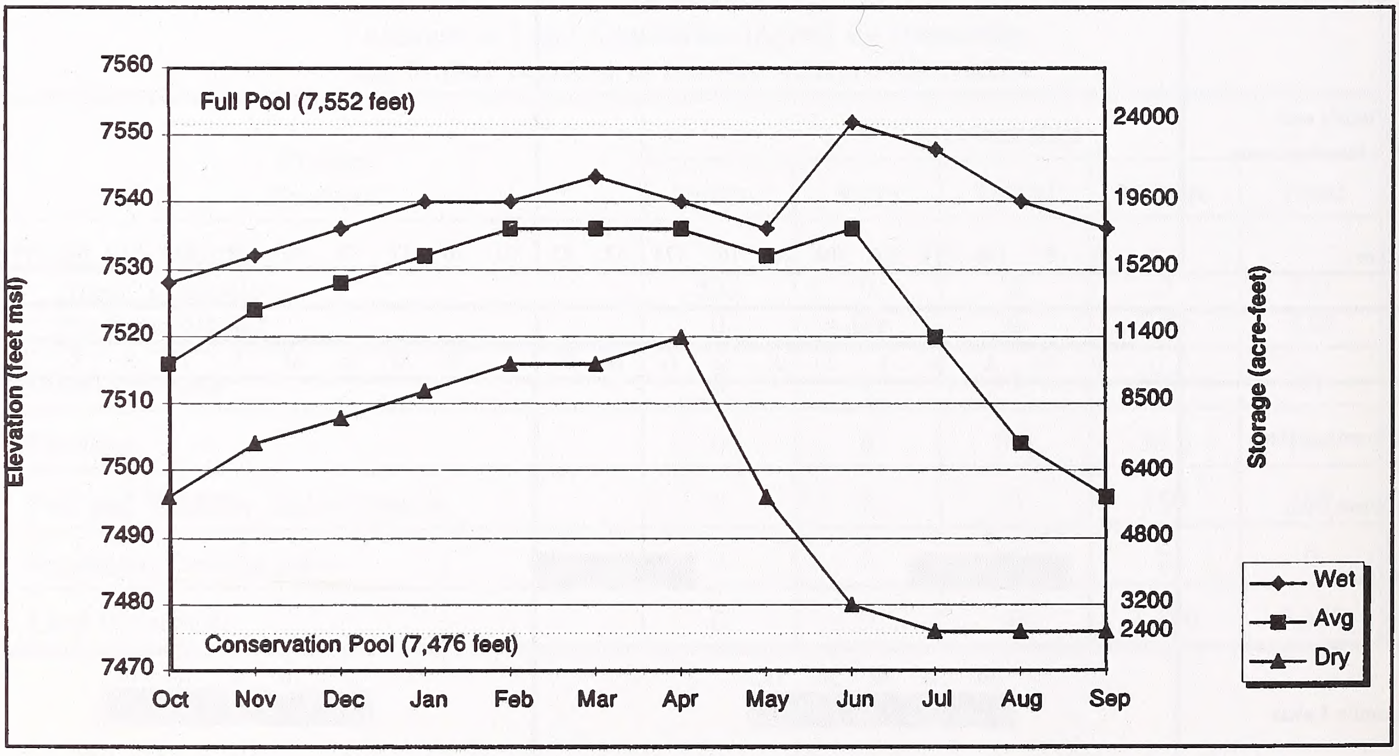
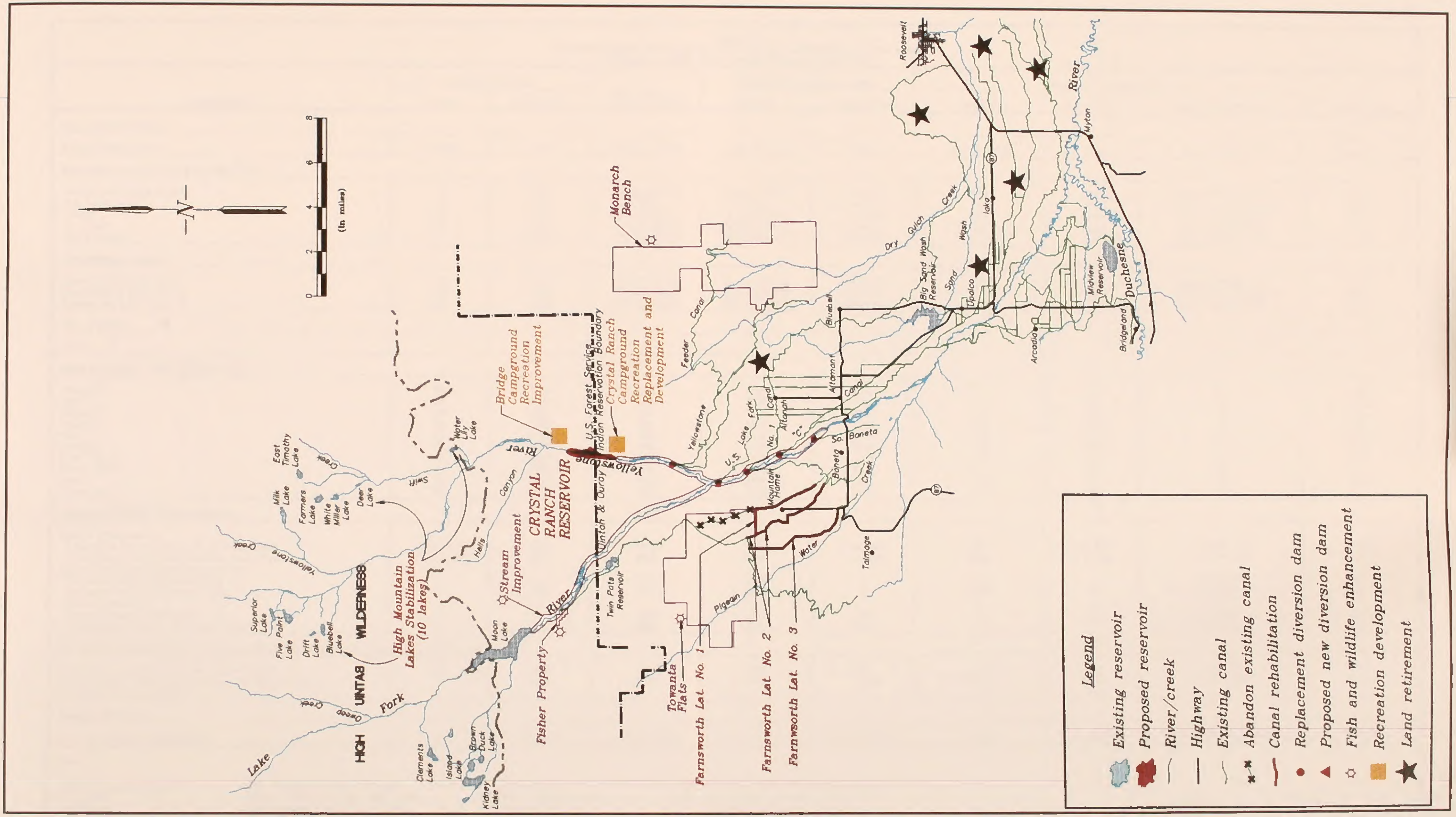


Figure 2-10
Average, Wet, and Dry Year End-of-Month Elevation and Storage for Crystal Ranch Reservoir (Crystal Ranch Alternative)



Map 2-13
Upalco Unit
Crystal Ranch Alternative

Table 2-24
Entities Responsible for Acquisition, Construction, and Operation and Maintenance of Features of the Crystal Ranch Alternative–Upalco Unit

Project Feature	Land Ownership		Management of Land Acquisition	Construction or Implementation		Operation and Maintenance			Land Access
	Present	Post Project		Funding	Management	Funding	Management	Agreement Signatories	
Dams and Reservoirs									
Crystal Ranch (new)	T,P,FS	DOI[a]	DOI,CUWCD	DOI,CUWCD	DOI	DOI,CUWCD	BIA	T,BIA,CUWCD,DOI	ALL,T[b]
Replacement and New Diversion Dams									
Yellowstone Feeder/Payne	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
U.S. Lake Fork	T	DOI	DOI	DOI	DOI	SAP	SAP	SAP,BIA,CUWCD,DOI	SAP
Boneta	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
"C" Canal	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
South Boneta	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Rehabilitate Canals									
Farnsworth Lateral No. 1	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Farnsworth Lateral No. 2	T,P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Farnsworth Lateral No. 3	T,P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
New Pipelines									
None									
High Mountain Lakes Stabilization									
Bluebell	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Drift	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Five Point	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Superior	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Milk	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Farmers	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
East Timothy	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
White Miller	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Deer	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Water Lily	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Fish and Wildlife: Enhancements									
Stream Improvement									
Lake Fork River (5 Miles in 18-mile Reach)	T or S or P	SAP	DOI	DOI	T or DOI	DOI	T or WR	T or WR,DOI	ALL,T[b]
Yellowstone River (2 Miles in 4.5-mile Reach)	T or S or P	SAP	DOI	DOI	T or DOI	DOI	T or WR	T or WR,DOI	ALL,T[b]
Big Game Winter Range Improvement									
Towanta Flats (11,500-acre Site)	T	SAP	DOI	DOI	T	T,BIA	T	T,DOI,BIA	ALL,T[b]
Monarch Bench (13,300-acre Site)	T	SAP	DOI	DOI	T	T,BIA	T	T,DOI,BIA	ALL,T[b]
Habitat Acquisition									
Fisher Property (160 acres)	P	FS	DOI	DOI	DOI	FS	FS	DOI,FS	ALL
Red Rocks/Duchesne Drainage Property	P	DOI[a]	DOI	DOI	DOI	T	T	T,DOI,BIA	ALL,T[b]
Recreation Developments: Minimum Basic Facilities for Environmental Protection									
Bridge Campground Recreation Improvement	FS	SAP	NA	DOI	FS	FS	FS	DOI,FS	ALL
Crystal Ranch Campground Recreation Replacement and Development (new)	T	DOI	DOI	DOI	T	DOI	T,BIA	T,DOI,BIA	ALL,T[b]
Land Retirement									
Land Retirement (1,300 acres)	P	T,P,DOI[c]	DOI,CUWCD	DOI,CUWCD	DOI,CUWCD	P,DOI	T,P,DOI	T,DOI,CUWCD,FWS,WR	SAP,ALL

Notes:

SAP = Same as present
T = Tribe
P = Private
BIA = Bureau of Indian Affairs
ALL = Tribal and non-Tribal public
DOI = Department of the Interior
S = State of Utah
FS = U.S. Forest Service
NA = Not applicable
CUWCD = Central Utah Water Conservancy District
WR = Utah Division of Wildlife Resources
FWS = U.S. Fish and Wildlife Service

[a]Held as trust lands for the Ute Indian Tribe.
[b]Access to all publics, but a Tribal permit may be required.
[c]Some may be water rights only.

calendar water year) through March, decrease slightly through May, then increase in June, reflecting storage of Yellowstone River water during the nonirrigation season and the occurrence of peak runoff in June. Reservoir elevation and storage would decline through September, then start to increase in October. Based on end-of-month operations data, reservoir water levels during an average water year would fluctuate 40 feet and would be considerably above the 2,400-acre-foot conservation pool elevation of 7,476 feet, but levels would not reach full pool elevation of 7,552 feet.

Crystal Ranch Reservoir would have 9,550 acre-feet of storage space allocated for use by the Ute Tribe. The model used to forecast reservoir operations and future river reach flows was based on the assumption that Tribal water would not be retained in storage but would be delivered downstream during the irrigation season according to crop demand on Indian-owned, Indian water-righted lands. It would also be used to irrigate Tribal lands that are now idle. Other reservoir storage space allocations would include 2,400 acre-feet for the conservation pool, 2,500 acre-feet for high mountain lakes storage replacement, 150 acre-feet for non-Indian-owned 1861 water-righted lands, 6,400 acre-feet for secondary water-righted lands, and 3,000 acre-feet for City of Roosevelt municipal and industrial purposes. In addition to these space allocations, a 200-acre-foot dead pool would be located below the intake structure.

Water would be released from Crystal Ranch Reservoir to match crop irrigation requirements and downstream water rights. The distribution of project water is discussed in Section 2.4.3, and future stream flows are shown in Table 2-26. Water would also be released or allowed to flow through year-round to provide minimum instream flows for fish. Minimum flow releases provided in the Yellowstone River would be 24 cfs October through March and 56 cfs April through September. Minimum flows during the nonirrigation season would be provided by a separate conduit through the dam that comes off the main outlet.

In times of extreme water shortage, when these minimum fish flows cannot be achieved without jeopardizing established water rights (drier than 1934 or when reservoir inflow is below the minimum flow), instream flows would be provided only to the extent necessary to ensure fish survival, as determined by the FWS and Ute Tribe, unless reservoir releases are made by separate agreement with an entity willing to release their water for instream flows. During wetter than dry winters, instream flows would be increased above the winter (October through March) minimum fish flow release. To ensure that these additional flows would be available for instream uses, a forecasting procedure and mechanism to implement changes in wintertime releases, when possible, would be established by the CUWCD in consultation with the FWS, Ute Tribe, BIA, Wildlife Resources, State Engineer, and potentially affected water users. These entities would develop an instream flow agreement that stipulates agreed-upon minimum flows and describes the procedure and mechanism for implementing flow changes. Further details on minimum instream flows are provided in Chapter 3, Section 3.6 Water Resources and Hydrology and Section 3.8 Aquatic Resources of this Draft EIS.

Crystal Ranch Dam and Reservoir would be operated and maintained the same as described for the Proposed Action (see Section 2.2.2.1.1.2).

2.4.2.2 Diversion Dams

Diversion dams associated with the Crystal Ranch Alternative would be identical to the Proposed Action (see Section 2.2.2.2), except that the Big Sand Wash Feeder Pipeline diversion dam would not be constructed. Under this alternative, an estimated 9.5 acres would be temporarily disturbed but reclaimed, and 7.8 acres would be permanently disturbed (see Table 2-5). These lands would be acquired under temporary and permanent easements, purchased, or acquired by condemnation if necessary.

2.4.2.3 Canal Rehabilitation

Farnsworth Canal Laterals No. 1, No. 2, and No. 3 would be rehabilitated under the Crystal Ranch Alternative. Approximately 87 acres of land would be required for construction. Of this total, 43.5 acres would be reclaimed while the remainder (43.5 acres) would be required for road access under a permanent easement and would not be reclaimed to the original condition. Descriptions of the three proposed Farnsworth Lateral Pipelines, construction procedures, and operation and maintenance procedures were presented under the Proposed Action (see Section 2.2.2.3).

Table 2-7 lists the location, number of sites, and acres of wetlands that would be preserved along the three Farnsworth Laterals under the wetland maintenance system. Under the Crystal Ranch Alternative, a total of 80.4 acres of wetlands would be preserved. Since wetlands maintenance generally requires about 4.5 acre-feet of water per acre, the 80.4 acres of preserved wetlands would require 362 acre-feet of water annually. Preserved wetlands would be acquired under a permanent easement, purchased, or acquired by condemnation if necessary.

2.4.2.4 High Mountain Lakes Stabilization

High mountain lakes stabilization would be identical to the Proposed Action (see Section 2.2.2.5).

2.4.2.5 Fish and Wildlife

2.4.2.5.1 Enhancement. Three fish and wildlife enhancements would be implemented under the Crystal Ranch Alternative. The first two, Stream Improvement and Big Game Winter Range Improvement, were described under the Proposed Action (see Section 2.2.2.6.1). The third, Habitat Acquisition, consists of the Red Rocks/Duchesne Drainage property, which was also described in Section 2.2.2.6.1, and the Fisher property, which was described under the Cow Canyon Alternative (see Section 2.3.2.5.1).

2.4.2.5.2 Mitigation. Fish and wildlife mitigation measures and their funding source would be the same as described under the Proposed Action (see Section 2.2.2.6.2) except for differences noted below.

2.4.2.5.2.1 Wildlife Habitat/Wetland Mitigation. Under the Crystal Ranch Alternative, mitigation measures to compensate for impacts on wildlife habitat that cannot be avoided would be implemented at the Brotherson and Lake Fork mitigation sites and along portions of rehabilitated canals that support wetland and riparian communities. The current vegetation cover types and the area of each type, along with the proposed acreage on which habitat development and habitat improvement measures would be implemented, are discussed in Chapter 3, Section 3.9 Wetland and Riparian Resources and Section 3.10 Wildlife Resources of this Draft EIS. In total, habitat improvement and habitat development measures would be implemented on 1,212 acres.

Under the Crystal Ranch Alternative, a total of 80.4 acres of wetland and riparian communities would be preserved. Since wetland maintenance in the project area generally requires about 4.5 acre-feet of water per acre, the 80.4 acres of preserved wetlands would require about 362 acre-feet of project water annually. This water would come from water savings realized as a result of canal rehabilitation and land retirement. Wetland maintenance systems installed would be the same as described for the Proposed Action (see Section 2.2.2.6.2.2).

2.4.2.5.2.2 Fish Passage. Fish passage would be the same as described in Section 2.2.2.2.

2.4.2.6 Recreation Developments

2.4.2.6.1 Minimum Basic Facilities for Environmental Protection. Two recreation developments would be implemented under the Crystal Ranch Alternative. The first, Crystal Ranch Campground Recreation Replacement and Development, was described under the Proposed Action (see Section 2.2.2.7.1.1). The second, Bridge Campground Recreation Improvement, was described under the Cow Canyon Alternative (see Section 2.3.2.6.1.1).

2.4.2.6.2 Enhancement. Recreation development enhancements would consist of Forest Service

Campground Upgrades, the same as described for the Proposed Action (see Section 2.2.2.7.2.1).

2.4.2.7 Land Retirement

The land retirement program described in Section 2.2.2.8 of the Proposed Action also applies to this alternative.

2.4.3 Delivery of Project Water

The general discussion of delivery of project water under the Proposed Action (see Section 2.2.3) also applies to the Crystal Ranch Alternative. Table 2-25 shows the amount of water that would be delivered under this alternative and the increased water deliveries. Table 2-26 shows future wet, average, and dry year flows in river reaches under the Crystal Ranch Alternative. Further details on stream flow regime are presented in Chapter 3, Section 3.6 Water Resources and Hydrology of this Draft EIS.

2.4.4 Summary of Project Detail

This section summarizes the amount of land to be impacted, the amount of acquisition, and the construction schedule for the Crystal Ranch Alternative. Table 2-27 summarizes the amount of land to be temporarily and permanently disturbed and is based on previous discussions of project feature disturbances. Table 2-28 shows the amount of land acquisition by ownership. Acquired land includes withdrawals (federal land), purchase or condemnation, and easements (temporary and permanent). Construction of recreation developments on National Forest land would be done under permits with the FS. The summary of construction schedules for all project features and mitigation measures is presented in Figure 2-11.

2.5 Twin Pots Alternative

2.5.1 General Description

Specific features of the Twin Pots Alternative and their locations are shown on Map 2-14 and listed in Table 2-1. Fish and wildlife mitigation measures are also listed in Table 2-1 and discussed below. Table 2-29 contains supporting reference information for the following text and lists land ownership; entities responsible for land acquisition, project construction, and operation and maintenance; and future land access for each project feature. Detailed descriptions of facilities, construction procedures, and operation and maintenance procedures are presented below.

2.5.2 Physical Features and Other Characteristics

2.5.2.1 Dams and Reservoirs

Dam and reservoir facilities under the Twin Pots Alternative would include the 12,000-acre-foot enlargement of Big Sand Wash Dam and Reservoir.

2.5.2.1.1 Big Sand Wash Dam and Reservoir. The active storage capacity of Big Sand Wash Reservoir would be increased by 12,000 acre-feet. Big Sand Wash Dam would be raised 26 feet to a height of 136 feet with a crest elevation of 5,918 feet. The two east dikes would be combined and the west dike would be replaced with an RCC

Table 2-25
Irrigation Water Supplies under Baseline Conditions and with the Crystal Ranch Alternative

Water Rights	Supply (acre-feet) Baseline	With Project	Change
Indian (1861)	42,093	49,723	7,630
Secondary	95,301	102,781	7,480

Table 2-26
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Crystal Ranch Alternative

Reach	Month											
	October	November	December	January	February	March	April	May	June	July	August	September
Y-1--Yellowstone High Mountain Lakes Storage (acre-feet)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Y-2--Yellowstone High Mountain Lakes to Reservoir (cfs)*												
Wet	146	93	74	63	57	61	75	311	818	458	236	157
Average	99	73	61	54	50	55	82	297	479	186	140	111
Dry	67	52	35	43	43	44	82	169	172	61	82	60
Y-3--Crystal Ranch Reservoir Storage (acre-feet)												
Wet	13448	15957	17706	18868	19627	20473	19723	17948	24000	22845	19529	17520
Average	10505	12848	14398	15593	16590	17743	17224	15829	17760	11390	7037	5861
Dry	5439	6928	8014	8941	9719	10689	10919	5851	3172	2400	2400	2400
Y-4--Reservoir to Yellowstone Feeder Diversion (cfs)												
Wet	56	51	44	44	44	50	73	320	802	457	259	180
Average	30	30	34	36	36	41	44	284	460	201	215	128
Dry	27	27	27	28	35	34	74	201	244	144	82	60
Y-5--Yellowstone Feeder Diversion to Confluence (cfs)												
Wet	37	51	44	44	44	37	55	244	663	352	107	143
Average	30	35	35	36	36	44	50	144	343	191	140	99
Dry	27	27	27	28	35	27	44	121	150	107	75	52
LF-1--Lake Fork High Mountain Lakes Storage (acre-feet)												
Wet	356	593	830	1067	1304	1660	2075	385	4859	2483	107	0
Average	297	475	653	831	1009	1306	1662	3444	891	1009	0	0
Dry	237	356	475	594	713	951	1248	3030	4218	1545	0	0
LF-2--Lake Fork High Mountain Lakes to Moon Lake (cfs)*												
Wet	91	56	43	34	28	28	32	343	818	311	154	99
Average	56	43	34	34	27	28	57	312	550	200	99	71
Dry	30	35	28	28	26	34	72	243	244	74	50	41
LF-3--Moon Lake to Farnsworth Diversion (cfs)												
Wet	1	7	16	12	0	0	82	243	670	462	267	151
Average	1	3	3	3	2	3	82	261	433	308	236	119
Dry	1	0	0	0	0	0	97	246	296	173	96	40
LF-4--Farnsworth Diversion to Rowley Ditch Diversion (cfs)												
Wet	0	0	1	12	0	7	60	127	514	323	163	143
Average	1	2	2	2	2	2	62	140	308	235	173	84
Dry	0	0	0	0	0	0	68	142	227	131	55	39

Notes:
*These data are based on information from the Rivermaster and Dam tender.
All storage data are end-of-month values.

Table 2-26
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Crystal Ranch Alternative

Reach	Month											
	October	November	December	January	February	March	April	May	June	July	August	September
LF-5--Rowley Ditch Diversion to Confluence (cfs)												
Wet	16	10	11	22	10	17	70	137	524	333	173	113
Average	11	12	12	12	12	12	72	156	318	243	183	94
Dry	16	33	16	33	10	10	70	152	237	141	65	49
LF-6--Confluence to "C" Canal Diversion (cfs)												
Wet	37	61	55	63	63	51	77	183	951	444	67	154
Average	41	47	47	49	49	46	83	164	428	211	169	112
Dry	37	37	37	38	35	37	70	86	183	129	72	74
LF-7--"C" Canal Diversion to South Boneta Diversion (cfs)												
Wet	0	13	27	65	60	26	23	63	676	265	63	97
Average	0	7	11	38	30	13	29	73	216	70	11	28
Dry	0	0	0	30	35	6	23	41	48	38	28	17
LF-8--South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion (cfs)												
Wet	0	13	27	65	63	26	27	86	671	260	60	95
Average	1	7	11	30	38	13	23	70	214	60	30	28
Dry	0	0	0	38	35	6	22	38	11	37	27	16
LF-9--Big Sand Wash Feeder Pipeline Diversion to Purdy Ditch Diversion (cfs)												
Wet	3	16	30	63	67	32	11	63	671	262	61	97
Average	3	9	13	51	51	38	32	72	214	60	39	27
Dry	3	3	2	11	38	6	26	33	17	30	23	17
LF-10--Purdy Ditch Diversion to Red Cap Diversion (cfs)												
Wet	3	10	30	60	67	32	23	57	661	248	50	91
Average	3	8	13	51	51	38	29	61	201	55	30	23
Dry	3	3	2	11	38	6	23	29	35	38	25	14
LF-11--Red Cap Diversion to Hamilton-Knudsen Diversion (cfs)												
Wet	3	16	30	60	67	32	23	33	627	215	26	79
Average	3	9	13	51	51	38	23	38	170	29	8	14
Dry	3	3	2	11	38	6	38	7	7	7	7	7
LF-12--Hamilton-Knudsen Diversion to Duchesne River (cfs)												
Wet	3	16	30	60	67	32	22	33	625	214	26	79
Average	3	9	13	51	51	38	23	38	169	29	8	14
Dry	3	3	2	41	30	6	38	7	7	7	7	7

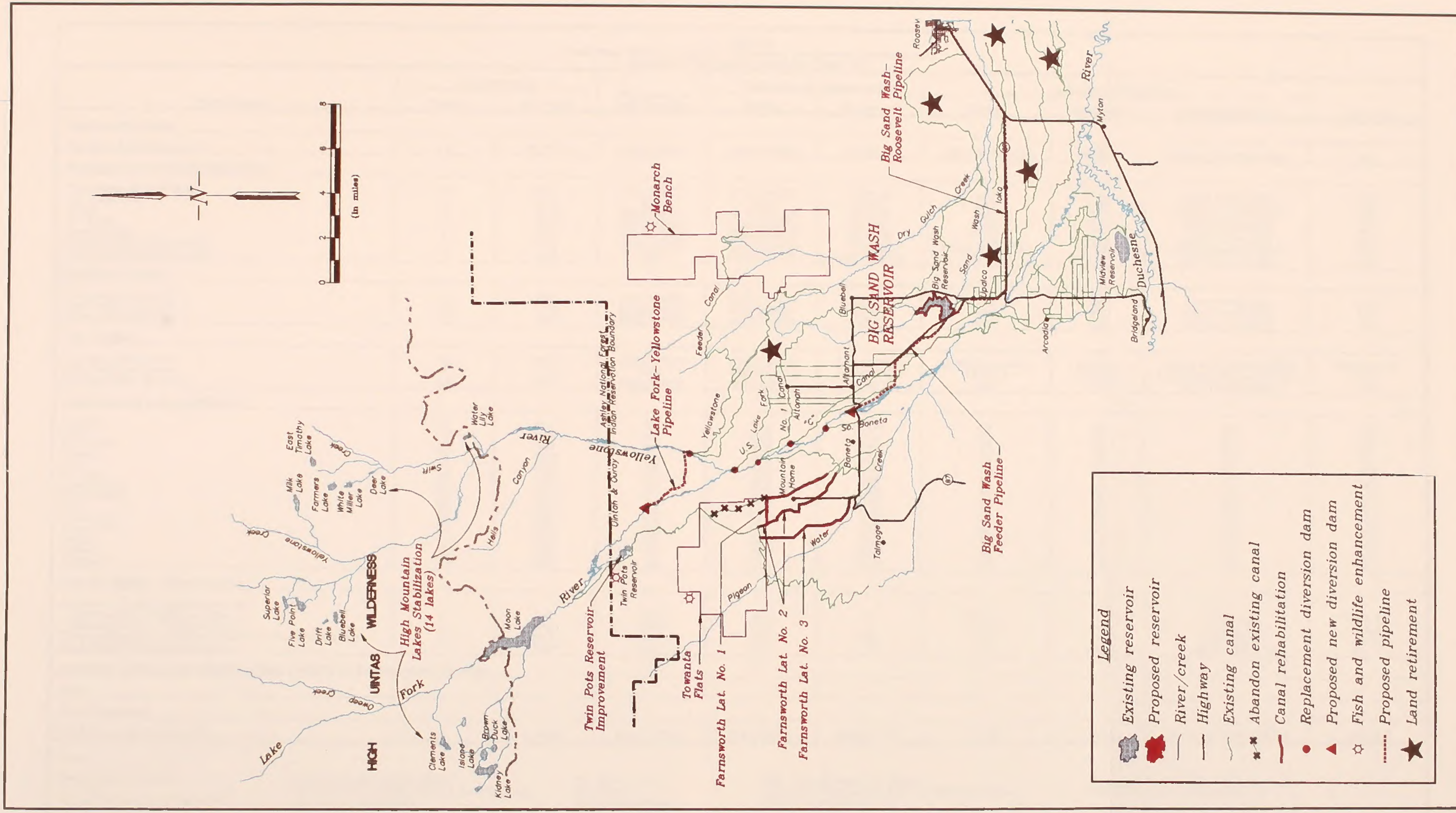
Notes:
*These data are based on information from the Rivermaster and Dam tender.
All storage data are end-of-month values.

Table 2-27 Amount of Tribal and Non-Tribal Land to be Temporarily Disturbed and Restored or Permanently Encumbered by Project Features of the Crystal Ranch Alternative						
Project Features	Acres Temporarily Disturbed and Restored			Acres Permanently Encumbered*		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Dams and Reservoirs Crystal Ranch	0	0	0	329	233	562
Diversion Dams	1.9	7.6	9.5	1.1	6.7	7.8
Canal Rehabilitation	1.9	41.6	43.5	1.9	122.0	123.9
Fish and Wildlife: Enhancements[b]	17.5	0	17.5	8.0	0	8.0
Recreation Developments	0	0	0	3.0	1.0	5.0

[a]Encumbered includes land whose use is limited by permanent acquisition such as ownership, right-of-ways, or easements.
[b]Some small portion of stream improvements may not be on Tribal land, but this will not be determined until final project design.

Table 2-28 Amount of Land Acquisition (Acres) by Ownership for Project Features of the Crystal Ranch Alternative					
Project Features	Ownership				
	Federal	State	Tribal	Private	Total
Dams and Reservoirs Crystal Ranch	97	0	570	310	977
Diversion Dams	0	0	3.0	14.3	17.3
Canal Rehabilitation	0	0	3.8	163.6	167.4
Fish and Wildlife: Enhancements*	0	0	17	160	177
Recreation Developments	0	0	4	0	4
Land Retirement	0	0	0	1,300	1,300

*In addition, all or a portion of 15,480 acres of privately owned Red Rocks/Duchesne Drainage property would be acquired.



Map 2–14
Upalco Unit
Twin Pots Alternative

Table 2-29
Entities Responsible for Acquisition, Construction, and Operation and Maintenance of Features of the Twin Pots Alternative–Upalco Unit

Project Feature	Land Ownership		Management of Land Acquisition	Construction or Implementation		Operation and Maintenance			Land Access
	Present	Post Project		Funding	Management	Funding	Management	Agreement Signatories	
Dams and Reservoirs									
Big Sand Wash Enlargement	P,S	MLWUA	DOI,CUWCD	DOI,CUWCD	CUWCD	CUWCD,MLWUA	MLWUA	MLWUA,CUWCD,DOI	ALL
Replacement and New Diversion Dams									
Yellowstone Feeder/Payne	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
U.S. Lake Fork	T	DOI	DOI	DOI	DOI	SAP	SAP	SAP,BIA,CUWCD,DOI	SAP
Boneta	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
"C" Canal	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
South Boneta	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Big Sand Wash Feeder (new)	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	CUWCD,MLWUA	MLWUA	CUWCD,DOI,MLWUA	SAP
Lake Fork-Yellowstone (new)	T	DOI	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	T,BIA	T,CUWCD,DOI,BIA	SAP
Rehabilitate Canals									
Farnsworth Lateral No. 1	P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Farnsworth Lateral No. 2	T,P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
Farnsworth Lateral No. 3	T,P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	SAP	SAP	SAP,CUWCD,DOI	SAP
New Pipelines									
Big Sand Wash Feeder	T,P	DOI	DOI,CUWCD	DOI,CUWCD	DOI,CUWCD	CUWCD,MLWUA	MLWUA	T,P,MLWUA,CUWCD,DOI	SAP,MLWUA
Lake Fork-Yellowstone	T	DOI	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	MLWUA	T,CUWCD,DOI,BIA,MLWUA	SAP
Big Sand Wash-Roosevelt	S,P	DOI	DOI,CUWCD	DOI,CUWCD	CUWCD	CITY	CITY	CITY,CUWCD,DOI	SAP
High Mountain Lakes Stabilization									
Bluebell	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Drift	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Five Point	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Superior	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Milk	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Farmers	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
East Timothy	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
White Miller	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Deer	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Water Lily	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Brown Duck	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Island	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Kidney	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Clements	FS	SAP	NA	DOI	DOI	FS	FS	NA	ALL
Fish and Wildlife: Enhancements									
Big Game Winter Range Improvement									
Towanta Flats (11,500-acre Site)	T	SAP	DOI	DOI	T	T,BIA	T	T,DOI,BIA	ALL,T[a]
Monarch Bench (13,300-acre Site)	T	SAP	DOI	DOI	T	T,BIA	T	T,DOI,BIA	ALL,T[a]
Habitat Acquisition: Red Rocks/Duchesne Drainage Property	P	DOI[b]	DOI	DOI	DOI	T	T	T,DOI,BIA	ALL,T[a]
Twin Pots Reservoir Improvement	T	DOI	DOI	DOI	T	DOI	T,BIA	T,DOI,BIA,MLWUA	ALL,T[a]
Recreation Developments: Minimum Basic Facilities for Environmental Protection									
None									
Land Retirement									
Land Retirement (1,300 acres)	P	T,P,DOI[c]	DOI,CUWCD	DOI,CUWCD	DOI,CUWCD	P,DOI	T,P,DOI	T,DOI,CUWCD,FWS,WR	SAP,ALL

Notes:

SAP = Same as present
T = Tribe
ALL = Tribal and non-Tribal public
BIA = Bureau of Indian Affairs
MLWUA = Moon Lake Water Users Association
FS = U.S. Forest Service
S = State of Utah
P = Private
NA = Not applicable
DOI = Department of the Interior
CUWCD = Central Utah Water Conservancy District
CITY = City of Roosevelt
WR = Utah Division of Wildlife Resources
FWS = U.S. Fish and Wildlife Service

[a]Access to all publics, but a Tribal permit may be required.
[b]Held as trust lands for the Ute Indian Tribe.
[c]Some may be water rights only.

Figure 2-11
Construction Schedule for the Crystal Ranch Alternative

Feature	Year 1												Year 2											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Crystal Ranch Dam				35	50	50	50	59	59	59	3					35	50	50	50	59	59	59	3	
Diversion Dams			7	7	7					7	7	7			7	7	7							
High Mountain Lakes																								
Rehabilitate Canals																								
Fish and Wildlife and Recreation Developments																	15	15	15	15	15			
Total Workers	0	0	7	42	57	50	50	59	59	66	10	7	0	0	7	42	72	65	65	74	74	59	3	0

Feature	Year 3												Year 4											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Crystal Ranch Dam				82	82	82	82	82	82	82	5					144	144	144	144	144	144	144	5	
Diversion Dams			7	7	7					7	7	7			7	7	7							
High Mountain Lakes																								
Rehabilitate Canals																					23	23	23	10
Fish and Wildlife and Recreation Developments																								
Total Workers	0	0	7	89	89	82	82	82	82	89	12	7	0	0	7	151	151	144	144	144	167	167	28	10

Feature	Year 5												Year 6											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Crystal Ranch Dam				115	115	115	115	115	115	115	5													
Diversion Dams																								
High Mountain Lakes				18	18	18	18	21								30	30	30	30	18				
Rehabilitate Canals			23	23	23				23	23	23	10			23	23	23							
Fish and Wildlife and Recreation Developments								15	25	30	25	10	10	10	10									
Total Workers	0	0	23	156	156	133	133	151	163	168	53	20	10	10	33	53	53	30	30	18	0	0	0	0

Estimated average number of workers per month shown above shaded areas.

embankment. Table 2-30 summarizes the physical features and facilities associated with the existing 12,000-acre-foot reservoir and proposed 12,000-acre-foot enlargement of Big Sand Wash Dam and Reservoir. Map 2-15 shows the locations of proposed modifications to the dam.

2.5.2.1.1.1 Dam and Reservoir Operations. The reservoir's primary water supply would come from the Lake Fork River via the "C" Canal and the proposed Big Sand Wash Feeder Pipeline. A small amount of runoff would come from the 11.3-square-mile Big Sand Wash watershed upstream of the dam. Based on the 64-year analysis period (1930-1993), the average flow of water diverted into Big Sand Wash Reservoir (reservoir inflow) would range from 28 cfs in March to 186 cfs in June. The overall average inflow would be 74 cfs.

Figure 2-12 shows estimated end-of-month water surface elevation and storage in the enlarged Big Sand Wash Reservoir for wet, average, and dry years based on the 64-year analysis period. Wet, average, and dry year estimates were determined using data from the same years of the analysis period as described for Crystal Ranch Reservoir under the Proposed Action (see Section 2.2.2.1.1.2).

During an average water year, Big Sand Wash Reservoir elevation and storage would be highest in April and lowest in September (Figure 2-12). Both would steadily increase from October (the start of the calendar water year) through April as diversions from the Lake Fork River are stored for delivery during the irrigation season. Reservoir elevation and storage would decline gradually through June, then more abruptly through September as water is released for irrigation. The reservoir would begin to refill in October. Based on end-of-month operations data, reservoir water levels during an average water year would fluctuate 71 feet and would remain above the 1,200-acre-foot conservation pool elevation of 5,794 feet, but levels would not reach full pool elevation of 5,910 feet.

Under the Twin Pots Alternative, Big Sand Wash Reservoir storage space allocations would include 1,200 acre-feet for the conservation pool, 3,500 acre-feet for City of Roosevelt municipal and industrial purposes, 6,500 acre-feet for high mountain lakes storage replacement, and 12,800 acre-feet (2,000 acre-feet more than currently available) for the Moon Lake Water Users Association. In addition to these space allocations, a 21-acre-foot dead pool would be located below the intake structure. Municipal and industrial water for the City of Roosevelt would be delivered from the reservoir to the City via the proposed Big Sand Wash-Roosevelt Feeder Pipeline, which is discussed below (see Section 2.5.2.4).

Big Sand Wash Dam and Reservoir would be constructed, operated, and maintained the same as described for the Proposed Action (see Section 2.2.2.1.2) with the following exceptions. Dam construction would begin in the second year of the overall 5-year construction period for the Twin Pots Alternative and extend over a 12-month period. Approximately 975,000 cubic yards of earth materials would be excavated for processing and sorting. Motorized equipment would use an estimated 400,000 gallons of petroleum products (diesel, gasoline, and grease). Major maintenance needs at the dam would be met on a scheduled and as-needed basis, the same as described in Section 2.2.2.1.1.2.

2.5.2.2 Diversion Dams

Diversion dams associated with the Twin Pots Alternative include those described for the Proposed Action (see Section 2.2.2.2) plus one additional structure. Under the Twin Pots Alternative, a concrete diversion dam would be constructed on the Lake Fork River to direct water to the proposed Lake Fork-Yellowstone Pipeline.

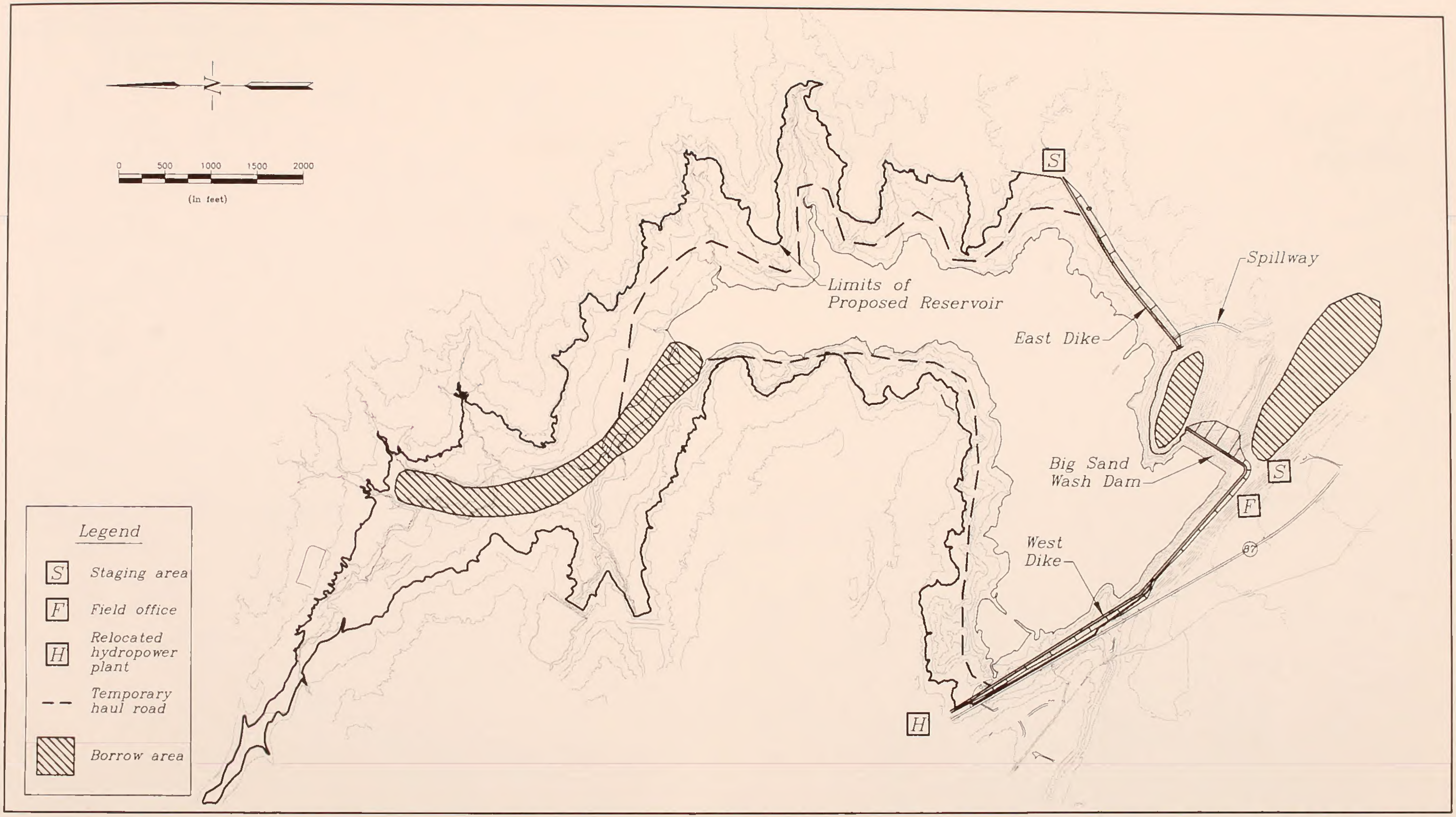
The proposed Lake Fork-Yellowstone diversion structure would be on the Lake Fork River approximately 2.2 miles upstream of the county road that crosses the upper Lake Fork. The general description of diversion dam facilities, and the construction, operation, and maintenance procedures presented in Section 2.2.2.2 also apply to the Lake Fork-Yellowstone diversion dam. Access to the site would be gained by constructing a permanent gravel road, 300 to 400 feet long and about 20 feet wide. In total, an estimated 13.3 acres

Table 2-30
Physical Features and Facilities for the Existing and 12,000-acre-foot Enlarged Big Sand Wash Dam and Reservoir
Twin Pots Alternative

Features	Existing	Enlarged
Dam		
Location	Big Sand Wash	Big Sand Wash
Type	Zoned earth and rock fill	Zoned earth and rock fill
Structural height (feet)	110	136
Crest elevation (feet msl)	5,892	5,918
Crest length (feet)	795	900
Crest width (feet)	25	25
East Dikes		
Type	Earth fill	Earth fill
Structural height (feet)	18	40
Crest elevation (feet msl)	5,892	5,918
Crest length (feet)	1,890	3,000
Crest width (feet)	16	20
West Dike		
Type	Earth fill	Roller-compacted concrete
Structural height (feet)	29	48
Crest elevation (feet msl)	5,892	5,918
Crest length (feet)	1,315	4,400
Crest width (feet)	16	20
Spillway		
Type	Unlined channel	Unlined channel
Crest elevation (feet msl)	5,885	5,910
Crest length (feet)	60	60
Unlined channel length (feet)	700	800
Probable Maximum Flood Design Capacity (cfs)	3,500	3,500
Intake Structure		
Type	Single, low level	Single, low level
Intake elevation (feet msl)	5,782	5,782
Outlet Works		
Conduit type	Reinforced concrete	Steel encased in concrete
Conduit diameter (inches)	40	36
Conduit length (feet)	536	350 (additional)
Maximum discharge (cfs)	200	250
Control gate type	Tandem gate valves	Tandem gate valves
Probable Maximum Flood (cfs)	18,000	18,000
Storage (acre-feet)		
Inactive (dead) pool	21	21
Conservation pool	1,200	1,200
Active pool	10,800	22,800
Total active	12,000	24,000

Table 2-30
Physical Features and Facilities for the Existing and 12,000-acre-foot Enlarged Big Sand Wash Dam and Reservoir
Twin Pots Alternative

Features	Existing	Enlarged
Reservoir (at full pool)		
Elevation (feet msl)	5,885	5,910
Length (miles)	1.6	2.5
Surface area (acres)	393	650
Shoreline length (miles)	7	12
Maximum depth (feet)	103	128
Mean depth (feet)	30	37
Conservation Pool Maximum Depth (feet)	12	12
Drainage Area (square miles)	11.3	11.3



Map 2-15
Twin Pots Alternative
Physical Features and Construction
Requirements, Big Sand Wash Dam and
Reservoir Enlargement (12,000 ac-ft)

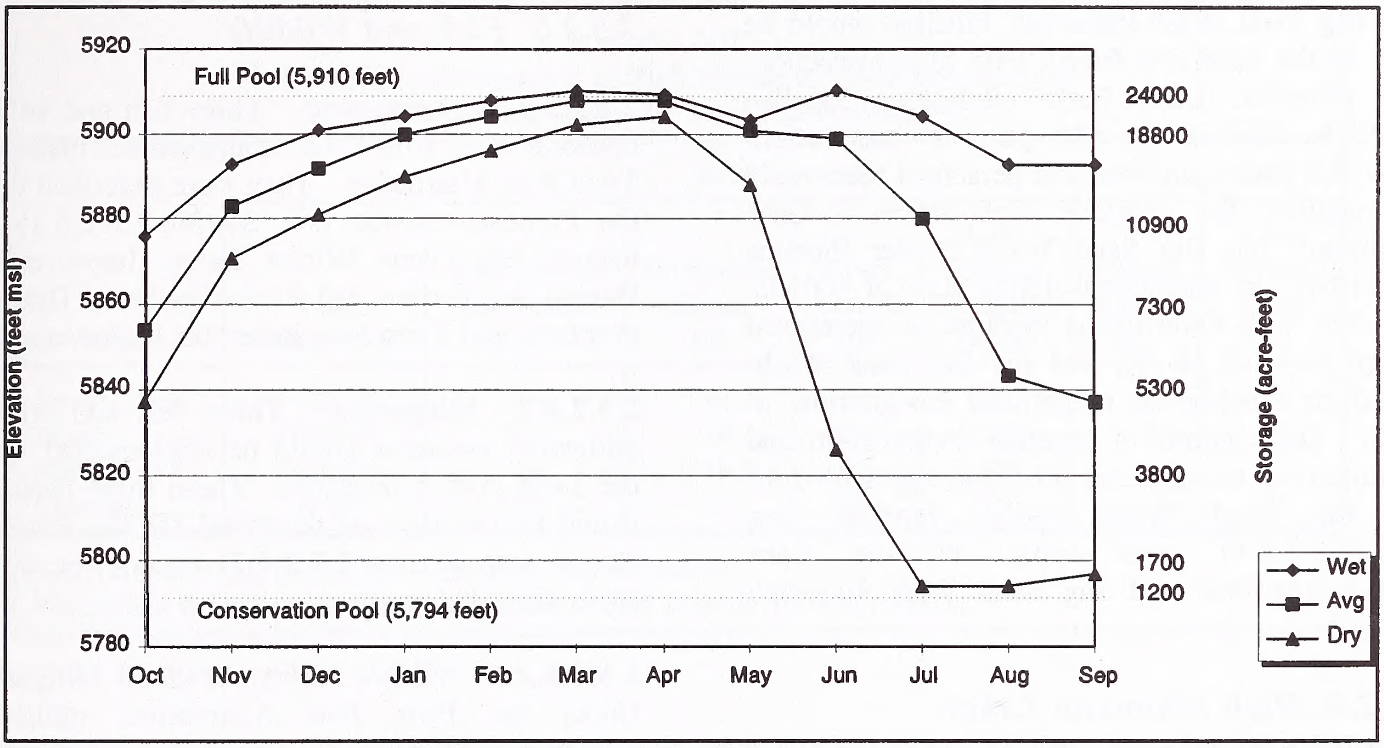


Figure 2-12
Average, Wet, and Dry Year End-of-Month Elevation and Storage for 12,000-acre-foot Enlarged Big Sand Wash Reservoir (Twin Pots Alternative)

would be temporarily disturbed but reclaimed, and 9.8 acres would be permanently disturbed under this alternative. These lands would be acquired under temporary and permanent easements.

2.5.2.3 Canal Rehabilitation

Canal rehabilitation would be identical to the Crystal Ranch Alternative (see Section 2.4.2.3).

2.5.2.4 Pipelines

Three pipelines would be constructed under the Twin Pots Alternative. They are the proposed Big Sand Wash Feeder Pipeline, the proposed Lake Fork-Yellowstone Pipeline, and the proposed Big Sand Wash-Roosevelt Pipeline. Map 2-14 shows their locations.

The Big Sand Wash Feeder Pipeline would follow the same corridor and be constructed, operated, and maintained the same as described for the Proposed Action (see Section 2.2.2.4). However, it would have a pipeline diameter of 60 inches rather than 39 inches to accommodate filling the 12,000-acre-foot enlargement of Big Sand Wash Reservoir.

The new 24-inch-diameter Lake Fork-Yellowstone Pipeline would begin at the proposed Lake Fork-Yellowstone Pipeline diversion structure on the Lake Fork River (see Section 2.5.2.2) and extend 3.6 miles to the Yellowstone River where it would discharge. Water discharged would meet replacement requirements in the Yellowstone River resulting from high mountain lakes stabilization. The new 15-inch-diameter Big Sand Wash-Roosevelt Pipeline would deliver water 15.4 miles from the enlarged Big Sand Wash Reservoir to the City of Roosevelt's existing distribution system. About 153 acres of land (50-foot-wide construction zone) would be required to construct these two pipelines and the Big Sand Wash Feeder Pipeline under the Twin Pots Alternative. Disturbed land would be reclaimed following construction.

The Big Sand Wash-Roosevelt Pipeline would be built in the third and fourth year of construction. The proposed Lake Fork-Yellowstone Pipeline would be built in the fifth year of construction. Table 2-9 lists equipment and personnel that would be required for pipeline construction. Once completed, the Big Sand Wash Feeder Pipeline would have an operational design flow of 100 cfs, the Lake Fork-Yellowstone Pipeline an operational design flow of 18 cfs, and the Big Sand Wash-Roosevelt Pipeline an operational design flow of 8 cfs. Descriptions of pipeline construction and operation and maintenance procedures presented for the Big Sand Wash Feeder Pipeline (see Section 2.2.2.4) also apply to the Lake Fork-Yellowstone and Big Sand Wash-Roosevelt Pipelines.

2.5.2.5 High Mountain Lakes Stabilization

High mountain lakes stabilization under the Twin Pots Alternative would include those lakes stabilized under the Proposed Action (see Section 2.2.2.5). In addition, four high mountain lakes in the upper Lake Fork River watershed that were modified in the 1920s for water storage would be stabilized under this alternative. Map 2-14 shows their locations.

Tables 2-31 and 2-32 list existing and proposed future characteristics of the additional four high mountain lakes that would be stabilized under the Twin Pots Alternative. Table 2-33 lists construction requirements for the motorized/mechanical tools stabilization of Brown Duck, Island, and Kidney Lakes. The minimum tools construction requirements for Clements Lake, the fourth lake, would include a crew of 12 in one camp and require 27 pack trips. They would remove 376 cubic yards while expending 4,120 labor hours over a 9-week period. The general description of facilities, construction procedures, and operation and maintenance procedures presented for the Proposed Action (see Section 2.2.2.5) also apply to the Twin Pots Alternative.

2.5.2.6 Fish and Wildlife

2.5.2.6.1 Enhancement. Three fish and wildlife enhancements would be implemented under the Twin Pots Alternative. They were described under the Proposed Action (see Section 2.2.2.6.1) and include Big Game Winter Range Improvement, Habitat Acquisition Red Rocks/Duchesne Drainage property, and Twin Pots Reservoir Improvement.

2.5.2.6.2 Mitigation. Three fish and wildlife mitigation measures would be implemented under the Twin Pots Alternative. These three measures would be the same as described for the Proposed Action (see Section 2.2.2.6.2) except for differences noted below.

2.5.2.6.2.1 Wildlife Habitat/Wetland Mitigation. Under the Twin Pots Alternative, mitigation measures to compensate for impacts on wildlife habitat that cannot be avoided would be implemented at the Evans and Clay Basin mitigation sites. The current vegetation cover types and the area of each type, along with the proposed acreage on which habitat development and habitat improvement measures would be implemented, are discussed in Chapter 3, Section 3.9 Wetland and Riparian Resources and Section 3.10 Wildlife Resources of this Draft EIS. In total, habitat improvement and habitat development measures would be implemented on 298 acres.

Under the Twin Pots Alternative, the wetland preservation and maintenance system program would be the same as described under the Crystal Ranch Alternative (see Section 2.4.2.5.2.1).

2.5.2.6.2.2 High Mountain Lakes Fish Habitat. Fourteen high mountain lakes currently used for seasonal irrigation water storage and delivery would be stabilized in the same manner as described for the Proposed Action (see Section 2.2.2.6.2.4). This would encourage the growth of submerged aquatic plants around the lake perimeter, which would further stabilize shoreline sediments and provide fish habitat. Fish stocking programs would remain the same as at present.

Table 2-31 Existing Characteristics of High Mountain Lakes Proposed for Stabilization under the Twin Pots Alternative[a]							
	Existing Dam						
Lake	Year Constructed	Mechanized Equipment Used?	Hydraulic Height (ft)	Crest Length (ft)	Lake Storage Volume[b] (ac-ft)	Trench Depth (ft)	Lake Surface Area (ac)
Brown Duck	1929/77	Yes	11	381	280	2.5	33
Island	1929/77	Yes	16.2	351	1,050	7.0	70
Kidney	1929/77	Yes	19.8	700	3,500	6.3	202
Clements	1922	No	13	590	420	0	58

[a]See Table 2-10 for other lakes included in this alternative.
[b]Calculated from data provided by the State of Utah Division of Water Rights.

Table 2-32 Future Characteristics of High Mountain Lakes Following Stabilization under the Twin Pots Alternative*						
	Stabilized Dam			Water Surface Elevation		
Lake	Breach Height (ft)	Breach Length (ft)	Surface Area (ac)	Natural (ft)	Existing (ft)	Stabilized (ft)
Brown Duck	8	25	29	10,172	10,181	10,177
Island	10	25	58	10,243	10,253	10,248
Kidney	12	25	180	10,278	10,290	10,281
Clements	9	25	31	10,466	10,477	10,471

*See Table 2-11 for other lakes included in this alternative.

Table 2-33
Construction Requirements for the Stabilization of
High Mountain Lakes under the Twin Pots Alternative
Using Motorized/Mechanical Tools*

Lake	Material Removed (cu yd)	No. of Laborers Required	Labor		No. of Camps	Pieces of Equipment	No. of Helicopter Flights	Staging Area (ac)	Fuel Consumption (gal.)
			Hours	Weeks					
Brown Duck	425	9	8,987	25	1	5	41	1	5,563
Island	625	9	13,210	37	1	5	60	1	7,347
Kidney	574	9	12,135	34	1	5	55	1	6,893

*See Table 2-11 for other lakes included in this alternative.

2.5.2.6.2.3 ***Fish Passage.*** Five existing diversion structures would be replaced with new diversion dams, and two new diversion structures would be built. These diversion dams would be designed to provide passage for juvenile and adult fish throughout the year as described in Section 2.2.2.2.

2.5.2.7 Land Retirement

The land retirement program described in Section 2.2.2.8 of the Proposed Action also applies to this alternative.

2.5.3 Delivery of Project Water

The general discussion of delivery of project water under the Proposed Action (see Section 2.2.3) also applies to the Twin Pots Alternative. However, municipal and industrial water would be delivered directly to the City of Roosevelt via the Big Sand Wash-Roosevelt Pipeline. Table 2-34 shows the amount of water that would be delivered under this alternative and the increased water deliveries. Table 2-35 shows future wet, average, and dry year flows in river reaches under the Twin Pots Alternative. Further details on stream flow regime are presented in Chapter 3, Section 3.6 Water Resources and Hydrology of this Draft EIS.

2.5.4 Summary of Project Detail

This section summarizes the amount of land to be impacted, the amount of acquisition, and the construction schedule for the Twin Pots Alternative. Table 2-36 summarizes the amount of land to be temporarily and permanently disturbed and is based on previous discussions of project feature disturbances. Table 2-37 shows the amount of land acquisition by ownership. Acquired land includes withdrawals (federal land), purchase or condemnation, and easements (temporary and permanent). The summary of construction schedules for all project features and mitigation measures is presented in Figure 2-13.

2.6 No Action Alternative

In the No Action Alternative, none of the features proposed in the Proposed Action or action alternatives would be constructed. Existing water supply conditions within the Upalco Unit would continue, and the needs and purposes of the project would remain unmet. Anticipated environmental impacts of the project would not occur, and proposed fish and wildlife enhancements and recreation developments would not be implemented.

Under the No Action Alternative, authorization to construct the Upalco Unit Replacement Project would terminate pursuant to provisions of Section 201(c) of the Central Utah Project Completion Act (CUPCA). Authorization for construction of a Section 203 Project would continue for 5 years from the date of completion of the Feasibility Studies pursuant to Section 203(a) of the CUPCA. A separate EIS and National Environmental Policy Act compliance would be required.

Table 2-34
Irrigation Water Supplies under Baseline Conditions and with the Twin Pots Alternative

Water Rights	Supply (acre-feet)		
	Baseline	With Project	Change
Indian (1861)	42,093	49,423	7,330
Secondary	95,301	102,481	7,180

Table 2-35
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Twin Pots Alternative

Reach	Month											
	October	November	December	January	February	March	April	May	June	July	August	September
Y-1--Yellowstone High Mountain Lakes Storage (acre-feet)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Y-2--Yellowstone High Mountain Lakes to Reservoir (cfs)*												
Wet	136	93	74	63	57	81	75	315	818	458	236	157
Average	99	74	81	54	54	55	82	297	479	186	140	111
Dry	67	52	45	46	40	43	82	169	172	81	82	60
Y-3--Crystal Ranch Reservoir Storage (acre-feet)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Y-4--Reservoir to Yellowstone Feeder Diversion (cfs)												
Wet	136	93	74	63	57	61	75	311	818	458	236	157
Average	99	74	81	54	54	55	82	297	479	186	140	111
Dry	67	52	45	43	40	43	82	169	172	81	82	60
Y-5--Yellowstone Feeder Diversion to Confluence (cfs)												
Wet	79	86	74	63	57	60	60	297	682	362	193	150
Average	44	81	99	54	54	54	60	239	383	121	87	86
Dry	27	40	37	43	40	40	60	134	112	46	76	53
LF-1--Lake Fork High Mountain Lakes Storage (acre-feet)												
Wet	0	0	0	0	0	0	0	0	0	0	0	0
Average	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
LF-2--Lake Fork High Mountain Lakes to Moon Lake (cfs)*												
Wet	37	32	37	46	32	43	40	333	789	371	193	103
Average	63	46	37	46	46	43	63	342	520	150	99	65
Dry	44	37	40	28	28	43	77	243	228	46	56	40
LF-3--Moon Lake to Farnsworth Diversion (cfs)												
Wet	0	3	46	12	0	0	43	223	661	147	256	137
Average	0	0	3	3	3	0	43	232	421	392	247	110
Dry	0	0	0	0	0	0	43	297	308	214	55	40
LF-4--Farnsworth Diversion to Rowley Ditch Diversion (cfs)												
Wet	0	3	46	12	0	7	57	119	530	312	147	60
Average	0	3	3	3	3	0	57	134	291	270	171	78
Dry	0	0	0	0	0	0	57	131	197	177	55	39

Notes:
*These data are based on information from the Rivermaster and Dam tender.
All storage data are end-of-month values.

Table 2-35
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Twin Pots Alternative

Reach	Month											
	October	November	December	January	February	March	April	May	June	July	August	September
LF-5--Rowley Ditch Diversion to Confluence (cfs)												
Wet	10	13	29	22	45	47	67	429	540	322	157	90
Average	13	13	13	13	40	13	67	443	301	280	181	88
Dry	10	10	45	10	45	45	67	141	207	107	65	39
LF-6--Confluence to "C" Canal Diversion (cfs)												
Wet	89	89	100	85	76	76	85	189	986	443	157	139
Average	53	74	73	67	64	67	45	107	150	171	105	90
Dry	47	47	47	53	50	40	85	40	107	110	72	72
LF-7--"C" Canal Diversion to South Boneta Diversion (cfs)												
Wet	89	89	100	85	76	76	76	176	969	426	443	131
Average	94	74	73	67	64	67	80	183	443	155	94	90
Dry	37	47	47	53	50	40	77	67	92	133	72	72
LF-8--South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion (cfs)												
Wet	89	89	100	85	76	76	75	172	965	421	139	129
Average	53	74	74	67	64	67	79	100	429	150	94	89
Dry	47	47	47	53	50	40	76	80	85	101	72	72
LF-9--Big Sand Wash Feeder Pipeline Diversion to Purdy Ditch Diversion (cfs)												
Wet	3	33	45	53	45	80	45	74	690	265	94	43
Average	3	11	15	21	29	40	35	92	245	74	39	22
Dry	3	3	2	3	3	23	29	40	45	45	29	17
LF-10--Purdy Ditch Diversion to Red Cap Diversion (cfs)												
Wet	3	33	45	53	45	80	37	62	677	251	13	37
Average	3	11	15	21	29	40	32	71	232	50	39	17
Dry	3	3	2	3	3	23	40	29	47	33	29	14
LF-11--Red Cap Diversion to Hamilton-Knudsen Diversion (cfs)												
Wet	3	33	45	53	45	80	32	40	644	218	10	27
Average	3	11	15	21	29	40	27	40	201	29	3	8
Dry	3	3	2	3	3	23	40	7	7	7	7	7
LF-12--Hamilton-Knudsen Diversion to Duchesne River (cfs)												
Wet	3	13	45	53	40	85	31	40	642	217	10	27
Average	3	11	15	21	29	45	27	40	230	29	3	8
Dry	3	3	2	3	3	23	40	7	7	7	7	7

Notes:
*These data are based on information from the Rivermaster and Dam tender.
All storage data are end-of-month values.

Table 2-36
Amount of Tribal and Non-Tribal Land to be Temporarily Disturbed and Restored or Permanently Encumbered by Project Features of the Twin Pots Alternative

Project Features	Acres Temporarily Disturbed and Restored			Acres Permanently Encumbered*		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Dams and Reservoirs Big Sand Wash	0	34	34	0	340	340
Diversion Dams	3.8	9.5	13.3	1.3	8.5	9.8
Canal Rehabilitation	1.9	41.6	43.5	1.9	122.0	123.9
Pipelines	15.0	61.5	76.5	15.0	61.5	76.5
Fish and Wildlife: Enhancements	9.0	0	9.0	12.3	0	12.3

*Encumbered includes land whose use is limited by permanent acquisition such as ownership, right-of-ways, or easements.

Table 2-37
Amount of Land Acquisition (Acres) by Ownership for Project Features of the Twin Pots Alternative

Project Features	Ownership				
	Federal	State	Tribal	Private	Total
Dams and Reservoirs Big Sand Wash	0	98	0	340	438
Diversion Dams	0	0	5.1	18.0	23.1
Canal Rehabilitation	0	0	3.8	163.6	167.4
Pipelines	0	91.5	30.0	31.5	153.0
Fish and Wildlife: Enhancements*	0	0	21.3	0	21.3
Land Retirement	0	0	0	1,300	1,300

*In addition, all or a portion of 15,480 acres of privately owned Red Rocks/Duchesne Drainage property would be acquired.

Figure 2-13
Construction Schedule for the Twin Pots Alternative

Year 1

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Big Sand Wash Dam												
Diversion Dams			8	8	8					8	8	8
Rehabilitate Canals												
Pipelines							24	30	30	30	22	
High Mountain Lakes												
Fish and Wildlife and Recreation Developments			10	10	10	10	10	10	10	10		
Total Workers	0	0	18	18	18	10	34	40	40	48	30	8

Year 2

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Big Sand Wash Dam			20	40	68	63	64	64	28	28	20	15
Diversion Dams												
Rehabilitate Canals												
Pipelines			20	30	30	30	30	30	30	30	30	12
High Mountain Lakes				18	18	18	18	18				
Fish and Wildlife and Recreation Developments												
Total Workers	0	0	40	88	116	111	112	112	58	58	50	27

Year 3

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Big Sand Wash Dam	10	10										
Diversion Dams			8	8	8					8	8	8
Rehabilitate Canals			23	23	23				23	23	23	10
Pipelines	12	12	20	20	20	20	20	20	20	20	12	5
High Mountain Lakes					30	30	18	18	18			
Fish and Wildlife and Recreation Developments												
Total Workers	22	22	51	51	81	50	38	38	61	51	43	23

Year 4

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Big Sand Wash Dam												
Diversion Dams			8	8	8					8	8	8
Rehabilitate Canals			23	23	23				23	23	23	10
Pipelines	5	10	10	10								
High Mountain Lakes					27	27	27	27				
Fish and Wildlife and Recreation Developments												
Total Workers	5	10	41	41	58	27	27	27	23	31	31	18

Year 5

Feature	J	F	M	A	M	J	J	A	S	O	N	D
Big Sand Wash Dam												
Diversion Dams												
Rehabilitate Canals												
Pipelines			36	48	48	48	48	48	48	36		
High Mountain Lakes				30	30	18	18	21				
Fish and Wildlife and Recreation Developments							7	7	7	7		
Total Workers	0	0	36	78	78	66	73	76	55	43	0	0

Estimated average number of workers per month shown above shaded areas.

Chapter 3
Affected Environment and Environmental Consequences

3.1 Introduction

This chapter describes the affected environment and environmental consequences that would result from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit Replacement Project (hereafter referred to as the Upalco Unit). The affected environment discussions describe existing conditions for resources within the project area of influence. The impact analyses focus on potential direct, indirect, total, and cumulative impacts on these resources. Potentially significant impacts, together with criteria developed at the outset of this study for assessing the significance of potential impacts, are identified. Mitigation measures are identified that would reduce or avoid certain adverse impacts or would compensate for some unavoidable adverse impacts. The final section of this chapter describes the irreversible and irretrievable commitment of resources for resource topics.

Technical reports and background documents were prepared for a number of the resource areas addressed in this Draft Environmental Impact Statement (Draft EIS). They contain detailed information on the affected environment and environmental consequences and were used in the preparation of this Draft EIS. These reports and documents are listed in Table 3.1-1. Limited numbers of each will be available for public review at the same location as this Draft EIS. This Draft EIS also references results of studies prepared for the Draft EIS for the Uintah Unit Replacement Project (hereafter referred to as the Uintah Unit), which is being prepared concurrently with the Upalco Unit Draft EIS. Copies of the Uintah Unit Draft EIS studies are available for public review at the Central Utah Water Conservancy District (CUWCD) offices.

3.2 Common Assumptions and Assessment Guidelines

A number of common assumptions and assessment guidelines were followed during the preparation of this Draft EIS and during the preparation of technical reports and background documents referenced in Section 3.1. These common assumptions and assessment guidelines are listed below. Assumptions and guidelines for specific resource areas are contained in the technical reports and background documents listed in Table 3.1-1.

- This Draft EIS is intended to satisfy National Environmental Policy Act (NEPA) requirements.
- More detailed studies and analyses would be conducted as part of some subsequent permitting processes and final project design.
- Project features were designed only to the feasibility level, which represents reasonable approximations for assessing potential project impacts and recommending appropriate mitigation measures.
- The expected life of the project is 100 years.
- Data sources and collection methods, impact analysis techniques, and significance criteria are described in specialist work plans and technical reports and were reviewed and commented on by the Department of the Interior (DOI), resource and regulatory agencies, the Ute Tribe, the Utah Outdoor Interests Coordinating Council (UOICC), and the project Planning Team at the initiation of the project.
- Data sources are from readily available literature and from specific project-area studies that were reviewed and commented on by agencies, the Ute Tribe, the UOICC, and the project Planning Team at the initiation of the project.

Table 3.1-1 Draft Technical Reports and Background Documents		
Title	**Author**	**Date**
Water Resources Technical Report, Upalco Unit Replacement Project and Uintah Unit Replacement Project, Central Utah Project	CH2M HILL/Horrocks	December 1996
Environmental Contaminants Technical Report, Upalco Unit Replacement Project and Uintah Unit Replacement Project, Central Utah Project	CH2M HILL/Horrocks	December 1996
Aquatic Resources Technical Report, Upalco Unit Replacement Project and Uintah Unit Replacement Project, Central Utah Project	CH2M HILL/Horrocks	December 1996
Wetland/Riparian Resource Technical Report, Upalco Unit Replacement Project and Uintah Unit Replacement Project, Central Utah Project	CH2M HILL/Horrocks	December 1996
Wildlife Resources Technical Report, Upalco Unit Replacement Project and Uintah Unit Replacement Project, Central Utah Project	CH2M HILL/Horrocks	December 1996
Threatened and Endangered Species Technical Report, Upalco Unit Replacement Project and Uintah Unit Replacement Project, Central Utah Project	CH2M HILL/Horrocks	December 1996
Cultural Resources Technical Report, Upalco Unit Replacement Project and Uintah Unit Replacement Project, Central Utah Project	Sagebrush Archaeological Consultants, Inc.	December 1996
Technical Report: Social & Cultural Impact Assessment, Uinta Basin Replacement Project	Dornbusch & Co., Inc.	August 1995
Technical Report: Socio-Economic Impact Assessment, Uinta Basin Replacement Project	Dornbusch & Co., Inc.	August 1995
Technical Report: Transportation Impact Assessment, Uinta Basin Replacement Project	Dornbusch & Co., Inc.	August 1995
Technical Report: Public Health & Safety Impact Assessment, Uinta Basin Replacement Project	Dornbusch & Co., Inc.	August 1995
Technical Report: Recreation Impact Assessment, Uinta Basin Replacement Project	Dornbusch & Co., Inc.	August 1995
Technical Report: Visual Quality Impact Assessment, Uinta Basin Replacement Project	Dornbusch & Co., Inc.	August 1995
Riparian Habitat Improvement Plan for the Central Utah Project: Uinta Basin Replacement Project	ECOTONE Environmental Consulting, Inc.	November 1995
Big Game Winter Range Improvement Plan for the Uintah and Ouray Indian Reservation Lands Associated with the Central Utah Project: Uinta Basin Replacement Project	ECOTONE Environmental Consulting, Inc.	August 1995
Recreation Site Enhancement Plan for the Uintah and Ouray Indian Reservation Lands Associated with the Central Utah Project: Uinta Basin Replacement Project	ECOTONE Environmental Consulting, Inc.	August 1995

- Environmental resource data have been developed and analyzed to the level of detail necessary to understand potential impacts and to distinguish project effects (both beneficial and adverse) among the Proposed Action and alternatives.

- The hydrology model developed for this study is the best available representation of current and predicted project water distribution.

- The hydrology model is the basis for assessing flow-related impacts on biological resources (aquatic resources, wetland/riparian resources, threatened and endangered plant and fish species) and for evaluating water quality and environmental contaminants' effects.

- All entities responsible for the implementation and operation of the project would remain the same over the life of the project.

- Mitigation measures would be implemented concurrent with the construction of project features.

- Fish and wildlife enhancements and recreation developments are considered to be project features that would improve environmental and recreation values in the Uinta Basin and are not intended to serve as mitigation measures.

- Impacts on non-Indian lands would be mitigated for on non-Indian lands.

- Cumulative impacts consist of the impacts of the Upalco Unit subject alternative (either the Proposed Action—Talmage, Cow Canyon Alternative, Crystal Ranch Alternative, or Twin Pots Alternative) plus the impacts of the Uintah Unit Proposed Action—Lower Uintah.

- Monitoring would be conducted to further define potential impacts of certain project actions (e.g., land retirement, changes in peak river flows) on wetlands.

- For the purpose of impact analysis, no distinctions were made between wetlands subject to jurisdiction under Section 404 of the Clean Water Act (CWA) and those that are not.

3.3 Sociocultural Resources

3.3.1 Introduction

This section addresses potential direct, indirect, total, and cumulative sociocultural impacts resulting from the construction, operation, and maintenance of the Proposed Action and alternatives of the Upalco Unit. The unique facets of a society—its social and cultural resources, group identity, autonomy, folkways, lifestyle, and relationship to the environment—can be significantly affected by any large-scale resource development project. This analysis focuses on the Native Americans living on and adjacent to the Uintah and Ouray Reservation, and the primarily Anglo-Saxon communities living near the Reservation.

3.3.2 Issues Eliminated from Further Analysis

All sociocultural issues identified during public scoping were analyzed. None were eliminated.

3.3.3 Issues Addressed in the Impact Analysis

Social and cultural issues identified during public scoping are addressed in the impact analysis and include the following:

1. Consistency of project features with traditional cultural values and desired lifestyles of Uinta Basin communities

2. Potential for Tribal and non-Indian autonomy in project control and management

3. Opportunities for economic growth provided by the project

4. Potential project effects on the non-Indian agrarian lifestyle in the Uinta Basin

5. Compatibility of recreational/environmental components of the project with non-Indian agrarian lifestyles

3.3.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes Duchesne and Uintah Counties in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the Uinta Basin's two principal population groups: Ute Indian Tribal members and the largely Anglo-Saxon residents of Duchesne and Uintah Counties.

3.3.5 Affected Environment

3.3.5.1 Ute Indian Tribe

As of September 1993, there were 3,158 members of the Ute Tribe in the region, the majority of whom live on the Uintah and Ouray Reservation (U.S. Bureau of Indian Affairs [BIA] 1993). The Ute Tribe is comprised of three bands: the Uintah, White River, and Uncompahgre. A six-member Business Committee, made up of two representatives from each band, elected by the band, oversees the Tribe's economic and social affairs. The Tribe's business is administered primarily from offices in Fort Duchesne and at Bottle Hollow, near Fort Duchesne, on U.S. Highway 40.

While the preservation of Ute culture is of foremost importance to the Tribal members on the Reservation, the need to balance traditional lifestyles with Tribal economic development is also widely recognized. Unlike their non-Indian neighbors, the Utes have not traditionally identified themselves as an agrarian people. The small portion of Ute families that practice agriculture grow alfalfa and grass hay for their livestock, and very few, if any, depend entirely on farming or ranching for their livelihood. Much of the farming on the Reservation is conducted by non-Indians who lease land from the Tribe. (Precise estimates of what portion of irrigated Tribal lands is leased are not available; however, it is estimated to be as high as 80 percent [Hugie 1995a].)

3.3.5.1.1 Control of Land and Natural Resources. For the greater part of their history, the Ute people have sought self-sufficiency. Even today, autonomy and self-determination are important issues to the Tribe. Efforts to turn Tribal members into farmers have mostly resulted in an increased reliance on outside, usually governmental, assistance. A large portion of the Reservation is arable and already under irrigation and therefore would benefit from increased water deliveries. However, Tribal members are suspicious of new proposals to develop the region's water because they believe past development projects have not greatly benefited them and often led to the appropriation of their resources by non-Indians.

Tribal sentiment regarding a new water project may depend in large part on the level of perceived Ute project control. This psychological element may depend on the location of new water storage facilities and the involvement of the Tribe in the planning and operation of those facilities. A general sentiment of the Tribe is that if it loses control of its water, the Tribe's sovereignty may be lost as well. Even if the project is structured to provide for Tribal control of its water but Tribal members perceive they do not have this control, they may not be supportive of the project.

3.3.5.1.2 Economic Development. For the Ute Tribe, the evaluation of any dam/irrigation project involves balancing Tribal economic development goals with the needs of their culture. Therefore, the possibility of increased water for agriculture and on-Reservation recreation opportunities may not alone make a project favorable. While the benefits that accrue to the Ute people need to fill perceived Tribal economic needs, the most significant of which is employment, these benefits must be attained in a manner that is consistent with their way of life.

Historically, the government has planned and implemented irrigation projects with only perfunctory concern for Tribal economic benefits. However, as the monetary settlement gained by the

Tribe through Title V of Public Law 102-575 demonstrates, the Ute people today are aware of the financial possibilities that water can produce and the economic potential of developing new supplies of water and water-based recreation in the Uinta Basin. Therefore, despite their ideological concerns regarding the impoundment of water (see Section 3.3.5.1.3), the Tribe has shown great resolve in attempting to develop their water resources. For example, in 1965, the Tribe entered into a Deferral Agreement with the United States whereby they were promised reservoirs for the impoundment and management of Tribal water. From that time through to the present, the Tribe has continually demanded that these promises be fulfilled.

3.3.5.1.3 Water. Water is one of two primary symbols in Ute religion—the other being the sun (or fire). Water plays a central role in many Ute ceremonies and is central to their spiritual way. An extremely important conviction of the Northern Utes is that water not be disrupted or impounded, but allowed to flow freely. In traditional Ute beliefs, which are still held by many in the Tribe today, the power in water is both depleted and replenished through motion. Interruption of flowing water can result in its power becoming unstable and dangerous. Many Northern Utes fear they will be punished for damming water and that water that is not allowed to flow gets old and breeds unnatural, and possibly harmful, forms of life.

3.3.5.2 Basin's Non-Indian Population

The second major cultural group present in the Uinta Basin consists of an Anglo-Saxon population that began migrating to the area in significant numbers when the Reservation was opened to homesteading in 1905. As the chief occupational aim of these settlers was farming, they quickly formed themselves into irrigation compacts and companies.

The descendants of these people comprise approximately 85 percent of the Uinta Basin's present population and live mostly in cities and towns within the Uintah and Ouray Reservation's original boundaries (U.S. Census Bureau 1991). While not as ethnically homogenous as the Utes, the non-Indians in the Basin are predominantly of the Mormon faith, a fact that contributes greatly to their society's cohesiveness. The Mormons have played a prominent role in the development of the arid West. Water storage and irrigation technologies developed by the Mormons contributed significantly to the efforts and success of the U.S. Bureau of Reclamation (USBR) and others in reclaiming millions of acres of western desert through water resource development.

3.3.5.2.1 Control of Land and Natural Resources. Many of the non-Indian basin residents see their independent lifestyle undermined by a government that is overregulatory and intrusive. They perceive the government's control of much of the area's lands and its restrictions on use and access to that land as an impingement on their freedom to prosper. These people, whose ancestors migrated to Utah in pursuit of personal freedom, are dismayed at their inability to effect their own agricultural prosperity because of restrictions on water use. Autonomy, therefore, is also foremost in the minds of the non-Indians of the Uinta Basin. As a highly unified society, they feel capable of serving the overall public interest and believe that government intrusion in resource management only jeopardizes their right of self-determination.

For decades, the federal and state governments have assured the non-Indian residents of the Uinta Basin that they would be provided with new water storage and conveyance systems to alleviate, if not eliminate, the water shortage problems faced by many farmers in the region. The Basin's endorsement of the original Central Utah Project (CUP) was a key element in this process. While the CUP design included water storage facilities and conveyance systems to serve parts of the Basin itself, water development in the Basin was never fully realized. Believing that their water has not been developed as promised in the past, a large portion of the Basin's non-Indian population, much like their Ute neighbors, is suspicious and skeptical of further government efforts to develop the region's water.

3.3.5.2.2 **Economic Development.** The non-Indian residents of the Basin are anxious to foster economic growth and prosperity through augmented agricultural viability. However, they are also concerned about the problems that can accompany resource development such as those experienced in the past. Oil shale extraction in the Basin in the late 1970s was accompanied by a substantial increase in a variety of social problems, including crime. Population increases in the Basin's non-Indian communities during this period were comprised primarily of individuals who came to the area solely to take advantage of new employment opportunities. Many only remained in the area as commuters or seasonal residents and did not contribute significantly to local communities. When oil prices dropped and economic recession struck the country in the early 1980s, there was significant migration from the Basin and retraction of the local economy. Consequently, any new large resource development project may raise concerns of a similar boom-bust economic cycle and be met with some anxiety by the Basin's non-Indian residents.

Despite the prospect of development-associated social problems, many perceive the current situation of Basin agriculture as precarious, an economic consideration that has dynamic effects on the cultural viability of the region and is the impetus behind a general desire for the rapid and efficient development of the region's water resources.

3.3.5.2.3 Water. Water to the non-Indian residents of the Uinta Basin does not carry the same types of spiritual qualities that it does for many Utes. Nevertheless, water (through agriculture) is the foundation of their cultural history. To the Basin's non-Indians, water is seen as a vital economic resource to be secured in the quest for sustaining a traditional, agrarian lifestyle. To them, water is the commodity that gives their arid region economic stability, and water rights are what give land value; water that is not diverted and used to irrigate fields and grow crops is considered wasted.

3.3.6 Impact Analysis

3.3.6.1 Significance Criteria

Potential impacts on the Basin's Indian and non-Indian societies are considered significant if the following conditions exist:

1. Project features would threaten the future of the Ute Tribe's or non-Indian autonomy and cultural self-sufficiency.

2. Project features would be markedly inconsistent with traditional Ute or non-Indian beliefs and ideologies surrounding water and other natural resources.

3. Implementation of project features would have a long-term beneficial impact on the efforts of the Basin's non-Indians to maintain their agrarian-based lifestyle.

4. The different project features included in the Proposed Action and each alternative, especially those that would potentially impact tourism and recreation, appear to conflict with Indian and non-Indian lifestyles within the Basin.

Significant impacts on the Basin's two principal cultures predicted to occur as a result of implementing the Proposed Action or alternatives include the following:

1. Some erosion of Ute Tribal autonomy because of dam location and the encroachment of non-Indians onto Reservation lands (mostly during project construction)

2. Violation of traditional Ute ideologies surrounding their relationship to, and use of, water

3. Enhancement of Ute Tribal opportunities for economic development and autonomy through the creation and rehabilitation of on-Reservation outdoor recreation destinations

4. Provision of significant short-term employment opportunities for Basin residents

5. Fortification of the non-Indian agrarian lifestyle through construction of long-promised irrigation water storage and delivery systems

6. Creation of new water-based outdoor recreation opportunities within the Uinta Basin

3.3.6.2 Potential Impacts Eliminated from Further Analysis

Impacts on the region's sociocultural resources eliminated from further analysis include the following:

1. Project oversight authority. (At all stages of project planning, development, and implementation, both Indian and non-Indian Basin residents would have a substantial oversight role. The social and cultural impact of this authority on the two cultures' autonomy would be uniform across all project alternatives.)

3.3.6.3 Proposed Action–Talmage

3.3.6.3.1 Ute Indian Tribe. The location of Crystal Ranch Dam and Reservoir on the Reservation may have a beneficial impact on Tribal self-determination by providing the Tribe with a management role in reservoir storage and releases. In addition, the location may ease the concerns of some Tribal members that the project may simply siphon water away from the Reservation. The high mountain lakes stabilization included in the Proposed Action (which would move water into lower-elevation reservoirs) would provide the Tribe with current information on the distribution of the region's waters.

One significant drawback of the Proposed Action would be the significant non-Indian activity on the Reservation during project construction. While oil development on the Reservation has also resulted in the necessary intrusion of non-Indians onto Tribal lands, further activity could still be viewed by Tribal members as an additional threat to their sovereignty.

Water storage, pipeline construction and diversion, and canal rehabilitation elements of the Proposed Action would have a positive impact on agricultural production on the Reservation. The project would also provide significant employment and income benefits to the Tribe during its construction. The Proposed Action would not only make it possible to increase the amount of Reservation land under irrigation, but also to raise the amount of water delivered to currently irrigated lands. Furthermore, the ability to better control irrigation scheduling could have a significant impact on farm productivity. While an agrarian lifestyle is not truly consistent with Tribal culture, additional water supplies could increase Reservation land values and concurrently increase Tribal returns from farming and leasing. In the long run, this economic benefit may help the Tribe to become more self-sufficient and thus help to protect its culture and way of life.

Under the Proposed Action, the Tribe could earn economic benefits from the recreation opportunities created by Crystal Ranch and Twin Pots Reservoirs. The new campground at Crystal Ranch Reservoir and the improved facilities at Clay Basin Pond should also enhance the recreation resources of the Reservation and the Basin as a whole. Recreation is a method of economic development highly favored by the Tribe because it does not necessarily infringe on Tribal values with respect to resource use.

While damming of the Yellowstone River may contradict Ute traditional beliefs regarding the flow of water, it would fulfill some of the Tribe's long-standing water storage goals. Additionally, the re-establishment of riparian habitat in degraded areas along the Yellowstone and Lake Fork Rivers should help to mitigate some of the Tribe's ideological concerns regarding dam construction.

3.3.6.3.2 Basin's Non-Indian Population. Assuming that Crystal Ranch Reservoir would not impinge on water allocations to non-Indian residents of the Basin, its location should not have a strong sociocultural impact on that community. However, there is a possibility that some non-Indian Basin residents who wish to use the new reservoir for recreation may be deterred by its on-Reservation location. Expanded recreation opportunities at Big Sand Wash Reservoir could help to partially offset these concerns.

Agriculture is of central importance to traditional Mormon culture and is a principal component of the Basin's economy. The Proposed Action may therefore be highly favorable to the Basin's non-Indian residents because it would result in a marked increase in irrigation water deliveries and security. The non-Indians in the Basin may also welcome the economic benefits associated with construction and implementation of the reservoir and other project features.

Damming the Yellowstone River and enlarging Big Sand Wash Reservoir should be looked upon as a favorable use of the region's water by the Basin's non-Indians because of the resulting potential benefits to agriculture. They may also consider canal rehabilitation and other water delivery system improvements to be an extremely valuable investment. The Proposed Action includes the greatest increase in water deliveries to Indian and non-Indian lands of the Upalco Unit alternatives. For this reason, non-Indian residents are likely to endorse the Proposed Action. With excess demand for water-based recreation in the Basin, construction of a new and accessible reservoir and enlargement of another reservoir may also be viewed as highly favorable uses of the Basin's water and enhancement of the non-Indian way of life.

3.3.6.3.3 Total Impacts. Table 3.3-1 summarizes the potential total sociocultural impacts of the Proposed Action.

3.3.6.3.4 Mitigation. There are no sociocultural mitigation measures for the Proposed Action.

3.3.6.4 Cow Canyon Alternative

3.3.6.4.1 Ute Indian Tribe. The location of Upper Yellowstone Dam and Reservoir north of the Reservation boundary could have significant ramifications on Tribal perceptions of their control of the region's water resources. Unlike the proposed enlargement of Big Sand Wash Reservoir, this project feature could have a significant effect on water flowing across the Reservation. While agricultural water deliveries may not be greatly affected (compared to the Proposed Action), the Utes may be uncomfortable with the ability of this reservoir to keep water from Ute lands. Furthermore, though it would be located off the Reservation, the Upper Yellowstone facility would generate considerable non-Indian traffic on the Reservation both during and after its construction. This could adversely impact Tribal efforts to maintain the sanctity of their lands.

This alternative would provide less economic potential for the Tribe than the Proposed Action. In terms of agriculture, the amount of new acreage that would be irrigated and the amount of water delivered to the average acre of irrigated land would be the same. The prospects for short-term construction employment are likely to be about the same, except that the off-Reservation location of the proposed dam could reduce the number of employment opportunities available to the Tribe (compared to the Proposed Action).

This alternative also carries lower potential for economic growth through recreation development. The location of the reservoir could limit the recreational benefits that would accrue to the Tribe.

Table 3.3-1
Sociocultural Resource Impact Summary
Proposed Action – Talmage

	Resource Control	Economic Development	Water	Overall
Ute Tribe	Beneficial	Very Beneficial	Adverse	**Beneficial**
Non-Indians	Beneficial	Very Beneficial	Beneficial	**Beneficial +**

Moreover, this alternative lacks several of the on-Reservation recreation developments and fish and wildlife enhancements of the Proposed Action.

An assessment of impacts on the Tribe relative to their views on water is found in Section 3.3.6.3.1.

3.3.6.4.2 Basin's Non-Indian Population. Construction of Upper Yellowstone Dam and Reservoir entirely on U.S. Forest Service (FS) land may cause non-Indians of the Uinta Basin to feel a little more comfortable with this site than with the Crystal Ranch site. However, non-Indians working for the Ashley National Forest may not look favorably on the placement of the dam, reservoir, fish and wildlife, and recreation features on FS land because funding restrictions are already limiting their ability to maintain recreation facilities. The impact of additional visitors in the area would likely add to their work burden despite mitigation measures to improve existing recreation sites.

Positive non-Indian employment and income effects from project construction and operation would be significant, though less than under the Proposed Action. The absence of additional improvements designed to foster recreation in the Basin may make the non-Indian population less receptive to this alternative. This alternative would generate a comparable though slightly lower amount of new water delivery to non-Indian lands. It would also include significantly fewer pipeline and canal renovations, which may be perceived as problematic for the region's agriculture.

This alternative should be consistent with non-Indian beliefs of water use. However, because it would provide slightly less additional water to the Basin's non-Indian farmers than the Proposed Action, some may think the region's water resources continue to be wasted.

3.3.6.4.3 Total Impacts. Table 3.3-2 summarizes the potential total sociocultural impacts of this alternative.

3.3.6.4.4 Mitigation. No socicultural mitigation measures are proposed for this alternative.

3.3.6.5 Crystal Ranch Alternative

3.3.6.5.1 Ute Indian Tribe. Potential impacts on Tribal autonomy from construction of Crystal Ranch Dam and Reservoir and stabilization of high mountain lakes under this alternative are the same as described for the Proposed Action (see Section 3.3.6.3.1).

This alternative has many features similar to those of the Proposed Action. The exclusion of the Big Sand Wash Reservoir enlargement is favorable with regards to Tribal autonomy because the existing reservoir is located off the Reservation, while the exclusion of Twin Pots Reservoir stabilization, a potentially important on-Reservation recreation resource for the Tribe, is not favorable.

Short-term employment benefits associated with project construction would not be as substantial as under the Proposed Action. Furthermore, new water delivery would be less under this alternative than under the Proposed Action or the Cow Canyon Alternative.

An assessment of impacts on the Tribe relative to their views on water is found in Section 3.3.6.3.1.

Table 3.3-2
Sociocultural Resource Impact Summary
Cow Canyon Alternative

	Resource Control	Economic Development	Water	Overall
Ute Tribe	Very Adverse	Beneficial	Adverse	**Adverse +**
Non-Indians	Neutral	Beneficial	Beneficial	**Beneficial -**

3.3.6.5.2 Basin's Non-Indian Population. An assessment of impacts on non-Indian autonomy from constructing Crystal Ranch Dam and Reservoir is found in Section 3.3.6.3.2. Positive non-Indian employment and income effects from project construction and operation would be significant, though less than under the Proposed Action or the Cow Canyon Alternative. The Crystal Ranch Alternative may also be considered less favorable because it would result in less new water delivery. When compared to the Proposed Action, non-Indian residents may perceive the exclusion of the Big Sand Wash Reservoir enlargement as a failure to maximize water resources of the Basin for agricultural use.

3.3.6.5.3 Total Impacts. Table 3.3-3 summarizes the potential total sociocultural impacts of this alternative.

3.3.6.5.4 Mitigation. No sociocultural mitigation measures are proposed for this alternative.

3.3.6.6 Twin Pots Alternative

3.3.6.6.1 Ute Indian Tribe. Although Big Sand Wash Reservoir is located off the Reservation and would capture waters that have already crossed Reservation lands, the Ute Tribe may still be wary of a reservoir that cannot be monitored on Reservation property. Stabilization of Twin Pots Reservoir could provide additional on-Reservation recreation opportunities.

The Tribe would realize the benefits of direct employment and increased income during project construction, although the smaller scale of this alternative would carry lower economic feature development potential than the Proposed Action or other alternatives.

The Twin Pots Alternative is projected to actually lower the amount of water delivered to the average Indian-owned acre of land under irrigation (includes lands that have been idle), resulting in only a marginal increase in annual net revenues generated from agriculture on those lands affected. In fact, currently irrigated acreage that would receive reduced water deliveries may experience a small decline in revenues. Overall, Indians earnings from leasing should remain unchanged.

This alternative would increase the amount of flat-water recreation opportunities available to the Tribe (with improvements at Twin Pots Reservoir), but it does not include construction of a major project feature site like the Proposed Action or other alternatives. Failure to provide substantial new on- or even near-Reservation recreation opportunities could hurt continued Tribal efforts to improve the quality of life on the Reservation.

Because the proposed expansion of Big Sand Wash Reservoir would not necessitate the obstruction of a river and the construction of a reservoir through damming, it should not upset Ute Tribal members with respect to their ideologies on water. Overall, the less severe environmental impact of this alternative may be looked upon favorably by the Tribe, while its failure to meet Tribal water storage goals may be viewed unfavorably.

3.3.6.6.2 Basin's Non-Indian Population. To non-Indian residents of the Basin, enlargement of a reservoir off the Reservation (Big Sand Wash) and simultaneous stabilization of a reservoir on Ute lands (Twin Pots) could appear to be an effective compromise with their Ute neighbors, lessening any non-Indian concern regarding control of water and water rights. The extensive canal rehabilitation included in this alternative, which may have a

Table 3.3-3
Sociocultural Resource Impact Summary
Crystal Ranch Alternative

	Resource Control	Economic Development	Water	Overall
Ute Tribe	Beneficial	Beneficial	Adverse	**Neutral +**
Non-Indians	Neutral	Beneficial	Beneficial	**Beneficial -**

greater positive effect on the agrarian-based lifestyle of non-Indians than the Tribe, could result in an enhanced ability to manage water to benefit agriculture. However, the failure to directly impound the Yellowstone River may cause great consternation among the Basin's non-Indian residents.

Economic benefits associated with the construction and management of components of the Twin Pots Alternative would undoubtedly be welcomed by the Basin's non-Indian residents. However, failure to take full advantage of the area's water resources could be perceived as an abject sacrifice of the future of agriculture in the region. Relative to other alternatives, the prospects for agriculture, and therefore agrarian lifestyles, are poor under the Twin Pots Alternative.

3.3.6.6.3 Total Impacts. Table 3.3.4 summarizes the potential total sociocultural impacts of this alternative.

3.3.6.6.4 Mitigation. No sociocultural mitigation measures are proposed for this alternative.

3.3.6.7 No Action Alternative

3.3.6.7.1 Ute Indian Tribe. Without a large construction project, on-Reservation traffic would remain at its present level, reducing Tribal concerns that the Reservation would become crowded with outsiders. However, failure to construct any of the dams set out in the Proposed Action or various project alternatives could be perceived by Tribal members as another case of the government failing to follow through on promises of helping the Tribe to access its rightfully held water. Failure to stabilize high mountain lakes would not provide the Tribe with current information on the distribution of the region's water.

Under a situation of no project implementation, the Ute Tribe would have no opportunities for employment during construction, operation, or maintenance of the project. Nor would they realize the benefits of increased visitation to the area that would likely result from new or improved recreation facilities. Given the high unemployment on the Reservation, the loss of any employment opportunities (even short term) is a concern.

Under this alternative, the Tribe would not face any ideological concerns regarding the impoundment of water.

3.3.6.7.2 Basin's Non-Indian Population. The No Action Alternative could deny non-Indian residents of the Basin what they perceive to be their right regarding development of the area's water resources. Such a situation may directly conflict with the dominant image of independent, self-made family farmers and ranchers. Failure to enhance future water supplies in an already struggling agricultural economy could jeopardize the prospects for revitalization and may threaten its existence.

The No Action Alternative would not provide short-term employment and long-term recreation opportunities that construction of a reservoir would provide. Completion of the Upalco Unit, particularly new reservoir storage, has been promised for decades, only to be repeatedly postponed; the No Action Alternative may be seen by the area's non-Indians as nothing short of betrayal.

3.3.6.7.3 Total Impacts. Table 3.3-5 summarizes the potential total sociocultural impacts of this alternative.

Table 3.3-4
Sociocultural Resource Impact Summary
Twin Pots Alternative

	Resource Control	Economic Development	Water	Overall
Ute Tribe	Neutral	Beneficial	Neutral	**Neutral +**
Non-Indians	Neutral	Neutral	Adverse	**Neutral -**

Table 3.3-5 Sociocultural Resource Impact Summary No Action Alternative				
	Resource Control	Economic Development	Water	Overall
Ute Tribe	Adverse	Adverse	Neutral	Adverse +
Non-Indians	Adverse	Very Adverse	Very Adverse	Very Adverse +

3.3.7 Cumulative Impacts

3.3.7.1 Proposed Action–Talmage and Uintah Unit Proposed Action–Lower Uintah

3.3.7.1.1 Ute Indian Tribe. The Proposed Actions of the Upalco and Uintah Units would carry the most favorable impacts for the Ute Tribe from a sociocultural perspective. Despite the potentially adverse impact on Ute ideologies regarding water and non-Indian encroachment on Tribal lands, construction of the two proposed dams on the northern edge of the Uintah and Ouray Reservation would provide jobs for Tribal members, enhance Indian-run tourism, and greatly foster Indian participation in the process of water management in the Basin.

In terms of recreation development and fish and wildlife enhancement features, these two alternatives offer the greatest positive impact.

3.3.7.1.2 Basin's Non-Indian Population. For the Basin's non-Indian community, the amount of new water available for irrigation would be greatest under this combination of projects. The non-Indians, however, may object to any failure to impound flows of the Whiterocks River. This objection should be somewhat offset by the amount of pipeline construction and rehabilitation and the general, positive impact on agrarian lifestyles in the Basin that would result if both Proposed Actions were implemented.

3.3.7.2 Cow Canyon Alternative and Uintah Unit Proposed Action–Lower Uintah

3.3.7.2.1 Ute Indian Tribe. This combination of alternatives would be the least favorable to Tribal members. The dam included in the Cow Canyon Alternative would lie off Reservation lands. Furthermore, benefits from fish and wildlife enhancement and recreation development features would be comparatively minor and may be judged inadequate in offsetting the less favorable location of the dam.

3.3.7.2.2 Basin's Non-Indian Population. To the non-Indian community, placing one dam on Reservation land (Lower Uintah Dam in the Uintah Unit) and the other on FS land (Upper Yellowstone Dam in the Upalco Unit) could seem a fair compromise. This positive impact would be offset, however, by non-Indian dissatisfaction with this combination's inferior water supply benefits (compared to the combination of both Units' Proposed Actions) and its smaller amount of canal rehabilitation.

3.3.7.3 Crystal Ranch Alternative and Uintah Unit Proposed Action–Lower Uintah

3.3.7.3.1 Ute Indian Tribe. This combination of alternatives would be favorable to the Ute Tribe because of the two on-Reservation dam sites. However, the positive impacts provided by the on-Reservation dams would be partly offset by the exclusion of the fish and wildlife enhancement features at Clay Basin Pond and Twin Pots. Moreover, the scope of non-Indian intrusion resulting from two on-Reservation dams (particularly during construction) may be somewhat disconcerting.

3.3.7.3.2 Basin's Non-Indian Population. This combination of alternatives would provide substantially less new water for non-Indian farmers in the Basin than if the Proposed Actions of both units were implemented. Therefore, the cumulative effects on the region's water supply may not be perceived by the Basin's non-Indians to adequately foster the continued viability of their agrarian lifestyle.

3.3.7.4 Twin Pots Alternative and Uintah Unit Proposed Action–Lower Uintah

3.3.7.4.1 Ute Indian Tribe. The absence of recreation development features present under some of the other Upalco Unit alternatives, and the exclusion of facilities accompanying a second major on-Reservation storage project would have an unfavorable cumulative sociocultural impact on the Ute Tribe. The impact on the Tribe's ideologies regarding water would be less adverse.

3.3.7.4.2 Basin's Non-Indian Population. For non-Indian Basin residents, the cumulative sociocultural benefits of the Twin Pots Alternative and Uintah Unit Proposed Action would be inferior to all other alternative combinations because of inferior water storage capacity. It could appear to some members of the non-Indian community that the Ute Tribe would benefit from the new dam (Lower Uintah) and the stabilization of a reservoir (Twin Pots) on their land, while the non-Indian community would have limited beneficial use of newly developed water in the region.

3.4 Socioeconomics

3.4.1 Introduction

This section addresses potential direct, indirect, total, and cumulative socioeconomic impacts resulting from the construction, operation, and maintenance of the Proposed Action and alternatives of the Upalco Unit. These impacts may result from project construction, as well as the project's effect on recreation resources and the irrigation water supply of the unit. The analysis considers the local impact area, defined as Duchesne and Uintah Counties, and the Uintah and Ouray Reservation. For the purposes of this analysis the Uintah and Ouray Reservation is considered to include those lands over which the Ute Tribe has complete and sovereign control. The socioeconomic group analyzed within the Reservation is the Ute Tribe. This assumption was made solely for the purposes of this analysis and is not an attempt in any manner to delineate the Reservation's boundaries.

3.4.2 Issues Eliminated from Further Analysis

- Population on the Uintah and Ouray Reservation (no project-associated migrants would be housed on the Reservation)
- Population in the Uinta Basin towns of Tabiona, Fruitland, Ouray, Jensen, Myton, Neola, Maeser, and Naples (these towns are either too far from project construction sites or do not have adequate infrastructure to attract project-associated migrants)
- Housing on the Uintah and Ouray Reservation (no project-associated migrants would be housed on the Reservation)
- Community infrastructure, except for law enforcement, on the Uintah and Ouray Reservation (no project-associated migrants would be housed on the Reservation)
- Property tax revenues in the local impact area (elimination partially based on guarantee of government offsets in lieu of eliminated property taxes)
- Net government tax revenues on the Uintah and Ouray Reservation (Tribal government tax revenues on the Reservation should be relatively unaffected by the project.)

3.4.3 Issues Addressed in the Impact Analysis

Issues identified during public scoping that are addressed in the impact analysis include the following:

- Employment associated directly and indirectly with project construction, operation, and maintenance
- Employment resulting from project-associated changes in agriculture and recreation
- Population changes associated directly and indirectly with project construction, operation, and maintenance
- Population changes resulting from project-associated changes in agriculture and recreation
- Output/earnings associated directly and indirectly with project construction, operation, and maintenance
- Output/earnings resulting from project-associated changes in agriculture and recreation
- Earnings of outfitters and guides in the Uinta Basin
- Project effects on temporary and permanent housing in Altamont, Duchesne, Roosevelt, and Vernal
- Effects of project-associated changes in housing demand on housing prices
- Adequacy of existing infrastructure in the local impact area and on the Uintah and Ouray Reservation to meet project-associated demand during project construction, operation, and maintenance

3.4.4 Description of Area of Influence

Two areas of influence are defined for the purpose of the socioeconomic impact assessment: the local impact area and the Uintah and Ouray Reservation. The local impact area is the area in which the principal socioeconomic effects of the project would occur and includes Duchesne and Uintah Counties. Potential socioeconomic impacts of the project, where significant, are addressed separately for Ute Tribal members of the Uintah and Ouray Reservation.

3.4.5 Affected Environment

3.4.5.1 Local Impact Area–Duchesne County

3.4.5.1.1 Employment. In 1994, 479 people or 8.4 percent of Duchesne County's 5,705-person civilian labor force were unemployed. This compares to an unemployment rate for the entire state of 3.7 percent (Utah Department of Employment Security 1994a). A large portion of the non-agricultural private sector employment in the county is in mining, services, and trade. The county's largest employer is the government, accounting for an estimated 1,470 jobs in 1994 (Governor's Office of Planning and Budget 1994a). In 1993, approximately 5 percent of total non-agricultural employment in Duchesne County, or 210 jobs, was associated with tourism and recreation (Utah Department of Community and Economic Development, Travel Council 1994). In that same year, estimated agricultural employment in the county included 881 jobs (Utah Department of Agriculture 1994).

3.4.5.1.2 Population. In 1994, the estimated population of Duchesne County was 13,300 people, approximately 0.7 percent of Utah's total. The population of the county is forecast to surpass 16,000 by the year 2010 (Governor's Office of Planning and Budget 1994a, 1995). In 1993, the population of Roosevelt, Duchesne County's largest city, was 4,308 (forecast to increase marginally to 4,323 by the year 2000). In 1993, Duchesne, the county's second largest city, had a population of 1,382 (forecast to decline to 1,324 by the year

2000). In 1992, Altamont had a population of 182 (forecast to decline to 175 by the year 2000) (Governor's Office of Planning and Budget 1994b).

3.4.5.1.3 Income/Output. The estimated average annual total industrial output of Duchesne County for the years 1990 to 1993 was $410.4 million in constant 1993 dollars. Of this amount, $13.3 million was in construction and $67.6 million was in manufacturing (Donner 1995). In 1992, farm cash receipts in Duchesne County were $28.8 million in constant 1993 dollars (Utah Department of Agriculture 1994). This includes a portion of about $11.3 million in revenues from the Upalco Unit's approximately 57,000 acres (Dornbusch & Company 1995d). In that same year, personal income from farming represented 10.5 percent of total personal income in the county and earnings from farming reached almost $12 million in 1993 dollars (Governor's Office of Planning and Budget 1995). It is estimated that spending by travelers and tourists in Duchesne County exceeded $10.4 million in 1993 (Utah Department of Community and Economic Development, Travel Council 1994).

3.4.5.1.4 Taxes. In 1994, the State of Utah distributed over $450,000 in combined sales and transient room tax revenues to Duchesne County communities (up from $436,000 in 1993). Transient room taxes represent less than 5 percent of this total. Unlike Uintah County, Duchesne County does not have a restaurant or car rental tax. While gross taxable sales in the county (and, subsequently, sales tax revenues) in nominal dollars remained fairly steady between 1990 and 1993, gross taxable room rents (and, subsequently, transient room tax revenues) increased over 45 percent during the same period (Phillips 1995).

3.4.5.1.5 Housing. In May 1995, the housing vacancy rate in Altamont, Duchesne, and Roosevelt was between 1.8 percent and 3.2 percent with very few rental homes available (Uintah Basin Board of Realtors 1995). For 1995, rents in Duchesne County ranged from $263 to $475 a month, while the purchase price of most homes ranged from $35,000 to $50,000 (Uintah Basin Association of Governments 1994; Houston 1995; Abegglen 1995).

3.4.5.1.6 Community Infrastructure.

3.4.5.1.6.1 Education. The Duchesne County School District is in stable fiscal condition despite some recent budgetary problems. Overall, the district could physically accommodate an increase of over 15 percent in its student body. However, schools in Roosevelt have reached enrollment levels that exceed state standards for school space capacity (Utah State Office of Education 1994, 1995).

3.4.5.1.6.2 Law Enforcement and Fire Protection. There are 1.91 police officers/jailers per 1,000 population in Duchesne County (compared to 1.86 per 1,000 for the entire state). Except for Roosevelt and the Uintah and Ouray Reservation, which have their own police forces, the Duchesne County Sheriff's Department is the principal law enforcement agency serving the county (supplemented by the Utah Highway Patrol). Out of Utah's 29 counties, Duchesne County has the eighth highest crime rate per 1,000 population (41.33) despite having the fifteenth largest population (Utah Department of Public Safety 1993).

Each of Duchesne County's cities is provided fire fighting services from volunteers. The county's fire fighting needs are well addressed, volunteers are well trained, and additional volunteers could quickly be added to respond to any increased demand for services (Grizzell and Lutz 1995).

3.4.5.1.6.3 Medical Services. The Uintah Basin Medical Center in Roosevelt is the only hospital in Duchesne County. Bed occupancy ranges from 40 to 45 percent. The Medical Center operates four satellite clinics (Director of Nursing, Uintah Basin Medical Center 1995). The county's existing medical facilities are in good condition and technologically current. One ambulance operates from each of the cities and towns of Altamont, Duchesne, Roosevelt, and Tabiona, and a transport ambulance operates out of Roosevelt (Bartola 1995).

3.4.5.1.6.4 Public Utilities. Companies providing natural gas to Duchesne County residences and businesses, such as Mountain Fuel and Utah Gas, easily meet current demand. Both Moon Lake Electric and Utah Power & Light have the capacity to provide four or five times more electricity than at present. In addition, US West and Uintah Basin Telephone report they have adequate telecommunications infrastructure in place to easily accommodate current and anticipated future demand.

Culinary water, solid waste treatment, and sewer system resources in Duchesne County all meet current demand. Solid waste in Altamont, Duchesne, and Roosevelt is collected by K&K Sanitation and deposited at the county landfill. Culinary water systems and sewer lagoons serving Altamont and Duchesne have substantial excess capacity. However, the city of Roosevelt is at capacity and has expressed concerns about their ability to meet future demand for culinary water. City managers and facility operators reported in 1995 that Roosevelt's sewer treatment system, which is designed for a population of 15,000, is experiencing some seepage problems.

3.4.5.2 Local Impact Area–Uintah County

3.4.5.2.1 Employment. In 1994, 615 people (or 6.3 percent of Uintah County's 9,725-person civilian labor force) were unemployed. This compares to an unemployment rate for the entire state of 3.7 percent (Utah Department of Employment Security 1994a). A large portion of the non-agricultural private sector employment in the county is in mining, services, and trade. The trade and services sectors are expected to provide the most significant amount of new employment over the next several years (Governor's Office of Planning and Budget 1994a). In 1993, almost 10 percent of non-agricultural employment in Uintah County, or 715 jobs, was associated with tourism and recreation (Utah Department of Community Development, Travel Council 1994). In that same year, estimated agricultural employment in the county included 755 jobs (Utah Department of Agriculture 1994).

3.4.5.2.2 Population. In 1994, the estimated population of Uintah County was 23,972 people, approximately 1.3 percent of Utah's total. The population of the county is forecast to surpass 30,750 by the year 2010 (Governor's Office of Planning and Budget 1994a, 1995). In 1993, Vernal, the county's largest city, had a population of 7,121 and was forecast to reach 7,907 by the year 2000 (Governor's Office of Planning and Budget 1994b).

3.4.5.2.3 Income/Output. The estimated average annual total industrial output of Uintah County for the years 1990 to 1993 was $786.6 million in constant 1993 dollars. Of this amount, $33.6 million was in construction and $44.0 million was in manufacturing (Donner 1995). In 1992, farm cash receipts in Uintah County were approximately $23.0 million in constant 1993 dollars (Utah Department of Agriculture 1994). In that same year, personal income from farming represented 3.2 percent of total personal income in the county and earnings from farming reached almost $6.7 million in 1993 dollars (Governor's Office of Planning and Budget 1995). It is estimated that spending by travelers and tourists in Uintah County exceeded $35.3 million in 1993 (Utah Department of Community and Economic Development, Traffic Council 1994).

3.4.5.2.4 Taxes. In 1994, the State of Utah distributed approximately $1,040,000 in combined sales, leasing, restaurant, and transient room tax revenues to Uintah County communities (up from $977,500 in 1993). Transient room taxes represent over 10 percent of this total. Between 1990 and 1993, gross taxable sales in the county (and, subsequently, sales tax revenues) and gross taxable room rents (and, subsequently, transient room tax revenues) increased by over 20 percent and 10 percent, respectively (Phillips 1995).

3.4.5.2.5 Housing. In May 1995, there was a 3.7 percent housing vacancy rate in Vernal, with very few rental homes available (Uintah Basin Board of Realtors 1995). In 1995, rents in the county ranged from $193 to $392 per month, while the average purchase price of a home was $53,000

(Ross 1995; Uintah Basin Association of Governments 1994; Houston 1995; Abegglen 1995).

3.4.5.2.6 Community Infrastructure.

3.4.5.2.6.1 Education. The Uintah County School District is in stable fiscal condition despite some recent budgetary problems. Overall, the district could physically accommodate an increase of almost 23 percent in its student body with no capacity constraints. Only at certain schools, in Vernal and Naples, does Uintah County enrollment already exceed state standards for school space capacity (Utah State Office of Education 1994, 1995).

3.4.5.2.6.2 Law Enforcement and Fire Protection. There are 1.74 police officers/jailers per 1,000 population in Uintah County (compared to 1.86 per 1,000 for the entire state). Except for Vernal, Naples, and the Uintah and Ouray Reservation, which have their own police forces, the Uintah County Sheriff's Department is the principal law enforcement agency serving the county (supplemented by the Utah Highway Patrol). Out of Utah's 29 counties, Uintah County has the sixth highest crime rate per 1,000 population (44.25) despite having the tenth largest population (Utah Department of Public Safety 1993).

Each of Uintah County's cities is provided fire fighting services from volunteers. Experts with the Fire and Rescue Academy in Orem, Utah, believe that the county's fire fighting needs are well addressed, that volunteers are well trained, and that additional volunteers could quickly be added to respond to any increased demand for services (Grizzell and Lutz 1995).

3.4.5.2.6.3 Medical Services. The Ashley Valley Medical Center in Vernal is the only hospital in Uintah County. Bed occupancy is just over 20 percent. The hospital does not have any satellite clinics (Labrum 1995). The county's existing medical facilities are in good condition and technologically current. Ambulance service in Uintah County is provided by a private company, Gold Cross. It has five ambulances in the county and an additional five that can be reassigned from Salt Lake City if needed (Smith 1995).

3.4.5.2.6.4 Public Utilities. Electric, natural gas, and telephone service resources available to Vernal and the rest of Uintah County were discussed in Section 3.4.5.1.6.4. Culinary water, solid waste treatment, and sewer system resources in Uintah County all meet current demands. While the 30-year-old culinary water system serving Vernal needs some repairs, there are currently no plans to modernize or expand the system. As in other basin communities, solid waste collection and disposal in Vernal is contracted to K & K Sanitation. Sewer collection and treatment in Vernal is provided by the Ashley Valley Water & Sewer Improvement District. City managers and facility operators reported in 1995 that the system is operating under capacity and has no major deficiencies.

3.4.5.3 Uintah and Ouray Reservation

3.4.5.3.1 Employment. In 1993, Ute Tribal members accounted for 23 percent of the unemployed in Uintah County despite comprising only 10 percent of the population (Utah Department of Employment Security 1994b). In that same year, the BIA estimated that approximately 48 percent of the Ute Tribe's potential workforce were unemployed (BIA 1993). According to the Tribe, there are currently 250 Tribal members available and interested in work on a construction project (Perank 1995).

3.4.5.3.2 Income/Output. In 1989, the average Native American household earned $14,600, 61.1 percent of the Basin average (U.S. Bureau of the Census 1991). There are an estimated 14,031 currently irrigated acres of Ute Tribal land within the Upalco Unit. It is estimated that these lands generate annual net revenues of approximately $325,000 in constant 1993 dollars (Dornbusch & Company 1995d). No accurate estimates are available on what portion of the lands are leased and what income the Tribe realizes from those leases. However, some estimate that about 80 percent of Tribal lands are leased.

In addition to agriculture, Ute-administered tourism and recreation generate revenues for the Tribe. During the 1993 fiscal year, the Tribe earned $15,748 from the sale of fishing permits. In 1994,

$15,600 was generated from the sale of big game hunting tags and $77,500 from the sale of three package hunts (Chapoose 1995). Tribal services at Bottle Hollow, including a gas station, convenience store, and restaurant, comprise the bulk of Ute-owned retail services available to recreationists and others in the region.

3.4.5.3.3 Community Infrastructure. The Tribal police station is located in Fort Duchesne. While the facility is in relatively good condition, financial constraints have limited needed maintenance and repairs. The police department has 14 full-time officers and 3 jailers. The number of officers and jailers per 1,000 population on the Reservation is 5.55 (compared to the state average of 1.86 per 1,000) (Reynolds 1995; Utah Department of Public Safety 1993). The Indian Health Services facility is located at Fort Duchesne.

3.4.6 Impact Analysis

The following analysis assumes that project construction for the Proposed Action or alternatives would begin in 1997.

3.4.6.1 Significance Criteria

Potential impacts are considered significant if in a single year any of the following conditions exist in the local impact area counties or on the Uintah and Ouray Reservation:

- The baseline unemployment rate would change by 10 percent or more in the local impact area counties.
- The baseline unemployment rate of Ute Tribal members would change measurably.
- Baseline total employment, or employment in a specific economic sector, would change by 10 percent or more.
- Baseline population would change by 10 percent or more.
- Baseline population in a particular city or town would change by 10 percent or more.
- Baseline total earnings or output in the local impact area counties would change by 10 percent or more.
- Baseline earnings or output in the local impact area counties in a specific economic sector would change by 10 percent or more.
- Baseline earnings of Ute Tribal members would change measurably.
- Baseline net government tax revenues in the local impact area counties would change by 10 percent or more.
- Demand for temporary and permanent housing, including mobile home and recreational vehicle space, would exceed baseline availability.
- Baseline housing prices would increase by 10 percent or more as a result of project-associated demand.
- Demand for community infrastructure resources would exceed baseline availability.

Significant impacts predicted to occur as a result of implementing the Proposed Action or alternatives are addressed in the impact analysis and include the following:

- A greater than 10 percent decline in unemployment in the local impact area counties during peak project construction, and a measurable decline in unemployment of Ute Tribal members for the duration of project construction
- A greater than 10 percent increase in employment and earnings in the construction sector of the local impact area counties for the duration of project construction
- A measurable increase in annual Ute Tribal earnings during project construction

- A greater than 10 percent increase in annual revenues from agriculture within the Upalco Unit following project construction

- Exhaustion of the supply of available family housing (single/multi-family housing) in the towns or cities of Altamont, Duchesne, and Roosevelt during project construction

- A greater than 10 percent increase in rental/ purchase prices for housing in Altamont, Duchesne, and Roosevelt during project construction

- Inability of existing public education facilities in Roosevelt to spatially accommodate expected increase in enrollment during project construction (no real decline in education services is anticipated)

- Inability of existing law enforcement resources of the cities of Roosevelt and Vernal and the Uintah and Ouray Reservation to maintain current service levels during project construction

3.4.6.2 Potential Impacts Eliminated from Further Analysis

Potential impacts on the following socioeconomic variables would be insignificant and therefore were eliminated from further analysis:

- Total employment, as well as agriculture, construction, tourism, and recreation-related employment in the local impact area and on the Uintah and Ouray Reservation

- Changes in population in the local impact area during and after project construction

- Changes in total earnings and output in the local impact area during and after project construction

- Changes in earnings from tourism and recreation-related activity in the Uinta Basin (including outfitters and guides)

- Changes in net government tax revenues of the local impact area counties

- Changes in RV space availability and rental prices in the local impact area

- Changes in the availability and price of housing in the Uinta Basin following project completion

- Changes in the availability of medical, fire fighting, and public utility services in the local impact area

3.4.6.3 Proposed Action–Talmage

3.4.6.3.1 Project Construction. The estimated potential employment impacts during construction of Proposed Action project features are summarized in Table 3.4-1. Estimated impacts on unemployment in the local impact area counties would be significant during the month of peak construction activity (based on the significance criteria in Section 3.4.6.1). In addition, Duchesne County would experience a significant increase in employment in its construction sector for the duration of project construction. Expected beneficial impacts on Ute Tribal unemployment would also be considered significant during the project's entire 7-year construction period.

Average annual earnings in Duchesne County's construction sector are expected to increase by about $3.3 million during project construction, representing about a 75 percent increase over recent earnings in that sector as a result of project-associated employment and non-labor input spending. In Uintah County, the impact on average annual earnings indirectly generated in the construction sector would be insignificant. The impact during construction on gross output of each county's construction sector would be of similar magnitudes.

It is estimated that average annual earnings of Ute Tribal members as a result of project construction would be about $0.9 million in constant 1993 dollars and about $6 million over the entire construction period. Additional annual earnings

Table 3.4-1
Potential Direct and Indirect Employment Impacts During Project Construction of the Proposed Action
(7-Year Construction Period)

Employment (FTE)[a]	Direct Employment (Residents)[b]	Indirect Employment (Residents)[c]	Total	Percent Impact on Unemployment[d] (%)	In-County Construction Jobs[e]	Percent Impact on Construction Sector[f] (%)
Duchesne County						
Average[g]	32	34	66	-5	59	+38
Peak Year[h]	59	34	93	-4	109	+70
Peak Month[i]	115	34	149	-13	213	+137
Uintah County						
Average	24	15	42	-5	0	0
Peak Year	50	15	65	-4	0	0
Peak Month	98	15	113	-13	-4	0
Ute Tribe (Uintah and Ouray Reservation)						
Average	13	5	18	-4	–	–
Peak Year	24	5	29	-4	–	–
Peak Month	48	5	53	-4	–	–

[a]FTE = Full-time equivalent.
[b]Number of jobs directly associated with the construction project filled by individuals living in the county.
[c]Number of jobs indirectly generated by project-driven expansion of the economy filled by individuals living in the county.
[d]When compared to 1994 unemployment—reflects project-associated migrant workers.
[e]Jobs geographically located within the county.
[f]When compared to employment in the county's construction sector in 1993 to 1994.
[g]Average = average monthly employment for the duration of project construction.
[h]Peak Year = average monthly employment during the year of greatest construction activity.
[i]Peak Month = employment during month of greatest construction activity.

would likely be realized by the Tribe from the sale of native materials and manufactured goods (about $120,000) and from contractor profits because of Tribal contractor-preference regulations (about $110,000).

The expected migration of 2 families to Altamont and 12 families to Duchesne and project-associated demand for family housing during peak project construction is likely to exhaust the available family housing and result in a greater than 10 percent increase in home and rental prices in these towns. (Based on estimates of available family housing, only 14 families can be accommodated in these Duchesne County towns—most other migrant families would likely locate in Roosevelt or Vernal.) In addition, project-associated increases in public school enrollment (increases estimated to reach 28) in Roosevelt during peak construction would exacerbate current problems of school overcrowding. Furthermore, while the impacts on population in the Uinta Basin as a result of project construction should not be significant—approximately 264 more people during peak project construction (based on the significance criteria in Section 3.4.6.1)—the anticipated increase in people and motor vehicle traffic in the Basin (particularly on the Uintah and Ouray Reservation) could affect the ability of the police departments of Roosevelt, Vernal, and the Uintah and Ouray Reservation to maintain current levels of law enforcement service.

3.4.6.3.2 Project Operations. No significant socioeconomic impacts are anticipated from operation of the Proposed Action. It is estimated that annual cash receipts from crop and livestock production within the unit would increase by approximately 8.2 percent; earnings would be expected to increase by about $170,000 in constant 1993 dollars, of which about $70,000 would be realized on Tribal lands.

3.4.6.3.3 Mitigation. No mitigation measures are proposed for the Proposed Action.

3.4.6.3.4 Unavoidable Adverse Impacts. Previously identified adverse impacts on housing, education, and law enforcement services would all be unavoidable.

3.4.6.4 Cow Canyon Alternative

3.4.6.4.1 Project Construction. The estimated potential employment impacts during construction of Cow Canyon Alternative project features are summarized in Table 3.4-2. Estimated impacts on unemployment in the local impact area counties would be significant in Uintah and Duchesne Counties during the month of peak construction activity (based on the significance criteria in Section 3.4.6.1). Duchesne County would experience a significant increase in employment in its individual construction sector for the duration of project construction. Expected beneficial impacts on Ute Tribal unemployment would also be considered significant during the project's entire 6-year construction period.

As a result of project-associated employment and non-labor input spending, average annual earnings in Duchesne County's construction sector are expected to increase by about $3.4 million during project construction, representing an almost 80 percent increase over recent earnings in that sector. Average annual earnings indirectly generated in the Uintah County construction sector would be insignificant. The impact during construction on gross output of each county's construction sector would be of similar magnitudes.

It is estimated that average annual earnings of Ute Tribal members as a result of project construction would be about $0.5 million in constant 1993 dollars and about $2.7 million over the entire construction period. Additional annual earnings would likely be realized by the Tribe from the sale of native materials and manufactured goods (about $105,000) and from contractor profits because of Tribal contractor-preference regulations (about $5,000).

The expected migration of 2 families to Altamont and 12 to Duchesne and project-associated demand for family housing in those towns during peak project construction would exhaust the available family housing and result in a greater than 10 percent increase in home and rental prices in these towns. (Based on estimates of available

Table 3.4-2
Potential Direct and Indirect Employment Impacts During Project Construction of the Cow Canyon Alternative
(6-Year Construction Period)

Employment (FTE)[a]	Direct Employment (Residents)[b]	Indirect Employment (Residents)[c]	Total	Percent Impact on Unemployment[d] (%)	In-County Construction Jobs[e]	Percent Impact on Construction Sector[f] (%)
Duchesne County						
Average[g]	31	31	62	-4	60	+39
Peak Year[h]	65	31	96	-8	125	+80
Peak Month[i]	106	31	137	-12	203	+131
Uintah County						
Average	29	19	48	-5	0	0
Peak Year[h]	60	19	79	-8	0	0
Peak Month	97	19	116	-13	-0	0
Ute Tribe (Uintah and Ouray Reservation)						
Average	6	5	11	-8	–	–
Peak Year	13	5	18	-3	–	–
Peak Month	21	5	26	-4	–	–

[a]FTE = Full-time equivalent.
[b]Number of jobs directly associated with the construction project filled by individuals living in the county.
[c]Number of jobs indirectly generated by project-driven expansion of the economy filled by individuals living in the county.
[d]When compared to 1994 unemployment–reflects project-associated migrant workers.
[e]Jobs geographically located within the county.
[f]When compared to employment in the county's construction sector in 1993 to 1994.
[g]Average = average monthly employment for the duration of project construction.
[h]Peak Year = average monthly employment during the year of greatest construction activity.
[i]Peak Month = employment during month of greatest construction activity.

family housing, only 14 families can be accommodated in these Duchesne County towns–most other migrant families would likely locate in Roosevelt or Vernal.) In addition, project-associated increases in public school enrollment (increases estimated to reach 29) in Roosevelt during peak construction would exacerbate current problems of school overcrowding. Furthermore, while the impacts on population in the Uinta Basin as a result of project construction should not be significant–approximately 285 more people at peak construction (based on the significance criteria in Section 3.4.6.1)–the anticipated increase in people and motor vehicle traffic in the Basin (particularly on the Uintah and Ouray Reservation) could affect the ability of the police departments of Roosevelt, Vernal, and the Uintah and Ouray Reservation to maintain current levels of law enforcement service.

3.4.6.4.2 Project Operations. No significant socioeconomic impacts are anticipated from operation of the Cow Canyon Alternative. It is estimated that annual cash receipts from crop and livestock production within the unit would increase by approximately 6.7 percent; earnings would increase by about $140,000 in constant 1993 dollars, of which about $70,000 would be realized on Tribal lands.

3.4.6.4.3 Mitigation. No mitigation is proposed for the Cow Canyon Alternative.

3.4.6.4.4 Unavoidable Adverse Impacts. Previously identified adverse impacts on housing, education, and law enforcement services would all be unavoidable.

3.4.6.5 Crystal Ranch Alternative

3.4.6.5.1 Project Construction. The estimated potential employment impacts during construction of Crystal Ranch Alternative project features are summarized in Table 3.4-3. Impacts on total unemployment in the local impact area counties would be significant during the month of peak construction activity (based on the significance criteria in Section 3.4.6.1). Duchesne County would experience a significant increase in employment in its construction sector for the duration of project construction. Expected beneficial impacts on Ute Tribal unemployment would also be considered significant during the project's entire 6-year construction period.

As a result of project-associated employment and non-labor input spending, average annual earnings in Duchesne County's construction sector are expected to grow by about $3.1 million during project construction, representing about a 70 percent increase in recent earnings in that sector. Average annual earnings indirectly generated in Uintah County's construction sector would be insignificant. The impact during construction on gross output of each county's construction sector would be of similar magnitudes.

It is estimated that average annual earnings of Ute Tribal members during project construction would be about $1.1 million in constant 1993 dollars and about $6.8 million over the entire construction period. Additional annual earnings would likely be realized by the Tribe from the sale of native materials and manufactured goods (about $120,000) and from contractor profits because of Tribal contractor-preference regulations (about $135,000).

The expected migration of 2 families to Altamont and 12 to Duchesne and project-associated demand for family housing in that city during peak project construction would exhaust the available family housing and result in a greater than 10 percent increase in home and rental prices in these towns. (Based on estimates of available family housing, only 14 families can be accommodated in these towns–other migrant families would likely locate in Roosevelt or Vernal.) In addition, project-associated increases in public school enrollment (increases estimated to reach 18) in Roosevelt during peak construction would exacerbate current problems of school overcrowding. Furthermore, while the impacts on population in the Uinta Basin as a result of project construction should not be significant–approximately 212 more people at peak construction (based on the significance criteria in Section 3.4.6.1)–the anticipated increase in people and motor vehicle traffic in the Basin (particularly on the Uintah and Ouray Reservation) could affect the ability of the police departments of Roosevelt,

Table 3.4-3
Potential Direct and Indirect Employment Impacts During Project Construction of the Crystal Ranch Alternative
(6-Year Construction Period)

Employment (FTE)[a]	Direct Employment (Residents)[b]	Indirect Employment (Residents)[c]	Total	Percent Impact on Unemployment[d] (%)	In-County Construction Jobs[e]	Percent Impact on Construction Sector[f] (%)
Duchesne County						
Average[g]	34	34	65	-5	96	+36
Peak Year	53	34	87	-7	96	+62
Peak Month[i]	93	34	127	-11	168	+108
Uintah County						
Average	25	12	37	-5	0	0
Peak Year	43	12	55	-7	0	0
Peak Month	75	12	87	-12	0	0
Ute Tribe (Uintah and Ouray Reservation)						
Average	16	5	21	-3	–	–
Peak Year	27	5	32	-5	–	–
Peak Month	34	5	52	-7	–	–

[a]FTE = Full-time equivalent.
[b]Number of jobs directly associated with the construction project filled by individuals living in the county.
[c]Number of jobs indirectly generated by project-driven expansion of the economy filled by individuals living in the county.
[d]When compared to 1994 unemployment—reflects project-associated migrant workers.
[e]Jobs geographically located within the county.
[f]When compared to employment in the county's construction sector in 1993 to 1994.
[g]Average = average monthly employment for the duration of project construction.
[h]Peak Year = average monthly employment during the year of greatest construction activity.
[i]Peak Month = employment during month of greatest construction activity.

Vernal, and the Uintah and Ouray Reservation to maintain current levels of law enforcement service.

Potential impacts on the region's housing, education, and law enforcement services would be similar to those described for the Proposed Action in Section 3.4.6.3.1.

3.4.6.5.2 Project Operations. No significant socioeconomic impacts are anticipated from operation of the Crystal Ranch Alternative. It is estimated that annual cash receipts from crop and livestock production within the unit would increase by about 6.4 percent; earnings would increase by about $130,000 in constant 1993 dollars, of which about $70,000 would be realized on Tribal lands.

3.4.6.5.3 Mitigation. No mitigation measures are proposed for this alternative.

3.4.6.5.4 Unavoidable Adverse Impacts. Previously identified adverse impacts on housing, education, and law enforcement services would be unavoidable.

3.4.6.6 Twin Pots Alternative

3.4.6.6.1 Project Construction. The estimated potential employment impacts during construction of Twin Pots Alternative project features are summarized in Table 3.4-4. Estimated impacts on unemployment in the local impact area counties would not be significant at any time during the project's construction (based on the significance criteria in Section 3.4.6.1). However, Duchesne County would experience a significant increase in employment in its construction sector for the duration of project construction. Expected beneficial impacts on Ute Tribal unemployment would also be considered significant during the project's entire 5-year construction period.

As a result of project-associated employment and non-labor input spending, average annual earnings in Duchesne County's construction sector are expected to increase by about $2.1 million during project construction, representing about a 50 percent increase over recent earnings in that sector. Average annual earnings indirectly generated in Uintah County's construction sector would be insignificant. The impact during construction on gross output of each county's construction sector would be of similar magnitudes.

It is estimated that average annual earnings of Ute Tribal members as a result of project construction would be about $0.4 million in constant 1993 dollars and about $1.8 million over the entire construction period. Additional annual earnings would likely be realized by the Tribe from the sale of native materials and manufactured goods (about $55,000) and from contractor profits because of Tribal contractor-preference regulations (about $50,000).

The expected migration of 2 families to Altamont and 12 to Duchesne and project-associated demand for family housing in that city during peak project construction would exhaust the available family housing and result in a greater than 10 percent increase in home and rental prices in these towns. (Based on estimates of available family housing, only 14 families can be accommodated in these towns—most other migrant families would likely locate in Roosevelt or Vernal.) In addition, project-associated increases in public school enrollment (increases estimated to reach 12) in Roosevelt during peak construction would exacerbate current problems of school overcrowding. Furthermore, while the impacts on population in the Uinta Basin as a result of project construction should not be significant—approximately 174 more people at peak construction (based on the significance criteria in Section 3.4.6.1)—the anticipated increase in people and motor vehicle traffic in the Basin (particularly on the Uintah and Ouray Reservation) could affect the ability of the police departments of Roosevelt, Vernal, and the Uintah and Ouray Reservation to maintain current levels of law enforcement service.

3.4.6.6.2 Project Operations. No significant socioeconomic impacts are anticipated from operation of the Twin Pots Alternative. It is estimated that annual cash receipts from crop and livestock production within the unit would increase by approximately 1.8 percent; associated earnings would increase by about $40,000 in constant 1993

Table 3.4-4
Potential Direct and Indirect Employment Impacts During Project Construction of the Twin Pots Alternative
(5-Year Construction Period)

Employment (FTE)[a]	Direct Employment (Residents)[b]	Indirect Employment (Residents)[c]	Total	Percent Impact on Unemployment[d] (%)	In-County Construction Jobs[e]	Percent Impact on Construction Sector[f] (%)
Duchesne County						
Average[g]	2[illegible]	27	50	-4	40	+26
Peak Year[h]	36	27	63	-[illegible]	64	+42
Peak Month[i]	66	27	93	-8	116	+75
Uintah County						
Average	17	10	27	-3	0	0
Peak Year	28	10	38	-4	0	0
Peak Month	50	17	60	-[illegible]	-[illegible]	0
Ute Tribe (Uintah and Ouray Reservation)						
Average	4	4	8	-1	–	–
Peak Year	7	4	11	-2	–	–
Peak Month	13	4	17	-2	–	[illegible]

[a]FTE = Full-time equivalent.
[b]Number of jobs directly associated with the construction project filled by individuals living in the county.
[c]Number of jobs indirectly generated by project-driven expansion of the economy filled by individuals living in the county.
[d]When compared to 1994 unemployment—reflects project-associated migrant workers.
[e]Jobs geographically located within the county.
[f]When compared to employment in the county's construction sector in 1993 to 1994.
[g]Average = average monthly employment for the duration of project construction.
[h]Peak Year = average monthly employment during the year of greatest construction activity.
[i]Peak Month = employment during month of greatest construction activity.

dollars. Earnings on non-Indian lands would actually decline by about $30,000 while an additional $70,000 in earnings would be realized on Tribal lands.

3.4.6.6.3 Mitigation. No mitigation is proposed for the Twin Pots Alternative.

3.4.6.6.4 Unavoidable Adverse Impacts. Previously identified impacts on housing, education, and law enforcement services would all be unavoidable.

3.4.6.7 No Action Alternative

The long-term viability of existing levels of commercial crop and livestock production within the Upalco Unit could be threatened if the irrigation water supply is not increased and made more reliable. This is principally because of increasing costs of agricultural production and stagnant to declining real agricultural commodity prices. In addition, a high-potential marginal return to water on currently irrigated lands within the unit would be realized.

3.4.7 Cumulative Impacts

3.4.7.1 Proposed Action–Talmage and Uintah Unit Proposed Action–Lower Uintah

During the 6 years from 1999 to 2004 that the Upalco and Uintah Unit Proposed Actions would be simultaneously under construction, the unemployment rate in Duchesne and Uintah Counties would be expected to decline by approximately 11 percent (when compared to 1994 and accounting for expected migration of workers to each county). In addition, average employment levels in Duchesne County's construction sector should increase by about 81 percent. Beneficial impacts on employment of Ute Tribal members should also be significant with average unemployment expected to drop by about 7 percent while both projects are under construction.

As a result of project-associated employment and non-labor input spending, average annual earnings in Duchesne County's construction sector are expected to grow by about $7.1 million during simultaneous project construction. This would represent over a 160 percent increase in recent earnings in that sector. In Uintah County, the average annual impact on earnings in the construction sector would be about $0.7 million, or less than 10 percent of recent earnings in that sector. The impact during construction on gross output of each county's construction sector would be of similar magnitudes.

It is estimated that average annual earnings of Ute Tribal members as a result of the projects during the 6 years of overlapping construction would be about $2.1 million in constant 1993 dollars. Additional annual earnings would be realized by the Tribe from the sale of native materials and manufactured goods (about $280,000) and from contractor profits because of Tribal contractor-preference regulations (about $300,000).

The cumulative project-associated migration of families to the Uinta Basin during project construction could reach approximately 119, a situation that would likely exhaust the available family housing and result in a greater than 10 percent increase in home and rental prices in Altamont, Duchesne, and Roosevelt. The influx of families to Vernal, predicted to reach approximately 60 at peak construction, should not have a significant impact on that city's housing market. In addition, project-associated increases in public school enrollment in Roosevelt during construction (increases of approximately 32 students) would exacerbate current problems of school overcrowding. Finally, while the cumulative impacts on population in any of the Basin cities during the project's construction would not be significant (according to significance criteria in Section 3.4.6.1)–at most, approximately 539 more people if peak construction activities of the two projects overlap–the anticipated increase in people and motor vehicle traffic in the Basin could affect the ability of the region's police departments to maintain current levels of law enforcement service.

No significant cumulative socioeconomic impacts are anticipated from the simultaneous operation of the proposed project features of the Upalco and Uintah Units.

3.4.7.2 Cow Canyon Alternative and Uintah Unit Proposed Action–Lower Uintah

During the 6 years from 1999 to 2004 that the Cow Canyon Alternative and the Uintah Unit Proposed Action would be under construction, the unemployment rate in Duchesne and Uintah Counties would be expected to decline by approximately 10 percent and 11 percent, respectively (when compared to 1994 and accounting for expected migration of workers to each county). In addition, average employment levels in Duchesne County's construction sector should increase by about 82 percent. Beneficial impacts on employment of Ute Tribal members should also be significant with average unemployment expected to drop by about 6 percent while both projects are under construction.

As a result of project-associated employment and non-labor input spending, average annual earnings in Duchesne County's construction sector are expected to grow by about $8.2 million during project construction, representing over a 190 percent increase in recent earnings in that sector. In Uintah County, the average annual impact on earnings in the construction sector would be about $0.7 million, or less than 10 percent of recent earnings in that sector. The impact during construction on gross output of each county's construction sector would be of similar magnitudes.

It is estimated that average annual earnings of Ute Tribal members as a result of the projects during the 6 years of construction would be about $1.7 million in constant 1993 dollars. Additional annual earnings would be realized by the Tribe from the sale of native materials and manufactured goods (about $265,000) and from contractor profits because of Tribal contractor-preference regulations (about $195,000).

The cumulative project-associated migration of families to the Uinta Basin during project construction could reach approximately 120, a situation that would likely exhaust the available family housing and result in a greater than 10 percent increase in home and rental prices in Altamont, Duchesne, and Roosevelt. The influx of families into Vernal, predicted to reach about 61 at the peak of construction, should not have a significant impact on the housing market. In addition, project-associated increases in public school enrollment in Roosevelt during construction (increases of approximately 32 students) would exacerbate current problems of school overcrowding. Finally, while the cumulative impacts on population in any of the Basin cities during the project's construction would not be significant (according to significance criteria in Section 3.4.6.1)–at most, approximately 560 more people if peak construction activities of the two projects overlap–the anticipated increase in people and motor vehicle traffic in the Basin could affect the ability of the region's police departments to maintain current levels of law enforcement service.

No significant cumulative socioeconomic impacts are anticipated from the simultaneous operation of the proposed project features of the Upalco and Uintah Units.

3.4.7.3 Crystal Ranch Alternative and Uintah Unit Proposed Action–Lower Uintah

During the 6 years from 1999 to 2004 that the Crystal Ranch Alternative and Uintah Unit Proposed Action would be simultaneously under construction, the unemployment rate in Duchesne and Uintah Counties would be expected to decline by approximately 11 percent (when compared to 1994 and accounting for expected migration of workers to each county). In addition, average employment levels in Duchesne County's construction sector should increase by about 79 percent. Beneficial impacts on employment of Ute Tribal members should also be significant with average unemployment expected to drop by about 7 percent while both projects are under construction.

As a result of project-associated employment and non-labor input spending, average annual earnings in Duchesne County's construction sector are expected to grow by about $6.9 million during simultaneous project construction. This would represent an almost 160 percent increase in recent earnings in that sector. In Uintah County, the average annual impact on earnings in the construction sector would be about $0.7 million, or less than 10 percent of recent earnings in that sector. The percentage impact during construction on gross output of each county's construction sector would be of similar magnitudes.

It is estimated that average annual earnings of Ute Tribal members as a result of the projects during the 6 years of overlapping construction would be about $2.3 million in constant 1993 dollars. Additional annual earnings would be realized by the Tribe from the sale of native materials and manufactured goods (about $280,000) and from contractor profits because of Tribal contractor-preference regulations (about $325,000).

The cumulative project-associated migration of families to the Uinta Basin during project construction could reach approximately 104, a situation that would likely exhaust the available family housing and result in a greater than 10 percent increase in home and rental prices in Altamont, Duchesne, and Roosevelt. The influx of families to Vernal, predicted to reach approximately 49 at peak construction, should not have a significant impact on that city's housing market. In addition, project-associated increases in public school enrollment in Roosevelt during construction (increases of approximately 32 students) would exacerbate current problems of school overcrowding. Finally, while the cumulative impacts on population in any of the Basin cities during the project's construction would not be significant (according to significance criteria in Section 3.4.6.1)—at most, approximately 487 more people if peak construction activities of the two projects overlap—the anticipated increase in people and motor vehicle traffic in the Basin could affect the ability of the region's police departments to maintain current levels of law enforcement service.

No significant cumulative socioeconomic impacts are anticipated from the simultaneous operation of the proposed project features of the Upalco and Uintah Units.

3.4.7.4 Twin Pots Alternative and Uintah Unit Proposed Action—Lower Uintah

During the 5 years from 1999 to 2003 that the Twin Pots Alternative and the Uintah Unit Proposed Action would be under construction, the unemployment rate in Duchesne and Uintah Counties would be expected to decline by approximately 10 percent and 9 percent, respectively (when compared to 1994 and accounting for expected migration of workers to each county). In addition, average employment levels in Duchesne County's construction sector should increase by about 69 percent. Beneficial impacts on employment of Ute Tribal members should also be significant with average unemployment expected to drop by about 5 percent while both projects are under construction.

As a result of project-associated employment and non-labor input spending, average annual earnings in Duchesne County's construction sector are expected to grow by about $5.9 million during project construction, representing almost a 140 percent increase in recent earnings in that sector. In Uintah County, the average annual impact on earnings in the construction sector would be about $0.7 million, or less than 10 percent of recent earnings in that sector. The percentage impact during construction on gross output of each county's construction sector would be of similar magnitudes.

It is estimated that average annual earnings of Ute Tribal members as a result of the projects during the 5 years of construction would be about $1.6 million in constant 1993 dollars. Additional annual earnings would be realized by the Tribe from the sale of native materials and manufactured goods (about $215,000) and from contractor profits because of Tribal contractor-preference regulations (about $240,000).

The cumulative project-associated migration of families to the Uinta Basin during project construction could reach approximately 95, a situation that would likely exhaust the available family housing and result in a greater than 10 percent increase in home and rental prices in Altamont, Duchesne, and

Roosevelt. The influx of an estimated 36 families to Vernal at peak construction should not have a significant impact on the housing market. In addition, project-associated increases in public school enrollment in Roosevelt during construction (increases of approximately 32 students) would exacerbate current problems of school overcrowding. Finally, while the cumulative impacts on population in any of the Basin cities during the project's construction would not be significant (according to significance criteria in Section 3.4.6.1—approximately 449 more people if peak construction activities of the two projects overlap), the anticipated increase in people and motor vehicle traffic in the Basin could affect the ability of the region's police departments to maintain current levels of law enforcement service.

No significant cumulative socioeconomic impacts are anticipated from the simultaneous operation of the proposed project features of the Upalco and Uintah Units.

3.5 Agriculture

3.5.1 Introduction

This section addresses potential direct, indirect, total, and cumulative impacts on irrigated crop production resulting from the construction, operation, and maintenance of the Proposed Action and alternatives of the Upalco Unit. Agricultural impacts specifically addressed include impacts on irrigated crop yields, resulting crop production, and the value of crop production. They are evaluated at the local level (Upalco Unit), the regional level (Duchesne and Uintah Counties), and for the State of Utah.

3.5.2 Issues Eliminated from Further Analysis

All agriculture issues identified during public scoping were analyzed. None were eliminated.

3.5.3 Issues Addressed in the Impact Analysis

Significant impacts on irrigated crop yields, irrigated crop production, and the value of crop production predicted to occur as a result of implementing the Proposed Action or alternatives are addressed in the impact analysis. The impact analysis is conducted assuming fixed cropping patterns and fixed local crop prices.

3.5.4 Description of the Area of Influence

Three areas of influence are defined for the purpose of assessing potential agricultural impacts: the project area, consisting of the geographic boundaries of the Upalco Unit; the region, consisting of the combined area of Duchesne and Uintah Counties; and the State of Utah (see Map 1-1 in Chapter 1.

3.5.5 Affected Environment

About 58,000 acres of irrigated cropland occur within the Upalco Unit service area, which lies entirely within Duchesne and Uintah Counties. About 14,000 of these acres are farmed by holders of Indian water rights, with the remainder farmed by those holding secondary water rights. In addition, with implementation of the Proposed Action or alternatives, about 1,300 acres of secondary water-righted lands would be withdrawn from irrigation as a result of land retirement. An additional 1,039 acres of 1861 water-righted lands are not presently being irrigated and are fallow or idle. Idle lands are defined as those lands that are Indian-owned, Indian-water-righted lands with an 1861 reserved water right that are currently fallow or idle. The idle lands located within the Uintah Indian Irrigation Project have been certified to Congress as irrigable lands. These lands have a reserved water right that can be exercised by the Tribe at any time. Some have been previously irrigated and all can be irrigated without the construction of the Proposed Action or additional diversion facilities.

3.5.6 Impact Analysis

3.5.6.1 Significance Criteria

Potential impacts are considered significant if they would result in a 10 percent or more increase in irrigated crop production within the project service area. Since crop proportions and crop prices are held fixed in the analysis, a 10 percent or more increase in crop yield would be necessary to achieve a 10 percent increase in crop production.

3.5.6.2 Potential Impacts Eliminated from Further Analysis

Potential impacts eliminated from further analysis because they are not expected to occur include the following:

- Impacts on dryland agriculture in the project area
- Impacts of increased production on local crop prices
- Impacts of increased water supplies on cropping patterns

3.5.6.3 Method of Estimating Yield Impacts

Impacts on crop production from project implementation result from impacts on crop yields. Crop yield impacts resulting from the Proposed Action and alternatives are estimated using a crop-water production function approach. For purposes of this analysis, a crop-water production function is a mathematical relationship showing how irrigation water supply impacts crop yields. Mathematical models used for the analysis were obtained from the Bureau of Reclamation's Denver Service Center and were adapted for the project area. The benefit of using the crop-water production function approach is a recognition that changes in crop yields are not necessarily directly proportional to changes in water supply.

Water supply data necessary to estimate yield impacts were obtained from Chapter 3 of the Project Feasibility Report.

3.5.6.4 Proposed Action–Talmage

Table 3.5-1 summarizes estimated potential impacts on irrigated acreage and crop yields associated with the Proposed Action. Data indicate that irrigated acreage would increase slightly for Indian water rights holders because of the addition of irrigation to Tribal lands that are now idle, and acreage would decrease for secondary water rights holders because of land retirement. Crop yields would increase for secondary water rights holders.

Table 3.5-2 summarizes the potential increase in crop production and the increased value of production because of the project. As shown, the project would increase crop production between 10 and 12 percent in the project area, indicating a significant beneficial impact on local irrigated agriculture. For the Duchesne and Uintah Counties area, production would increase between 5 and 12 percent, depending on the crop considered, also indicating significant beneficial impacts. However, from a statewide perspective, the increase would range from less than 1 percent to 2 percent, indicating a less than significant impact.

Overall, the project would increase the value of crop production by about $1.5 million annually. Similar to production levels, this beneficial impact is significant in the project area and in the Duchesne and Uintah Counties area. However, it is not significant compared to the overall value of crop production in Utah.

3.5.6.5 Cow Canyon Alternative

Table 3.5-3 summarizes estimated potential impacts on irrigated acreage and crop yields for the Cow Canyon Alternative. Irrigated acreage would increase slightly for Indian water rights holders because of the addition of irrigation to Tribal lands that are now idle, and acreage would decrease for secondary water rights holders because of land retirement. Crop yields would increase for secondary water rights holders.

Table 3.5-1

Crop Acreages and Yields for the Proposed Action

Crop	Crop Proportions (%)	Irrigated Acreage in Project Area, Based on Proportions[a]				Units	Estimated Crop Yields With and Without the Project[b]			
		No Action Alternative		Proposed Action			No Action Alternative		Proposed Action	
		Indian Water Rights	Secondary Water Rights	Indian Water Rights[c]	Secondary Water Rights[d]		Indian Water Rights	Secondary Water Rights	Indian Water Rights	Secondary Water Rights
Alfalfa	50.0	7,016	22,205	7,535	21,555	Tons	4.7	3.5	4.7	3.9
Grass hay	17.5	2,455	7,772	2,637	7,544	Tons	3.1	2.3	3.1	2.6
Irrigated pasture	17.5	2,455	7,772	2,637	7,544	AUM[e]	9.5	7.1	9.5	8.0
Barley	10.0	1,403	4,441	1,507	4,311	Bushels	110	77	110	89
Corn	5.0	702	2,221	754	2,156	Bushels	137	100	137	114
Total	**100.0**	**14,031**	**43,110**	**15,070**	**43,110**					

[a]Crop proportions are based on those used in the Project Feasibility Report to estimate consumptive use of project water.
[b]Yield impacts are based on production function analysis.
[c]The increase in acreage over the No Action Alternative is due to inclusion of 1,039 acres of new irrigation service.
[d]The reduction in acreage is due to 1,300 acres of retired lands.
[e]AUM = Animal unit month (represents the amount of forage consumed by a cow and calf in one month).

Table 3.5-2

Increased Crop Production Attributable to the Proposed Action

Crop	Units	Potential Increase in Production Because of the Project				Percentage Increase in Production		
		Indian Water Rights[a]	Secondary Water Rights[b]	Total Increase in Production	Value of Increased Production	Project Area	Duchesne and Uintah Counties	State of Utah
Alfalfa	Tons	2,439	6,346	8,785	$ 799,435	10.3	4.5	0.5
Grass hay	Tons	564	1,738	2,302	209,482	10.0	10.0	1.7
Irrigated pasture	AUM[c]	1,729	5,171	6,900	262,200	9.5	9.5	1.5
Small grain	Bushels	11,440	41,722	53,162	127,589	11.7	11.7	0.7
Corn	Bushels	7,124	23,684	30,808	77,020	10.3	9.9	0.5
Total					**$ 1,475,726**			

[a]Indian water rights impacts include an increase in production on existing lands and inclusion of idle lands.
[b]Secondary water rights impacts include a reduction of 1,300 acres because of land retirement.
[c]AUM = Animal unit month (represents the amount of forage consumed by a cow and calf in one month).

Table 3.5-4 summarizes the potential increase in crop production and the increased value of production because of the project. The project would increase crop production between 10 and 12 percent in the project area, indicating a significant beneficial impact on local irrigated agriculture. For the Duchesne and Uintah Counties area, production would increase between 5 and 12 percent, depending on the crop considered, also indicating significant beneficial impacts. However, from a statewide perspective, the increase would range from less than 1 percent to 2 percent, indicating a less than significant impact.

Overall, the project would increase crop production value by about $1.5 million annually. Similar to production levels, this beneficial impact would be significant in the project area and in the Duchesne and Uintah Counties area, but not in the State of Utah.

3.5.6.6 Crystal Ranch Alternative

Table 3.5-5 summarizes estimated potential impacts on irrigated acreage and crop yields associated with the Crystal Ranch Alternative. Irrigated acreage would increase slightly for Indian water rights holders because of the addition of irrigation to Tribal lands that are now idle, and would decrease for secondary water rights holders because of land retirement. Crop yields would increase for secondary water rights holders.

Table 3.5-6 summarizes the potential increase in crop production and the increased value of production for this alternative. The project would increase crop production between 8 and 10 percent in the project area, indicating a significant beneficial impact on local irrigated agriculture for at least one crop considered. For the Duchesne and Uintah Counties area, production would increase between 4 and 10 percent, depending on the crop considered, also indicating significant beneficial impacts for some crops. However, from a statewide perspective, the increase would be about 1 percent or less, indicating a less than significant impact.

Overall, the project would increase crop production value by about $1.3 million annually. Similar to production levels, this beneficial impact would be significant in the project area and in the Duchesne and Uintah Counties area, but not in the State of Utah.

3.5.6.7 Twin Pots Alternative

Table 3.5-7 summarizes estimated potential impacts on irrigated acreage and crop yields for the Twin Pots Alternative. Irrigated acreage would increase slightly for Indian water rights holders because of the addition of irrigation to Tribal lands that are now idle, and acreage would decrease for secondary water rights holders because of land retirement. Crop yields would increase for secondary water rights holders.

Table 3.5-8 summarizes the potential increase in crop production and the increased value of production because of the project. The project would increase crop production between 8 and 10 percent in the project area, indicating a significant beneficial impact on local irrigated agriculture for at least one crop considered. For the Duchesne and Uintah Counties area, production would increase between 4 and 10 percent, depending on the crop considered, also indicating significant beneficial impacts for some crops. However, from a statewide perspective, the increase would be about 1 percent or less, indicating a less than significant impact.

Overall, the project would increase crop production value by about $1.3 million annually. Similar to production levels, this beneficial impact would be significant in the project area and in the Duchesne and Uintah Counties area, but not in the State of Utah.

3.5.6.8 No Action Alternative

Agriculture in the project area and in the Duchesne and Uintah Counties area would not be expected to differ substantially under this alternative from existing conditions. Future agriculture conditions would probably be similar to conditions described for the Affected Environment (Section 3.5.5) and as shown in Table 3.5-1 for Indian and secondary water rights acreages and associated crop yields under the No Action Alternative.

Table 3.5-3

Crop Acreages and Yields for the Cow Canyon Alternative

Crop	Crop Proportions (%)	Irrigated Acreage in Project Area, Based on Proportions[a]				Units	Estimated Crop Yields With and Without the Project[b]			
		No Action Alternative		Cow Canyon Alternative			No Action Alternative		Cow Canyon Alterntive	
		Indian Water Rights	Secondary Water Rights	Indian Water Rights[c]	Secondary Water Rights[d]		Indian Water Rights	Secondary Water Rights	Indian Water Rights	Secondary Water Rights
Alfalfa	50.0	7,016	22,205	7,535	21,555	Tons	4.7	3.5	4.7	3.9
Grass hay	17.5	2,455	7,772	2,637	7,544	Tons	3.1	2.3	3.1	2.6
Irrigated pasture	17.5	2,455	7,772	2,637	7,544	AUM[e]	9.5	7.1	9.5	8.0
Barley	10.0	1,403	4,441	1,507	4,311	Bushels	110	77	110	89
Corn	5.0	702	2,221	754	2,156	Bushels	137	100	137	114
Total	**100.0**	**14,031**	**44,410**	**15,070**	**43,110**					

[a]Crop proportions are based upon those used in the Project Feasibility Report to estimate consumptive use of project water.
[b]Yield impacts are based on production function analysis.
[c]The increase in acreage over the No Action Alternative is due to inclusion of 1,039 acres of new irrigation service.
[d]The reduction in acreage is due to 1,300 acres of retired lands.
[e]AUM = Animal unit month (represents the amount of forage consumed by a cow and calf in one month).

Table 3.5-4

Increased Crop Production Attributable to the Cow Canyon Alternative

Crop	Units	Potential Increase in Production Because of the Project			Value of Increased Production	Percentage Increase in Production		
		Indian Water Rights[a]	Secondary Water Rights[b]	Total Increase in Production		Project Area	Duchesne and Uintah Counties	State of Utah
Alfalfa	Tons	2,439	6,346	8,785	$ 799,435	10.3	4.5	0.5
Grass hay	Tons	564	1,738	2,302	209,482	10.0	10.0	1.7
Irrigated pasture	AUM[c]	1,729	5,171	6,900	262,200	9.5	9.5	1.5
Small grain	Bushels	11,440	41,722	53,162	127,589	11.7	11.7	0.7
Corn	Bushels	7,124	23,684	30,808	77,020	10.3	9.9	0.5
Total					**$ 1,475,726**			

[a]Indian water rights impacts include an increase in production on existing lands and inclusion of idle lands.
[b]Secondary water rights impacts include a reduction of 1,300 acres because of land retirement.
[c]AUM = Animal unit month (represents the amount of forage consumed by a cow and calf in one month).

Table 3.5-5

Crop Acreages and Yields for the Crystal Ranch Alternative

Crop	Crop Proportions	Irrigated Acreage in Project Area, Based on Proportions[a]				Units	Estimated Crop Yields With and Without the Project[b]			
		No Action Alternative		Crystal Ranch Alternative			No Action Alternative		Crystal Ranch Alternative	
		Indian Water Rights	Secondary Water Rights	Indian Water Rights[c]	Secondary Water Rights[d]		Indian Water Rights	Secondary Water Rights	Indian Water Rights	Secondary Water Rights
Alfalfa	50.0	7,016	22,205	7,535	21,555	Tons	4.7	3.5	4.7	3.9
Grass hay	17.5	2,455	7,772	2,637	7,544	Tons	3.1	2.3	3.1	2.5
Irrigated pasture	17.5	2,455	7,772	2,637	7,544	AUM[e]	9.5	7.1	9.5	7.9
Barley	10.0	1,403	4,441	1,507	4,311	Bushels	110	77	110	87
Corn	5.0	702	2,221	754	2,156	Bushels	137	100	137	112
Total	**100.0**	**14,031**	**44,410**	**15,070**	**43,110**					

[a]Crop proportions are based upon those used in the Project Feasibility Report to estimate consumptive use of project water.

[b]Yield impacts are based on production function analysis.

[c]The increase in acreage over the No Action Alternative is due to inclusion of 1,039 acres of new irrigation service.

[d]The reduction in acreage is due to 1,300 acres of retired lands.

[e]AUM = Animal unit month (represents the amount of forage consumed by a cow and calf in one month).

Table 3.5-6

Increased Crop Production Attributable to the Crystal Ranch Alternative

Crop	Units	Potential Increase in Production Because of the Project			Value of Increased Production	Percentage Increase in Production		
		Indian Water Rights[a]	Secondary Water Rights[b]	Total Increase in Production		Project Area	Duchesne and Uintah Counties	State of Utah
Alfalfa	Tons	2,439	6,346	8,785	$ 799,435	8.9	3.9	0.4
Grass hay	Tons	564	984	1,548	140,868	8.8	8.8	1.5
Irrigated pasture	AUM[c]	1,729	4,417	6,146	233,548	8.3	8.3	1.3
Small grain	Bushels	11,440	33,100	44,540	106,896	10.2	10.2	0.6
Corn	Bushels	7,124	19,372	26,496	66,240	9.0	8.7	0.4
Total					**$ 1,346,987**			

[a]Indian water rights impacts include an increase in production on existing lands and inclusion of idle lands.

[b]Secondary water rights impacts include a reduction of 1,300 acres because of land retirement.

[c]AUM = Animal unit month (represents the amount of forage consumed by a cow and calf in one month).

Table 3.5-7

Crop Acreages and Yields for the Twin Pots Alternative

Crop	Crop Proportions (%)	Irrigated Acreage in Project Area, Based on Proportions[a]				Units	Estimated Crop Yields With and Without the Project[b]			
		No Action Alternative		Twin Pots Alternative			No Action Alternative		Twin Pots Alternative	
		Indian Water Rights	Secondary Water Rights	Indian Water Rights[c]	Secondary Water Rights[d]		Indian Water Rights	Secondary Water Rights	Indian Water Rights	Secondary Water Rights
Alfalfa	50.0	7,016	22,205	7,535	21,555	Tons	4.7	3.5	4.7	3.9
Grass hay	17.5	2,455	7,772	2,637	7,544	Tons	3.1	2.3	3.1	2.5
Irrigated pasture	17.5	2,455	7,772	2,637	7,544	AUM[e]	9.5	7.1	9.5	7.8
Barley	10.0	1,403	4,441	1,507	4,311	Bushels	110	77	110	87
Corn	5.0	702	2,221	754	2,156	Bushels	137	100	137	112
Total	**100.0**	**14,031**	**44,410**	**15,070**	**43,110**					

[a]Crop proportions are based upon those used in the Project Feasibility Report to estimate consumptive use of project water.

[b]Yield impacts are based on production function analysis.

[c]The increase in acreage over the No Action Alternative is due to inclusion of 1,039 acres of new irrigation service.

[d]The reduction in acreage is due to 1,300 acres of retired lands.

[e]AUM = Animal unit month (represents the amount of forage consumed by a cow and calf in one month).

Table 3.5-8

Increased Crop Production Attributable to the Twin Pots Alternative

Crop	Units	Potential Increase in Production Because of the Project			Value of Increased Production	Percentage Increase in Production		
		Indian Water Rights[a]	Secondary Water Rights[b]	Total Increase in Production		Project Area	Duchesne and Uintah Counties	State of Utah
Alfalfa	Tons	2,439	6,346	8,785	$ 799,435	8.6	3.7	0.4
Grass hay	Tons	564	984	1,548	140,868	8.4	8.4	1.4
Irrigated pasture	AUM[c]	1,729	3,662	5,391	204,858	8.0	8.0	1.3
Small grain	Bushels	11,440	33,100	44,540	106,896	9.8	9.8	0.6
Corn	Bushels	7,124	19,372	26,496	66,240	8.6	8.4	0.4
Total					**$ 1,318,297**			

[a]Indian water rights impacts include an increase in production on existing lands and inclusion of idle lands.

[b]Secondary water rights impacts include a reduction of 1,300 because of land retirement.

[c]AUM = Animal unit month (represents the amount of forage consumed by a cow and calf in one month).

3.5.7 Cumulative Impacts

Table 3.5-9 summarizes the cumulative impacts of the Upalco Unit Proposed Action and alternatives and the Uintah Unit Proposed Action.

3.5.7.1 Upalco and Uintah Units' Proposed Actions

The two Proposed Actions would result in significant increases in local and regional agriculture output. However, from a statewide perspective, the increase would not be significant.

The value of local irrigated production would increase by more than $3.6 million annually.

3.5.7.2 Cow Canyon Alternative and Uintah Unit Proposed Action–Lower Uintah

The Cow Canyon Alternative and the Uintah Unit Proposed Action would result in significant increases in local and regional agriculture output. However, from a statewide perspective, the increase would not be significant. The value of local irrigated production would increase by more than $3.6 million annually.

3.5.7.3 Crystal Ranch Alternative and Uintah Unit Proposed Action–Lower Uintah

The Crystal Ranch Alternative and the Uintah Unit Proposed Action would result in significant increases in local and regional agriculture output. However, from a statewide perspective, the increase would not be significant. The value of local irrigated production would increase by more than $3.4 million annually.

3.5.7.4 Twin Pots Alternative and Uintah Unit Proposed Action–Lower Uintah

The Twin Pots Alternative and the Uintah Unit Proposed Action would result in significant increases in local and regional agriculture output. However, from a statewide perspective, the increase would not be significant. The value of local irrigated production would increase by more than $3.4 million annually.

3.6 Water Resources and Hydrology

3.6.1 Introduction

This section addresses potential changes to, and impacts on, surface water and groundwater resources and hydrology resulting from the Proposed Action and alternatives of the Upalco Unit. The discussion focuses on the affected (baseline) environment followed by a summary of potential direct, indirect, total, and/or cumulative water resource and hydrologic effects. More detailed information on water resources and hydrology is contained in the Water Resources Technical Report (CH2M HILL/Horrocks 1996e).

3.6.2 Issues Eliminated from Further Analysis

All water resource issues identified during public scoping were analyzed. None were eliminated.

3.6.3 Issues Addressed in the Impact Analysis

During public scoping, the following issues and concerns related to water resources were identified by Federal, State, and local agencies, and the public:

- The quantity and quality of water available for direct or indirect use determines its existing and future beneficial uses.
- There is concern that changes to and impacts on water quantity and quality will occur.
- All impacts on water quantity and quality must be accounted for, including modification of peak and low flows, and effects on groundwater recharge, floodplains, and downstream loading of salts and other contaminants.

Table 3.5-9

Cumulative Impacts: Proposed Action or Alternatives Combined with the Uintah Unit Proposed Action

Proposed Action and Uintah Unit Proposed Action

Crop	Units	Potential Increase in Production Because of the Project: Indian Water Rights	Secondary Water Rights	Total Increase in Production	Value of Increased Production	Percentage Increase in Production: Combined Project Areas	Duchesne and Uintah Counties	State of Utah
Alfalfa	Tons	12,179	9,946	22,125	$ 2,013,375	11.9	9.7	1.1
Grass hay	Tons	2,784	2,528	5,312	483,392	11.6	22.3	3.7
Irrigated pasture	AUM*	8,489	7,421	15,910	604,580	11.2	24.7	3.4
Small grain	Bushels	57,660	61,952	119,612	287,069	13.3	33.4	1.6
Corn	Bushels	35,354	34,144	69,498	173,745	11.9	21.7	1.1
Total					**$ 3,562,161**			

Cow Canyon Alternative and Uintah Unit Proposed Action

Crop	Units	Potential Increase in Production Because of the Project: Indian Water Rights	Secondary Water Rights	Total Increase in Production	Value of Increased Production	Percentage Increase in Production: Combined Project Areas	Duchesne and Uintah Counties	State of Utah
Alfalfa	Tons	12,179	9,946	22,125	$ 2,013,375	11.9	9.7	1.1
Grass hay	Tons	2,784	2,528	5,312	483,392	11.6	22.3	3.7
Irrigated pasture	AUM*	8,489	7,421	15,910	604,580	11.2	24.7	3.4
Small grain	Bushels	57,660	61,952	119,612	287,069	13.3	33.4	1.6
Corn	Bushels	35,354	34,144	69,498	173,745	11.9	21.7	1.1
Total					**$ 3,562,161**			

Crystal Ranch Alternative and Uintah Unit Proposed Action

Crop	Units	Potential Increase in Production Because of the Project: Indian Water Rights	Secondary Water Rights	Total Increase in Production	Value of Increased Production	Percentage Increase in Production: Combined Project Areas	Duchesne and Uintah Counties	State of Utah
Alfalfa	Tons	12,179	9,946	22,125	$ 2,013,375	11.2	9.1	1.0
Grass hay	Tons	2,784	1,774	4,558	414,778	11.0	21.0	3.5
Irrigated pasture	AUM*	8,489	6,667	15,156	575,928	10.5	23.2	3.2
Small grain	Bushels	57,660	56,770	114,430	274,632	12.5	31.4	1.5
Corn	Bushels	35,354	29,832	65,186	162,965	11.2	20.4	1.0
Total					**$ 3,441,678**			

Twin Pots Alternative and Uintah Unit Proposed Action

Crop	Units	Potential Increase in Production Because of the Project: Indian Water Rights	Secondary Water Rights	Total Increase in Production	Value of Increased Production	Percentage Increase in Production: Combined Project Areas	Duchesne and Uintah Counties	State of Utah
Alfalfa	Tons	12,179	9,946	22,125	$ 2,013,375	11.0	9.0	1.0
Grass hay	Tons	2,784	1,774	4,558	414,778	10.8	20.6	3.4
Irrigated pasture	AUM*	8,489	5,912	14,401	547,238	10.4	22.9	3.1
Small grain	Bushels	57,660	53,330	110,990	266,376	12.3	30.9	1.4
Corn	Bushels	35,354	29,832	65,186	162,965	11.0	20.1	1.0
Total					**$ 3,404,732**			

*AUM = Animal unit month (represents the amount of forage consumed by a cow and calf in one month).

- Each project feature, including dam and reservoir construction, canal rehabilitation, and water conservation measures, will affect site and local hydrology and the related environment.
- The collective impacts of project features will impact downstream water resources.
- Modification of peak flows will impact the river ecosystem.
- Water conservation measures and systems, such as improved delivery systems, should be provided.
- There is a desire to decrease downstream salt loads.

Issues, concerns, and environmental impacts on "Aquatic Resources," "Wetland Resources," "Wildlife Resources," and "Threatened and Endangered Species" that are either directly or indirectly related to changes in water resource conditions are identified and described under their respective headings in Sections 3.8 through 3.11 of this chapter. These potential environmental effects may be related to changes in the quantity or quality of surface water, groundwater, and/or recharge.

3.6.4 Description of Area of Influence

The area of influence for water resources in the Upalco Unit includes the headwaters and tributaries of the Lake Fork and Yellowstone Rivers downstream to the confluence of the Lake Fork River with the Duchesne River near Myton (see Map 1-1 in Chapter 1). The project area of influence also includes the Colorado River because of potential flow and salinity impacts downstream at Imperial Dam. The seven-state Colorado River Basin Salinity Control Forum has worked with the U.S. Environmental Protection Agency (EPA) and affected states to develop salinity standards for the Colorado River and an implementation plan for controlling/reducing salinity in the Colorado River system (including the project area).

3.6.5 Affected Environment

This section describes existing (baseline) hydrologic and water resource conditions potentially affected by the Proposed Action and each of the Upalco Unit alternatives. The discussion includes a general description of the water resource characteristics best addressed on a unit-wide basis, and those that need to be addressed on a more localized basis.

3.6.5.1 Proposed Action–Talmage

3.6.5.1.1 Surface Water Hydrology. The Lake Fork and Yellowstone Rivers make up the primary drainage system of the Upalco Unit. These rivers originate in the Uinta Mountains and flow south through deep canyons cut through bedrock and broad, alluvial floodplains. Annual precipitation ranges from more than 38 inches in the upper part of the unit to less than 8 inches in the lower part of the unit.

Most of the water in the unit originates in high mountain and upland areas as snowfall in late winter and early spring. Precipitation in the lower basin is primarily from thunderstorms during the summer and is generally ineffective as a source of water for streams or groundwater recharge. From 1940 to 1976, the precipitation data at the City of Roosevelt show July was the driest month and October was the wettest.

Collectively, the Lake Fork River above Moon Lake Reservoir and the Yellowstone River above the Yellowstone Feeder Canal provide most of the incoming surface water to the Upalco Unit with average annual flows of 91,000 and 99,000 acre-feet, respectively. Unit-wide, the total average annual inflow from all tributaries is about 192,000 acre-feet. Of this total, about 169,000 acre-feet (88 percent) is diverted for irrigation through a network of canals and pipelines, and 10,700 acre-feet (6 percent) returns to the Lake Fork River near the southern part of the unit as agricultural return flows.

3.6.5.1.1.1 High Mountain Lakes. All of the 10 high mountain lakes proposed for stabilization under the Proposed Action are located in the upper

Yellowstone River watershed within the High Uintas Wilderness (HUW) (see Map 2-1 in Chapter 2). Existing lake characteristics are summarized in Section 2.2.2.5 of Chapter 2. Collectively, the lakes yield on average about 2,000 acre-feet of irrigation water and water storage rights total about 2,787 acre-feet.

The lake outlet gates are typically closed about mid-October (after the Indian [1861] irrigation water right has been met) to store inflow for delivery during the irrigation season. The lakes may not refill until high runoff occurs in the spring and/or summer. Once the lakes are filled, inflow passes through the lakes (via spillways) with little or no reduction in peak flow. Usually in late June or early July, the outlet gates are opened and left for a 2-week period before they are readjusted to maintain a constant flow. This cycle is repeated until the lakes are drawn down to the outlet level and diversions for secondary water right holders have ended.

During normal and high-flow years, the high mountain lakes have little effect on peak annual runoff since they fill before peak spring/summer runoff occurs. During low-flow years, however, some spring/summer runoff may be stored in these lakes, which helps attenuate peak flows.

None of the high mountain lakes located in the upper Lake Fork River watershed would be stabilized under the Proposed Action.

3.6.5.1.1.2 Dams and Reservoirs. Besides the high mountain lakes described above, the forebay for Moon Lake Electric's power plant is the only other impoundment located on the Yellowstone River.

Under the Proposed Action, Crystal Ranch Dam and Reservoir would be constructed on the Yellowstone River about 4 miles upstream from the confluence of the Yellowstone and Lake Fork Rivers (see Map 2-1 in Chapter 2). At the reservoir site, the braided river channel is in a steep-walled, flat-bottomed, glacially cut valley. The valley walls are composed of gravelly, sandy, and silty lateral moraines.

Twin Pots Dam and Reservoir are located offstream on an unnamed channel just west of the Lake Fork River (see Map 2-1 in Chapter 2). The existing reservoir has an estimated capacity of 4,050 acre-feet and receives water from the Lake Fork River via the Farnsworth Canal. A 100-cfs turnout from the Farnsworth Canal near the northwest end of the reservoir provides the reservoir water supply. Average annual diversions for Twin Pots Reservoir total about 3,800 acre-feet, or about 4 percent of the average annual inflow above Moon Lake. The reservoir, operated and maintained by the Moon Lake Water Users Association, is typically drained by the end of the irrigation season with only the 21-acre-foot dead (inactive) pool remaining.

Big Sand Wash Dam and Reservoir are located offstream on Big Sand Wash, a tributary of Dry Gulch Creek (see Map 2-1 in Chapter 2). The existing reservoir has a storage capacity of 12,000 acre-feet (about 6 percent of the unit's average annual inflow) and receives water from the Lake Fork River via the "C" Canal. Diversions from the Lake Fork River typically fill Big Sand Wash Reservoir by mid-March and average about 48,000 acre-feet per year. Peak reservoir inflow usually occurs in May and averages about 10,000 acre-feet.

During the nonirrigation season (October through March), end-of-month storage steadily rises as Big Sand Wash Reservoir is operated to store surplus winter flows for delivery during the irrigation season. No reservoir releases occur until the irrigation season (April through September) or until the reservoir fills and spills. During the irrigation season, end-of-month storage generally fluctuates from April through June, declines in July and August, and rises in September as the reservoir is operated to meet irrigation demands. Reservoir releases generally increase from April through July and decline in August and September.

3.6.5.1.1.3 River Reaches. In the upper part of the Upalco Unit, the Lake Fork and Yellowstone Rivers generally flow in deep, narrow glacial valleys up to 2,000 feet deep. The rivers join in the middle part of the unit and flow southeast in multiple channels, joining the Duchesne River near Myton. In the middle and lower part of the unit, the river valleys become shallower and broader as they flow across broad, alluvial floodplains and glacial outwash deposits.

Most irrigation diversions occur during spring and early summer when river flows are high and sufficient water is available. Diversions exceeding crop consumptive use (CU) requirements are common during this time of year as irrigators attempt to compensate for water shortages that occur in late summer during lower flow periods. This overdiversion of water decreases irrigation efficiency by increasing surface runoff and irrigation deep percolation. Some of this runoff and deep percolation is used on croplands lower in the unit, some is used by phreatophytes (e.g., in wetland areas and other non-crop areas), and some returns to the river as drainage and agricultural return flows.

Using the Water Budget Model developed for this study, baseline flows (by month) in wet, average, and dry years were estimated for each of the 17 river reaches (5 on the Yellowstone River and 12 on the Lake Fork River) studied in the Upalco Unit. Table 3.6-1 presents the baseline monthly flow estimates and Map 2-10 in Chapter 2 shows the location of each river reach. Since the river reach data were calculated at the model node located either at the top or bottom of the reach, the baseline data presented may not exactly reflect flows throughout the river reach.

Table 3.6-2 summarizes, for selected river reaches, baseline ranked annual peak (maximum) flows for the Upalco Unit. The 2-year return period data reflect channel and wetland maintenance flows; the 5-, 10-, and 20-year data reflect overbank flows that are essential to regenerate and maintain riparian and wetland plants; and the 20- and 50-year data reflect peak flood discharges that can affect channel maintenance processes.

Additional hydrologic data are contained in the Water Resources Technical Report (CH2M HILL/Horrocks 1996e). These data were used by other resource specialists to determine potential impacts on water quality; aquatic, wetland, and wildlife resources; and on threatened and endangered species.

3.6.5.1.1.4 Irrigation Canals and Seepage. Canals in the Upalco Unit are generally unlined. The wetland/riparian communities that have developed where there is an ample water source from canal leaks and seepage are discussed in Section 3.9 Wetland and Riparian Resources of this chapter. Unit-wide, canal seepage losses are approximately 22,000 acre-feet annually, reducing conveyance efficiency and overall irrigation efficiency.

3.6.5.1.2 Groundwater Hydrology. The bedrock and surficial geology of the Uinta Basin define the configuration and characteristics of Upalco Unit aquifers. Two types of aquifers are present: shallow, unconfined aquifers in the unconsolidated glacial/alluvial deposits; and a deep, confined, regional aquifer in the consolidated bedrock formations. For the Uinta Basin, total groundwater storage is estimated to be about 28 million acre-feet (Hood and Fields 1978).

Groundwater in the shallow, unconfined aquifers moves southward, generally following the topographic gradient, and discharges to surface waters in the southern part of the unit. These aquifers contain much less water than the large regional aquifer, and groundwater movement through them occurs more rapidly. Groundwater storage in the shallow aquifers is estimated to be about 2 million acre-feet, or about 7 percent of the total groundwater volume in the Uinta Basin (Hood and Fields 1978). Hydraulic conductivities range from 2 to 1,800 feet per day, but are generally in the order of 20 to 80 feet per day (Hood 1976).

Overall, as the size of the aquifer material (glacial outwash and alluvium) declines from north to south, the hydrologic conductivities also decline. Therefore, the lowest hydrologic conductivities generally occur in the southern part of the unit.

In bench and upland areas, shallow groundwater moves toward streams and rivers and discharges as springs where low-permeability bedrocks outcrop in

Table 3.6-1
Baseline Flows for Upalco Unit

Page 1 of 2

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
Y-1--Yellowstone High Mountain Lakes Storage (acre-feet)													
Wet	Baseline	772	1187	1602	2017	2467	3001	3773	3994	3994	2034	74	0
Average	Baseline	594	891	1188	1485	1782	2198	2792	3861	3994	2034	74	0
Dry	Baseline	416	594	772	970	1148	1445	1861	2573	3464	1504	0	0
Y-2--Yellowstone High Mountain Lakes to Reservoir (cfs)													
Wet	Baseline	134	86	67	56	50	51	61	295	818	491	237	157
Average	Baseline	90	68	56	49	45	47	70	284	482	217	141	111
Dry	Baseline	61	49	42	40	37	38	74	162	181	106	82	60
Y-3--Reservoir Storage (acre-feet)													
Wet	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
Average	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
Dry	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
Y-4--Reservoir to Yellowstone Feeder Diversion (cfs)													
Wet	Baseline	134	86	67	56	50	51	61	295	818	491	237	157
Average	Baseline	90	68	56	49	45	47	70	284	482	217	141	111
Dry	Baseline	61	49	42	40	37	38	74	162	181	106	82	60
Y-5--Yellowstone Feeder Diversion to Confluence (cfs)													
Wet	Baseline	70	85	67	56	50	50	49	237	683	392	189	137
Average	Baseline	23	63	55	49	45	46	56	225	381	150	91	85
Dry	Baseline	3	32	37	40	37	37	60	125	123	70	70	51
LF-1--Lake Fork High Mountain Lakes Storage (acre-feet)													
Wet	Baseline	356	593	830	1067	1304	1660	2075	385	4859	2483	107	0
Average	Baseline	297	475	653	831	1009	1306	1662	3444	891	1889	0	0
Dry	Baseline	237	356	475	594	713	951	1248	3030	4218	1545	0	0
LF-2--Lake Fork High Mountain Lakes to Moon Lake (cfs)													
Wet	Baseline	91	58	43	34	28	28	42	303	819	411	154	99
Average	Baseline	58	43	34	30	27	28	57	312	550	200	99	71
Dry	Baseline	40	35	28	26	26	30	72	213	248	74	56	41
LF-3--Moon Lake to Farnsworth Diversion (cfs)													
Wet	Baseline	1	0	0	0	7	8	47	229	644	439	267	165
Average	Baseline	4	3	2	2	2	2	46	226	458	393	261	107
Dry	Baseline	1	0	0	0	0	0	42	240	398	111	55	39

Table 3.6-1
Baseline Flows for Upalco Unit

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-4--Farnsworth Diversion to Rowley Ditch Diversion (cfs)													
Wet	Baseline	0	0	0	0	7	7	21	125	513	304	158	108
Average	Baseline	3	2	2	2	2	2	20	125	330	279	198	82
Dry	Baseline	0	0	0	0	0	0	16	149	313	100	52	36
LF-5--Rowley Ditch Diversion to Confluence (cfs)													
Wet	Baseline	10	17	27	22	20	18	32	156	644	341	197	112
Average	Baseline	14	14	14	14	14	15	33	173	404	307	246	101
Dry	Baseline	10	10	10	10	10	10	25	173	343	209	97	58
LF-6--Confluence to "C" Canal Diversion (cfs)													
Wet	Baseline	80	103	94	79	70	69	31	194	1076	476	179	141
Average	Baseline	37	77	69	63	59	61	40	199	535	208	154	92
Dry	Baseline	13	42	47	50	47	48	35	99	232	111	47	40
LF-7--"C" Canal Diversion to South Boneta Diversion (cfs)													
Wet	Baseline	10	52	44	67	67	56	13	78	650	268	63	71
Average	Baseline	3	12	20	61	57	39	14	75	239	72	38	22
Dry	Baseline	0	0	2	50	47	15	8	40	46	28	22	13
LF-8--South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion (cfs)													
Wet	Baseline	10	59	63	79	70	56	12	95	758	287	71	84
Average	Baseline	3	14	23	63	59	41	15	92	287	71	38	24
Dry	Baseline	0	0	2	50	47	15	7	38	44	33	25	14
LF-9--Big Sand Wash Feeder Pipeline Diversion to Purdy Ditch Diversion (cfs)													
Wet	Baseline	13	55	46	69	71	62	16	76	648	266	61	70
Average	Baseline	6	15	23	63	61	45	18	73	237	70	36	22
Dry	Baseline	3	3	5	52	50	21	12	39	45	29	23	14
LF-10--Purdy Ditch Diversion to Red Cap Diversion (cfs)													
Wet	Baseline	13	62	65	81	73	62	14	86	747	276	62	80
Average	Baseline	6	17	25	66	63	47	17	84	277	61	31	20
Dry	Baseline	3	3	5	52	50	21	9	29	35	30	24	13
LF-11--Red Cap Diversion to Hamilton-Knudsen Diversion (cfs)													
Wet	Baseline	13	62	65	81	73	62	7	59	713	240	33	65
Average	Baseline	6	17	25	66	63	47	10	56	242	26	4	6
Dry	Baseline	3	3	5	52	50	21	2	2	2	1	0	0
LF-12--Hamilton-Knudsen Diversion to Duchesne River (cfs)													
Wet	Baseline	13	62	65	81	73	62	6	57	711	238	31	64
Average	Baseline	6	17	25	66	63	47	9	55	240	24	2	6
Dry	Baseline	3	3	5	52	50	21	2	0	0	0	0	0

Table 3.6-2

Ranked Annual Peak Flows for the Upalco Unit

Reach	Return Period[a]	Baseline[b] (cfs)	Reach	Return Period[a]	Baseline[b] (cfs)
Y-2	Yellowstone High Mountain Lakes to Reservoir		LF-6	Confluence to "C" Canal Diversion	
	2-yr	893		2-yr	829
	5-yr	1,242		5-yr	1,463
	10-yr	1,496		10-yr	1,943
	20-yr	1,752		20-yr	2,167
	50-yr	1,884		50-yr	2,396
Y-4	Reservoir to Yellowstone Feeder Diversion		LF-7	"C" Canal Diversion to South Boneta Diversion	
	2-yr	741		2-yr	494
	5-yr	980		5-yr	1,111
	10-yr	1,179		10-yr	1,629
	20-yr	1,302		20-yr	1,776
	50-yr	1,432		50-yr	2,017
Y-5	Yellowstone Feeder Diversion to Confluence		LF-8	South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion	
	2-yr	601		2-yr	489
	5-yr	840		5-yr	1,106
	10-yr	1,039		10-yr	1,624
	20-yr	1,162		20-yr	1,771
	50-yr	1,292		50-yr	2,012
LF-2	Lake Fork High Mountain Lakes to Moon Lake		LF-10	Purdy Ditch Diversion to Red Cap Diversion	
	2-yr	1,011		2-yr	480
	5-yr	1,516		5-yr	1,096
	10-yr	1,742		10-yr	1,613
	20-yr	1,820		20-yr	1,761
	50-yr	1,948		50-yr	2,002
LF-3	Moon Lake to Farnsworth Diversion		LF-11	Red Cap Diversion to Hamilton-Knudsen Diversion	
	2-yr	742		2-yr	445
	5-yr	1,091		5-yr	1,061
	10-yr	1,297		10-yr	1,580
	20-yr	1,461		20-yr	1,726
	50-yr	1,489		50-yr	1,968

Table 3.6-2

Ranked Annual Peak Flows for the Upalco Unit

Reach	Return Period[a]	Baseline[b] (cfs)	Reach	Return Period[a]	Baseline[b] (cfs)
LF-4	**Farnsworth Diversion to Rowley Ditch Diversion**		LF-12	**Hamilton-Knudsen Diversion to Duchesne River**	
	2-yr	610		2-yr	443
	5-yr	954		5-yr	1,059
	20-yr	1,168		10-yr	1,577
	20-yr	1,333		20-yr	1,724
	50-yr	1,358		50-yr	1,966
LF-5	**Rowley Ditch Diversion to Confluence**				
	2-yr	620			
	5-yr	964			
	10-yr	1,178			
	20-yr	1,343			
	50-yr	1,368			

Notes:

Flows ranked largest to smallest by California Method (Chow 1964).

[a]The return period is the average duration required to experience the given flow (or greater). For example, the baseline peak flow of 620 cfs will be reached or exceeded once within a 2-year period, on average, at the Rowley Ditch Diversion to Confluence.

[b]5-, 10-, 20- and 50-year return period flows are linearly interpolated.

valley walls. These aquifers are primarily recharged locally by high stream flows during spring runoff and infiltration from leaky canals and irrigation deep percolation. They also respond rapidly to changes in recharge or discharge, such as canal seepage and well pumping.

The deep, regional aquifer consists of deeply circulating groundwater that moves south-southeast from its recharge area in the Uinta Mountains. About 95 percent of the recharge (about 500,000 acre-feet per year) occurs from precipitation and snowmelt in the Uinta Mountains. The main areas of discharge are in the southern and eastern parts of the Basin. Of the estimated 300,000 acre-feet of annual discharge, about 160,000 acre-feet occurs as evapotranspiration, about 12,000 acre-feet is discharged by well pumping, and the rest (128,000 acre-feet) is discharge from springs and diffuse seepage.

The regional aquifer is confined under most of the Upalco Unit by the low-permeability Duchesne River and Uinta Formations, which consist of interbedded sandstones, siltstones, claystones, and shale (Hood 1976). Because of the fine-grained nature of the consolidated rocks, the hydraulic conductivity ranges from 0.3 to 1.3 feet per day (Hood 1976) with most of the groundwater moving through fractures and higher permeability materials (i.e., sandy beds). Fractures in these formations are generally the main avenues of water movement to wells in the area. Near the southern part of the Basin, the regional aquifer is under artesian pressure. The hydrostatic pressure has been measured from 50 to 120 feet above ground surface, which indicates upward leakage (Hood and Fields 1978).

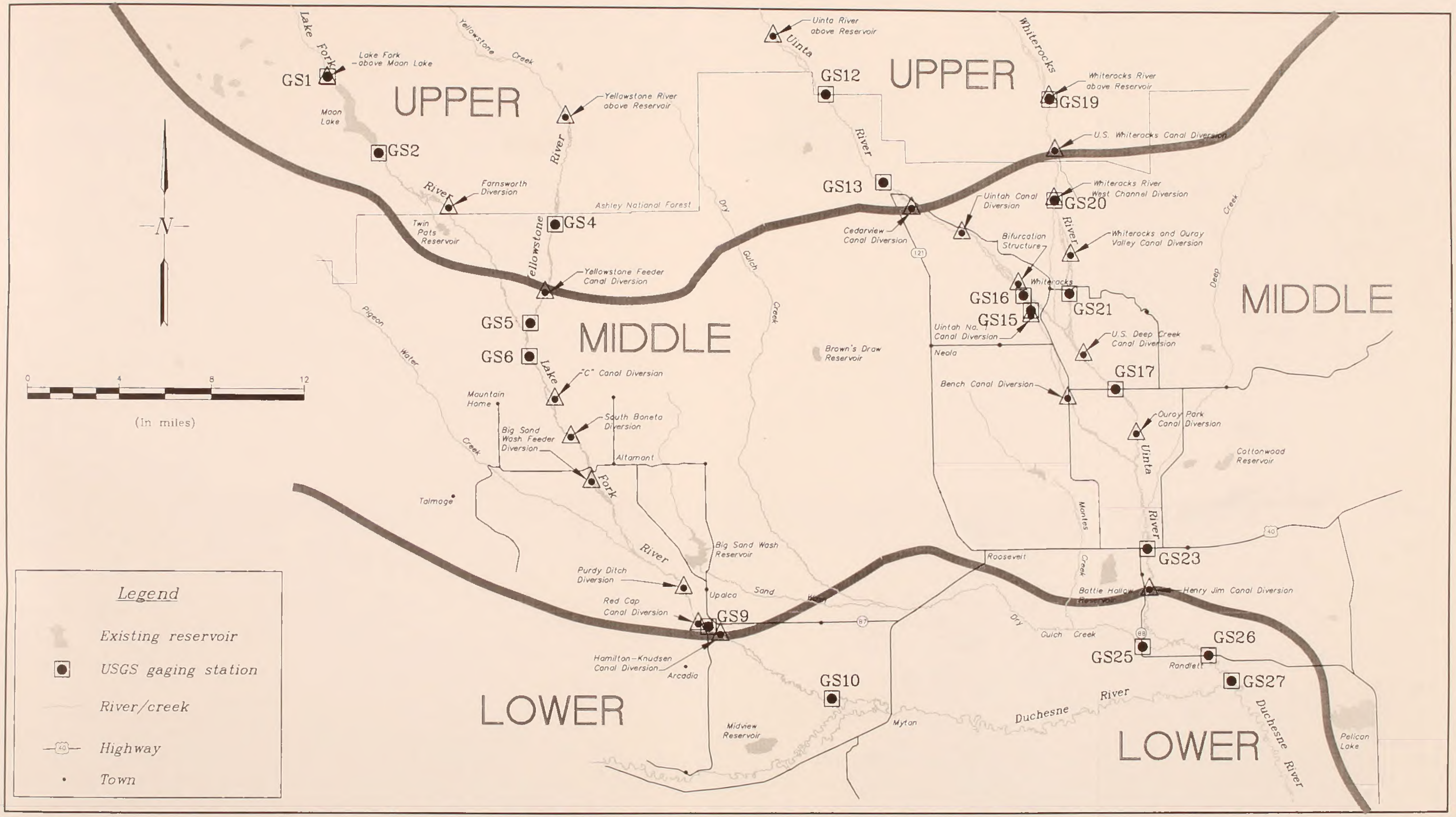
Because of distinctive geologic and hydrologic differences in the shallow aquifers, the Upalco Unit was divided into three subunits. The Upper Upalco Subunit consists of the Uinta Mountains; mountain lake basins; and deep, glacially cut river valleys underlain by coarse-grained shallow aquifers recharged by precipitation and snowmelt. The Middle Upalco Subunit consists of flat benchlands and uplands underlain by shallow aquifers recharged by surface waters, canal seepage, and irrigation deep percolation. The Lower Upalco Subunit consists of wide, flat river valleys underlain by fine-grained shallow aquifers that discharge to surface waters. Map 3.6-1 shows the three shallow aquifer subunits for the Upalco and Uintah Units.

3.6.5.1.2.1 Upper Upalco Subunit. The high mountain lakes area consists of gravelly, sandy, and silty glacial ground moraine or bouldery talus overlying quartzite bedrock. The area is covered by deep snow much of the year, and serves as a major recharge area for the entire Upalco Unit. Groundwater is very shallow and many saturated bogs, meadows, and springs are present in the lake basins. Currently, when the high mountain lakes are drawn down for irrigation, groundwater drains from adjacent meadows and glacial till into the lakes. The shallow aquifer recharges local tributary streams and rivers, which eventually recharge shallow aquifers farther south in the Unit. Water percolating into bedrock material eventually moves down into the deep, regional aquifer.

Farther south, the Crystal Ranch Reservoir site overlies highly permeable, gravelly alluvium in the valley bottom, and moderately permeable glacial till along the valley walls. The valley bottom alluvium is estimated to be more than 100 feet thick (Stetson Engineers 1995a) and contains a shallow, unconfined, highly permeable aquifer that is recharged primarily by Yellowstone River percolation and seepage from valley walls. Because the hydraulic conductivity of the alluvium is high (30 to 200 feet per day), the shallow aquifer shows a direct and rapid response to changes in river levels and flows. Typically, valley-bottom shallow aquifers are at or near the same elevation as adjacent surface waters.

The reservoir site is underlain by low-permeability bedrock of the Duchesne River Formation (Stokes and Madsen 1961), which prevents shallow groundwater in the valley alluvium from infiltrating the bedrock and its confined, regional aquifer.

Twin Pots Reservoir is surrounded by glacial moraine that consists of unsorted and unstratified gravel, sand, and silt. The thickness of the moraine deposits appears to be several hundred feet at the reservoir site and likely contains shallow,



Map 3.6-1
Upalco and Uintah Units
Subunits Designated to Describe
Groundwater Characteristics

unconfined groundwater that is recharged locally by reservoir seepage and snowmelt infiltration.

3.6.5.1.2.2 Middle Upalco Subunit. Overlying the Duchesne River and Uinta Formations are glacial moraines, glacial outwash gravels, alluvium, and related coarse-grained deposits that range in thickness from a few feet to more than 200 feet. These unconsolidated deposits form a nearly continuous sheet of material that comprises the most prolific shallow aquifer in the middle subunit. Groundwater in these deposits is unconfined; locally it may be semiconfined by fine-grained sediments near the land surface (Hood 1976). Shallow aquifer recharge occurs primarily from river loss/percolation, canal seepage, and agricultural return flows (surface runoff and irrigation deep percolation). Depth to groundwater varies seasonally, but it is usually within 10 feet of the surface.

The shallow aquifers in the middle subunit provide water to numerous shallow wells and springs in the area. Based on historical shallow well data (Hood and Fields 1978), these wells experience large fluctuations because of factors such as yearly precipitation and seasonal irrigation patterns. No definitive trend in well water levels could be determined from the historical data, but natural and human-induced fluctuations already occur.

Springs occur where rivers downcut through bench gravels into low-permeability bedrock, forcing shallow groundwater to move laterally and discharge at bedrock outcrops. Shallow groundwater discharging out of valley walls as springs is an important hydrogeologic feature in the middle subunit.

The Lake Fork River flows through a wide, flat-bottomed valley in the middle subunit. The floodplain is underlain by sand and gravel and contains shallow, unconfined groundwater, which responds rapidly to changes in river flow. Some recharge to the floodplain shallow aquifer occurs through seepage from the shallow aquifers on adjacent benches and uplands.

Most irrigated agriculture occurs in the middle subunit on soils formed in alluvial and glacial deposits. Proposed canal rehabilitation and pipeline construction would occur on benches and valley bottoms underlain by shallow aquifers primarily comprised of alluvial and outwash gravels and shallow bedrock.

No alluvial or glacial outwash material that would contain shallow groundwater is present at the Big Sand Wash Reservoir site. Deeper groundwater is present in the Duchesne River Formation beneath the reservoir site, but this groundwater is part of the regional aquifer, which is confined by low-permeability shales, siltstones, and sandstones in the area.

3.6.5.1.2.3 Lower Upalco Subunit. The Lake Fork River in the lower subunit is a meandering stream that has a low gradient and carries a large suspended sediment load. The river alluvium is largely fine-grained and contains a lower permeability aquifer than farther upstream. Groundwater input to this shallow, alluvial aquifer occurs through discharge from adjacent shallow aquifers and upward leakage from the regional aquifer.

Outcrops of Duchesne River and Uinta Formation bedrock are prevalent in the lower subunit. Groundwater in these bedrock formations has an upward gradient and discharges as springs under artesian pressure. Overall, potential land retirement areas are not recharge areas for the shallow or deep aquifers. The lower part of the subunit tends to be an area of discharge for both aquifers.

3.6.5.1.2.4 Shallow Aquifer Groundwater Budget. Table 3.6-3 shows the shallow aquifer groundwater budget for the Upalco Unit. Currently, most shallow aquifer recharge occurs during peak spring runoff in May and June with little recharge later in the summer after the peak flow is past. Canal seepage loss, irrigation deep percolation, and downward river percolation are the primary sources of shallow aquifer recharge. Under baseline conditions, approximately 47,350 acre-feet annually recharges the shallow aquifer.

Table 3.6-3
Shallow Aquifer Groundwater Budget for the Upalco Unit—Baseline Conditions

Upalco Unit Recharge	Precipitation	Canal Seepage	Irrigation Deep Percolation	River Loss	Total
Baseline (ac-ft/yr)	1,000	22,000	5,350	19,000	47,350

Unit-wide, canal seepage losses are about 22,000 acre-feet. This represents about 46 percent of the total shallow aquifer recharge budget, or about 13 percent of the 169,000 acre-feet diverted for irrigation annually. Recharge to the shallow aquifer from irrigation deep percolation is currently about 5,350 acre-feet, or half the annual agricultural return flow (10,700 acre-feet).

3.6.5.2 Cow Canyon Alternative

The affected environment and baseline hydrologic conditions for the Cow Canyon Alternative are the same as described for the Proposed Action, except as noted.

Upper Yellowstone Dam and Reservoir would be constructed on the Yellowstone River about 1,600 feet upstream from the Yellowstone Ranch and about 2.4 miles downstream from the confluence of Swift Creek and the Yellowstone River (see Map 2-11 in Chapter 2). Two small, unmeasured drainages (Hells Canyon and Cow Canyon) enter the river above and below the dam site. Baseline monthly inflows at this site are represented by the data shown in Table 3.6-1 for River Reach Y-2 (Yellowstone High Mountain Lakes to Reservoir).

The river valley overlies well-sorted gravel and sand with a high hydraulic conductivity. The eastern wall of the valley is composed of sandy and gravelly glacial till. These gravelly deposits contain a shallow aquifer recharged by water loss from the river and groundwater movement down the valley walls. Spring discharges from a landslide deposit at Cow Canyon, located on the western side of the proposed reservoir, further indicate the presence of shallow groundwater in valley walls. Spring discharges at the toe of the landslide are piped down-valley to provide a domestic water supply for the Upper Country Water District.

Alluvium and glacial till at the Upper Yellowstone Reservoir site overlie limestone and sandstone bedrock. The cavernous Madison Limestone, which dips to the south and underlies much of the reservoir site, is an important aquifer in the Upalco Unit and Uinta Basin. However, groundwater moves rapidly through this limestone and may be detrimental to reservoir storage.

3.6.5.3 Crystal Ranch Alternative

The affected environment and baseline hydrologic conditions for the Crystal Ranch Alternative are the same as described for the Proposed Action.

3.6.5.4 Twins Pots Alternative

The affected environment and baseline hydrologic conditions for the Twin Pots Alternative are the same as described for the Proposed Action, except as noted.

In addition to the 10 high mountain lakes that would be stabilized under the Proposed Action, the Twin Pots Alternative includes Brown Duck, Island, Kidney, and Clements Lakes in the upper Lake Fork River watershed (see Map 2-14 in Chapter 2). Existing lake characteristics are summarized in Section 2.2.2.5 of Chapter 2. Collectively, the four lakes yield on average about 3,500 acre-feet of irrigation water and water storage rights total about 6,299 acre-feet. Surface water hydrology and high mountain lake operations are the same as described for the Proposed Action (see Section 3.6.5.1.1.1).

3.6.6 Impact Analysis

This section identifies and describes the environmental impacts of the Proposed Action and each Upalco Unit alternative on surface water and groundwater resources. The discussion focuses on the hydrologic changes and effects expected from project construction and operation.

3.6.6.1 Significance Criteria

Changes in and effects on surface water and groundwater hydrology were identified by comparing "with project" (Proposed Action and alternative) conditions to "without project" (baseline) conditions. Based on the hydrologic changes and effects identified, direct, indirect, total, and/or cumulative impacts on water quality, environmental contaminants, and biological resources (i.e., threatened and endangered species, wetlands, aquatic resources, and wildlife) were determined. Potential impacts on water quality and biological resources are presented under their respective headings in this chapter, and were evaluated against the specific significance criteria developed for these environmental attributes. No specific significance criteria were developed or used, however, to assess whether a particular hydrologic change or effect would be significant.

3.6.6.2 Potential Impacts Eliminated from Further Analysis

Under the Proposed Action and each of the action alternatives evaluated (Cow Canyon, Crystal Ranch, and Twin Pots), construction-related impacts would be essentially the same and include minor water use and temporary stream diversion activities.

A small amount of water (either surface or groundwater) would be used to construct the project features proposed. Construction impacts on surface and groundwater quantity would be negligible compared to available water supplies.

A small cofferdam would be used during the construction of onstream storage facilities (Crystal Ranch or Upper Yellowstone Dam) to divert Yellowstone River water through a conduit around the work site. The cofferdam would not impact surface water hydrology since it would not have any controlled storage volume.

In the fall preceding the summer construction season, the outlet works for each high mountain lake proposed for stabilization would be left open to allow each lake to be drawn down to its lowest level and to pass subsequent lake inflows downstream. Surface water hydrology during lake stabilization would not be affected since lake inflows would be diverted around the work site and released downstream. Dam embankment materials removed would be spread over an area within the lake below the old high-water level, but above the future high-water level of the stabilized lake. Any old concrete would be buried beneath the substrate below the stabilized waterline.

Big Sand Wash and Twin Pots are existing offstream reservoir facilities. Construction work related to increasing the capacity of Big Sand Wash Reservoir would occur primarily outside the existing reservoir and would not affect current reservoir operations. Twin Pots Dam rehabilitation activities would occur primarily in and near the reservoir area. Minimal cofferdam or diversion facilities would be needed to divert surface water inflow around the Twin Pots work site.

Replacement and new diversion dam construction would not impact surface or groundwater hydrology since no change in river flows would occur. Concrete used to construct diversion dams would be placed during low flow periods (August through November) on one side of the river first, while water is diverted to the other side. A coffer dike or sheetpile wall would separate the construction area from the side of the river used to convey river flow. After construction of half of the diversion structure, flows would be diverted over the newly built concrete section and a coffer dike installed to separate river flow from the construction area on the other side of the river.

Potential short-term impacts would be avoided or reduced by following the standard construction requirements outlined in Appendix A.

3.6.6.3 Proposed Action–Talmage

3.6.6.3.1 Potential Operational Impacts on Surface Water Hydrology. The operation of project features, including reservoirs, diversions, canals, and pipelines, would cause changes in surface water hydrology, storage, delivery, and use. Individual project features are discussed only when notable hydrologic changes would occur.

Changing the quantity and timing of surface water flows would allow more water to be used for crop production, instream flows, and other project purposes. Water use changes (i.e., increased crop use, even water use throughout the growing season, and a 2- to 3-week extension in late season irrigation deliveries), and improved water management (i.e., water delivery matched to crop requirements and canals converted to pipelines) would decrease the amount of water leaving the Upalco Unit and Uinta Basin.

The Water Budget Model developed for this study was used to quantify potential changes in Upalco Unit river flows and reservoir storage. Based on the hydrologic changes identified, potential environmental effects and impacts on water quality, environmental contaminants, and biological resources were determined and evaluated.

3.6.6.3.1.1 High Mountain Lakes. With the stabilization of 10 high mountain lakes in the upper Yellowstone River watershed, the outlet pipes would be plugged and water surface elevations maintained year-round at the stabilized elevations proposed (see Section 2.1.2.5 in Chapter 2). Past drawdowns ranging from 4 feet (Bluebell and White Miller) to 27 feet (East Timothy) would be eliminated since the lakes would no longer be used for irrigation. Water surface fluctuations would be limited to those associated with natural flow conditions.

A total of about 1,098 acre-feet of project water would be required for a one-time filling of the lakes to the stabilized elevations proposed. Once this initial filling has taken place, lake inflow and outflow would mirror natural conditions. High winter and spring flows that were used in the past to yield about 2,000 acre-feet of irrigation water would pass downstream and be stored in Crystal Ranch Reservoir. High mountain lake water storage rights would be transferred to the United States and stored in Crystal Ranch Reservoir.

None of the high mountain lakes located in the upper Lake Fork River watershed would be stabilized, and lake operations would continue as in the past.

3.6.6.3.1.2 Dams and Reservoirs. Crystal Ranch Reservoir would have a total storage capacity of 24,000 acre-feet. This represents about 24 percent of the average annual flow in the Yellowstone River, or 13 percent of the average annual unit inflow. The reservoir would fill most often in June and, on an annual basis, would fill about 84 percent of the time.

Crystal Ranch Reservoir would store water and release water in accordance with the priority system and existing water rights. Project (1964 priority) water would be stored after 1861, secondary, and minimum instream flow water. Under the Proposed Action, reservoir storage space allocations would include 2,400 acre-feet for the conservation pool; 2,500 acre-feet for high mountain lakes storage replacement; 9,550 acre-feet for the Ute Tribe; 150 acre-feet for non-Indian-owned 1861 water-righted land; and 9,400 acre-feet for secondary water-righted land.

Reductions in reservoir storage volume caused by siltation or other unforeseen events would be from the dead storage pool that is exclusive of the identified storage allocations. Any additional storage space required for siltation would be distributed in proportion to the identified storage space allocations. Reservoir evaporation and seepage losses would be calculated monthly and shared based on the percentage of water in storage at the beginning of the month for the Ute Tribe, secondary water-righted land, non-Indian-owned 1861 water-righted land, and high mountain lake storage.

Except in times of extreme shortage, minimum instream flows would be provided in the Yellowstone River from Crystal Ranch Reservoir to the

Yellowstone Feeder Canal at the rate of 24 cfs from October through March and 56 cfs from April through September, and from the Yellowstone Feeder Canal to the river's confluence with the Lake Fork River at the rate of 24 cfs from October through March and 38 cfs from April through September. Minimum instream flows in the Lake Fork River would be provided from the Yellowstone River confluence to the Big Sand Wash Feeder Pipeline diversion at the rate of 24 cfs from October through March and 72 cfs from April through September.

In times of extreme shortage when the minimum flows cannot be achieved without jeopardizing established water rights (drier than 1934 or when reservoir inflow is below the minimum flow), instream flows would be provided only to the extent necessary to ensure fish survival (as determined by the FWS and Ute Tribe), unless reservoir releases are made by separate agreement with an entity willing to release their water for instream flows.

During wetter than dry winters, instream flows would be increased above the winter (October through March) minimum flow releases. To ensure that these additional flows would be available for instream uses, a forecasting procedure and mechanism to implement changes in wintertime releases, when possible, would be established by the CUWCD in consultation with the FWS, the Ute Tribe, the BIA, Utah Division of Wildlife Resources (Wildlife Resources), State Engineer, and potentially affected water users.

From October through March, reservoir releases would average between 41 and 47 cfs, and the 24 cfs minimum instream flow would be met or exceeded 100 percent of the time. From April through September, reservoir releases would generally rise from April through June, decline from July through September, and average between 87 and 447 cfs. The 56 cfs minimum instream flow would be met or exceeded about 95 percent of the time. Additional information on Crystal Ranch Dam and Reservoir operations is provided in Chapter 2 (see Section 2.2.2.1.1).

After enlargement, Big Sand Wash Reservoir would have a total storage capacity of 21,000 acre-feet. This represents about 23 percent of the average annual flow in the Lake Fork River above Moon Lake and about 11 percent of the average annual unit inflow. The primary water supply for Big Sand Wash Reservoir would come from the Lake Fork River via the "C" Canal and the proposed Big Sand Wash Feeder Pipeline. The reservoir would fill most often in April and June and, on an annual basis, would fill about 61 percent of the time.

Big Sand Wash Reservoir storage space allocations would include 1,200 acre-feet for the conservation pool; 3,500 acre-feet for City of Roosevelt municipal and industrial purposes; and 16,300 acre-feet (5,500 acre-feet more than currently available) for the Moon Lake Water Users Association for secondary water-righted land. Reservoir releases would be made only during the irrigation season (April through September) and remain essentially constant during each month. Releases would generally rise from April through July, decline in August and September, and average between 41 and 204 cfs. No releases would be made to provide minimum flows since the reservoir is an offstream facility. Additional information on Big Sand Wash Dam and Reservoir operations is provided in Chapter 2 (see Section 2.2.2.1.2).

Municipal and industrial water for the City of Roosevelt would be stored in the enlarged Big Sand Wash Reservoir and made available by an exchange with secondary water right water stored in Crystal Ranch Reservoir. The water would be delivered to Brown's Draw Reservoir via the Yellowstone Feeder Canal. Such an exchange would be limited to a maximum of 3,000 acre-feet during any particular year from October 1 through September 30.

After dam replacement, Twin Pots Reservoir would have a total active storage capacity of 3,768 acre-feet (about 2 percent of the average annual unit inflow) and would no longer be used primarily for irrigation purposes. When the Farnsworth Canal is operational, reservoir water levels would be maintained by diverting enough water from the Lake Fork River under the Tribe's 1861 priority water right to maintain the water level desired by the Tribe, replace any evaporation and seepage losses, maintain water quality, and assure maintenance of a viable sport fishery and riparian habitat. Water stored in Twin Pots Reservoir may also be used by the Tribe for irrigation as long as a reservoir conservation pool (discussed in Section 2.2.2.6.1.5) is retained sufficient for year-round fish habitat. Water used for irrigation would be from the Tribe's 1861 priority water right. The average annual diversion requirement would total about 1,840 acre-feet of which about 390 acre-feet would compensate for evaporation losses and 1,450 acre-feet for seepage losses (Stetson 1995). When the Farnsworth Canal is not operational, reservoir pool levels would fall because of seepage and evaporation losses, but would remain high enough to sustain a conservation pool to maintain a year-round Tribal sport fishery and fish habitat.

At any time that Moon Lake spills in accordance with current (pre-1996) operations, the Moon Lake Water Users Association may deliver the amount spilled, up to a maximum of 2,000 acre-feet of its water, to Twin Pots Reservoir and exchange the water so stored in Twin Pots Reservoir for a like amount of Tribal water stored in Crystal Ranch Reservoir. (Under current operations, Moon Lake spills an average of 6 out of 10 years.) Such an exchange would be limited to a maximum of 2,000 acre-feet during an irrigation season.

Locally, project reservoirs would generally increase recharge to the shallow groundwater system and increase evaporation, causing a small decrease in overall surface water supply. Changes in groundwater hydrology resulting from reservoir seepage are discussed in Section 3.6.6.3.2.

3.6.6.3.1.3 River Reaches. Using the Water Budget Model, baseline and "with project" flows (by month) were estimated for wet, average, and dry years. Wet and dry year conditions were developed using the average of the 4 years with the largest volume of water (1941, 1944, 1965, 1983) and the 4 years with the smallest volume of water (1934, 1977, 1988, 1989), respectively, in the 64-year analysis period. Average conditions were developed using the average of all the years (1930 through 1993) in the 64-year analysis period. Table 3.6-4 shows, by river reach and month, the difference (in cfs) and percent change in flow expected under the Proposed Action compared to baseline (without project) conditions. The percent change is calculated on a 6-month (October through March and April through September) and 12-month (annual) basis. It should be noted that the estimated monthly flow in dry and/or average years may exceed the flow in average and/or wet years because of the timing of reservoir inflows and releases.

Yellowstone River. With high mountain lake stabilization, lake storage would no longer be used for irrigation purposes. Consequently, flows originating in the upper Yellowstone River watershed (Uinta Mountains) down to Crystal Ranch Reservoir would be uncontrolled and follow natural runoff patterns. Flows entering the reservoir would generally be higher from October through May; lower in June, July, and August; and unchanged in September. Since the lakes would be stabilized near natural lake levels, peak flows below the lakes would be similar to natural (pre-1900s) conditions.

From the reservoir to the Lake Fork River confluence, flows would generally be lower from October through March, higher in April and May, lower in June, and higher from July through September. Seasonally, the river reach data show average flows would be 25 percent lower from October through March, and 7 to 8 percent higher from April through September. Average annual flows would be zero to 1 percent higher than baseline.

Minimum instream flows would be provided in the Yellowstone River from Crystal Ranch Reservoir to the Yellowstone Feeder Canal (River Reach Y-4) at a rate of 24 cfs from October through March and 56 cfs from April through September, and from the Yellowstone Feeder Canal to the river's confluence with the Lake Fork River (River Reach Y-5) at the rate of 24 cfs from October through March and 38 cfs from April through September. Data in Table 3.6-4 show that the 24 cfs minimum flow would be met except in October, November, and December when dry year flows would range between 17 and 21 cfs in River Reach Y-5. The

Table 3.6-4
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Proposed Action

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
Y-1--Yellowstone High Mountain Lakes Storage (acre-feet)													
Wet	Baseline	772	1187	1602	2017	2467	3001	3773	3994	3994	2034	74	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-772	-1187	-1602	-2017	-2467	-3001	-3773	-3994	-3994	-2034	-74	0
Average	Baseline	594	891	1188	1485	1782	2198	2792	3861	3994	2034	74	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-594	-891	-1188	-1485	-1782	-2198	-2792	-3861	-3994	-2034	-74	0
Dry	Baseline	416	594	772	970	1148	1445	1861	2573	3464	1504	0	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-416	-594	-772	-970	-1148	-1445	-1861	-2573	-3464	-1504	0	0
Y-2--Yellowstone High Mountain Lakes to Reservoir (cfs)													
Wet	Baseline	134	86	67	56	50	51	61	295	818	491	237	157
	Alternative	146	93	74	63	57	61	75	311	818	458	236	157
	Difference	12	7	7	7	7	10	14	16	0	-33	-1	0
Average	Baseline	90	68	56	49	45	47	70	284	482	217	141	111
	Alternative	99	73	61	54	50	55	82	297	479	186	140	111
	Difference	9	5	5	5	5	8	12	13	-3	-31	-1	0
Dry	Baseline	61	49	42	40	37	38	74	162	181	106	82	60
	Alternative	67	52	45	43	40	43	82	169	172	81	82	60
	Difference	6	3	3	3	3	5	8	7	-9	-25	0	0
Y-3--Reservoir Storage (acre-feet)													
Wet	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	21884	23618	24000	24000	24000	24000	23856	23701	24000	23820	23270	22547
	Difference	21884	23618	24000	24000	24000	24000	23856	23701	24000	23820	23270	22547
Average	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	17258	18511	19266	19794	20195	20666	20185	20312	21704	16659	12919	11929
	Difference	17258	18511	19266	19794	20195	20666	20185	20312	21704	16659	12919	11929
Dry	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	12551	13323	13843	14248	14533	15049	15164	12398	8954	4588	2400	2400
	Difference	12551	13323	13843	14248	14533	15049	15164	12398	8954	4588	2400	2400

Table 3.6-4
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Proposed Action

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
Y-4--Reservoir to Yellowstone Feeder Diversion (cfs)													
Wet	Baseline	134	86	67	56	50	51	61	295	818	491	237	157
	Alternative	73	58	56	58	57	60	78	313	810	457	242	167
	Difference	-61	-28	-11	2	7	9	17	18	-8	-34	5	10
Average	Baseline	90	68	56	49	45	47	70	284	482	217	141	111
	Alternative	47	45	45	43	41	45	87	288	447	268	200	125
	Difference	-43	-23	-11	-6	-4	-2	17	4	-35	51	59	14
Dry	Baseline	61	49	42	40	37	38	74	162	181	106	82	60
	Alternative	27	36	36	35	35	34	75	209	215	147	118	60
	Difference	-34	-13	-6	-5	-2	-4	1	47	34	41	36	0
Y-5--Yellowstone Feeder Diversion to Confluence (cfs)													
Wet	Baseline	70	85	67	56	50	50	49	237	683	392	189	137
	Alternative	57	53	46	55	57	39	54	242	674	358	193	151
	Difference	-13	-32	-21	-1	7	-11	5	5	-9	-34	4	14
Average	Baseline	23	63	55	49	45	46	56	225	381	150	91	85
	Alternative	29	37	34	40	39	33	63	213	347	192	139	100
	Difference	6	-26	-21	-9	-6	-13	7	-12	-34	42	48	15
Dry	Baseline	3	32	37	40	37	37	60	125	123	70	70	51
	Alternative	17	17	21	28	27	27	60	147	159	106	99	53
	Difference	14	-15	-16	-12	-10	-10	0	22	36	36	29	2
LF-1--Lake Fork High Mountain Lakes Storage (acre-feet)													
Wet	Baseline	356	593	830	1067	1304	1660	2075	385	4859	2483	107	0
	Alternative	356	593	830	1067	1304	1660	2075	385	4859	2483	107	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Average	Baseline	297	475	653	831	1009	1306	1662	3444	891	1889	0	0
	Alternative	297	475	653	831	1009	1306	1662	3444	891	1889	0	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Dry	Baseline	237	356	475	594	713	951	1248	3030	4218	1545	0	0
	Alternative	237	356	475	594	713	951	1248	3030	4218	1545	0	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.6-4
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Proposed Action

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-2--Lake Fork High Mountain Lakes to Moon Lake (cfs)													
Wet	Baseline	91	58	43	34	28	28	42	303	819	411	154	99
	Alternative	91	58	43	34	28	28	42	303	819	411	154	99
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Average	Baseline	58	43	34	30	27	28	57	312	550	200	99	71
	Alternative	58	43	34	30	27	28	57	312	550	200	99	71
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Dry	Baseline	40	35	28	26	26	30	72	213	248	74	56	41
	Alternative	40	35	28	26	26	30	72	213	248	74	56	41
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
LF-3--Moon Lake to Farnsworth Diversion (cfs)													
Wet	Baseline	1	0	0	0	7	8	47	229	644	439	267	165
	Alternative	1	7	16	12	9	8	92	243	670	462	267	151
	Difference	0	7	16	12	2	0	45	14	26	23	0	-14
Average	Baseline	4	3	2	2	2	2	46	226	458	393	261	107
	Alternative	1	3	3	3	2	2	92	261	433	348	236	119
	Difference	-3	0	1	1	0	0	46	35	-25	-45	-25	12
Dry	Baseline	1	0	0	0	0	0	42	240	398	111	55	39
	Alternative	1	0	0	0	0	0	97	246	296	173	96	40
	Difference	0	0	0	0	0	0	55	6	-102	62	41	1
LF-4--Farnsworth Diversion to Rowley Ditch Diversion (cfs)													
Wet	Baseline	0	0	0	0	7	7	21	125	513	304	158	108
	Alternative	0	6	16	12	9	7	65	139	539	327	159	94
	Difference	0	6	16	12	2	0	44	14	26	23	1	-14
Average	Baseline	3	2	2	2	2	2	20	125	330	279	198	82
	Alternative	1	2	3	2	2	3	66	158	303	224	150	80
	Difference	-2	0	1	0	0	1	46	33	-27	-55	-48	-2
Dry	Baseline	0	0	0	0	0	0	16	149	313	100	52	36
	Alternative	0	0	0	0	0	0	71	143	185	132	79	39
	Difference	0	0	0	0	0	0	55	-6	-128	32	27	3

Table 3.6-4

Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Proposed Action

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-5--Rowley Ditch Diversion to Confluence (cfs)													
Wet	Baseline	10	17	27	22	20	18	32	156	644	341	197	112
	Alternative	10	16	26	22	19	17	75	149	549	337	169	104
	Difference	0	-1	-1	0	-1	-1	43	-7	-95	-4	-28	-8
Average	Baseline	14	14	14	14	14	15	33	173	404	307	246	101
	Alternative	11	12	13	12	12	13	76	168	313	234	160	90
	Difference	-3	-2	-1	-2	-2	-2	43	-5	-91	-73	-86	-11
Dry	Baseline	10	10	10	10	10	10	25	173	343	209	97	58
	Alternative	10	10	10	10	10	10	81	153	195	142	89	49
	Difference	0	0	0	0	0	0	56	-20	-148	-67	-8	-9
LF-6--Confluence to "C" Canal Diversion (cfs)													
Wet	Baseline	80	103	94	79	70	69	31	194	1076	476	179	141
	Alternative	65	67	70	80	76	54	83	205	987	454	175	155
	Difference	-15	-36	-24	1	6	-15	52	11	-89	-22	-4	14
Average	Baseline	37	77	69	63	59	61	40	199	535	208	154	92
	Alternative	43	52	50	56	53	48	90	191	418	192	128	106
	Difference	6	-25	-19	-7	-6	-13	50	-8	-117	-16	-26	14
Dry	Baseline	13	42	47	50	47	48	35	99	232	111	47	40
	Alternative	37	37	37	46	45	41	85	103	119	116	98	73
	Difference	24	-5	-10	-4	-2	-7	50	4	-113	5	51	33
LF-7--"C" Canal Diversion to South Boneta Diversion (cfs)													
Wet	Baseline	10	52	44	67	67	56	13	78	650	268	63	71
	Alternative	65	67	70	80	76	54	79	191	970	437	161	147
	Difference	55	15	26	13	9	-2	66	113	320	169	98	76
Average	Baseline	3	12	20	61	57	39	14	75	239	72	38	22
	Alternative	43	52	50	56	53	48	87	177	401	176	116	100
	Difference	40	40	30	-5	-4	9	73	102	162	104	78	78
Dry	Baseline	0	0	2	50	47	15	8	40	46	28	22	13
	Alternative	37	37	37	46	45	41	82	90	104	108	95	72
	Difference	37	37	35	-4	-2	26	74	50	58	80	73	59

Table 3.6-4
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Proposed Action

Reach		October	November	December	January	February	March	April	May	June	July	August	September
LF-8--South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion (cfs)													
Wet	Baseline	10	59	63	79	70	56	12	95	758	287	71	84
	Alternative	65	67	70	80	76	54	78	187	966	432	157	145
	Difference	55	8	7	1	6	-2	66	92	208	145	86	61
Average	Baseline	3	14	23	63	59	41	15	92	287	71	38	24
	Alternative	43	52	50	56	53	48	86	173	396	171	113	98
	Difference	40	38	27	-7	-6	7	71	81	109	100	75	74
Dry	Baseline	0	0	2	50	47	15	7	38	44	33	25	14
	Alternative	37	37	37	46	45	41	81	86	99	106	95	72
	Difference	37	37	35	-4	-2	26	74	48	55	73	70	58
LF-9--Big Sand Wash Feeder Pipeline Diversion to Purdy Ditch Diversion (cfs)													
Wet	Baseline	13	55	46	69	71	62	16	76	648	266	61	70
	Alternative	3	3	35	36	31	38	34	56	706	262	57	53
	Difference	-10	-52	-11	-33	-40	-24	18	-20	58	-4	-4	-17
Average	Baseline	6	15	23	63	61	45	18	73	237	70	36	22
	Alternative	7	10	15	18	18	26	30	72	217	68	40	22
	Difference	1	-5	-8	-45	-43	-19	12	-1	-20	-2	4	0
Dry	Baseline	3	3	5	52	50	21	12	39	45	29	23	14
	Alternative	3	3	2	3	4	12	22	40	49	41	31	17
	Difference	0	0	-3	-49	-46	-9	10	1	4	12	8	3
LF-10--Purdy Ditch Diversion to Red Cap Diversion (cfs)													
Wet	Baseline	13	62	65	81	73	62	14	86	747	276	62	80
	Alternative	3	3	35	36	31	38	32	45	693	248	46	48
	Difference	-10	-59	-30	-45	-42	-24	18	-41	-54	-28	-16	-32
Average	Baseline	6	17	25	66	63	47	17	84	277	61	31	20
	Alternative	7	10	15	18	18	26	2	62	204	55	30	18
	Difference	1	-7	-10	-48	-45	-21	-15	-22	-73	-6	-1	-2
Dry	Baseline	3	3	5	52	50	21	9	29	35	30	24	13
	Alternative	3	3	2	3	4	12	19	29	36	33	26	14
	Difference	0	0	-3	-49	-46	-9	10	0	1	3	2	1

Table 3.6-4
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Proposed Action

Reach		October	November	December	January	February	March	April	May	June	July	August	September
LF-11--Red Cap Diversion to Hamilton-Knudsen Diversion (cfs)													
Wet	Baseline	13	62	65	81	73	62	7	59	713	240	33	65
	Alternative	3	3	35	36	31	38	26	22	659	216	22	37
	Difference	-10	-59	-30	-45	-42	-24	19	-37	-54	-23	-11	-28
Average	Baseline	6	17	25	66	63	47	15	56	242	26	4	6
	Alternative	7	10	15	18	18	26	23	39	172	24	8	9
	Difference	1	17	-10	-49	-45	-21	13	-17	-70	-2	[illegible]	3
Dry	Baseline	3	3	5	-2	50	21	2	2	2	1	0	0
	Alternative	3	3	2	3	4	12	15	7	7	7	7	37
	Difference	0	0	-3	-49	-46	-9	15	5	[illegible]	6	7	37
LF-12--Hamilton-Knudsen Diversion to Duchesne River (cfs)													
Wet	Baseline	13	62	65	81	73	62	0	57	711	238	31	64
	Alternative	3	3	35	36	31	38	26	22	657	216	22	37
	Difference	-10	-59	-30	-49	-42	-24	26	-35	-54	-23	-9	-27
Average	Baseline	6	17	25	66	63	47	0	59	240	24	2	6
	Alternative	7	10	15	18	18	26	23	39	172	24	8	9
	Difference	1	17	-10	-49	-45	-21	15	-16	-68	0	[illegible]	3
Dry	Baseline	3	3	5	-2	50	21	2	0	0	0	0	0
	Alternative	3	3	2	3	4	12	15	7	7	7	7	7
	Difference	0	0	-3	-49	-46	-9	15	7	7	7	7	7

Notes:
Alternative represents typical Proposed Action in each river reach during wet, average, and dry years.

56 and 38 cfs minimum flows would be met under all hydrologic conditions.

Lake Fork River. No flow changes would occur in the upper Lake Fork River watershed above Moon Lake since none of the high mountain lakes located in the upper watershed would be stabilized, but would be operated for irrigation purposes as in the past. From Moon Lake to the river's confluence with the Yellowstone River, average flows would be zero to 14 percent lower from October through March, and zero to 18 percent lower from April through September than baseline.

From the confluence to the "C" Canal diversion, average flows would be 17 percent lower from October through March and 8 percent lower from April through September. From the "C" Canal diversion to the Big Sand Wash Feeder Pipeline diversion, average flows would be substantially higher in all months except January and February. Estimated average flows would be 49 to 57 percent higher from October through March, and 97 to 130 percent higher from April through September.

From the Big Sand Wash Feeder Pipeline diversion to the river's confluence with the Duchesne River, average flows would be substantially lower (56 to 58 percent) from October through March, and 2 to 24 percent lower from April through September. On an annual basis, average flows in the lower river would be 34 percent lower than baseline.

Minimum instream flows would be provided in the Lake Fork River from the Yellowstone River confluence down to the Big Sand Wash Feeder Pipeline diversion at a rate of 24 cfs from October through March and 72 cfs from April through September. Data in Table 3.6-4 show that these minimum flows would be met under all hydrologic conditions.

Table 3.6-5 shows the ranked annual peak flows and percent change in flows estimated for the Proposed Action. The 2-, 5-, 10-, and 20-year data were used to assess potential impacts on aquatic and wildlife resources, wetlands, and threatened and endangered species. The 20- and 50-year data, which illustrate the potential effect on peak flood discharges and fluvial processes, show that peak flood discharges would generally be unchanged or reduced (2 to 7 percent) compared to baseline conditions.

Increased peak flood discharges would occur on the Lake Fork River between the "C" Canal diversion down to the river's confluence with the Duchesne River. Table 3.6-5 shows that 20- and 50- year peak flows would increase by 19 and 15 percent, respectively, between the "C" Canal diversion down to the Big Sand Wash Feeder Pipeline diversion and that 20-year peak flows would increase by 4 to 5 percent from the Purdy Ditch diversion down to the Duchesne River.

3.6.6.3.1.4 Irrigation Canals and Seepage. Converting 23.5 miles of selected unlined canal reaches to pipelines and abandoning the first 2.7 miles of Farnsworth Lateral No. 1 would reduce canal seepage losses and thereby increase the amount of water available for project purposes by an estimated 2,000 acre-feet annually.

The wetland/riparian areas that presently depend on canal leakage for a water source are described in Section 3.9 Wetland and Riparian Resources. Under the Proposed Action, a total of 83 acres of canal dependent wetlands would be preserved by providing 374 acre-feet of project water per year for wetland maintenance systems. A complete description and quantification of the wetlands to be preserved and lost as a result of canal rehabilitation is included in Section 3.9.

Overall, less water would be diverted for agricultural use during spring high-flow periods than under baseline conditions. Changes in spring diversion patterns would cause the following unit-wide effects:

- Reduced river diversions during spring would reduce the quantity of water (return flows) in small creeks and drainages.
- Limited overirrigation would reduce subsurface drainage and shallow groundwater recharge, making less subsurface drainage available for discharge to creeks and drains.

Table 3.6-5
Ranked Annual Peak Flows for the Upalco Unit Proposed Action

Reach	Return Period[a]	Baseline[b] (cfs)	Proposed Action[b] (cfs)	Percent Change	Reach	Return Period[a]	Baseline[b] (cfs)	Proposed Action[b] (cfs)	Percent Change
Y-2	Yellowstone High Mountain Lakes to Reservoir				LF-6	Confluence to "C" Canal Diversion			
	2-yr	893	893	0%		2-yr	829	580	-30%
	5-yr	1,242	1,242	0%		5-yr	1,463	1,364	-7%
	10-yr	1,496	1,496	0%		10-yr	1,943	1,884	-3%
	20-yr	1,752	1,752	0%		20-yr	2,167	2,130	-2%
	50-yr	1,884	1,884	0%		50-yr	2,396	2,344	-2%
Y-4	Reservoir to Yellowstone Feeder Diversion				LF-7	"C" Canal Diversion to South Boneta Diversion			
	2-yr	741	664	-10%		2-yr	494	563	14%
	5-yr	980	883	-10%		5-yr	1,111	1,349	21%
	10-yr	1,179	1,167	-1%		10-yr	1,629	1,867	15%
	20-yr	1,302	1,299	0%		20-yr	1,776	2,113	19%
	50-yr	1,432	1,429	0%		50-yr	2,017	2,327	15%
Y-5	Yellowstone Feeder Diversion to Confluence				LF-8	South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion			
	2-yr	601	524	-13%		2-yr	489	558	14%
	5-yr	840	743	-12%		5-yr	1,106	1,345	22%
	10-yr	1,039	1,027	-1%		10-yr	1,624	1,863	15%
	20-yr	1,162	1,159	0%		20-yr	1,771	2,108	19%
	50-yr	1,292	1,289	0%		50-yr	2,012	2,322	15%
LF-2	Lake Fork High Mountain Lakes to Moon Lake				LF-10	Purdy Ditch Diversion to Red Cap Diversion			
	2-yr	1,011	1,011	0%		2-yr	480	150	-69%
	5-yr	1,516	1,516	0%		5-yr	1,096	994	-9%
	10-yr	1,742	1,742	0%		10-yr	1,613	1,514	-6%
	20-yr	1,820	1,820	0%		20-yr	1,761	1,839	4%
	50-yr	1,948	1,948	0%		50-yr	2,002	1,993	0%
LF-3	Moon Lake to Farnsworth Diversion				LF-11	Red Cap Diversion to Hamilton-Knudsen Diversion			
	2-yr	742	511	-31%		2-yr	445	124	-72%
	5-yr	1,091	955	-12%		5-yr	1,061	960	-9%
	10-yr	1,297	1,205	-7%		10-yr	1,580	1,480	-6%
	20-yr	1,461	1,366	-7%		20-yr	1,726	1,804	5%
	50-yr	1,489	1,448	-3%		50-yr	1,968	1,959	0%

Table 3.6-5

Ranked Annual Peak Flows for the Upalco Unit Proposed Action

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Reach	Return Period[a]	Baseline[b] (cfs)	Proposed Action[b] (cfs)	Percent Change	Reach	Return Period[a]	Baseline[b] (cfs)	Proposed Action[b] (cfs)	Percent Change
LF-4	Farnsworth Diversion to Rowley Ditch Diversion				LF-12	Hamilton-Knudsen Diversion to Duchesne River			
	2-yr	610	390	-36%		2-yr	443	123	-72%
	5-yr	954	830	-13%		5-yr	1,059	958	-10%
	10-yr	1,168	1,078	-8%		10-yr	1,577	1,477	-6%
	20-yr	1,333	1,238	-7%		20-yr	1,724	1,802	5%
	50-yr	1,358	1,317	-3%		50-yr	1,966	1,957	0%
LF-5	Rowley Ditch Diversion to Confluence								
	2-yr	620	400	-35%					
	5-yr	964	840	-13%					
	10-yr	1,178	1,088	-8%					
	20-yr	1,343	1,248	-7%					
	50-yr	1,368	1,327	-3%					

Notes:

Flows ranked largest to smallest by California Method (Chow 1964).

[a]The return period is the average duration required to experience the given flow (or greater). For example, the baseline peak flow of 620 cfs will be reached or exceeded once within a 2-year period, on average at the Rowley Ditch Diversion to Confluence.

[b]5-, 10-, 20- and 50-year return period flows are linearly interpolated.

- Reduced water availability in spring may encourage improved water management and capital improvements that would increase irrigation efficiency.

Project water would be available during summer when stored water would be released for irrigation to supplement natural flows and to extend late season deliveries by 2 to 3 weeks. Based on Water Budget Model estimates, about 177,000 acre-feet per year would be diverted under the Proposed Action compared to 169,000 acre-feet per year under baseline conditions. Changes in summer diversion patterns and in late season irrigation deliveries would cause the following unit-wide effects:

- More late-summer subsurface drainage would discharge to creeks and drains.

- More late-summer water would increase crop production.

- Increased crop production potential would encourage water management improvements to increase irrigation efficiency and crop production.

- Prolonged flows in the river channels and canals would extend the water source for fish, wildlife, and/or vegetation.

With increased project reservoir storage capacity, late season irrigation deliveries would be extended and irrigation diversions better matched to crop CU requirements. These changes would increase crop production and thereby crop CU (water used by crops where initially applied), and decrease indirect CU (runoff water used by downstream irrigators, wetlands, and phreatophytes). Unit-wide, Table 3.6-6 shows that crop CU would increase by 39 percent, indirect CU and return flows would decrease by 21 percent, and water leaving the unit (outflow) would decrease by 38 percent (10,300 acre-feet), annually.

The retirement of about 1,300 acres of agricultural land in the lower Upalco Unit would make about 3,300 acre-feet of water available for project purposes. Of the 3,300 acre-feet made available, about half would be allocated to the project water supply and half would flow down the Lake Fork River to the Duchesne River. This additional water is included in the flows estimated by the Water Budget Model.

3.6.6.3.2 Potential Operational Impacts on Groundwater Hydrology.

3.6.6.3.2.1 Upper Upalco Subunit. With high mountain lakes stabilization, higher shallow groundwater levels in adjacent meadows and glacial till would be maintained year-round since lake drawdown and related groundwater discharge into the lakes would be eliminated. Those lakes situated in bedrock and surrounded by talus deposits are fed by overland flow and percolation of snowmelt through the talus. Stabilization of these lakes would not affect the local groundwater regime because shallow groundwater is essentially absent.

Crystal Ranch Reservoir operations would change seasonal streamflow patterns and increase the duration of canal flows throughout the Upalco Unit. These changes would affect shallow aquifer recharge patterns along the river and beneath bench and upland areas. Anticipated effects would be most apparent in the shallow aquifers beneath and near the Yellowstone River and would essentially coincide with changes in river levels and flows.

Changes in Crystal Ranch Reservoir pool elevations as a result of inflow and downstream releases would affect shallow aquifer recharge at the reservoir site. Reservoir pool fluctuations would locally raise or lower the adjacent shallow aquifer. While the reservoir is filling, water would saturate adjacent, unconsolidated materials and cause the water table to rise. Similarly, when reservoir pool levels fall, shallow groundwater would discharge into the reservoir from these saturated materials and cause shallow aquifer levels to fall.

Seepage losses from Crystal Ranch Reservoir would saturate adjacent glacial and alluvial materials, and would locally increase shallow aquifer recharge. However, localized shallow groundwater that normally would flow through the river alluvium

Table 3.6-6

Total Water Inflow, Agricultural Use, and Outflow Summary for the Upalco Unit Proposed Action

			Water Use					Outflow		
	Inflow	Diversion[a]	Crop CU		Indirect CU[b]		River[c]	Return Flow		Total
Upalco Unit	(ac-ft)	(ac-ft)	(%)[d]	(ac-ft)	(%)	(ac-ft)	(ac-ft)	(%)	(ac-ft)	(ac-ft)
Baseline	192,000	169,000	43%	72,800	51%	85,800	6,500	6%[e]	10,700	27,200
Proposed Action	192,000	177,000	57%	101,100	38%	67,800	6,500	5%[f]	8,500	16,900
Change in Water Use and Outflow		+8,000		+28,300		-18,000			-2,200	-10,300

Notes:

CU = Consumptive Use.

Numbers are rounded to the nearest 100 acre-feet. Therefore, the numbers may not sum to total shown because of roundoff and may not agree exactly with numbers given in the Feasibility Study.

Diversion (169,000 acre-feet) - Yellowstone Feeder Canal Diversion to Uintah Unit (16,575 acre-feet) + reduction in outflow (10,300 acre-feet) = Proposed Action Water Supply (162,725 acre-feet).

[a]Includes 16,575 acre-feet annually diverted through the Yellowstone Feeder Canal.
[b]Indirect CU includes phreatophytes and downstream irrigators.
[c]Includes river corridor losses by phreatophytes, stock watering, minor diversions, and the difference between groundwater recharge and discharge.
[d]Overall efficiency based on conveyance efficiency of 85 percent, irrigation type mix, and baseline model diversion.
[e]Calculated based on baseline load analysis.
[f]Assume same proportion of return flow and secondary CU as baseline.

down-valley would be impeded by the grout curtain constructed under the dam. Consequently, the downstream water table may be lowered while the reservoir is filling, but would likely experience fewer fluctuations because of generally lower and longer hydrograph peaks.

Under the Proposed Action, average seasonal flows below Crystal Ranch Reservoir to the Lake Fork River confluence would be 25 percent lower from October through March, and 7 to 8 percent higher from April through September. Shallow aquifer levels and recharge adjacent to the Yellowstone River would rise and fall in direct response to these changes in river flow. However, these flow changes are not expected to cause impacts on adjacent shallow groundwater levels because the annual amount of water available for river loss/ percolation and recharge would remain essentially unchanged (zero to 1 percent higher). In dry years, the estimated 10 to 11 percent increase in annual flows is expected to slightly improve adjacent shallow groundwater levels and recharge (see Table 3.6-4, River Reaches Y-4 and Y-5).

The Twin Pots Reservoir improvement would maintain a higher, more stable shallow groundwater level adjacent to the reservoir. By maintaining higher reservoir water levels when the Farnsworth Canal is operating to maintain a viable sport fishery, riparian habitat, and water quality, water would saturate adjacent moraine materials and cause the water table to rise. Higher, more stable shallow groundwater levels would also be maintained because groundwater drainage back into the reservoir from drawdown would be reduced. During the nonirrigation season (when the Farnsworth Canal is not operating), reservoir pool levels would fall because of reservoir seepage and evaporation. However, adjacent shallow groundwater levels would be higher than now since the reservoir pool would not be empty at the end of the irrigation season (September), but would remain high enough to assure the maintenance of water quality, year-round fish habitat, and a recreational sport fishery. Adjacent moraine materials would also remain saturated by seepage from the reservoir and snowmelt.

Groundwater hydrology in the upper Lake Fork River watershed above Moon Lake would not be changed by the Proposed Action since no project features or operational changes are proposed in this area. From Moon Lake to the confluence with the Yellowstone River, shallow aquifer levels adjacent to the river would rise and fall in direct response to seasonal changes in river flow. Although unquantified, the largest localized drop in upper subunit shallow groundwater levels is expected to occur below the Rowley Ditch diversion where average annual flows would decline by an estimated 17 percent (see Table 3.6-4 River Reaches LF-3, LF-4, and LF-5).

3.6.6.3.2.2 Middle Upalco Subunit. Most shallow aquifer recharge occurs during peak spring runoff in May and June with little recharge later in the summer after the peak flow is past. Canal seepage losses, irrigation deep percolation, and downward river percolation are the primary sources of shallow aquifer recharge in the middle subunit.

The conversion of 23.5 miles of selected unlined canal reaches to pipelines and abandonment of the first 2.7 miles of Farnsworth Lateral No. 1 would reduce canal seepage losses and recharge to the shallow aquifer by an estimated 2,000 acre-feet per year. Shallow groundwater levels beneath and near these sections of canal would be slightly lowered. The 374 acre-feet of water annually used to maintain 83 acres of canal dependent wetland/ riparian habitat would not provide any measurable recharge to the underlying shallow aquifer.

Under the Proposed Action, water use changes and improved water management would cause an estimated 21 percent decrease (1,100 acre-feet per year) in shallow aquifer recharge from irrigation deep percolation. This change would occur because of increased crop consumptive use and improved irrigation efficiencies. Unit-wide, reduced recharge from canal seepage and irrigation deep percolation would result in an estimated 7 percent decrease (3,100 acre-feet per year) in recharge to the shallow, unconfined aquifer. Total recharge to the shallow aquifer would be about 44,250 acre-feet per year compared to 47,350 acre-feet per year under baseline conditions. Minor changes in localized shallow well water levels are anticipated, but they cannot be quantified with available information.

Late summer releases from Crystal Ranch Reservoir would help sustain river and canal flows, and thus extend the shallow aquifer recharge period. Recharge to the shallow aquifer would be less while water is being stored in the reservoir, but would increase as water is released later in the summer. Overall, water levels in the shallow aquifer should experience smaller fluctuations, a result observed in other parts of the Uinta Basin, such as below Steinaker Reservoir near Vernal.

Enlarging Big Sand Wash Reservoir likely would not change any local groundwater conditions. The reservoir overlies relatively impermeable bedrock of the Duchesne River formation and not alluvial or glacial outwash material, which would contain shallow groundwater.

When shallow aquifer levels are closely and directly tied to river levels, changes in groundwater levels can be approximated by estimating changes in water surface elevations. Water surface elevation changes in July, August, and September were estimated at three Lake Fork River locations within the middle subunit. The July through September analysis period was selected because this is typically the driest period for wetland and riparian. Of particular concern is the potential effect changes in river elevation could have on habitat utilized by the Ute ladies'-tresses orchid (*Spiranthes diluvialis*), a federally listed threatened species.

Under the Proposed Action, water surface elevations in a mean water year would decrease about -0.4 foot in July and August, and increase about 0.1 foot in September above the "C" Canal diversion; increase about 0.3, 0.5, and 0.8 foot in July, August and September, respectively, above the Big Sand Wash Pipeline diversion; and increase about 0.2 foot in July and August and about 0.3 foot in September above the Hamilton-Knudsen diversion. Water surface elevations in a dry water year would increase about 0.1, 0.2, and 0.3 foot in July, August, and September, respectively, above the "C" Canal diversion; increase about 0.3, 0.7, and 1.1 feet in July, August and September, respectively, above the Big Sand Wash Pipeline diversion; and increase about 0.2 foot in July and about 0.8 foot in August and September above the Hamilton-Knudsen diversion. Similar localized changes in shallow groundwater levels are anticipated adjacent to these Lake Fork River locations.

3.6.6.3.2.3 Lower Upalco Subunit. This part of the shallow aquifer is not an area of aquifer recharge but discharge through seepage into adjacent surface waters. Maintaining groundwater levels more consistently throughout the year would maintain more stable discharges to surface waters.

Approximately 1,300 acres would be retired from irrigated agriculture within the lower subunit. This would make about 3,300 acre-feet of water available for project purposes (i.e., environmental features or agricultural supply). Related changes in shallow groundwater hydrology as a result of land retirement in the lower subunit is expected to be negligible.

Upward leakage in the lower subunit from the regional aquifer to the shallow aquifer would not change. The regional aquifer is recharged in the upper basin (Uinta Mountains), and is under artesian pressure and confined by low-permeability strata in the lower subunit, which protects it from changes in the shallow aquifer.

3.6.6.4 Cow Canyon Alternative

Similar to the Proposed Action, construction and operation of the Cow Canyon Alternative would change the timing and quantity of surface water flows in the Upalco Unit and allow more water to be used for crop production, instream flows, and other project purposes. Water use changes (i.e., increased crop use, even water use throughout the growing season, and a 2- to 3-week extension in late season irrigation deliveries), and improved water management (i.e., water delivery matched to crop requirements) would decrease the amount of water leaving the Upalco Unit and Uinta Basin.

Under this alternative, proposed onstream storage (Upper Yellowstone Reservoir) would be constructed higher in the upper Yellowstone River watershed and hydrologic changes related to canal rehabilitation and Twin Pots Reservoir rehabilitation would not occur.

3.6.6.4.1 Potential Operational Impacts on Surface Water Hydrology. Impacts on surface water hydrology would be the same as described for the Proposed Action, except as noted.

3.6.6.4.1.1 High Mountain Lakes. With lake stabilization in the upper Yellowstone River watershed, water storage rights for 2,500 acre-feet would be transferred to the United States and stored in the Upper Yellowstone Reservoir.

3.6.6.4.1.2 Dams and Reservoirs. Upper Yellowstone Dam and Reservoir would be constructed on the Yellowstone River approximately 5.5 miles farther upstream (see Map 2-11 in Chapter 2) than the Proposed Action's Crystal Ranch dam site. The reservoir would have a total storage capacity of 25,000 acre-feet, which represents about 25 percent of the average annual flow in the Yellowstone River, or about 13 percent of the average annual unit inflow. The reservoir would fill most often in March and, on an annual basis, would fill about 98 percent of the time.

Upper Yellowstone Reservoir would store and release water in accordance with the priority system and existing water rights. Project (1964 priority) water would be stored after 1861, secondary, and minimum instream flow water. Under the Cow Canyon Alternative, reservoir storage space allocations would include 2,500 acre-feet for the conservation pool; 2,500 acre-feet for high mountain lakes storage replacement; 10,000 acre-feet for the Ute Tribe; 150 acre-feet for non-Indian-owned 1861 water-righted-land; and 9,850 acre-feet for secondary water-righted land.

Minimum instream flows provided in the Yellowstone and Lake Fork Rivers would be the same as described for the Proposed Action (see Section 3.6.6.3.1.2).

From October through March, reservoir releases would average between 41 and 47 cfs, and the 24 cfs minimum instream flow would be met or exceeded 100 percent of the time. From April through September, reservoir releases would generally rise from April through June, decline from July through September, and average between 87 and 447 cfs. The 56 cfs minimum instream flow would be met or exceeded about 95 percent of the time. Additional information on Upper Yellowstone Dam and Reservoir operations is provided in Chapter 2 (see Section 2.3.2.1.1).

Under the Cow Canyon Alternative, Big Sand Wash Reservoir would be enlarged and operated as described under the Proposed Action (see Section 3.6.6.3.1.2 and Chapter 2 Section 2.2.2.1.2). The enlarged reservoir would fill most often in April and, on an annual basis, would fill about 59 percent of the time. Similar to the Proposed Action, municipal and industrial water for the City of Roosevelt would be stored in the enlarged Big Sand Wash Reservoir and made available by an exchange with secondary water right water stored in Upper Yellowstone Reservoir. The water would be delivered to Brown's Draw Reservoir via the Yellowstone Feeder Canal. Such an exchange would be limited to a maximum of 3,000 acre-feet during any particular year from October 1 through September 30.

Twin Pots Reservoir would not be completely stabilized and would continue to be operated in part for irrigation purposes as described in Section 3.6.5.1.1.2.

3.6.6.4.1.3 River Reaches. Using the Water Budget Model, baseline and "with project" flows (by month) were estimated for wet, average, and dry years. Wet and dry year conditions were developed using the average of the 4 years with the largest volume of water (1941, 1944, 1965, 1983) and the 4 years with the smallest volume of water (1934, 1977, 1988, 1989), respectively, in the 64-year analysis period. Average conditions were developed using the average of all the years (1930 through 1993) in the 64-year analysis period. Table 3.6-7 shows, by river reach and month, the difference (in cfs) and percent change in flow expected under the Cow Canyon Alternative compared to baseline (without project) conditions. The percent change is calculated on a 6-month

Table 3.6-7
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Cow Canyon Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
Y-1--Yellowstone High Mountain Lakes Storage (acre-feet)													
Wet	Baseline	772	1187	1602	2017	2467	3001	3773	3994	3994	2034	74	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-772	-1187	-1602	-2017	-2467	-3001	-3773	-3994	-3994	-2034	-74	0
Average	Baseline	594	891	1188	1485	1782	2198	2792	3861	3994	2034	74	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-594	-891	-1188	-1485	-1782	-2198	-2792	-3861	-3994	-2034	-74	0
Dry	Baseline	416	594	772	970	1148	1445	1861	2573	3464	1504	0	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-416	-594	-772	-970	-1148	-1445	-1861	-2573	-3464	-1504	0	0
Y-2--Yellowstone High Mountain Lakes to Reservoir (cfs)													
Wet	Baseline	134	86	67	56	50	51	61	295	818	491	237	157
	Alternative	146	93	74	63	57	61	75	311	818	458	236	157
	Difference	12	7	7	7	7	10	14	16	0	-33	-1	0
Average	Baseline	90	68	56	49	45	47	70	284	482	217	141	111
	Alternative	99	73	61	54	50	55	82	297	479	186	140	111
	Difference	9	5	5	5	5	8	12	13	-3	-31	-1	0
Dry	Baseline	61	49	42	40	37	38	74	162	181	106	82	60
	Alternative	67	52	45	43	40	43	82	169	172	81	82	60
	Difference	6	3	3	3	3	5	8	7	-9	-25	0	0
Y-3--Reservoir Storage (acre-feet)													
Wet	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	25000	25000	25000	25000	25000	25000	24839	24685	25000	24809	24218	23473
	Difference	25000	25000	25000	25000	25000	25000	24839	24685	25000	24809	24218	23473
Average	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	24361	24567	24707	24824	24897	24843	24258	23669	23911	19408	15001	13511
	Difference	24361	24567	24707	24824	24897	24843	24258	23669	23911	19408	15001	13511
Dry	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	23728	23804	23846	23856	23860	23907	23416	20325	14711	5115	2500	2500
	Difference	23728	23804	23846	23856	23860	23907	23416	20325	14711	5115	2500	2500

Table 3.6-7
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Cow Canyon Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
Y-4--Reservoir to Yellowstone Feeder Diversion (cfs)													
Wet	Baseline	134	86	67	56	50	51	61	295	818	491	237	157
	Alternative	71	57	55	54	57	60	78	313	811	458	243	169
	Difference	-63	-29	-12	-2	7	9	17	18	-7	-33	6	12
Average	Baseline	90	68	56	49	45	47	70	284	482	217	141	111
	Alternative	47	45	44	43	41	44	87	287	447	272	202	127
	Difference	-43	-23	-12	-6	-4	-3	17	3	-35	55	61	16
Dry	Baseline	61	49	42	40	37	38	74	162	181	106	82	60
	Alternative	27	36	36	35	35	34	75	209	215	149	122	60
	Difference	-34	-13	-6	-5	-2	-4	1	47	34	43	40	0
Y-5--Yellowstone Feeder Diversion to Confluence (cfs)													
Wet	Baseline	70	85	67	56	50	50	49	237	683	392	189	137
	Alternative	53	51	44	44	57	37	56	242	674	359	202	152
	Difference	-17	-34	-23	-12	7	-13	7	5	-9	-33	13	15
Average	Baseline	23	63	55	49	45	46	56	225	381	150	91	85
	Alternative	32	39	37	43	41	35	61	208	338	193	142	101
	Difference	9	-24	-18	-6	-4	-11	5	-17	-43	43	51	16
Dry	Baseline	3	32	37	40	37	37	60	125	123	70	70	51
	Alternative	27	27	27	35	35	30	52	138	136	106	101	53
	Difference	24	-5	-10	-5	-2	-7	-8	13	13	36	31	2
LF-1--Lake Fork High Mountain Lakes Storage (acre-feet)													
Wet	Baseline	356	593	830	1067	1304	1660	2075	385	4859	2483	107	0
	Alternative	356	593	830	1067	1304	1660	2075	385	4859	2483	107	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Average	Baseline	297	475	653	831	1009	1306	1662	3444	891	1889	0	0
	Alternative	297	475	653	831	1009	1306	1662	3444	891	1889	0	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Dry	Baseline	237	356	475	594	713	951	1248	3030	4218	1545	0	0
	Alternative	237	356	475	594	713	951	1248	3030	4218	1545	0	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.6-7
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Cow Canyon Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-2--Lake Fork High Mountain Lakes to Moon Lake (cfs)													
Wet	Baseline	91	58	43	34	28	28	42	303	819	411	154	99
	Alternative	91	58	43	34	28	28	42	303	819	411	154	99
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Average	Baseline	58	43	34	30	27	28	57	312	550	200	99	71
	Alternative	58	43	34	30	27	28	57	312	550	200	99	71
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Dry	Baseline	40	35	28	26	26	30	72	213	248	74	56	41
	Alternative	40	35	28	26	26	30	72	213	248	74	56	41
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
LF-3--Moon Lake to Farnsworth Diversion (cfs)													
Wet	Baseline	1	0	0	0	7	8	47	229	644	439	267	165
	Alternative	1	7	16	12	9	8	91	241	676	461	265	150
	Difference	0	7	16	12	2	0	44	12	32	22	-2	-15
Average	Baseline	4	3	2	2	2	2	46	226	458	393	261	107
	Alternative	1	3	3	3	2	3	92	260	435	347	235	119
	Difference	-3	0	1	1	0	1	46	34	-23	-46	-26	12
Dry	Baseline	1	0	0	0	0	0	42	240	398	111	55	39
	Alternative	1	0	0	0	0	0	97	246	295	175	98	40
	Difference	0	0	0	0	0	0	55	6	-103	64	43	1
LF-4--Farnsworth Diversion to Rowley Ditch Diversion (cfs)													
Wet	Baseline	0	0	0	0	7	7	21	125	513	304	158	108
	Alternative	0	6	16	12	9	7	64	138	544	326	156	93
	Difference	0	6	16	12	2	0	43	13	31	22	-2	-15
Average	Baseline	3	2	2	2	2	2	20	125	330	279	198	82
	Alternative	1	2	3	2	2	3	65	158	305	223	149	80
	Difference	-2	0	1	0	0	1	45	33	-25	-56	-49	-2
Dry	Baseline	0	0	0	0	0	0	16	149	313	100	52	36
	Alternative	0	0	0	0	0	0	70	142	184	135	81	39
	Difference	0	0	0	0	0	0	54	-7	-129	35	29	3

Table 3.6-7
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Cow Canyon Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-5--Rowley Ditch Diversion to Confluence (cfs)													
Wet	Baseline	10	17	27	22	20	18	32	156	644	341	197	112
	Alternative	10	16	26	22	19	17	74	148	554	336	166	103
	Difference	0	-1	-1	0	-1	-1	42	-8	-90	-5	-31	-9
Average	Baseline	14	14	14	14	14	15	33	173	404	307	246	101
	Alternative	11	12	13	12	12	13	75	168	315	233	159	90
	Difference	-3	-2	-1	-2	-2	-2	42	-5	-89	-74	-87	-11
Dry	Baseline	10	10	10	10	10	10	25	173	343	209	97	58
	Alternative	10	10	10	10	10	10	80	152	194	145	91	49
	Difference	0	0	0	0	0	0	55	-21	-149	-64	-6	-9
LF-6--Confluence to "C" Canal Diversion (cfs)													
Wet	Baseline	80	103	94	79	70	69	31	194	1076	476	179	141
	Alternative	63	67	70	79	76	55	83	204	993	454	175	154
	Difference	-17	-36	-24	0	6	-14	52	10	-83	-22	-4	13
Average	Baseline	37	77	69	63	59	61	40	199	535	208	154	92
	Alternative	43	52	50	55	53	48	90	189	419	194	128	106
	Difference	6	-25	-19	-8	-6	-13	50	-10	-116	-14	-26	14
Dry	Baseline	13	42	47	50	47	48	35	99	232	111	47	40
	Alternative	37	37	37	46	45	40	85	103	119	119	101	73
	Difference	24	-5	-10	-4	-2	-8	50	4	-113	8	54	33
LF-7--"C" Canal Diversion to South Boneta Diversion (cfs)													
Wet	Baseline	10	52	44	67	67	56	13	78	650	268	63	71
	Alternative	63	67	70	76	76	55	80	190	976	436	160	147
	Difference	53	15	26	9	9	-1	67	112	326	168	97	76
Average	Baseline	3	12	20	61	57	39	14	75	239	72	38	22
	Alternative	43	52	50	55	53	48	86	176	402	177	117	100
	Difference	40	40	30	-6	-4	9	72	101	163	105	79	78
Dry	Baseline	0	0	2	50	47	15	8	40	46	28	22	13
	Alternative	37	37	37	46	45	40	82	89	103	111	98	72
	Difference	37	37	35	-4	-2	25	74	49	57	83	76	59

Table 3.6-7
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Cow Canyon Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-8--South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion (cfs)													
Wet	Baseline	10	59	63	79	70	56	12	95	758	287	71	84
	Alternative	63	67	70	76	76	55	79	186	972	432	157	145
	Difference	53	8	7	-3	6	-1	67	91	214	145	86	61
Average	Baseline	3	14	23	63	59	41	15	92	287	71	38	24
	Alternative	43	52	50	55	53	48	85	172	398	172	113	99
	Difference	40	38	27	-8	-6	7	70	80	111	101	75	75
Dry	Baseline	0	0	2	50	47	15	7	38	44	33	25	14
	Alternative	37	37	37	46	45	40	81	86	99	109	98	72
	Difference	37	37	35	-4	-2	25	74	48	55	76	73	58
LF-9--Big Sand Wash Feeder Pipeline Diversion to Purdy Ditch Diversion (cfs)													
Wet	Baseline	13	55	46	69	71	62	16	76	648	266	61	70
	Alternative	3	3	33	36	31	38	35	52	712	262	57	52
	Difference	-10	-52	-13	-33	-40	-24	19	-24	64	-4	-4	-18
Average	Baseline	6	15	23	63	61	45	18	73	237	70	36	22
	Alternative	7	10	14	18	18	26	30	72	218	68	50	22
	Difference	1	-5	-9	-45	-43	-19	12	-1	-19	-2	14	0
Dry	Baseline	3	3	5	52	50	21	12	39	45	29	23	14
	Alternative	3	3	2	3	4	11	21	40	49	41	31	17
	Difference	0	0	-3	-49	-46	-10	9	1	4	12	8	3
LF-10--Purdy Ditch Diversion to Red Cap Diversion (cfs)													
Wet	Baseline	13	62	65	81	73	62	14	86	747	276	62	80
	Alternative	3	3	33	36	31	38	32	41	698	249	46	47
	Difference	-10	-59	-32	-45	-42	-24	18	-45	-49	-27	-16	-33
Average	Baseline	6	17	25	66	63	47	17	84	277	61	31	20
	Alternative	7	10	14	18	18	26	27	62	205	55	30	18
	Difference	1	-7	-11	-48	-45	-21	10	-22	-72	-6	-1	-2
Dry	Baseline	3	3	5	52	50	21	9	29	35	30	24	13
	Alternative	3	3	2	3	4	11	19	29	37	33	26	14
	Difference	0	0	-3	-49	-46	-10	10	0	2	3	2	1

Table 3.6-7
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Cow Canyon Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-11--Red Cap Diversion to Hamilton-Knudsen Diversion (cfs)													
Wet	Baseline	13	62	65	81	73	62	7	55	713	240	33	65
	Alternative	3	3	33	36	31	38	27	18	665	215	22	36
	Difference	-10	-59	-32	-45	-42	-24	20	-41	-49	-24	-11	-28
Average	Baseline	6	17	25	66	63	47	10	55	242	26	0	6
	Alternative	7	10	14	18	18	26	23	39	173	26	0	9
	Difference	1	-7	-11	-48	-45	-21	13	-17	-68	-1	0	3
Dry	Baseline	3	3	5	52	50	21	2	2	2	1	0	0
	Alternative	3	3	2	3	4	11	15	7	7	7	7	7
	Difference	0	0	33	-48	-46	-10	13	5	5	6	7	7
LF-12--Hamilton-Knudsen Diversion to Duchesne River (cfs)													
Wet	Baseline	13	62	65	81	73	62	6	57	711	238	31	64
	Alternative	3	3	33	36	31	38	27	18	662	215	22	36
	Difference	-10	-59	-32	-45	-42	-24	21	-39	-49	-23	-9	-28
Average	Baseline	6	17	25	66	63	47	9	55	240	24	2	6
	Alternative	7	10	14	18	18	26	23	39	173	24	0	9
	Difference	1	-7	-11	-48	-45	-21	10	-16	-67	0	0	3
Dry	Baseline	3	3	5	52	50	21	2	0	0	0	0	0
	Alternative	3	3	2	3	4	11	15	7	7	7	7	7
	Difference	0	0	33	-49	-46	-10	13	7	7	7	7	7

(October through March and April through September) and 12-month (annual) basis. It should be noted that the estimated monthly flow in dry and/or average years may exceed the flow in average and/or wet years because of the timing of reservoir inflows and releases.

Yellowstone River. With high mountain lakes stabilization, flows originating in the upper Yellowstone River watershed (Uinta Mountains) down to Upper Yellowstone Reservoir would be the same as the Proposed Action. From the reservoir to the Lake Fork River confluence, flows would generally be lower from October through March, higher in April and May, lower in June, and higher from July through September. Seasonally, the river reach data show average flows would be 19 to 26 percent lower from October through March, and 6 to 9 percent higher from April through September. Average annual flows would be zero to 2 percent higher than baseline.

Data in Table 3.6-7 show that the 24 and 56 cfs minimum instream flows provided in River Reach Y-4 and the 24 and 38 cfs minimum flows provided in River Reach Y-5 would be met under all hydrologic conditions.

Lake Fork River. No flow changes would occur in the upper Lake Fork River watershed since the high mountain lakes located above Moon Lake would not be stabilized but operated for irrigation purposes as in the past. From Moon Lake to the river's confluence with the Duchesne River, monthly flows and flow patterns under the Cow Canyon Alternative (see Table 3.6-7) would be essentially the same as estimated and described for the Proposed Action (see Section 3.6.6.3.1.3).

Data in Table 3.6-7 show that the 24 and 72 cfs minimum instream flows provided in the Lake Fork River would be met under all hydrologic conditions.

Table 3.6-8 shows the ranked annual peak flows and percent change in flows estimated for the Cow Canyon Alternative. The 2-, 5-, 10-, and 20-year data were used to assess potential impacts on aquatic and wildlife resources, wetlands, and threatened and endangered species. The 20- and 50-year data, which illustrate the potential effect on peak flood discharges and fluvial processes, show that peak flood discharges would generally be unchanged or reduced (1 to 5 percent) compared to baseline conditions.

Table 3.6-8 shows that 20- and 50- year peak flows would increase by 19 and 16 percent, respectively, from the "C Canal diversion down to the Big Sand Wash Feeder Pipeline diversion, and by 4 to 5 percent and 1 percent, respectively, from the Purdy Ditch diversion down to the Duchesne River.

3.6.6.4.1.4 Irrigation Canals and Seepage. Since no canal rehabilitation or abandonment would occur under the Cow Canyon Alternative, canal seepage losses would not change from baseline conditions. Unit-wide effects resulting from changes in spring and summer diversion patterns would be the same as described for the Proposed Action (see Section 3.6.6.3.1.4).

Based on Water Budget Model estimates, about 178,000 acre-feet per year would be diverted under the Cow Canyon Alternative compared to 169,000 acre-feet per year under baseline conditions. Unit-wide, Table 3.6-9 shows that crop CU would increase by 39 percent, indirect CU and return flows would decrease by 21 percent, and water leaving the unit (outflow) would decrease by 38 percent (10,400), annually. These percentages are the same as estimated for the Proposed Action.

3.6.6.4.2 Potential Operational Impacts on Groundwater Hydrology. Changes in groundwater hydrology would be the same as the Proposed Action, except as noted.

3.6.6.4.2.1 Upper Upalco Subunit. Proposed Upper Yellowstone Reservoir releases, monthly flow patterns, and shallow aquifer materials and characteristics are essentially the same as those estimated and described for Crystal Ranch Reservoir under the Proposed Action. Consequently, changes in groundwater hydrology and recharge in the upper subunit resulting from

Table 3.6-8

Ranked Annual Peak Flows for the Upalco Unit Cow Canyon Alternative

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Reach	Return Period[a]	Baseline[b] (cfs)	Cow Canyon[b] (cfs)	Percent Change	Reach	Return Period[a]	Baseline[b] (cfs)	Cow Canyon[b] (cfs)	Percent Change
Y-2	Yellowstone High Mountain Lakes to Reservoir				LF-6	Confluence to "C" Canal Diversion			
	2-yr	893	893	0%		2-yr	829	583	-30%
	5-yr	1,242	1,242	0%		5-yr	1,463	1,365	-7%
	10-yr	1,496	1,496	0%		10-yr	1,943	1,901	-2%
	20-yr	1,752	1,752	0%		20-yr	2,167	2,131	-2%
	50-yr	1,884	1,884	0%		50-yr	2,396	2,362	-1%
Y-4	Reservoir to Yellowstone Feeder Diversion				LF-7	"C" Canal Diversion to South Boneta Diversion			
	2-yr	741	659	-11%		2-yr	494	566	15%
	5-yr	980	884	-10%		5-yr	1,111	1,349	21%
	10-yr	1,179	1,167	-1%		10-yr	1,629	1,884	16%
	20-yr	1,302	1,299	0%		20-yr	1,776	2,113	19%
	50-yr	1,432	1,430	0%		50-yr	2,017	2,346	16%
Y-5	Yellowstone Feeder Diversion to Confluence				LF-8	South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion			
	2-yr	601	519	-14%		2-yr	489	561	15%
	5-yr	840	744	-12%		5-yr	1,106	1,345	22%
	10-yr	1,039	1,027	-1%		10-yr	1,624	1,879	16%
	20-yr	1,162	1,159	0%		20-yr	1,771	2,109	19%
	50-yr	1,292	1,290	0%		50-yr	2,012	2,341	16%
LF-2	Lake Fork High Mountain Lakes to Moon Lake				LF-10	Purdy Ditch Diversion to Red Cap Diversion			
	2-yr	1,011	1,011	0%		2-yr	480	154	-68%
	5-yr	1,516	1,516	0%		5-yr	1,096	995	-9%
	10-yr	1,742	1,742	0%		10-yr	1,613	1,533	-5%
	20-yr	1,820	1,820	0%		20-yr	1,761	1,840	4%
	50-yr	1,948	1,948	0%		50-yr	2,002	2,017	1%
LF-3	Moon Lake to Farnsworth Diversion				LF-11	Red Cap Diversion to Hamilton-Knudsen Diversion			
	2-yr	742	525	-29%		2-yr	445	124	-72%
	5-yr	1,091	968	-11%		5-yr	1,061	961	-9%
	10-yr	1,297	1,223	-6%		10-yr	1,580	1,499	-5%
	20-yr	1,461	1,397	-4%		20-yr	1,726	1,805	5%
	50-yr	1,489	1,448	-3%		50-yr	1,968	1,983	1%

Table 3.6-8

Ranked Annual Peak Flows for the Upalco Unit Cow Canyon Alternative

Reach	Return Period[a]	Baseline[b] (cfs)	Cow Canyon[b] (cfs)	Percent Change	Reach	Return Period[a]	Baseline[b] (cfs)	Cow Canyon[b] (cfs)	Percent Change
LF-4	Farnsworth Diversion to Rowley Ditch Diversion				LF-12	Hamilton-Knudsen Diversion to Duchesne River			
	2-yr	610	403	-36%		2-yr	443	123	-72%
	5-yr	954	849	-11%		5-yr	1,059	959	-9%
	10-yr	1,168	1,097	-6%		10-yr	1,577	1,497	-5%
	20-yr	1,333	1,269	-5%		20-yr	1,724	1,803	5%
	50-yr	1,358	1,317	-3%		50-yr	1,966	1,981	1%
LF-5	Rowley Ditch Diversion to Confluence								
	2-yr	620	403	-35%					
	5-yr	964	859	-11%					
	10-yr	1,178	1,107	-6%					
	20-yr	1,343	1,279	-5%					
	50-yr	1,368	1,327	-3%					

Notes:

Flows ranked largest to smallest by California Method (Chow 1964).

[a]The return period is the average duration required to experience the given flow (or greater). For example, the baseline peak flow of 620 cfs will be reached or exceeded once within a 2-year period, on average, at the Rowley Ditch Diversion to Confluence.

[b]5-, 10-, 20- and 50-year return period flows are linearly interpolated.

Table 3.6-9
Total Water Inflow, Agricultural Use, and Outflow Summary for the Upalco Unit Cow Canyon Alternative

			Water Use					Outflow		
	Inflow	Diversion[a]	Crop CU		Indirect CU[b]		River[c]	Return Flow		Total
Upalco Unit	(ac-ft)	(ac-ft)	(%)[d]	(ac-ft)	(%)	(ac-ft)	(ac-ft)	(%)	(ac-ft)	(ac-ft)
Baseline	192,000	169,000	43%	72,800	51%	85,800	6,500	6%[e]	10,700	27,200
Cow Canyon	192,000	178,000	57%	101,200	38%	67,900	6,500	5%[f]	8,500	16,800
Change in Water Use and Outflow		+9,000		+28,400		-17,900			-2,200	-10,400

Notes:
CU = Consumptive Use.
Numbers are rounded to the nearest 100 acre-feet. Therefore, the numbers may not sum to total shown because of roundoff and may not agree exactly with numbers given in the Feasibility Study.

[a] Includes 16,575 acre-feet annually diverted through the Yellowstone Feeder Canal.
[b] Indirect CU includes phreatophytes and downstream irrigators.
[c] Includes river corridor losses by phreatophytes, stock watering, minor diversions, and the difference between groundwater recharge and discharge.
[d] Overall efficiency based on conveyance efficiency of 85 percent, irrigation type mix, and baseline model diversion.
[e] Calculated based on baseline load analysis.
[f] Assume same proportion of return flow and secondary CU as baseline.

Upper Yellowstone Reservoir operations would be essentially the same as those described for Crystal Ranch Reservoir under the Proposed Action (see Section 3.6.6.3.2.1). Although unquantified, the presence of cavernous limestone in the central part of the upper valley is expected to result in higher reservoir seepage losses, which would further increase local shallow aquifer levels and recharge.

Under the Cow Canyon Alternative, average seasonal flows below Upper Yellowstone Reservoir to the Lake Fork River confluence would be 19 to 26 percent lower from October through March, and 6 to 9 percent higher from April through September. Shallow aquifer levels and recharge adjacent to the Yellowstone River would rise and fall in direct response to these changes in river flow. However, these flow changes are expected to cause negligible impacts on shallow groundwater levels because the annual amount of water available for river loss/percolation and recharge would remain essentially unchanged (zero to 2 percent higher). In dry years, the estimated 11 to 12 percent increase in annual flows is expected to slightly improve adjacent shallow groundwater levels and recharge (see Table 3.6-7, River Reaches Y-4 and Y-5).

Several springs used by the Upper Country Water District for a domestic water supply discharge from the toe of a large landslide deposit located at Cow Canyon. Upper Yellowstone Reservoir would inundate the lower springs and render them unusable as a domestic water supply, but spring recharge would not be affected since recharge occurs higher up on the landslide. Saturating the toe of the landslide could result in slope movement or failure.

Under the Cow Canyon Alternative, the Upper Country Water District supply would be replaced with water from Upper Yellowstone Reservoir. The water would be treated in a packaged water treatment facility immediately below the dam in a previously disturbed area. Water for the treatment plant would be delivered through a 12-inch conduit and regulating valve through the dam and distributed via an existing 12-inch supply pipeline.

Groundwater hydrology at Twin Pots Reservoir would be the same as baseline conditions since no facility improvements would be made. The reservoir would continue to be used in part for irrigation water delivery and experience seasonal drawdowns and groundwater effects as in the past (see Section 3.6.5.1.1.2).

3.6.6.4.2.2 Middle Upalco Subunit. No change in canal seepage losses or in related shallow aquifer levels or recharge would occur under the Cow Canyon Alternative. Unit-wide, the only anticipated change in shallow aquifer recharge would be a 21 percent reduction (1,100 acre-feet) in irrigation deep percolation because of increased crop consumptive use and improved irrigation efficiencies. Total shallow aquifer recharge would be about 46,250 acre-feet per year, or about 2 percent less than baseline conditions (47,350 acre-feet).

When shallow aquifer levels are closely and directly tied to river levels, changes in groundwater levels can be approximated by estimating changes in water surface elevations. Under the Cow Canyon Alternative, water surface elevations in a mean water year would decrease about -0.4 foot in July and August, and increase about 0.1 foot in September above the "C" Canal diversion; increase about 0.3, 0.5, and 0.8 foot in July, August and September, respectively, above the Big Sand Wash Pipeline diversion; and increase about 0.2 foot in July and August and about 0.3 foot in September above the Hamilton-Knudsen diversion. Water surface elevations in a dry water year would increase about 0.1, 0.2, and 0.3 foot in July, August, and September, respectively, above the "C" Canal diversion; increase about 0.3, 0.7, and 1.1 feet in July, August and September, respectively, above the Big Sand Wash Pipeline diversion; and increase about 0.2 foot in July and about 0.8 foot in August and September above the Hamilton-Knudsen diversion. Similar localized changes in shallow groundwater levels are anticipated adjacent to these Lake Fork River locations.

3.6.6.5 Crystal Ranch Alternative

Similar to the Proposed Action, construction and operation of the Crystal Ranch Alternative would change the timing and quantity of surface water flows in the Upalco Unit and allow more water to be used for crop production, instream flows, and other project purposes. Water use changes (i.e., increased crop use, even water use throughout the growing season, and a 2- to 3-week extension in late season irrigation deliveries), and improved water management (i.e., water delivery matched to crop requirements and canals converted to pipelines) would decrease the amount of water leaving the Upalco Unit and Uinta Basin.

Under this alternative, proposed onstream storage (Crystal Ranch Reservoir) would be constructed on the Yellowstone River. Hydrologic changes related to the enlargement of Big Sand Wash Reservoir; the Big Sand Wash Feeder diversion and pipeline; rehabilitation of the Ottosen, Blackburn, Anderson, and Tony Smith Laterals; and Twin Pots Reservoir rehabilitation would not occur since these project features are not proposed.

3.6.6.5.1 Potential Operational Impacts on Surface Water Hydrology. Impacts on surface water hydrology would be the same as the Proposed Action, except as noted.

3.6.6.5.1.1 Dams and Reservoirs. Under the Crystal Ranch Alternative, Crystal Ranch Reservoir would have the same total storage capacity (24,000 acre-feet) as the Proposed Action. The reservoir would fill most often in June and, on an annual basis, would fill about 64 percent of the time. Reservoir storage space allocations would include 2,400 acre-feet for the conservation pool; 2,500 acre-feet for high mountain lakes storage replacement; 9,550 acre-feet for the Ute Tribe; 150 acre-feet for non-Indian-owned 1861 water-righted land; 6,400 acre-feet for secondary water-righted land; and 3,000 acre-feet for City of Roosevelt municipal and industrial purposes.

Minimum instream flows in the Yellowstone River from Crystal Ranch Dam to the Lake Fork River confluence would be the same as described for the Proposed Action. In the Lake Fork River, minimum flows would be provided from the Yellowstone River confluence down to the "C" Canal diversion at a rate of 24 cfs from October through March and 72 cfs from April through September.

Reservoir operations would differ slightly from the Proposed Action because Big Sand Wash Reservoir would not be enlarged and Twin Pots Reservoir would not be rehabilitated under this alternative. Both Big Sand Wash and Twin Pots would continue to be operated for irrigation purposes as in the past (see Section 3.6.5.1.1.2).

From October through March, reservoir releases would average between 36 and 41 cfs, and the 24 cfs minimum instream flow would be met or exceeded 100 percent of the time. From April through September, reservoir releases would generally rise from April through June, decline from July through September, and average between 88 and 460 cfs. The 56 cfs minimum instream flow would be met or exceeded about 95 percent of the time. Additional information on Crystal Ranch Dam and Reservoir operations under the Crystal Ranch Alternative is provided in Chapter 2 (see Section 2.3.2.1.1).

Municipal and industrial water for the City of Roosevelt would be made available by an exchange with secondary water right water stored in Crystal Ranch Reservoir. The water would be delivered to Brown's Draw Reservoir via the Yellowstone Feeder Canal. Such an exchange would be limited to a maximum of 3,000 acre-feet during any particular year from October 1 through September 30.

3.6.6.5.1.2 River Reaches. Using the Water Budget Model, baseline and "with project" flows (by month) were estimated for wet, average, and dry years. Wet and dry year conditions were developed using the average of the 4 years with the largest volume of water (1941, 1944, 1965, 1983) and the 4 years with the smallest volume of water (1934, 1977, 1988, 1989), respectively, in the 64-year analysis period. Average conditions were developed using the average of all the years (1930 through 1993) in the 64-year analysis period. Table 3.6-10 shows, by river reach and month, the difference (in cfs) and percent change in flow expected under the Crystal Ranch Alternative compared to baseline (without project) conditions. The percent change is calculated on a 6-month (October through March and April through September) and 12-month (annual) basis. It should be noted that the estimated monthly flow in dry and/or average years may exceed the flow in average and/or wet years because of the timing of reservoir inflows and releases.

Yellowstone River. With high mountain lakes stabilization, flows originating in the upper Yellowstone River watershed (Uinta Mountains) down to Crystal Ranch Reservoir would be the same as estimated and described for the Proposed Action (see Section 3.6.6.3.1.3). Flows entering the reservoir would be higher from October through May; lower in June, July, and August; and unchanged in September.

From the reservoir to the Lake Fork River confluence, average flows would generally be lower from October through March, higher in April, lower in May and June, and higher from July through September. Seasonally, the river reach data show average flows substantially lower (27 to 35 percent) from October through March, and 5 to 12 percent higher from April through September than baseline.

Data in Table 3.6-10 show that the 24 and 56 cfs minimum instream flows provided in River Reach Y-4 and the 24 and 38 cfs minimum flows provided in River Reach Y-5 would be met under all hydrologic conditions.

Lake Fork River. No flow changes would occur in the upper Lake Fork River watershed since the high mountain lakes located above Moon Lake would not be stabilized, but operated for irrigation purposes as in the past. From Moon Lake to the river's confluence with the Yellowstone River, average annual flows would be zero to 16 percent lower than baseline.

From the confluence to the "C" Canal diversion, average flows would be 24 percent lower from October through March and 5 percent lower from April through September. From the "C" Canal diversion to the Big Sand Wash Feeder Pipeline diversion, average flows would be substantially lower (33 to 36 percent) from October through March and zero to 17 percent lower from April through September. Average annual flows though this reach would be 10 to 22 percent lower than baseline.

From the Big Sand Wash Feeder Pipeline diversion to the river's confluence with the Duchesne River, average flows would be substantially lower (31 to 35 percent) from October through March and 1 to 19 percent lower from April through September. On an annual basis, average flows in the lower river would be 24 percent lower than baseline.

Data in Table 3.6-10 show that the 24 and 72 cfs minimum instream flows provided in the Lake Fork River from the Yellowstone River confluence down to the "C" Canal diversion would be met under all hydrologic conditions.

Table 3.6-11 shows the ranked annual peak flows and percent change in flows estimated for the Crystal Ranch Alternative. The 2-, 5-, 10-, and 20-year data were used to assess potential impacts on aquatic and wildlife resources, wetlands, and threatened and endangered species. The 20- and 50-year data, which illustrate the potential effect on peak flood discharges and fluvial processes, show that peak flood discharges would be unchanged or reduced compared to baseline conditions. The largest reductions would occur on the Lake Fork River from Moon Lake down to the Yellowstone River confluence with reductions in 20-year peak flood discharges ranging between 15 and 17 percent.

3.6.6.5.1.3 Irrigation Canals and Seepage. Converting 14.4 miles of selected unlined canal reaches to pipelines along Farnsworth Laterals No. 1, No. 2, and No. 3 and abandoning the first 2.7 miles of Lateral No. 1 would reduce canal seepage losses and thereby increase the amount of

Table 3.6-10
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Crystal Ranch Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
Y-1--Yellowstone High Mountain Lakes Storage (acre-feet)													
Wet	Baseline	772	1187	1602	2017	2467	3001	3773	3994	3994	2034	74	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-772	-1187	-1602	-2017	-2467	-3001	-3773	-3994	-3994	-2034	-74	0
Average	Baseline	594	891	1188	1485	1782	2198	2792	3861	3994	2034	74	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-594	-891	-1188	-1485	-1782	-2198	-2792	-3861	-3994	-2034	-74	0
Dry	Baseline	416	594	772	970	1148	1445	1861	2573	3464	1504	0	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-416	-594	-772	-970	-1148	-1445	-1861	-2573	-3464	-1504	0	0
Y-2--Yellowstone High Mountain Lakes to Reservoir (cfs)													
Wet	Baseline	134	86	67	56	50	51	61	295	818	491	237	157
	Alternative	146	93	74	63	57	61	75	311	818	458	236	157
	Difference	12	7	7	7	7	10	14	16	0	-33	-1	0
Average	Baseline	90	68	56	49	45	47	70	284	482	217	141	111
	Alternative	99	73	61	54	50	55	82	297	479	186	140	111
	Difference	9	5	5	5	5	8	12	13	-3	-31	-1	0
Dry	Baseline	61	49	42	40	37	38	74	162	181	106	82	60
	Alternative	67	52	45	43	40	43	82	169	172	81	82	60
	Difference	6	3	3	3	3	5	8	7	-9	-25	0	0
Y-3--Reservoir Storage (acre-feet)													
Wet	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	13448	15957	17706	18868	19627	20473	19723	17948	24000	22845	19529	17520
	Difference	13448	15957	17706	18868	19627	20473	19723	17948	24000	22845	19529	17520
Average	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	10505	12848	14398	15593	16590	17743	17224	15829	17760	11390	7037	5861
	Difference	10505	12848	14398	15593	16590	17743	17224	15829	17760	11390	7037	5861
Dry	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	5439	6928	8014	8941	9719	10689	10919	5851	3172	2400	2400	2400
	Difference	5439	6928	8014	8941	9719	10689	10919	5851	3172	2400	2400	2400

Table 3.6-10
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Crystal Ranch Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
Y-4--Reservoir to Yellowstone Feeder Diversion (cfs)													
Wet	Baseline	134	86	67	56	50	51	61	295	818	491	237	157
	Alternative	56	51	44	43	44	56	79	320	802	457	259	180
	Difference	-78	-35	-23	-13	-6	5	18	25	-16	-34	22	23
Average	Baseline	90	68	56	49	45	47	70	284	482	217	141	111
	Alternative	39	40	38	36	36	41	88	284	460	281	215	128
	Difference	-51	-28	-18	-13	-9	-6	18	0	-22	64	74	17
Dry	Baseline	61	49	42	40	37	38	74	162	181	106	82	60
	Alternative	27	27	27	28	35	34	73	201	244	144	82	60
	Difference	-34	-22	-15	-12	-2	-4	-1	39	63	38	0	0
Y-5--Yellowstone Feeder Diversion to Confluence (cfs)													
Wet	Baseline	70	85	67	56	50	50	49	237	683	392	189	137
	Alternative	37	51	44	43	44	37	55	234	663	352	187	143
	Difference	-33	-34	-23	-13	-6	-13	6	-3	-20	-40	-2	6
Average	Baseline	23	63	55	49	45	46	56	225	381	150	91	85
	Alternative	30	35	35	36	36	33	58	194	343	191	149	98
	Difference	7	-28	-20	-13	-9	-13	2	-31	-38	41	58	13
Dry	Baseline	3	32	37	40	37	37	60	125	123	70	70	51
	Alternative	27	27	27	28	35	27	48	121	150	107	75	52
	Difference	24	-5	-10	-12	-2	-10	-12	-4	27	37	5	1
LF-1--Lake Fork High Mountain Lakes Storage (acre-feet)													
Wet	Baseline	356	593	830	1067	1304	1660	2075	385	4859	2483	107	0
	Alternative	356	593	830	1067	1304	1660	2075	385	4859	2483	107	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Average	Baseline	297	475	653	831	1009	1306	1662	3444	891	1889	0	0
	Alternative	297	475	653	831	1009	1306	1662	3444	891	1889	0	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Dry	Baseline	237	356	475	594	713	951	1248	3030	4218	1545	0	0
	Alternative	237	356	475	594	713	951	1248	3030	4218	1545	0	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.6-10
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Crystal Ranch Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-2--Lake Fork High Mountain Lakes to Moon Lake (cfs)													
Wet	Baseline	91	58	43	34	28	28	42	303	819	411	154	99
	Alternative	91	58	43	34	28	28	42	303	819	411	154	99
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Average	Baseline	58	43	34	30	27	28	57	312	550	200	99	71
	Alternative	58	43	34	30	27	28	57	312	550	200	99	71
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Dry	Baseline	40	35	28	26	26	30	72	213	248	74	56	41
	Alternative	40	35	28	26	26	30	72	213	248	74	56	41
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
LF-3--Moon Lake to Farnsworth Diversion (cfs)													
Wet	Baseline	1	0	0	0	7	8	47	229	644	439	267	165
	Alternative	1	7	16	12	9	8	92	243	670	462	267	151
	Difference	0	7	16	12	2	0	45	14	26	23	0	-14
Average	Baseline	4	3	2	2	2	2	46	226	458	393	261	107
	Alternative	1	3	3	3	2	3	92	261	433	348	236	119
	Difference	-3	0	1	1	0	1	46	35	-25	-45	-25	12
Dry	Baseline	1	0	0	0	0	0	42	240	398	111	55	39
	Alternative	1	0	0	0	0	0	97	246	296	173	96	40
	Difference	0	0	0	0	0	0	55	6	-102	62	41	1
LF-4--Farnsworth Diversion to Rowley Ditch Diversion (cfs)													
Wet	Baseline	0	0	0	0	7	7	21	125	513	304	158	108
	Alternative	0	0	1	12	9	7	60	127	514	323	163	103
	Difference	0	0	1	12	2	0	39	2	1	19	5	-5
Average	Baseline	3	2	2	2	2	2	20	125	330	279	198	82
	Alternative	1	2	2	2	2	2	62	146	308	235	173	84
	Difference	-2	0	0	0	0	0	42	21	-22	-44	-25	2
Dry	Baseline	0	0	0	0	0	0	16	149	313	100	52	36
	Alternative	0	0	0	0	0	0	68	142	227	131	55	39
	Difference	0	0	0	0	0	0	52	-7	-86	31	3	3

Table 3.6-10
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Crystal Ranch Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-5--Rowley Ditch Diversion to Confluence (cfs)													
Wet	Baseline	10	17	27	22	20	18	32	156	644	341	197	112
	Alternative	10	10	11	22	19	17	70	137	524	333	173	113
	Difference	0	-7	-16	0	-1	-1	38	-19	-120	-8	-24	1
Average	Baseline	14	14	14	14	14	15	33	173	404	307	246	101
	Alternative	11	12	12	12	12	12	72	156	318	243	183	94
	Difference	-3	-2	-2	-2	-2	-3	39	-17	-86	-64	-63	-7
Dry	Baseline	10	10	10	10	10	10	25	173	343	209	97	58
	Alternative	10	10	10	10	10	10	78	152	237	141	65	49
	Difference	0	0	0	0	0	0	53	-21	-106	-68	-32	-9
LF-6--Confluence to "C" Canal Diversion (cfs)													
Wet	Baseline	80	103	94	79	70	69	31	194	1076	476	179	141
	Alternative	47	61	55	65	63	54	77	184	951	444	167	154
	Difference	-33	-42	-39	-14	-7	-15	46	-10	-125	-32	-12	13
Average	Baseline	37	77	69	63	59	61	40	199	535	208	154	92
	Alternative	41	47	47	49	48	46	83	164	428	211	169	112
	Difference	4	-30	-22	-14	-11	-15	43	-35	-107	3	15	20
Dry	Baseline	13	42	47	50	47	48	35	99	232	111	47	40
	Alternative	37	37	37	38	45	37	79	86	183	129	72	72
	Difference	24	-5	-10	-12	-2	-11	44	-13	-49	18	25	32
LF-7--"C" Canal Diversion to South Boneta Diversion (cfs)													
Wet	Baseline	10	52	44	67	67	56	13	78	650	268	63	71
	Alternative	0	13	27	65	63	26	28	69	676	265	64	97
	Difference	-10	-39	-17	-2	-4	-30	15	-9	26	-3	1	26
Average	Baseline	3	12	20	61	57	39	14	75	239	72	38	22
	Alternative	0	7	11	49	48	13	29	73	216	70	41	28
	Difference	-3	-5	-9	-12	-9	-26	15	-2	-23	-2	3	6
Dry	Baseline	0	0	2	50	47	15	8	40	46	28	22	13
	Alternative	0	0	0	38	45	0	23	41	48	39	28	17
	Difference	0	0	-2	-12	-2	-15	15	1	2	11	6	4

Table 3.6-10
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Crystal Ranch Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-8--South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion (cfs)													
Wet	Baseline	10	59	63	79	70	56	12	95	758	287	71	84
	Alternative	0	13	27	65	63	26	27	66	671	260	60	95
	Difference	-10	-46	-36	-14	-7	-30	15	-29	-87	-27	-11	-11
Average	Baseline	3	14	23	63	59	41	15	92	287	71	38	24
	Alternative	1	7	11	49	48	13	28	70	211	66	38	26
	Difference	-2	-7	-12	-14	-11	-28	13	-22	-76	-5	0	2
Dry	Baseline	0	0	2	50	47	15	7	38	44	33	25	14
	Alternative	0	0	0	38	45	0	22	38	44	37	27	16
	Difference	0	0	-2	-12	-2	-15	15	0	0	4	2	2
LF-9--Big Sand Wash Feeder Pipeline Diversion to Purdy Ditch Diversion (cfs)													
Wet	Baseline	13	55	46	69	71	62	16	76	648	266	61	70
	Alternative	3	16	30	68	67	32	31	68	674	262	61	97
	Difference	-10	-39	-16	-1	-4	-30	15	-8	26	-4	0	27
Average	Baseline	6	15	23	63	61	45	18	73	237	70	36	22
	Alternative	3	9	13	51	51	19	32	72	214	68	39	27
	Difference	-3	-6	-10	-12	-10	-26	14	-1	-23	-2	3	5
Dry	Baseline	3	3	5	52	50	21	12	39	45	29	23	14
	Alternative	3	3	2	41	49	6	26	40	47	39	28	17
	Difference	0	0	-3	-11	-1	-15	14	1	2	10	5	3
LF-10--Purdy Ditch Diversion to Red Cap Diversion (cfs)													
Wet	Baseline	13	62	65	81	73	62	14	86	747	276	62	80
	Alternative	3	16	30	68	67	32	28	57	661	248	50	91
	Difference	-10	-46	-35	-13	-6	-30	14	-29	-86	-28	-12	11
Average	Baseline	6	17	25	66	63	47	17	84	277	61	31	20
	Alternative	3	9	13	51	51	19	29	61	201	55	30	23
	Difference	-3	-8	-12	-15	-12	-28	12	-23	-76	-6	-1	3
Dry	Baseline	3	3	5	52	50	21	9	29	35	30	24	13
	Alternative	3	3	2	41	49	6	23	29	35	33	25	14
	Difference	0	0	-3	-11	-1	-15	14	0	0	3	1	1

Table 3.6-10
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Crystal Ranch Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-11--Red Cap Diversion to Hamilton-Knudsen Diversion (cfs)													
Wet	Baseline	13	62	66	81	73	62	7	59	713	240	33	65
	Alternative	3	16	30	66	67	32	23	34	627	215	26	79
	Difference	-10	-46	-35	-13	-6	-30	16	-25	-86	-25	-7	14
Average	Baseline	6	17	25	66	63	47	16	56	242	26	4	0
	Alternative	3	9	13	51	81	19	23	34	170	26	4	14
	Difference	13	-8	-12	-15	-12	-28	14	-18	-72	-1	4	0
Dry	Baseline	3	3	5	52	50	21	2	2	2	1	4	0
	Alternative	13	3	2	41	49	6	18	7	7	7	7	7
	Difference	6	0	73	-11	41	-15	16	5	5	6	7	7
LF-12--Hamilton-Knudsen Diversion to Duchesne River (cfs)													
Wet	Baseline	13	52	66	81	73	62	6	57	711	238	31	64
	Alternative	3	-46	30	66	67	32	22	34	625	214	26	79
	Difference	-10	-46	-35	-13	-6	-30	16	-23	-86	-24	-5	15
Average	Baseline	6	17	25	66	63	47	1	55	240	24	2	0
	Alternative	3	9	13	81	81	19	24	34	169	26	2	14
	Difference	13	-8	-12	-15	-12	-28	14	-17	-71	1	4	0
Dry	Baseline	3	3	5	52	50	21	2	0	4	0	4	0
	Alternative	3	3	2	41	49	6	16	7	7	7	7	7
	Difference	6	0	73	-11	-1	-15	16	7	7	7	7	7

Table 3.6-11

Ranked Annual Peak Flows for the Upalco Unit Crystal Ranch Alternative

Reach	Return Period[a]	Baseline[b] (cfs)	Crystal Ranch[b] (cfs)	Percent Change	Reach	Return Period[a]	Baseline[b] (cfs)	Crystal Ranch[b] (cfs)	Percent Change
Y-2	Yellowstone High Mountain Lakes to Reservoir				LF-6	Confluence to "C" Canal Diversion			
	2-yr	893	893	0%		2-yr	829	546	-34%
	5-yr	1,242	1,242	0%		5-yr	1,463	1,176	-20%
	10-yr	1,496	1,496	0%		10-yr	1,943	1,501	-23%
	20-yr	1,752	1,752	0%		20-yr	2,167	2,060	-5%
	50-yr	1,884	1,884	0%		50-yr	2,396	2,273	-5%
Y-4	Reservoir to Yellowstone Feeder Diversion				LF-7	"C" Canal Diversion to South Boneta Diversion			
	2-yr	741	659	-11%		2-yr	494	211	-57%
	5-yr	980	883	-10%		5-yr	1,111	873	-21%
	10-yr	1,179	1,167	-1%		10-yr	1,629	1,246	-24%
	20-yr	1,302	1,299	0%		20-yr	1,776	1,725	-3%
	50-yr	1,432	1,429	0%		50-yr	2,017	2,020	0%
Y-5	Yellowstone Feeder Diversion to Confluence				LF-8	South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion			
	2-yr	601	519	-14%		2-yr	489	207	-58%
	5-yr	840	743	-12%		5-yr	1,106	868	-22%
	10-yr	1,039	1,027	-1%		10-yr	1,624	1,241	-24%
	20-yr	1,162	1,159	0%		20-yr	1,771	1,721	-3%
	50-yr	1,292	1,289	0%		50-yr	2,012	2,015	0%
LF-2	Lake Fork High Mountain Lakes to Moon Lake				LF-10	Purdy Ditch Diversion to Red Cap Diversion			
	2-yr	1,011	1,011	0%		2-yr	480	196	-59%
	5-yr	1,516	1,516	0%		5-yr	1,096	858	-22%
	10-yr	1,742	1,742	0%		10-yr	1,613	1,231	-24%
	20-yr	1,820	1,820	0%		20-yr	1,761	1,711	-3%
	50-yr	1,948	1,948	0%		50-yr	2,002	2,005	0%
LF-3	Moon Lake to Farnsworth Diversion				LF-11	Red Cap Diversion to Hamilton-Knudsen Diversion			
	2-yr	742	502	-32%		2-yr	445	161	-64%
	5-yr	1,091	880	-19%		5-yr	1,061	825	-22%
	10-yr	1,297	1,060	-18%		10-yr	1,580	1,198	-24%
	20-yr	1,461	1,234	-16%		20-yr	1,726	1,677	-3%
	50-yr	1,489	1,448	-3%		50-yr	1,968	1,970	0%

Table 3.6-11

Ranked Annual Peak Flows for the Upalco Unit Crystal Ranch Alternative

Page 2 of 2

Reach	Return Period[a]	Baseline[b] (cfs)	Crystal Ranch[b] (cfs)	Percent Change	Reach	Return Period[a]	Baseline[b] (cfs)	Crystal Ranch[b] (cfs)	Percent Change
LF-4	**Farnsworth Diversion to Rowley Ditch Diversion**				LF-12	**Hamilton-Knudsen Diversion to Duchesne River**			
	2-yr	610	400	-36%		2-yr	443	158	-64%
	5-yr	964	751	-21%		5-yr	1,059	823	-22%
	10-yr	1,168	928	-21%		10-yr	1,577	1,196	-24%
	20-yr	1,343	1,111	-17%		20-yr	1,724	1,674	-3%
	50-yr	1,358	1,317	-3%		50-yr	1,966	1,968	0%
LF-5	**Rowley Ditch Diversion to Confluence**								
	2-yr	620	400	-35%					
	5-yr	964	761	-21%					
	10-yr	1,178	938	-20%					
	20-yr	1,343	1,111	-17%					
	50-yr	1,368	1,327	-3%					

Notes:

Flows ranked largest to smallest by California Method (Chow 1964).

[a]The return period is the average duration required to experience the given flow (or greater). For example, the baseline peak flow of 620 cfs will be reached or exceeded once within a 2-year period, on average, at the Rowley Ditch Diversion to Confluence.

[b]5-, 10-, 20- and 50-year return period flows are linearly interpolated.

water available for project purposes by an estimated 1,500 acre-feet annually.

The wetland/riparian areas, which presently depend on canal leakage for a water source, are described in Section 3.9 Wetland and Riparian Resources. Under the Crystal Ranch Alternative, a total of 80.4 acres of canal dependent wetlands would be preserved by providing 362 acre-feet of project water per year for wetland maintenance systems. A complete description and quantification of the wetlands to be preserved and lost as a result of canal rehabilitation is included in Section 3.9. Unit-wide effects resulting from changes in spring and summer diversion patterns would be the same as described for the Proposed Action (see Section 3.6.6.3.1.4).

Based on Water Budget Model estimates, about 174,000 acre-feet per year would be diverted under the Crystal Ranch Alternative compared to 169,000 acre-feet under baseline conditions. Unit-wide, Table 3.6-12 shows that crop CU would increase by 36 percent, indirect CU and return flows would decrease by 22 percent, and water leaving the unit (outflow) would decrease by 27 percent (7,300 acre-feet) annually.

3.6.6.5.2 Potential Operational Impacts on Groundwater Hydrology. Changes in groundwater hydrology would be the same as the Proposed Action, except as noted.

3.6.6.5.2.1 Upper Upalco Subunit. Under the Crystal Ranch Alternative, average seasonal flows below Crystal Ranch Reservoir to the Lake Fork River confluence would be 27 to 35 percent lower from October through March, and 5 to 12 percent higher from April through September. Shallow aquifer levels and recharge adjacent to the Yellowstone River would rise and fall in direct response to these changes in river flow. However, these flow changes are expected to cause negligible impacts on adjacent shallow groundwater levels because the annual amount of water available for river loss/percolation and recharge would remain essentially unchanged (2 percent lower to 2 percent higher). In dry years, the estimated 5 to 6 percent increase in annual flows is expected to slightly improve adjacent shallow groundwater levels and recharge (see Table 3.6-10, River Reaches Y-4 and Y-5).

Groundwater hydrology in the upper Lake Fork River watershed above Moon Lake would not be changed by the Crystal Ranch Alternative since no project features or operational changes are proposed in this area. From Moon Lake to the confluence with the Yellowstone River, shallow aquifer levels adjacent to the river would rise and fall in direct response to seasonal changes in river flow. Although unquantified, the largest localized drop in shallow groundwater levels is expected to occur below the Rowley Ditch diversion where average annual flows would decline by an estimated 16 percent (see Table 3.6-10 River Reaches LF-3, LF-4, and LF-5).

Groundwater hydrology at Twin Pots Reservoir would be the same as baseline conditions since no facility improvements would be made. The reservoir would continue to be used in part for irrigation water delivery and experience seasonal drawdowns and groundwater effects as in the past (see Section 3.6.5.1.1.2).

3.6.6.5.2.2 Middle Upalco Subunit. Converting 14.4 miles of selected unlined canal reaches to pipelines along Farnsworth Laterals No. 1, No. 2, and No. 3 and abandoning the first 2.7 miles of Lateral No. 1 would reduce canal seepage losses and recharge to the shallow aquifer by an estimated 1,500 acre-feet per year. Shallow groundwater levels beneath and near these sections of canal would be slightly lowered. The 362 acre-feet of water annually used to maintain 80.4 acres of canal dependent wetland/riparian habitat would not provide any measurable recharge to the underlying shallow aquifer.

Under the Crystal Ranch Alternative, water use changes and improved water management would cause an estimated 22 percent decrease (1,200 acre-feet per year) in shallow aquifer recharge from irrigation deep percolation. This change would occur because of increased crop consumptive use and improved irrigation efficiencies. Unit-wide, reduced recharge from canal seepage and irrigation deep percolation would result in an estimated

Table 3.6-12
Total Water Inflow, Agricultural Use, and Outflow Summary for the Upalco Unit Crystal Ranch Alternative

Upalco Unit	Inflow (ac-ft)	Diversion[a] (ac-ft)	Water Use: Crop CU (%)[d]	Water Use: Crop CU (ac-ft)	Water Use: Indirect CU[b] (%)	Water Use: Indirect CU[b] (ac-ft)	River[c] (ac-ft)	Outflow: Return Flow (%)	Outflow: Return Flow (ac-ft)	Outflow: Total (ac-ft)
Baseline	192,000	169,000	43%	72,800	51%	85,800	6,500	6%[e]	10,700	27,200
Crystal Ranch	192,000	174,000	57%	99,300	38%	66,600	6,500	5%[f]	8,300	19,900
Change in Water Use and Outflow		+5,000		+26,500		-19,200			-2,400	-7,300

Notes:
CU = Consumptive Use.
Numbers are rounded to the nearest 100 acre-feet. Therefore, the numbers may not sum to total shown because of roundoff and may not agree exactly with numbers given in the Feasibility Study.

[a]Includes 16,575 acre-feet annually diverted through the Yellowstone Feeder Canal.
[b]Indirect CU includes phreatophytes and downstream irrigators.
[c]Includes river corridor losses by phreatophytes, stock watering, minor diversions, and the difference between groundwater recharge and discharge.
[d]Overall efficiency based on conveyance efficiency of 85 percent, irrigation type mix, and baseline model diversion.
[e]Calculated based on baseline load analysis.
[f]Assume same proportion of return flow and secondary CU as baseline.

6 percent decrease (2,700 acre-feet per year) in recharge to the shallow, unconfined aquifer. Total recharge to the shallow aquifer would be about 44,650 acre-feet per year compared to 47,350 acre-feet per year under baseline conditions.

Groundwater hydrology at Big Sand Wash Reservoir would be the same as baseline conditions since no facility improvements would be made. The reservoir would continue to be operated for irrigation and experience seasonal drawdowns and no shallow groundwater effects as in the past (see Section 3.6.5.1.1.2).

When shallow aquifer levels are closely and directly tied to river levels, changes in groundwater levels can be approximated by estimating changes in water surface elevations. Under the Crystal Ranch Alternative, water surface elevations in a mean water year would remain unchanged in July, and increase about 0.1 foot in August and September above the "C" Canal diversion; remain unchanged in July, August and September above the Big Sand Wash Pipeline diversion; and increase about 0.2 foot in July and August and about 0.3 foot in September above the Hamilton-Knudsen diversion. Water surface elevations in a dry water year would remain unchanged in July, and increase about 0.2 foot in August and 0.3 foot in September above the "C" Canal diversion; decrease about -0.1 foot in July and remain unchanged in August and September above the Big Sand Wash Pipeline diversion; and increase about 0.2 foot in July and about 0.8 foot in August and September above the Hamilton-Knudsen diversion. Similar localized changes in shallow groundwater levels are anticipated adjacent to these Lake Fork River locations.

3.6.6.6 Twin Pots Alternative

Similar to the Proposed Action, construction and operation of the Twin Pots Alternative would impact the timing and quantity of surface water flows in the Upalco Unit and allow more water to be used for crop production and other project purposes. Water use changes (i.e., increased crop use, even water use throughout the growing season, and a 2- to 3-week extension in late season irrigation deliveries), and improved water management (i.e., water delivery matched to crop requirements and canals converted to pipelines) would decrease the amount of water leaving the Upalco Unit and Uinta Basin.

Under this alternative, hydrologic changes related to an onstream storage facility on the Yellowstone River, and the rehabilitation of the Ottosen, Blackburn, Anderson, and Tony Smith Laterals would not occur since these project features are not proposed. Additional hydrologic changes would occur, however, with the stabilization of four high mountain lakes in the upper Lake Fork River watershed and the construction of the Lake Fork-Yellowstone diversion dam and pipeline.

No minimum instream flows would be provided under this alternative since no onstream reservoirs are proposed.

3.6.6.6.1 Potential Operational Impacts on Surface Water Hydrology. Impacts on surface water hydrology would be the same as the Proposed Action, except as noted.

3.6.6.6.1.1 High Mountain Lakes. With the stabilization of four additional high mountain lakes (Brown Duck, Island, Kidney, and Clements) in the upper Lake Fork River watershed, the outlet pipes would be plugged and water surface elevations maintained year-round at the stabilized elevations proposed (see Section 2.4.2.5 of Chapter 2). Past drawdowns ranging from 11 feet (Brown Duck and Clements) to 18 feet (Kidney) would be eliminated since the lakes would no longer be used for irrigation. Water surface fluctuations would be limited to those associated with natural flow conditions.

A total of about 2,755 acre-feet of project water would be required for a one-time filling of the four lakes to the stabilized elevations proposed. Once this initial filling has taken place, lake inflow and outflow would mirror natural conditions. High winter and spring flows that were used in the past to yield about 3,500 acre-feet of irrigation water would pass downstream and be stored in the enlarged Big Sand Wash Reservoir. Water storage rights in these four lakes would be transferred to the United States and stored in Big Sand Wash Reservoir.

When combined with the 10 high mountain lakes proposed for stabilization in the upper Yellowstone River watershed, a total of about 3,853 acre-feet of project water would be required for a one-time filling of the lakes to the stabilized elevations proposed, water storage rights for 6,500 acre-feet would be transferred to the enlarged Big Sand Wash Reservoir. High winter and spring flows that were used in the past to yield about 5,500 acre-feet of irrigation water would pass downstream and be diverted or stored in the enlarged Big Sand Wash Reservoir.

3.6.6.6.1.2 Dams and Reservoirs. After enlargement, Big Sand Wash Reservoir would have a total storage capacity of 24,000 acre-feet (about 13 percent of the unit's average annual inflow and 3,000 acre-feet more than under the Proposed Action or Cow Canyon Alternative). The reservoir would fill most often in April and, on an annual basis, would fill about 86 percent of the time. Reservoir storage space allocations would include: 1,200 acre-feet for the conservation pool; 3,500 acre-feet for City of Roosevelt municipal and industrial purposes; 6,500 acre-feet for high mountain lakes storage replacement; and 12,800 acre-feet (2,000 acre-feet more than currently available) for the Moon Lake Water Users Association for secondary water-righted land. Reservoir releases would be made only during the irrigation season (April through September) and remain essentially constant during each month. Releases would generally rise from April through July, decline in August and September, and average between 42 and 205 cfs. Additional information on Big Sand Wash Dam and Reservoir operations is provided in Chapter 2 (see Section 2.5.2.1.1).

The existing Twin Pots Dam would be removed, replaced, and operated as described under the Proposed Action (see Section 3.6.6.3.1.2). At any time that Moon Lake spills in accordance with current (pre-1996) operations, the Moon Lake Water Users Association may deliver the amount spilled, up to a maximum of 2,000 acre-feet of its water, to Twin Pots Reservoir and exchange the water so stored in Twin Pots Reservoir for a like amount of 1861 water right water in the Lake Fork River for diversion or storage in Big Sand Wash Reservoir. (Under current operations, Moon Lake spills an average of 6 out of 10 years.) Such an exchange would be limited to a maximum of 2,000 acre-feet during an irrigation season.

Municipal and industrial water (3,000 acre-feet) for the City of Roosevelt would be stored in Big Sand Wash Reservoir and delivered via the proposed Big Sand Wash-Roosevelt Feeder Pipeline.

3.6.6.6.1.3 River Reaches. Using the Water Budget Model, baseline and "with project" flows (by month) were estimated for wet, average, and dry years. Wet and dry year conditions were developed using the average of the 4 years with the largest volume of water (1941, 1944, 1965, 1983) and the 4 years with the smallest volume of water (1934, 1977, 1988, 1989), respectively, in the 64-year analysis period. Average conditions were developed using the average of all the years (1930 through 1993) in the 64-year analysis period. Table 3.6-13 shows, by river reach and month, the difference (in cfs) and percent change in flow expected under the Twin Pots Alternative compared to baseline (without project) conditions. The percent change is calculated on a 6-month (October through March and April through September) and 12-month (annual) basis. It should be noted that the estimated monthly flow in dry and/or average years may exceed the flow in average and/or wet years because of the timing of reservoir inflows and releases.

Yellowstone River. With high mountain lakes stabilization, flows originating in the upper Yellowstone River watershed (Uinta Mountains) would be uncontrolled and follow natural runoff patterns. Since the lakes would generally be stabilized near natural levels, peak flows below the lakes would be similar to natural (pre-1900s) conditions.

From the high mountain lakes down to the Lake Fork River confluence, flows would generally be higher from October through May; lower in June, July, and August; and unchanged in September.

Table 3.6-13
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Twin Pots Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
Y-1--Yellowstone High Mountain Lakes Storage (acre-feet)													
Wet	Baseline	772	1187	1602	2017	2467	3001	3773	3994	3994	2034	74	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-772	-1187	-1602	-2017	-2467	-3001	-3773	-3994	-3994	-2034	-74	0
Average	Baseline	594	891	1188	1485	1782	2198	2792	3861	3994	2034	74	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-594	-891	-1188	-1485	-1782	-2198	-2792	-3861	-3994	-2034	-74	0
Dry	Baseline	416	594	772	970	1148	1445	1861	2573	3464	1504	0	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-416	-594	-772	-970	-1148	-1445	-1861	-2573	-3464	-1504	0	0
Y-2--Yellowstone High Mountain Lakes to Reservoir (cfs)													
Wet	Baseline	134	86	67	56	50	51	61	295	818	491	237	157
	Alternative	146	93	74	63	57	61	75	315	818	458	236	157
	Difference	12	7	7	7	7	10	14	20	0	-33	-1	0
Average	Baseline	90	68	56	49	45	47	70	284	482	217	141	111
	Alternative	99	73	61	54	50	55	82	297	479	186	140	111
	Difference	9	5	5	5	5	8	12	13	-3	-31	-1	0
Dry	Baseline	61	49	42	40	37	38	74	162	181	106	82	60
	Alternative	67	52	45	43	40	43	82	169	172	81	82	60
	Difference	6	3	3	3	3	5	8	7	-9	-25	0	0
Y-3--Reservoir Storage (acre-feet)													
Wet	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Average	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0
Dry	Baseline	0	0	0	0	0	0	0	0	0	0	0	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	0	0	0	0	0	0	0	0	0	0	0	0

Table 3.6-13
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Twin Pots Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
Y-4--Reservoir to Yellowstone Feeder Diversion (cfs)													
Wet	Baseline	134	86	67	56	50	51	61	295	818	491	237	157
	Alternative	146	93	74	63	57	61	75	311	818	458	236	157
	Difference	12	7	7	7	7	10	14	16	0	-33	-1	0
Average	Baseline	90	68	56	49	45	47	70	284	482	217	141	111
	Alternative	99	73	61	54	50	55	82	297	479	186	140	111
	Difference	9	5	5	5	5	8	12	13	-3	-31	-1	0
Dry	Baseline	61	49	42	40	37	38	74	162	181	106	82	60
	Alternative	67	52	45	43	40	43	82	169	172	81	82	60
	Difference	6	3	3	3	3	5	8	7	-9	-25	0	0
Y-5--Yellowstone Feeder Diversion to Confluence (cfs)													
Wet	Baseline	70	85	67	56	50	50	49	237	683	392	189	137
	Alternative	79	86	74	63	57	60	60	247	682	362	193	150
	Difference	9	1	7	7	7	10	11	10	-1	-30	4	13
Average	Baseline	23	63	55	49	45	46	56	225	381	150	91	85
	Alternative	40	61	59	54	50	53	64	239	383	121	87	86
	Difference	17	-2	4	5	5	7	8	14	2	-29	-4	1
Dry	Baseline	3	32	37	40	37	37	60	125	123	70	70	51
	Alternative	27	36	37	43	40	39	60	134	112	46	76	53
	Difference	24	4	0	3	3	2	0	9	-11	-24	6	2
LF-1--Lake Fork High Mountain Lakes Storage (acre-feet)													
Wet	Baseline	356	593	830	1067	1304	1660	2075	3850	4859	2483	107	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-356	-593	-830	-1067	-1304	-1660	-2075	-3850	-4859	-2483	-107	0
Average	Baseline	297	475	653	831	1009	1306	1662	3444	4859	1889	0	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-297	-475	-653	-831	-1009	-1306	-1662	-3444	-4859	-1889	0	0
Dry	Baseline	237	356	475	594	713	951	1248	3030	4218	1545	0	0
	Alternative	0	0	0	0	0	0	0	0	0	0	0	0
	Difference	-237	-356	-475	-594	-713	-951	-1248	-3030	-4218	-1545	0	0

Table 3.6-13
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Twin Pots Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-2--Lake Fork High Mountain Lakes to Moon Lake (cfs)													
Wet	Baseline	91	58	43	34	28	28	42	303	819	411	154	99
	Alternative	97	62	47	38	32	34	49	333	789	371	153	103
	Difference	6	4	4	4	4	6	7	30	-30	-40	-1	4
Average	Baseline	58	43	34	30	27	28	57	312	550	200	99	71
	Alternative	63	46	37	33	30	33	63	342	520	150	99	65
	Difference	5	3	3	3	3	5	6	30	-30	-50	0	-6
Dry	Baseline	40	35	28	26	26	30	72	213	248	74	56	41
	Alternative	44	37	30	28	28	33	77	243	228	48	56	44
	Difference	4	2	2	2	2	3	5	30	-20	-26	0	3
LF-3--Moon Lake to Farnsworth Diversion (cfs)													
Wet	Baseline	1	0	0	0	7	8	47	229	644	439	267	165
	Alternative	1	3	16	12	9	8	84	223	661	447	256	137
	Difference	0	3	16	12	2	0	37	-6	17	8	-11	-28
Average	Baseline	4	3	2	2	2	2	46	226	458	393	261	107
	Alternative	4	4	4	3	3	4	83	232	421	392	247	110
	Difference	0	1	2	1	1	2	37	6	-37	-1	-14	3
Dry	Baseline	1	0	0	0	0	0	42	240	398	111	55	39
	Alternative	1	0	0	0	1	0	84	217	308	214	55	40
	Difference	0	0	0	0	1	0	42	-23	-90	103	0	1
LF-4--Farnsworth Diversion to Rowley Ditch Diversion (cfs)													
Wet	Baseline	0	0	0	0	7	7	21	125	513	304	158	108
	Alternative	0	3	16	12	9	7	57	119	530	312	147	80
	Difference	0	3	16	12	2	0	36	-6	17	8	-11	-28
Average	Baseline	3	2	2	2	2	2	20	125	330	279	198	82
	Alternative	3	3	3	3	3	3	57	133	291	270	171	78
	Difference	0	1	1	1	1	1	37	8	-39	-9	-27	-4
Dry	Baseline	0	0	0	0	0	0	16	149	313	100	52	36
	Alternative	0	0	0	0	0	0	57	131	197	177	55	39
	Difference	0	0	0	0	0	0	41	-18	-116	77	3	3

Table 3.6-13
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Twin Pots Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-5--Rowley Ditch Diversion to Confluence (cfs)													
Wet	Baseline	10	17	27	22	20	18	32	156	644	341	197	112
	Alternative	10	13	26	22	19	17	67	129	540	322	157	90
	Difference	0	-4	-1	0	-1	-1	35	-27	-104	-19	-40	-22
Average	Baseline	14	14	14	14	14	15	33	173	404	307	246	101
	Alternative	13	13	13	13	13	13	67	143	301	280	181	88
	Difference	-1	-1	-1	-1	-1	-2	34	-30	-103	-27	-65	-13
Dry	Baseline	10	10	10	10	10	10	25	173	343	209	97	58
	Alternative	10	10	10	10	10	10	67	141	207	187	65	49
	Difference	0	0	0	0	0	0	42	-32	-136	-22	-32	-9
LF-6--Confluence to "C" Canal Diversion (cfs)													
Wet	Baseline	80	103	94	79	70	69	31	194	1076	476	179	141
	Alternative	89	99	100	85	76	78	80	189	986	443	157	139
	Difference	9	-4	6	6	6	9	49	-5	-90	-33	-22	-2
Average	Baseline	37	77	69	63	59	61	40	199	535	208	154	92
	Alternative	53	74	73	67	64	67	40	197	450	171	105	96
	Difference	16	-3	4	4	5	6	0	-2	-85	-37	-49	4
Dry	Baseline	13	42	47	50	47	48	35	99	232	111	47	40
	Alternative	37	47	47	53	50	49	80	99	107	110	72	72
	Difference	24	5	0	3	3	1	45	0	-125	-1	25	32
LF-7--"C" Canal Diversion to South Boneta Diversion (cfs)													
Wet	Baseline	10	52	44	67	67	56	13	78	650	268	63	71
	Alternative	89	99	100	85	76	78	76	176	969	426	143	131
	Difference	79	47	56	18	9	22	63	98	319	158	80	60
Average	Baseline	3	12	20	61	57	39	14	75	239	72	38	22
	Alternative	53	74	73	67	64	67	80	183	433	155	94	90
	Difference	50	62	53	6	7	28	66	108	194	83	56	68
Dry	Baseline	0	0	2	50	47	15	8	40	46	28	22	13
	Alternative	37	47	47	53	50	49	77	87	92	103	72	72
	Difference	37	47	45	3	3	34	69	47	46	75	50	59

Table 3.6-13
Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Twin Pots Alternative

Reach		October	November	December	January	February	March	April	May	June	July	August	September
		Month											
LF-8--South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion (cfs)													
Wet	Baseline	10	59	63	79	70	56	12	95	758	287	71	84
	Alternative	89	99	100	85	76	78	75	172	965	421	139	129
	Difference	79	40	37	6	6	22	63	77	207	134	68	45
Average	Baseline	3	14	23	63	59	41	15	92	207	71	38	24
	Alternative	53	74	73	67	64	67	79	180	429	150	91	89
	Difference	50	60	50	4	5	26	64	88	142	79	53	65
Dry	Baseline	0	0	2	50	47	15	7	38	44	33	25	14
	Alternative	37	47	47	53	50	49	76	84	88	101	72	72
	Difference	37	47	45	3	3	34	69	40	44	68	47	58
LF-9--Big Sand Wash Feeder Pipeline Diversion to Purdy Ditch Diversion (cfs)													
Wet	Baseline	13	55	46	69	71	62	16	76	648	266	61	70
	Alternative	3	33	45	53	48	80	40	73	690	265	54	43
	Difference	-10	-22	-1	-16	-23	18	24	-3	42	71	-7	-27
Average	Baseline	6	15	23	63	61	45	16	73	237	79	36	22
	Alternative	8	11	15	21	28	49	35	92	245	71	39	22
	Difference	2	-4	-8	-42	-33	4	17	9	8	1	3	0
Dry	Baseline	3	3	5	52	50	21	12	39	45	29	23	14
	Alternative	3	3	2	3	8	23	20	40	49	40	29	17
	Difference	0	0	-3	-49	-42	2	9	1	4	11	6	3
LF-10--Purdy Ditch Diversion to Red Cap Diversion (cfs)													
Wet	Baseline	13	62	65	81	73	62	14	88	747	276	62	80
	Alternative	3	33	45	53	48	80	37	62	677	251	43	37
	Difference	-10	-29	-20	-28	-25	18	24	-24	-70	-25	-19	-43
Average	Baseline	6	17	25	66	63	47	17	84	277	61	31	20
	Alternative	8	11	15	21	28	49	32	71	232	59	30	17
	Difference	2	-6	-10	-45	-35	2	15	-13	45	-2	-1	-3
Dry	Baseline	3	3	5	52	50	21	9	29	35	30	24	13
	Alternative	3	3	2	3	8	23	18	29	37	33	25	14
	Difference	0	0	-3	-49	-42	2	9	9	2	3	1	1
LF-11--Red Cap Diversion to Hamilton-Knudsen Diversion (cfs)													
Wet	Baseline	13	62	65	81	73	62	7	59	713	240	33	65
	Alternative	3	33	45	53	48	80	32	40	644	218	19	27
	Difference	-10	-29	-20	-28	-25	18	25	-19	-69	-22	-14	-38
Average	Baseline	6	17	25	66	63	47	16	56	242	26	4	6
	Alternative	8	11	15	21	28	49	27	48	201	29	8	8
	Difference	2	-6	-10	-45	-35	2	17	-8	-41	2	4	2
Dry	Baseline	3	3	5	52	50	21	2	2	2	1	0	0
	Alternative	3	3	2	3	8	23	14	7	7	7	7	7
	Difference	0	0	-3	-49	-42	2	12	5	5	6	7	7

Table 3.6-13

Comparison of Wet, Average, and Dry Year Flows by River Reach in the Yellowstone (Y) and Lake Fork (LF) Rivers for the Upalco Unit Twin Pots Alternative

Reach		Month											
		October	November	December	January	February	March	April	May	June	July	August	September
LF-12--Hamilton-Knudsen Diversion to Duchesne River (cfs)													
Wet	Baseline	13	62	65	81	73	62	6	57	711	238	31	64
	Alternative	3	33	15	53	48	80	31	-40	642	217	18	27
	Difference	-10	-25	-23	-28	-25	18	25	-17	-69	-21	-13	-37
Average	Baseline	6	17	25	66	63	47	9	55	240	24	[illegible]	8
	Alternative	3	11	15	81	28	49	27	-40	200	28	0	8
	Difference	13	8	-10	-45	-35	2	18	-7	-40	4	0	2
Dry	Baseline	3	8	6	62	50	21	2	0	0	0	0	0
	Alternative	3	8	2	3	8	23	14	7	7	7	7	7
	Difference	6	0	13	-49	-42	2	12	7	7	1	[illegible]	7

Seasonally, the river reach data show average flows would be 10 to 13 percent higher from October through March, and 1 percent lower from April through September than baseline. On an annual basis, average flows in the Yellowstone River would be about 2 percent higher than baseline.

Lake Fork River. With high mountain lakes stabilization, flows originating in the upper Lake Fork River watershed (Uinta Mountains) down to Moon Lake would be uncontrolled and follow natural runoff patterns. Since the lakes would generally be stabilized near natural levels, peak flows below the lakes would be similar to natural (pre-1900s) conditions.

From the high mountain lakes down to Moon Lake, flows would generally be higher from October through May; lower in June and July; and essentially unchanged in August and September. Seasonally, the river reach data show average flows would be 10 percent higher from October through March, and 4 percent lower from April through September than baseline. Average annual flows would be about 2 percent lower than baseline.

From Moon Lake to the Rowley Ditch diversion, average flows would be substantially higher (38 to 47 percent) from October through March, and zero to 3 percent lower from April through September. From the Rowley Ditch diversion to the river's confluence with the Yellowstone River, flows would generally be lower in all months and under all hydrologic conditions. Average annual flows in this reach would be 16 percent lower than baseline. From the Yellowstone River confluence to the "C" Canal diversion, average flows would be about 9 percent higher from October through March, and 14 percent lower from April through September.

The largest increase in flows would occur from the "C" Canal diversion down to the Big Sand Wash Pipeline diversion with flows higher in all months and under all hydrologic conditions. Annual flows in this river reach would be 48 to 190 percent higher than baseline.

From the Big Sand Wash Feeder Pipeline diversion to the river's confluence with the Duchesne River, average flows would be substantially lower (38 to 43 percent) from October through March and generally 5 to 10 percent lower the rest of the year. Average annual flows in the lower river would be about 20 percent lower than baseline.

Table 3.6-14 shows the ranked annual peak flows and percent change in flows estimated for the Twin Pots Alternative. The 2-, 5-, 10-, and 20-year data were used to assess potential impacts on aquatic and wildlife resources, wetlands, and threatened and endangered species. The 20- and 50-year data, which illustrate the potential effect on peak flood discharges and fluvial processes, show that peak flood discharges would generally be unchanged or reduced (1 to 7 percent) compared to baseline conditions.

Increased peak flood discharges would occur on the Lake Fork River from the "C" Canal diversion down to the river's confluence with the Duchesne River. Table 3.6-14 shows that 20- and 50- year peak flows would increase by 20 and 13 percent, respectively, from the "C" Canal diversion down to the Big Sand Wash Feeder Pipeline diversion, and increase by 7 and 2 percent, respectively, from the Purdy Ditch diversion down to the Duchesne River.

3.6.6.6.1.4 Irrigation Canals and Seepage. Canal seepage loss reductions and wetland preservation proposals under the Twin Pots Alternative would be the same as described under the Crystal Ranch Alternative (see Section 3.6.6.5.1.3).

Based on Water Budget Model estimates, about 174,000 acre-feet per year would be diverted under the Twin Pots Alternative compared to 169,000 acre-feet under baseline conditions. Unit-wide, Table 3.6-15 shows that crop CU would increase by 36 percent, indirect CU and return flows would decrease by 23 percent, and water leaving the Unit (outflow) would decrease by 25 percent (6,700 acre-feet), annually.

3.6.6.6.2 Potential Operational Impacts on Groundwater Hydrology. Changes in groundwater hydrology would be the same as the Proposed Action, except as noted.

Table 3.6-14

Ranked Annual Peak Flows for the Upalco Unit Twin Pots Alternative

Page 1 of 2

Reach	Return Period[a]	Baseline[b] (cfs)	Twin Pots[b] (cfs)	Percent Change	Reach	Return Period[a]	Baseline[b] (cfs)	Twin Pots[b] (cfs)	Percent Change
Y-2	Yellowstone High Mountain Lakes to Reservoir				LF-6	Confluence to "C" Canal Diversion			
	2-yr	893	893	0%		2-yr	829	664	-20%
	5-yr	1,242	1,242	0%		5-yr	1,463	1,422	-3%
	10-yr	1,496	1,496	0%		10-yr	1,943	1,915	-1%
	20-yr	1,752	1,752	0%		20-yr	2,167	2,141	-1%
	50-yr	1,884	1,884	0%		50-yr	2,396	2,302	-4%
Y-4	Reservoir to Yellowstone Feeder Diversion				LF-7	"C" Canal Diversion to South Boneta Diversion			
	2-yr	741	741	0%		2-yr	494	647	31%
	5-yr	980	980	0%		5-yr	1,111	1,404	26%
	10-yr	1,179	1,179	0%		10-yr	1,629	1,898	17%
	20-yr	1,302	1,302	0%		20-yr	1,776	2,124	20%
	50-yr	1,432	1,432	0%		50-yr	2,017	2,285	13%
Y-5	Yellowstone Feeder Diversion to Confluence				LF-8	South Boneta Diversion to Big Sand Wash Feeder Pipeline Diversion			
	2-yr	601	601	0%		2-yr	489	643	31%
	5-yr	840	840	0%		5-yr	1,106	1,399	26%
	10-yr	1,039	1,039	0%		10-yr	1,624	1,893	17%
	20-yr	1,162	1,162	0%		20-yr	1,771	2,120	20%
	50-yr	1,292	1,292	0%		50-yr	2,012	2,280	13%
LF-2	Lake Fork High Mountain Lakes to Moon Lake				LF-10	Purdy Ditch Diversion to Red Cap Diversion			
	2-yr	1,011	1,011	0%		2-yr	480	394	-18%
	5-yr	1,516	1,516	0%		5-yr	1,096	1,060	-3%
	10-yr	1,742	1,742	0%		10-yr	1,613	1,632	1%
	20-yr	1,820	1,820	0%		20-yr	1,761	1,881	7%
	50-yr	1,948	1,948	0%		50-yr	2,002	2,041	2%
LF-3	Moon Lake to Farnsworth Diversion				LF-11	Red Cap Diversion to Hamilton-Knudsen Diversion			
	2-yr	742	670	-10%		2-yr	445	361	-19%
	5-yr	1,091	1,028	-6%		5-yr	1,061	1,026	-3%
	10-yr	1,297	1,222	-6%		10-yr	1,580	1,598	1%
	20-yr	1,461	1,372	-6%		20-yr	1,726	1,847	7%
	50-yr	1,489	1,448	-3%		50-yr	1,968	2,007	2%

Table 3.6-14

Ranked Annual Peak Flows for the Upalco Unit Twin Pots Alternative

Reach	Return Period[a]	Baseline[b] (cfs)	Twin Pots[b] (cfs)	Percent Change	Reach	Return Period[a]	Baseline[b] (cfs)	Twin Pots[b] (cfs)	Percent Change
LF-4	**Farnsworth Diversion to Rowley Ditch Diversion**				LF-12	**Hamilton-Knudsen Diversion to Duchesne River**			
	2-yr	620	544	-11%		2-yr	443	358	-19%
	5-yr	954	891	-7%		5-yr	1,059	1,023	-3%
	10-yr	1,168	1,093	-6%		10-yr	1,577	1,596	1%
	20-yr	1,333	1,242	-7%		20-yr	1,724	1,844	7%
	50-yr	1,358	1,317	-3%		50-yr	1,966	2,005	2%
LF-5	**Rowley Ditch Diversion to Confluence**								
	2-yr	620	554	-11%					
	5-yr	964	901	-6%					
	10-yr	1,178	1,103	-6%					
	20-yr	1,343	1,252	-7%					
	50-yr	1,358	1,327	-3%					

Notes:

Flows ranked largest to smallest by California Method (Chow 1964).

[a]The return period is the average duration required to experience the given flow (or greater). For example, the baseline peak flow of 620 cfs will be reached or exceeded once within a 2-year period, on average, at the Rowley Ditch Diversion to Confluence.

[b]5-, 10-, 20- and 50-year return period flows are linearly interpolated.

Table 3.6-15
Total Water Inflow, Agricultural Use, and Outflow Summary for the Upalco Unit Twin Pots Alternative

			Water Use					Outflow		
	Inflow	Diversion[a]	Crop CU		Indirect CU[b]		River[c]	Return Flow		Total
Upalco Unit	(ac-ft)	(ac-ft)	(%)[d]	(ac-ft)	(%)	(ac-ft)	(ac-ft)	(%)	(ac-ft)	(ac-ft)
Baseline	192,000	169,000	43%	72,800	51%	85,800	6,500	6%[e]	10,700	27,200
Twin Pots	192,000	174,000	57%	99,000	38%	66,400	6,500	5%[f]	8,300	20,500
Change in Water Use and Outflow		+5,000		+26,200		-19,400			-2,400	-6,700

Notes:
CU = Consumptive Use.
Numbers are rounded to the nearest 100 acre-feet. Therefore, the numbers may not sum to total shown because of roundoff and may not agree exactly with numbers given in the Feasibility Study.

[a]Includes 16,575 acre-feet annually diverted through the Yellowstone Feeder Canal.
[b]Indirect CU includes phreatophytes and downstream irrigators.
[c]Includes river corridor losses by phreatophytes, stock watering, minor diversions, and the difference between groundwater recharge and discharge.
[d]Overall efficiency based on conveyance efficiency of 85 percent, irrigation type mix, and baseline model diversion.
[e]Calculated based on baseline load analysis.
[f]Assume same proportion of return flow and secondary CU as baseline.

Changes in groundwater hydrology resulting from high mountain lakes stabilization would be positive, similar in nature, but greater in extent than those described under the Proposed Action (see Section 3.6.6.3.1.1) since 4 high mountain lakes in the upper Lake Fork River watershed would be stabilized in addition to the 10 lakes proposed for stabilization in the upper Yellowstone River watershed.

Groundwater effects associated with the construction of an onstream reservoir (i.e., Crystal Ranch or Upper Yellowstone) on the Yellowstone River would not occur under the Twin Pots Alternative. However, with high mountain lakes stabilization, shallow groundwater levels and recharge along the Yellowstone River would increase because river flows/percolation would generally be higher than baseline conditions. The shallow aquifer water table in this area is closely related to river discharge and responds very rapidly to changes in river flow.

Unit-wide changes in shallow aquifer recharge under the Twin Pots Alternative would be the same as estimated for the Crystal Ranch Alternative (see Section 3.6.6.5.2.2).

When shallow aquifer levels are closely and directly tied to river levels, changes in groundwater levels can be approximated by estimating changes in water surface elevations. Under the Twin Pots Alternative, water surface elevation changes in mean and dry water years would be the same as estimated for the Cow Canyon Alternative (see Section 3.6.6.4.2.2). Similar localized changes in shallow groundwater levels are anticipated adjacent to these Lake Fork River locations.

3.6.6.7 No Action Alternative

3.6.6.7.1 Trends. If this project is not implemented, high mountain lake storage and river diversions would continue to be operated as in the past. No additional storage would be built, no diversions or canals rehabilitated, no pipelines constructed, and no fish and wildlife enhancements or recreation developments accomplished. The Basin's water supply would continue to be limited, particularly during late summer, and canal seepage losses would continue.

Based on results from the Natural Resources Conservation Service (NRCS) Salinity Reduction Program, some conversion from flood irrigation to sprinkler irrigation is expected because of the need to improve water management and conservation practices. Pressure to use water as efficiently as possible would increase as water becomes increasingly expensive and valuable, and water control and measurement becomes increasingly important.

3.6.6.7.2 Future Conditions. The water resources system (i.e., high mountain lakes, rivers, reservoirs, canals, etc.) would remain essentially the same, with the percentage of sprinkler irrigation systems increasing. Conversion to sprinkler irrigation would lead to a decrease in deep percolation and surface runoff and a net reduction in the amount of water leaving the unit. The amount of low-quality recharge waters entering streams, surface runoff, and shallow groundwater would decline slightly at lower elevations in the unit. Overall, future water resource and hydrologic conditions in the Upalco Unit would remain essentially the same as baseline conditions.

3.6.6.7.3 Consequences of Not Meeting Project Needs. Without additional storage, crop yields would continue to be limited and water would continue to be overdiverted in spring to compensate for the lack of water in late summer. This would cause excess surface runoff, deep percolation, and lower quality return flows entering the river system. The cause of these consequences would fall more heavily on secondary water right holders. The continued practice of "dry damming" and drying up some river reaches because of overdiversion would adversely affect other river resources.

3.6.7 Cumulative Impacts

To assess the cumulative impact on flows leaving the Uinta Basin and downstream in the Colorado River (as measured at Imperial Dam), the amount of water leaving the Upalco Unit under the Proposed Action and each of the Upalco Unit alternatives is combined with the amount of water leaving the Uintah Unit under the Proposed Action and compared to baseline conditions. This cumulative change in flows influences salt concentrations and loads leaving the Basin and the cumulative effect downstream on the Colorado River system salinity control program. Cumulative changes in salt loads and concentrations are assessed in Section 3.7 Water Quality and Contaminants.

3.6.7.1 Proposed Action–Talmage

Combining the Proposed Actions for the Upalco and Uintah Units would result in an estimated 34 percent reduction (25,300 acre-feet) in the average annual flow leaving the Uinta Basin. The combined average annual flow leaving the two units would be about 48,400 acre-feet compared to 73,700 acre-feet under baseline conditions. This cumulative reduction in flow leaving the Uinta Basin would result in a 0.3 percent flow reduction in the Colorado River. The estimated average annual flow at Imperial Dam would be about 7,246,000 acre-feet.

3.6.7.2 Cow Canyon Alternative

Combining the Upalco Unit's Cow Canyon Alternative with the Uinta Unit's Proposed Action would result in an estimated 34 percent reduction (25,400 acre-feet) in the average annual flow leaving the Uinta Basin. The combined average annual flow leaving the two units would be about 48,300 acre-feet compared to 73,700 acre-feet under baseline conditions. This cumulative reduction in flow leaving the Uinta Basin would result in a 0.3 percent flow reduction in the Colorado River. The estimated average annual flow at Imperial Dam would be about 7,246,000 acre-feet.

3.6.7.3 Crystal Ranch Alternative

Combining the Upalco Unit's Crystal Ranch Alternative with the Uinta Unit's Proposed Action would result in an estimated 30 percent reduction (22,300 acre-feet) in the average annual flow leaving the Uinta Basin. The combined average annual flow leaving the two units would be about 51,400 acre-feet compared to 73,700 acre-feet under baseline conditions. This cumulative reduction in flow leaving the Uinta Basin would result in a 0.3 percent flow reduction in the Colorado River. The estimated average annual flow at Imperial Dam would be about 7,249,000 acre-feet.

3.6.7.4 Twin Pots Alternative

Combining the Upalco Unit's Twin Pots Alternative with the Uintah Unit's Proposed Action would result in an estimated 29 percent reduction (21,700 acre-feet) in the average annual flow leaving the Uinta Basin. The combined average annual flow leaving the two units would be about 52,000 acre-feet compared to 73,700 acre-feet under baseline conditions. This cumulative reduction in flow leaving the Uinta Basin would result in a 0.3 percent flow reduction in the Colorado River. The estimated average annual flow at Imperial Dam would be about 7,249,000 acre-feet.

3.7 Water Quality and Contaminants

3.7.1 Introduction

This section addresses potential changes to, and impacts on, surface water and groundwater quality and environmental contaminants associated with the project features of the Proposed Action and alternatives of the Upalco Unit. The discussion focuses on the affected (baseline) environment followed by a summary of potential direct, indirect, total, and/or cumulative impacts on water quality and environmental contaminants. Additional information on water quality and environmental contaminants is contained in the Water Resources Technical Report (CH2M HILL/Horrocks 1996e) and the Environmental Contaminants Technical Report (CH2M HILL/Horrocks 1996c).

3.7.2 Issues Eliminated from Further Analysis

All water quality or contaminant issues identified during public scoping were analyzed. None were eliminated.

3.7.3 Issues Addressed in the Impact Analysis

Water quality and environmental contaminant issues and concerns identified during public scoping focused on potential changes in water quality and contaminant levels. Projected changes were identified and assessed for their probable qualitative effect on bioaccumulation, risks to fish and wildlife, and beneficial use designations.

3.7.4 Description of Area of Influence

The area of influence for water quality and contaminants is the same as described in Section 3.6.4 Water Resources and Hydrology.

3.7.5 Affected Environment

This section describes existing (baseline) surface and ground water quality and environmental contaminant (trace element) conditions potentially affected by the Proposed Action and each of the Upalco Unit alternatives. The discussion includes a general description of the water quality/contaminant characteristics best addressed on a unit-wide basis, and those that need to be addressed on a more localized basis.

3.7.5.1 Proposed Action–Talmage

3.7.5.1.1 Surface Water Quality. Surface water quality in the Upalco Unit is characterized by excellent quality, high mountain source waters that gradually increase in constituent concentrations as they flow downstream to lower elevations. This degradation in water quality is the result of natural and human-induced non-point infusions of salt, sediment, and contaminants. Most constituents are contributed by non-point source inputs such as agricultural return flows. Water temperatures range from 0°C (32°F) at all locations in winter to between 18° and 26°C (64° to 78°F) in summer, depending on elevation.

In 1994, the Utah Department of Environmental Quality reclassified the waters of the state so as to protect the beneficial uses designated within each class against controllable pollution. Table 3.7-1 summarizes the water quality standards and numeric criteria established for each beneficial use classification, and Tables 3.7-2 and 3.7-3 present the water quality guidelines for irrigation use. It should be noted, however, that the Department of Environmental Quality lacks jurisdiction to establish water quality standards within the boundaries of the Uintah and Ouray Reservation.

3.7.5.1.1.1 High Mountain Lakes. The Utah Department of Environmental Quality (1994) has classified 8 of the 10 lakes proposed for stabilization (except White Miller and Deer) as Class 2B, 3A, and 4 waters (protected for secondary contact recreation, cold water fish/aquatic life, and agricultural uses, respectively).

All the high mountain lakes can be characterized as clean, clear lakes supporting a cold water trout fishery. However, annual drawdowns ranging from 4 feet (Blue Bell and White Miller) to 27 feet (East Timothy) may cause a temporary, seasonal degradation in water quality because of increased shoreline erosion, a stimulation of algal growth as a result of subsequent nutrient input from shoreline erosion, and the loss of shallow water attached aquatic plants that help stabilize the shoreline, take up nutrients, and provide fish habitat. Estimated water quality conditions (see Table 3.7-4) and discussions with the Utah Division of Water Quality indicate that all the high mountain lakes meet the numeric criteria established for their beneficial use designation.

3.7.5.1.1.2 Dams and Reservoirs. Historical water quality records and a eutrophication model were used to determine baseline water quality conditions and the quality of surface waters entering existing and proposed Upalco Unit reservoirs. Table 3.7-5 summarizes the historical data as flow-weighted mean and maximum constituent concentrations. The water supply for the proposed Crystal Ranch Reservoir is represented by the "Yellowstone River near Altonah" data, for Twin Pots Reservoir by the "Lake Fork River below Moon Lake" data, and for Big Sand Wash Reservoir by a blended water supply from these two data points.

Table 3.7-1 Water Quality Standards and Numerical Criteria							
	Utah Water Quality Standards				EPA Criteria		
					Drink-ing Water MCL	Freshwater	
Parameter	(Class 1C) Domestic Use	(Class 2) Recrea-tion	(Class 4) Agricultural	(Class 3) Aquatic Life		Chronic	Acute
pH (range)	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0	--	6.5-9.0	--
Dissolved Oxygen (mg/L)							
Minimum	5.5	5.5	5.5			(NA/5.0)c (NA/4.0)w	(5.0/4.0)c (5.0/3.0)
30-day avg.[a]				6.5c, 5.5w		(NA/6.5)c (NA/5.5)w	w --
7-day avg.[a]				(9.5/5.0)c (6.0/4.0)w		(6.5/NA)c (6.0/NA)w	-- --
1-day avg.[a]				(8.0/4.0)c (5.0/3.0)w		--	
TDS (mg/L)	--	--	1200	--	--	--	--
Nitrate (mg/L as N)	10	4	--	4	10	--	--
Ammonia (mg/L as N)	--	--	--	b	--	b	b
Phosphate (mg/L as P)	--	0.05	--	0.05	--	--	--
Arsenic III (mg/L) 4 day/1 hour	(as total) 0.050	--	(as total) 0.100	0.1900/0.360	--	0.190	0.360
Boron (mg/L) 4 day/1 hour	--	--	0.750	--	--	--	--
Cadmium (mg/L) 4 day/1 hour[c]	0.010	--	0.010	0.0011/0.0039	0.005	0.0011	0.0039
Chromium III (mg/L) 4 day/1 hour[c]	(as total) 0.050	--	(as total) 0.100	0.210/1.700	0.100	0.210	1.400
Copper (mg/L) 4 day/1 hour[c]	--	--	0.200	0.012/0.018	1.300	0.012	0.018
Lead (mg/L) 4 day/1 hour[c]	0.050	--	0.100	0.0032/0.082	0.005	0.0032	0.083
Mercury (mg/L) 4 day/1 hour	0.002	--	--	0.000012/0.0024	0.002	0.000012	0.0024
Nickel (mg/L) 4 day/1 hour	--	--	--	0.160/1.400	--	0.160	1.400
Selenium (mg/L) 4 day/1 hour	0.010	--	0.750	0.0050/0.020	0.050	0.005	0.020
Silver (mg/L) 4 day/1 hour[c]	0.050	--	--	0.00012/0.0041	--	0.00012	0.0041
Uranium/gross alpha radiation (nCi/L)	0.010	--	0.015	0.015	--	--	--
Zinc (mg/L) 4 day/1 hour[c]	--	--	--	0.1100/0.120	--	0.160	0.120

Notes:
MCL = Maximum Contaminant Level
NA = Not applicable
c = Coldwater criteria
w = Warmwater criteria
nCi/L = nanocuries per liter

[a]Not applicable for lower depths of lakes; criteria = early life stages present/all other life stages present.
[b]pH and temperature-dependent; tables in criteria documents.
[c]Hardness dependent criteria (here @100 ppm hardness as $CaCO_3$).

Table 3.7-2
Guidelines for Interpretation of Water Quality for Irrigation*

Potential Irrigation Problem		Degree of Restriction on Use		
Salinity	**Units**	**None**	**Slight to Moderate**	**Severe**
As EC	uS/cm	<700	700 to 3,000	>3,000
As TDS	mg/L	<450	450 to 2,000	>2,000
Infiltration (evaluated using SAR with EC)				
SAR		EC		
0 to 3	me/L	>700	700 to 200	<200
3 to 6	me/L	>1,200	1,200 to 300	<300
6 to 12	me/L	>1,900	1,900 to 500	<500
12 to 20	me/L	>2,900	2,900 to 1,300	<1,300
20 to 40	me/L	>5,000	5,000 to 2,900	<2,900
Specific Ion Toxicity				
Boron	mg/L	<0.7	0.7 to 3.0	>3.0

*Adapted from Water Quality for Agriculture (Ayers and Westcot 1989).

Table 3.7-3
Recommended Maximum Concentrations of Trace Elements in Irrigation Waters[a]

Element (Symbol)	Continuous[b] (mg/L)	20 Years[c] (mg/L)
Aluminum (Al)	0.1	20.0
Arsenic (As)	0.1	2.0
Beryllium (Be)	0.1	5.0
Boron (B)	d	2.5
Cadmium (Cd)	0.01	0.05
Chromium (Cr)	0.1	1.0
Cobalt (Co)	0.05	5.0
Copper (Cu)	0.2	5.0
Fluoride (F)	1.0	15.0
Iron (Fe)	0.1	20.0
Lead (Pb)	5.0	10.0
Lithium (Li)	2.5	2.5
Manganese (Mn)	0.2	15.0
Molybdenum (Mo)	0.01	0.05[e]
Nickel (Ni)	0.2	2.0
Selenium (Se)	0.02	0.02
Vanadium (V)	2.0	1.0
Zinc (Zn)	2.0	10.0

Source: *National Academy of Sciences and National Academy of Engineering 1972* (in Driscoll 1986).

[a]These levels normally do not adversely affect plants and soils. No data are available for mercury (Hg), silver (Ag), tin (Sn), titanium (Ti), or tungsten (W).
[b]For waters used continously on soils (mg/L).
[c]For use up to 20 years on fine-textured soils of pH 6.0 to 8.5 (mg/L).
[d]No problem when less than 0.75 mg/L; increasing problem when between 0.75 and 2.0 mg/L; severe problem when greater than 2.0 mg/L.
[e]For only acid fine-textured soils and acid soils with relatively high iron oxide content.

Table 3.7-4 Estimated Baseline Water Quality Conditions–Upalco Unit						
	Mid-summer Average Conditions			Suspended Sediment Concentrations		
					Outflow	
Reservoir	Chlorophyll (µg/L)	Water Clarity (Secchi depth) (ft)	Probability of Oxygen Depletion (%)	Inflow Average (mg/L)	Low Range (mg/L)	High Range (mg/L)
High Mountain Lakes	0.28	10.9	16	1.5	0.045	0.15
Big Sand Wash	0.28	10.8	36	9.3	0.186	0.744
Twin Pots	0.26	9.2	12	9.3	0.093	0.465

Water quality records collected by the Utah Division of Water Quality (Utah Department of Environmental Quality 1996) indicate reservoirs in the Upalco Unit (Big Sand Wash and Moon Lake) and surrounding area (Upper Stillwater) possess "very good" (Big Sand Wash and Moon Lake) to "excellent" (Upper Stillwater) water quality supportive of all beneficial uses. None of the reservoirs examined by the state exhibited water quality exceedances and the highest elevation lakes had the best water quality. The state sampling results are generally supportive of the baseline water quality conditions estimated for Upalco Unit lakes and reservoirs (see Table 3.7-4).

Yellowstone River water quality is excellent near the proposed Crystal Ranch Reservoir site. The water is clear, with low concentrations of total dissolved solids (TDS) and total suspended solids (TSS). Low salinity (measured as TDS), combined with a low sodium adsorption ratio (SAR), indicates excellent water quality (see Table 3.7-5). All beneficial uses and water quality criteria are currently being met.

The State of Utah has classified Twin Pots and Big Sand Wash Reservoirs as Class 1C, 2B, 3A and 4 waters (protected for domestic purposes with prior treatment, secondary contact recreation, cold water fish/aquatic life, and agricultural uses, respectively).

Water for Twin Pots Reservoir is supplied from the Lake Fork River below Moon Lake via the Farnsworth Diversion. Water quality is excellent in this river reach as indicated by very low conductivity, TDS, and TSS levels (see Table 3.7-5). The low influent nutrient loads entering Twin Pots suggest that the reservoir has a low potential for eutrophication as indicated by correspondingly low values for chlorophyll, high water clarity, and a low probability for oxygen depletion (see Table 3.7-4). All beneficial uses and water quality criteria are currently being met.

Water for Big Sand Wash Reservoir is supplied from the Lake Fork River via the "C" Canal diversion located downstream from the confluence of the Lake Fork and Yellowstone Rivers. Using historical Lake Fork and Yellowstone River mean concentrations for nitrogen and phosphorus, eutrophication model results indicate a low potential for eutrophication and subsequent water quality problems (see Table 3.7-4). All beneficial uses and water quality criteria are currently being met (Utah Department of Environmental Quality 1996).

3.7.5.1.1.3 River Reaches. The State of Utah has classified the entire Lake Fork/Yellowstone River system, from the confluence with the Duchesne River to headwaters, as Class 1C, 2B, 3A, and 4 waters (protected for domestic purposes with prior treatment, secondary contact recreation, cold water fish/aquatic life, and agricultural uses, respectively).

Upper Lake Fork and Yellowstone River waters have similar quality. Both rivers and their tributary streams are cold and clear with low dissolved and particulate constituent concentrations. Mean TDS

Table 3.7-5

Water Quality Summary of Flow-Weighted Means for the Upalco Unit[a]

		Lake Fork River below Moon Lake[b] (1958-1994)		Yellowstone River near Altonah[c] (1958-1994)		Pigeon Water Creek[d] (1994)		Lake Fork River near Myton[e] (1941-1994)		Duchesne River at Myton[f] (1979-1992)	
Parameter	Units	Mean	Maximum	Mean	Maximum	Mean	Maximum	Mean	Maximum	Mean	Maximum
Conductivity	uS/cm[g]	26.2	50.0	51.7	279.0	1195.0	1210.0	881.4	6000.0	445.6	2610.0
pH		7.3	8	7.9	8.6	8.4	8.5	8.3	8.4	8.1	9.2
HCO3	(mg/L)	15.2	22.0	28.6	120.0	-	-	250.0	280.0	272.0	415.0
Hardness	(mg/L)	23	18	32	140	608	690	395	440	335	795
Nitrate-N	(mg/L)	<.01	<.01	0.122	0.190	<.05	<.05	0.089	0.200	0.123	0.483
Total-P	(mg/L)	0.009	0.020	-	0.030	0.023	0.050	0.060	0.100	0.085	0.750
Ca	(mg/L)	4.1	7.2	8.3	37.0	-	-	91.6	110.0	71.5	180.0
Mg	(mg/L)	0.6	1.0	2.3	11.0	-	-	35.4	42.0	40.0	84.0
Na	(mg/L)	0.7	0.9	1.1	5.1	-	-	140.0	180.0	96.5	400.0
K	(mg/L)	0.4	0.4	0.6	1.2	-	-	4.6	5.7	2.9	7.0
Cl	(mg/L)	0.9	1.2	0.6	6.7	-	-	52.1	390.0	23.9	136.0
SO4	(mg/L)	7.4	37.0	12.9	71.0	-	-	418.6	510.0	305.0	1100.0
As[h]	(mg/L)	-	0.004	-	0.001	0.0036	0.005	0.0039	0.005	0.0029	0.004
B[h]	(mg/L)	<0.010	<0.010	<0.010	<0.010	0.336	0.620	0.418	0.560	0.591	0.880
Cd[h]	(mg/L)	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01
Cr[h]	(mg/L)	-	<0.001	-	<0.001	-	<0.001	-	<0.001	-	<0.001
Cu[h]	(mg/L)	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01
Fe[h]	(mg/L)	0.097	0.430	0.060	0.080	0.014	0.021	0.019	0.050	0.020	0.026
Pb[h]	(mg/L)	-	<0.001	-	<0.001	-	<0.001		<0.001	-	<0.001
Mn[h]	(mg/L)	0.007	0.150	0.039	0.012	0.046	0.100	0.083	0.230	0.036	0.061
Hg[h]	(mg/L)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	0.0004	<0.0001	<0.0001
Se[h]	(mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zn[h]	(mg/L)	-	0.020	0.0063	0.020	-	0.003	-	0.010	-	0.008
TDS	(mg/L)	11	31	48	176	717	946	584[i]	4175[i]	290	2222
TSS[h]	(mg/L)	9.3	198.0	6.4	20.0	16.0	68.0	143.0	223.0	69.0	117.0
SAR		0.09	0.08	0.08	0.19			3.14	3.70	2.26	6.17
Gross alpha	(nCi/L)	-	<0.0006	-	0.0007	0.0032	0.0042	0.0051	0.016	0.0055	0.0082

Notes:

nCi/L = nanocuries per liter.

- = Data missing or detection insufficient to estimate mean values.

[a] Flow-weighted indicates that samples taken during higher flows were given proportionally more weight in the calculated average.

[b] Source is USGS with 107 records.

[c] Source is USGS with 191 records.

[d] Source is Contaminants Study (CH2M HILL/Horrocks 1996c) with 6 records.

[e] Source is USGS with 47 records.

[f] Source is State of Utah with 101 records. Only EC and TDS means are flow-weighted; others are arithmetic.

[g] Microsiemens per centimeter.

[h] All data in these rows are from 1993-1994 Contaminants Study (CH2M HILL/Horrocks 1996c) results only.

[i] TDS estimated from EC (see Chapter G-2).

and TSS at upper elevation locations are less than 50 mg/L; and salinity, boron, and SAR levels are low (see Table 3.7-5). This high-quality water meets all beneficial use designations and water quality criteria.

Middle river reach waters range in quality from high-quality, upper-elevation waters to degraded, low-elevation waters. As water moves down through the Basin and is used and reused for irrigation, it picks up increasing amounts of salt, sediment, and other constituents that return to the river as agricultural return flows.

The largest single source of agricultural return flow entering the Lake Fork River is Pigeon Water Creek. Pigeon Water Creek is more saline (mean TDS of 717 mg/L) than upper elevation waters with increased hardness and alkalinity (see Table 3.7-5), but water quality remains within the agricultural and other water quality criteria set by the state and acceptable for all designated beneficial uses. Mean and maximum TDS concentrations and electrical conductivity (EC) measurements indicate a slight to moderate restriction on use for irrigation.

Low-elevation waters are strongly affected by agricultural return flows. In addition to Pigeon Water Creek, other low-elevation samples representative of agricultural return flows and shallow groundwater conditions indicate: 1) a slight to severe restriction on use for irrigation because of high TDS and boron concentrations; 2) some maximum TDS and boron concentrations near Ioka and Roosevelt exceed the state agricultural criteria of 1,200 mg/L for TDS and 0.750 mg/L for boron; and 3) manganese concentrations near Ioka and Hancock Cove exceed the recommended maximum concentration in irrigation waters. Several low-elevation samples also exceeded the EPA chronic or acute freshwater criteria for mercury, silver, and/or lead.

3.7.5.1.1.4 Irrigation Canals and Seepage. Canal water quality is directly related to the quality of its source waters. For upper elevation diversions, surface water quality at canal and diversion rehabilitation sites is generally very high and essentially the same as upper Lake Fork and Yellowstone River waters. Diversions and canals downstream from the confluence of Pigeon Water Creek with the Lake Fork River have lower water quality because of the addition of agricultural return flows.

Most irrigation takes place on the bench and upland areas which characterize the middle part of the unit. The process of canal seepage and shallow groundwater exchange results in water from upper canals moving into and degrading water in lower canals. In this general way, canal and irrigation systems affect water quality in lower-elevation streams, surface runoff/drains, and groundwater. As water moves to lower elevations through this interconnected system, its quality becomes degraded and similar to agricultural return flows (i.e., Pigeon Water Creek).

3.7.5.1.2 Groundwater Quality. In 1991, the Utah Department of Environmental Quality established groundwater quality protection standards. Groundwaters are classified based on existing groundwater quality, including parameters such as TDS and primary maximum contaminant levels (MCLs). Contaminants include metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, and zinc), pesticides, and volatile organic chemicals. Although none of the Uinta Basin aquifers have been classified by the state, groundwater protection levels for unclassified groundwater areas are determined by existing groundwater quality.

Based on existing groundwater data, Upalco Unit shallow aquifers likely fall into two categories: Class IA (pristine groundwater with TDS levels less than 500 mg/L and no contaminant concentrations that exceed primary MCLs); and Class II (drinking water quality groundwater with TDS levels between 500 and 3,000 mg/L and no contaminant concentrations that exceed primary MCLs).

Groundwater quality is closely related to the quality of its source waters that provide recharge. As groundwater moves south, its quality is lowered because much of the recharge comes from lower quality canal seepage, agricultural return flows (including irrigation deep percolation), and river loss/percolation. Past and recent groundwater studies show TDS concentrations generally average from less than 500 mg/L in the upper and middle subunits to 2,071 mg/L in the lower subunit, with the increase in TDS readily apparent from north to south. TDS trends would likely be similar in the shallow and deep aquifers.

Groundwater quality in the regional, confined aquifer ranges from high to low. Quality is generally high in the upper (northern) part of the aquifer close to high-quality recharge areas (i.e., Uinta Mountains), and becomes degraded as the water moves deeper and farther south (Hood and Fields 1978). Degradation occurs as groundwater passes through the Uinta and Duchesne Formations, which dissolve easily and contribute TDS to the groundwater passing through them. Thus, by the time groundwater discharges in the lower subunit, it is saline and contains high TDS concentrations. Groundwater quality in the regional aquifer, however, is not assessed further since it is protected from surface water influences.

3.7.5.1.2.1 Upper Upalco Subunit. Shallow groundwater quality is high in the upper subunit because: 1) aquifer recharge is primarily from high-quality surface waters and snowmelt; 2) alluvial gravels that contain the aquifer have very low solubility and do not contribute TDS; and 3) the groundwater is just entering the system and has not dissolved soluble ions from the host bedrock. Shallow aquifers in the upper subunit likely would be classified as Class IA (pristine) waters.

3.7.5.1.2.2 Middle Upalco Subunit. Shallow groundwater quality becomes increasingly degraded (i.e., higher in TDS) as it moves north to south through the middle subunit. This degradation occurs because: 1) canal seepage and irrigation deep percolation leach dissolved solids out of soils and aquifer materials; 2) the alluvium contains a higher percentage of soluble bedrock materials; and 3) soils and alluvium become more saline because of increasingly poor drainage and more soluble bedrock materials.

The six trace element sampling sites (TE1 through TE6) located in the middle subunit indicate metal concentrations to be either not detectable or below primary MCLs. As shown in Table 3.7-6, TDS concentrations range between 172 and 769 mg/L, average 476 mg/L, and indicate a slight to moderate restriction on use for irrigation. All sample results above the detection limit for lead have concentrations higher than the EPA chronic freshwater criteria (0.0032 mg/L) and drinking water MCL (0.005 mg/L). Shallow aquifers in the middle subunit likely would be classified as Class IA (pristine) waters in the upper part of the subunit, and as Class II (drinking water quality) waters in the lower part of the subunit.

3.7.5.1.2.3 Lower Upalco Subunit. Most soils and some alluvial gravels in the lower subunit are derived from the Duchesne River and Uinta River Formations. These formations contain large amounts of soluble salts, which tend to dissolve as water moves through them. Saline soils, which are common in the lower part of the subunit (i.e., land retirement areas), tend to further increase salinity loads in the shallow aquifer.

The shallow aquifer is partly recharged by the upward movement of groundwater from the confined, regional aquifer (Hood and Fields 1976). This upward-moving water accumulates dissolved solids as it flows through the Duchesne River and Uinta River Formations, contributing additional TDS loads to the shallow aquifer. Recharge from canal seepage, irrigation deep percolation, and percolation of lower-quality surface waters also contribute to degraded groundwater quality in the lower subunit.

The four trace element sampling sites (TE7 through TE10) located in the lower subunit indicate metal concentrations to be either not detectable or below primary MCLs. As shown in Table 3.7-6, TDS concentrations range between 940 and 2,117 mg/L, average 1,618 mg/L, and indicate a slight to severe restriction on use for irrigation. All sample results above the detection limit for lead have concentrations higher than the EPA chronic freshwater criteria and drinking water MCL. Shallow aquifers

Table 3.7-6
Summary of Average Groundwater TDS and Trace Metal Concentrations—Middle and Lower Upalco Subunits

Sample Location	SC	TDS	As	Cd	Cr	Cu	Pb	Hg	Se	Ag	Zn
TE1 (Middle)	554	372	0.001	ND	ND	ND	0.009	ND	ND	ND	f
TE2 (Middle)	826	562	0.0031	ND	ND	ND	0.007	ND	ND	ND	ND
TE3 (Middle)	1,120	769	0.008	ND	ND	ND	0.008	ND	ND	ND	ND
TE4 (Middle)	707	478	0.007	ND	ND	ND	0.008	ND	ND	ND	ND
TE5 (Middle)	749	508	0.011	ND	ND	ND	0.006	ND	ND	ND	f
TE6 (Middle)	263	172	f	ND	ND	ND	0.008	ND	ND	ND	f
TE7 (Lower)	2,555	1,797	0.003	ND	ND	ND	0.010	ND	ND	ND	f
TE8 (Lower)	1,362	940	0.002	ND	ND	ND	0.010	f	ND	ND	f
TE9 (Lower)	2,995	2,117	0.007	ND	ND	ND	0.015	ND	ND	f	ND
TE10 (Lower)	2,305	1,616	ND	ND	ND	ND	0.011	ND	ND	ND	f
MCLs[a]											
Primary			0.05	0.01	0.05	NC	0.05	0.002	0.01	0.05	NC
Secondary			NC	NC	NC	1.0	NC	NC	NC	NC	5.0
Aquatic Life Toxicity[a]											
Acute[b]			0.36	0.0039	1.7	0.018	0.083	0.0024	0.02	0.0041	0.120
Chronic[c]			0.19	0.0011	0.210	0.012	0.0032	0.000012	0.005	0.00012	0.110

Notes:
All metal concentrations in mg/L (milligrams/liter).
SC = specific conductance, in μmhos/cm.
TDS = total dissolved solids in mg/L, converted from SC using log (TDS)=1.03*log(SC) - 0.255
ND = nondetected
NC = no criteria
f = If the constituent was detected in less than half of the samples, then no mean was calculated.

[a]U.S. Environmental Protection Agency (1986).
[b]Criterion Maximum Concentration value. Represents the threshold value at or below which there should be no unacceptable effects on freshwater aquatic organisms if the 1-hour average concentration does not exceed that value more than once every 3 years on the average.
[c]Chronic Continuous Concentration. This represents the threshold value at or below which there should be no unacceptable effects on freshwater aquatic organisms and their uses if the 4-day average concentration does not exceed that value more than once every 3 years on the average.

in the lower subunit likely would be classified as Class II (drinking water quality) waters.

3.7.5.1.3 Environmental Contaminants. Following is a summary of the baseline findings contained in the Environmental Contaminants Technical Report (CH2M HILL/Horrocks 1996c). The report details existing contaminant (trace element) levels in the Upalco Unit and evaluates potential impacts from project implementation. Overall, the baseline contaminants data indicate that low-elevation areas within the unit are of greatest concern for contaminants exposure and related effects.

3.7.5.1.3.1 Contaminants in Surface Waters. Trace elements in Upalco Unit surface waters are generally not detectable and below state and EPA water quality criteria. The major cations (calcium, magnesium, potassium, and sodium) have a broad range of concentrations throughout the unit, but generally tend to increase from higher to lower elevations, reflecting a general increase in conductivity, salinity (TDS), and ionic enrichment at lower elevation sites. Total suspended sediment (TSS), nutrients (nitrogen and phosphorus), and radioactive elements are also higher at low-elevation sites.

Baseline trace element concentrations in the lower Lake Fork River near Myton are summarized as flow-weighted means in Table 3.7-7. For those trace elements with concentrations above the detection limit, only boron and manganese are noticeably higher and consistently exceed detection limits in lower-elevation locations.

A single sample collected from the Duchesne River at Myton had a boron concentration of 0.880 mg/L, which exceeds the state water quality standard for agricultural use (0.750 mg/L). One sample from the Lake Fork River near Myton had a dissolved mercury concentration of 0.0004 mg/L, which exceeds the EPA chronic freshwater criteria (0.000012 mg/L). A different water sample from the Lake Fork River near Myton slightly exceeded the state gross alpha radiation criteria of 0.015 nanocuries per liter (nCi/L) for domestic use, agriculture, and aquatic life with a value of 0.016 nCi/L, and the recommended maximum concentration for manganese in irrigation waters (0.2 mg/L) with a value of 0.23 mg/L. Selenium was not detected in surface water at any of the lower-elevation sites.

3.7.5.1.3.2 Contaminants in Fish. The National Contaminant Biomonitoring Program (NCBP) 85th percentile guidelines for freshwater fish are used to indicate elevated levels and exposure to environmental contaminants (Schmitt and Brumbaugh 1990). For the Upalco Unit, some fish tissue concentrations exceeded the 85th percentile for arsenic, copper, mercury, selenium, and zinc.

Overall, trace element concentrations detected in fish tissue generally increased from fall to summer samples with the highest concentrations detected in low-elevation samples. Mean, low-elevation fish tissue concentrations for arsenic, boron, copper, mercury, and selenium were about 2, 3.6, 1.1, 1.3, and 1.4 times higher in summer than fall, respectively. Based on the baseline data gathered, the trace elements of greatest concern for fish bioaccumulation in the Upalco Unit are copper, selenium, and zinc.

Copper in fish tissues obtained from high-elevation source waters showed a slight decrease in mean concentrations from fall to summer samples (4.0 to 3.2 μg/g) in contrast to low-elevation samples, which showed mean concentrations increasing from 3.8 to 4.0 μg/g, respectively. The highest concentrations detected in high- and low-elevation fish tissues were 4.3 μg/g in the Yellowstone River and 6.1 μg/g in the Duchesne River at Myton. The NCBP 85th percentile for copper (4.0 μg/g) was exceeded in 8 of 11 low-elevation fish samples.

Similarly, mean selenium concentrations in fish obtained from high-elevation source waters decreased from fall to summer samples (3.2 μg/g to 2.2 μg/g) in contrast to low-elevation samples, which increased from about 3.7 μg/g to 5.0 μg/g, respectively. The highest concentration detected was 7.5 μg/g in Pigeon Water Creek. The NCBP 85th percentile for selenium (2.9 μg/g) was exceeded in 10 of 11 low-elevation fish samples. Predicted selenium effect levels (U.S. Department

Table 3.7-7 **Baseline Trace Element Concentrations for the Upalco Unit** **Annual Average Concentrations** **(mg/L)**	
Water Quality Constituent	**Lower Lake Fork River**
Arsenic	0.0039
Boron	0.418
Cadmium	<0.001
Chromium	<0.001
Copper	<0.001
Iron	0.019
Lead	<0.001
Manganese	0.083
Mercury	<0.0001
Selenium-D	<0.001
Selenium-T	<0.001
Zinc	<0.01
Gross Alpha*	0.0051
*In nanocuries per liter (nCi/L).	

of the Interior [DOI] 1993) for coldwater fish are: "no effect" (less than 2 $\mu g/g$), "level of concern" (between 2 and 5 $\mu g/g$), and "toxicity threshold" (greater than 5 $\mu g/g$). For warmwater fish, the "no effect," "level of concern," and "toxicity threshold" assessment levels are less than 3 $\mu g/g$, between 3 and 6 $\mu g/g$, and greater than 6 $\mu g/g$, respectively.

Mean zinc concentrations in fish from low-elevation waters showed a decline from fall to summer (172 $\mu g/g$ to 118 $\mu g/g$) compared to upper-elevation samples, which showed little change (81 $\mu g/g$ to 86 $\mu g/g$), respectively. The highest concentration detected was 199 $\mu g/g$ in Myrin Ranch Pond. Higher zinc levels in lower river fish may be attributable to possible sediment ingestion, contaminant inputs, or other factors contributing zinc to their diet. The NCBP 85th percentile for zinc (136.8 $\mu g/g$) was exceeded in 6 of 11 low-elevation fish samples.

Organochlorine pesticide residues in fish were generally below detection limits. Pesticide residues slightly above the detection limit were found in two lower river samples, but at levels below biological effect levels. No other organochlorine pesticides were found above the detection limit.

3.7.5.1.3.3 Contaminants in Aquatic Invertebrates. Trace elements in aquatic invertebrates were analyzed to determine if birds are being exposed to elevated levels in their diet. Mixed aquatic invertebrate and insect samples throughout the Upalco Unit showed both mean and maximum concentrations for arsenic, chromium, mercury, lead, and zinc in ranges considered normal or acceptable using dietary exposure criteria (Puls 1988). Levels detected were below the maximum tolerable levels identified by the National Academy of Sciences for bird diets (NAS 1980).

Invertebrate boron concentrations from the upper Lake Fork River (27 $\mu g/g$) and Pigeon Water Creek (34 $\mu g/g$) exceeded the bird dietary "acceptable" level of 13 $\mu g/g$. The mean boron concentration in low-elevation invertebrates was about 10 $\mu g/g$.

Invertebrate selenium concentrations from the Yellowstone River (2.8 $\mu g/g$) and Pigeon Water Creek (2.6 $\mu g/g$) exceeded the 2.0 $\mu g/g$ maximum tolerable dietary level established by the NAS. The average selenium concentration in lower-elevation invertebrates was about 0.93 $\mu g/g$. Although selenium was not detected in bottom sediment or surface water samples, the presence of selenium in aquatic invertebrates (up to 2.8 $\mu g/g$) indicates that this trace element is bioaccumulated.

Copper was found at higher levels in crayfish (as high as 91 $\mu g/g$ from the Lake Fork River at Myton) than in other invertebrates. Invertebrate copper concentrations were above assessment values considered normal in bird diets (10 $\mu g/g$ to 50 $\mu g/g$) but below the maximum tolerable level (300 $\mu g/g$).

3.7.5.1.3.4 Contaminants in Aquatic Plants. Low-elevation aquatic plants show low to moderate levels of trace elements. With the exception of boron and selenium, plant tissue samples did not exhibit elevated contaminant levels. Boron levels were generally low, except for a single sample of pondweed collected from Pigeon Water Creek. This sample, containing 802 $\mu g/g$ of boron, is significantly elevated when compared against the low-elevation average of 73 $\mu g/g$. Elevated fish and invertebrate boron levels at this location indicate local boron sources within the Pigeon Water Creek watershed.

Selenium was detected in pondweed samples from Midview Reservoir (3.6 $\mu g/g$) and the Duchesne River at Myton (2.3 $\mu g/g$). These concentrations are within the 2.0 to 6.0 $\mu g/g$ dietary "level of concern established for fish and wildlife (DOI 1993). The results are consistent with the unit-wide and basin-wide pattern of higher selenium levels being detected at lower elevation sampling sites.

3.7.5.1.3.5 Contaminants in Bird Eggs. Bird eggs collected from coot, western grebe, and killdeer nests at low-elevation sites showed that most trace elements were within normal concentration ranges. Mercury and selenium levels, however, were elevated in western grebe eggs when compared to other bird eggs sampled.

In freshwater marshes, the normal background mercury concentration in bird eggs is less than 1.0 μg/g. While the 1.5 μg/g level detected in western grebe samples from Midview Reservoir is marginally above the normal background level, it is about 1.4 to 21.4 times higher than other egg samples collected in the Upalco Unit.

Selenium concentrations were generally below the less than 3 μg/g "no effect" level for waterbird eggs (DOI 1993). The only exception was western grebe eggs at Midview Reservoir, which ranged in concentration from 3.7 to 4.3 μg/g. Compared to an overall low-elevation average concentration of 2.2 μg/g for all species, the western grebe egg average of 4.07 μg/g is within the "level of concern" range for selenium toxicity (3 to 8 μg/g), is below the potential "toxicity threshold" of 8 μg/g, and indicates a moderate level of dietary exposure. The mean selenium concentration in western grebe eggs from nearby Stewart Lake, an area with documented selenium contamination problems, was 24.6 μg/g.

Since coot eggs at Midview Reservoir showed only background selenium levels (less than 2 μg/g), dietary exposure could occur outside the project study area during waterbird seasonal migrations. Differences between the bird species may also be caused by differences in diet (i.e., coots eat vegetation while grebes eat fish). Overall, selenium concentrations in bird diets and eggs indicate a concern for potential selenium toxicity to fish and invertebrate-eating aquatic birds if these concentrations increase to values indicating increased potential for toxicological effects.

Boron concentrations in Upalco Unit bird eggs ranged from 0.58 to 5.8 μg/g, compared to a low-elevation average of 1.8 μg/g. In an extensive assessment of trace element toxicity in California's San Joaquin Valley, eggs averaging 3 to 13 μg/g of boron exhibited normal viability. Consequently, boron should not be a cause of concern in Upalco Unit waterfowl.

3.7.5.2 Cow Canyon Alternative

The affected environment and baseline conditions for the Cow Canyon Alternative are the same as described for the Proposed Action.

3.7.5.3 Crystal Ranch Alternative

The affected environment and baseline conditions for the Crystal Ranch Alternative are the same as described for the Proposed Action.

3.7.5.4 Twin Pots Alternative

The affected environment and baseline conditions for the Twin Pots Alternative are the same as described for the Proposed Action, except as noted.

Under the Twin Pots Alternative, four additional high mountain lakes would be stabilized in the upper Lake Fork River watershed. The Utah Department of Environmental Quality (1994) has classified all four lakes as Class 2B, 3A, and 4 waters (protected for secondary contact recreation, cold water fish/aquatic life, and agricultural uses, respectively). In addition, Island Lake has been classified as Class 1C waters (protected for domestic use with treatment).

The high mountain lakes can be characterized as clean, clear lakes supporting a cold water trout fishery. However, annual drawdowns ranging from 11 feet (Brown Duck) to 18 feet (Kidney) may cause a temporary, seasonal degradation in water quality. Model estimates of baseline high mountain lake water quality in the upper Lake Fork River watershed are the same as estimated for the high mountain lakes in the upper Yellowstone River watershed (see Table 3.7-4 in Section 3.7.5.1.1.1). These water quality estimates and discussions with the Utah Division of Water Quality indicate that all the high mountain lakes meet the numeric criteria established for their beneficial use designation.

3.7.6 Impact Analysis

This section identifies and describes the environmental impacts of the Proposed Action and each Upalco Unit alternative on water quality and environmental contaminants. The discussion focuses on the impacts considered potentially significant.

3.7.6.1 Significance Criteria

The significance criteria used to assess potential impacts on surface water and groundwater quality and environmental contaminants include the following:

- Established federal/state water quality standards, numeric criteria, and beneficial use designations
- Guidelines restricting water use for irrigation
- Changes in salinity loads to the Colorado River system
- Established standards and guidelines for environmental contaminants in water and biota

Estimates of "with project" water quality conditions were compared to established federal and state water quality standards and numeric criteria (see Table 3.7-1). Changes in water quality constituent concentrations that exceed the numeric criteria established by the state (Utah Department of Environmental Quality 1994) and/or EPA (1986) would be considered significant. Similarly, changes in water quality that would further impair beneficial use designations established by the state would be considered significant.

Guidelines for interpreting the quality of irrigation water developed by Driscoll (1986) and the University of California (Ayers and Westcot 1989) were used to assess the quality of water for irrigation use (see Tables 3.7-2 and 3.7-3). Changes in water quality constituent concentrations would determine the degree of restriction on use for irrigation (Driscoll 1986), and whether recommended maximum concentrations of trace elements in irrigation waters would be exceeded (Ayers and Westcot 1989).

Because of the high level of concern for salinity (TDS) loads entering the Colorado River system, this water quality-related issue is considered separately from other water quality issues. The implementation plan for controlling salinity in the Colorado River system emphasizes point source controls and non-point source Best Management Practices (BMPs) to reduce salinity anywhere in the Colorado River drainage, including the project area. Any change in salt loads (measured as TDS) from the project area (Lake Fork/Uinta Rivers) entering the Colorado River system would be considered significant. Salinity (TDS) limits (879 mg/L) have been established on the Colorado River at Imperial Dam.

Federal and state water quality standards and numeric criteria have been established to evaluate trace element (contaminant) concentrations in drinking water, agricultural water, and use for aquatic life (see Table 3.7-1). The assessment of contaminant concentrations in sediment and biota allows an impact evaluation that may not be apparent from the water quality data alone. However, specific trace element criteria have not been promulgated for bioaccumulation or sediments. Therefore, projected changes in contaminant concentrations were extrapolated to biota and compared against: 1) assessment guidelines for trace element and pesticide contaminant concentrations in fish (see Table 3.7-8); 2) assessment guidelines for trace element concentrations in bird diets (see Table 3.7-9); and 3) selenium effect levels for fish and wildlife (see Table 3.7-10). These assessments of potential toxicity to fish and wildlife provided the basis to evaluate whether beneficial uses relating to fish and wildlife would be impacted.

Results of the Environmental Contaminants Study (CH2M HILL/Horrocks 1996c) were used to evaluate potential impacts on water quality and biota. Previous studies have shown selenium to be the most frequently elevated contaminant of concern. Therefore, the contaminants study focused on selenium, but also examined other trace elements and organochlorine contaminants.

Table 3.7-8
Mean, Elevated (85th Percentile), and Maximum Trace Element and Pesticide Contaminant Concentrations in Fish
(μg/g dry weight)

Parameter	National Freshwater Fish Contaminant Biomonitoring Program		
	Geometric Mean	Elevated Levels (85th Percentile)	Maximum
Trace Metals			
Arsenic	0.56	1.08	6.00
Cadmium	0.88	0.20	0.88
Chromium	NE	NE	NE
Copper	0.88	0.88	92.40
Lead	0.40	0.88	19.52
Mercury	0.40	0.88	1.48
Selenium	1.68	2.92	9.20
Zinc	86.80	136.80	473.60
Organochlorine Pesticides			
4,4-DDE	0.76	NE	18.96

Sources: Schmitt and Brumbaugh (1990) (for trace metals); Schmitt, Zajicek, and Peterman 1990 (for pesticides).

Notes:
Average moisture content of fish was about 75 percent in these studies. Approximate dry weight concentrations were therefore derived from wet weight concentrations by multiplying by a factor of 4.
4,4-DDE = 4,4-Dichlorodiphenyldichloroethylene.
NE = Not established.

Table 3.7-9
Assessment Values for Trace Element Concentrations in Bird Diets
(μg/g)

Element	Reference/Source				
	Eisler[a] Acceptable	Puls[b] Normal/ Adequate	Puls[b] High	Puls[b] Toxic	National Academy of Sciences[c] Maximum Tolerable Level
Arsenic[d]	<100[e]	100[e]	NE	NE	100[e]
Boron	<13 FW	NE	NE	NE	NE
Cadmium	<0.1 FW	<5	10 - 20	>20	0.5[f]
Chromium	<10	5 - 20	NE	>300	1,000
Copper	NE	10 - 50	100 - 200	>200	300[d]
Lead	<10	NA	25[g]	NA	30[f]
Mercury	<0.1 FW	<0.1	1 - 50	5 - 100	2[f]
Selenium	<6[h]	0.3 - 1.1	3 - 5	>5	2
Zinc	<178	98 - 200	800 - 2,000	>2,000	1,000

Notes:
All values refer to dry weight concentrations unless otherwise noted as FW (fresh weight).
NE = Not established.
< = less than.
> = greater than.

[a]Eisler (1985a, 1985b, 1986, 1987, 1988a, 1988b, 1989, 1990, 1993).
[b]Puls (1988); all values given as dry weight for poultry or waterfowl (when available).
[c]NAS (1980); all values given as dry weight for poultry.
[d]Based on Phillips (1990) and Stanley et al. (1994).
[e]Arsenic in organic form, which is less toxic than inorganic arsenic.
[f]Level based on human food residue considerations.
[g]Maximum no-effect level for waterfowl.
[h]Based on Ohlendorf, Hothem, and Welsh (1989), and DOI (1993).

Table 3.7-10 Predicted Selenium Effect Levels for Fish and Wildlife			
Water	**No Effect**[a]	**Level of Concern**[b]	**Toxicity Threshold**[c]
Water (µg/L, total recoverable)	<1	1 - 3	>3
Sediment (µg/g, dry weight)	<2	2 - 4	>6
Dietary[d] (µg/g, dry weight)	<2	2 - 6	>6
Waterbird eggs[e] (µg/g, dry weight)	<3	3 - 8	>8
Warmwater fish (µg/g, dry weight, whole body)	<3	3 - 6	>6
Coldwater fish (µg/g, dry weight, whole body)	<2	2 - 6	>5

Source: DOI (1993).

[a]Selenium concentrations below this level in various media do not appear to be related to any discernible adverse effects on fish and wildlife and are typical of background levels in environments not affected by selenium.

[b]Selenium concentrations at this level in various media rarely appear to be related to any discernible adverse effects on fish and wildlife but are elevated above typical background levels.

[c]Selenium concentrations exceeding this level in various media do appear related to adverse effects on some fish and wildlife species, such as increased risk of teratogenesis and embryo mortality.

[d]Dietary criteria are based on average daily exposure.

[e]Waterbird criteria are based on population means.

3.7.6.2 Potential Impacts Eliminated from Further Analysis

Projected water quality conditions under the Proposed Action and each Upalco Unit alternative were compared to baseline conditions to identify the potential water quality effect, and to the significance criteria to determine whether the expected effect would be significant. Based on this analysis, many potential construction and operational impacts on surface water and groundwater quality were judged insignificant and therefore eliminated from further analysis. These potential impacts are summarized below. Additional water quality information and supporting data are contained in the Water Resources Technical Report (CH2M HILL/Horrocks 1996e).

3.7.6.2.1 Potential Construction Impacts Eliminated from Further Analysis. Potential construction-related impacts on surface and/or groundwater quality would include sediment from temporary soil disturbance, accidental releases of fuels or other liquids, and increased turbidity and sedimentation during instream activities (i.e., construction of diversion structures, cofferdams, dams and reservoirs, habitat improvement/bank stabilization structures, fishing piers, dikes, and river crossings). Such impacts would have the potential to increase concentrations for parameters specified by the State of Utah, including turbidity, sedimentation, and other pollutants.

These potential impacts are expected to be temporary and minor as environmental protection requirements for the prevention of water pollution, erosion and sediment control, spill prevention and containment, and other measures would be implemented to avoid or reduce water quality impacts during construction (see the standard construction requirements outlined in Appendix A). No significant or long-term impacts to surface or groundwater quality are expected.

Water quality impacts associated with the Clay Basin Settlement Pond fish and wildlife enhancement feature would be avoided by draining the pond completely and allowing it to dry for 4 to 6 months prior to bottom sediment removal. Approximately, 1,000 cubic yards of silt would be removed and hauled to a site directly north of Clay Basin to be used as fill for the development of a sediment settling pond. Additional material removed may be used to level picnic sites and improve parking facilities. Fish habitat structures and a fishing pier would be installed prior to pond refilling.

Construction activities in the Upalco Unit would be performed in accordance with the Non-point Source Water Pollution Control Plan for Hydrologic Modifications in Utah (Robinson 1994). The plan specifies BMPs for non-point source water pollution control where there is potential for disturbing stream channels, riparian areas, and floodplains.

Any potential for adverse impacts resulting from an accidental release of petroleum products into surface water or groundwater would be reduced by adhering to spill containment and countermeasure requirements included in CUWCD's construction specifications and Spill Prevention, Containment, and Countermeasure (SPCC) Plan. Such specifications would include worker education, incidence reporting, and remediation provisions in the event of a spill.

To reduce adverse impacts on water quality, instream construction activities would be conducted during low-flow seasons to the extent practicable, and limited or avoided in riparian, stream, seep, and spring areas during periods of unstable soil and streambank conditions caused by high soil moisture, snowmelt runoff, or extended periods of rain.

Areas and periods for limited construction activities would be identified through consultation with soil, fish and wildlife, and water resource management agencies and included in CUWCD construction specifications. Contractors would be required to monitor water quality during any construction activities that could impact surface water quality.

3.7.6.2.2 Potential Operational Impacts on Surface Water Quality Eliminated from Further Analysis. Under the Proposed Action and each Upalco Unit alternative (except the No Action Alternative), some operational impacts on surface water quality were eliminated from further analysis because the expected effects were not considered significant.

3.7.6.2.2.1 ***High Mountain Lakes***. With high mountain lakes stabilization in the upper Lake Fork and Yellowstone River watersheds, stabilized water surface elevations would be maintained year-round. Water quality impacts related to these stabilizations would be positive because existing, seasonal shoreline erosion and subsequent nutrient loading during drawdown would be eliminated. The degree of water quality improvement is expected to be proportional to the extent lake drawdown would be eliminated. Current drawdowns in the upper Yellowstone River watershed range from 4 feet (Bluebell and White Miller) to 27 feet (East Timothy) and from 11 feet (Brown Duck and Clements) to 18 feet (Kidney) in the upper Lake Fork River watershed. Stabilized water surface elevations would also encourage the growth of submerged aquatic plants around the lake perimeter, which would further stabilize lakeshore sediments and provide fish habitat.

Below the stabilized lakes, streamflows would exhibit normal, seasonal high mountain stream hydrologic patterns in comparison to regulated flows below proposed storage reservoirs. Stabilized lake outflows would be higher in fall, winter and spring, and related increases in downstream turbidity (suspended sediments) would be similar to natural (pre-1900s) conditions.

All the high mountain lakes would continue to be characterized as clean, high-quality mountain lakes supporting a cold water (trout) fishery. Although specific water quality changes related to these stabilizations were not quantified, water quality impacts on upper-elevation waters resulting from lake stabilization would be positive. There would be no significant impacts on lake or downstream water quality, and all water quality criteria and beneficial use designations would continue to be met.

3.7.6.2.2.2 ***Dams and Reservoirs***. Projected water quality conditions for proposed Crystal Ranch and Upper Yellowstone Reservoirs, the enlarged Big Sand Wash Reservoir, and the stabilized Twin Pots Reservoir would meet all applicable water quality criteria and beneficial use designations. Proposed reservoir operations are not expected to cause significant water quality impacts in the reservoirs or on downstream water quality.

The potential for excessive growth of algae and aquatic plants (eutrophication) in Crystal Ranch and Upper Yellowstone Reservoirs was estimated based on mid-summer average conditions for chlorophyll concentrations, water clarity, and potential for oxygen depletion in deep water (see Table 3.7-11). A low probability of mid-summer oxygen depletion, low nutrient levels in the inflow water, and minimal hydraulic retention time would help minimize water quality changes compared to existing stream quality.

Neither reservoir is expected to experience winter oxygen depletion or water quality degradation caused by eutrophication. Estimates of winter oxygen levels (see Table 3.7-11) are well above the minimum criterion of 5 mg/L for predicting successful over-winter fish survival. Settling of most suspended sediments and typically associated phosphorus and metals would result in a net positive water quality effect as outflow water clarity is expected to be high.

The water quality record for Moon Lake was used to indicate average, long-term reservoir conditions because of its similarity in geographic location, elevation, and quality of source waters. Moon Lake has very good water quality and no detrimental impact downstream on the Lake Fork River (Judd 1996). Outflow water quality from the proposed reservoirs is expected to be similar to Moon Lake and supportive of all beneficial uses and water quality criteria.

None of the reservoirs recently examined by the state (Utah Department of Environmental Quality 1996) exhibited water quality criteria exceedances and the highest elevation lakes had the best water quality (see Section 3.7.5.1.1.2). The state water quality records indicate "very good" (Moon Lake and Big Sand Wash Reservoir) to "excellent" (Upper Stillwater) water quality conditions in

Table 3.7-11

Estimated Baseline, Upalco Unit Proposed Action, and Alternative Water Quality Conditions

Reservoir	Mid-summer Average Conditions: Chlorophyll (ug/L)	Mid-summer Average Conditions: Water Clarity (Secchi depth) (ft)	Mid-summer Average Conditions: Probability of Oxygen Depletion (%)	Winter: Lowest Oxygen Concentration (mg/L)	Suspended Sediment Concentrations: Inflow Average (mg/L)	Suspended Sediment Concentrations: Outflow Low Range (mg/L)	Suspended Sediment Concentrations: Outflow High Range (mg/L)
Baseline Conditions							
High Mountain Lakes	0.28	10.9	16	*	1.5	0.045	0.15
Big Sand Wash	0.28	10.8	36	*	9.3	0.186	0.744
Twin Pots	0.26	9.2	12	*	9.3	0.093	0.465
Proposed Action and Alternative Conditions							
High Mountain Lakes	(Qualitative only, see text)						
Crystal Ranch	0.26	10.0	14	7.0	2.6	0.093	0.286
Upper Yellowstone	0.24	11.1	18	7.7	2.6	0.104	0.338
Big Sand Wash	0.23	11.0	19	*	9.3	0.186	0.744
Twin Pots	0.26	9.2	12	*	9.3	0.093	0.465

* = Winter oxygen depletion not modeled.

Upalco Unit and nearby reservoirs. Projected water quality conditions in Crystal Ranch and Upper Yellowstone Reservoirs are expected to follow these examples and the estimates provided in Table 3.7-11 to form oligotrophic reservoirs with very good water quality.

Both Crystal Ranch and Upper Yellowstone Reservoirs would collect bedload material and suspended sediments because of decreased reservoir water velocities. Consequently, reservoir outflow water would cause net erosion downstream because of reduced suspended sediment concentrations in the water. The rate of downstream erosion, armoring, and bank stabilization would depend on existing sediment loads, and on the composition of channel bed and bank materials. Significant changes often occur in rivers that carry high sediment loads with channels composed primarily of fine-grained sediments. River channels composed of cobbles and boulders are impacted less because they have the capacity to armor and dissipate energy.

The drainage area (watershed) above the Crystal Ranch and Upper Yellowstone Reservoir sites is comprised of numerous high mountain lakes, and is relatively stable as sediment production is low. Consequently, the volumes of suspended and bedload sediment expected to be transported to the proposed reservoirs would be relatively small. It is estimated that 120 acre-feet of suspended sediment (USBR 1977) and 75 acre-feet of bedload sediment would be deposited in either reservoir over their 100-year expected life. This is less than 1 percent of their active storage capacity. Below the intake structure, the reservoirs' dead (inactive) storage pool of 200 acre-feet would accommodate the expected sediment load.

Stream reaches upstream and downstream of the proposed reservoirs have relatively steep gradients averaging approximately 1.9 percent. Most of the fine sediments (sand and small gravel) produced in the watershed are transported through these reaches. Since channel bed materials are comprised primarily of large gravel, cobbles, and boulders, there is a high degree of armoring and pavement that exists throughout these reaches. Consequently, the streambeds are inactive most of the time.

Before bed materials can be mobilized, the surficial armoring and/or pavement must be moved. Transport analysis indicates that daily flows greater than 1,400 cfs would be required in order to mobilize and transport significant amounts of bed material. With the development of either Crystal Ranch or Upper Yellowstone Reservoir, average daily flows equal to or exceeding 1,400 cfs would be expected about 45 days in 100 years. Therefore, even with the cutoff of sediment loads at the reservoir, impacts downstream would be modest. Limited degradation would be expected in the river reach extending from the reservoirs down to the Yellowstone Feeder Canal, a distance of about 2.5 miles for Crystal Ranch Reservoir and 7.5 miles for Upper Yellowstone Reservoir, with diminishing amounts through the reach from the Yellowstone Feeder Canal to the river's confluence with the Lake Fork River as some small local tributary flow would provide a small source of sediment. Degradation would be limited to those locations where static armoring does not presently exist and would be expected to take place slowly.

Big Sand Wash Reservoir is an offstream storage facility located in the middle part of the Upalco Unit. More than 90 percent of the influent suspended sediment load is expected to be trapped in the reservoir, and the potential for eutrophication should be slightly reduced by the enhanced depth of the enlarged reservoir (see Table 3.7-11). Although predicted over-winter dissolved oxygen levels in offstream reservoirs were not modeled, the conservation pool in the enlarged reservoir would continue to provide 1,200 acre-feet of storage and successful over-winter fish survival. Reservoir operations are not expected to cause significant water quality impacts in the reservoir or to reservoir release water quality.

Reduced fluctuation of Twin Pots Reservoir is not expected to have any quantifiable effects on factors contributing to eutrophication (see Table 3.7-11). By utilizing reservoir storage primarily to support a year-round sport fishery, fish habitat, riparian communities, and recreational opportunities, reservoir pool levels would be maintained at higher levels than in the past. Consequently, current shoreline erosion and subsequent nutrient inputs caused by reservoir drawdown would be reduced and produce a net positive effect on reservoir water quality.

*3.7.6.2.2.3 **River Reaches**.* Projected water quality conditions in upper-elevation river reaches would be that of the existing upper rivers as modified by high mountain lakes stabilization and proposed reservoir operations. As indicated above, no significant impacts on upper Lake Fork River or Yellowstone River water quality are expected from high mountain lakes stabilization or proposed reservoir operations. Upper-elevation river water quality is expected to remain essentially the same as baseline conditions and would continue to meet all applicable water quality criteria and beneficial use designations.

Mid-section Lake Fork River water quality (upstream from Pigeon Water Creek) is not expected to experience significant water quality changes. Although water moving down through the unit becomes increasingly degraded by the non-point infusion of salts and other constituents entering the river, the blended upper-source waters would continue to maintain constituent concentrations below the numeric criteria established to protect designated beneficial uses, including cold water aquatic biota and agriculture. Potentially significant changes in water quality would occur below Pigeon Water Creek following the addition of agricultural return flows into the lower Lake Fork River (see Section 3.7.6.3.1).

To be considered eligible for participation in the land retirement program, a land parcel must be currently irrigated, have a valid secondary water right, and be located in an area of relatively high soil and groundwater salinity. These lands currently contribute disproportionately large amounts of salt loading to regional surface waters and underlying shallow aquifers. With project development, land retirement in the lower Upalco Unit would have a net positive impact on salt load reduction in the lower Lake Fork River by locally reducing agricultural return flows and increasing the amount of water left in the lower Lake Fork River during the irrigation season. The net impact of the land retirement program on water quality is incorporated into the salt load model results presented in Section 3.7.6.3.1.

*3.7.6.2.2.4 **Irrigation Canals and Seepage**.* Influent water quality at irrigation diversions would be that of blended, high-quality, upper-elevation source waters. Under the Proposed Action and each Upalco Unit alternative (except the No Action Alternative), water use changes (i.e., increased crop use and even water use throughout the irrigation season) and improved water management (i.e., water delivery matched to crop requirements and/or canals converted to pipelines) would cause a decrease in the amount of water channeled back to the river and leaving the unit as agricultural return flows. Since the mechanisms of water quality degradation through the irrigation and return flow system would not be altered, return flows from bench and upland agricultural areas are projected to be similar to baseline conditions.

Unit-wide water use changes and improved water management would decrease agricultural return flows, a result of reduced runoff and irrigation deep percolation. Subsequently, there would be less water moving salts and other constituents out of soils and shallow aquifers into the lower river system. Changes in salt loads and salt concentrations in water leaving the unit and downstream impacts on the Colorado River system are addressed in Section 3.7.6.3.1.

3.7.6.2.3 Potential Operational Impacts on Groundwater Quality Eliminated from Further Analysis. Under the Proposed Action and each Upalco Unit alternative (except the No Action Alternative), operational impacts on groundwater quality were eliminated from further analysis because the expected effects were not considered significant.

Groundwater quality is closely related to the quality of its source waters that provide recharge. For those shallow aquifers adjacent to or near surface waters, changes in groundwater quality would reflect expected changes in surface water quality. For those shallow aquifers located away from surface waters (i.e., beneath bench and upland agricultural areas), changes in groundwater quality would reflect expected changes in recharge waters originating from canal seepage and irrigation deep percolation. These changes would be controlled by chemical interactions with local soil and shallow aquifer materials (see Section 3.7.6.2.3.2).

Groundwater in the regional aquifer is deep circulating, recharged by precipitation in the upper watershed, confined by low-permeability strata, contains a very large volume of groundwater, and has an upward gradient in the lower unit. Therefore, any changes in surface water quality or groundwater quality in the shallow aquifers would not influence the quality of the regional aquifer.

3.7.6.2.3.1 Upper Upalco Subunit. In the upper subunit, there is a close and direct relationship between surface water and groundwater in the shallow, unconfined aquifers. Projected surface water quality conditions in upper-elevation river reaches, lakes, and reservoirs is expected to be "very good" and meet all applicable beneficial use designations and water quality criteria (see Section 3.7.6.2.2). Consequently, any recharge that occurs into the shallow aquifer system from river loss/percolation or reservoir seepage would result in groundwater quality remaining essentially the same as baseline conditions. Shallow aquifers in the upper subunit are expected to meet the groundwater protection standards for Class IA (pristine) waters.

3.7.6.2.3.2 Middle Upalco Subunit. Since mid-section Lake Fork River water quality (upstream from Pigeon Water Creek) is not expected to experience significant water quality changes, groundwater quality in the shallow aquifers beneath and adjacent to the river is expected to be similar to baseline conditions.

Beneath bench and upland agricultural areas, past USBR studies in the Uinta Basin show that water moving salt through the shallow groundwater system reaches an equilibrium with aquifer materials. More importantly, these studies show that EC, an indicator of salt concentrations, remains nearly constant through the year even though the flow of water through the shallow aquifer varied greatly (USBR 1986). Consequently, TDS concentrations in the shallow aquifer system and in discharging groundwaters of the middle subunit would be essentially the same as baseline conditions.

Middle subunit shallow aquifers receive most of their recharge from canal seepage loss and irrigation deep percolation. With improved water management (i.e., converting canals to pipelines) and increased crop consumptive use, canal seepage and/or irrigation deep percolation would be reduced. With less shallow groundwater moving salts and other constituents out of soils and aquifers into adjacent surface waters, total salt and other constituent loads discharged from the shallow aquifer system into the lower Lake Fork River would be reduced. Overall, shallow aquifers in the middle subunit are expected to meet the groundwater protection standards for Class IA (pristine) waters in the upper part of the subunit, and for Class II (drinking water quality) waters in the lower part of the subunit.

No changes to groundwater quality are anticipated by enlarging and operating Big Sand Wash Reservoir. The reservoir is not located in a recharge area for the shallow aquifer, and reservoir water quality is expected to remain favorable for all beneficial use designations. Deeper groundwater is present in the Duchesne River Formation beneath the reservoir, but this groundwater is part of the regional aquifer, which is confined by low-permeability shale beds in this area.

3.7.6.2.3.3 Lower Upalco Subunit. Shallow groundwater quality in the lower subunit is degraded because canal seepage and irrigation deep percolation waters that enter the shallow aquifer tend to have significantly degraded quality because they flow across saline soils, and intercept return flows from progressively lower stream channels and canals that contain increasingly higher concentrations of leached soluble ions.

With water use changes and improved water management, low-quality surface and subsurface return flows entering the shallow aquifer would be reduced. Consequently, although TDS concentrations in subsurface return flows would remain essentially unchanged, with less return flow moving salts and other constituents, total salt and constituent loads discharged from the shallow aquifer into the lower river system would be reduced. Overall, shallow groundwater quality in the lower subunit is expected to be essentially the same as baseline conditions and meet the groundwater protection standards for Class II waters. The most noticeable positive change would occur in land retirement areas by reducing salt loads in the underlying shallow aquifer that discharge as agricultural return flows.

3.7.6.2.4 Potential Operational Impacts on Environmental Contaminants Eliminated from Further Analysis. Bottom sediments were collected as part of the Environmental Contaminants Study (CH2M HILL/Horrocks 1996c). Concentrations of trace elements in bottom sediments showed considerable variability among Upalco Unit stream and pond sites. However, none of the sediment samples exceeded sediment screening levels for toxic constituents, nor were sediments considered a mechanism for evaluating environmental effects.

Organochlorine analyses for sediment and biological samples were eliminated from further study because study results indicated that these contaminants were not accumulating at significant levels in Upalco Unit fish populations.

3.7.6.3 Proposed Action–Talmage

This section identifies and summarizes the operational impacts on surface water quality and environmental contaminants considered potentially significant under the Proposed Action and describes mitigation. The primary location for water quality and contaminant (trace element) assessment was the lower Lake Fork River near Myton, just upstream from its confluence with the Duchesne River.

An understanding of the concept of stream constituent loading is essential to an evaluation of surface water quality impacts. Constituent loads are estimated by multiplying constituent concentrations by streamflow. Thus, changes in load are influenced by changes in either concentration, flow, or both. Under the Proposed Action, lower Lake Fork River TDS concentrations are projected to increase in combination with a relatively greater decrease in unit outflow. Counter-intuitively, the net result is a decrease in salt load associated with an increase in concentration.

3.7.6.3.1 Potential Operational Impacts on Surface Water Quality. Changes in surface water quality were estimated based on current agricultural return flow quality, river quality, and relationships among river flow, EC and TDS. TDS was the key water quality constituent evaluated because of a clear trend toward increasing trace element concentrations with increasing TDS concentrations in surface waters, and because of the high level of concern for salinity (TDS) loads in the Colorado River system.

The operation of proposed reservoirs, diversions, canals, and pipelines would change annual and seasonal flow and diversion patterns. Overall, water leaving the unit (outflow) would decrease by 10,300 acre-feet since there would be less water in the river system. This is a result of increased diversion requirements and less agricultural return flows resulting from increased crop consumptive use and improved irrigation efficiencies.

These changes are expected to increase the mean salinity concentration in the lower Lake Fork River near Myton, but decrease the annual salt load contributed from the Upalco Unit to the Colorado River. Under the Proposed Action, the mass balance analysis (which combines agricultural return flows with lower river flows) shows that mean annual TDS concentrations in the lower Lake Fork River would increase by 29 percent (169 mg/L); average annual flows leaving the unit (outflow) would be reduced by 38 percent (10,300 acre-feet); and the annual salt load in the lower Lake Fork River would decrease by 22 percent (4,800 tons), compared to baseline conditions (see Table 3.7-12). With a reduced salt load (4,800 tons per year) leaving the Upalco Unit, the salt load is expected to decrease (0.1 percent) in the Colorado River at Imperial Dam.

Table 3.7-12 Flow and Salinity Impacts on the Colorado River for the Proposed Action						
	Flow		TDS Concentration		Salt Mass (load)	
	(1,000 ac-ft/yr)	% change	(mg/L)	% change	(1,000 tons/yr)	% change
Colorado River[a]	7,271	NA	834	NA	8,253	NA
Lake Fork River near Myton						
Baseline	27.2	NA	584	NA	22.1	NA
Proposed Action	16.9	NA	753	NA	17.3	NA
Change (Baseline to Proposed Action)	-10.3	-38	169	29	-4.8	-22
Colorado River with Proposed Action[b]	7,261	-0.1	835	0.1	8,248	-0.1

Notes:
NA = Not applicable.

[a]At Imperial Dam; 50-year modeled average.
[b]New values based on estimated impact on the Colorado River.

Water diverted for irrigation and that returns to the river system as runoff or deep percolation has a higher concentration of TDS than water that stays in the river. Under the Proposed Action, the salinity (TDS) concentration in water leaving the unit would increase because 11 percent more of the outflow would be lower-quality agricultural return flows rather than higher-quality river water. Salt loads would decline, however, since 21 percent less water would be leaving the unit as runoff and irrigation deep percolation.

The projected increase in the mean TDS concentration to 753 mg/L would be well below the state water quality criteria for agriculture (1,200 mg/L), but would indicate a slight restriction on use for irrigation (see Tables 3.7-1 and 3.7-2).

3.7.6.3.2 Potential Operational Impacts on Environmental Contaminants. Projected changes in surface water quality were used to estimate changes in environmental contaminant (trace element) constituent concentrations in the lower Lake Fork River. Projected changes in water quality and trace elements from implementing the Proposed Action were then compared to established water quality standards and numeric criteria. To assess probable qualitative impacts on bioaccumulation and risks to fish and wildlife, projected water quality changes were extrapolated to biota and compared against established assessment guidelines and effect levels (see Tables 3.7-8, 3.7-9, and 3.7-10). These assessments of potential toxicity to fish and wildlife provided the basis to evaluate whether beneficial uses relating to fish and wildlife would be impaired.

3.7.6.3.2.1 Contaminants in Surface Waters. Trace elements and TDS were analyzed from the water quality samples collected as part of this study. The results incorporated a wide range of concentrations of all elements and indicated a clear trend toward increasing trace element concentrations with increasing TDS concentrations. Statistically significant positive trace element-TDS relationships were found for arsenic, boron, iron, manganese, and alpha radiation with nonsignificant but positive trends apparent for selenium and zinc (CH2M HILL/Horrocks 1996c). Because of these known relationships, and because no better or complex models were available, all trace element concentrations were assumed to vary positively with TDS for all water quality projections.

Under the Proposed Action, the projected 29 percent increase in the mean TDS concentration in the lower Lake Fork River is expected to result in a proportionate increase in mean concentrations of all dissolved ionic compounds, including selenium. Mean trace element concentrations for arsenic, boron, iron, manganese, and gross alpha radioactivity would increase by measurable amounts (see Table 3.7-13), but none of the mean trace element concentrations projected would exceed established water quality criteria (see Table 3.7-1). No estimates are available for mercury, selenium, and five other trace elements because mean values for baseline conditions were less than the detection limit.

Although mean trace element concentrations in the lower Lake Fork River are projected to increase above baseline conditions, changes in the frequency and magnitude of peak (maximum) concentrations were not modeled and are unknown. However, the projected 29 percent (169 mg/L) increase in the mean TDS concentration to 753 mg/L is expected to proportionately increase the number of agricultural water quality criteria exceedances for TDS and boron, and trace element contaminant effects in localized areas near the lower Lake Fork/ Duchesne River.

The projected increase in mean TDS concentrations would affect those low-elevation river reaches and

Table 3.7-13
Projected Trace Element Concentrations for the Proposed Action Based on Projected Annual Mean Total Dissolved Solids (TDS) Concentrations

Water Quality Constituent	Annual Mean Concentrations (mg/L)	
	Lower Lake Fork River	
	Baseline	Proposed Action
Arsenic	0.0039	0.005
Boron	0.418	0.[illegible]5
Cadmium*	<0.001	<0.001
Chromium*	<0.001	<0.001
Copper*	<0.010	<0.010
Iron	0.019	<0.0[illegible]1
Lead*	<0.001	<0.001
Manganese	0.083	0.107
Mercury*	<0.0001	<0.010
Selenium-D*	<0.001	<0.001
Selenium-T*	<0.001	<0.001
Zinc*	<0.01	<0.01
Gross Alpha**	0.0051	<0.001

*For baseline means less than the detection limit, no change in concentration can be predicted.
**In nanocuries per liter (nCi/L).

areas currently experiencing salinity (TDS) problems and/or trace element exceedances. In the project area, significant water quality impacts would likely be limited to high TDS concentrations in the lowest river reaches, which include the Lake Fork River near Myton and the Duchesne River at Myton. Impacts related to changes in boron and selenium concentrations are expected to be minimal and localized within the lower project area as well.

Predicted selenium concentrations in surface water were derived through an evaluation of the general relationship between selenium and TDS concentrations. On average, baseline and Proposed Action surface water selenium concentrations in the lower Lake Fork River are expected to remain near the limit of detection (< 0.001 mg/L).

*3.7.6.3.2.2 **Contaminants in Biota**.* Bioaccumulation and toxicity from selenium is of particular concern in the Upalco Unit as selenium was shown to be accumulated to borderline toxic levels in some fish and bird samples in the lower unit (see Section 3.7.5.1.3). Under the Proposed Action, projected average selenium concentrations in fall fish tissues (4.76 μg/g) would remain at elevated levels (above the 85th percentile of 2.9 μg/g), and in summer fish tissues (6.4 μg/g) would be slightly above the "toxicity threshold" identified for fish and dietary criteria (see Table 3.7-10). However, the projected 29 percent increase in selenium levels is not expected to increase the general level of toxicity in resident fish and wildlife. The projected increase in mean tissue selenium concentrations does not represent a significant increase in the category of toxicity over current conditions (see Table 3.7-10) as confirmed by the contaminants criteria developed by Lemly and Smith (1987) and Maier and Knight (1994).

Projected selenium levels in fish-eating western grebe eggs (5.24 μg/g) would remain within the currently measured "level of concern" range of 3 to 8 μg/g. Similarly, projected selenium levels in aquatic plants (3.71 μg/g) would remain within the 2 to 6 μg/g dietary "level of concern" range established for fish and wildlife.

Average copper (4.36 and 5.21 μg/g) and zinc (222.1 and 154.9 μg/g) concentrations in fall and summer fish tissues would remain at elevated levels (above the 85th percentiles of 4.0 and 136.8 μg/g, respectively). The projected 29 percent increase in tissue concentrations for these two trace elements, however, would not result in a significant increase in toxicological effects.

There is already some level of beneficial use impairment in Upalco Unit resident fish and wildlife populations because of the presence of trace elements at levels considered borderline toxicity. Implementation of the Proposed Action is not expected to change this level of fish and wildlife toxicity or cause an additional impairment of beneficial uses relative to fish and wildlife since no significant toxicological changes from baseline are expected.

3.7.6.3.3 Mitigation. There are uncertainties in future trace element contaminant concentrations in the project area, the level of bioaccumulation in potentially affected fish and wildlife populations, and possible toxicological effects caused by trace elements. Post-project monitoring of fish and wildlife bioaccumulation will be used as a check on EIS projected concentrations and toxicological impacts. Fish in new reservoirs and fish and birds from lower-elevation stream and reservoir locations will be monitored for tissue concentrations of trace elements. The spatial extent, frequency, and duration of the monitoring and selection of target species will be determined following consultation with FWS, the Ute Tribe, Wildlife Resources, and other interested participants. A technical committee will be formed to develop the scope of the monitoring plan and oversee the interpretation and results.

3.7.6.4 Cow Canyon Alternative

This section identifies and summarizes the operational impacts on surface water quality and environmental contaminants considered potentially significant under the Cow Canyon Alternative and describes mitigation. Under this alternative, Twin Pots Reservoir water quality would remain unchanged since the reservoir level would not be stabilized, but continue to be drawn down for irrigation as in the past.

3.7.6.4.1 Potential Operational Impacts on Surface Water Quality. Operation of the project features included in the Cow Canyon Alternative would change annual and seasonal flow and diversion patterns similar to the Proposed Action. Overall, water leaving the unit (outflow) would decrease by 10,400 acre-feet since there would be less water in the river system. This is a result of increased diversion requirements and less agricultural return flows resulting from increased crop consumptive use and improved irrigation efficiencies.

These changes are expected to increase the mean salinity concentration in the lower Lake Fork River near Myton, but decrease the annual salt load contributed from the Upalco Unit to the Colorado River. Under the Cow Canyon Alternative, the mass balance analysis (which combines agricultural return flows with lower river flows) shows that mean annual TDS concentrations in the lower Lake Fork River would increase by 30 percent (175 mg/L); average annual flows leaving the unit (outflow) would be reduced by 38 percent (10,400 acre-feet); and the annual salt load in the lower Lake Fork River would decrease by 22 percent (4,800 tons), compared to baseline conditions (see Table 3.7-14). With a reduced salt load (4,800 tons per year) leaving the Upalco Unit, the salt load is expected to decrease (0.1 percent) in the Colorado River at Imperial Dam.

Water diverted for irrigation and that returns to the river system as runoff or deep percolation has a higher concentration of TDS than water that stays in the river. Under the Cow Canyon Alternative, the salinity (TDS) concentration in water leaving the unit would increase because 12 percent more of the outflow would be lower-quality agricultural return flows rather than higher-quality river water. Salt loads would decline, however, since 21 percent less water would be leaving the unit as runoff and irrigation deep percolation.

The projected increase in the mean TDS concentration to 759 mg/L would be well below the state water quality criteria for agriculture (1,200 mg/L), but would indicate a slight restriction on use for irrigation (see Tables 3.7-1 and 3.7-2).

3.7.6.4.2 Potential Operational Impacts on Environmental Contaminants. Mean TDS concentrations in the lower Lake Fork River are

Table 3.7-14
Flow and Salinity Impacts on the Colorado River for the Cow Canyon Alternative

	Flow		TDS Concentration		Salt Mass (load)	
	(1,000 ac-ft/yr)	% Change	(mg/L)	% Change	(1,000 tons/yr)	% Change
Colorado River[a]	7,271	NA	834	NA	8,253	NA
Lake Fork River near Myton						
Baseline	27.2	NA	584	NA	22.1	NA
Cow Canyon	16.8	NA	759	NA	17.3	NA
Change (Baseline to Cow Canyon)	-10.4	-38	175	30	-4.8	-22
Colorado River with Cow Canyon[b]	7,261	-0.1	835	0.1	8,248	-0.1

Notes:
NA = Not applicable.

[a]At Imperial Dam; 50-year modeled average.
[b]New values based on estimated impact on the Colorado River.

expected to increase about 30 percent under the Cow Canyon Alternative compared to 29 percent under the Proposed Action. Consequently, the projected increase in trace element concentrations (see Table 3.7-15) in lower Lake Fork River water quality and area biota under the Cow Canyon Alternative would be essentially the same as the levels projected for the Proposed Action. Impacts related to these increased contaminant levels would be the same as described for the Proposed Action (see Section 3.7.6.3.2.2).

3.7.6.4.3 Mitigation. Mitigation would be the same as described for the Proposed Action (see Section 3.7.6.3.3).

3.7.6.5 Crystal Ranch Alternative

This section identifies and summarizes the operational impacts on surface water quality and environmental contaminants considered potentially significant under the Crystal Ranch Alternative and describes mitigation. Under this alternative, Twin Pots Reservoir would not be rehabilitated and Big Sand Wash Reservoir would not be enlarged. Consequently, water quality conditions in Twin Pots and Big Sand Wash Reservoirs would remain the same as baseline conditions.

3.7.6.5.1 Potential Operational Impacts on Surface Water Hydrology. Operation of the project features included in the Crystal Ranch

Table 3.7-15
Projected Trace Element Concentrations for the Cow Canyon Alternative
Based on Projected Annual Mean Total Dissolved Solids (TDS) Concentrations

Annual Mean Concentrations (mg/L)		
	Lower Lake Fork River	
Water Quality Constituent	Baseline	Cow Canyon
Arsenic	0.0039	0.539
Boron	0.418	0.539
Cadmium*	<0.001	<0.001
Chromium*	<0.001	<0.001
Copper*	<0.010	<0.010
Iron	0.019	0.0245
Lead*	<0.001	<0.001
Manganese	0.083	0.108
Mercury*	<0.0001	<0.0001
Selenium-D*	<0.001	<0.001
Selenium-T*	<0.001	<0.001
Zinc*	<0.01	<0.01
Gross Alpha**	0.0051	0.0066

*For baseline means less than the detection limit, no change in concentration can be predicted.
**In nanocuries per liter (nCi/L).

Alternative would change annual and seasonal flow and diversion patterns. Overall, water leaving the unit would decrease since there would be less water in the river system because of increased diversion requirements (5,000 acre-feet), and less agricultural return flows (2,400 acre-feet) because of increased crop consumptive use and improved irrigation efficiencies.

These changes are expected to increase the mean salinity concentration in the lower Lake Fork River near Myton, but decrease the annual salt load contributed from the Upalco Unit to the Colorado River. Under the Crystal Ranch Alternative, the mass balance analysis (which combines agricultural return flows with lower river flows) shows that mean annual TDS concentrations in the lower Lake Fork River would increase by 8 percent (49 mg/L); average annual flows leaving the unit (outflow) would be reduced by 27 percent (7,300 acre-feet); and the annual salt load in the lower Lake Fork River would decrease by 22 percent (5,000 tons), compared to baseline conditions (see Table 3.7-16). With a reduced salt load (5,000 tons per year) leaving the Upalco Unit, the salt load is expected to decrease (0.1 percent) in the Colorado River at Imperial Dam.

Water diverted for irrigation and that returns to the river system as runoff or deep percolation has a higher concentration of TDS than water that stays in the river. Under the Crystal Ranch Alternative, the salinity (TDS) concentration in water leaving the unit would increase because 3 percent more of the outflow would be lower-quality agricultural return flows. Salt loads would decline, however, since 22 percent less water would be leaving the unit as runoff and irrigation deep percolation.

The projected increase in the mean TDS concentration to 633 mg/L would be well below the state water quality criteria for agriculture (1,200 mg/L), but would indicate a slight restriction on use for irrigation (see Tables 3.7-1 and 3.7-2).

3.7.6.5.2 Potential Operational Impacts on Environmental Contaminants. Projected changes in water quality and trace elements from implementing the Crystal Ranch Alternative were estimated and compared to established water quality criteria, assessment guidelines, and effect levels. Toxicity assessments provided the basis to evaluate whether beneficial uses relating to fish and wildlife would be impaired.

Table 3.7-16
Flow and Salinity Impacts on the Colorado River for the Crystal Ranch Alternative

	Flow		TDS Concentration		Salt Mass (load)	
	(1,000 ac-ft/yr)	% Change	(mg/L)	% Change	(1,000 tons/yr)	% Change
Colorado River[a]	7,271	NA	834	NA	8,253	NA
Lake Fork River near Myton						
Baseline	27.2	NA	834	NA	22.1	NA
Crystal Ranch	19.9	NA	633	NA	17.1	NA
Change (Baseline to Crystal Ranch)	-7.3	-27	49	8	-5	-22
Colorado River with Crystal Ranch[b]	7,264	-0.1	835	0.1	8,248	-0.1

Notes:
NA = Not applicable.

[a]At Imperial Dam; 50-year modeled average.
[b]New values based on estimated impact on the Colorado River.

3.7.6.5.2.1 Contaminants in Surface Waters. Under the Crystal Ranch Alternative, mean trace element concentrations for arsenic, boron, iron, manganese, and gross alpha radioactivity would increase by measurable amounts (see Table 3.7-17), but none of the mean trace element concentrations projected would exceed established water quality criteria (see Table 3.7-1).

Although mean trace element concentrations in the lower Lake Fork River are projected to increase above baseline conditions, changes in the frequency and magnitude of peak (maximum) concentrations were not modeled and are unknown. However, the projected 8 percent (49 mg/L) increase in the mean TDS concentration to 633 mg/L is expected to proportionately increase mean concentrations of all dissolved ionic constituents, including selenium. Consequently, the number of agricultural water quality exceedances for TDS and boron, and trace element contaminant effects in localized areas near the lower Lake Fork/Duchesne River are expected to either increase slightly or remain essentially the same as baseline conditions. Water quality impacts would likely be limited to those low-elevation river reaches and areas currently experiencing high TDS concentrations and/or trace element exceedances.

3.7.6.5.2.2 Contaminants in Biota. Under the Crystal Ranch Alternative, projected average selenium concentrations in fall fish tissues (4.0 μg/g) would remain at elevated levels (above the 85th percentile of 2.9 μg/g), and in summer fish tissues (5.38 μg/g) would remain within the

Table 3.7-17
Projected Trace Element Concentrations for the Crystal Ranch Alternative Based on Projected Annual Mean Total Dissolved Solids (TDS) Concentrations

Annual Mean Concentrations (mg/L)		
	Lower Lake Fork River	
Water Quality Constituent	**Baseline**	**Crystal Ranch**
Arsenic	0.0039	0.0042
Boron	0.418	0.451
Cadmium*	<0.001	<0.001
Chromium*	<0.001	<0.001
Copper*	<0.010	<0.0[illegible]
Iron	0.[illegible]18	0.0205
Lead*	<0.001	<0.001
Manganese	0.083	0.090
Mercury*	<0.0001	<0.0001
Selenium-D*	<0.001	<0.001
Selenium-T*	<0.001	<0.001
Zinc*	<0.01	<0.01
Gross Alpha**	0.0051	0.0055

*For baseline means less than the detection limit, no change in concentration can be predicted.
**In nanocuries per liter (nCi/L).

"level of concern" identified for fish and dietary criteria (2 to 6 μg/g). Consequently, the projected 8 percent increase in selenium levels is not expected to increase the general level of toxicity in resident fish and wildlife compared to baseline conditions.

Projected selenium levels in fish-eating western grebe eggs (4.41 μg/g) would remain within the currently measured "level of concern" range of 3 to 8 μg/g. Similarly, projected selenium levels in aquatic plants (3.12 μg/g) would remain within the 2 to 6 μg/g dietary "level of concern" range established for fish and wildlife.

Average copper levels (4.38 μg/g) in summer fish tissues and zinc levels (186.7 μg/g) in fall fish tissues would remain at elevated levels (above the 85th percentiles of 4.0 and 136.8 μg/g, respectively). The projected 8 percent increase in tissue concentrations for these two trace elements, however, would not result in a significant increase in toxicological effects.

There is already some level of beneficial use impairment in Upalco Unit resident fish and wildlife populations because of the presence of trace elements at levels considered borderline toxicity. Implementation of the Crystal Ranch Alternative is not expected to change this level of fish and wildlife toxicity or cause an additional impairment of beneficial uses relative to fish and wildlife since no significant toxicological changes from baseline are expected.

3.7.6.5.3 Mitigation. Mitigation would be the same as described for the Proposed Action (see Section 3.7.6.3.3).

3.7.6.6 Twin Pots Alternative

This section identifies and summarizes the operational impacts on surface water quality and environmental contaminants considered potentially significant under the Twin Pots Alternative and describes mitigation. Under this alternative, surface water quality in the Yellowstone River would remain essentially the same as baseline conditions since no onstream storage facility is proposed.

3.7.6.6.1 Potential Operational Impacts on Surface Water Quality. Operation of the project features included in the Twin Pots Alternative would change annual and seasonal flow and diversion patterns. Overall, water leaving the unit would decrease by 6,700 acre-feet since there would be less water in the river system. This is a result of increased diversion requirements and less agricultural return flows resulting from increased crop consumptive use and improved irrigation efficiencies.

These changes are expected to increase the mean salinity concentration in the lower Lake Fork River near Myton, but decrease the annual salt load contributed from the Upalco Unit to the Colorado River. Under the Twin Pots Alternative, the mass balance analysis (which combines agricultural return flows with lower river flows) shows that mean annual TDS concentrations in the lower Lake Fork River would increase by 6 percent (33 mg/L); average annual flows leaving the unit (outflow) would be reduced by 25 percent (6,700 acre-feet); and the annual salt load in the lower Lake Fork River would decrease by 22 percent (4,900 tons), compared to baseline conditions (see Table 3.7-18).

With a reduced salt load (4,900 tons per year) leaving the Upalco Unit, the salt load is expected to decrease (0.1 percent) in the Colorado River at Imperial Dam.

Water diverted for irrigation and that returns to the river system as runoff or deep percolation has a higher concentration of TDS than water that stays in the river. Under the Twin Pots Alternative, the salinity (TDS) concentration in water leaving the unit would increase because 1 percent more of the outflow would be lower-quality agricultural return flows. Salt loads would decline, however, since 22 percent less water would be leaving the unit as runoff and irrigation deep percolation.

The projected increase in the mean TDS concentration to 617 mg/L would be well below the state water quality criteria for agriculture (1,200 mg/L), but would indicate a slight restriction on use for irrigation (see Tables 3.7-1 and 3.7-2).

Table 3.7-18
Flow and Salinity Impacts on the Colorado River for the Twin Pots Alternative

	Flow		TDS Concentration		Salt Mass (load)	
	(1,000 ac-ft/yr)	% Change	(mg/L)	% Change	(1,000 tons/yr)	% Change
Colorado River[a]	7,271	NA	834	NA	8,253	NA
Lake Fork River near Myton						
Baseline	27.2	NA	834	NA	22.1	NA
Twin Pots	20.5	NA	617	NA	17.2	NA
Change (baseline to Twin Pots)	-6.7	-25	33	6	-4.9	-22
Colorado River with Twin Pots[b]	7,264	-0.1	835	0.1	8,248	-0.1

Notes:
NA = Not applicable.
[a]At Imperial Dam; 50-year modeled average.
[b]New values based on estimated impact on the Colorado River.

3.7.6.6.2 Potential Operational Impacts on Environmental Contaminants. Projected changes in water quality and trace elements from implementing the Twin Pots Alternative were estimated and compared to established water quality criteria, assessment guidelines, and effect levels. Toxicity assessments provided the basis to evaluate whether beneficial uses relating to fish and wildlife would be impaired.

3.7.6.6.2.1 Contaminants in Surface Waters. Under the Twin Pots Alternative, mean trace element concentrations for arsenic, boron, iron, manganese, and gross alpha radioactivity would increase by measurable amounts (see Table 3.7-19), but none of the mean trace element concentrations projected would exceed established water quality criteria (see Table 3.7-1).

Although mean trace element concentrations in the lower Lake Fork River are projected to increase above baseline conditions, changes in the frequency and magnitude of peak (maximum) concentrations were not modeled and are unknown. However, the projected 6 percent (33 mg/L) increase in the mean TDS concentration to 617 mg/L is expected to proportionately increase mean concentrations of all dissolved ionic constituents, including selenium. Consequently, the number of agricultural water quality exceedances for TDS and boron, and trace element contaminant effects in localized areas near the lower Lake Fork/Duchesne River are expected to either increase slightly or remain essentially the same as baseline conditions. Water quality impacts would likely be limited to these low-elevation river reaches and areas currently experiencing high TDS concentrations and/or trace element exceedances.

3.7.6.6.2.2 Contaminants in Biota. Under the Twin Pots Alternative, projected average selenium concentrations in fall fish tissues (3.9 μg/g) would remain at elevated levels (above the 85th percentile of 2.9 μg/g), and in summer fish tissues (5.24 μg/g) would remain within the "level of concern" identified for fish and dietary criteria (2 to 6 μg/g). Consequently, the projected 6 percent increase in selenium levels is not expected to increase the general level of toxicity in resident fish and wildlife compared to baseline conditions.

Projected selenium levels in fish-eating western grebe eggs (4.3 μg/g) would remain within the currently measured "level of concern" range of 3 to 8 μg/g. Similarly, projected selenium levels in aquatic plants (3.04 μg/g) would remain within the 2 to 6 μg/g dietary "level of concern" range established for fish and wildlife.

Table 3.7-19 Projected Trace Element Concentrations for the Twin Pots Alternative Based on Projected Annual Mean Total Dissolved Solids (TDS) Concentrations		
Annual Mean Concentrations (mg/L)		
	Lower Lake Fork River	
Water Quality Constituent	**Baseline**	**Twin Pots**
Arsenic	0.0039	0.0041
Boron	0.4[illegible]3	0.443
Cadmium*	<0.001	<0.001
Chromium*	<0.001	<0.001
Copper*	<0.0[illegible]1	<0.0[illegible]1
Iron	0.019	0.0201
Lead*	<0.001	<0.001
Manganese	0.083	0.088
Mercury*	<0.0001	<0.0001
Selenium-D*	<0.001	<0.001
Selenium-T*	<0.001	<0.001
Zinc*	<0.01	<0.01
Gross Alpha**	0.0051	0.0054

*For baseline means less than the detection limit, no change in concentration can be predicted.
**In nanocuries per liter (nCi/L).

Average copper levels (4.27 μg/g) in summer fish tissues and zinc levels (182 μg/g) in fall fish tissues would remain at elevated levels (above the 85th percentiles of 4.0 and 136.8 μg/g, respectively). The projected 6 percent increase in tissue concentrations for these two trace elements, however, would not result in a significant increase in toxicological effects.

There is already some level of beneficial use impairment in Upalco Unit resident fish and wildlife populations because of the presence of trace elements at levels considered borderline toxicity. Implementation of the Twin Pots Alternative is not expected to change this level of fish and wildlife toxicity or cause an additional impairment of beneficial uses relative to fish and wildlife since no significant toxicological changes from baseline are expected.

3.7.6.6.3 Mitigation. Mitigation would be the same as described for the Proposed Action (see Section 3.7.6.3.3).

3.7.6.7 No Action Alternative

3.7.6.7.1 Trends. Expected water resource trends if the project is not implemented are described in Section 3.6.6.7.1 Water Resources and Hydrology. No trends have been identified with respect to contamination by potentially toxic trace elements.

3.7.6.7.2 Future Conditions. The water resources system (high mountain lakes, rivers, reservoirs, canals, etc.) and future water quality conditions associated with the continued use of this water supply and delivery system would remain essentially the same as baseline conditions. However, the gradual conversion from flood to sprinkler irrigation would lead to a decrease in irrigation deep percolation and surface runoff (agricultural return flows) because of improved irrigation efficiencies.

With no change in irrigation diversions (169,000 acre-feet per year) but irrigation losses reduced because of improved irrigation efficiencies, agricultural return flows entering the lower Lake Fork River would be reduced. Consequently, both the annual amount of water leaving the unit (outflow) and the annual salt load in the lower river would be reduced. The salinity (TDS) concentration in water leaving the unit would also decline because a smaller percentage of the outflow would be low-quality agricultural return flows. With a reduced salt load leaving the unit, salinity is expected to decrease in the Colorado River at Imperial Dam.

All applicable water quality criteria and beneficial use designations would continue to be met in the upper and middle portions of the Upalco Unit. In lower-elevation reaches, however, the gradual reduction in TDS concentrations in the lower Lake Fork River associated with the conversion from flood to sprinkler irrigation would result in a corresponding decrease in average concentrations of all dissolved ionic constituents, including selenium. Consequently, the number of agricultural water quality criteria exceedances for TDS and boron, and trace element contaminant effects are expected to decrease slightly or remain essentially the same as baseline conditions. Some maximum TDS and boron values would continue to exceed the state numeric criteria for agricultural use, and some maximum trace element values for mercury, silver, and/or lead would continue to exceed the EPA chronic or acute freshwater criteria.

3.7.6.7.3 Consequences of Not Meeting Project Needs. The consequences of not meeting project needs are described in Section 3.6.6.7.3 Water Resources and Hydrology.

3.7.7 Cumulative Impacts

To assess the cumulative impact on salinity concentrations and salt loads leaving the Uinta Basin on the Colorado River system, the amount of water and salt leaving the Upalco Unit under the Proposed Action and each of the Upalco Unit alternatives is combined with the amount of water and salt leaving the Uintah Unit under the Proposed Action and compared to baseline conditions. This cumulative change in flows, salt (TDS) concentrations, and salt loads leaving the Uinta Basin determines the cumulative effect downstream on the Colorado River system salinity control program. The salinity (TDS) limit in the Colorado River at Imperial Dam is 879 mg/L.

Similarly, the cumulative impact on environmental contaminants in Uinta Basin biota was assessed by combining the net impact of the Proposed Action and each of the Upalco Unit alternatives with the net impact of the Uintah Unit Proposed Action.

3.7.7.1 Proposed Action–Talmage

Table 3.7-20 summarizes the estimated cumulative change in Uinta Basin and Colorado River flows, salt concentrations, and salt loads when the Proposed Actions for the Upalco and Uintah Units are combined. The cumulative impact of combining both Proposed Actions would be to reduce the average annual flow leaving the Uinta Basin about 34 percent (25,300 acre-feet per year), increase salt concentrations about 24 percent to 662 mg/L, and reduce salt loads about 19 percent (10,100 tons per year). Consequently, flows and salt loads in the Colorado River at Imperial Dam would be reduced by an estimated 0.3 and 0.1 percent, respectively. The salt concentration in the Colorado River would increase from 834 mg/L to 836 mg/L, which is below the salinity (TDS) limit (879 mg/L) established at Imperial Dam.

Cumulative water quality criteria exceedances would be increased approximately in proportion to the combined increase (24 percent) in the mean

Table 3.7-20 **Cumulative Flow and Salinity Impacts on the Colorado River with the Upalco Unit Proposed Action and Uintah Unit Proposed Action**						
	Flow		**TDS Concentration**		**Salt Mass (load)**	
	(1,000 ac-ft/yr)	**% Change**	**(mg/L)**	**% Change**	**(1,000 tons/yr)**	**% Change**
Colorado River[a]	7,271	NA	834	NA	8,253	NA
Lake Fork and Uinta Rivers						
Baseline (Upalco and Uintah Units)[b]	73.7	NA	836	NA	53.7	NA
Proposed Actions (Upalco and Uintah units[c])	48.4	NA	662	NA	43.6	NA
Change	-25.3	-34	126	24	-10.1	-19
Colorado River with Proposed Actions[c]	7,246	-0.3	836	0.2	8,243	-0.1

Notes:
NA = Not applicable.

[a]At Imperial Dam; 50-year modeled average.
[b]Concentration is a weighted average; others are sums.
[c]New values based on estimated impact on the Colorado River.

TDS concentration shown in Table 3.7-20. Although the Uintah Unit's Proposed Action individually would result in a 23 percent increase in mean contaminant concentrations in low-elevation Uinta River waters, the combined cumulative increase in TDS and environmental contaminant levels would be less than the individual increase (29 percent) estimated for the Upalco Unit's Proposed Action (CH2M HILL/Horrocks 1996c). The projected cumulative increase (24 percent) in environmental contaminant levels is not considered toxicologically significant.

There is already some level of beneficial use impairment in Uinta Basin resident fish and wildlife populations because of the presence of trace elements at levels considered borderline toxicity.

Implementation of the Proposed Actions for the Upalco and Uintah Units is not expected to change this level of fish and wildlife toxicity or cause an additional impairment of beneficial uses relative to fish and wildlife since no significant cumulative changes in environmental contaminant levels in biota from baseline are expected.

3.7.7.2 Cow Canyon Alternative

Table 3.7-21 summarizes the estimated cumulative change in Uinta Basin and Colorado River flows, salt concentrations, and salt loads when the Upalco Unit's Cow Canyon Alternative is combined with the Uintah Unit's Proposed Action. The cumulative impact of combining the Cow Canyon Alternative with the Uintah Unit's Proposed Action would be to reduce the average annual flow leaving the Uinta Basin about 34 percent (25,400 acre-feet per year), increase salt concentrations about 25 percent to 668 mg/L, and reduce salt loads about 19 percent (10,100 tons per year). Consequently, flows and salt loads in the Colorado River at Imperial Dam would be reduced by an estimated 0.3 and 0.1 percent, respectively. The salt concentration in the Colorado River would increase from 834 mg/L to 837 mg/L, which is below the salinity (TDS) limit (879 mg/L) established at Imperial Dam.

Cumulative water quality criteria exceedances would be increased approximately in proportion to the combined increase (25 percent) in the mean TDS concentration shown in Table 3.7-21. However,

Table 3.7-21 Cumulative Flow and Salinity Impacts on the Colorado River with the Upalco Unit Cow Canyon Alternative and Uintah Unit Proposed Action						
	Flow		TDS Concentration		Salt Mass (load)	
	(1,000 ac-ft/yr)	% Change	(mg/L)	% Change	(1,000 tons/yr)	% Change
Colorado River[a]	7,271	NA	834	NA	8,253	NA
Lake Fork and Uinta Rivers						
Baseline (Upalco and Uintah Units)[b]	73.7	NA	534	NA	53.7	NA
Cow Canyon and Uintah Unit Proposed Action[c]	48.3	NA	668	NA	43.6	NA
Change	-25.4	-34	134	25	-10.1	-19
Colorado River with Cow Canyon and Uintah Unit Proposed Action[c]	7,246	-0.3	837	0.4	8,243	-0.1

Notes:
NA = Not applicable.

[a]At Imperial Dam; 50-year modeled average.
[b]Concentration is a weighted average; others are sums.
[c]New values based on estimated impact on the Colorado River.

although the Uintah Unit's Proposed Action individually would result in a 23 percent increase in mean contaminant concentrations in low-elevation Uinta River waters, the combined cumulative increase in TDS and environmental contaminant levels would be less than the individual increase (30 percent) estimated for the Cow Canyon Alternative (CH2M HILL/Horrocks 1996c). The projected cumulative increase (25 percent) in environmental contaminant levels is not considered toxicologically significant.

There is already some level of beneficial use impairment in Uinta Basin resident fish and wildlife populations because of the presence of trace elements at levels considered borderline toxicity.

Implementation of the Cow Canyon Alternative with the Uintah Unit's Proposed Action is not expected to change this level of fish and wildlife toxicity or cause an additional impairment of beneficial uses relative to fish and wildlife since no significant cumulative changes in environmental contaminant levels in biota from baseline are expected.

3.7.7.3 Crystal Ranch Alternative

Table 3.7-22 summarizes the estimated cumulative change in Uinta Basin and Colorado River flows, salt concentrations, and salt loads when the Upalco Unit's Crystal Ranch Alternative is combined with the Uintah Unit's Proposed Action. The cumulative impact of combining the Crystal Ranch Alternative with the Uintah Unit's Proposed Action would be to reduce the average annual flow leaving the Uinta Basin about 30 percent (22,300 acre-feet per year), increase salt concentrations about 16 percent to 621 mg/L, and reduce salt loads about 19 percent (10,300 tons per year). Consequently, flows and salt loads in the Colorado River at Imperial Dam would be reduced by an estimated 0.3 and 0.1 percent, respectively. The salt concentration in the Colorado River would increase from 834 mg/L to 836 mg/L, which is below the salinity (TDS) limit (879 mg/L) established at Imperial Dam.

Table 3.7-22 Cumulative Flow and Salinity Impacts on the Colorado River with the Upalco Unit Crystal Ranch Alternative and Uintah Unit Proposed Action						
	Flow		TDS Concentration		Salt Mass (load)	
	(1,000 ac-ft/yr)	% Change	(mg/L)	% Change	(1,000 tons/yr)	% Change
Colorado River[a]	7,271	NA	834	NA	8,253	NA
Lake Fork and Uinta Rivers						
Baseline (Upalco and Uintah Units)[b]	73.7	NA	534	NA	53.7	NA
Crystal Ranch and Uintah Unit Proposed Action	51.4	NA	621	NA	43.4	NA
Change	-22.3	-30	87	16	-10.3	-19
Colorado River with Crystal Ranch and Uintah Unit Proposed Action[c]	7,249	-0.3	836	0.2	8,243	-0.1

Notes:
NA = Not applicable.

[a]At Imperial Dam; 50-year modeled average.
[b]Concentration is a weighted average; others are sums.
[c]New values based on estimated impact on the Colorado River.

Cumulative water quality criteria exceedances would be increased approximately in proportion to the combined increase (16 percent) in the mean TDS concentration shown in Table 3.7-22. However, the small increase (8 percent) in mean contaminant concentrations projected for the Crystal Ranch Alternative, when combined with the projected 23 percent increase in constituent concentrations under the Uintah Unit's Proposed Action, would not result in net adverse cumulative impacts on fish and wildlife (CH2M HILL/ Horrocks 1996c) because the projected cumulative increase (16 percent) in environmental contaminant levels is not considered toxicologically significant.

There is already some level of beneficial use impairment in Uinta Basin resident fish and wildlife populations because of the presence of trace elements at levels considered borderline toxicity.

Implementation of the Crystal Ranch Alternative with the Uintah Unit's Proposed Action is not expected to change this level of fish and wildlife toxicity or cause an additional impairment of beneficial uses relative to fish and wildlife since no significant cumulative changes in environmental contaminant levels in biota from baseline are expected.

3.7.7.4 Twin Pots Alternative

Table 3.7-23 summarizes the estimated cumulative change in Uinta Basin and Colorado River flows, salt concentrations, and salt loads when the Upalco Unit's Twin Pots Alternative is combined with the Uintah Unit's Proposed Action. The cumulative impact of combining the Twin Pots Alternative with the Uintah Unit's Proposed Action would be to reduce the average annual flow leaving the Uinta Basin about 29 percent (21,700 acre-feet per year), increase salt concentrations about 15 percent to 615 mg/L, and reduce salt loads about 19 percent (10,200 tons per year). Consequently, flows and salt loads in the Colorado River at Imperial Dam would be reduced by an estimated 0.3 and 0.1 percent, respectively. The salt concentration in

Table 3.7-23 Cumulative Flow and Salinity Impacts on the Colorado River with the Upalco Unit Twin Pots Alternative and Uintah Unit Proposed Action						
	Flow		TDS Concentration		Salt Mass (load)	
	(1,000 ac-ft/yr)	% Change	(mg/L)	% Change	(1,000 tons/yr)	% Change
Colorado River[a]	7,271	NA	834	NA	8,253	NA
Lake Fork and Uinta Rivers						
Baseline (Upalco and Uintah Units)[b]	73.7	NA	534	NA	53.7	NA
Twin Pots and Uintah unit Proposed Action[c]	52	NA	615	NA	43.5	NA
Change	-21.7	-29	81	15	-10.2	-19
Colorado River with Twin Pots and Uintah Unit Proposed Action[d]	7,249	-0.3	836	0.2	8,243	-0.1

Note:
NA = Not applicable.

[a]At Imperial Dam; 50-year modeled average.
[b]Concentration is a weighted average; others are sums.
[c]New values based on estimated impact on the Colorado River.

the Colorado River would increase from 834 mg/L to 836 mg/L, which is below the salinity (TDS) limit (879 mg/L) established at Imperial Dam.

Cumulative water quality criteria exceedances would be increased approximately in proportion to the combined increase (15 percent) in the mean TDS concentration shown in Table 3.7-23. However, the small increase (6 percent) in mean contaminant concentrations projected for the Twin Pots Alternative, when combined with the projected 23 percent increase in constituent concentrations under the Uintah Unit's Proposed Action, would not result in net adverse cumulative impacts on fish and wildlife (CH2M HILL/Horrocks 1996c) because the projected cumulative increase (15 percent) in environmental contaminant levels is not considered toxicologically significant.

There is already some level of beneficial use impairment in Uinta Basin resident fish and wildlife populations because of the presence of trace elements at levels considered borderline toxicity. Implementation of the Twin Pots Alternative with the Uintah Unit's Proposed Action is not expected to change this level of fish and wildlife toxicity or cause an additional impairment of beneficial uses relative to fish and wildlife since no significant cumulative changes in environmental contaminant levels in biota from baseline are expected.

3.8 Aquatic Resources

3.8.1 Introduction

This analysis summarizes results of fisheries and aquatic habitat studies conducted during 1994; assesses potential impacts on these resources resulting from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit; and recommends appropriate mitigation measures. These subjects are described in greater detail in the Aquatic Resources Technical Report (CH2M HILL/Horrocks 1996a).

3.8.2 Issues Eliminated from Further Analysis

All issues identified during public scoping were analyzed. None were eliminated.

3.8.3 Issues Addressed in the Impact Analysis

Issues addressed include high mountain lakes stabilization; conservation pools and fish-rearing potential in proposed storage reservoirs; instream flows and habitat for fish; channel-shaping flows; fish passage; and stream habitat improvements. Significant adverse impacts on aquatic resources predicted to occur as a result of implementing the Upalco Unit Proposed Action or alternatives are addressed in the analysis and include the following:

- Inundation of 2.6 miles of the Yellowstone River by Crystal Ranch Reservoir, loss of the existing fishery in this reach, and blockage of upstream fish passage at the dam (Proposed Action and Crystal Ranch Alternative).

- Inundation of 2.0 miles of the Yellowstone River by Upper Yellowstone Reservoir, loss of the existing fishery in this reach, and blockage of upstream fish passage at the dam (Cow Canyon Alternative).

- Reduction in "effective stream habitat" in some reaches of the Lake Fork and Yellowstone Rivers (Proposed Action and all alternatives).

3.8.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the project feature sites for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

3.8.5 Affected Environment

3.8.5.1 Proposed Action

3.8.5.1.1 High Mountain Lakes. The 10 high mountain lakes proposed for stabilization are in the upper Yellowstone River drainage. Recreational fisheries in these lakes are exclusively for brook trout (*Salvelinus fontinalis*) and/or cutthroat trout (*Oncorhynchus clarki*). Brook trout are present in each lake, while cutthroat trout are present in Deer, Bluebell, East Timothy, Five Point, and Superior Lakes. Fishing pressure at most lakes is light to moderate (Wildlife Resources 1981, 1986).

Water levels and aquatic habitat in all but Farmers, White Miller, and Water Lily Lakes, which are stable, decline during summer and early fall as water is released to meet downstream demands. Depending on the lake, water levels can fluctuate between about 5 feet and 27 feet. Lake surface area can generally decline about 50 percent during drawdowns. As the lakes begin to refill in late fall and water is stored for the following year, flows to outlet streams and their aquatic habitat are reduced or eliminated until late spring.

3.8.5.1.2 Dams and Reservoirs. Crystal Ranch Dam would be at river mile (RM) 8.5 on the Yellowstone River. The reservoir would extend 2.6 miles in portions of river study reaches YL-A and YL-B, which are shown on Map 3.8-1. Aquatic resources in these and other study reaches in the Lake Fork and Yellowstone Rivers are described below in Section 3.8.5.1.3 River Corridors.

The offstream Big Sand Wash Reservoir, which would be enlarged 9,000 acre-feet under the Proposed Action, supports a popular recreational fishery for trout, bass, and sunfish. It has a conservation pool of 1,200 acre-feet of water that the State of Utah purchased to enhance reservoir fisheries habitat.

3.8.5.1.3 River Corridors.

3.8.5.1.3.1 Flow Regime. Two primary factors limiting fish populations in the Lake Fork and

Yellowstone Rivers are instream habitat during low-flow growth periods, which is best represented by September flows, and instream habitat during low-flow winter months. Estimated September and winter flows under baseline conditions in river reaches where instream fish habitat was evaluated are compared against projected flows under the Proposed Action and alternatives in Section 3.8.6 Impact Analysis.

3.8.5.1.3.2 Water Temperature. Maximum daily water temperatures at Upalco Unit gaging stations during early August ranged from 58°F just downstream from Moon Lake to 83°F near the confluence of the Lake Fork and Duchesne Rivers. This temperature regime supports the observed longitudinal distribution of fish species in project area streams based on their temperature tolerances (Bell 1991; Eaton et al. 1995).

Maximum temperatures in the upper Lake Fork (58°F) and upper Yellowstone (66°F) Rivers are within optimal rearing temperatures of 54 to 66°F for rainbow trout (*Oncorhynchus mykiss*) and 39 to 70°F for brown trout (*Salmo trutta*). They are well below upper tolerance temperatures for brook trout and cutthroat trout (72°F), which are present in upper river reaches. At the Lake Fork-Yellowstone River confluence, water temperatures are too warm for brook trout. Further downstream at the "C" Canal diversion near Altamont, temperatures approach the upper tolerance limit (75°F) for rainbow and brown trout.

Temperatures of 78 to 83°F at the most downstream Lake Fork stations exceed upper tolerance rearing temperatures of 72 to 75°F for all trout species observed in the Upalco Unit and upper lethal temperatures for brook trout (77°F) and cutthroat trout (73°F). Only one brown trout was collected near one of the more downstream stations (in study reach LF-C2), and no trout were collected below this point. Maximum temperatures in the lower Lake Fork River exceeded 78°F and are more suited to carp (*Cyprinus carpio*), sunfish, and, to some extent, suckers, the predominant fish observed in the lower river.

3.8.5.1.3.3 Habitat. Fisheries habitat in each study reach shown on Map 3.8-1 is briefly summarized below.

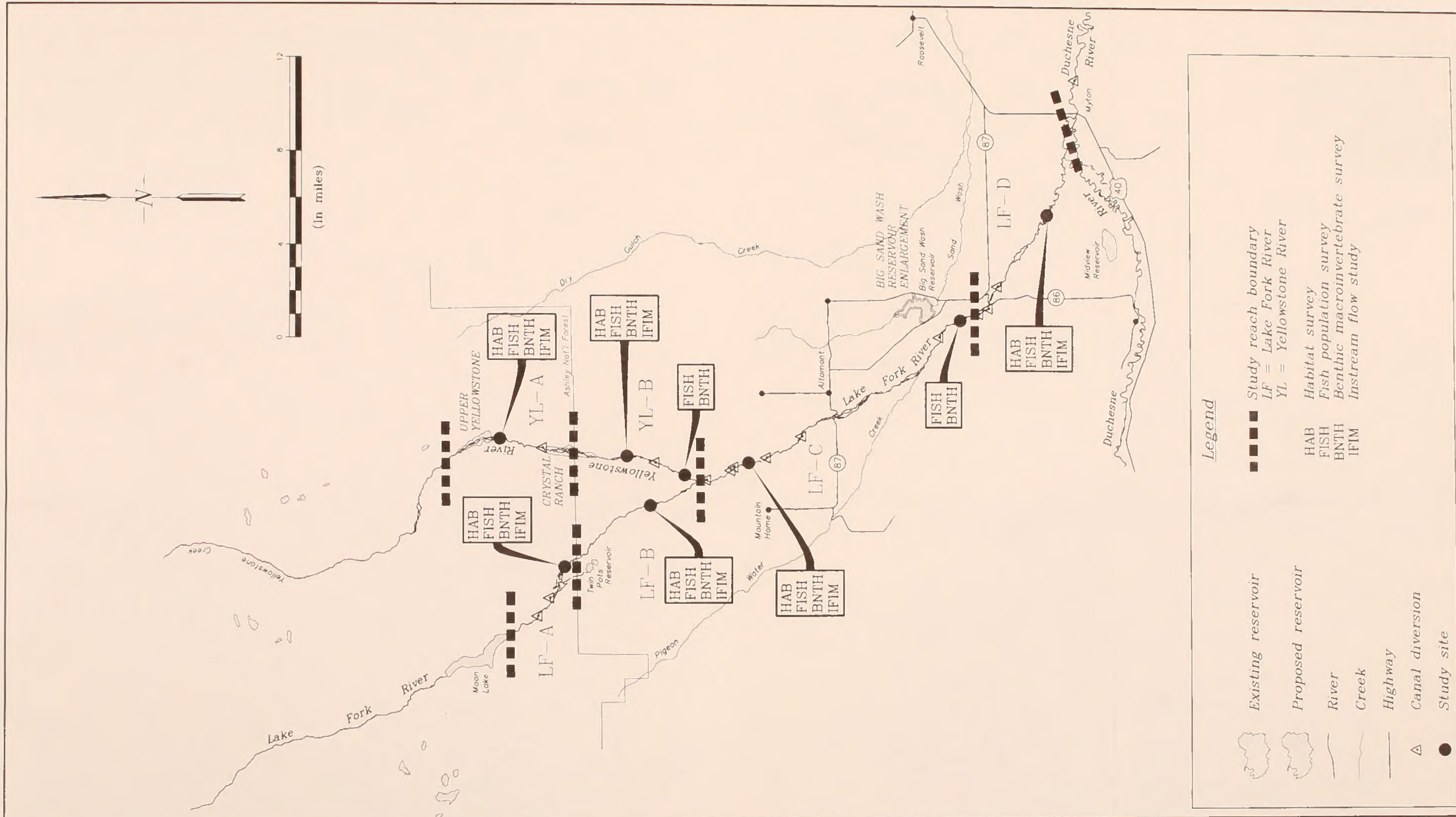
Upper Lake Fork River (Reach LF-A). This reach extends 3.4 miles from the Farnsworth Canal diversion to the Ashley National Forest/Tribal boundary. Fisheries habitat is generally very good. It is characterized by an abundance of large, deep pools, cool temperatures, clear water, clean substrates, and extensive food-producing areas (clean cobbles in riffles).

Middle Lake Fork River (Reach LF-B). This reach extends 7.4 miles from the Forest/Tribal boundary downstream to the Yellowstone River confluence. Fisheries habitat is generally poor because of the severe lack of pools. Spawning habitat is available, but fry rearing habitat is lacking except in pocket water. Low-flow conditions, also a problem, now create glides where pools might otherwise have existed.

Middle Lake Fork River (Reach LF-C). This reach extends 17.0 miles from the Yellowstone River confluence to the Red Cap Canal diversion. Overall, trout habitat is fair. Primary limiting factors are the lack of pools and spawning areas and the absence of instream cover. The conspicuous absence of small cottonwoods suggests cattle preclude their recruitment.

Lower Lake Fork River (Reach LF-D). This reach extends 11.1 miles from the Red Cap Canal diversion downstream to the Duchesne River confluence at Myton. Overall, fisheries habitat is good for carp, but poor to nonexistent for trout. Limiting factors for trout include high water temperatures, poor water quality, lack of spawning and food-producing areas, and lack of instream cover other than water turbidity. Water quality problems (primarily the result of silty irrigation return flows) are the principal cause of poor trout habitat, although sparse riparian vegetation is also a factor.

Upper Yellowstone River (Reach YL-A). This reach extends 7.8 miles from the confluence with Swift Creek downstream to the Forest/Tribal



Map 3.8-1
Upalco Unit
Aquatic Resources Study Sites

boundary. The upper half of the proposed Crystal Ranch Reservoir, which would inundate 2.5 miles of river, would be in the most downstream portion of this reach. Fisheries habitat is generally fair, with side channels probably providing very important spawning and early rearing/refuge areas. Limiting factors include a lack of pools and overhead cover; relatively steep channel gradient, which limits the amount of holding water in riffles and rapids; and flood flows, which sweep away most large woody debris and scour a wide channel.

Lower Yellowstone River (Reach YL-B). This reach extends 10.2 miles from the Forest/Tribal boundary downstream to the Lake Fork River confluence. The lower half of the proposed Crystal Ranch Reservoir would be in the most upstream portion of this reach. Overall, fisheries habitat is fair. There are adequate spawning areas, and food production potential is very high. However, the few pools present are shallow and have limited overhead cover. Channel exposure is also a major problem and would benefit from encroachment by riparian vegetation and cottonwood stand regrowth.

3.8.5.1.3.4 Benthic Invertebrates. Macroinvertebrate community structure and taxa observed in the Lake Fork changed longitudinally along the river. Study results indicate cool, running water/erosional habitat in the three upstream study reaches (LF-A, LF-B, LF-C1). This is reflected in the dominant faunal groups collected (Trichoptera or caddisflies, Ephemeroptera or mayflies) and the relatively high abundance of common net spinners (caddisfly Family Hydropsychidae) and spiny crawlers (mayfly Family Ephemerellidae), which are generally found in faster-moving, clear, cool water.

Study results in the two most downstream reaches of the Lake Fork (LF-C2, LF-D) indicate warm, running water/depositional habitat. Dominant faunal groups in these reaches included Coleoptera (aquatic beetles) and Diptera (midges). The dominant riffle beetle (Family Elmidae) in Reach LF-C2 is often associated with warmer, slow-moving water, which is consistent with the very low summer flows in this reach because of upstream irrigation diversions. Diversity and evenness (the distribution of organisms among taxa) were also lower in the two downstream reaches than upstream. In general, diversity values between 1 and 3 represent slightly degraded conditions (Reaches LF-A, LF-C2, and LF-D) while values greater than 3 represent clean water (Reaches LF-B and LF-C1) (Wilhm and Dorris 1968).

Macroinvertebrate community structure in the Yellowstone River varied considerably among the three study reaches. However, study results indicate cool, running water/erosional habitat, even in Reach YL-B2 in the lower Yellowstone, which is dewatered in late summer. Ephemeroptera or Trichoptera was the dominant faunal group in each reach. Taxa diversity, number of taxa, and evenness decreased in a downstream direction, while total density increased. Diversity indices generally indicate clean water in Reach YL-A and slightly degraded conditions in Reaches YL-B1 and YL-B2.

3.8.5.1.3.5 Fish Populations. Fish population studies were conducted in eight reaches of the Lake Fork and Yellowstone Rivers (see Map 3.8-1). Table 3.8-1 lists fish species collected, and Figure 3.8-1 depicts trout density and relative abundance in each river reach. Study results are summarized below.

Upper Lake Fork River (Reach LF-A). Fish species collected included brook, brown, and hybrid rainbow/cutthroat trout; mountain sucker (*Catostomus platyrhynchus*); sculpin (*Cottus* spp); and speckled dace (*Rhinichthys osculus*). The total trout population estimate was 648 fish per mile of main stem river. Of this total, brook trout were most abundant (43 percent), followed by rainbow/cutthroat trout (39 percent) and brown trout (18 percent). Trout collected were 38 to 500 millimeters (mm) long and averaged 233 mm.

Middle Lake Fork River (Reach LF-B). Brook, brown, and rainbow/cutthroat trout; sculpin; and speckled dace were collected in this reach. The total trout population estimate was 930 fish per mile of main stem river. Brown trout were most abundant (63 percent), followed by rainbow/cutthroat trout (36 percent) and brook trout (1 percent).

Table 3.8-1
Distribution of Fish Species Collected in the Lake Fork (LF) and Yellowstone (YL) Rivers

Species	Study Reach/Station							
	LF-A	LF-B	LF-C1	LF-C2	LF-D	YL-A	YL-B1	YL-B2
Brook trout	●	●				●	●	
Brown trout	●	●	●	●		●	●	●
Rainbow, cutthroat, and/or hybrids	●	●	●			●	●	●
Mountain whitefish			●[a]			●		●
Sculpin spp.	●	●	●				●	●
Mountain sucker	●		●			●	●	●
Flannelmouth sucker			●					
White sucker			●	●	●			
Carp					●			
Speckled dace	●	●	●					●
Minnow spp.[b]					●			
Green sunfish					●			

[a]Collected in an off-channel seep fed by an irrigation canal.
[b]Probably speckled dace.

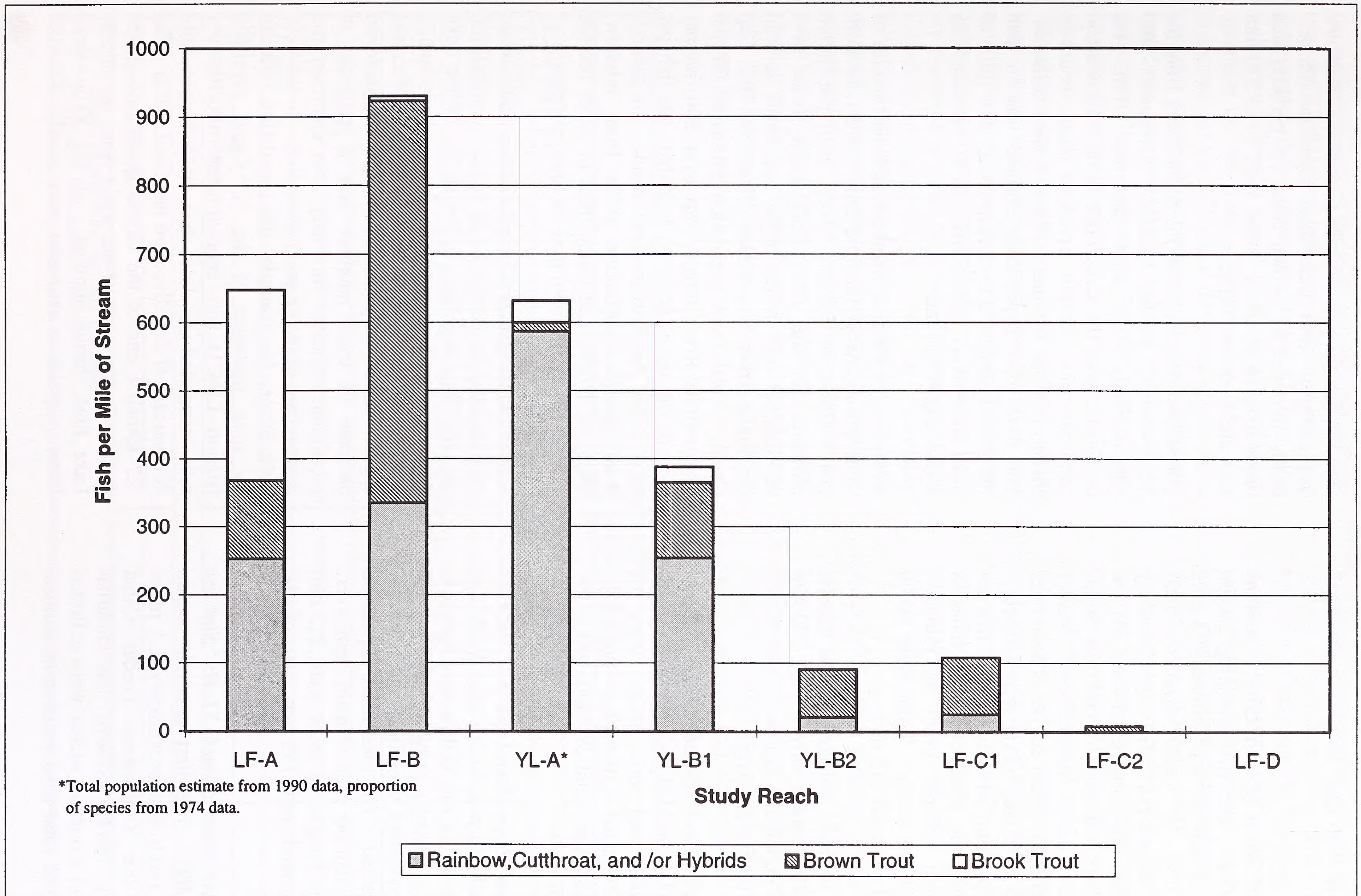


Figure 3.8-1
Trout Population Estimates (fish per mile) and Relative Abundance of Species by Study Reach, Upalco Unit

Trout were 65 to 370 mm long and averaged 235 mm.

Middle Lake Fork River (Reach LF-C: Stations LF-C1 and LF-C2). The first sampling station (LF-C1) in this reach is approximately 1 mile upstream from the "C" Canal diversion near Altonah, and the second (LF-C2) is approximately 2 miles downstream from this diversion. At the first station, brown and rainbow/cutthroat trout, sculpin, speckled dace, flannelmouth sucker (*Catostomus latipinnis*), white sucker (*Catostomus commersoni*), and mountain sucker were collected. The total trout population estimate was 108 fish per mile of main stem river, with about three times as many brown trout (83 per mile) as rainbow/cutthroat trout (25 per mile). Trout were 80 to 423 mm long and averaged 215 mm.

The only trout species collected at the second station (LF-C2) was a single brown trout 320 mm long. Estimated population size was eight brown trout per mile of main stem river.

Lower Lake Fork River (Reach LF-D). Carp, minnows (probably speckled dace), green sunfish (*Lepomis cyanellus*), and white sucker were the only fish species collected in this reach. Population estimates were 2,377 carp and 29 white sucker per mile of main stem river.

Upper Yellowstone River (Reach YL-A). Wildlife Resources sampled fish populations near the Bridge Campground and east of the Yellowstone Ranch in September 1990. Brook, brown, rainbow, and cutthroat trout; mountain whitefish; and mountain sucker were collected. The total trout population estimate was 631 fish per mile of main stem river. Weighted average lengths of trout were 215 mm near the campground and 193 mm east of the ranch.

Lower Yellowstone River (Reach YL-B: Stations YL-B1 and YL-B2). The first sampling station (YL-B1) in this reach is approximately 1.1 miles upstream from the Yellowstone Feeder Canal diversion. Brook, brown, rainbow, and cutthroat trout; sculpin; and mountain sucker were collected at this station. The total trout population estimate was 388 fish per mile of main stem river. Rainbow and cutthroat trout were most abundant (65 percent), followed by brown trout (29 percent) and brook trout (6 percent). Trout were 55 to 330 mm long and averaged 191 mm.

The second station (YL-B2) is downstream from the Yellowstone Feeder Canal diversion and approximately 0.3 mile upstream from the confluence with the Lake Fork River. Brown and cutthroat trout, sculpin, speckled dace, mountain sucker, and one mountain whitefish were collected. The total trout population estimate was 91 fish (70 brown trout, 21 cutthroat trout) per mile of main stem river. Trout were 80 to 495 mm long and averaged 238 mm.

Overview. Estimated numbers and distribution of trout species change longitudinally in the Lake Fork and Yellowstone Rivers. Total trout population estimates for the Lake Fork range from over 900 fish per mile in the upper reaches to none in the lower river downstream from the Red Cap Canal. Total trout population estimates for the Yellowstone River range from over 600 fish per mile in the upper reach to less than 100 fish per mile in the downstream-most reach. In general, trout species composition shifts from rainbow/cutthroat hybrids and brook trout in upper reaches of both rivers to brown trout in lower reaches.

The two most apparent factors causing downstream changes in trout numbers and species composition are river flow and water temperature. In the Lake Fork system, flows generally decrease proceeding downstream because of diversions. This decrease appears most responsible for the downstream decrease in trout numbers and is reflected in population estimates for study sites upstream and downstream of major canal diversions. In the Lake Fork River, for example, the population estimate for trout upstream of the "C" Canal diversion (station LF-C1) was approximately 100 fish per mile compared to less than 10 fish per mile downstream of this diversion (station LF-C2). The "C" Canal is one of the largest diversions on the river and takes most of the water from the middle Lake Fork during summer. In the Yellowstone River, population estimates were nearly 400 trout per mile upstream of the Yellowstone Feeder Canal (station YL-B1) and less than 100 trout per mile downstream of this diversion (station YL-B2). The Yellowstone Feeder Canal is the largest irrigation diversion on the river. Temperatures below this diversion and the "C" Canal diversion appear to be tolerable for trout as indicated by their presence; therefore, the decrease in habitat resulting from decreased flows appears to be the factor most limiting trout numbers.

The downstream increase in river water temperatures during summer appears to be the factor that most controls trout species composition. Increasing downstream water temperatures in the Lake Fork are primarily a result of flow reduction because of irrigation withdrawals, as well as decreasing elevation and associated warmer ambient air temperatures at these lower elevations. In addition, stream channels in the lower river reaches are generally wider, have a lower gradient, and less riparian shading. These factors also contribute to the substantial downstream increase in water temperatures.

Brook trout and cutthroat trout have the narrowest optimal temperature range and lowest temperature tolerance of trout species collected during the study. It is not surprising these species or rainbow/cutthroat hybrids are only found in upper reaches of both rivers where temperatures are lowest. In downstream reaches, trout species composition shifts toward rainbow and brown trout, which tolerate warmer water temperatures than brook and cutthroat trout. In the more downstream reaches of both rivers, almost all trout collected were brown trout. No trout were collected in the most downstream reach of the Lake Fork River because of poor water quality resulting from high temperature and heavy sediment load, both attributable to decreased river flows and irrigation return flows.

3.8.5.1.3.6 Fish Passage. Table 3.8-2 lists fish passage conditions at the 13 canal diversions in the Upalco Unit–11 on the Lake Fork River and 2 on the Yellowstone River. Five of these diversions are temporary structures. They are typically bulldozed river-rock sills just downstream from the canal

Table 3.8-2
Existing Conditions of Upalco Unit Diversion Dams

	Type	Existing Fish Passage?
Lake Fork River		
Farnsworth	P	No
Rowley	T	Yes
U.S. Lake Fork	P	No
Boneta	None	Yes
Dry Gulch No. 1	T	Yes
"C" Canal	P	No
South Boneta	T	Yes
Purdy	P	Yes
Uteland	None	Yes
Red Cap	P	No
Hamilton-Knudsen	T	Yes
Yellowstone River		
Crystal Ranch	T	Yes
Yellowstone/Payne	P	No

P = Permanent structure; usually concrete.
T = Temporary; bulldozed rubble.

intake that usually remain intact until the next high-flow event and possibly until next year's peak runoff. This type of structure usually creates a very short rapids/cascade, which is not inherently a barrier to fish passage except at extremely low flow. As these structures deteriorate, they become riffle-like in nature, making them less of a barrier, even at low flow.

There are six permanent diversion structures in the Upalco Unit (Table 3.8-2). These are typically low concrete dams that extend across the entire channel. Five of these—the Farnsworth, U.S. Lake Fork, "C", Red Cap, and Yellowstone Feeder/Payne Canal diversions—are impassable to upstream migrating fish. Only the Purdy Canal diversion, the sixth permanent structure, is believed to allow fish passage in its present configuration.

There are two other permanent blocks to upstream fish passage in the Upalco Unit—Moon Lake Dam on the Lake Fork River and the Yellowstone hydroelectric diversion dam on the Yellowstone River. Neither dam has a fish ladder. Off-channel dams, such as Big Sand Wash Dam, do not impede fish passage in main stem rivers.

3.8.5.1.4 Fish and Wildlife Enhancement.

3.8.5.1.4.1 Stream Habitat Improvements. Stream habitat improvements are proposed under the Proposed Action for the Lake Fork and Yellowstone Rivers and are described in Chapter 2, Section 2.2.2.6.1.1. These improvements would include the placement of instream structures, bank stabilization, and the enhancement of riparian vegetation in areas where they could be effectively applied and the potential for benefits to aquatic resources are greatest. Examples of such areas would include those that presently have, or are expected to have after project implementation, degraded instream and/or riparian habitat, heavy angling pressure, or those areas having adequate angler access.

ECOTONE Environmental Consulting, Inc. (1995c) has tentatively identified sections of river in the Upalco Unit that appear to have the greatest potential for improvement. These corridors include 5 miles of the Lake Fork River within an 18-mile reach from the Moon Lake outlet to 7 miles below its confluence with the Yellowstone River, and 2 miles of the Yellowstone River within a 4.5-mile reach from the proposed Crystal Ranch Dam site to its confluence with the Lake Fork River. Only the proposed stream improvements would potentially affect aquatic resources in the main stem Lake Fork (Reaches LF-A, LF-B, and LF-C) and Yellowstone Rivers (Reach YL-B). Along with these river corridors, some of the stream reaches (both upstream and downstream) at some diversion dams may also represent areas that could benefit from improvements. The riparian area, streambanks, and channel bottoms have been degraded through diversion structure maintenance.

3.8.5.1.4.2 Clay Basin Settlement Pond Fish Enhancement. Clay Basin Pond would be dredged and fish structures installed to enhance fish habitat.

3.8.5.1.4.3 Twin Pots Reservoir Improvement. Proposed water management activities at Twin Pots Reservoir would provide year-round fish habitat and are intended to improve the fisheries potential of this reservoir, which supports rainbow, brook, and cutthroat trout, mountain whitefish, and mountain sucker. Reservoir habitat is now degraded because of widely fluctuating water levels (FWS 1985).

3.8.5.1.5 Recreation Developments. Fair quality fish habitat in Reach YL-B of the Yellowstone River would be improved through construction of fish habitat structures near the proposed Crystal Ranch Campground.

3.8.5.2 Cow Canyon Alternative

3.8.5.2.1 High Mountain Lakes. Aquatic resources are the same as described for the Proposed Action (see Section 3.8.5.1.1).

3.8.5.2.2 Dams and Reservoirs. Upper Yellowstone Reservoir would extend 1.7 miles on the Yellowstone River in the upstream portion of Reach YL-A (see Map 3.8-1). Aquatic resources in this and downstream reaches of the Yellowstone and Lake Fork Rivers were described in

Section 3.8.5.1.3. The Cow Canyon Alternative also includes enlargement of Big Sand Wash Reservoir by 9,000 acre-feet. Its aquatic resources are the same as described for the Proposed Action (see Section 3.8.5.1.2).

3.8.5.2.3 River Corridors. Aquatic resources in reaches of the Yellowstone and Lake Fork Rivers that would potentially be affected by the Cow Canyon Alternative were described under the Proposed Action (see Section 3.8.5.1.3).

3.8.5.2.4 Fish and Wildlife Enhancement. The only fish and wildlife enhancement relative to aquatic resources proposed under the Cow Canyon Alternative is stream habitat improvement. Aquatic resources potentially affected by stream improvements are the same as described for the Proposed Action (see Section 3.8.5.1.4.1).

3.8.5.2.5 Recreation Developments. There would be no recreation developments relative to aquatic resources.

3.8.5.3 Crystal Ranch Alternative

3.8.5.3.1 High Mountain Lakes. Aquatic resources are the same as described for the Proposed Action (see Section 3.8.5.1.1).

3.8.5.3.2 Dams and Reservoirs. Aquatic resources in the Yellowstone River at the proposed Crystal Ranch Reservoir site are the same as described for the Proposed Action (see Section 3.8.5.1.2).

3.8.5.3.3 River Corridors. Aquatic resources in reaches of the Yellowstone and Lake Fork Rivers that would potentially be affected by the Crystal Ranch Alternative were described under the Proposed Action (see Section 3.8.5.1.3).

3.8.5.3.4 Fish and Wildlife Enhancement. The only fish and wildlife enhancement relative to aquatic resources proposed under the Crystal Ranch Alternative is stream habitat improvement. Aquatic resources potentially affected by stream improvement are the same as described for the Proposed Action (see Section 3.8.5.1.4.1).

3.8.5.3.5 Recreation Developments. Recreation developments relative to aquatic resources are the same as described for the Proposed Action (see Section 3.8.5.1.5).

3.8.5.4 Twin Pots Alternative

3.8.5.4.1 High Mountain Lakes. Aquatic resources include those described for the Proposed Action (see Section 3.8.5.1.1) plus those for Brown Duck, Island, Kidney, and Clements Lakes in the upper Lake Fork River drainage. Brook trout are present in all but Clements Lake, while cutthroat trout are present in all four lakes. Fishing pressure is heavy on Brown Duck Lake and moderate on Clements, Island, and Kidney Lakes (Wildlife Resources 1981, 1986a).

Water levels and aquatic habitat in the four lakes decline during summer and early fall as water is released to meet downstream demands. As examples, lake surface area can decline from 79 to 12 acres in Clements Lake and from 190 to 168 acres in Kidney Lake. Depending on the lake, water levels can fluctuate between about 7 feet and 17 feet. Flows to outlet streams and their aquatic habitat are reduced or eliminated from late fall through late spring as water entering the lakes is stored for the following year.

3.8.5.4.2 Dams and Reservoirs. Aquatic resources in Big Sand Wash Reservoir, which would be enlarged 12,000 acre-feet under this alternative, are the same as described for the Proposed Action (see Section 3.8.5.1.2).

3.8.5.4.3 River Corridors. Aquatic resources in reaches of the Yellowstone and Lake Fork Rivers that would potentially be affected by the Twin Pots Alternative were described under the Proposed Action (see Section 3.8.5.1.3). If potential impacts occur in river corridors, they would result from project features other than main stem reservoirs since none are proposed under this alternative.

3.8.5.4.4 Fish and Wildlife Enhancement. The only fish and wildlife enhancement relative to aquatic resources proposed under the Twin Pots Alternative is the Twin Pots Reservoir Improvement. Aquatic resources potentially affected by this improvement are the same as described for the Proposed Action (see Section 3.8.5.1.4.3).

3.8.5.4.5 Recreation Developments. There would be no recreation developments relative to aquatic resources.

3.8.6 Impact Analysis

3.8.6.1 Significance Criteria

Potential impacts on aquatic resources in rivers are considered significant if project construction, implementation, or long-term operation would cause a loss of "effective stream habitat" for the fisheries community in the affected river reaches. The term "effective stream habitat" refers to the spatially and temporally variable habitat elements, lifestages, and/or seasons that act to limit populations of adult fish in each river reach. "Effective stream habitat" can be measured and expressed quantitatively as Habitat Units (HU) of stream area. Habitat elements may include physical, chemical, or biological factors that determine the effectiveness of the stream habitat for fish.

Potential impacts on aquatic resources in high mountain lakes are considered significant if stabilization would result in a decrease of more than 5 percent of a lake's euphotic zone. The euphotic zone is defined as water less than 15 feet deep. The volume of water in the euphotic zone is an important determinant of a lake's fish-rearing and aquatic production potential.

3.8.6.2 Proposed Action–Talmage

3.8.6.2.1 High Mountain Lakes. Lakes would be stabilized at levels zero to 5 feet above their original "natural" level, which would benefit aquatic resources in a number of ways. It would eliminate the exposure and desiccation during drawdown of aquatic insects that are primary food sources for trout; provide good, shallow-water cover for trout by inundating a band of rocks near the original shoreline of most lakes; increase the size of the shallow euphotic zone, aquatic productivity, and, potentially, fish growth; and prevent the potential for winter fish kills by maintaining maximum water depths greater than 15 feet. In addition, restoring lake outlet streams to their original "natural" hydrologic condition would increase fall and winter base flows and May through June peak runoff flows; improve stream fish-rearing and food-production potential; and prevent the potential dewatering and freezing of brook trout eggs that incubate in stream gravels over winter.

3.8.6.2.2 Dams and Reservoirs.

3.8.6.2.2.1 Conservation Pool. The conservation pool in the proposed Crystal Ranch Reservoir would have 2,400 acre-feet of storage (10 percent of total reservoir volume), a surface area of about 70 acres, and an average depth of about 34 feet. Oxygen depletion modeling showed predicted oxygen levels in the reservoir during winter would never drop below 8 milligrams per liter (mg/L) under oligotrophic (nutrient poor) conditions or below 7 mg/L under mesotrophic (moderate nutrient levels) conditions (Hardy, Addley & Associates, Inc. 1995). These oxygen levels are well above the minimum criterion of 5 mg/L for predicting successful over-winter fish survival.

The conservation pool in the enlarged Big Sand Wash Reservoir would continue to provide 1,200 acre-feet of storage and successful over-winter fish survival.

3.8.6.2.2.2 Fish-Rearing Potential. The proposed Crystal Ranch Reservoir would be stocked annually with fingerling trout and managed as a put-grow-and-take fishery. Rainbow trout (*Oncorhynchus mykiss*) or Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) would most likely be stocked in the reservoir. Based on Wildlife Resources guidelines, approximately 157,000 fingerlings would be stocked during the first year and 52,000 to 105,000 fingerlings would be stocked each year thereafter. The Ute Tribe Fish and Wildlife Department and the FWS would be responsible for establishing final fish stocking rates for reservoirs (or portions thereof) within Tribal jurisdiction. Wildlife Resources would establish final fish stocking rates for reservoirs (or portions thereof) outside of Tribal jurisdiction. Natural survival of stocked trout should exceed 50 percent based on studies in similar reservoirs. In addition, appropriate stocking of the Yellowstone/Lake Fork drainage downstream of Crystal Ranch Dam would be included in this program.

Big Sand Wash Reservoir should continue to support a recreational fishery for trout, bass, and sunfish. Wildlife Resources would consider increasing fish stocking rates because of the proposed increase in reservoir surface area during spring and summer.

3.8.6.2.2.3 Stream Inundation. Crystal Ranch Dam and Reservoir would inundate 2.6 miles of the Yellowstone River.

3.8.6.2.3 River Corridors.

3.8.6.2.3.1 Instream Flows.

Minimum Flows. Table 3.8-3 shows minimum instream flows that were established during the alternative development process using varying percentages of the mean annual flow in conjunction with an understanding of constraints imposed by the existing water conveyance system. Instream flows were incorporated into the Proposed Action and alternatives where flows could be controlled to assure fish habitat would be protected and enhanced and, hopefully, to offset losses of stream habitat from reservoir inundation. Presently, effective trout habitat only exists in the Lake Fork River downstream to the "C" Canal diversion because of frequent dewatering below that point. With the Proposed Action, minimum flows would extend downstream to the proposed Big Sand Wash Feeder Pipeline diversion, which would be 2 miles downstream of the "C" Canal diversion. It was not considered biologically practicable to develop minimum flows for reaches downstream of the pipeline diversion since fish production is severely limited by poor water quality in these lower stream reaches. Also, no minimum flows were established in the Lake Fork River upstream of the Yellowstone River confluence because flows in this reach are controlled by Moon Lake Reservoir, which is not part of this project.

During extreme water shortages, when these minimum flows cannot be achieved without jeopardizing established water rights, instream flows would be provided only to the extent necessary to ensure fish survival, as determined by the Ute Tribe and FWS, unless reservoir releases are made by separate agreement with an entity willing to release its water for instream flows. During wetter than dry winters, instream flows

Table 3.8-3
Upalco Unit – Minimum Instream Flows

River/Location	Minimum Flow (cfs)	
	April-September	October-March
Lake Fork River		
Inflow to "C" Canal Diversion	72	24
Inflow to Big Sand Wash Feeder Pipeline[a]	72	24
Yellowstone River		
Inflow to Yellowstone Feeder Canal[b]	56	24
Inflow to Lake Fork River[b]	56	24

[a]Except Crystal Ranch Alternative.
[b]Except Twin Pots Alternative.

would be increased above the minimums indicated in Table 3.8-3. To ensure that these additional flows are made available for instream uses, a forecasting procedure and mechanism to implement changes in wintertime releases, when possible, would be established by the CUWCD in consultation with the Ute Tribe, FWS, BIA, Wildlife Resources, State Engineer, and potentially affected water users.

Simulation of hydrological conditions for the Proposed Action indicates minimum instream flows would be exceeded most months and most years during the irrigation season as a direct consequence of water deliveries for irrigation. Minimum flows are of concern, however, during dry years and especially in late summer. Therefore, the primary value of minimum flows would be to prevent fish-population-limiting flow events that now occur during dry years.

Rearing Flows (September). Late summer baseflows are very important for supporting fish populations in project area rivers. Therefore, the instream flow habitat analysis focused on predicted flow changes during September (lowest growing season flow month) as affected by the proposed project reservoirs and minimum flows. Baseline and predicted September flows for the Proposed Action and alternatives are compared for a normal water year (50 percent flow exceedance) in Table 3.8-4 and for a dry water year (90 percent flow exceedance) in Table 3.8-5).

The greatest change in the Lake Fork/Yellowstone River flow regime under the Proposed Action would be increased flow in the Lake Fork and lower Yellowstone Rivers during September in both a normal water year and dry water year (see Tables 3.8-4 and 3.8-5). In the Lake Fork River, the increase in September flows would be substantial, ranging from 11 cfs to 57 cfs in a normal year and 33 cfs to 65 cfs in a dry year.

The most substantial instream flow change in the Yellowstone River would result from inundation of 2.6 miles of river in the proposed Crystal Ranch Reservoir site. Flow changes under the Proposed Action in the lower Yellowstone River would be much less substantial than in the Lake Fork, ranging from 15 cfs in a normal year to 8 cfs in a dry year (see Tables 3.8-4 and 3.8-5).

Winter Flows. Winter flows are also important in sustaining fish populations, particularly by providing enough flow to cover refuge areas where trout reside during winter. Trout seek refuge in crevices among boulders in deep pools or congregate amid heavy accumulations of brush and other woody debris in pools with lower water velocities (Bjornn 1971; Campbell and Neuner 1985; Hillman, Griffith, and Platts 1987). Such refuge areas are somewhat limited in the Lake Fork and Yellowstone Rivers. Because of this, the instream flow habitat analysis also focused on predicted flow changes during winter (analyzing the lowest monthly flow for the period November through March) as affected by the proposed project reservoirs and minimum flows. Baseline and predicted winter flows for the Proposed Action and alternatives are compared for a normal water year (50 percent flow exceedance) in Table 3.8-6 and for a dry water year (90 percent flow exceedance) in Table 3.8-7.

In the Lake Fork River during winter, Proposed Action flows would remain the same as baseline flows upstream of the Yellowstone River confluence and increase by 37 cfs between the "C" Canal and Big Sand Wash Feeder Pipeline diversions during normal and dry water years. Lake Fork River flows from the Yellowstone River downstream to the "C" Canal diversion would decrease by 20 cfs compared to baseline during a normal water year (Table 3.8-6) but increase by 24 cfs during a dry water year (Table 3.8-7).

In the Yellowstone River during winter, Proposed Action flows downstream of the Crystal Ranch Dam site would decrease by 19 cfs compared to baseline during a normal water year (Table 3.8-6). Proposed Action flows during a dry water year would decrease 5 cfs from the dam site downstream to the Yellowstone Feeder Canal diversion but be 25 cfs greater than baseline flows downstream to the confluence with the Lake Fork River (Table 3.8-7). It is expected that water released from the proposed storage reservoir during the

Table 3.8-4
Comparison of September Flows by River Reach under Baseline Conditions and the Proposed Action and Alternatives 50 Percent Flow Exceedance Levels*

Reach		September 50 Percent Exceedance Flows (cfs)				
Begin	End	Baseline	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots
Lake Fork River						
Big Sand Wash Feeder Pipeline	"C" Canal	19	76	77	21	74
"C" Canal	Confluence with Yellowstone River	72	88	89	85	86
Confluence with Yellowstone River	Forest/Tribal Boundary	71	82	82	77	64
Forest/Tribal Boundary	Farnsworth Canal	71	82	82	77	64
Yellowstone River						
Confluence with Lake Fork River	Yellowstone Feeder Canal	74	89	90	80	76
Yellowstone Feeder Canal	Crystal Ranch Dam (CRD) Site	102	117	118	104	102
CRD Site	CRD Inundation Limit	102	0	118	0	102
CRD Inundation Limit	Powerhouse	102	102	118	102	102
Powerhouse	IFIM Study Split (YL-A1, 2)	42	42	42	42	42
IFIM Study Split (YL-A1, 2)	Upper Yellowstone Dam (UYD) Site	42	42	42	42	42
UYD Site	Powerhouse Dam	42	42	0	42	42
Powerhouse Dam	Head of Power Reservoir	0	0	0	0	0
Head of Power Reservoir	UYD Inundation Limit	102	102	0	102	102

*Flows in September that, on average, would be exceeded 50 percent of the time.

Table 3.8-5
Comparison of September Flows by River Reach under Baseline Conditions and the Proposed Action and Alternatives 90 Percent Flow Exceedance Levels*

Reach		September 90 Percent Exceedance Flows (cfs)				
Begin	End	Baseline	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots
Lake Fork River						
Big Sand Wash Feeder Pipeline	"C" Canal	7	72	72	7	72
"C" Canal	Confluence with Yellowstone River	39	72	72	72	72
Confluence with Yellowstone River	Forest/Tribal Boundary	10	50	50	48	33
Forest/Tribal Boundary	Farnsworth Canal	10	50	50	48	33
Yellowstone River						
Confluence with Lake Fork River	Yellowstone Feeder Canal	47	55	55	53	45
Yellowstone Feeder Canal	Crystal Ranch Dam (CRD) Site	64	66	66	65	64
CRD Site	CRD Inundation Limit	64	0	66	0	64
CRD Inundation Limit	Powerhouse	64	64	66	64	64
Powerhouse	IFIM Study Split (YL-A1, 2)	35	35	35	35	35
IFIM Study Split (YL-A1, 2)	Upper Yellowstone Dam (UYD) Site	35	35	35	35	35
UYD Site	Powerhouse Dam	35	35	0	35	35
Powerhouse Dam	Head of Power Reservoir	0	0	0	0	0
Head of Power Reservoir	UYD Inundation Limit	64	64	0	64	64

*Flows in September that, on average, would be exceeded 90 percent of the time.

Table 3.8-6
Comparison of Lowest Winter Monthly Flows by River Reach under Baseline Conditions and the Proposed Action and Alternatives 50 Percent Flow Exceedance Levels[a]

Reach		Lowest Winter Monthly 50 Percent Exceedance Flows (cfs)				
Begin	End	Baseline	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots
Lake Fork River						
Big Sand Wash Feeder Pipeline	"C" Canal	0	37	37	0	62
"C" Canal	Confluence with Yellowstone River	57	37	37	37	62
Confluence with Yellowstone River	Forest/Tribal Boundary	10	10	10	10	10
Forest/Tribal Boundary	Farnsworth Canal	10	10	10	10	10
Yellowstone River						
Confluence with Lake Fork River	Yellowstone Feeder Canal	46	27	27	27	51
Yellowstone Feeder Canal	Crystal Ranch Dam (CRD) Site	46	27	27	27	51
CRD Site	CRD Inundation Limit	46	—[b]	27	—[b]	—[b]
CRD Inundation Limit	Powerhouse	46	—[b]	27	—[b]	—[b]
Powerhouse	IFIM Study Split (YL-A1, 2)	20	—[b]	20	—[b]	—[b]
IFIM Study Split (YL-A1, 2)	Upper Yellowstone Dam Site	20	—[b]	20	—[b]	—[b]

[a]Lowest winter monthly flows for the period November through March that, on average, would be exceeded 50 percent of the time.
[b]Reach flows only applicable to Cow Canyon Alternative in the analysis of winter habitat.

Table 3.8-7
Comparison of Lowest Winter Monthly Flows by River Reach
under Baseline Conditions and the Proposed Action and Alternatives
90 Percent Flow Exceedance Levels[a]

Reach		Lowest Winter Monthly 90 Percent Exceedance Flows (cfs)				
Begin	End	Baseline	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots
Lake Fork River						
Big Sand Wash Feeder Pipeline	"C" Canal	0	37	37	0	37
"C" Canal	Confluence with Yellowstone River	13	37	37	37	37
Confluence with Yellowstone River	Forest/Tribal Boundary	10	10	10	10	10
Forest/Tribal Boundary	Farnsworth Canal	10	10	10	10	10
Yellowstone River						
Confluence with Lake Fork River	Yellowstone Feeder Canal	2	27	27	27	27
Yellowstone Feeder Canal	Crystal Ranch Dam (CRD) Site	32	27	27	27	36
CRD Site	CRD Inundation Limit	32	—[b]	27	—[b]	—[b]
CRD Inundation Limit	Powerhouse	32	—[b]	27	—[b]	—[b]
Powerhouse	IFIM Study Split (YL-A1, 2)	20	—[b]	20	—[b]	—[b]
IFIM Study Split (YL-A1, 2)	Upper Yellowstone Dam Site	20	—[b]	20	—[b]	—[b]

[a]Lowest winter monthly flows for the period November through March that, on average, would be exceeded 90 percent of the time.
[b]Reach flows only applicable to Cow Canyon Alternative in the analysis of winter habitat.

winter would be slightly warmer than it is under baseline conditions. This should help reduce the formation of ice, particularly in river reaches nearest the dam and benefit fish. The formation of ice on stream substrate limits the amount of winter fish habitat by clogging refuge sites and disrupts crevices that contain fish eggs and aquatic insects.

3.8.6.2.3.2 Rearing Habitat (September)–Normal Water Year (50 Percent Flow Exceedance).

Trout Fry. The Proposed Action would result in about a 5 percent decrease in total instream trout fry habitat in the Lake Fork/Yellowstone River system compared to baseline conditions (Table 3.8-8). Most of this decrease would be from inundation of 2.6 miles of the Yellowstone River by the proposed Crystal Ranch Reservoir. However, fry habitat would also decrease in both the Lake Fork and lower Yellowstone Rivers because of higher flows in the rivers than under baseline conditions. This is not surprising since trout fry prefer slower and shallower water than other trout lifestages. This predicted loss of trout fry habitat is not, however, considered biologically significant to trout populations in the system. Availability of fry habitat is typically not considered a limiting factor for trout populations unless it is severely reduced during flood events coinciding with the early fry stage in May and June (Anderson and Nehring 1985).

The only area where trout fry habitat would increase under the Proposed Action is in the Lake Fork River below the "C" Canal. The minimum flows for this river reach would create "new" trout habitat that presently is assumed not to exist.

Juvenile Trout. The Proposed Action would result in only a slight loss (1.2 percent) in total instream juvenile trout habitat compared to baseline conditions (Table 3.8-8). As with fry, most instream juvenile habitat would be lost in the reservoir inundation zone, while decreases and gains would occur in portions of the Lake Fork River. The reach below the "C" Canal would contain newly created habitat, the same as for fry.

Adult Trout. The Proposed Action would result in essentially no net change in total instream adult trout habitat compared to baseline conditions (Table 3.8-8). As with juveniles, there would be habitat losses as well as gains.

Table 3.8-8
Percent Change in Rearing (September) Instream Trout Habitat (Weighted Usable Area) by Lifestage from Baseline Conditions in the Lake Fork/Yellowstone System
Proposed Action

Flow Exceedance Level and River	Trout Lifestage					
	Fry		Juvenile		Adult	
50 Percent (Normal)						
Lake Fork River	+4.7	(83,059)	+7.0	(73,634)	+10.6	(117,972)
Yellowstone River	-18.2	(-237,420)	-15.3	(-93,577)	-15.1	(-111,078)
Total	-5.1	(-154,361)	-1.2	(-19,943)	+0.4	(6,894)
90 Percent (Dry)						
Lake Fork River	+19.4	(309,954)	+105.7	(526,392)	+143.1	(636,590)
Yellowstone River	-17.0	(-234,858)	-14.8	(-86,290)	-15.1	(-104,981)
Total	+2.5	(75,096)	+40.8	(440,102)	+46.7	(531,609)

Note:
Numbers in parentheses show change in total usable habitat area (in square feet).

Rearing Habitat Summary. Primary factors associated with the Proposed Action that would affect instream trout habitat during a normal water year include the 1) loss of 2.6 miles of stream habitat through inundation by the Crystal Ranch Reservoir; 2) increase in late summer flows in the Lake Fork River; and 3) creation of 2 miles of trout habitat below the "C" Canal.

Instream habitat in the proposed reservoir inundation zone represents the area of greatest habitat loss for all three lifestages of trout under the Proposed Action. Under baseline conditions, the reservoir inundation zone accounts for about 15 percent of the total juvenile and adult habitat in the Yellowstone River and about 6 percent of the overall habitat in the entire Lake Fork/Yellowstone system.

Increased flows in the Lake Fork River under the Proposed Action would provide a mixture of habitat gains and losses for juvenile and adult lifestages. In the uppermost study portion of the Lake Fork River (Study Reach LF-A), baseline flows provide closer to optimal habitat for most of the species/lifestages of trout than would Proposed Action flows. The reverse is true for the river reach immediately downstream (Study Reach LF-B), where the Proposed Action flow regime would provide more habitat for most trout species/lifestages than baseline flows.

There would be gains in trout habitat under the Proposed Action in portions of the Lake Fork/Yellowstone River system downstream of the proposed Crystal Ranch Reservoir in a normal water year. However, these projected gains, at best, appear to just offset the projected loss of instream habitat in the reservoir inundation zone. Even though the Proposed Action would create almost as much "new" trout habitat in the Lake Fork River below the "C" Canal, it would be of lesser quality in terms of river length lost in the reservoir inundation zone. This is a function of higher flows under baseline conditions in the inundation zone and of habitat-discharge relationships that generally show increasing habitat with increasing flows in the upper Yellowstone River.

3.8.6.2.3.3 Rearing Habitat (September)–Dry Water Year (90 Percent Flow Exceedance).

Trout Fry. The Proposed Action would result in a 2.5 percent increase in overall trout fry habitat compared to baseline conditions in a dry water year (Table 3.8-8). Habitat losses and gains in specific river reaches under the Proposed Action would be similar to those described above for a normal water year.

Juvenile Trout. Total instream juvenile trout habitat would increase about 41 percent over baseline conditions under the Proposed Action (Table 3.8-8). Aside from the newly created habitat below the "C" Canal, almost all habitat gains would occur in the upper Lake Fork River between its confluence with the Yellowstone River and Farnsworth Canal where Proposed Action flows would provide close to optimal habitat. Habitat would be lost between the "C" Canal and its confluence with the Yellowstone River.

Adult Trout. As with juveniles, flows under the Proposed Action would result in a substantial increase (about 47 percent) in total adult trout habitat compared to baseline conditions (Table 3.8-8). The only notable difference from habitat changes described for juveniles is that there would be no appreciable change in adult trout habitat in the Lake Fork River between the "C" Canal and its confluence with the Yellowstone River.

Rearing Habitat Summary. Primary factors associated with the Proposed Action that would affect instream trout habitat during a dry water year are essentially the same as those described above for a normal water year. Increased flows under the Proposed Action would provide substantially more juvenile and adult habitat in the upper Lake Fork than is now present for these two lifestages. In fact, habitat gain in this river reach would be six times that of habitat lost in the proposed reservoir inundation zone in the Yellowstone River.

Availability of suitable rearing habitat during dry years is most important to the long-term sustained viability of fish populations. Drought conditions can severely reduce trout populations, and recovery of the populations with more favorable flow conditions can take several years. This concept, referred to as biological bottlenecking, is important when interpreting results of instream flow habitat modeling. In general, changes in habitat in a dry year would best represent potential long-term impacts that the Proposed Action and alternatives would have on fish populations in the rivers. Therefore, because conditions during a dry year are considered significant in maintaining a viable trout population, the Proposed Action should alleviate most of the biological bottlenecking attributable to summer low-flow periods presently occurring under baseline conditions.

3.8.6.2.3.4 Winter Trout Habitat.

Normal Water Year (50 Percent Flow Exceedance). Flows under the Proposed Action would result in only a slight decrease (0.6 percent) in overall winter trout habitat in the Lake Fork/ Yellowstone system in a normal water year compared to baseline conditions (Table 3.8-9). All of the habitat loss in the system would occur in the Yellowstone River since winter flows under the Proposed Action would be about 19 cubic feet per second (cfs) less than those under baseline conditions (Table 3.8-6). These lower winter flows would result in a net loss of winter habitat of about 16 percent in the Yellowstone River compared to baseline conditions.

Overall winter habitat in the Lake Fork River would increase by about 4 percent compared to baseline conditions (Table 3.8-9). Winter habitat in the Lake Fork would remain unchanged in the upper river and increase by about 65 percent between the confluence with the Yellowstone River and the "C" Canal. Also, as described for rearing habitat, there would be newly created winter trout habitat below the "C" Canal under the Proposed Action.

Dry Water Year (90 Percent Flow Exceedance). In a dry water year, winter habitat in the Lake Fork/ Yellowstone system would increase by 4 percent under the Proposed Action compared to baseline conditions (Table 3.8-9). Winter habitat in the Yellowstone River would increase by about 42 percent compared to baseline conditions. All of the gains would occur in the reach below the Yellowstone Feeder Canal where the Proposed Action flow of 27 cfs would be substantially higher than the extreme low flow of 2 cfs that now occurs under baseline conditions.

Table 3.8-9
Percent Change in Winter Instream Trout Habitat (Weighted Usable Area) from Baseline Conditions in the Lake Fork/Yellowstone System
Proposed Action and Alternatives

Flow Exceedance Level and River	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots
50 Percent (Normal)				
Lake Fork River	+3.9 (3,549)	+3.9 (3,549)	+1.6 (1,477)	+1.0 (899)
Yellowstone River	-16.2 (-4,292)	-12.4 (-5,728)	-16.2 (-4,292)	+4.9 (1,308)
Total	-0.6 (-743)	-1.6 (-2,179)	-2.4 (-2,815)	+1.9 (2,207)
90 Percent (Dry)				
Lake Fork River	-2.1 (-2,090)	-2.1 (-2,090)	-4.3 (-4,163)	-2.1 (-2,090)
Yellowstone River	+42.4 (6,609)	+17.8 (6,125)	+42.4 (6,609)	+48.9 (7,616)
Total	+4.0 (4,519)	+3.1 (4,035)	+2.1 (2,446)	+4.9 (5,526)

Note:
Numbers in parentheses show change in total usable habitat area (in square feet).

Winter habitat in the Lake Fork River would decrease by about 2 percent compared to baseline conditions. All of the habitat loss would occur in the reach between the confluence with the Yellowstone River and the "C" Canal. Habitat in the upper Lake Fork would remain unchanged and new habitat would be created below the "C" Canal.

Winter Habitat Summary. Under the Proposed Action, overall winter instream habitat would remain essentially unchanged in normal water years and increase slightly in dry water years compared to baseline. The changes in dry-year habitat would probably be the most meaningful from a long-term fish population standpoint. Therefore, when viewed on a systemwide scale, the Proposed Action would enhance the over-wintering potential of project-area rivers. However, winter habitat would decrease in the middle Lake Fork River and the upper Yellowstone River in dry years and this loss may become a population bottleneck in these reaches. It is unknown how significant this reduction in habitat could be because the absolute amount of winter habitat necessary to successfully over-winter the number of trout supported by the summer rearing habitat is unknown. Therefore, it can only be conservatively assumed that the loss of winter habitat in the middle Lake Fork River and the upper Yellowstone River has the potential to limit their respective trout populations.

3.8.6.2.3.5 Channel-Shaping Flows. Under baseline conditions, the channel-shaping 2-year high-flow event, based on 6-day average flows, is 741 cfs. With the proposed Crystal Ranch Reservoir in place, the recurrence interval for a flow of 741 cfs immediately downstream from the dam would be 2.4 years. These results indicate Crystal Ranch Reservoir would have only a minor influence on the attenuation of peak flow events.

High-flow events would still occur during the late May and June runoff period and within a few weeks (always later) of when they naturally occur (baseline conditions). Also, the duration and rate of flow change surrounding the peak would essentially follow the natural regime. Thus, no adverse impact on fisheries or other aquatic resources is anticipated.

3.8.6.2.3.6 Fish Passage. Operational impacts of diversion dam rehabilitation under the Proposed Action would all be positive. Fish passage would be substantially improved since all rehabilitated diversions and the new diversion would be designed to provide passage for juvenile and adult fish throughout the year as well as unimpeded bedload movement. The three permanent diversion dams included in the Proposed Action that presently block fish passage (Yellowstone Feeder/Payne, "C", and U.S. Lake Fork) are in areas used by trout that should benefit from unimpeded passage.

Construction and operation of Crystal Ranch Dam would completely block upstream fish passage. The Yellowstone Hydroelectric Power Plant diversion dam, which now blocks upstream fish passage, is 5.8 miles upstream from the Proposed Crystal Ranch Dam site. As a result, an additional 5.8 miles of Yellowstone River would be isolated from upstream fish movements.

3.8.6.2.4 Fish and Wildlife Enhancement.

3.8.6.2.4.1 Stream Habitat Improvements. Specific benefits to the fishery potentially resulting from stream habitat improvements are the creation of rearing and winter habitat, potential increase in spawning habitat, reduced summer water temperatures, and elimination of disturbed habitat upstream and downstream of water diversions. Channel stabilization and instream structures would help form and stabilize pool habitat. Pool habitat now appears limited in reaches proposed for improvement and may be limiting effective fish habitat during low-flow periods and winter. Pools serve as the most effective refuge habitat under both these conditions. In addition, channel stabilization and some instream structures may result in hydraulic conditions that favor the deposition of spawning gravel. Most gravel now in the system is fairly evenly distributed throughout the predominantly cobble substrate and does not provide much suitable spawning habitat.

Riparian vegetation improvements would increase shading along the river. Increased shading, coupled with cooler water being released from the proposed onstream reservoir, would result in more optimal temperatures extending farther downstream for fish rearing.

3.8.6.2.4.2 Twin Pots Reservoir Improvement. Reduction of water level fluctuation in Twin Pots Reservoir would increase food production because of a larger euphotic zone, promote nearshore vegetation, and perhaps improve over-winter fish survival. A conservation pool would be maintained to provide year-round fish habitat.

3.8.6.2.4.3 Clay Basin Settlement Pond Fish Enhancement. Dredging the Clay Basin Settlement Pond would improve water quality by providing cooler water temperatures and higher oxygen levels, which typically result when water volume is increased. The proposed habitat structures would increase fish-rearing habitat and potentially result in increased fishing opportunities.

3.8.6.2.5 Recreation Developments. Placing fish habitat improvement structures near the proposed Crystal Ranch Campground would increase fish-rearing habitat and potentially result in increased fishing opportunities adjacent to the campground.

3.8.6.2.6 Total Impacts and Mitigation. Assessing total impacts of the Proposed Action on fisheries resources requires understanding how the various project components would combine to affect fish in the watershed. Three largely separate fisheries would be affected by the project: high mountain lake, reservoir, and stream fisheries. The only connection between the three is the change in river flows that would occur with high mountain lakes stabilization and reservoir operation. Other than that, the three fisheries are essentially unrelated.

Changes to high mountain lakes' fish populations would likely be positive but not significantly so. These lakes currently support good trout populations, comparable to other natural lakes in the High Uintas Wilderness. These populations would be no worse off under stabilized lake level conditions than they are at present. Probably the greatest fisheries benefit associated with lake stabilization would be improved aesthetics as the presently dewatered zone around each lake becomes revegetated. Their more natural visual appearance would enhance the attractiveness of these lakes to recreational anglers, providing a higher-quality fishing experience consistent with the purposes of the High Uintas Wilderness.

The proposed Crystal Ranch Reservoir would provide year-round habitat for a new fishery that would not exist without the project. Although supported largely by stocking hatchery Colorado River cutthroat trout or rainbow trout, the reservoir fishery would very likely be popular with local anglers. Creation of this reservoir fishery would be at the expense of the existing stream fishery in the 2.6-mile reach of the Yellowstone River that would be inundated. The dam would also block upstream fish passage.

Stream fisheries (primarily trout) downstream of the proposed reservoir would be enhanced significantly by the following project features:

- Minimum flows during critical time periods would eliminate some of the flow-related "biological bottlenecks" that now limit fish populations.

- Upstream fish passage facilities would be constructed at all replaced and new diversion dams.

- Specific areas of streambank and channel disturbance in the Lake Fork and Yellowstone Rivers would be eliminated and riparian habitat would be improved.

- Improved flow measurement and control at diversion points would promote improved water management for instream flows and other flow-related fish and wildlife enhancements.

- Water released from Crystal Ranch Reservoir would be up to 10°F cooler during summer compared to existing conditions. This would maintain stream temperatures more within the preferred range of trout species occurring in the upper reaches of project-area streams.

- Water released from the reservoir would be slightly warmer in early winter, thus helping prevent the formation of frazil and anchor ice, which can be detrimental to fish and fish habitat.

- Two miles of "new" trout habitat would be created in the Lake Fork River below the "C" Canal diversion.

- Fish would be stocked, as appropriate, in the Yellowstone/Lake Fork drainage downstream of Crystal Ranch Dam.

Overall, because of reservoir formation and changes in the downstream flow regime, trout habitat during the critical low-flow period (September) in a normal water year would decrease slightly for fry and remain about the same or increase slightly for juveniles and adults compared to baseline conditions. In a dry water year, fry habitat would increase slightly while juvenile and adult habitat would increase by about 41 to 47 percent over baseline conditions.

Trout populations in project-area streams are quite limited now, even in the upper reaches that have not been substantially affected by land use activities. Relatively low nutrient levels, exceedingly high runoff flows because of the south-facing watersheds, and channel geomorphic conditions (lack of pools) combine to provide natural conditions poorly suited to support large trout populations. In the context of potential project-related impacts, it is important to recognize that project-area streams are not now, nor could they become in the future, high-yield fish producers.

In addition to the stream habitat gains obtained with minimum instream flows, the enhancement of instream and riparian habitat in specific areas of the Lake Fork and Yellowstone Rivers, release of cooler reservoir water in late summer, and prevention of anchor ice formation in winter would combine to improve conditions for stream fisheries under the Proposed Action. Creation of a new reservoir fishery, stocking fish downstream of the dam, stabilization of Twin Pots Reservoir, and stabilization of high mountain lakes would provide added fisheries benefits.

Based on the winter habitat analysis, it can only be conservatively assumed that the loss of winter habitat in the middle Lake Fork River and the upper Yellowstone River has the potential to limit their respective trout populations. Many of the project features, such as stream habitat improvements, may provide additional winter habitat not accounted for in this analysis and could possibly offset projected habitat losses.

3.8.6.2.7 Unavoidable Adverse Impacts. These would include inundation of 2.6 miles of the Yellowstone River by Crystal Ranch Reservoir, loss of the existing stream fishery in this reach, and blockage of upstream fish passage at the dam. There would be a reduction in "effective stream habitat" in some reaches of the Lake Fork and Yellowstone Rivers.

3.8.6.3 Cow Canyon Alternative

3.8.6.3.1 High Mountain Lakes. Potential benefits to aquatic resources in high mountain lakes and outlet streams would be the same as described for the Proposed Action (see Section 3.8.6.2.1).

3.8.6.3.2 Dams and Reservoirs. The conservation pool and fish-rearing potential of the enlarged Big Sand Wash Reservoir would be the same as described for the Proposed Action (see Section 3.8.6.2.2). The proposed Upper Yellowstone Reservoir is addressed below.

3.8.6.3.2.1 Conservation Pool. The conservation pool in the proposed Upper Yellowstone Reservoir would have 2,500 acre-feet of storage, a surface area of 77 acres, and an average depth of 32 feet. Oxygen depletion modeling showed that predicted over-winter oxygen levels in the reservoir would never drop below 8.5 mg/L under oligotrophic conditions or below 7.7 mg/L under mesotrophic conditions (Hardy, Addley & Associates, Inc. 1995). Both levels are well above the minimum oxygen criterion of 5 mg/L for predicting successful over-winter fish survival.

3.8.6.3.2.2 Fish-Rearing Potential. Approximately 100,000 fingerling trout (perhaps rainbow trout or Colorado River cutthroat trout) would be stocked in Upper Yellowstone Reservoir during the first year of inundation and managed as a put-grow-and-take fishery. Approximately 33,500 to 67,000 fingerlings would be stocked every year thereafter, depending on fish growth, survival, and angler catch rates. Natural survival of stocked trout should exceed 50 percent based on studies in similar reservoirs (Crosby 1995). In addition, appropriate stocking of the Yellowstone/Lake Fork drainage downstream of Upper Yellowstone Dam would be included in this program.

3.8.6.3.2.3 Stream Inundation. Upper Yellowstone Dam and Reservoir would inundate 2 miles of the Yellowstone River.

3.8.6.3.3 River Corridors.

3.8.6.3.3.1 Instream Flows.

Minimum Flows. Minimum instream flows for the Lake Fork and Yellowstone Rivers are the same as described for the Proposed Action (see Table 3.8-3).

Rearing Flows (September). The proposed September flow regimes during normal and dry water years are compared against baseline flows in Tables 3.8-4 and 3.8-5 and are similar to those described for the Proposed Action. Flows would increase in the Lake Fork and lower Yellowstone Rivers during September in normal and dry water years. The proposed Upper Yellowstone Reservoir would inundate 2.0 miles of the Yellowstone River, including 0.2 mile of the existing Yellowstone Hydroelectric Power Plant Reservoir. The Upper Yellowstone Reservoir would, therefore, effectively eliminate 1.8 miles of stream habitat in the Yellowstone River.

Winter Flows. Proposed winter flows in the Lake Fork River and lower Yellowstone River during normal and dry water years are the same as described for the Proposed Action (Tables 3.8-6 and 3.8-7). Farther upstream in the Yellowstone River and below the Upper Yellowstone Dam site, flows would be the same or 19 cfs less than baseline flows in a normal year and the same or 5 cfs less than baseline flows in a dry year.

Table 3.8-10
Percent Change in Rearing (September) Instream Trout Habitat (Weighted Usable Area) by Lifestage from Baseline Conditions in the Lake Fork/Yellowstone System
Cow Canyon Alternative

Flow Exceedance Level and River	Trout Lifestage: Fry		Juvenile		Adult	
50 Percent (Normal)						
Lake Fork River	+4.5	(78,956)	+6.9	(72,424)	+10.4	(116,577)
Yellowstone River	-17.0	(-221,417)	-20.2	(-123,575)	-17.9	(-131,917)
Total	-4.7	(-142,461)	-3.1	(-51,151)	-0.8	(-15,340)
90 Percent (Dry)						
Lake Fork River	+19.4	(309,954)	+105.7	(526,392)	+143.1	(636,590)
Yellowstone River	-12.4	(-171,910)	-16.6	(-96,344)	-15.5	(-107,897)
Total	+4.6	(138,044)	+39.9	(430,048)	+46.4	(528,693)

Note:
Numbers in parentheses show change in total usable habitat area (in square feet).

3.8.6.3.3.2 Rearing Habitat (September)–Normal Water Year (50 Percent Flow Exceedance).

Trout Fry. The Cow Canyon Alternative would result in about a 5 percent decrease in total instream trout fry habitat in the Lake Fork/Yellowstone River system compared to baseline conditions (Table 3.8-10). Most of the habitat decrease would occur in the Yellowstone River in the inundation zone of the proposed reservoir. However, some habitat loss would also occur in the lower Yellowstone River because of increased flows compared to baseline conditions (fry prefer slower, shallower water). Habitat would increase in the Lake Fork River below the "C" Canal because of newly created habitat.

Juvenile Trout. Juvenile trout habitat would decrease slightly (about 3 percent) from baseline conditions under the Cow Canyon Alternative (Table 3.8-10). As with fry, most of the habitat loss would occur in the proposed reservoir inundation zone and in the lower Yellowstone River because of increased flows. "New" habitat would be created below the "C" Canal diversion.

Adult Trout. The Cow Canyon Alternative would result in a slight decrease (about 1 percent) in total instream adult trout habitat compared to baseline conditions (Table 3.8-10). Most losses would occur in the inundation zone of the proposed reservoir. The largest gains would occur in the Lake Fork River between the Yellowstone River and Tribal boundary and below the "C" Canal diversion.

Rearing Habitat Summary. Primary factors associated with the Cow Canyon Alternative that would affect instream trout habitat during a normal water year are similar to those described for the Proposed Action. Stream habitat would be lost in the inundation zone of the proposed Upper Yellowstone Reservoir, which represents about 6 percent of the total juvenile and adult habitat in the Lake Fork/Yellowstone River system and about 16 percent of the total Yellowstone River habitat. Habitat losses and gains would occur in portions of the Lake Fork River, depending on lifestage, because of increased flows compared to baseline conditions. Two miles of "new" trout habitat would be created below the "C" Canal diversion.

3.8.6.3.3.3 Rearing Habitat (September)–Dry Water Year (90 Percent Flow Exceedance).

Trout Fry. The Cow Canyon Alternative would result in about a 5 percent gain in overall trout fry habitat compared to baseline conditions in the Lake Fork/Yellowstone River system (Table 3.8-10). Most habitat decreases would occur in the reservoir inundation zone and in the lower Yellowstone River. Most habitat increases would occur in the Lake Fork River between its confluence with the Yellowstone River and Tribal boundary and below the "C" Canal Diversion.

Juvenile Trout. Total instream juvenile trout habitat under the Cow Canyon Alternative would increase about 40 percent in a dry water year compared to baseline conditions (Table 3.8-10). Most decreases would occur in the inundation zone of the proposed reservoir and most gains would occur in the Lake Fork River because of increased flows over baseline.

Adult Trout. Total adult trout habitat under the Cow Canyon Alternative would increase by about 46 percent in a dry year compared to baseline conditions (Table 3.8-10). Habitat gains and losses would be similar to those described for juveniles, except adult trout habitat would remain essentially the same in the Lake Fork River between the "C" Canal diversion and Yellowstone River confluence.

Rearing Habitat Summary. Primary factors affecting instream trout habitat in a dry water year under the Cow Canyon Alternative are the same as those described for a normal water year. However, because baseline flows are relatively low in most river reaches during a dry year, increased flows under this alternative would provide substantially more juvenile and adult habitat. Habitat gains in the Lake Fork River would provide nearly seven times the amount of habitat lost in the Upper Yellowstone Reservoir inundation zone. The "new" habitat that would be created below the "C" Canal diversion would more than offset habitat losses caused by higher flows in the river reach immediately upstream from this diversion.

3.8.6.3.3.4 Winter Habitat.

Normal Water Year (50 Percent Flow Exceedance). Flows for the Cow Canyon Alternative would essentially be the same as those for the Proposed Action and would result in a slight overall decrease in winter habitat in the system of about 2 percent (Table 3.8-9). The only difference from the Proposed Action is that habitat would decrease in a longer section of the Yellowstone River. The proposed Upper Yellowstone Dam site (Cow Canyon Alternative) is about 5.5 miles upstream from the Crystal Ranch Dam site (Proposed Action). This would result in less habitat between the Yellowstone River powerhouse and the Yellowstone Feeder Canal compared to baseline conditions (Table 3.8-9).

Dry Water Year (90 Percent Flow Exceedance). Winter habitat for the Cow Canyon Alternative during a dry year would increase by about 3 percent compared to baseline conditions (Table 3.8-9). The specific areas of habitat change, and the magnitude of those changes, would be similar to those for the Proposed Action except that a longer section of the Yellowstone River would experience a decrease in habitat because of lower flows.

Winter Habitat Summary. Impacts on winter habitat for the Cow Canyon Alternative would be essentially the same as those described for the Proposed Action.

3.8.6.3.3.5 Channel-Shaping Flows. Under baseline conditions, the channel-shaping 2-year high-flow event is 741 cfs. With the proposed Upper Yellowstone Reservoir in place, the recurrence interval for a flow of 741 cfs immediately downstream from the dam would be 2.4 years. This change would not significantly impact maintenance of channel conditions downstream of the reservoir for the same reasons as described for the Proposed Action (see Section 3.8.6.2.3.5).

3.8.6.3.3.6 Fish Passage. The same diversion dams would be replaced and the same new diversion dam would be constructed as under the Proposed Action. Fisheries benefits associated with diversion dam replacement would be the same as described for the Proposed Action (see Section 3.8.6.2.3.6).

Construction and operation of Upper Yellowstone Dam would completely block upstream fish passage. This impact would be less than under the Proposed Action since the Yellowstone Hydroelectric Power Plant diversion dam, which now blocks upstream fish passage, is only 0.4 mile upstream from the Upper Yellowstone Dam site. Also, the additional 0.4 mile of Yellowstone River that would be isolated from upstream fish movements is in the bypass reach of the power plant and provides relatively low-quality fish habitat.

3.8.6.3.4 Fish and Wildlife Enhancement. The only fish and wildlife enhancement relative to aquatic resources proposed under the Cow Canyon Alternative is stream habitat improvement. Potential fisheries benefits associated with proposed stream habitat improvement are the same as described for the Proposed Action (see Section 3.8.6.2.4.1).

3.8.6.3.5 Recreation Developments. There would be no recreation developments relative to aquatic resources.

3.8.6.3.6 Total Impacts and Mitigation. Total impacts and mitigation of the Cow Canyon Alternative on fisheries resources would be similar to those described for the Proposed Action and include the following:

- Improved high mountain lakes' fish populations and a higher-quality fishing experience because of lake stabilization

- Development of year-round habitat and creation of a new reservoir trout fishery in the proposed Upper Yellowstone Reservoir

- Appropriate stocking of fish in the Yellowstone/Lake Fork drainage downstream of Upper Yellowstone Dam

- Inundation of 2 miles of the Yellowstone River, loss of the existing stream fishery in this reach, and blockage of upstream fish passage at the dam

- Elimination of some fisheries-limiting "biological bottlenecks" through minimum flows

- Construction of upstream fish passage facilities, elimination of streambank and channel disturbance, and improved flow measurement and control at replaced and new diversion dams

- Reservoir releases of cooler water during summer and slightly warmer water during winter compared to baseline river temperatures

- Creation of 2 miles of "new" trout habitat below the "C" Canal diversion in the Lake Fork River

- Long-term improvements to stream channel and riparian features important to fish and fish habitat through riparian habitat and instream improvements

Overall, because of reservoir formation and changes in the downstream flow regime, trout habitat during the critical low-flow period (September) in a normal water year would decrease slightly for fry and juveniles and increase slightly for adults compared to baseline conditions. In a dry water year, fry habitat would increase slightly while juvenile and adult habitat would increase by about 40 to 46 percent over baseline conditions. These changes, together with stream benefits listed above, would combine to improve overall conditions for stream fisheries under the Cow Canyon Alternative. Creation of a new reservoir fishery and stabilization of high mountain lakes would be added benefits. Unlike the Proposed Action, Twin Pots Reservoir would not be stabilized.

Impacts on winter habitat and mitigation for the Cow Canyon Alternative would be essentially the same as those described for the Proposed Action. In dry years, overall winter habitat would increase in the Lake Fork/Yellowstone River system by about 3 percent. However, habitat would still decrease by about 4,200 square feet in the middle Lake Fork River and by about 1,000 square feet in the upper Yellowstone River. Some project features may help offset these losses but are not accounted for in this analysis.

3.8.6.3.7 Unavoidable Adverse Impacts. These would include inundation of 2.0 miles of the Yellowstone River by Upper Yellowstone Reservoir, loss of the existing fishery in this reach, and blockage of upstream fish passage at the dam. There would be a reduction in "effective stream habitat" in some reaches of the Lake Fork and Yellowstone Rivers.

3.8.6.4 Crystal Ranch Alternative

3.8.6.4.1 High Mountain Lakes. Potential benefits to aquatic resources in high mountain lakes and outlet streams would be the same as described for the Proposed Action (see Section 3.8.6.2.1).

3.8.6.4.2 Dams and Reservoirs. The conservation pool and fish-rearing potential as well as stream length inundated for the proposed Crystal Ranch Reservoir would be the same as described for the Proposed Action (see Section 3.8.6.2.2).

3.8.6.4.3 River Corridors.

3.8.6.4.3.1 Instream Flows.

Minimum Flows. Minimum instream flows for the Lake Fork and Yellowstone Rivers are the same as for the Proposed Action (see Table 3.8-3) with one exception. No minimum flow was developed for the Lake Fork River below the "C" Canal diversion since the Big Sand Wash Feeder Pipeline is not a project feature under the Crystal Ranch Alternative. Therefore, a minimum flow below the "C" Canal diversion would not be compatible with the delivery of irrigation water, given the system that would be in place under this alternative.

Rearing Flows (September). The greatest change in the Lake Fork/Yellowstone River flow regime under the Crystal Ranch Alternative would be increased flows in the Lake Fork River during September in both normal and dry water years (Tables 3.8-4 and 3.8-5). Specifically, flows would increase upstream of the "C" Canal diversion. Also, the proposed Crystal Ranch Reservoir would inundate and effectively eliminate 2.6 miles of stream habitat on the Yellowstone River.

Winter Flows. Flows during winter under the Crystal Ranch Alternative would differ from baseline conditions the same as described for the Proposed Action, with one exception. There would be no flow below the "C" Canal under this alternative, the same as existing conditions.

3.8.6.4.3.2 Rearing Habitat (September)—Normal Water Year (50 Percent Flow Exceedance

Trout Fry. The Crystal Ranch Alternative would result in an 8.5 percent decrease in total instream trout fry habitat compared to baseline conditions in a normal water year (Table 3.8-11). Most of this habitat loss would be in the inundation zone of the proposed reservoir, in the Lake Fork River between the "C" Canal diversion and Yellowstone River, and in the lower Yellowstone River because of increased flows.

Juvenile Trout. The Crystal Ranch Alternative would result in about a 5 percent decrease in total juvenile trout habitat compared to baseline conditions in a normal water year (Table 3.8-11). Other than the reservoir inundation zone, most of the habitat loss would occur in the Lake Fork River between the "C" Canal diversion and Yellowstone River confluence because of increased flows.

Adult Trout. Total adult trout habitat would also decrease by about 5 percent compared to baseline conditions in a normal water year (Table 3.8-11). Adult habitat gains and losses would be similar in location and magnitude to those for juveniles.

Rearing Habitat Summary. As with the Proposed Action and Cow Canyon Alternative, factors most affecting instream trout habitat under the Crystal Ranch Alternative would be the reservoir inundation zone and increased flows in the Lake Fork River. However, the only area where Lake Fork River

Table 3.8-11
Percent Change in Rearing (September) Instream Trout Habitat (Weighted Usable Area) by Lifestage from Baseline Conditions in the Lake Fork/Yellowstone System
Crystal Ranch Alternative

Flow Exceedance Level and River	Trout Lifestage					
	Fry		Juvenile		Adult	
50 Percent (Normal)						
Lake Fork River	-2.6	(-44,824)	+0.8	(8,048)	+1.3	(14,733)
Yellowstone River	-16.4	(-213,894)	-14.8	(-90,512)	-15.3	(-112,460)
Total	-8.5	(-258,718)	-4.9	(-82,464)	-5.3	(-97,727)
90 Percent (Dry)						
Lake Fork River	+10.0	(159,596)	+91.6	(455,881)	+119.6	(531,754)
Yellowstone River	-16.9	(-233,722)	-15.1	(-87,818)	-15.4	(-106,545)
Total	-2.5	(-74,126)	+34.1	(368,063)	+37.3	(425,209)

Note:
Numbers in parentheses show change in total usable habitat area (in square feet).

flows would appreciably increase over baseline would be between the "C" Canal diversion and Yellowstone River confluence. As discussed in the previous analyses, increased flows in this river reach during a normal water year would result in decreased juvenile and adult trout habitat. This decrease, together with the substantial habitat loss in the inundation zone and the absence of any "new" habitat below the "C" Canal diversion, would result in an overall loss of trout habitat for all lifestages.

3.8.6.4.3.3 Rearing Habitat (September)–Dry Water Year (90 Percent Flow Exceedance).

Trout Fry. The Crystal Ranch Alternative would result in a slight decrease (2.5 percent) in trout fry habitat compared to baseline conditions during a dry water year (Table 3.8-11). The location of fry habitat losses and gains would be similar to those described for a normal water year. The major difference would be that habitat would be gained in the Lake Fork River between the Yellowstone River confluence and Tribal boundary.

Juvenile Trout. Total juvenile trout habitat would increase by about 34 percent over baseline conditions in a dry water year (Table 3.8-11). There would be substantial habitat gains in the Lake Fork River between the Yellowstone River confluence and Farnsworth Canal because of increased flows over baseline. The most substantial habitat loss would occur in the inundation zone of the proposed Crystal Ranch Reservoir.

Adult Trout. The Crystal Ranch Alternative would result in about a 37 percent increase in adult trout habitat over baseline conditions in a dry water year (Table 3.8-11). Adult habitat would increase throughout the river system except in the reservoir inundation zone and just below the Yellowstone Feeder Canal where there would be a slight decrease.

Rearing Habitat Summary. Even though the Crystal Ranch Alternative would not create any "new" trout habitat, there would be substantial increases in juvenile and adult trout habitat in the river system during a dry water year. Habitat gains in the upper Lake Fork River from increased flows over baseline conditions would more than offset habitat losses in the proposed reservoir inundation zone.

3.8.6.4.3.4 Winter Habitat.

Normal Water Year (50 Percent Flow Exceedance). Flows for the Crystal Ranch Alternative would decrease winter habitat by about 2 percent during a normal water year compared to baseline conditions (Table 3.8-9). The specific areas of change in habitat, and the magnitude of those changes, would be similar to those for the Proposed Action since the reach flows would be similar. The only exception would be that under the Crystal Ranch Alternative no new trout habitat would be created below the "C" Canal on the Lake Fork River.

Dry Water Year (90 Percent Flow Exceedance). Flows for the Crystal Ranch Alternative would increase winter habitat by about 2 percent during a dry water year compared to baseline conditions (Table 3.8-9). The specific areas of habitat change, and the magnitude of those changes, would be similar to those for the Proposed Action since the reach flows would be similar. The only exception would be that under the Crystal Ranch Alternative no new trout habitat would be created below the "C" Canal on the Lake Fork River.

Winter Habitat Summary. Impacts on winter habitat for the Crystal Ranch Alternative would be essentially the same as those described for the Proposed Action.

3.8.6.4.3.5 Channel-Shaping Flows. Under baseline conditions, the channel-shaping 2-year high-flow event is 741 cfs. With the proposed Crystal Ranch Reservoir in place, the recurrence interval for a flow of 741 cfs immediately downstream from the dam would be 2.5 years. This change would not significantly impact maintenance of channel conditions downstream of the reservoir for the same reasons as described for the Proposed Action (see Section 3.8.6.2.3.5).

3.8.6.4.3.6 Fish Passage. Potential fish passage benefits at rehabilitated diversion dams and impacts at the proposed Crystal Ranch Dam and Reservoir are the same as described for the Proposed Action (see Section 3.8.6.2.3.6).

3.8.6.4.4 Fish and Wildlife Enhancement. The only fish and wildlife enhancement relative to aquatic resources proposed under the Crystal Ranch Alternative is stream habitat improvement. Potential fisheries benefits associated with this improvement are the same as described for the Proposed Action (see Section 3.8.6.2.4.1).

3.8.6.4.5 Recreation Developments. Potential benefits associated with Crystal Ranch Campground are the same as discussed for the Proposed Action (see Section 3.8.6.2.5).

3.8.6.4.6 Total Impacts and Mitigation. Total impacts and mitigation of the Crystal Ranch Alternative on fisheries resources would be similar to those described for the Proposed Action, except no "new" trout habitat would be created below the "C" Canal diversion on the Lake Fork River. Total impacts include the following:

- Improved high mountain lakes' fish populations and a higher-quality fishing experience because of lake stabilization
- Development of year-round habitat and creation of a new reservoir trout fishery in the proposed Crystal Ranch Reservoir
- Appropriate stocking of fish in the Yellowstone/Lake Fork drainage downstream of Crystal Ranch Dam
- Inundation of 2.6 miles of the Yellowstone River, loss of the existing stream fishery in this reach, and blockage of upstream fish passage at the dam
- Elimination of some fisheries-limiting "biological bottlenecks" through minimum flows
- Construction of upstream fish passage facilities, elimination of streambank and channel disturbance, and improved flow measurement and control at replaced and new diversion dams
- Reservoir releases of cooler water during summer and slightly warmer water during winter compared to baseline conditions
- Long-term improvements to stream channel and riparian features important to fish and fish habitat through riparian habitat and instream improvements

Overall, because of reservoir formation and changes in the downstream flow regime, trout habitat during the critical low-flow period (September) in a normal water year would decrease slightly for fry, juveniles, and adults compared to baseline conditions. In a dry water year, fry habitat would decrease slightly while juvenile and adult habitat would increase by about 35 percent over baseline conditions. These changes and stream benefits listed above would combine to improve overall conditions for steam fisheries under the Crystal Ranch Alternative. Additional benefits would include creation of a new reservoir fishery and stabilization of high mountain lakes.

Impacts on winter habitat and mitigation for the Crystal Ranch Alternative would be essentially the same as those described for the Proposed Action. In dry water years, overall winter habitat would increase in the Lake Fork/Yellowstone River system by about 2 percent. However, habitat would still decrease by about 4,200 square feet in the middle Lake Fork River and by about 600 square feet in the upper Yellowstone River. Some project features may help offset these losses but are not accounted for in this analysis.

3.8.6.4.7 Unavoidable Adverse Impacts. These would include inundation of 2.6 miles of the Yellowstone River by Crystal Ranch Reservoir, loss of the existing fishery in this reach, and blockage of upstream fish passage at the dam. There would be a reduction in "effective stream habitat" in some reaches of the Lake Fork and Yellowstone Rivers.

3.8.6.5 Twin Pots Alternative

3.8.6.5.1 High Mountain Lakes. Potential benefits to aquatic resources in the 14 high mountain lakes that would be stabilized and in their outlet streams would be the same as described for the 10 high mountain lakes that would be stabilized under the Proposed Action (see Section 3.8.6.2.1).

3.8.6.5.2 Dams and Reservoirs. The conservation pool and fish-rearing potential of the enlarged Big Sand Wash Reservoir would be the same as described for the Proposed Action (see Section 3.8.6.2.2).

3.8.6.5.3 River Corridors.

3.8.6.5.3.1 Instream Flows.

Minimum Flows. Minimum instream flows for the Lake Fork River under the Twin Pots Alternative are the same as those for the Proposed Action. No minimum flows were developed for the Yellowstone River because no project features are proposed under this alternative that would allow minimum flows to be maintained.

Rearing Flows (September). The greatest change in the Lake Fork/Yellowstone River system flow regime under the Twin Pots Alternative would be increased flows in the Lake Fork River. Flows in the Yellowstone River below the Yellowstone Feeder Canal diversion would increase only slightly in a normal year and decrease slightly in a dry year (Tables 3.8-4 and 3.8-5). These small changes in flow are a result of no onstream storage reservoirs being proposed under this alternative. The only exception would be construction of the Big Sand Wash Feeder Pipeline below the "C" Canal diversion on the Lake Fork River, which would result in substantially increased flows over baseline, consistent with the minimum instream flows for this river reach.

Winter Flows. Proposed winter flows in the Lake Fork River under the Twin Pots Alternative would be from zero cfs to 62 cfs greater than baseline flows during a normal water year and from zero cfs to 37 cfs greater than baseline flows in a dry water year (Tables 3.8-6 and 3.8-7). In the Yellowstone River, proposed winter flows would be 5 cfs greater than baseline flows during a normal water year and from 4 cfs to 25 cfs greater than baseline flows during a dry water year (Tables 3.8-6 and 3.8-7).

3.8.6.5.3.2 Rearing Habitat (September)—Normal Water Year (50 Percent Flow Exceedance

Trout Fry. The Twin Pots Alternative would result in a slight increase (3.7 percent) in total trout fry habitat over baseline conditions in a normal water year (Table 3.8-12). The only reach where fry habitat would substantially increase is below the "C" Canal diversion where "new" habitat would be created because of providing water for diversion to the Big Sand Wash Feeder Pipeline.

Juvenile Trout. Juvenile trout habitat would only increase by about 1 percent over baseline conditions in a normal water year under the Twin Pots Alternative (Table 3.8-12). Virtually all habitat gains would be in the Lake Fork River, with most below the "C" Canal diversion from creation of "new" habitat. Habitat losses would occur in the upper and middle reaches of the Lake Fork River and lower Yellowstone River because of increased flows.

Adult Trout. Total adult trout habitat would increase about 2 percent over baseline conditions in a normal water year under the Twin Pots Alternative (Table 3.8-12). Specific areas of habitat gains and losses would be similar to those described for juvenile trout.

Rearing Habitat Summary. Increased flows in the Lake Fork River over baseline conditions in a normal water year would result in habitat losses and gains for all trout lifestages. However, the most substantial habitat change would be the creation of "new" habitat below the "C" Canal diversion. Without this gain, flows under the Twin Pots Alternative would result in essentially no net change in juvenile and adult habitat and a net loss of fry habitat.

Table 3.8-12
Percent Change in Rearing (September) Instream Trout Habitat (Weighted Usable Area) by Lifestage from Baseline Conditions in the Lake Fork/Yellowstone River System
Twin Pots Alternative

Flow Exceedance Level and River	Trout Lifestage					
	Fry		Juvenile		Adult	
50 Percent (Normal)						
Lake Fork River	+6.7	(116,440)	+1.8	(18,541)	+3.5	(38,608)
Yellowstone River	-0.3	(-3,271)	-0.1	(-87)	-0.1	(-110)
Total	+3.7	(113,169)	+1.1	(18,454)	+2.1	(38,498)
90 Percent (Dry)						
Lake Fork River	+18.5	(295,399)	+76.6	(381,377)	+108.6	(482,888)
Yellowstone River	+0.1	(485)	-0.2	(-880)	-0.3	(-1,963)
Total	+9.9	(295,884)	+35.3	(380,497)	+42.2	(480,925)

Note:
Numbers in parentheses show change in total usable habitat area (in square feet).

3.8.6.5.3.3 Rearing Habitat (September)—Dry Water Year (90 Percent Flow Exceedance).

Trout Fry. Total trout fry habitat would increase about 10 percent over baseline conditions in a dry water year under the Twin Pots Alternative (Table 3.8-12). Areas of habitat gains and losses would be similar to those for a normal water year.

Juvenile Trout. Total juvenile trout habitat would increase about 35 percent over baseline conditions in a dry water year under the Twin Pots Alternative (Table 3.8-12). Most gains would occur in the Lake Fork River between the Yellowstone River confluence and Tribal boundary because of increased flows. Juvenile habitat would also increase in the upper reach of the Lake Fork River, and "new" habitat would be created below the "C" Canal diversion.

Adult Trout. Total adult trout habitat would increase about 42 percent over baseline conditions in a dry water year under the Twin Pots Alternative (Table 3.8-12). Habitat changes would be similar to those described for juveniles, except adult habitat would also increase in the Lake Fork River between the "C" Canal diversion and Yellowstone River confluence.

Rearing Habitat Summary. As described for the Proposed Action and alternatives, increased flow in the upper Lake Fork River during a dry water year would substantially increase juvenile and adult trout habitat in the Lake Fork/Yellowstone River system. The creation of "new" habitat below the "C" Canal diversion would also represent substantial habitat gains for all trout lifestages.

3.8.6.5.3.4 Winter Habitat.

Normal Water Year (50 Percent Flow Exceedance). Under the Twin Pots Alternative, winter habitat would increase by about 2 percent during a normal water year compared to baseline conditions (Table 3.8-9). Habitat would increase in all reaches of the system except in the middle Lake Fork River where habitat would decrease by about 11 percent. This decrease would result from higher flows compared to baseline conditions. Unlike the Proposed Action and other alternatives, habitat would increase by about 5 percent in the Yellowstone River both above and below the Yellowstone

Feeder Canal since project flows would be about 6 cfs greater than baseline flows.

Dry Water Year (90 Percent Flow Exceedance). Flows for the Twin Pots Alternative would increase winter habitat by about 5 percent during a dry water year compared to baseline conditions (Table 3.8-9). The specific areas of habitat change, and the magnitude of those changes, would be similar to those for the Proposed Action since the reach flows would be similar. The only exception would be that under the Twin Pots Alternative there would be slightly more flow in the Yellowstone River above the Yellowstone Feeder Canal, resulting in an increase in winter habitat in this reach compared to baseline conditions. This alternative would also result in newly created trout habitat below the "C" Canal diversion in the Lake Fork River.

Winter Habitat Summary. Impacts on winter habitat for the Twin Pots Alternative would be essentially the same as those described for the Proposed Action.

3.8.6.5.3.5 Channel-Shaping Flows. The Twin Pots Alternative does not include onstream storage reservoirs and therefore would have minimal influence on high-flow events. For example, the baseline 2-year high-flow event of 741 cfs on the Yellowstone River would have the same recurrence interval (2 years) under this alternative. This would have no effect on maintenance of channel conditions.

3.8.6.5.3.6 Fish Passage. Potential fish passage benefits at rehabilitated diversion dams would be the same as described for the Proposed Action (see Section 3.8.6.2.3.6). New diversion dams would have fish passage facilities.

3.8.6.5.4 Fish and Wildlife Enhancement. The only fish and wildlife enhancement relative to aquatic resources proposed under the Twin Pots Alternative is the Twin Pots Reservoir Improvement. Potential benefits associated with reduced water fluctuation in Twin Pots Reservoir are the same as discussed for the Proposed Action (see Section 3.8.6.2.4.2).

3.8.6.5.5 Recreation Developments. No recreation developments are proposed under this alternative.

3.8.6.5.6 Total Impacts and Mitigation. Total impacts and mitigation associated with the Twin Pots Alternative would be somewhat similar to those described for the Proposed Action, although no onstream reservoirs are proposed under this alternative. Total impacts include the following:

- Improved high mountain lakes' and Twin Pots Reservoir fish populations and a higher-quality fishing experience because of lake and reservoir stabilization

- Elimination of some fisheries—limiting "biological bottlenecks" on the Lake Fork River through minimum flows

- Construction of upstream fish passage facilities, elimination of streambank and channel disturbance, and improved flow measurement and control at replaced and new diversion dams

- The creation of "new" trout habitat below the "C" Canal diversion on the Lake Fork River

The flow regime in the Lake Fork and lower Yellowstone Rivers would change slightly under the Twin Pots Alternative. Because of this, trout habitat during the critical low-flow period (September) in a normal water year would increase slightly for all lifestages compared to baseline conditions. In a dry water year, fry habitat would increase by about 10 percent while juvenile and adult habitat would increase by about 35 to 40 percent over baseline conditions. The combined effect of these impacts would be a substantial overall improvement in stream and high mountain lake fishery resources.

Impacts on winter habitat for the Twin Pots Alternative would be essentially the same as those described for the Proposed Action. In dry years, overall winter habitat would increase in the Lake Fork/Yellowstone River system by about 2 percent. However, winter habitat would decrease by about

4,200 square feet in the middle Lake Fork River; flows and habitat in the upper Yellowstone would be generally similar to baseline conditions.

3.8.6.5.7 Unavoidable Adverse Impacts. These would include small losses of "effective stream habitat" in some reaches of the Lake Fork and Yellowstone Rivers.

3.8.6.6 No Action Alternative

3.8.6.6.1 Trends. Fish populations in the Upalco Unit appear to have developed in response to degraded instream and riparian habitat, mostly in the mid- to lower reaches, as well as frequent high-flow and low-flow events. Densities of trout appear low in many river reaches, fish are generally small, and spawning success appears limited. Warm water temperatures and poor water quality in the lower Lake Fork River limit fish populations to only those species, such as carp and suckers, that can tolerate these conditions. This fishery would most likely continue to exist in its present state.

3.8.6.6.2 Future Conditions. If the Proposed Action or any of the alternatives are not implemented, instream and riparian habitat and fish resources would remain essentially unchanged. The following conditions, and their consequences on fish resources, would continue to persist:

- Degradation and destruction of riparian vegetation as a result of grazing and water diversion structure maintenance
- Accelerated streambank erosion through riparian grazing and diversion maintenance
- Continuation of severe low flows during late summer, particularly during dry years
- Continuation of severe low flows during winter in portions of the river system

3.8.6.6.3 Consequences of Not Meeting Project Needs. The purpose and needs of the project are primarily related to meeting irrigation demands. Therefore, there would be no effects on aquatic resources from not meeting project needs.

3.8.7 Cumulative Impacts

Cumulative impacts on aquatic resources would consist of the total impacts of the Proposed Action or one of the three alternatives (Cow Canyon, Crystal Ranch, Twin Pots) plus the total impacts of the Uintah Unit Proposed Action, which are described in the Uintah Unit EIS. Because the Upalco and Uintah Units are defined by watershed boundaries, there is no physical connection between them that would cause impacts in one unit to affect aquatic resources in the other unit.

Changes in streamflows for the Upalco and Uintah Units' Proposed Actions and alternatives would cumulatively affect flows in the Duchesne River. These flows, and those farther downstream in the Green River, are of concern for several federally listed fish species. Potential impacts on these species are discussed in Section 3.11 Threatened and Endangered Species.

3.9 Wetland and Riparian Resources

3.9.1 Introduction

The wetland and riparian resources (resources) analysis addresses known and estimated direct, indirect, total, and cumulative potential impacts resulting from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit. Mitigation strategies are identified that would minimize or avoid impacts or would compensate for unavoidable impacts.

3.9.2 Issues Eliminated from Further Analysis

All wetland and riparian resource issues identified during public scoping were analyzed. However, some aspects of this project would not significantly affect these resources. These impacts would generally result in a temporary loss of habitat that would subsequently be replaced naturally or through implementation of mitigation measures. Thus, in the long term, there would be no net loss of these resources. In these instances, analysis is limited to a brief description of existing conditions, and resources are not addressed in the impact analysis.

Of particular importance in this regard is the stabilization of high mountain lakes. Lake stabilization would change pool levels and result in a temporary loss of existing resources along lake shorelines. Subsequent to stabilization, however, natural replacement of more persistent wetlands is expected to occur along the new lake margins. Replacement is anticipated to result in no net loss of area, function, or value for this resource because soils have not been eroded from the drawdown areas and stable water levels would promote growth of wetland and riparian species. The Wetland/Riparian Resource Technical Report (CH2M HILL/Horrocks 1996f) discusses these effects in detail.

3.9.3 Issues Addressed in the Impact Analysis

Issues identified during public scoping are addressed in the impact analysis. These issues have been combined into four major subject areas that include the following:

1. All impacts on wetland and riparian communities must be accounted for, including losses resulting from canal rehabilitation and water conservation measures.

2. Impacts on wetland and riparian communities should be avoided where possible because of the difficulty and very high costs of replacing these resources.

3. All impacts on wetland and riparian communities must be mitigated in-kind and as close to the impact site as possible.

4. Mitigating impacts by restoring degraded wetland and riparian communities would require very large areas but has proven to be much more successful than creating new wetlands.

Sources of significant temporary or permanent impacts on existing wetland and riparian resources predicted to occur from the project are addressed in the impact analysis and include the following:

- New dams and reservoirs would eliminate existing resources in the immediate area of construction and potentially affect downstream resources over time from operational effects.

- Rehabilitation or construction of new diversion structures would fill wetlands.

- Rehabilitation or abandonment of canals or replacement with pipelines would result in either temporary or permanent losses of wetland and riparian communities.

- Construction of pipelines and haul roads would fill or excavate existing wetlands. In most cases, this would result in temporary impacts on these resources.

- Land retirement, reduced secondary irrigation water availability for wetlands, and irrigation of Tribal idle lands would result in impacts on wetland and riparian communities.

3.9.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the project feature sites for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

3.9.5 Affected Environment

Wetland and riparian cover types in the project area include emergent wetlands, wet meadows, and shrub and forested riparian communities. Each of these types performs or provides specifically different functions and values depending on their size, position within the landscape, location relative to other habitats, and other factors. The composition of these cover types is discussed in the Wetland/Riparian Resource Technical Report (CH2M HILL/Horrocks 1996f).

This section summarizes the types and amounts of wetland and riparian resources that would be significantly affected by the Proposed Action and alternatives. Resources that would be unaffected or only temporarily affected are not discussed further in this document (see Section 3.9.2).

3.9.5.1 Proposed Action–Talmage

Wetland and riparian resources potentially affected by the Proposed Action are listed in Tables 3.9-1 and 3.9-2.

3.9.5.1.1 High Mountain Lakes. Ten high mountain lakes would be stabilized as part of the Proposed Action. Emergent, wet meadow, and shrub riparian communities grow along the margins of many of the lakes (Table 3.9-1).

3.9.5.1.2 Dams and Reservoirs. Most wetland and riparian communities in the vicinity of proposed dams and reservoirs are on non-Tribal land except for forested riparian communities at the Crystal Ranch site (Table 3.9-1). Most resources near the Crystal Ranch site are either shrub or forested riparian communities while those at the Big Sand Wash Reservoir enlargement site are primarily shrub riparian communities.

3.9.5.1.3 River Corridors. Wetland and riparian cover types are present within the floodways of the Yellowstone and Lake Fork Rivers downstream of the proposed Crystal Ranch Dam site and downstream of the proposed Big Sand Wash Feeder Pipeline diversion site (Table 3.9-2 and Map 3.9-1). Most of this cover occurs at lower elevations and along low stream gradients. Of the 5,790 acres of wetland and riparian cover types identified along river corridors in the Upalco Unit, 91 percent occur along the Lake Fork River. The remaining 9 percent occur along the Yellowstone River below the Crystal Ranch Dam site.

3.9.5.1.4 Diversion Dams. Emergent wetland, shrub riparian, and forested riparian cover types occur near many of the proposed diversion dam rehabilitation sites. Specific community types and vegetation density vary widely depending on diversion dam location and characteristics of the stream channel associated with the site. CH2M HILL/Horrocks (1996f) provides additional detail about these resources. Because precise locations of rehabilitated diversion dams are not known at this time, exact acres of potentially affected resources could not be determined.

3.9.5.1.5 Canals. Some wetland and riparian systems in the project area depend on canal leakage for water. These resources occur along Farnsworth Canal Laterals No. 1, No. 2, and No. 3 and the Ottosen, Blackburn, Anderson, and Tony Smith Laterals (Map 3.9-2). Seventy-three percent of this acreage is wet meadow on non-Tribal lands.

3.9.5.1.6 Pipelines. A shrub riparian community occurs along the Big Sand Wash Feeder Pipeline route on non-Tribal land (Map 3.9-3).

3.9.5.1.7 Fish and Wildlife Enhancement. Relatively few wetland and riparian resources exist in the immediate vicinity of fish and wildlife enhancement areas. Big game winter range improvements would increase flooding in the area following diking and likely expand wetlands in this area if fences are installed to exclude livestock. While no detailed wetland and riparian resource survey was conducted at the Twin Pots area, approximately 0.5 acre of small clumps of willows and cottonwood along with scattered colonies of emergent sedges and rushes grow along the high-water line of the reservoir.

Clay Basin Settlement Pond contains less than 5 acres of emergent wetlands that occur in areas influenced by the reservoir or surrounding it. These wetlands support a small nesting population of diving and dabbling ducks and shorebirds. A small riparian corridor is seasonally persistent in the drainage upstream from the pond.

The Red Rocks/Duchesne Drainage property may contain resources representative of all wetland and riparian cover types. The future management focus for this area is to manage areas of critical, high-value, or substantial big game range for wildlife values as well as protect the riparian corridor.

Table 3.9-1
Wetland Acreage and Cover Type by Project Feature--Proposed Action

	Emergent Wetlands		Wet Meadow		Shrub Riparian		Forested Riparian	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
Dams/Reservoirs								
(Including Borrow Areas)								
Big Sand Wash		7		4		20		
Crystal Ranch			1	35	27	60	67	17
Replacement and New Diversion Dams								
"C" Canal								X
Boneta		X				X		X
Big Sand Wash Feeder[a]								
South Boneta		X				X		X
Yellowstone Feeder/Payne		X				X		
U.S. Lake Fork							X	
Rehabilitate Canals								
Anderson				39				
Blackburn				6				
Farnsworth Lateral No. 1			4	18	1		9	
Farnsworth Lateral No. 2								4
Farnsworth Lateral No. 3				17		5		2
Ottosen								5
Tony Smith				1				
Pipelines								
Big Sand Wash Feeder						15		
High Mountain Lakes Stabilization								
Bluebell Lake		X				X		
Deer Lake		X						
Drift Lake[b]								
East Timothy Lake[b]								
Farmers Lake						X		
Five Point Lake		X				X		
Milk Lake		X		X				
Superior Lake[b]								
White Miller Lake		X		X		X		
Water Lily Lake[c]								

Table 3.9-1
Wetland Acreage and Cover Type by Project Feature--Proposed Action

	Emergent Wetlands		Wet Meadow		Shrub Riparian		Forested Riparian	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
Fish and Wildlife Enhancement								
Clay Basin Settlement Pond Fish Enhancement	<0.5				X			
Twin Pots Reservoir Improvement	X				0.3		0.2	
Big Game Winter Range Improvement[d]			X		X			
Habitat Acquisition[d]		X		X		X		X
Recreation Developments								
Crystal Ranch Campground Recreation Replacement and Development							2	
Irrigate Tribal Idle Lands								
	4		49		46		21	
Secondary Irrigation Water-supported Wetlands								
	4	74	16	789	16	752	7	345
Land Retirement								
		18		38		<18		<18

Notes:
Blank spaces indicate no occurrence of cover type, unless otherwise footnoted and X = cover type present.
[a]New diversion, location unknown at time of surveys.
[b]No wetland and riparian cover types are present at these lakes.
[c]Lake not visited, no data available.
[d]Habitat potentially occurring.
[e]Idle lands are not project features but would be affected by the project.
[f]The estimated total number of acres of wetland and riparian cover types that may be impacted by reduced availablity of secondary irrigation water represents a crude estimate, as described in the text.
[g]Includes both direct and potential indirect impacts. See text for explanation and discussion of monitoring.

Table 3.9-2 River Corridor Wetland and Riparian Cover Types (in acres)					
Reach	**Reach Description**	**Emergent Wetlands**	**Wet Meadow**	**Shrub Riparian**	**Forested Riparian**
I	Yellowstone River (Crystal Ranch Dam Site to Lake Fork River)	0	0	40	480
II	Lake Fork River (Yellowstone River to Big Sand Wash Feeder Pipeline)	0	340	510	860
III	Lake Fork River (Big Sand Wash Feeder Pipeline Site to the Duchesne River)	20	1,290	1,480	770

3.9.5.1.8 Recreation Developments. Two acres of forested riparian habitat exist on Tribal land in the Crystal Ranch Campground area.

3.9.5.1.9 Land Retirement. Water rights would be acquired on approximately 1,300 acres, and irrigation would be stopped. The composition of wetland and riparian resources on these lands varies from parcel to parcel, ranging from none to 15 percent of gross acreage.

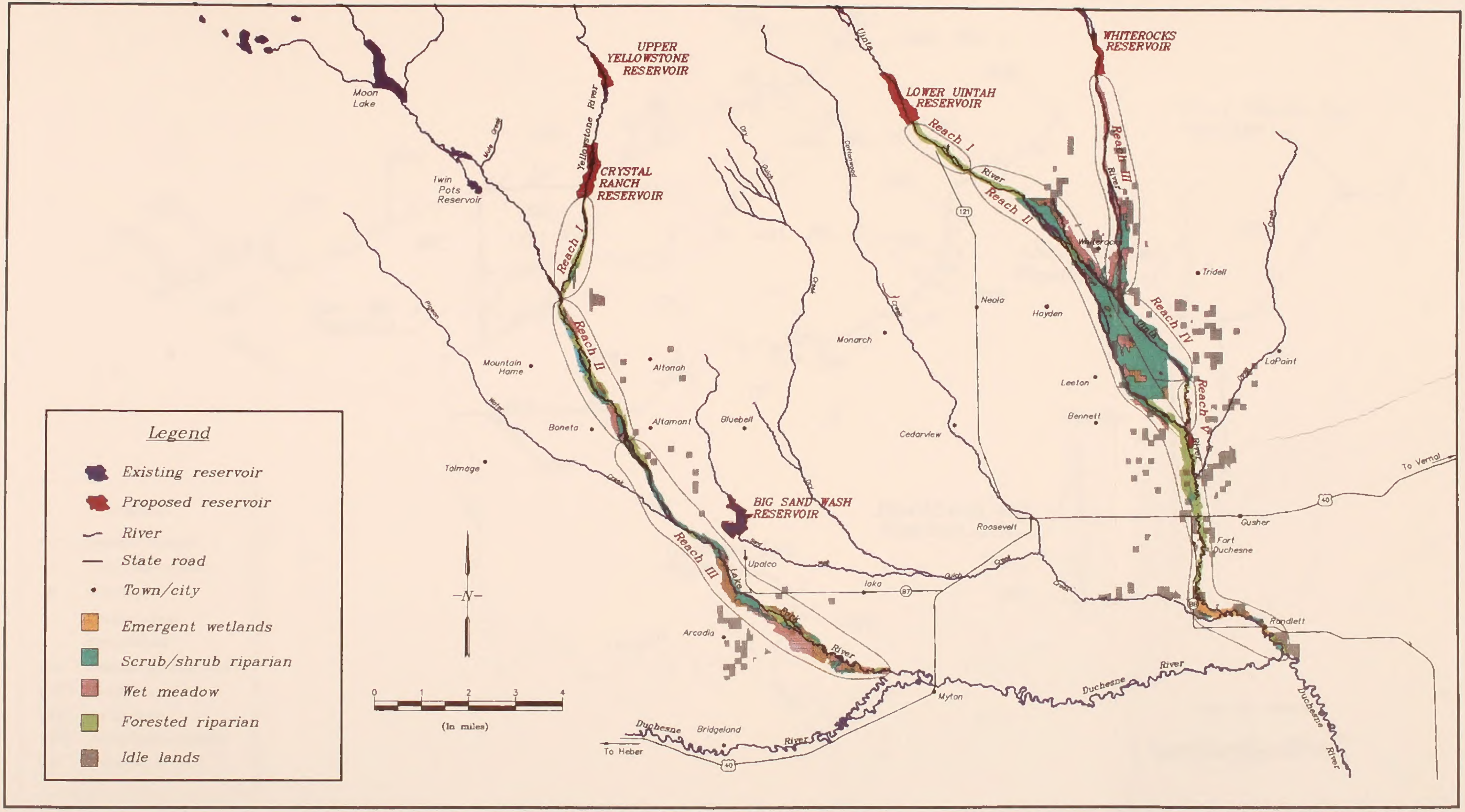
3.9.5.1.10 Irrigation of Tribal Idle Lands. Approximately 1,038 acres of Tribal lands that are currently idle and have an 1861 water right would be irrigated. Of this total, about 160 acres are occupied by shrub riparian, wet meadow, emergent wetland, and forested riparian cover types (Table 3.9-1). The Idle Lands Addendum (North State Resources 1996) to the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g) presents a detailed description of cover types for the idle lands.

3.9.5.1.11 Secondary Irrigation Water-Supported Wetlands. Runoff of excess irrigation water is called secondary irrigation water. The portion of secondary irrigation water that supports wetland and riparian communities in the Upalco Unit and the actual acreage of wetlands and riparian communities supported by this water are not known. For the purpose of developing a crude estimate of the acres of wetlands that could be impacted when this water supply is reduced, we have assumed that 50 percent of secondary irrigation water is used consumptively by wetlands. This 50 percent figure may be too high or too low; there is no way of knowing for certain. However, it is known that 10,700 acre-feet of secondary irrigation water (which represents an unknown portion of the total secondary irrigation runoff) makes its way back to the Lake Fork River as return flow and an unknown amount of secondary irrigation water is reapplied to crops, so not all secondary irrigation runoff is used consumptively by wetlands. Wetlands in northern Utah are estimated to require an average of 4.5 acre-feet of water during the growing season (Christiansen and Low 1970). These figures and the amounts by which secondary irrigation water would be reduced by the Proposed Action and alternatives will be used to develop crude estimates of the impacts of reduced secondary irrigation runoff on wetlands and riparian communities.

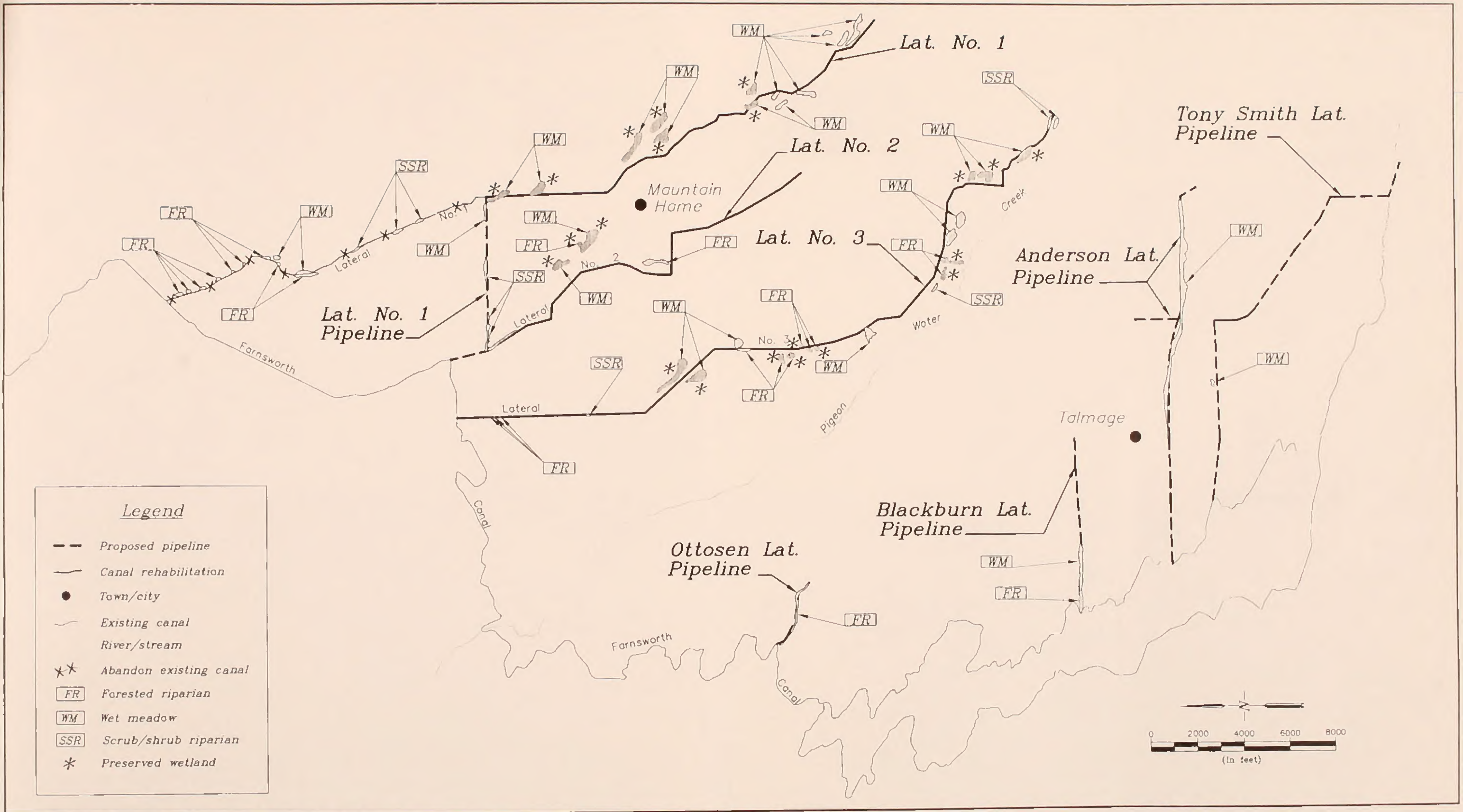
Several other assumptions were used to develop estimates of the impacts of water conservation on Tribal idle lands. The first is that water conservation measures that affect the amount of secondary irrigation water available for wetlands would be implemented evenly across all irrigated lands, regardless of ownership or location. The second assumption is based on the first: the potential impacts of water conservation measures on Tribal idle lands would occur in the same proportion that the area of Tribal idle land is to the total area of all irrigated land in the Upalco Unit. The impacts of reduced availability of this water would be monitored and mitigation requirements would be determined following the Record of Decision.

3.9.5.2 Cow Canyon Alternative

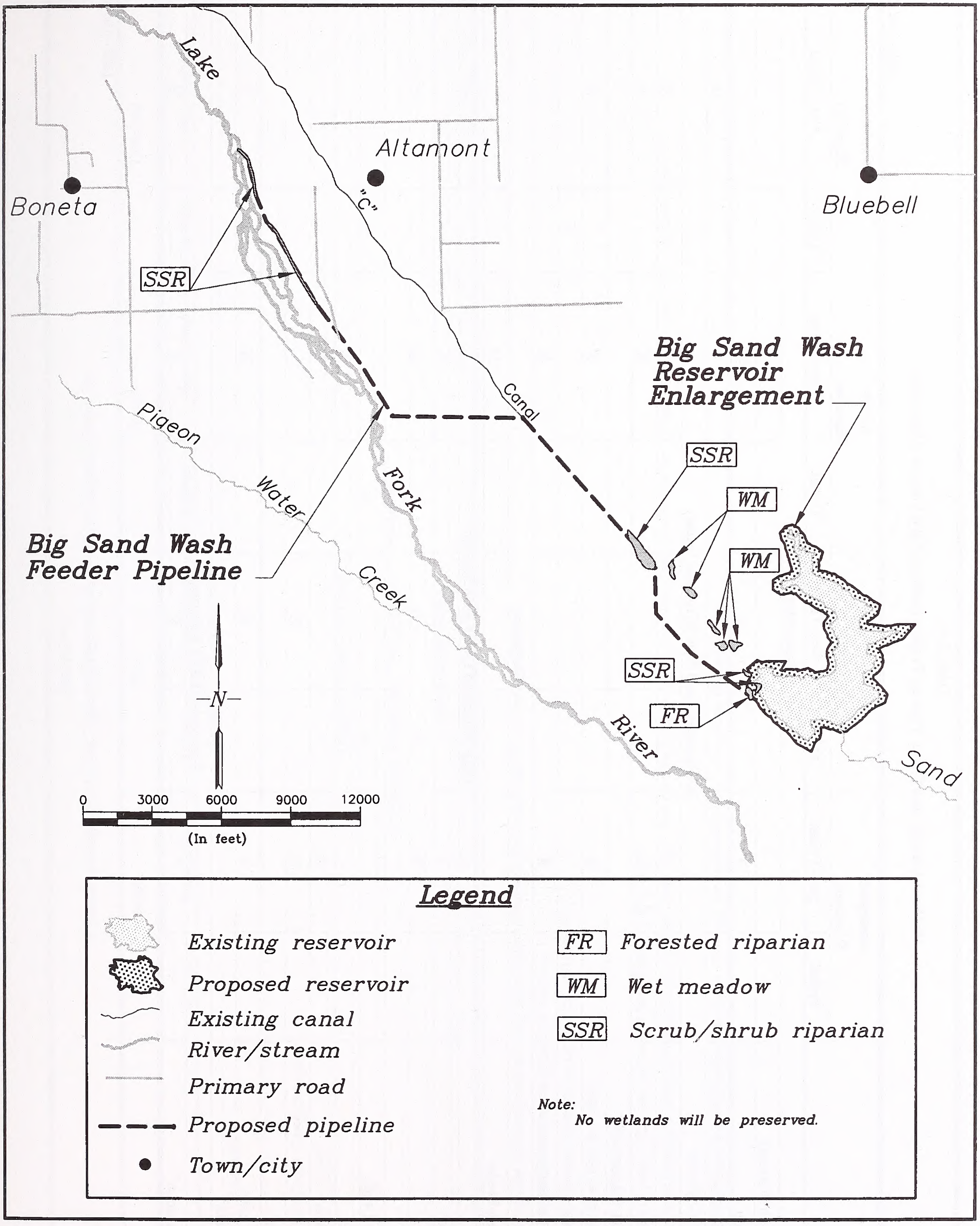
Tables 3.9-2 and 3.9-3 and Maps 3.9-1 and 3.9-3 summarize the wetland and riparian resources



Map 3.9-1
Upalco Unit
Wetland/Riparian Cover Type
River Corridors



Map 3.9-2
Upalco Unit
Wetland/Riparian Cover Types
Farnsworth Canal, Laterals, and Pipelines



Map 3.9-3
Proposed Action - Talmage
Wetland/Riparian Cover Types
Big Sand Wash Feeder Pipeline

Table 3.9-3

Wetland Acreage and Cover Type by Project Feature--Cow Canyon Alternative

	Emergent Wetlands		Wet Meadow		Shrub Riparian		Forested Riparian	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
Dams/Reservoirs								
(Including Borrow Areas)								
Big Sand Wash		7		4		20		
Upper Yellowstone				1		9		48
Replacement and New Diversion Dams								
"C" Canal								X
Boneta		X				X		X
Big Sand Wash Feeder[a]								
South Boneta		X				X		X
U.S. Lake Fork							X	
Yellowstone Feeder/Payne		X				X		
Pipelines								
Big Sand Wash Feeder						15		
High Mountain Lakes Stabilization								
Bluebell Lake		X				X		
Deer Lake		X						
Drift Lake[b]								
East Timothy Lake[b]								
Farmers Lake						X		
Five Point Lake		X				X		
Milk Lake		X		X				
Superior Lake[b]								
White Miller Lake		X		X		X		
Water Lily Lake[c]								
Fish and Wildlife Enhancement								
Habitat Acquisition[d]				X		X		X

Table 3.9-3

Wetland Acreage and Cover Type by Project Feature--Cow Canyon Alternative

	Emergent Wetlands		Wet Meadow		Shrub Riparian		Forested Riparian	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
Recreation Developments								
Fish Creek Trail Recreation Improvement								X
Bridge and Swift Creek Campgrounds Recreation Improvement								
Irrigate Tribal Idle Lands[e]								
	4		49		46		21	
Secondary Irrigation Water-supported Wetlands[f]								
	1	74	16	784	16	748	7	343
Land Retirement[g]								
		18		38		<18		<18

Notes:

Blank spaces indicate no occurrence of cover type, unless otherwise footnoted and X = cover type present.

[a]New diversion, location unknown at time of surveys.

[b]No wetland and riparian cover types are present at these lakes.

[c]Lake not visited, no data available.

[d]Habitat potentially occurring.

[e]Idle lands are not project features but would be affected by the project.

[f]The estimated total number of acres of wetland and riparian cover types that may be impacted by reduced availablity of secondary irrigation water represents a crude estimate, as described in the text.

[g]Includes both direct and potential indirect impacts. See text for explanation and discussion of monitoring.

potentially affected by this alternative. Resources affected at high mountain lakes, pipeline routes, diversion dams, land retirement areas, irrigation of Tribal idle lands, and secondary irrigation water-supported wetlands, are identical to those described for the Proposed Action. There would be no canal rehabilitation and thus no affect on resources. The remainder of this section focuses on differences between resources potentially affected by the Cow Canyon Alternative and the Proposed Action.

3.9.5.2.1 Dams and Reservoirs. Wetland and riparian communities in the vicinity of proposed dams and reservoirs are on non-Tribal lands. About 87 percent of this acreage consists of shrub and forested riparian communities (Table 3.9-3).

3.9.5.2.2 River Corridors. Wetland and riparian cover types occur within the floodways of the Yellowstone and Lake Fork Rivers downstream of the Upper Yellowstone Dam site and downstream of the Big Sand Wash Feeder Pipeline diversion site. Forested riparian, shrub riparian, wet meadow, and emergent wetland cover types are present in the reach between the proposed Upper Yellowstone and Crystal Ranch Dam sites. However, river corridor acreage figures below the Upper Yellowstone Dam site (Table 3.9-2 and Map 3.9-1) are the same as for below the Crystal Ranch Dam site (discussed under the Proposed Action) because there are no additional acreage data for the reach between the two sites. This lack of data is discussed in CH2M HILL/Horrocks (1996f).

3.9.5.2.3 Fish and Wildlife Enhancement. Habitat that would be acquired at the Fisher property on the Lake Fork River includes wet meadow, shrub riparian, and forested riparian cover types.

3.9.5.2.4 Recreation Developments. Development of the Fish Creek Trail would affect forested riparian habitat on non-Tribal lands. Other recreation developments would not affect these resources.

3.9.5.3 Crystal Ranch Alternative

Affected wetland and riparian resources are listed in Table 3.9-4 and shown on Maps 3.9-1 and 3.9-2. Acreage potentially affected is less than the Proposed Action because the Big Sand Wash Dam, Pipeline, and diversion, and the Anderson, Blackburn, Ottosen, and Tony Smith Laterals are not included in this alternative. Resources potentially affected by canal rehabilitation differ from the Proposed Action in terms of cover type and amount. Riparian resources potentially affected by high mountain lakes, fish and wildlife enhancements, recreation developments, irrigation of Tribal idle lands, reduced availability of water for secondary irrigation water-supported wetlands, and land retirement in this alternative were described under the Proposed Action.

3.9.5.3.1 River Corridors. The downstream river corridor cover types associated with Crystal Ranch Reservoir are shown in Table 3.9-2 and on Map 3.9-1 and are the same as discussed for the Proposed Action.

3.9.5.3.2 Canals. Canal-affected wet meadow, shrub riparian, and forested riparian resources at Farnsworth Laterals No. 1, No. 2, and No. 3 occur on Tribal and non-Tribal lands.

3.9.5.4 Twin Pots Alternative

Tables 3.9-2 and 3.9-5 and Maps 3.9-1, 3.9-2, and 3.9-3 show the wetland and riparian resources potentially affected by this alternative. Enlargement of Big Sand Wash Reservoir would affect emergent, wet meadow, and shrub riparian habitat on non-Tribal lands. No recreation developments are proposed in this alternative. Land retirement, irrigation of Tribal idle lands, and reduced availability of water for secondary irrigation water-supported wetlands would affect the same resources as described for the Proposed Action.

3.9.5.4.1 High Mountain Lakes. In addition to the resources discussed in Section 3.9.5.1.1, four additional lakes in the Lake Fork River drainage would be stabilized. Only wet meadow vegetation grows along these lakes (Table 3.9-5).

Table 3.9-4
Wetland Acreage and Cover Type by Project Feature--Crystal Ranch Alternative

	Emergent Wetlands		Wet Meadow		Shrub Riparian		Forested Riparian	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
Dams/Reservoirs								
(Including Borrow Areas)								
Crystal Ranch			1	35	27	60	67	17
Replacement and New Diversion Dams								
"C" Canal								X
Boneta		X				X		X
South Boneta		X				X		X
U.S. Lake Fork							X	
Yellowstone Feeder/Payne		X				X		
Rehabilitate Canals								
Farnsworth Lateral No. 1			4	18	1		9	
Farnsworth Lateral No. 2								4
Farnsworth Lateral No. 3				18		5		2
High Mountain Lakes Stabilization								
Bluebell Lake		X				X		
Deer Lake		X						
Drift Lake[a]								
Five Point Lake		X				X		
East Timothy Lake[a]								
Farmers Lake						X		
Milk Lake		X		X				
Superior Lake[a]								
White Miller Lake		X		X		X		
Water Lily Lake[b]								
Fish and Wildlife Enhancement								
Habitat Acquisition[c]		X		X		X		X
Big Game Winter Range Improvement[c]			X		X			

Table 3.9-4
Wetland Acreage and Cover Type by Project Feature--Crystal Ranch Alternative

	Emergent Wetlands		Wet Meadow		Shrub Riparian		Forested Riparian	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
Recreation Developments								
Bridge Creek Campground Recreation Improvement								
Crystal Ranch Campground Recreation Replacement and Development							2	
Irrigate Tribal Idle Lands[d]								
	4		47		45		21	
Secondary Irrigation Water-supported Wetlands[e]								
	1	80	17	841	17	801	8	368
Land Retirement[f]								
		18		38		<18		<18

Notes:
Blank spaces indicate no occurrence of cover type, unless otherwise footnoted and X = cover type present.
[a]No wetland and riparian cover types are present at these lakes.
[b]Lake not visited, no data available.
[c]Habitat potentially occurring.
[d]Idle lands are not project features but would be affected by the project.
[f]The estimated total number of acres of wetland and riparian cover types that may be impacted by reduced availablity of secondary irrigation water represents a crude estimate, as described in the text.
[f]Includes both direct and potential indirect impacts. See text for explanation and discussion of monitoring.

Table 3.9-5
Wetland Acreage and Cover Type by Project Feature--Twin Pots Alternative

	Emergent Wetlands		Wet Meadow		Shrub Riparian		Forested Riparian	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
Dams/Reservoirs								
(Including Borrow Areas)								
Big Sand Wash		7		X		20		
Replacement and New Diversion Dams								
"C" Canal								X
Boneta		X				X		X
Big Sand Wash Feeder[a]								
Lake Fork--Yellowstone[a]								
South Boneta		X				X		X
U.S. Lake Fork							X	
Yellowstone Feeder/Payne		X				X		
Rehabilitate Canals								
Farnsworth Lateral No. 1			X	18	1		9	
Farnsworth Lateral No. 2								4
Farnsworth Lateral No. 3				17		5		2
Pipelines								
Big Sand Wash Feeder						15		
Lake Fork--Yellowstone			9		14	1	7	
High Mountain Lakes Stabilization								
Bluebell Lake		X				X		
Brown Duck[b]								
Clements				X				
Deer Lake		X						
Drift Lake[b]								
East Timothy Lake[b]								
Farmers Lake						X		
Five Point Lake		X				X		
Island				X				
Kidney				X				
Milk Lake		X		X				
Superior Lake[b]								
White Miller Lake		X		X		X		
Water Lily Lake[c]								

Table 3.9-5
Wetland Acreage and Cover Type by Project Feature--Twin Pots Alternative

	Emergent Wetlands		Wet Meadow		Shrub Riparian		Forested Riparian	
	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal	Tribal	Non-Tribal
Fish and Wildlife Enhancement								
Twin Pots Reservoir Improvement	X				0.3		0.2	
Big Game Winter Range Improvement[d]			X		X			
Habitat Acquisition[d]		X		X		X		X
Recreation Developments								
None								
Irrigate Tribal Idle Lands[e]								
	4		47		45		21	
Secondary Irrigation Water-supported Wetlands[f]								
	4	81	17	850	17	810	8	372
Land Retirement[g]								
		18		38		<18		<18

Notes:

Blank spaces indicate no occurrence of cover type, unless otherwise footnoted and X = cover type present.

[a]New diversion, location unknown at time of surveys.

[b]No wetland and riparian cover types are present at these lakes.

[c]Lake not visited, no data available.

[d]Habitat potentially occurring.

[e]Idle lands are not project features but would be affected by the project.

[f]The estimated total number of acres of wetland and riparian cover types that may be impacted by reduced availablity of secondary irrigation water represents a crude estimate, as described in the text.

[g]Includes both direct and potential indirect impacts. See text for explanation and discussion of monitoring.

3.9.5.4.2 River Corridors. Cover types in the Lake Fork River corridor downstream of the Big Sand Wash Feeder Pipeline diversion site are identified in Reach III on Map 3.9-1 and Table 3.9-2. River corridor cover types were discussed under the Proposed Action.

3.9.5.4.3 Diversion Dams. Wetland and riparian resources affected by diversion dams are the same as for the Proposed Action except that a new diversion, the Lake Fork-Yellowstone, is proposed under this alternative (see Table 3.9-5).

3.9.5.4.4 Canals. About 77 percent of canal-affected wetlands occur on non-Tribal land, mostly as wet meadow systems. The remaining wet meadow shrub riparian, and forested riparian communities occur on Tribal lands.

3.9.5.4.5 Pipelines. This alternative includes construction of the Lake Fork-Yellowstone Pipeline, which would pass through wet meadow and woody riparian systems, primarily on Tribal land. No data are available on the Big Sand Wash-Roosevelt Pipeline route, which would be almost entirely within existing highway right-of-ways.

3.9.5.4.6 Fish and Wildlife Enhancement. Wetland and riparian resources at fish and wildlife enhancement areas are the same as for the Proposed Action.

3.9.6 Impact Analysis

3.9.6.1 Significance Criteria

Potential impacts on wetland and riparian resources are considered significant if project implementation results in any loss of wetland acreage (extent) or function as quantified by Average Annual Habitat Units (AAHUs) calculated in the Habitat Evaluation Procedure (HEP) study (see Wildlife Resources Technical Report, CH2M HILL/Horrocks 1996g).

Based on this criterion, all impacts on wetlands and riparian communities would be significant because of the loss of acreage and function prior to implementation of mitigation measures.

3.9.6.2 Impact Analysis Methods

The HEP method was selected by the CUWCD and the resource and regulatory agencies involved with the project as the primary tool for assessing impacts of the major project features on wildlife habitat. The HEP method is described in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g). Other potential project impacts on wetlands and riparian communities were not included in the HEP study. The impacts of land retirement and reduced availability of secondary irrigation water on wetlands and riparian communities could not be quantified at the time of the HEP study and currently consist of only estimates based on predicted changes in potential water availability for wetlands. The specific locations where impacts may occur because of these project features are also not known, so no site-specific HEP field data, which is necessary for a HEP study, could be collected. The need to assess the impacts of irrigating Tribal idle lands was not known until October 1996. Therefore, habitat values on these lands could not be determined during the available time frame for completion of the Upalco Unit Replacement Project Draft EIS. All of these impacts are estimated in terms of affected acres rather than by using HEP and are reported in the following sections. The impacts would be monitored and appropriate mitigation measures would be developed and implemented as needed in consultation with the Ute Tribe and resource and regulatory agencies.

3.9.6.3 Potential Impacts Eliminated from Further Analysis

Tables 3.9-1, 3.9-3, 3.9-4, and 3.9-5 include project feature sites where wetland and riparian areas are not present. Wetland resources would not be impacted by the Proposed Action or alternatives at these sites and they have been eliminated from further analysis. As noted earlier, impacts on high mountain lakes have been similarly eliminated from further analysis. These impacts, if not possible to avoid, would be assessed following land retirement, and appropriate compensatory mitigation would be developed and implemented following coordination with CUWCD, the Ute Tribe, and State and Federal resource agencies (see Section 3.9.6.4.11).

3.9.6.4 Proposed Action–Talmage

3.9.6.4.1 Dams and Reservoirs. Dams and reservoirs affect wetland and riparian resources through habitat inundation and dam construction. A total of 238 acres of mostly forested and shrub riparian communities (Table 3.9-6), representing 896 AAHUs, would be impacted by reservoir development on Tribal and non-Tribal land.

3.9.6.4.2 River Corridors. Table 3.9-7 lists baseline flows and expected flows under the Proposed Action for representative stations on the Yellowstone and Lake Fork Rivers. The Water Resources Technical Report (CH2M HILL/Horrocks 1996e) contains additional flow data and CH2M HILL/Horrocks (1996f) provides further detail regarding the potential changes to wetland and riparian resources resulting from the Proposed Action.

Wetland and riparian resources along river corridors can be affected through changes to stream hydrology as reflected by discharge volumes and flow patterns and the timing of peak flows. It must be emphasized that impacts on downstream resources could result from a complex interaction of changed hydrology, land use patterns, and watershed processes resulting from the project. As such, specific impacts are currently unquantifiable. Future monitoring would be implemented to assess impacts and to determine and implement appropriate compensation for them (see Section 3.9.6.4.11).

In particular, impacts can result from a reduction in flood events that scour the channel and portions of adjoining floodplains in the early spring. Small-seeded species, notably cottonwood and willow, generally rely on scouring to create bare mineral soil upon which their seeds germinate. Thus, it is possible that a reduction in scouring would reduce the regenerative potential of these species and, over the long term, reduce their presence in riparian areas (Fenner, Brady, and Patton 1985; Rood and Mahoney 1990; Rood and Heinze-Milne 1989; Stromberg, Patton, and Richter 1991). Similarly, floodflow reductions can reduce the frequency and breadth of distribution of new propagules to the system exported from upstream sources. This can change the composition and structure of these communities over time.

Spring peak flow events are expected to occur from 1 to 2 weeks later than at present with the project. This may result in a reduction in the rate of seed germination and seedling establishment and survival for cottonwoods during a given year and also in a longer time period between years when successful establishment occurs. The expected long-term impact of a reduced rate and frequency of cottonwood germination and survival would be a gradual decline in the extent of cottonwood forest.

Operation of the proposed reservoirs and river diversions would result in minor changes in the volume of peak discharge to downstream reaches.

Yellowstone River Flow Patterns. Changes to flow patterns would result in lower than baseline winter flows and somewhat higher summer discharges on the Yellowstone River. Lower winter flows would occur at a time when streamside vegetation is dormant and requires less moisture. Higher summer flows could increase moisture availability during normally dry months. As a result, these changes are not expected to reduce the extent or quality of existing resources very near the river and may even reduce the stress on these resources during the summer.

Lake Fork River Flow Patterns. Flow patterns would vary on the Lake Fork River as a result of the Proposed Action (CH2M HILL/Horrocks 1996f). At the "C" Canal, lower than baseline flows would occur from November through March and June through August with higher than baseline flows the remainder of the year. This could adversely affect wetland and riparian vegetation along the reach upstream of the "C" canal. While flow patterns would change along other reaches of the Lake Fork, they are not expected to affect wetland and riparian vegetation found there (CH2M HILL/Horrocks 1996f).

Table 3.9-6
HEP Evaluated Impacts at Reservoirs and Canals In Acres--Proposed Action[a]

Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Wetland and Riparian Cover Types Total		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Reservoirs															
Big Sand Wash	0	7	7	0	4	[illegible]	0	20	20	0	0	0	0	31	31
Crystal Ranch	0	0	0	[illegible]	39	39	27	60	84	67	17	84	95	112	207
Twin Pots	0	7	0	0	4	0	0	0	0	0	0	0	0	0	6
Subtotal	0	[illegible]	7	[illegible]	39	20	2[illegible]	20	107	67	17	84	2[illegible]	143	238
Canals															
Farnsworth Lateral No. 1	0	0	0	[illegible]	17	22	1	0	1	[illegible]	0	[illegible]	2[illegible]	17	32
Farnsworth Lateral No. 2	0	0	0	0	4	0	0	0	0	0	4	[illegible]	0	[illegible]	4
Farnsworth Lateral No. 3	0	0	0	0	17	17	0	5	[illegible]	0	2	2	0	24	4
Ottosen	0	0	0	0	4	0	0	0	0	0	4	[illegible]	0	5	5
Blackburn	0	0	0	0	4	[illegible]	0	0	0	0	4	0	0	5	6
Anderson	0	0	0	0	39	39	0	0	0	0	4	0	0	39	39
Tony Smith	0	0	0	0	4	1	0	0	0	0	0	0	0	4	4
Subtotal	0	0	0	[illegible]	81	2[illegible]	1	5	[illegible]	[illegible]	17	20	2[illegible]	17	111
Total	0	7	7	5	120	125	28	85	113	76	28	104	109	240	349

[a]Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availablity of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in this section.

Table 3.9-7
Flow Data for Representative Stations on the Yellowstone and Lake Fork Rivers
(in cubic feet per second)

Return Period	Yellowstone Feeder* (Inflow) (Yellowstone River)					"C" Canal* (Inflow) (Lake Fork River)				
	Baseline	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots	Baseline	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots
	Maximum Flood Flows									
2-year	741	664 (2.4)	659 (2.4)	659 (2.5)	741 (2)	829	580 (2.9)	583 (2.9)	546 (3.3)	664 (2.5)
5-year	980	883 (7.2)	884 (4.9)	883 (7.5)	980 (5)	1,463	1,364 (7.1)	1,365 (6.7)	1,176 (9.1)	1,422 (6.2)
10-year	1,179	1,167 (10.6)	1,167 (9.9)	1,167 (10.6)	1,179 (10)	1,943	1,884 (13.3)	1,901 (13.3)	1,501 (14.8)	1,915 (11.0)
20-year	1,302	1,299 (20.2)	1,299 (20)	1,299 (20)	1,302 (20)	2,167	2,130 (22.7)	2,131 (22.4)	2,060 (35)	2,141 (24.6)
Month	Median Annual Flow Distribution (50 Percent Exceedance)									
October	83	27	27	27	92	10	37	37	37	37
November	66	27	27	27	71	76	37	37	37	77
December	57	27	27	27	62	67	37	37	37	72
January	51	27	27	27	56	61	37	37	37	66
February	46	44	42	27	51	57	54	54	37	62
March	47	50	50	27	55	57	37	37	37	65
April	59	77	77	77	71	32	84	84	78	79
May	221	236	235	238	233	76	99	99	80	101
June	425	361	358	368	425	340	264	261	278	291
July	185	238	240	266	152	188	105	105	186	105
August	132	205	207	242	131	186	98	98	204	97
September	102	117	118	104	102	72	88	89	85	86

Table 3.9-7
Flow Data for Representative Stations on the Yellowstone and Lake Fork Rivers
(in cubic feet per second)

Return Period	Yellowstone Feeder* (Inflow) (Yellowstone River)					"C" Canal* (Inflow) (Lake Fork River)				
	Baseline	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots	Baseline	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots
	Maximum Flood Flows									
2-year	741	664 (2.4)	659 (2.4)	659 (2.5)	741 (2)	829	580 (2.9)	583 (2.9)	546 (3.3)	664 (2.5)
5-year	980	883 (7.2)	884 (4.9)	883 (7.5)	980 (5)	1,463	1,364 (7.1)	1,365 (6.7)	1,176 (9.1)	1,422 (6.2)
10-year	1,179	1,167 (10.6)	1,167 (9.9)	1,167 (10.6)	1,179 (10)	1,943	1,884 (13.3)	1,901 (13.3)	1,501 (14.8)	1,915 (11.0)
20-year	1,302	1,299 (20.2)	1,299 (20)	1,299 (20)	1,302 (20)	2,167	2,130 (22.7)	2,131 (22.4)	2,060 (35)	2,141 (24.6)
Month	Median Annual Flow Distribution (50 Percent Exceedance)									
October	83	27	27	27	92	10	37	37	37	37
November	66	27	27	27	71	76	37	37	37	77
December	57	27	27	27	62	67	37	37	37	72
January	51	27	27	27	56	61	37	37	37	66
February	46	44	42	27	51	57	54	54	37	62
March	47	50	50	27	55	57	37	37	37	65
April	59	77	77	77	71	32	84	84	78	79
May	221	236	235	238	233	76	99	99	80	ı01
June	425	361	358	368	425	340	264	261	278	291
July	185	238	240	266	152	188	105	105	186	105
August	132	205	207	242	131	186	98	98	204	97
September	102	117	118	104	102	72	88	89	85	86

3.9.6.4.3 Diversion Dams. Since the precise locations and designs of rehabilitated diversion dams are not known at this time, the impacts of these structures on resources cannot be quantified. Best management practices (BMPs) would be employed during construction and operation of the dams to avoid and minimize impacts on wetland and riparian resources (see Appendix A). CH2M HILL/Horrocks (1996f) contains more detail on this potential area of impact.

3.9.6.4.4 Canals. Canal rehabilitation and operation would reduce leakage from canals and affect wetland resources dependent on this leakage. A total of 111 acres of these resources would be affected by the Proposed Action. Most occur on non-Tribal land as wet meadow communities, although 26 acres of forested- and shrub-dominated riparian areas would also be affected (Table 3.9-6). A loss of approximately 200 AAHUs would result from canal rehabilitation under the Proposed Action (Table 3.9-8).

3.9.6.4.5 Pipelines. Temporary loss of 15 acres of shrub riparian habitat would result from construction of the Big Sand Wash Feeder Pipeline (Table 3.9-1). This habitat occurs on non-Tribal land and would be replaced following construction (see Section 3.9.6.4.11). Periodic maintenance of the pipeline may result in additional temporary impacts on resources during the lifetime of the facility. Operation of the pipeline is not expected to impact wetland resources.

3.9.6.4.6 Land Retirement. Land retirement would result in both direct and indirect impacts on wetland and riparian communities. Direct impacts would occur on the retirement parcels because irrigation of these lands would cease.

More than 10,000 acres of potential retirement lands were roughly mapped during November 1996 (North State Resources 1996) to assess the mitigation potential of these parcels. The proportions of each cover type on these lands were used to estimate the acres of wetland cover types on the 1,300 acres of lands that would be retired. This results in an estimate of less than 65 acres of wetlands and riparian communities that would be directly impacted by land retirement (Table 3.9-1).

Indirect impacts may occur on wetlands located near the retired parcels if the wetlands are supported by secondary irrigation water that currently runs off of these parcels. Approximately 3,300 acre-feet of water would be saved from the 1,300 acres of land that would be retired. On the average, about 7.3 percent of the water that is actually delivered to irrigated lands (after conveyance losses) becomes secondary irrigation runoff water, and half of this would be available to support wetland and riparian communities located below (downgradient) lands that would be retired. The loss of about 120 acre-feet (3,300 x 0.073 x 0.5) of secondary irrigation runoff available for wetlands because retired lands would no longer be irrigated could indirectly impact about 27 acres of wetland and riparian communities.

3.9.6.4.7 Irrigation of Tribal Idle Lands. Tribal idle lands that would be irrigated include 160 acres of wetlands and riparian communities. Six of these acres may be impacted by the reduced availability of secondary irrigation water as discussed in Section 3.9.6.4.8. The remaining 154 acres of these wetland and riparian communities would be lost if the Tribal idle lands are converted for irrigation (Table 3.9-1).

3.9.6.4.8 Secondary Irrigation Water-Supported Wetlands. In addition to the impacts of land retirement, secondary irrigation water availability would decrease by 18,000 acre-feet as a result of project operation because less water would be diverted from rivers during high-flow periods. Based on the assumption stated earlier, about half of the 18,000 acre-feet (or 9,000 acre-feet) would no longer be available to support wetlands. Based on the 4.5 acre-feet per acre figure for consumptive use by wetlands, 1,450 acre-feet of water could support up to 2,000 acres of wetlands that occur on both Tribal and non-Tribal lands (Table 3.9-1).

A crude estimate of the impact of the reduction in secondary irrigation water on wetlands assumes that all 9,000 acre-feet are used by wetlands and that all 2,000 acres of these areas would be lost when the

Table 3.9-8
HEP Evaluated Impacts at Reservoirs and Canals in Average Annual Habitat Units--Proposed Action[a, b]

Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Wetland and Riparian Cover Types Total		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Reservoirs															
Big Sand Wash	0.00	-19.78	-19.78	0.00	-5.20	-5.20	0.00	-17.33	-17.33	0.00	0.00	0.00	0.00	-42.31	-42.31
Crystal Ranch	0.00	0.00	0.00	-2.54	-88.68	-91.22	-106.51	-236.67	-343.18	-299.93	-76.11	-376.04	-452.15	-401.46	-853.61
Subtotal	0.00	-19.78	**-19.78**	**-2.54**	**-93.88**	**-96.42**	**-106.51**	**-254.00**	**-360.51**	**-299.93**	-76.11	-376.04	**-452.15**	**-443.77**	**-895.92**
Canals															
Canals	0.00	0.00	0.00	-7.34	-163.26	-170.60	-1.45	-13.10	-14.55	-8.97	-6.78	-15.75	-17.76	-183.14	-200.90
Total	**0.00**	-19.78	-19.78	-9.88	**-257.14**	-267.02	**-107.96**	**-267.10**	**-375.06**	**-308.90**	**-82.89**	**-391.79**	**-469.91**	**-626.91**	**-1,096.82**

[a]**Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availablity of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in this section.**

[b]This is a summary of detailed information on habitat suitability for target species determined through HEP analysis. See the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g) for a full discussion on how these values were determined.

water supply is removed. The loss includes 6 acres that would occur on Tribal idle lands. These impacts would be significant.

3.9.6.4.9 Fish and Wildlife Enhancement and Recreation Developments. Construction of small dikes in association with improvements to big game winter range may impact minor areas of riparian or wetland resources, although subsequent flooding may result in some wetlands expansion. Habitat acquisition of the Red Rocks/Duchesne Drainage area would result in improved wetland and riparian habitat condition as livestock grazing is reduced or eliminated to protect riparian corridors.

Stream improvements would be implemented along approximately 5 and 2 miles on the Lake Fork and Yellowstone Rivers, respectively. This would involve establishment of riparian vegetation in degraded areas and development of aquatic habitat to improve fisheries. The location is dependent on the degree of prior disturbance, feasibility of the proposed work, and whether water is available. Stream improvements would enhance riparian vegetation in areas not heavily grazed.

One-half acre of wetland would be lost upon stabilization of Twin Pots Reservoir, while stable water levels would benefit submerged and emergent wetland vegetation. Development of Crystal Ranch Campground would result in the loss of approximately 2 acres of forested riparian habitat.

3.9.6.4.10 Total Impacts. The Proposed Action would affect 364 acres of wetland and riparian resources evaluated using HEP (Tables 3.9-9 and 3.9-10). Of this amount, 96 percent (349 acres) would be lost permanently (see Table 3.9-6). This represents a functional loss of approximately 1,097 AAHUs for dam, reservoir, and canal impacts (Table 3.9-8). Mitigation measures are expected to substantially offset these losses (see Section 3.9.6.4.11). Up to 2,212 additional acres of wetlands and riparian communities that were not evaluated using HEP may also be impacted by land retirement, reduced availability of secondary irrigation water, and irrigation of Tribal idle lands (Table 3.9-10). Known and estimated total losses of wetlands and riparian communities would be 883 acres. Other potential, currently unquantifiable impacts could occur because of changes in downstream river discharge.

3.9.6.4.11 Mitigation. Mitigation includes activities focused on avoiding and minimizing impacts and monitoring and compensating for unavoidable impacts on wetland and riparian resources. Unavoidable impacts on these resources would be compensated by development and improvement of wetland and riparian habitat at the Clay Basin, Brotherson, and Lake Fork mitigation sites (see Section 4 of the Wildlife Resources Technical Report, CH2M HILL/Horrocks 1996g). Habitat development would involve a change in cover type from upland to wetland or riparian. Habitat improvement would involve increasing wildlife habitat values in wetland and riparian communities by eliminating grazing, planting, or other measures.

A total of 1,132 acres of new or improved wetland or riparian habitat is proposed for mitigation. Habitat development would account for approximately 68 percent of this total while habitat improvement would account for the remainder. About 147 mitigation acres would be along canals with the remainder on the mitigation sites noted above. The proposed mitigation would be equivalent to a net functional gain of approximately 320 AAHUs of new or improved resources (Table 3.9-9) comparing wetland and riparian habitat impacts from dams, reservoirs, and canals with the increased habitat values of the proposed mitigation measures. Habitat Units that are predicted to be gained as a result of implementing the proposed mitigation measures are based on the assumption that the measures are successful in achieving the stated goals. Habitat improvement and development measures described above would compensate for impacts from dams, reservoirs, and canal rehabilitation.

A total of 2,212 acres of potential impacts on wetlands and riparian communities were not included in the HEP analysis because the location of impact areas or the nature of the potential impacts was not known at the time of the HEP study. Potential impacts that were not included in the HEP study included those that may result from

Table 3.9-9
Comparison of Average Annual Habitat Units Lost and Gained as a Result of Reservoirs and Canals and Proposed Mitigation[a, b]

Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Wetland and Riparian Cover Types Total		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Proposed Action															
Lost	0	-19.78	-19.78	-9.88	-257.14	-267.02	-107.96	-267.10	-375.06	-308.90	-82.89	-391.79	-469.91	-626.91	-1,096.82
Gained	0	27.43	27.43	198.23	253.08	451.31	432.05	2.36	434.41	454.61	48.75	503.36	1,084.89	331.62	1,416.51
Net Change	**0**	**7.65**	**7.65**	**188.35**	**-4.06**	**184.29**	**324.09**	**-264.74**	**59.35**	**145.71**	**-34.14**	**111.57**	**614.98**	**-295.29**	**319.69**
Cow Canyon Alternative															
Lost	0	-19.78	-19.78	0	-6.61	-6.61	0	-42.40	-42.40	0	-97.66	-97.66	0	-166.45	-166.45
Gained	0	27.43	27.43	0	416.55	416.55	0	418.66	418.66	0	207.78	207.78	0	1,070.42	1,070.42
Net Change	**0**	**7.65**	**7.65**	**0**	**409.94**	**409.94**	**0**	**376.26**	**376.26**	**0**	**110.12**	**110.12**	**0**	**903.97**	**903.97**
Crystal Ranch Alternative															
Lost	0	0	0	-9.88	-158.59	-168.47	-107.96	-249.97	-357.93	-308.90	-79.68	-388.58	-426.75	-488.04	-914.79
Gained	0	0	0	198.23	17.06	215.29	432.05	2.12	434.17	454.61	47.00	501.61	1,084.99	66.18	1,151.17
Net Change	**0**	**0**	**0**	**188.35**	**-141.53**	**46.82**	**324.09**	**-247.85**	**76.24**	**145.71**	**-32.68**	**113.03**	**658.24**	**-421.86**	**236.38**
Twin Pots Alternative															
Lost	0	-19.78	-19.78	-7.34	-72.62	-79.96	-1.45	-29.96	-31.41	-8.97	-3.45	-12.42	-17.76	-125.81	-143.57
Gained	0	27.43	27.43	0.00	253.08	253.08	0.00	2.12	2.12	0.00	47.00	47.00	0.00	329.63	329.63
Net Change	**0**	**7.65**	**7.65**	**-7.34**	**180.46**	**173.12**	**-1.45**	**-27.84**	**-29.29**	**-8.97**	**43.55**	**34.58**	**-17.76**	**203.82**	**186.06**

[a]**Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availablity of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in this section.**

[b]This is a summary of detailed information on habitat suitability for target species determined through the HEP analysis. See the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g) for how these values were determined.

Table 3.9-10

Known and Estimated Wetland Impacts and Proposed Mitigation in Acres--Proposed Action

Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Totals		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Impacts															
Permanent Impacts															
Dams and Reservoirs	0	7	7	[illegible]	39	40	27	80	107	67	17	84	**95**	**143**	**238**
Canals	0	0	0	[illegible]	71	85	1	5	6	[illegible]	11	20	**14**	**97**	**111**
Irrigate Tribal Idle Lands[a]	[illegible]	[illegible]	4	49	0	49	46	0	46	21	0	21	**120**	**0**	**120**
Secondary Irrigation Water-Supported Wetlands[b]	1	74	75	16	789	805	16	752	768	7	345	352	**40**	**1,960**	**2,000**
Land Retirement[c]															
Direct Impacts	0	13	13	0	26	26	0	13	13	0	13	13	**0**	**65**	**65**
Potential Indirect Impacts[f]	0	5	5	0	12	12	0	[illegible]	5	0	[illegible]	5	**0**	**27**	**27**
Total Permanent	**[illegible]**	**99**	**104**	**70**	**947**	**1,017**	**90**	**855**	**945**	**104**	**391**	**495**	**269**	**2,292**	**2,561**
Temporary Impacts															
Pipelines[a, d]	0	0	0	0	0	0	0	15	15	0	0	0	**0**	**15**	**15**
Mitigation															
Habitat Development															
Mitigation Sites	0	10	10	100	145	245	250	0	250	200	0	200	**550**	**155**	**705**
Canals	0	0	0	0	31	31	0	0	6	0	**33**	33	**0**	**64**	**64**
Subtotal Development	**0**	**10**	**10**	**104**	**176**	**276**	250	**0**	**250**	**200**	**33**	**233**	**550**	**219**	**769**
Habitat Improvement															
Mitigation Sites	0	0	0	39	0	39	142	0	142	99	0	99	**280**	**0**	**280**
Canals	0	0	0	0	71	71	0	0	0	0	12	12	**0**	**83**	**83**
Subtotal Improvement	**0**	**0**	**0**	39	71	**110**	142	**0**	142	**99**	**12**	**111**	**280**	**83**	**363**
Total Mitigation	**0**	**10**	**10**	**139**	**247**	**386**	**392**	**0**	**392**	**299**	**45**	**344**	**830**	**302**	**1,132**
Gain/Loss															
Net Change[e]	**-5**	**-89**	**-94**	**69**	**-700**	**-631**	**302**	**-855**	**-553**	**195**	**-346**	**-151**	**561**	**-1,990**	**-1,429**

[a]Idle lands are not project features but would be affected by the project. Tribal idle lands include 160 acres of wetland and riparian communities. Six of these acres would be impacted by water conservation measures and 154 acres would be impacted by conversion of idle lands to agriculture.

[b]The estimated total number of acres of wetland and riparian cover types that may be impacted by reduced availablity of secondary irrigation water represents a crude estimate, as described in the text.

[c]These areas would be directly impacted. Other potential indirect impacts on wetlands situated below (downgradient) from retired lands would be monitored as described in the text.

[d]In-kind mitigation would occur at the location of pipeline impacts.

[e]Net change equals mitigation acres minus quantified and estimated permanent impacts.

[f]See text for discussion of how potential indirect impacts were calculated.

irrigation of Tribal idle lands, land retirement, and reduced availability of secondary irrigation water for wetlands (Table 3.9-10). Counting all quantified or estimated impacts on wetlands and riparian communities, there would be a net loss of 1,429 acres of wetlands and riparian communities after mitigation. Impacts from these project features would be mitigated at the site of the impact (onsite) to the extent possible as described in CH2M HILL/Horrocks (1996f). Specific mitigation measures associated with these other project features or impacts are described below.

All compensation would be determined through coordination among the CUWCD, Ute Tribe, COE, Utah Division of Wildlife Resources, and FWS.

Reservoirs. Unavoidable loss of wetland and riparian resources from reservoir construction would be mitigated through wetland and riparian development or improvement at one of the mitigation sites discussed above.

River Corridors. River and floodplain hydrology would be monitored before and up to 25 years after reservoir construction to determine potential impacts resulting from changes in peak flows (see Appendix C, CH2M HILL/Horrocks 1996f). If warranted, additional monitoring would be conducted to assess the effects of hydrologic change on the extent and condition of wetland and riparian communities. Mitigation measures would be developed to compensate for any losses.

Diversion Dams. Impacts on resources from diversion dam rehabilitation would be quantified during dam design. Mitigation would primarily occur through minimization of impacts. BMPs would be employed throughout construction. Compensatory habitat would be developed onsite to replace wetland or riparian habitat unavoidably lost. This habitat would be developed onsite and in-kind with locally available native stock.

Canals. Resources lost from canal rehabilitation would be replaced through development or improvement of onsite habitat and at the mitigation sites noted above.

Pipelines. Temporary impacts from pipeline construction would be mitigated through reestablishment of wetland and riparian vegetation along the pipeline trench and along temporary construction access roads. A permanent maintenance road would not be reclaimed. Liners would be used within pipeline trenches to minimize potential surface or subsurface drainage of wetland and riparian sites by the pipeline. Native species would be used to revegetate these areas.

Fish and Wildlife Enhancement and Recreation Developments. If it is determined during final design that unavoidable adverse impacts on wetland and riparian areas would result from these activities, onsite and in-kind habitat improvement would be implemented using the same types of measures described in the Mitigation Plan in Section 4 of the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g).

Land Retirement. No additional mitigation is proposed at this time because there would be a net increase in the total acreage of wetlands and riparian communities when impacts are compared to mitigation (Table 3.9-10).

Tribal Idle Lands. Immediately before they are converted from idle lands to irrigated lands status, Tribal lands would be monitored to determine potential effects of the proposed conversion on wetland and/or riparian vegetation growing on them. If wetland or riparian vegetation habitat are likely to decline on these lands because of their conversion to irrigated status, then habitat would be developed as compensatory mitigation. Mitigation may also be provided in the forms of habitat development and/or habitat improvement at retirement lands that are suited to this purpose (see Wildlife Resources Technical Report: Idle Lands Addendum [North State Resources 1996]).

Secondary Irrigation Water-Supported Wetlands. The effects of reduced availability of secondary irrigation water for wetlands would be monitored as described in Appendix B and in the Wetland/Riparian Resource Technical Report (CH2M HILL/Horrocks 1996f) to determine the actual impacts. Mitigating impacts may involve avoiding impacts by providing alternative water sources for affected areas or by implementing additional habitat improvement and development measures at proposed mitigation areas.

3.9.6.4.12 Unavoidable Adverse Impacts. All unavoidable adverse impacts on wetland and riparian resources resulting from the Proposed Action would be subject to compensatory mitigation as described above.

3.9.6.4.13 Cumulative Impacts. Cumulative impacts are those impacts that would result from the implementation of the Uintah Unit and Upalco Unit Proposed Actions. All project features and actions would result in known and estimated permanent cumulative losses of 5,188 acres of wetland and riparian communities with an estimated 2,627 acres resulting from implementation of the Uintah Unit Replacement Project. Other potential, currently unquantifiable impacts could occur because of changes in the amount and timing of downstream river discharge.

3.9.6.5 Cow Canyon Alternative

3.9.6.5.1 Dams and Reservoirs. A total of 94 acres of mostly forested and shrub riparian communities would be impacted by reservoir development on non-Tribal land (Table 3.9-11). This represents a loss of about 167 AAHUs (Table 3.9-12).

3.9.6.5.2 River Corridors. Table 3.9-7 lists baseline flows and expected flows under the Cow Canyon Alternative for representative stations on the Yellowstone and Lake Fork Rivers. The effects of flow changes on wetland and riparian resources along river corridors were discussed in Section 3.9.6.4.2.

Peak flows in the Yellowstone River would be approximately 10 to 15 percent less than baseline flows. Depending on the reach, peak flows in the Lake Fork River would either decrease or increase. Changes in flow volume could affect regeneration of small-seeded species along either of these drainages.

Yellowstone River Flow Patterns. Flow patterns would generally be the same as reported for the Proposed Action (Section 3.9.6.3.2). Winter flows would be slightly lower and summer flows slightly higher than for the Proposed Action. Expected impacts would be the same as described for the Proposed Action.

Lake Fork River Flow Patterns. Flow patterns would vary on the Lake Fork River as a result of this alternative (CH2M HILL/Horrocks 1996f). While pattern changes would occur along the Lake Fork, they are not expected to affect wetland and riparian vegetation found there and may actually enhance the resource adjacent to the river (CH2M HILL/Horrocks 1996f).

3.9.6.5.3 Diversion Dams. Impacts would be identical to those of the Proposed Action (see Section 3.9.6.4.3).

3.9.6.5.4 Pipelines. Impacts would be identical to those of the Proposed Action (see Section 3.9.6.4.5).

3.9.6.5.5. Land Retirement. These impacts would be the same as described for the Proposed Action.

3.9.6.5.6. Irrigation of Tribal Idle Lands. These impacts would be the same as described for the Proposed Action.

3.9.6.5.7 Secondary Irrigation Water-Supported Wetlands. Secondary irrigation water available to wetlands would be reduced by 17,900 acre-feet. The estimated impact would be the loss of 1,989 acres of wetlands and riparian communities. Six acres of the loss on Tribal land would be on Tribal idle lands.

3.9.6.5.8 Fish and Wildlife Enhancement and Recreation Developments. Acquisition of the Fisher property should enhance wetland and riparian resources by reducing grazing pressure. A small amount of streamside vegetation would be disturbed while improving Fish Creek Trail. Stream improvements would be the same as described for the Proposed Action.

Table 3.9-11

HEP Evaluated Impacts at Reservoirs and Canals in Acres--Cow Canyon Alternative[a]

Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Wetland and Riparian Cover Types Total		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Reservoirs															
Big Sand Wash	0	7	7	0	4	[illegible]	0	20	20	0	0	0	0	31	31
Upper Yellowstone	0	5[b]	5	0	1	[illegible]	0	[illegible]	[illegible]	0	94	48	0	63	63
Subtotal	0	31	12	0	[illegible]	5	0	29	29	0	48	48	0	94	94
Canals															
Canals	0	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]	0
Subtotal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	12	12	0	5	5	0	29	29	0	48	48	0	94	94

[a]Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availablity of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in this section.

[b]Includes 5 acreas of beaver pond cover type.

Table 3.9-12

HEP Evaluated Impacts at Reservoirs and Canals in Average Annual Habitat Units--Cow Canyon Alternative[a,b]

Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Wetland and Riparian Cover Types		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Reservoirs															
Big Sand Wash	0	-19.78	-19.78	0	-5.2	-5.2	0	-17.33	-17.33	0	0	0	0	-42.31	-42.31
Upper Yellowstone	0	0	0	0	-1.41	-1.41	0	-25.07	-25.07	0	-97.66	-97.66	0	-124.14	-124.14
Subtotal	0	-19.78	-19.78	0	-6.61	-6.61	0	-42.4	-42.4	0	-97.66	-97.66	0	-166.45	-166.45
Canals															
Canals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	-19.78	-19.78	0	-6.61	-6.61	0	-42.4	-42.4	0	-97.66	-97.66	0	-166.45	-166.45

[a]Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availablity of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in this section.

[b]This is a summary of detailed information on habitat suitability for target species determined through HEP analysis. See the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g) for a full discussion on how these values were determined.

3.9.6.5.9 Total Impacts. Tables 3.9-12 and 3.9-13 list the total impacts of the Cow Canyon Alternative on wetland and riparian area and function. Approximately 109 acres of wetland and riparian habitat would be impacted by dams, reservoirs, and canals, with all but 15 acres permanently lost. This portion of total losses represents approximately 167 AAHUs. Mitigation measures are expected to substantially offset these losses (see Section 3.9.6.5.10). Up to 2,201 additional acres of wetlands and riparian communities that were not evaluated using HEP may also be impacted by land retirement, reduced availability of secondary irrigation water, and irrigation of Tribal idle lands (Table 3.9-13). Known and estimated total losses of wetlands and riparian communities would be 2,295 acres. Other potential, currently unquantifiable impacts could occur because of changes in the amount and timing of downstream river discharge.

3.9.6.5.10 Mitigation. Compensation for unavoidable impacts on wetland and riparian resources would occur through development of wetland and riparian habitat at the Clay Basin and Lake Fork mitigation sites (see Section 4 of the Wildlife Resources Technical Report, CH2M HILL/Horrocks 1996g). Table 3.9-9 lists the functional gains from mitigation under this alternative.

A total of 605 acres of new wetland or riparian habitat is proposed for mitigation. All mitigation would be in the form of habitat development on mitigation sites. The proposed wetland and riparian resource development would be equivalent to a net functional gain of approximately 904 AAHUs (Table 3.9-9) comparing wetland and riparian habitat impacts from dams, reservoirs, and canals with the increased habitat values of the proposed mitigation measures. Habitat Units that are predicted to be gained as a result of implementing the proposed mitigation measures are based on the assumption that the measures are successful in achieving the stated goals. Habitat improvement and habitat development measures described above would compensate for impacts from dams and reservoirs.

A total of 2,201 acres of potential impacts on wetlands and riparian communities were not included in the HEP analysis because the location of impact areas or the nature of the potential impacts was not known at the time of the HEP study. Potential impacts that were not included in the HEP study included those that may result from irrigation of Tribal idle lands, land retirement, and reduced availability of secondary irrigation water for wetlands (Table 3.9-13). Counting all quantified or estimated impacts on wetlands and riparian communities, there would be a net loss of 1,690 acres of wetlands and riparian communities after mitigation. Impacts from these project features would be mitigated at the site of the impact (onsite) to the extent possible as described in CH2M HILL/Horrocks (1996f). Specific mitigation measures associated with these other project features (reservoirs, river corridors, diversion dams, pipelines, land retirement, irrigation of Tribal lands, reduced secondary irrigation water, fish and wildlife enhancements, and recreation developments) are the same as for the Proposed Action (Section 3.9.6.4.11).

All compensation would be determined through coordination among the CUWCD, Ute Tribe, COE, Utah Division of Wildlife Resources, and FWS.

3.9.6.5.11 Unavoidable Adverse Impacts. All unavoidable adverse impacts on wetland and riparian resources resulting from this alternative would be subject to compensatory mitigation as described above.

3.9.6.5.12 Cumulative Impacts. All project features and actions would result in known and estimated cumulative losses of 4,922 acres of wetland and riparian communities with an estimated 2,627 acres resulting from implementation of the Uintah Unit Replacement Project. Other potential, currently unquantifiable impacts could occur because of changes in the amount and timing of downstream river discharge.

Table 3.9-13 Known and Estimated Wetland Impacts and Proposed Mitigation in Acres--Cow Canyon Alternative															
Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Totals		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Impacts															
Permanent Impacts															
Dams and Reservoirs	0	12*	12	0	5	5	0	29	29	0	48	48	0	94	94
Canals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Irrigate Tribal Idle Lands[a]	[illegible]	0	4	49	0	49	46	0	46	21	0	21	120	0	120
Secondary Irrigation Water-Supported Wetlands[b]	7	74	75	16	784	800	16	748	764	7	343	350	40	1,949	1,989
Land Retirement[c]															
Direct Impacts	0	13	13	0	26	26	13	0	13	13	0	13	26	39	65
Potential Indirect Impacts[f]	0	5	5	0	12	12	0	[illegible]	5	0	5	5	0	27	27
Total Permanent	[illegible]	104	109	65	827	892	75	782	857	41	396	437	186	2,109	2,295
Temporary Impacts															
Pipelines[a, d]	0	0	0	0	0	0	0	15	15	0	0	0	0	15	15
Mitigation															
Habitat Development															
Mitigation Sites	0	10	10	0	245	245	0	250	250	0	100	100	0	605	605
Canals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Development	0	10	10	0	245	245	0	250	250	0	100	100	0	605	605
Habitat Improvement															
Mitigation Sites	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Canals	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal Improvement	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Mitigation	0	10	10	0	245	245	0	250	250	0	100	100	0	605	605
Gain/Loss															
Net Change[e]	-5	-94	-99	-65	-582	-647	-75	-532	-607	-41	-296	-337	-186	-1,504	-1,690

*Includes 5 acreas of beaver pond cover type.

[a]Idle lands are not project features but would be affected by the project. Tribal idle lands include 160 acres of wetland and riparian communities. Six of these acres would be impacted by water conservation measures and 154 acres would be impacted by conversion of idle lands to agriculture.

[b]The estimated total number of acres of wetland and riparian cover types that may be impacted by reduced availablity of secondary irrigation water represents a crude estimate, as described in the text.

[c]These areas would be directly impacted. Other potential indirect impacts on wetlands situated below (downgradient) from retired lands would be monitored as described in the text.

[d]In-kind mitigation would occur at the location of pipeline impacts.

[e]Net change equals mitigation acres minus quantified and estimated permanent impacts.

[f]See text for discussion of how potential indirect impacts were calculated.

3.9.6.6 Crystal Ranch Alternative

3.9.6.6.1 Dams and Reservoirs. A total of 207 acres of mostly forested and shrub riparian communities, representing 811 AAHUs, would be impacted by reservoir development on Tribal and non-Tribal lands (Tables 3.9-14 and 3.9-15).

3.9.6.6.2 River Corridors. Table 3.9-7 lists baseline flows and expected flows under the Crystal Ranch Alternative for representative stations on the Yellowstone and Lake Fork Rivers. Section 3.9.6.4.2 addressed general effects of flow changes on wetland and riparian resources.

Yellowstone River Discharge Volumes and Flow Patterns. Peak discharge in the Yellowstone River would be approximately 11 percent less than that for the baseline 2- and 5-year events. Essentially no change would occur for less frequent events. Winter flows would be somewhat lower and summer flows higher than baseline levels. Depending on the month, spring flows would be higher or lower than baseline. These changes are not expected to affect wetland and riparian resources along the river. A 1- to 2-week delay in the timing of peak flows would impact wetland and riparian communities as previously described.

Lake Fork River Discharge Volumes and Flow Patterns. All peak flows in the Lake Fork River would decrease and peak flow timing would be delayed by 1 to 2 weeks compared to baseline levels. Flow patterns would vary on the Lake Fork River depending on the month and river reach (CH2M HILL/Horrocks 1996f). These flow patterns and discharge changes are expected to reduce maintenance, establishment, and recruitment of wetland and riparian species along the entire length of the river, especially above the "C" Canal (CH2M HILL/Horrocks 1996f).

3.9.6.6.3 Diversion Dams. Diversion dam impacts would be the same as for the Proposed Action (Section 3.9.6.3.3) except that the Big Sand Wash Feeder Pipeline diversion is not part of this alternative.

3.9.6.6.4 Canals. A total of 60 acres of wetland and riparian resources, mostly wet meadows and forested riparian on non-Tribal land, would be impacted and approximately 105 AAHUs lost (Table 3.9-15).

3.9.6.6.5 Land Retirement. These impacts would be the same as described for the Proposed Action.

3.9.6.6.6 Irrigation of Tribal Idle Lands. These impacts would be the same as described for the Proposed Action.

3.9.6.6.7 Secondary Irrigation Water-Supported Wetlands. Based on the stated assumptions, secondary irrigation water available to wetlands would be reduced by 19,200 acre-feet. The estimated impact would be the loss of 2,133 acres of wetlands and riparian communities. Six acres of this loss would occur on Tribal idle lands.

3.9.6.6.8 Fish and Wildlife Enhancement and Recreation Developments. Resources impacted by these activities were described under the Proposed Action (Section 3.9.6.4.9) or Cow Canyon Alternative (Section 3.9.6.5.8).

Stream improvements as described for the Proposed Action would be implemented along approximately 5 and 2 miles on the Lake Fork and Yellowstone Rivers, respectively. Stream improvements would enhance riparian vegetation in areas not heavily grazed.

3.9.6.6.9 Total Impacts. Tables 3.9-14 and 3.9-15 list the total impacts of the Crystal Ranch Alternative on wetland and riparian resources. Dams, reservoirs, and canals would result in the permanent loss of 267 acres of these resources. This represents a functional loss of approximately 915 AAHUs. Mitigation measures are expected to substantially offset these losses (see Section 3.9.6.6.10). Up to 2,342 additional acres of wetlands and riparian communities that were not evaluated using HEP may also be impacted by land retirement, reduced availability of secondary irrigation water, and irrigation of Tribal idle lands (Table 3.9-16). Known and estimated total losses of wetlands and riparian communities would be

Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Wetland and Riparian Cover Types Total		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Reservoirs															
Crystal Ranch	0	0	0	[illegible]	35	36	27	60	67	67	17	84	95	112	207
Subtotal	**0**	**0**	**0**	**[illegible]**	**35**	**36**	**27**	**60**	**67**	**67**	**18**	**84**	**15**	**112**	**207**
Canals															
Farnsworth Lateral No. 1	0	0	0	0	18	22	[illegible]	0	1	0	0	0	14	18	32
Farnsworth Lateral No. 2	0	0	0	0	0	0	0	0	0	0	6	0	0	4	4
Farnsworth Lateral No. 3	0	0	0	0	18	17	0	[illegible]	[illegible]	0	2	2	0	24	24
Subtotal	**0**	**0**	**0**	**[illegible]**	**18**	**36**	**[illegible]**	**[illegible]**	**[illegible]**	**0**	**6**	**15**	**84**	**46**	**60**
Total	**0**	**0**	**0**	**5**	**70**	**75**	**28**	**65**	**99**	**76**	**23**	**99**	**109**	**158**	**267**

Table 3.9-14
HEP Evaluated Impacts at Reservoirs and Canals in Acres--Crystal Ranch Alternative[a]

[a]Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availablity of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in this section.

Table 3.9-15
HEP Evaluated Impacts at Reservoirs and Canals in Average Annual Habitat Units--Crystal Ranch Alternative[a, b]

Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Wetland and Riparian Cover Types Total		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Reservoirs															
Crystal Ranch	0	0	0	-2.54	-88.68	-91.22	-106.51	-236.67	-343.18	-299.93	-76.11	-376.04	-408.98	-401.46	-810.44
Subtotal	0	**0**	**0**	**-2.54**	-88.68	**-91.22**	**-106.51**	-236.67	**-343.18**	**-299.93**	-76.11	**-376.04**	**-408.98**	**-401.46**	**-810.44**
Canals															
Canals	0	0	0	-7.34	-69.91	-77.25	-1.45	-13.1	-14.55	-8.97	-3.57	-12.55	-17.77	-86.58	-104.35
Total	**[illegible]**	**0**	**0**	**-9.88**	**-158.59**	**-168.47**	**-107.96**	**-249.77**	**-357.73**	**-308.90**	**-79.68**	**-388.59**	**-426.75**	**-488.04**	**-914.79**

[a]Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availablity of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in this section.
[b]This is a summary of detailed information on habitat suitability for target species determined through HEP analysis. See the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g) for a full discussion on how these values were determined.

Table 3.9-16
Known and Estimated Wetland Impacts and Proposed Mitigation in Acres--Crystal Ranch Alternative

Project Feature	Emergent Wetlands Tribal	Emergent Wetlands Non-Tribal	Emergent Wetlands Total	Wet Meadow Tribal	Wet Meadow Non-Tribal	Wet Meadow Total	Shrub Riparian Tribal	Shrub Riparian Non-Tribal	Shrub Riparian Total	Forested Riparian Tribal	Forested Riparian Non-Tribal	Forested Riparian Total	Totals Tribal	Totals Non-Tribal	Totals Total
Impacts															
Permanent Impacts															
Dams and Reservoirs	0	0	0	1	35	36	27	60	87	67	17	84	**95**	**102**	**207**
Canals	0	0	0	[illegible]	35	39	1	5	6	9	6	15	**14**	**64**	**60**
Irrigate Tribal Idle Lands[a]	0	0	0	47	0	47	45	0	45	21	0	21	**117**	**0**	**117**
Secondary Irrigation Water-Supported Wetlands[b]	1	80	81	17	841	858	17	801	818	8	368	376	**43**	**2,090**	**2,133**
Land Retirement[c]			0			0			0			0			
Direct Impacts	0	13	13	0	26	26	0	13	13	0	13	13	**0**	**65**	**65**
Potential Indirect Impacts[f]	0	5	5	0	12	12	0	[illegible]	5	0	[illegible]	5	**0**	**27**	**27**
Total Permanent	**[illegible]**	**98**	**103**	**69**	**949**	**1,018**	**90**	**884**	**974**	**105**	**409**	**514**	**269**	**2,340**	**2,609**
Temporary Impacts															
Pipelines[a, d]	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**0**
Mitigation															
Habitat Development															
Mitigation Sites	0	0	0	100	0	100	250	0	250	200	0	200	**550**	**0**	**550**
Canals	0	0	0	0	31	31	0	0	0	0	33	33	**0**	**64**	**64**
Subtotal Development	**0**	**0**	**0**	**100**	31	**131**	**250**	**0**	250	**200**	33	**233**	**550**	**64**	**614**
Habitat Improvement															
Mitigation Sites	0	0	0	39	0	39	142	0	142	99	0	99	**280**	**0**	**280**
Canals	0	0	0	0	71	71	0	0	0	0	10	10	**0**	**81**	**81**
Subtotal Improvement	**0**	**0**	**0**	**39**	**71**	**110**	**142**	**0**	142	**99**	**10**	**109**	**280**	**81**	**361**
Total Mitigation	**0**	**0**	**0**	**139**	**102**	**241**	**392**	**0**	**392**	**299**	**43**	**342**	**830**	**145**	**975**
Gain/Loss															
Net Change[e]	**-5**	**-98**	**-103**	**70**	**-847**	**-777**	**302**	**-884**	**-582**	**194**	**-366**	**-172**	**561**	**-2,195**	**-1,634**

[a]Idle lands are not project features but would be affected by the project. Tribal idle lands include 160 acres of wetland and riparian communities. Six of these acres would be impacted by water conservation measures and 154 acres would be impacted by conversion of idle lands to agriculture.
[b]The estimated total number of acres of wetland and riparian cover types that may be impacted by reduced availablity of secondary irrigation water represents a crude estimate, as described in the text.
[c]These areas would be directly impacted. Other potential indirect impacts on wetlands situated below (downgradient) from retired lands would be monitored as described in the text.
[d]In-kind mitigation would occur at the location of pipeline impacts.
[e]Net change equals mitigation acres minus quantified and estimated permanent impacts.
[f]See text for discussion of how potential indirect impacts were calculated.

2,609 acres. Other potential, currently unquantifiable impacts could occur because of changes in the amount and timing of downstream river discharge.

3.9.6.6.10 Mitigation. A total of 975 acres of developed or improved wetland or riparian habitat is proposed (Table 3.9-16) at the Brotherson and Lake Fork mitigation sites (see Section 4 of the Wildlife Resources Technical Report, CH2M HILL/Horrocks 1996g).

Habitat development would account for approximately 63 percent of this area while habitat improvements would be implemented on approximately 37 percent. The proposed mitigation would result in a net functional gain of approximately 237 AAHUs (Table 3.9-9) comparing wetland and riparian habitat impacts from dams, reservoirs, and canals with the increased habitat values of the proposed mitigation measures. Habitat Units that are predicted to be gained as a result of implementing the proposed mitigation measures are based on the assumption that the measures are successful in achieving the stated goals. Habitat improvement and habitat development measures described above would compensate for impacts from dams, reservoirs, and canal rehabilitation.

A total of 2,342 acres of potential impacts on wetlands and riparian communities were not included in the HEP analysis because the location of impact areas or the nature of the potential impacts was not known at the time of the HEP study. Potential impacts that were not included in the HEP study included those that may result from irrigation of Tribal idle lands, land retirement, and reduced availability of secondary irrigation water for wetlands (Table 3.9-16). Counting all quantified or estimated impacts on wetlands and riparian communities, there would be a net loss of 1,634 acres of wetlands and riparian communities after mitigation. Impacts from other project features would be mitigated at the site of the impact (onsite) to the extent possible as described in CH2M HILL/Horrocks (1996f).

Specific mitigation measures associated with these other project features (reservoirs, river corridors, diversion dams, canal rehabilitation, land retirement, irrigation of Tribal idle lands, reduced secondary irrigation water, fish and wildlife enhancements, and recreation developments) were described in Section 3.9.6.4.11. All compensation would be determined through coordination among the CUWCD, Ute Tribe, COE, Utah Division of Wildlife Resources, and FWS.

3.9.6.6.11 Unavoidable Adverse Impacts. All unavoidable adverse impacts on wetland and riparian resources resulting from this alternative would be subject to compensatory mitigation as described above.

3.9.6.6.12 Cumulative Impacts. All project features and actions would result in known and estimated cumulative losses of 5,236 acres of wetland and riparian communities with an estimated 2,627 acres resulting from implementation of the Uintah Unit Replacement Project. Other potential, currently unquantifiable impacts could occur because of changes in the amount and timing of downstream river discharge.

3.9.6.7 Twin Pots Alternative

3.9.6.7.1 Dams and Reservoirs. A total of 31 acres of mostly shrub riparian communities, representing 42 AAHUs, would be impacted by reservoir development on non-Tribal land (Table 3.9-17).

3.9.6.7.2 River Corridors. Implementation of the Twin Pots Alternative would not affect peak flows in the Yellowstone River (Table 3.9-7) or associated wetland and riparian vegetation. Lake Fork River maximum flows would be lower than baseline and monthly flows would vary by river reach (CH2M HILL/Horrocks 1996f). Potential impacts on wetland and riparian habitat could occur on the upper reaches of the Lake Fork River as a result of decreased summer flows. A 1- to 2-week delay in the timing of peak flows would impact wetland and riparian communities as previously described.

3.9.6.7.3 Diversion Dams. Impacts would be identical to those described for the Proposed Action. In addition, construction of the Lake Fork-Yellowstone Pipeline diversion dam may result in

Table 3.9-17
HEP Evaluated Impacts at Reservoirs and Canals in Acres--Twin Pots Alternative*

Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Wetland and Riparian Cover Types Total		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total
Reservoirs															
Big Sand Wash	0	7	7	0	4	4	0	20	20	0	0	0	0	31	31
Subtotal	0	7	7	0	4	4	0	20	20	0	0	0	0	31	31
Canals															
Farnsworth Lateral No. 1	0	0	0	0	18	22	[illegible]	0	6	0	0	0	14	14	32
Farnsworth Lateral No. 2	0	0	0	0	4	4	0	0	6	0	0	0	0	0	4
Farnsworth Lateral No. 3	0	0	0	0	17	17	0	5	6	0	[illegible]	2	0	24	24
Subtotal	0	0	0	[illegible]	35	39	[illegible]	[illegible]	6	0	0	15	14	46	60
Total	6	7	7	1	39	43	1	25	26	9	6	15	14	77	91

*Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availablity of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in this section.

minor impacts on wetland and riparian resources. Section 3.9.6.4.3 of the Proposed Action and CH2M HILL/Horrocks (1996f) discuss measures that would be taken to avoid or reduce these impacts.

3.9.6.7.4 Canals. Impacts on wetland and riparian resources from canal rehabilitation would be the same as for the Crystal Ranch Alternative (see Section 3.9.6.6.4).

3.9.6.7.5 Pipelines. Temporary loss of 46 acres of wet meadow, shrub riparian, and forested riparian habitat would result from construction of the Big Sand Wash Feeder and Lake Fork-Yellowstone Pipelines (Tables 3.9-5 and 3.9-18). Temporary habitat losses at the Big Sand Wash-Roosevelt Pipeline would probably be minor since this pipeline corridor is almost entirely within existing highway right-of-ways. Habitat losses would be replaced following construction (see Section 3.9.6.7.11). Periodic maintenance of the pipelines may result in additional temporary impacts.

3.9.6.7.6 Land Retirement. These impacts would be the same as described for the Proposed Action.

3.9.6.7.7 Irrigation of Tribal Idle Lands. These impacts would be the same as described for the Proposed Action.

3.9.6.7.8 Secondary Irrigation Water-Supported Wetlands. Secondary irrigation water available to wetlands would be reduced by 19,400 acre-feet. The estimated impact would be the loss of 2,156 acres of wetlands and riparian communities. Six acres of this loss would occur on Tribal idle lands.

3.9.6.7.9 Fish and Wildlife Enhancement. Impacts on wetland and riparian resources from fish and wildlife enhancements were described under the Proposed Action (Section 3.9.6.4.9).

3.9.6.7.10 Total Impacts. Dams, reservoirs, and canals would result in the permanent loss of 137 acres of wetlands and riparian areas under the Twin Pots Alternative (Table 3.9-18) with 66 percent of this area permanently affected. This represents a functional loss of approximately 144 AAHUs (Table 3.9-9). Mitigation measures are expected to substantially offset these losses (see Section 3.9.6.7.11). An estimated 567 additional acres of wetlands and riparian communities that were not evaluated using HEP may also be impacted by land retirement, reduced availability of secondary irrigation water, and irrigation of Tribal idle lands (Table 3.9-18). Known and estimated total losses of wetlands and riparian communities would be 658 acres. Other potential, currently unquantifiable impacts could occur because of changes in the amount and timing of downstream river discharge.

3.9.6.7.11 Mitigation. Unavoidable impacts on these resources would be mitigated by habitat development and improvement at the Evans and Clay Basin mitigation sites and along rehabilitated canals (see Section 4 of the Wildlife Resources Technical Report, CH2M HILL/Horrocks 1996g). A total of 300 acres of new or improved wetland or riparian habitat is proposed (Table 3.9-18). Habitat development would account for approximately 73 percent of this area, while habitat improvement would account for approximately 27 percent. Mitigation measures would result in a net functional gain of approximately 186 AAHUs (Table 3.9-9) comparing wetland and riparian habitat impacts from only dams, reservoirs, and canals with the increased habitat values of the proposed mitigation measures. Habitat Units that are predicted to be gained as a result of implementing the proposed mitigation measures are based on the assumption that the measures are successful in achieving the stated goals. The habitat improvement and development measures described above would compensate for impacts from dams, reservoirs, and canal rehabilitation.

A total of 2,330 acres of potential impacts on wetlands and riparian communities were not included in the HEP analysis because the location of impact areas or the nature of the potential impacts was not known at the time of the HEP study. Potential impacts that were not included in the HEP study included those that may result from irrigation of Tribal idle lands, land retirement, and reduced availability of secondary irrigation water

Table 3.9-18

Known and Estimated Wetland Impacts and Proposed Mitigation in Acres--Twin Pots Alternative

Project Feature	Emergent Wetlands			Wet Meadow			Shrub Riparian			Forested Riparian			Totals		
	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribal	Non-Tribal	Total	Tribe	Non-Tribal	Total
Impacts															
Permanent Impacts															
Dams and Reservoirs	0	7	7	0	0	4	0	20	20	0	0	0	**0**	**31**	**31**
Canals	0	0	0	0	35	39	1	5	0	0	0	15	**14**	**46**	**60**
Irrigate Tribal Idle Lands[a]	0	0	4	47	0	47	45	0	45	21	0	21	**117**	**0**	**117**
Secondary Irrigation Water-Supported Wetlands[b]	1	81	82	17	850	867	17	810	827	8	372	380	**43**	**2,113**	**2,156**
Land Retirement[c]															
Direct Impacts	0	6	6	0	12	12	0	6	6	0	6	6	**0**	**30**	**30**
Potential Indirect Impacts[f]	0	5	5	0	12	12	0	5	5	0	0	5	**0**	**27**	**27**
Total Permanent	**0**	**99**	**104**	**68**	**913**	**981**	**63**	**846**	**909**	**38**	**389**	**427**	**174**	**2,247**	**2,421**
Temporary Impacts															
Pipelines[a, d]	0	0	0	0	0	9	14	16	30	7	0	7	**30**	**16**	**46**
Mitigation															
Habitat Development															
Mitigation Sites	0	10	10	0	145	145	0	0	0	0	0	0	**0**	**155**	**155**
Canals	0	0	0	0	31	31	0	0	0	0	33	33	**0**	**64**	**64**
Subtotal Development	**0**	**10**	**10**	**0**	**176**	**176**	**0**	**0**	**0**	**0**	**43**	33	**0**	**219**	**219**
Habitat Improvement															
Mitigation Sites	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	**0**
Canals	0	0	0	0	71	71	0	0	0	0	10	10	**0**	**81**	**81**
Subtotal Improvement	**0**	**0**	**0**	**0**	**71**	**71**	**0**	**0**	**0**	**0**	**10**	**10**	**0**	**71**	**81**
Total Mitigation	**0**	**10**	**10**	**0**	**247**	**247**	**0**	**0**	**0**	**0**	**43**	**43**	**0**	**300**	**300**
Gain/Loss															
Net Change[e]	**-5**	**-89**	**-94**	**-68**	**-666**	**-734**	**-63**	**-846**	**-909**	**-38**	**-346**	**-384**	**-174**	**-1,947**	**-2,121**

[a] Idle lands are not project features but would be affected by the project. Tribal idle lands include 160 acres of wetland and riparian communities. Six of these acres would be impacted by water conservation measures and 154 acres would be impacted by conversion of idle lands to agriculture.

[b] The estimated total number of acres of wetland and riparian cover types that may be impacted by reduced availablity of secondary irrigation water represents a crude estimate, as described in the text.

[c] These areas would be directly impacted. Other potential indirect impacts on wetlands situated below (downgradient) from retired lands would be monitored as described in the text.

[d] In-kind mitigation would occur at the location of pipeline impacts.

[e] Net change equals mitigation acres minus quantified and estimated permanent impacts.

[f] See text for discussion of how potential indirect impacts were calculated.

for wetlands (Table 3.9-18). Counting all quantified or estimated impacts on wetlands and riparian communities, there would be a net loss of 2,121 acres of wetlands and riparian communities after mitigation. Impacts from other project features would be mitigated at the site of the impact (onsite) to the extent possible as described in CH2M HILL/Horrocks (1996f).

Specific mitigation measures associated with these other project features (reservoirs, river corridors, diversion dams, canal rehabilitation, pipelines, land retirement, irrigation of Tribal idle lands, reduced secondary irrigation water, and fish and wildlife enhancements) were described in Section 3.9.6.4.11. All compensation would be determined through coordination among the CUWCD, Ute Tribe, COE, Utah Division of Wildlife Resources, and FWS.

3.9.6.7.12 Unavoidable Adverse Impacts. All unavoidable adverse impacts on wetland and riparian resources resulting from this alternative would be subject to compensatory mitigation as discussed above.

3.9.6.7.13 Cumulative Impacts. All project features and actions would result in known and estimated cumulative losses of 5,048 acres of wetland and riparian communities with an estimated 2,627 acres resulting from implementation of the Uintah Unit Replacement Project. Other potential, currently unquantifiable impacts could occur because of changes in the amount and timing of downstream river discharge.

3.9.6.8 No Action Alternative

If no action is taken, present trends affecting wetland and riparian resources in the Uinta Basin would continue into the future. Irrigation water diversion from the Lake Fork and Yellowstone Rivers would continue, with diversions highest during peak flows in early summer. Peak and monthly flows would remain unchanged from the present. Unlined canals would indefinitely sustain certain wetland and riparian areas through leakage of canal water. Wetland and riparian resources within reservoir fill areas and borrow areas would not be lost. Storage and regulation of irrigation water releases would not change. As a result, high groundwater tables, seeps, and irrigation return flows would likely continue to support these resources.

Improved water use efficiency would likely occur over time in some areas, resulting in closer regulation of water application and a reduction in runoff. Without mitigation, this could result in a decline in wetland and riparian habitat supported by irrigation runoff and return flow over the long term.

Without the project, mitigation measures would not be required, and fish and wildlife enhancement and recreation development features would not be implemented.

3.10 Wildlife Resources

3.10.1 Introduction

The wildlife resources analysis addresses potential impacts on wildlife habitat and species resulting from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit. The analysis focuses on direct, indirect, total, and cumulative potential impacts on wildlife habitat and certain species, including big game, sage grouse, and raptors. Threatened, endangered, candidate, and FS sensitive wildlife species are addressed in Section 3.11 Threatened and Endangered Species. Mitigation strategies are identified that will reduce or avoid certain impacts or will compensate for some unavoidable impacts.

3.10.2 Issues Eliminated from Further Analysis

All wildlife resources issues identified during public scoping were analyzed.

3.10.3 Issues Addressed in the Impact Analysis

Significant impacts on wildlife resources predicted to occur as a result of implementing the Upalco

Unit Proposed Action or alternatives are addressed in the impact analysis and include the following: loss of wetland, riparian, and upland wildlife habitat; loss of critical and normal big game winter range; impacts on certain raptors; and impacts on sage grouse breeding complexes.

3.10.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the project feature sites for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

3.10.5 Affected Environment

Wildlife habitat cover types in the Upalco Unit were described in detail in the Wetland/Riparian Resource Technical Report (CH2M HILL/Horrocks 1996f), the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g), and North State Resources (1996), along with the protocols used for mapping cover types. Protocols developed by Cowardin et al. (1979) for wetland and riparian communities that rely on canopy coverage of the tallest vegetation as well as tree and shrub height were used for cover type mapping. These cover type designations were used for the HEP study and for all mapping. Cover types present in the area of project features include conifer (pure and mixed stands), mixed conifer/deciduous (conifer and either aspen or cottonwood), upland aspen, Russian olive, forested riparian, shrub riparian, emergent wetland, wet meadow, open water, beaver pond complex (mix of open water and shrub and forest riparian), sagebrush/grass (including all upland shrub and grass types), juniper, irrigated lands (irrigated croplands and pasture with minor inclusions of farmsteads and outbuildings), and bare ground.

Information is also presented on big game winter and spring distribution and cover type use, sage grouse habitat and breeding complex distribution, and raptor wintering and nesting near reservoir and canal rehabilitation sites and at other project feature sites where data are available.

3.10.5.1 Proposed Action–Talmage

3.10.5.1.1 High Mountain Lakes. Wetland and riparian cover types in the potentially affected area at six of the lakes include emergent wetland, shrub riparian, and/or wet meadow as described in Section 3.9 Wetland and Riparian Resources and in the Wetland/Riparian Resource Technical Report (CH2M HILL/Horrocks 1996f).

Wildlife use of these areas is probably relatively low because of the generally small vegetation patch size and high elevation of the sites. However, wildlife use would be relatively high compared to that of high elevation upland cover types. For most wildlife, the season of use is the snow-free period, which generally extends from June or early July to September or October. Some of the more common wildlife that use these cover types at high mountain lakes include a few species of passerine birds that breed or forage in shrub riparian communities, a few species of small mammals, and a few moose (*Alces alces*) that feed on shrubs or aquatic plants during summer and early fall.

3.10.5.1.2 Dams and Reservoirs.

3.10.5.1.2.1 Wildlife Habitat. The acreage of each of the vegetation cover types present at the Crystal Ranch and Big Sand Wash Dam and Reservoir sites is shown in Table 3.10-1.

3.10.5.1.2.2 Big Game. Big game distribution in the vicinity of proposed dams and reservoirs was determined through the use of aerial surveys during two winters. The results of the aerial surveys are presented in detail in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g) and highlights are summarized below.

The Utah Division of Wildlife Resources (Wildlife Resources) classifies and has mapped mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), and moose winter, summer, and year-long range. The classification system uses a rating of the relative importance of areas for these species. Relative importance ratings, as defined by Wildlife Resources, include the following categories:

Table 3.10-1
Acreage of Affected Cover Types for Dam and Reservoir,[a] Canal Rehabilitation, and Pipeline Construction Sites for the Proposed Action – Talmage

Cover Type	Reservoir and Cover Type Acreage				Canals		Pipelines	Land Retirement (Non-Tribal)	Idle Lands (Tribal)	Secondary Irrigation Water-Supported Wetlands
	Crystal Ranch (Non-Tribal)	Crystal Ranch (Tribal)	Big Sand Wash (Non-Tribal)		Tribal	Non-Tribal				
	Acres Permanently Impacted	Acres Permanently Impacted	Acres Permanently Impacted	Acres Temporarily Impacted[b]	Acres Permanently Impacted	Acres Permanently Impacted	Acres Temporarily Impacted[c]	Acres Permanently Impacted	Acres Permanently Impacted	Acres Permanently Impacted
Conifer	0	0	0	0	0	0	0	0	0	--
Deciduous/conifer mix	0	0	0	0	0	0	0	0	0	--
Upland aspen	0	0	0	0	0	0	0	0	0	--
Forest riparian	17	67	0	0	9	11	0	19	28	352
Shrub riparian	60	27	20	0	1	5	15	19	62	768
Emergent wetland	0	0	7	0	0	0	0	19	5	75
Wet meadow	35	1	4	0	4	81	1	38	65	805
Open water	18	10	0	0	0	0	0	13	0	--
Beaver pond	0	0	0	0	0	0	0	0	0	--
Irrigated	42	0	11	0	0	0	35	819	61	--
Sagebrush/grass	57	224	309	22	0	0	14	338	809	--
Juniper	0	0	43	5	0	0	10	13	8	--
Bare ground	4	0	1	7	0	0	0	0	0	--
Russian olive	0	0	0	0	0	0	0	52	0	--
Total	233	329	395	34	14	97	75	1,330	1,038	2,000

Notes:
Cover type area was calculated to the nearest 0.1 acre by the Geographic Information System. All numbers were raised to the next whole number on this table. This was not done for the HEP analysis. Therefore, acreage on this table may not exactly match acreage shown on tables presenting HEP study results.

[a]Dams, reservoirs, and canal rehabilitation were included in the HEP study.
[b]The column Acres Temporarily Impacted does not appear for sites without temporary impacts.
[c]Most of the impacts from pipelines would be temporary.

- **Critical**—sensitive use areas that, because of limited abundance and/or unique qualities, constitute irreplaceable, critical requirements for high-interest wildlife

- **High value**—intensive use areas that, because of relatively wide distribution, do not constitute critical areas but are highly important to high-interest wildlife

- **Substantial value**—existence areas used regularly by high-interest wildlife, but at moderate levels with little or no concentrated use by these species

- **Limited**—occasional use areas that either are sparsely populated or show sporadic use by high-interest wildlife

The proposed Crystal Ranch Reservoir site is classified as critical mule deer winter range. No deer were observed in or near the Crystal Ranch site during two aerial flights in late February and early March 1993 when there was a heavy snowpack. Deer were frequently observed in and adjacent to the site during the winter of 1993-1994 when snow accumulation was relatively low.

The lower third and a small portion of the western lower half of the Crystal Ranch site are classified as critical elk winter range. The remainder of the Crystal Ranch site is not classified as elk winter range. One herd of eight elk was observed within the reservoir area during the winter of 1993-1994 when there was a relatively low snowpack.

The Crystal Ranch Reservoir site is just downstream of higher elevation lands classified as critical year-long moose range. Field observations indicated that riparian cover types in the Crystal Ranch site provide important, heavily utilized browse for moose. Therefore, the entire Crystal Ranch site probably constitutes critical year-long range, with much of the use likely occurring during the winter. Moose generally move to higher elevations during summer.

The Big Sand Wash Reservoir enlargement site is classified as high-value, year-long range for mule deer. Deer were observed most frequently in juniper and sagebrush/grass cover types in the area during both winters. Wildlife Resources (1978a) indicated that juniper provides excellent cover and fair forage. Smaller numbers of deer were also seen near the reservoir during spring green-up surveys.

3.10.5.1.2.3 ***Sage Grouse***. The southern third of the Crystal Ranch Reservoir site is classified as year-long sage grouse (*Centrocercus urophasianus*) range because of sagebrush/grass communities bordering the riparian zone. Sagebrush/grass areas at the reservoir site generally occur on fairly steep slopes not suitable for leks. Two leks are known to occur within about 1.75 miles of the proposed reservoir site. Sagebrush/grass communities at the Crystal Ranch site either occur on relatively steep slopes or are heavily grazed and do not appear to provide suitable nesting habitat for sage grouse.

The proposed Big Sand Wash Reservoir enlargement area does not contain lands classified as sage grouse habitat. No leks were located during aerial surveys and none are known to exist within 4 miles of this site.

3.10.5.1.2.4 ***Raptors***. The status of sensitive, threatened, or endangered raptors is addressed in detail in Section 3.11. Single northern goshawks (*Accipiter gentilis*) were observed within about 0.5 mile of the Crystal Ranch Reservoir site on two occasions during 1994.

Goshawk nesting areas are typically 20 to 30 acres in size and contain one or more high-density stands of large, old trees with a dense canopy cover (Hayward and Escano 1989; Crocker-Bedford and Chaney 1988; Reynolds, Meslow, and Wight 1982). The model used to evaluate goshawk habitat for the HEP study indicated that tree basal area needed to approach 150 square feet for an area to be suitable goshawk nesting habitat. No sampled areas within the Crystal Ranch Reservoir site meet these characteristics, so the lack of nests at this time is not unexpected. However, FS data indicate that there are several goshawk nests in stands with less than 140 square feet of basal area in the Ashley National Forest. Goshawks forage over large areas of 5,000 to 6,000 acres (Reynolds 1983; Kennedy 1990). Information on foraging habitat preferences is limited but suggests that mature forests with occasional openings are preferred (Fischer 1986; Widen 1985). Riparian stands on the Crystal Ranch site are likely used by foraging goshawks.

A single golden eagle (*Aquila chrysaetos*) was seen over mixed sagebrush/grass and juniper about 0.25 mile east of the reservoir site. No raptor nests were located near the Crystal Ranch site during spring helicopter surveys. Several other raptor species likely use the Crystal Ranch area on a regular to irregular basis. A flammulated owl (*Otus flammeolus*) was heard calling near the reservoir site.

Raptor observations near Big Sand Wash Reservoir included a winter sighting of a rough-legged hawk (*Buteo lagopus*), a red-tailed hawk (*Buteo jamaicensis*), and a northern harrier (*Circus cyaneus*). Other raptor species expected in the reservoir area include short-eared owl (*Asio flammeus*), American kestrel (*Falco sparverius*), golden eagle, barn owl (*Tyto alba*), screech owl (*Otus kennicottii*), and, during migration and winter, sharp-shinned and Cooper's hawks (*Accipiter striatus* and *A. cooperii*, respectively).

3.10.5.1.3 River Corridors. Detailed wildlife survey results along river corridors are shown on the maps in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g). River corridors or floodplains support extensive wetland and riparian communities intermixed with uplands. Big game use of river corridors below dams varies considerably from year to year depending on the depth of mountain snows, with more animals using river corridors during heavy snow years (CH2M HILL/Horrocks 1996g). Many raptors used river corridors below proposed dam sites during the winter. Common species included red-tailed and rough-legged hawks, golden eagles, northern goshawks, and bald eagles. Most birds were perched in cottonwood trees, which also contained many large stick nests. Aerial surveys of river corridors were not intended to identify nesting raptors.

Based on hydrologic studies reported in the Water Resources Technical Report (CH2M HILL/Horrocks 1996e) wildlife and wildlife habitat (wetland and riparian communities) along river corridors below proposed reservoirs may be impacted by the Upalco Unit Proposed Action and alternatives. The affected environment along river corridors includes wetland and riparian communities located on broad floodplains below proposed onstream reservoirs. The extent and condition of these communities vary considerably depending on the width of the floodplain, hydrologic conditions, the extent of human disturbance such as water diversion and channelization, and grazing intensity.

3.10.5.1.4 Diversion Dams. Wetland and riparian cover types present in the vicinity of diversion dams include wet meadow, emergent wetland, and forest and shrub riparian. The specific type and area of these cover types are highly variable as is the extent of disturbance at each site. Wildlife use of these areas would also vary considerably depending on the levels of human disturbance and the type, amount, and condition of habitat present at the diversion and in the surrounding area. Since many diversion dam sites include riparian communities and wet meadows, some of the more common species in these areas would include red-tailed hawks; great-horned owls; various songbirds including warblers, flycatchers, and sparrows; killdeer (*Charadrius viciferus*); common snipe (*Gallinago gallinago*); a variety of small mammals, including bats; and several amphibians.

3.10.5.1.5 Canal Rehabilitation.

3.10.5.1.5.1 Wildlife Habitat. The vegetation cover types and the area of each cover type that would be affected by canal rehabilitation as part of the Proposed Action are listed in Table 3.10-1. Wildlife habitat values of these areas determined during the HEP study are presented in Section 3.10.6 Impact Analysis.

3.10.5.1.5.2 Big Game. Forest and shrub riparian communities along canals provide valuable escape cover in agricultural areas where other cover is lacking, and some winter browse for mule deer and elk. The dense cover of larger forest and shrub riparian areas is probably used for fawning by mule deer, especially in areas of critical year-long range. Flowing canals provide a source of drinking water, and in some areas the only source.

Areas surrounding canals to be rehabilitated are classified as critical winter range or critical year-long range for mule deer (Wildlife Resources Technical Report [CH2M HILL/Horrocks 1996g]). Most of these canals pass through areas classified as substantial value elk winter range. Portions of the Farnsworth Laterals No. 1 and No. 2 pass through unclassified range for elk, meaning these lands have no known significance for elk. Proposed canal rehabilitation areas are unclassified for moose.

3.10.5.1.5.3 ***Raptors***. Raptor use of areas along canals depends on the specific cover types present. Forest riparian areas with large trees and snags (larger than 10-inch-diameter) would support nests of large raptors such as red-tailed hawks or great horned owls and cavity nesters such as American kestrels or screech owls. Large trees are also occasionally used by golden eagles as perches. Rough-legged hawks are relatively abundant in the project area during winter and use trees overlooking open fields, meadows, and sagebrush/grass communities for perches from which to hunt. Larger forest/shrub stands may also be used by species such as long-eared owls (*Asio otus*). Northern harriers and short-eared owls use open fields, meadows, and sagebrush/grass communities for foraging and nesting.

3.10.5.1.5.4 ***Sage Grouse***. The northernmost portions of the three Farnsworth Laterals are in an area classified as limited summer range for sage grouse while the southern three-quarters of the laterals are located in year-long range (Wildlife Resources Technical Report [CH2M HILL/Horrocks 1996g]).

Existing canal seeps and leaks support wet meadows, which are particularly important foraging areas for young sage grouse during the spring. Succulent forbs are often high in protein and are important foods for young grouse (Western States Sage Grouse Committee 1982). Klott and Lindzey (1990) identified sites supporting dense grasses and forbs as preferred brood habitat for sage grouse in southwest Wyoming. Forbs dominate sage grouse foods during spring and summer, especially for juvenile birds through 12 weeks of age (Peterson 1970; Savage 1969; Klebenow and Gray 1968). Sage grouse, where they are present, use wet meadows along canals during spring, summer, and fall.

3.10.5.1.6 Pipelines.

3.10.5.1.6.1 ***Wildlife Habitat***. The area of vegetation cover types occurring within the proposed pipeline corridor is shown in Table 3.10-1. Sagebrush/grass, shrub riparian, and juniper are the three primary native plant communities that would be crossed by the pipeline.

3.10.5.1.6.2 ***Big Game***. The Big Sand Wash Feeder Pipeline would be constructed through land classified as high-value, year-long range for mule deer but unclassified for elk or moose. Mule deer use riparian areas for escape cover and fawning (Wildlife Resources 1978a).

3.10.5.1.6.3 ***Raptors***. Raptor use of riparian communities along the pipeline route would be similar to that described in Section 3.10.5.1.5.3 for the same cover types along canals. Large trees are probably the single most important habitat feature for raptors since they can support many species of nesting raptors and provide perches from which to hunt over surrounding open cover types.

3.10.5.1.7 Fish and Wildlife Enhancement and Recreation Developments. Proposed fish and wildlife enhancement features include big game winter range improvement and water developments at Monarch Bench and Towanta Flats; Twin Pots Reservoir improvement; Red Rocks/Duchesne drainage habitat acquisition, Clay Basin Pond improvements, and stream improvements. Range improvement activities would include seeding forb, browse, and grass mixtures over existing vegetation to improve big game forage and developing small openings in extensive juniper stands. Water developments at Towanta Flats and Monarch Bench would occur in areas occupied by sagebrush/grass, wet meadow, and riparian communities. Areas of the Red Rocks/Duchesne drainage classified as critical, high value, or substantial big game winter range would be managed for wildlife and riparian corridors would be protected. Proposed recreation developments include the Crystal Ranch Campground.

3.10.5.1.8 Land Retirement. Water rights to lands would be purchased as part of the land retirement feature. These lands include a mix of irrigated pasture, croplands, and natural cover types (Table 3.10-1). Small wet meadows and riparian areas occur at the lower end of some irrigated pastures. Depending on their location, these lands may provide forage for deer during early spring, nesting cover for the small pheasant population that occupies the Uinta Basin, and foraging areas for a few species of shorebirds.

3.10.5.1.9 Secondary Irrigation Water-Supported Wetlands. Runoff of excess irrigation water is called secondary irrigation water. The portion of secondary irrigation water that supports wetland and riparian communities in the Upalco Unit and the actual acreage of wetlands and riparian communities supported by this water are not known. For the purpose of developing a crude estimate of the acres of wetlands that could be impacted when this water supply is reduced, we have assumed that 50 percent of secondary irrigation water is used consumptively by wetlands. This 50 percent figure may be too high or too low; there is no way of knowing for certain. However, it is known that 10,700 acre-feet of secondary irrigation water (which represents an unknown portion of the total secondary irrigation runoff) makes its way back to the Lake Fork River as return flow and an unknown amount of secondary irrigation water is reapplied to crops, so not all secondary irrigation runoff is used consumptively by wetlands. Wetlands in northern Utah are estimated to require an average of 4.5 acre-feet of water during the growing season (Christiansen and Low 1970). These figures and the amounts by which secondary irrigation water would be reduced by the Proposed Action and alternatives will be used to develop crude estimates of the impacts of reduced secondary irrigation runoff on wetlands and riparian communities.

Several other assumptions were used to develop estimates of the impacts of water conservation on Tribal idle lands. The first is that water conservation measures that affect the amount of secondary irrigation water available for wetlands would be implemented evenly across all irrigated lands, regardless of ownership or location. The second assumption is based on the first: the potential impacts of water conservation measures on Tribal idle lands would occur in the same proportion that the area of Tribal idle land is to the total area of all irrigated land in the Upalco Unit. The impacts of reduced availability of this water would be monitored and mitigation requirements will be determined following the Record of Decision.

3.10.5.1.10 Tribal Idle Lands.

3.10.5.1.10.1 Wildlife Habitat. The acreage of each of the vegetation cover types present on idle lands within the Upalco Unit is shown in Table 3.10-1. The general patterns of wildlife use of these habitats are discussed in detail in the Wildlife Resources Technical Report (CH2M HILL/ Horrocks 1996g). HEP analyses were not conducted for idle lands. Habitat values on idle lands are assumed to be similar to the values calculated for the same cover types located at other project feature sites. This assumption probably slightly overestimates the habitat values of idle lands because other project features are closer on average to water.

3.10.5.1.10.2 Big Game. Idle lands north of the U.S. Lake Fork Canal are located in areas designated by Wildlife Resources as critical mule deer winter range. Idle lands within the floodplain of the Lake Fork River south of Big Sand Wash Reservoir are designated critical year-long mule deer range. The majority of idle lands located between U.S. Lake Fork Canal and Big Sand Wash Reservoir are classified as high-value winter or year-long mule deer range. South of Big Sand Wash Reservoir, idle lands outside of river floodplains are classified as substantial winter or year-long mule deer range.

Idle lands located on the Yellowstone River floodplain are classified as critical elk winter range. No other idle lands on the Upalco Unit are designated by Wildlife Resources as elk range, but elk were observed east of idle lands bordering the Lake Fork River near Pigeon Water Creek.

None of the idle lands in the Upalco Unit are located in areas designated by Wildlife Resources as moose habitat .

3.10.5.1.10.3 Sage Grouse. The northernmost parcel of idle land in the Upalco Unit is located approximately 1.25 miles from a sage grouse lek. No other idle lands within the unit are located within 2 miles of a breeding complex. Idle lands located north and west of Altonah are in areas designated by Wildlife Resources as year-long range or limited summer range. Idle lands located south and east of Altonah are not classified as sage grouse range.

3.10.5.1.10.4 Raptors. Raptor use of idle lands varies according to the vegetation cover types present. Open-country raptors such as red-tailed hawks, northern harriers, and American kestrels are abundant in sagebrush/grass, irrigated fields, and wet meadow habitats throughout the area. Rough-legged hawk use of these habitats is common during fall and winter. Golden eagles forage over wide-spread open areas; a pair were observed near idle lands located south of the Lake Fork River. Northern harriers and short-eared owls likely nest in relatively undisturbed open habitat on some idle lands, particularly those with tall wet meadow vegetation.

Raptor nests are common in riparian habitats associated with the Upalco Unit's river corridors and floodplains (CH2M HILL/Horrocks 1996g). Large trees in these areas contain numerous large stick nests, many of which likely are raptor nests. Species observed on or near idle lands in riparian habitat include red-tailed hawks, rough-legged hawks, and Cooper's hawks. Large trees associated with human dwellings and farm windbreaks are also potential nest trees for raptors, especially for relatively human-tolerant species such as red-tailed hawks and great horned owls.

3.10.5.2 Cow Canyon Alternative

3.10.5.2.1 High Mountain Lakes. The same 10 high mountain lakes would be stabilized under the Cow Canyon Alternative as under the Proposed Action. Therefore, wildlife habitat is identical to that of the Proposed Action.

3.10.5.2.2 Dams and Reservoirs.

3.10.5.2.2.1 Wildlife Habitat. The cover types and area of each type occurring at Cow Canyon Alternative dams and reservoirs are shown in Table 3.10-2.

3.10.5.2.2.2 Big Game. The proposed Upper Yellowstone Reservoir site is in high-value summer range for mule deer. It is not classified as winter range and no deer were observed in the area during two winter aerial surveys or during spring green-up surveys. The reservoir area is classified as high-value elk summer range. Elk were observed in the forested riparian community in the river floodplain within and just downstream from the reservoir site during the mild 1993-1994 winter and downstream from the reservoir during February 1993, the snowy winter.

The Upper Yellowstone Reservoir site is classified as critical year-long moose range. No moose were observed within 3 miles of the proposed reservoir site during aerial surveys. Moose as well as many moose tracks were seen within the reservoir area during the summer. Winter moose use would be concentrated in areas with riparian shrubs, the primary winter food for moose, and in conifer areas, which provide thermal cover.

3.10.5.2.2.3 Sage Grouse. The Upper Yellowstone site is not classified for sage grouse and no grouse would be expected in the immediate area. Potential sage grouse use of the proposed Big Sand Wash Reservoir enlargement area was described under the Proposed Action.

3.10.5.2.2.4 Raptors. Observed raptor use of the Upper Yellowstone Reservoir area included several goshawk sightings in the vicinity. No goshawk nests were found in or adjacent to the reservoir

Table 3.10-2
Acreage of Affected Cover Types for Dam and Reservoir,[a] Canal Rehabilitation, and Pipeline Construction Sites for the Cow Canyon Alternative

Cover Type	Reservoir and Cover Type Acreage: Upper Yellowstone (Non-Tribal) Acres Permanently Impacted	Upper Yellowstone (Non-Tribal) Acres Temporarily Impacted	Big Sand Wash (Non-Tribal) Acres Permanently Impacted	Big Sand Wash (Non-Tribal) Acres Temporarily Impacted[b]	Pipelines Acres Temporarily Impacted[c]	Land Retirement (Non-Tribal Acres Permanently Impacted	Idle Lands (Tribal) Acres Permanently Impacted	Secondary Irrigation Water-Supported Wetlands Acres Permanently Impacted
Conifer	37	3	0	0	§	0	0	--
Deciduous/conifer mix	55	5	0	0	3	0	0	--
Upland aspen	77	●	4	0	3	0	0	--
Forest riparian	48	3	7	0	0	19	28	350
Shrub riparian	9	§	19	0	15	19	62	764
Emergent wetland	0	§	7	0	3	19	●	75
Wet meadow	1	§	4	0	0	38	65	800
Open water	32	0	0	0	0	13	0	--
Beaver pond	5	§	0	0	3	0	0	--
Irrigated	4	§	11	0	15	819	61	--
Sagebrush/grass	94	12	8(9	22	0	338	809	--
Juniper	0	§	43	●	1§	13	8	--
Bare ground	1	3	1	●	3	0	0	--
Russian olive	0	3	0	0	0	52	0	--
Total	363	23	395	34	1§	1,330	1,038	1,989

Notes:
Cover type area was calculated to the nearest 0.1 acre by the Geographic Information System. All numbers were raised to the next whole number on this table. This was not done for the HEP analysis. Therefore, acreage on this table may not exactly match acreage shown on tables presenting HEP study results.

[a]Dams, reservoirs, and canal rehabilitation were included in the HEP study.
[b]The column Acres Temporarily Impacted does not appear for sites without temporary impacts.
[c]Most of the impacts from pipelines would be temporary.

area. No sampled areas in the Upper Yellowstone Reservoir site had characteristics of preferred nest stands as defined by the HEP goshawk model so the lack of nests at this site is not unexpected. Goshawks likely forage in, and in small openings within, conifer and forest riparian cover types at the proposed reservoir site.

A single golden eagle was seen over the forest riparian community within the proposed Upper Yellowstone Reservoir site and another was seen about 2 miles upstream from the upper reservoir site boundary. No raptor nests were found near the Upper Yellowstone site during spring helicopter or ground surveys. Species expected to use the Upper Yellowstone Reservoir area on a regular to irregular basis are described in the Wildlife Resources Technical Report (CH2M HILL/ Horrocks 1996g).

Raptor observations near Big Sand Wash Reservoir were described under the Proposed Action.

3.10.5.2.3 River Corridors. Potentially affected habitat types would be similar to those described for the Proposed Action and include wetland and riparian communities located on floodplains below the proposed onstream reservoir.

3.10.5.2.4 Diversion Dams. Wildlife habitat types in the vicinity of diversion dams would be the same as described for the Proposed Action.

3.10.5.2.5 Canals. No canals would be rehabilitated under the Cow Canyon Alternative.

3.10.5.2.6 Pipelines. The Big Sand Wash Feeder Pipeline was discussed under the Proposed Action.

3.10.5.2.7 Fish and Wildlife Enhancement and Recreation Developments. Fish and wildlife enhancement features under the Cow Canyon Alternative include habitat acquisition of the Fisher property, from which livestock grazing would be removed, and stream improvements. The Bridge and Swift Creek Campground improvements and Fish Creek Recreation Trail improvement would be implemented for recreation within areas of mostly upland cover types.

3.10.5.2.8 Land Retirement. The types of lands and wildlife habitat would be the same as described for the Proposed Action (Table 3.10-2).

3.10.5.2.9 Secondary Irrigation Water-Supported Wetlands. As described for the Proposed Action, changes in secondary water availability would affect wetland and riparian communities located downgradient from irrigated lands for each of the Upalco Unit alternatives.

3.10.5.2.10 Tribal Idle Lands. The same idle lands would be subject to conversion under the Cow Canyon Alternative as under the Proposed Action. Wildlife habitats on these lands are described in Section 3.10.5.1.10.

3.10.5.3 Crystal Ranch Alternative

3.10.5.3.1 High Mountain Lakes. The same 10 high mountain lakes would be stabilized under the Crystal Ranch Alternative as under the Proposed Action.

3.10.5.3.2 Dams and Reservoirs. Table 3.10-3 lists vegetation cover types and acres of each in the proposed footprint of the dam, reservoir, and associated borrow pits and roads under the Crystal Ranch Alternative. Big game, raptor, and sage grouse occurrence at the Crystal Ranch Reservoir site were described under the Proposed Action.

3.10.5.3.3 River Corridors. Wildlife habitat types along river corridors would be the same as described for the Proposed Action. The extent and condition of river corridor habitats would vary depending on the width of the floodplain, hydrologic conditions, and the extent of grazing and other disturbance factors.

3.10.5.3.4 Diversion Dams. Wildlife habitat in the vicinity of diversion dams was described for the Proposed Action.

3.10.5.3.5 Canals and Pipelines. Wildlife habitat and big game, raptor, and sage grouse occurrence along the three Farnsworth Laterals and the new right-of-way for the Farnsworth Lateral No. 1 Pipeline were described under the Proposed Action

Table 3.10-3
Acreage of Affected Cover Types for Dam and Reservoir,[a] Canal Rehabilitation, and Pipeline Construction Sites for the Crystal Ranch Alternative

Cover Type	Reservoir and Cover Type Acreage		Canals		Pipelines	Land Retirement (Non-Tribal)	Idle Lands (Tribal)	Secondary Irrigation Water-Supported Wetlands
	Crystal Ranch (Non-Tribal)	Crystal Ranch (Tribal)	Tribal	Non-Tribal				
	Acres Permanently Impacted	Acres Permanently Impacted	Acres Permanently Impacted	Acres Permanently Impacted	Acres Temporarily Impacted[b]	Acres Permanently Impacted	Acres Permanently Impacted	Acres Permanently Impacted
Conifer	0	0	0	0	0	0	0	--
Deciduous/conifer mix	0	0	0	0	0	0	0	--
Upland aspen	0	0	0	0	0	0	0	--
Forest riparian	18	57	9	[illegible]	0	19	28	376
Shrub riparian	60	27	1	[illegible]	0	19	62	818
Emergent wetland	0	0	9	0	0	19	[illegible]	81
Wet meadow	35	1	[illegible]	35	0	38	65	858
Open water	18	13	0	0	0	13	0	--
Beaver pond	0	0	9	0	0	0	0	--
Irrigated	18	0	0	0	0	338	61	--
Sagebrush/grass	57	224	0	0	0	338	809	--
Juniper	0	0	0	0	0	13	8	--
Bare ground	4	0	0	0	0	0	0	--
Russian olive	0	0	0	0	0	52	0	--
Total	233	329	14	46	0	1,330	1,038	2,133

Notes:
Cover type area was calculated to the nearest 0.1 acre by the Geographic Information System. All numbers were raised to the next whole number on this table. This was not done for the HEP analysis. Therefore, acreage on this table may not exactly match acreage shown on tables presenting HEP study results.

[a]Dams, reservoirs, and canal rehabilitation were included in the HEP study.
[b]Most of the impacts from pipelines would be temporary impacts.

and in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g). Cover types that would be affected by canal rehabilitation and pipelines under the Crystal Ranch Alternative are shown in Table 3.10-3.

3.10.5.3.6 Fish and Wildlife Enhancement and Recreation Developments. Except for the Twin Pots and Clay Basin Pond features, the same fish and wildlife enhancement features described for the Proposed Action would be implemented under the Crystal Ranch Alternative. Affected wildlife habitat would also be the same as the Proposed Action for these features. Habitat acquisition described for the Cow Canyon Alternative would be implemented under the Crystal Ranch Alternative. Recreation developments (Crystal Ranch and Bridge Campgrounds) were described for the Proposed Action or the Cow Canyon Alternative.

3.10.5.3.7 Land Retirement. These lands and wildlife habitat would be the same as described for the Proposed Action.

3.10.5.3.8 Secondary Irrigation Water-Supported Wetlands. As described for the Proposed Action, changes in secondary water availability would affect wetland and riparian communities located downgradient from irrigated lands for each of the Upalco Unit alternatives.

3.10.5.3.9 Tribal Idle Lands. The same idle lands would be subject to conversion under the Crystal Ranch Alternative as under the Proposed Action (Section 3.10.5.2.10).

3.10.5.4 Twin Pots Alternative

3.10.5.4.1 High Mountain Lakes. An additional 4 high mountain lakes in the Lake Fork drainage plus the 10 in the Yellowstone drainage described under the Proposed Action would be stabilized under the Twin Pots Alternative.

3.10.5.4.2 Dams and Reservoirs. Table 3.10-4 lists vegetation cover types and acres of each in the proposed Big Sand Wash Reservoir and Dam footprint, associated borrow pits, and roads under the Twin Pots Alternative. Big game, raptor, and sage grouse occurrence near Big Sand Wash Reservoir were described under the Proposed Action.

3.10.5.4.3 River Corridors. Potentially affected habitat types would be similar to those described for the Upalco Unit Proposed Action and include wetland and riparian communities located on floodplains.

3.10.5.4.4 Diversion Dams. Wildlife habitat at diversion dams would be the same as described for the Upalco Unit Proposed Action.

3.10.5.4.5 Canals. Affected wildlife habitat along canals (Table 3.10-4) would be the same as described for the Farnsworth Laterals under the Proposed Action.

3.10.5.4.6 Pipelines.

3.10.5.4.6.1 Wildlife Habitat. The Twin Pots Alternative includes constructing a section of the Farnsworth Lateral No. 1 Pipeline in a new right-of-way and the Big Sand Wash Feeder Pipeline, the same as described under the Proposed Action, and the Lake Fork-Yellowstone and Big Sand Wash-Roosevelt Pipelines. Cover types along pipeline routes are shown in Table 3.10-4. General wildlife habitat value of wetland and riparian cover types along pipelines was discussed under the Proposed Action.

3.10.5.4.6.2 Big Game. The Big Sand Wash Feeder Pipeline route was described under the Proposed Action. The proposed Lake Fork-Yellowstone Pipeline would pass through critical mule deer and elk winter range.

3.10.5.4.6.3 Raptors. Raptor species expected to use the Lake Fork-Yellowstone Pipeline route would be the same as described for pipelines under the Proposed Action and would depend on specific cover types and size of the cover type blocks present.

3.10.5.4.6.4 Sage Grouse. Sage grouse habitat in the vicinity of the Farnsworth Laterals was described under the Proposed Action. The Lake Fork-Yellowstone Pipeline route is within about

Table 3.10-4
Acreage of Affected Cover Types for Dam and Reservoir,[a]
Canal Rehabilitation, and Pipeline Construction Sites for the
Twin Pots Alternative

Cover Type	Reservoir and Cover Type Acreage: Big Sand Wash (Non-Tribal)		Canals: Tribal	Canals: Non-Tribal	Pipelines	Land Retirement (Non-Tribal)	Idle Lands (Tribal)	Secondary Irrigation Water-Supported Wetlands
	Acres Permanently Impacted	Acres Temporarily Impacted[b]	Acres Permanently Impacted	Acres Permanently Impacted	Acres Temporarily Impacted[c]	Acres Permanently Impacted	Acres Permanently Impacted	Acres Permanently Impacted
Conifer	0	0	0	0	0	0	0	--
Deciduous/conifer mix	0	0	0	0	0	0	0	--
Upland aspen	0	0	0	0	0	0	0	--
Forest riparian	0	0	0	1	•	19	28	380
Shrub riparian	20	0	1	5	35	19	62	827
Emergent wetland	7	0	0	0	0	19	5	82
Wet meadow	4	0	5	35	0	19	65	867
Open water	0	0	0	0	0	19	0	--
Beaver pond	0	0	0	0	0	0	0	--
Irrigated	11	0	0	0	35	119	61	--
Sagebrush/grass	309	22	0	0	28	338	809	--
Juniper	43	•	0	0	10	13	8	--
Bare ground	1	•	0	0	0	0	0	--
Russian olive	0	0	0	0	0	52	0	--
Total	395	34	28	46	119	1,330	1,038	2,156

Notes:
Cover type area was calculated to the nearest 0.1 acre by the Geographic Information System. All numbers were raised to the next whole number on this table. This was not done for the HEP analysis. Therefore, acreage on this table may not exactly match acreage shown on tables presenting HEP study results.

[a]Dams, reservoirs, and canal rehabilitation were included in the HEP study.
[b]The column Acres Temporarily Impacted does not appear for sites without temporary impacts.
[c]Most of the impacts from pipelines would be temporary.

0.75 mile of two leks, the centers of sage grouse breeding complexes, and is entirely within land classified as year-long sage grouse range.

3.10.5.4.7 Fish and Wildlife Enhancement and Recreation Developments. The Twin Pots Reservoir improvement, Towanta Flats and Monarch Bench range improvements and water developments, and the Red Rocks/Duchesne drainage habitat acquisition described under the Proposed Action would also be implemented for this alternative. The affected environment and future management would also be the same as described previously.

3.10.5.4.8 Land Retirement. The types of lands and wildlife habitat would be the same as described for the Proposed Action.

3.10.5.4.9 Secondary Irrigation Water-Supported Wetlands. As described for the Proposed Action, changes in secondary water availability would affect wetland and riparian communities located downgradient from irrigated lands for each of the Upalco Unit alternatives.

3.10.5.4.10 Tribal Idle Lands. The same idle lands would be subject to conversion under the Twin Pots Alternative as under the Proposed Action (Section 3.10.5.2.10).

3.10.6 Impact Analysis

Environmental consequences of the Upalco Unit Proposed Action and alternatives are described for each main project feature for which significant impacts are expected. The general types of impacts on wildlife and their habitat are expected to be similar for each project feature. Specific impacts, such as area of habitat type affected or site-specific impacts on big game winter range, would vary by alternative and project feature. Distinctions between impacts on Tribal and non-Tribal lands are presented in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g).

Land management and biological resource agency representatives selected HEP as the primary impact assessment tool for wildlife habitat, including plant communities such as wetlands and riparian areas. The wildlife evaluation species selected for the HEP study were chosen as representatives of the plant communities or vegetation cover types present within affected areas. Evaluation species were also selected to represent special habitat features of those cover types. HEP study results are presented on the basis of cover types rather than evaluation species. A discussion of the HEP process is included in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g).

The HEP study evaluated baseline conditions and potential total impacts of all proposed reservoirs and canal rehabilitation within the Upalco Unit. Therefore, HEP study results presented below do not separate impacts or mitigation requirements of canals from those of onstream or offstream reservoirs.

Other potential project impacts on wetlands and riparian communities were not included in the HEP study. The impacts of land retirement and reduced availability of secondary irrigation water on wetlands and riparian communities could not be quantified at the time of the HEP study and currently consist of only estimates based on predicted changes in potential water availability for wetlands. The specific locations where impacts may occur because of these project features are also not known, so no HEP field data could be collected. Habitat values on these lands could not be determined during the available time frame for completion of the Upalco Unit Draft EIS. Project impacts resulting from land retirement, irrigation of Tribal idle lands, and reduced availability of secondary irrigation water are assessed on the basis of the estimated acreage of the cover types that would be impacted.

The resource and land management agencies identified three other terrestrial biological resource areas that required special efforts beyond the HEP study. These included big game winter and spring range, sage grouse breeding complexes, and raptor nesting. The following discussions of project impacts related to reservoirs and canals and mitigation for those impacts focus on the results of the HEP study as well as these three resource areas.

All general wildlife habitat impacts and mitigation measures for dams, reservoirs, and canal rehabilitation are addressed through the results of the HEP study. Potential significant impacts on special habitat features, including big game winter and spring range, sage grouse breeding complexes, and raptor nesting, are discussed separately for each project feature as appropriate. Finally, the impact discussion also addresses certain resource categories or special classes of impacts that are not addressed by HEP or the other wildlife studies.

Mitigation measures specific to these special biological resource areas focus on avoiding impacts through restrictions on construction periods, rerouting project features such as pipelines, and avoiding sensitive habitats for roads or soil disposal; minimizing impacts through field surveys to locate species of interest, working around occupied sites, and restricting clearing of sensitive vegetation; and minimizing the duration of impacts through careful and timely reclamation of native plant communities. These measures are discussed in appropriate parts of this section and in Appendix B.

3.10.6.1 Significance Criteria

Potential impacts on wildlife resources are considered significant if a project feature or action is determined to have one or more of the following effects:

- The loss of wetland or riparian communities at any single location; no distinction is made between jurisdictional and other wetlands
- The loss of any critical big game winter range (either as designated by Wildlife Resources or as observed during field surveys) and/or 10 percent of normal big game winter range
- The abandonment of active nesting sites for golden eagles
- The abandonment of active nest sites for northern goshawks or ferruginous hawks
- The loss of a sage grouse breeding complex; loss is defined to include the total abandonment of a lek

3.10.6.2 Potential Impacts Eliminated from Further Analysis

With a few exceptions, potential impacts that were determined to not be significant based on the significance criteria established following agency review were eliminated from further analysis. These nonsignificant impacts are discussed by project feature below and are not discussed separately for each alternative.

Some project features would have no significant impacts regardless of the alternative. These features are discussed briefly below and are not discussed further for any of the alternatives in Section 3.10.6 of this document but are described in detail in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g). The significance of an impact for any project feature may vary by alternative. For these features, the nonsignificant impacts are discussed below and not discussed further by alternative in the impact section of this document. Expected significant impacts for these project features are discussed separately by alternative.

3.10.6.2.1 High Mountain Lakes. Potential impacts on wetland and riparian cover types resulting from high mountain lakes stabilization are described in Section 3.9.6. Generally, areas of these cover types lost from stabilizing water levels below present levels are expected to be replaced by the same cover types that would develop at suitable water depths and soil moisture conditions around the new lakeshore.

The current wetland and riparian vegetation around high mountain lakes has developed in the presence of extensive annual growing season drawdowns, which typically limits the extent of these vegetation types. Field inspection of the high mountain lakes indicates that soils have generally not eroded from the current drawdown zones. Over the long term, the same wetland and riparian cover types as those present today are expected to develop because soils are present to support these cover types and water levels would not fluctuate as in the past. Stable water levels are expected to allow at least as much wetland and riparian vegetation to develop as is present today. Littoral zone vegetation is currently limited by the fact that this zone is exposed and dried out every year during the summer irrigation drawdown. This annual drawdown would no longer occur following lake stabilization. Therefore, littoral zone vegetation would be expected to develop to its full potential under stable water conditions. This would result in a more extensive and fully developed littoral zone plant community than is currently present at high mountain lakes.

Stable water conditions may result in a small net overall increase in the extent of wetland and riparian vegetation over a period of 2 to 3 years for the littoral zone and 5 to 25 years for riparian communities. Wildlife habitat values would decline initially during this period of adjustment but would be expected to return to at least pre-stabilization levels in 5 to 25 years.

3.10.6.2.2 Dams and Reservoirs.

3.10.6.2.2.1 Migration and Local Movement. Studies in the project area by Wildlife Resources (1978a) indicate that, in the Uinta Basin, deer migration between summer and winter range typically occurs along ridges and benches between major drainages. The proposed onstream reservoirs are generally oriented in the same direction as migratory movements and are not located on ridges or benches. No major movement patterns were reported in river bottom areas that would be occupied by reservoirs. Offstream reservoirs are not located along migration routes. Therefore, the proposed reservoirs would not significantly interfere with seasonal mule deer migration patterns.

Local movement across onstream reservoirs would be impeded by open water. Deer have been known to cross frozen lakes. It is likely that occasionally a deer would drown after falling through the ice early in the winter or spring. Neither of these would constitute significant impacts based on the established criteria.

The major onstream reservoirs would not be expected to impact elk migration patterns and would have minor impacts on local movement. Moose movements would be affected by the proposed onstream reservoirs, but measurable negative impacts are unlikely.

3.10.6.2.2.2 Mule Deer Fawning Areas. Forest and shrub riparian areas used by mule deer for fawning would be lost because of construction of onstream dams. When deer numbers are relatively high, a reduction in fawning area would result in some use of less than optimal areas for fawning and possibly a small increase in predation rates on fawns. Based on the established significance criteria, this impact would not be significant.

3.10.6.2.2.3 Construction Disturbance. Construction of dams would require 3 to 5 years. Big game would be displaced from the immediate areas near construction sites during this period. Displacement distance would vary by species and be greatest where cover is limited and sight distances are longest, as in sagebrush/grass communities, and when human activity is greatest. Animals would habituate to construction activities to some degree. A slight increase in deer/vehicle collisions, resulting in some mortality, would also be expected because of increased traffic levels. These impacts are not considered significant based on the criteria.

3.10.6.2.2.4 Sage Grouse. No impacts on sage grouse breeding complexes would be expected to result from construction of proposed reservoirs in the Upalco Unit.

3.10.6.2.2.5 Raptors. Raptor foraging and potential nest sites occurring within the dam and reservoir areas would be lost. Goshawks likely forage in the areas of onstream reservoirs. Red-tailed hawks, American kestrels, and great horned owls are the most common raptors in the area and would be most affected by habitat loss. No large stick nests were found within reservoir areas during field surveys so no currently known nests would be impacted. Raptors would also be displaced from near construction areas. These impacts are not considered significant based on the criteria.

3.10.6.2.3 Canal Rehabilitation.

3.10.6.2.3.1 Big Game. Canals provide drinking water for big game and other wildlife, either directly from the canal or from water that leaks from canals. In nonagricultural areas, this may be the only surface water present during drier parts of summer and early fall. Canal leakage would be eliminated along rehabilitated canals in the Upalco Unit. This loss would be partially offset at one or more locations along each rehabilitated canal by supplying surface water as part of the irrigation system in wetland and riparian areas that would be preserved or developed along the canal. However, since only a few sources would be developed, water would be available at fewer locations for deer and elk than is now available. Potential deer fawning areas would also be lost. Furthermore, fewer water sources may concentrate big game animals, making them more vulnerable to predation and hunting mortality. Also, the loss of free water during the summer for lactating does may negatively affect fawn survival. These would not be significant impacts based on the established criteria.

Deer, and to a much lesser extent elk, can occasionally become trapped in open canals and drown. Although apparently not a significant problem now, it sometimes occurs. The use of concrete or plastic to line canals would severely impair the ability of a deer or elk caught in a canal to escape, resulting in an increased mortality rate. Canals lined with compacted clay would not contribute to increased drownings.

3.10.6.2.3.2 Raptors. Loss of actual or potential raptor nest trees and some nest abandonment would occur during canal rehabilitation through riparian areas. Nest disturbance and possible abandonment would also occur during construction. However, the primary species that would be affected (red-tailed hawks and great horned owls) are not as sensitive to nest abandonment as are some other species such as ferruginous hawks. Based on the significance criteria, no significant impacts are anticipated.

3.10.6.2.3.3 Sage Grouse. Rehabilitation of canal segments located more than 2 miles from sage grouse leks would not result in any significant impacts on sage grouse.

Existing canal seeps and leaks support wet meadows, which are particularly important foraging areas for young sage grouse during the spring. Succulent forbs are often high in protein and are important foods for young grouse (Western States Sage Grouse Committee 1982). Klott and Lindzey (1990) identified sites supporting dense grasses and forbs as preferred brood habitat for sage grouse in southwest Wyoming. Forbs dominate sage grouse foods during spring and summer, especially for juvenile birds through 12 weeks of age (Peterson 1970; Savage 1969; Klebenow and Gray 1968). Where they are present, sage grouse use wet meadows along canals during spring, summer, and fall. Wet meadows are particularly important foraging areas for young sage grouse during the spring.

There would be a net loss of wet meadow area and canal seeps following rehabilitation of all canals and implementation of mitigation measures along the canals. The fact that there would be fewer wet meadows and canal seeps along canals that pass through sage grouse range may have a negative impact on the survival of sage grouse broods since wet meadows are important foraging areas for young sage grouse (Western States Sage Grouse Committee 1982; Klott and Lindzey 1990). While this would not be a significant impact based on the established criteria, any actions that impact sage grouse populations, which are declining throughout the West, must be considered to be significant. Also, since this habitat loss is associated with a loss of wetlands, a significant impact, potential secondary impacts on sage grouse brood survival are discussed below as appropriate for each alternative.

3.10.6.2.4 River Corridors. Reductions in peak and growing season river flows have significant impacts on establishment and recruitment of riparian communities and on maintenance of both riparian and wetland communities. Flow reductions that would result in significant impacts on wetland or riparian communities would occur under some of the alternatives and are discussed in Section 3.9.6.

Flow reductions under the Proposed Action and Cow Canyon Alternative are predicted to be minor or not occur, and no significant impacts are expected.

3.10.6.2.5 Pipelines.

3.10.6.2.5.1 Big Game. Potential impacts from pipeline construction on big game include permanent and temporary habitat loss, disturbance on critical winter range during construction, and disturbance during annual maintenance activities. Impacts on critical winter range would be minimized by avoiding critical periods during construction. Loss of forest and shrub riparian communities would impact mule deer fawning. Temporary, though long-term, riparian habitat loss within right-of-ways would persist 10 to 25 years as revegetation proceeds. Increased human presence associated with pipeline maintenance activities in riparian areas would decrease their value as fawning areas if disturbance occurred during the fawning period. None of these impacts is considered significant.

3.10.6.2.5.2 Raptors. Some loss of actual or potential raptor nest trees and some nest abandonment would occur during pipeline construction through riparian areas and juniper communities. Nest abandonment resulting from construction and periodic disturbance during maintenance activities would occur occasionally. However, the primary species that would be affected (red-tailed hawks, great horned owls, and American kestrels) are not as sensitive to nest abandonment as are some other species such as ferruginous hawks. None of these impacts is considered significant.

3.10.6.2.5.3 Sage Grouse. New pipeline segments located more than 2 miles from sage grouse leks would not result in any significant impacts on sage grouse.

3.10.6.2.6 Fish and Wildlife Enhancement and Recreation Developments. These project features would result in a variety of nonsignificant impacts on wildlife and wildlife habitat. Types of impacts would vary depending upon the specific nature of the action and the levels of human activity associated with future use or operation of the feature. Impacts would include habitat loss for a variety of species and displacement during construction and use.

Actual or potential raptor nest trees would be lost (either directly or indirectly) at new or improved campgrounds. Direct impacts would involve tree removal while indirect impacts would involve human disturbance in campgrounds that would preclude raptor nesting in the vicinity. Diurnal raptors would also be displaced from an area within several hundred feet of the campground during late spring, summer, and fall. Other campground improvements resulting in additional human use would have similar displacement effects.

Habitat for all wildlife species that occupy areas where campground development or improvement would occur would be either permanently eliminated or degraded in quality. This would impact small mammals, birds, reptiles, amphibians, and insects because of direct habitat loss. In addition, avian abundance and species diversity would be reduced in campgrounds because of human presence during the breeding season (Blakesley and Reese 1988).

Human disturbance of big game would increase substantially near campgrounds that would receive additional human use because of project improvements, thereby reducing the value of surrounding areas for big game during the summer and fall.

3.10.6.2.7 Habitat Fragmentation. Each of the project features would create openings or gaps in the plant communities present in the landscape matrix, thereby destroying wildlife habitat. However, because the areas affected by project features would be very small relative to the size of the Upalco Unit, the matrix in which these gaps would occur would remain essentially unchanged by project features relative to the remaining matrix of habitats within the unit or the Uinta Basin. Therefore, while there would certainly be significant impacts on wildlife and wildlife habitat on a local scale, on a landscape scale neither the total nor the cumulative impacts of the Proposed Action and alternatives would constitute what is typically defined by Noss and Cooperrider (1994) as habitat fragmentation. Therefore, habitat fragmentation is not discussed further below.

3.10.6.2.8 Tribal Idle Lands.

*3.10.6.2.8.1 **Raptors**.* Loss of potential raptor nest trees would occur as a result of converting natural habitats to irrigated lands, and some loss of active nests and nest abandonment could also occur from conversion-related disturbances. However, idle lands are not located in areas containing suitable nesting habitat for northern goshawks. The likelihood of disturbing ferruginous hawk and golden eagle nests is also unlikely because most idle lands in the Upalco Unit are located relatively close to human activity. Such areas tend to be avoided as nesting locations by these species. Based on the significance criteria, no significant impacts to raptors are anticipated.

3.10.6.3 Proposed Action–Talmage

3.10.6.3.1 Dams and Reservoirs.

*3.10.6.3.1.1 **Wildlife Habitat**.* Implementation of the Proposed Action would result in the loss of 562 and 429 acres of habitat at the Crystal Ranch and Big Sand Wash Reservoir sites, respectively (Table 3.10-1). Sagebrush/grass cover types would be most affected by project development while open water areas would increase at the reservoir sites. Significant impacts on wetland and riparian communities would occur.

As noted above, HEP was used to assess the combined impacts of dams, reservoirs, and canals on wildlife habitat. Therefore, the HEP results presented below are for all three of these project features. The changes in AAHUs represent the change in baseline conditions present at dam, reservoir, and canal rehabilitation sites over the 100-year project life (Table 3.10-5). The largest losses of AAHUs would occur in the irrigated land, sagebrush/grass, and forest and shrub riparian cover types.

*3.10.6.3.1.2 **Big Game**.* In addition to direct big game habitat loss addressed through the HEP study, potential significant loss of winter range is addressed below. The reader is referred to the Wildlife Resources Technical Report (CH2M HILL/ Horrocks 1996g) for a more detailed discussion.

The Crystal Ranch Reservoir site is located in critical mule deer winter range. About 281 acres of sagebrush/grass cover type, the vegetation type most heavily used by mule deer during the winter (Wildlife Resources 1978a), would be lost as a result of the dam, reservoir, and associated features (Table 3.10-1). Surrounding sagebrush/grass areas would receive slightly higher use at a given deer herd size as a result of this habitat loss. Based on the stated significance criteria, the loss of critical mule deer winter range would be considered significant.

Generally, the same conclusions stated for deer apply to elk populations around the Crystal Ranch Reservoir site. About one-third of this site is classified as critical elk winter range. Its loss would be significant based on the established significance criteria.

The primary effect of losing about 171 acres of forest and shrub riparian areas on moose would be a reduction in the availability of preferred moose browse. Based on aerial surveys, this effect may be greatest during winters of intermediate severity, when moose movement at higher elevations would be restricted by snow and the Crystal Ranch area would no longer provide forage because of the reservoir. The Crystal Ranch site is just downstream from the boundary of classified critical moose year-long range. However, the widespread evidence of moose use of the site suggests that the entire area may be considered to be critical year-long range. Since winter range is not classified separately from year-long range for moose, this loss of habitat would probably be considered significant.

*3.10.6.3.1.3 **Sage Grouse**.* The proposed Crystal Ranch Reservoir is located within 2 miles of a sage grouse lek. However, topographic features between these locations and the steepness of the sagebrush/ grass cover types at the Crystal Ranch site indicate that construction of the dam would not impact this lek.

Table 3.10-5
Net Change in AAHUs by Cover Type from Dams, Reservoirs, and Canals and Mitigation for the Proposed Action—Talmage*

Cover Type	Non-Tribal			Tribal		
	Change from Feature	Change from Mitigation	Net Change	Change from Feature	Change from Mitigation	Net Change
Beaver pond	0.00	-0.06	-0.06	0.00	0.00	0.00
Conifer	0.00	0.00	0.00	0.00	0.00	0.00
Deciduous/conifer mix	0.00	0.00	0.00	0.00	0.00	0.00
Emergent wetland	-19.78	27.43	7.65	0.00	0.00	0.00
Forest riparian	-82.88	295.57	212.69	-308.91	207.78	-101.13
Irrigated lands	-112.37	-275.83	-388.20	0.00	-1,484.02	-1,484.02
Juniper	-76.61	-22.96	-99.57	0.00	0.00	0.00
Open water	332.41	4.32	336.73	55.71	0.00	55.71
Shrub riparian	-267.10	15.75	-251.35	-107.96	418.67	310.71
Sagebrush/grass	-686.06	-177.02	-863.08	-610.82	168.01	-442.81
Upland aspen/hardwoods	0.00	0.00	0.00	0.00	0.00	0.00
Wet meadow	-257.15	252.98	-4.17	-2.20	198.33	196.13

*Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availability of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in Section 3.9 Wetland and Riparian Resources.

3.10.6.3.2 River Corridors. Construction of large onstream reservoirs, including Crystal Ranch, raises the potential for a type of impact on semiaquatic mammals, certain small mammal species, and amphibians that goes beyond direct wildlife habitat loss addressed by the HEP study and Mitigation Plan. Species such as beavers, river otters, certain small mammals and amphibians, including salamanders and frogs, depend exclusively on riverine environments in wetlands and riparian communities along rivers. While river otters and beavers move relatively short distances over land to new habitat, they more often move up and down occupied drainages. Small mammals and amphibians that require riverine environments rarely move even moderate distances through upland cover types. Construction of large onstream dams, such as Crystal Ranch, would block up- and downstream movements past the dam and effectively form two populations of these species. Genetic exchange between populations would be severely restricted or eliminated and the likelihood of long-term persistence of upstream populations would be reduced (Soule 1987; Thomas 1990).

It is unlikely any noticeable impact would occur during the life of the project unless some other action caused the loss of one or more of these species upstream of the dam. In this case, recolonization of formerly occupied areas would be very slow if it occurred at all. This potential impact was not listed in the significance criteria. However, if the migration block formed by Crystal Ranch Dam and a catastrophic event combine to eliminate one or more species from the Yellowstone River system upstream from the dam, this impact would be very significant at the local population level. The probability of such an occurrence is believed to be very low.

Changes in the timing of peak flows below dams may impact the long-term viability of downstream forest riparian communities. According to Mahoney and Rood (1993), a critical period for cottonwood establishment occurs annually. This seedling establishment period starts with the onset of seed release and continues through the period of seed release, which typically lasts from 4 to 6 weeks. The seedling establishment period ends about 1 week after seed release is complete, when the small cottonwood seeds lose their viability. Improper moisture conditions (too much, too little, too early, or too late) during this period would result in the failure of seedling establishment for that year.

The timing of peak flows in Uinta Basin rivers varies somewhat from year to year under natural conditions and this annual variation will not change. However, peak flow events are expected to occur from 1 to 2 weeks later than at present with the project. This may result in a reduction in the rate of seed germination, seedling establishment, and survival for cottonwoods during a given year and in a longer period between years when successful establishment occurs. The expected long-term impact of a reduced rate and frequency of cottonwood germination and survival would be a gradual decline in the extent of cottonwood forest.

3.10.6.3.3 Diversion Dams. Exact locations of new diversion dams to replace old ones were not determined at the time of field studies. Therefore, specific impacts on wildlife habitat have not been identified. Impacts at diversion dams would be limited to immediate areas around the dams and access roads and would probably amount to less than 2 acres at each site. Activities and disturbance in wetlands and riparian communities would generally be limited to actions that must occur in those cover types. Construction staging and equipment storage and access roads would be minimized in wetlands or riparian areas to the greatest extent feasible. The exact extent of wetland impacts would be determined prior to application for a COE Section 404 permit. Construction impacts would be temporary, although replacement of trees would require many years. Areas occupied by new diversion dams and permanent access roads would be permanently lost. Mitigation of both temporary and permanent impacts would occur at the site of the impact, regardless of ownership. Therefore, impacts on wildlife habitat would be long term but not permanent.

3.10.6.3.4 Canals.

3.10.6.3.4.1 Wildlife Habitat. Table 3.10-1 presents acres of vegetation cover types that would be impacted by canal rehabilitation under the Proposed Action. Canal rehabilitation impacts on wildlife habitat were addressed through the HEP study and reported in Table 3.10-5. Significant impacts on wetland and riparian communities would occur. Specific measures that would be undertaken to avoid or reduce potential impacts on wildlife habitat, big game, sage grouse, and raptors are described in Section 3.10.6.3.11 Mitigation and in Appendices A and B.

3.10.6.3.4.2 Sage Grouse. Sage grouse populations are declining throughout the West as human development encroaches into previously undisturbed sagebrush communities. Sage grouse are extremely sensitive to new disturbance within 2 miles of a lek. Removal of native sagebrush/grass communities is considered to constitute disturbance. Disturbance within this 2-mile radius may result in abandonment of the lek.

Most of the lengths of the Farnsworth Laterals, Ottosen Lateral, and Blackburn Lateral Canals are located within year-long sage grouse range, and there are breeding complexes within 2 miles of the Farnsworth Laterals. Therefore, rehabilitation of these canals would have the potential of impacting sage grouse breeding complexes. Field surveys, construction timing restrictions, and careful reclamation described in Appendices A and B would be followed to avoid and reduce potential impacts on sage grouse.

There would be a net loss of wet meadow area and canal seeps following canal rehabilitation and implementation of mitigation measures along the canals. The fact that there would be fewer wet meadows and canal seeps along canals may have a negative impact on the survival of sage grouse broods since wet meadows are important foraging areas for young sage grouse (Western States Sage Grouse Committee 1982; Klott and Lindzey 1990).

3.10.6.3.5 Pipelines. Areas of cover types that would be disturbed by pipeline construction for the Proposed Action are shown in Table 3.10-1. Significant impacts on wetland and riparian communities would occur. All impacts on plant communities would be mitigated in place. Specific measures that would be undertaken to avoid or reduce potential impacts on wildlife habitat, big game, sage grouse, and raptors are described in Section 3.10.6.3.11 Mitigation.

Direct habitat losses in construction right-of-ways but beyond access roads would not be permanent. About 75 percent of the acres impacted by pipeline construction (Table 3.10-1) would not be permanently impacted. The duration of the temporary impacts would vary depending on the cover type affected. Complete reclamation of upland cover types and replacement of lost wildlife habitat values would require 10 to 20 years, while wet meadows would recover in 3 to 5 years. Full recovery of plant communities and wildlife habitat values in riparian areas would take 10 to 15 years for shrub communities and 10 to 25 years for forest communities. All wildlife species that use affected areas would be impacted by habitat loss and by periodic disturbance resulting from pipeline maintenance activities. Field surveys, construction timing restrictions, and careful reclamation described in Appendices A and B would be followed to avoid and reduce potential impacts on sage grouse.

3.10.6.3.6 Fish and Wildlife Enhancement and Recreation Developments. Mule deer and elk could benefit from proposed range improvements on Monarch Bench and Towanta Flats. Big game should also benefit from habitat acquisition in the Red Rocks/Duchesne drainage because it would be managed primarily for wildlife.

Proposed water developments on Monarch Bench and Towanta Flats would not benefit big game during the winter as they do not require free water at this time. Development of water sources may actually be detrimental to big game since the presence of water may cause the animals to remain on the winter range longer than normal, leading to degradation of range conditions (Wildlife Resources 1996). Water developments may also result in additional utilization of range resources by livestock in areas where grazing has not been a factor because of the current lack of water during the summer. This would degrade winter range conditions for big game, especially elk.

Other fish and wildlife enhancements that would be implemented under the Proposed Action and the acreage that would be impacted by each feature include Clay Basin Pond (1.5 acres) and Twin Pots Reservoir (4.3 acres). Stream improvement would be implemented along 7 miles of river and affect up to 18 acres of land. Riparian habitat conditions would improve along stream improvement river reaches if grazing is controlled.

Development of the Crystal Ranch Campground on a 20-acre site would result in the direct loss of 2 acres of riparian vegetation. Impacts of the loss of riparian vegetation on big game have been described.

3.10.6.3.7 Land Retirement. Irrigation water would no longer be applied to lands that are retired. Wet meadow and/or riparian areas supported either directly or indirectly by this water would dry up and revert to upland species. It is estimated that the water provided to irrigate these lands may support about 95 acres of wetlands and riparian areas located on, and adjacent to, retirement lands. Impacts on wetlands and riparian communities would be monitored as described in the Wetland/Riparian Resource Technical Report (CH2M HILL/Horrocks 1996f).

The best use of retired lands in terms of upland habitat development potential would be determined in conjunction with resource agencies following project authorization. Management plans for specific parcels of retired lands would be developed with the agencies.

3.10.6.3.8 Secondary Irrigation Water-Supported Wetlands. Crude estimated impacts on wetlands and riparian communities and the basis for the estimate were discussed in Section 3.9. It is estimated that up to 2,000 acres of wetland and riparian communities could be impacted by reduced availability of secondary irrigation water. The actual number of acres of wetlands supported by secondary irrigation water and the impacts of reduced availability of this water will be determined following the Record of Decision.

Types of impacts on wildlife resulting from the loss of these wetlands and riparian communities would be similar to types of impacts resulting from loss of these cover types from other project features. Losses of wet meadows could also affect survival of sage grouse broods as described for canal rehabilitation if large areas are impacted. Monitoring of this potential impact will be conducted and is discussed in the Wetland/Riparian Resource Technical Report (CH2M HILL/Horrocks 1996f).

3.10.6.3.9 Tribal Idle Lands.

3.10.6.3.9.1 Wildlife Habitat. Irrigation of idle lands would result in the conversion of approximately 1,038 acres from idle lands status (generally natural habitats) to irrigated status (generally pasture and cropland). Sagebrush/grass cover types would be most widely affected by conversion to irrigated land (809 acres), followed by wet meadow (65 acres), shrub riparian (62 acres), forested riparian (28 acres), juniper (8 acres) and emergent wetland (5 acres). Additionally, about 61 acres of lands in idle status presently receive some irrigation. Significant impacts would occur at any site where more than 1 acre of riparian habitat is converted to irrigated land.

3.10.6.3.9.2 Big Game. Idle lands north of the U.S. Lake Fork Canal are located in critical mule deer winter range. Idle lands located on the Yellowstone River floodplain are classified as critical elk winter range. The significance of irrigation-related impacts on idle lands in these areas depends upon the current cover types and the post-irrigation cover types. Potential loss of critical winter habitat is considered significant. Conversion of sagebrush/grass and riparian habitats to irrigated land would be of highest significance for mule deer and elk.

3.10.6.3.9.3 Sage Grouse. The northernmost parcel of idle land in the Upalco Unit is located approximately 1.25 miles from a sage grouse lek.

Sage grouse are sensitive to human disturbance within 2 miles of a lek. Conversion of sagebrush/grass habitat to irrigated land within 2 miles of a lek could result in significant impacts on local populations, particularly if conversion activities occur during the breeding season. Conducting field surveys and implementing the timing restrictions described in Appendices A and B would reduce potential impacts on sage grouse. Conversion of wet meadows to agriculture could result in the loss of sage grouse brooding habitat.

About 817 acres of native upland communities (809 acres of sagebrush/grass plus 8 acres of juniper) on idle lands would be lost if these lands are converted to agriculture (Table 3.10-1). Approximately 6 acres of the 160 acres of wetland and riparian areas on idle lands would be impacted by the reduced availability of secondary irrigation water, leaving 154 acres that would be impacted by conversion of idle lands to agriculture.

These impacts would be monitored and appropriate mitigation measures would be developed and implemented as needed in consultation with the Ute Tribe and resource and regulatory agencies.

3.10.6.3.10 Total Impacts. For the most part, total impacts of project features on wildlife habitat under the Proposed Action would be no greater than impacts already described. The proposed reservoirs are located so far from each other and from canals, pipelines, fish and wildlife enhancements and recreation developments, and idle lands under the Proposed Action that no synergistic effects among these features would be expected.

The combined impacts of canal rehabilitation and reduction in secondary irrigation water availability on wetland and riparian communities could be greater than indicated by the sum of the impacted acreage alone. This is because the affected wetlands and riparian communities often provide the only permanent wildlife cover within large areas of agricultural land, and much of this permanent cover could be lost. The loss of a large percentage of permanent cover within an area would also eliminate or substantially reduce wildlife foraging in surrounding agricultural areas, especially by mule deer and elk, thereby resulting in a greater loss of usable wildlife habitat than indicated by the affected acreage of wetland and riparian communities alone.

Since there are no degrees of significance attached to the significance criteria, once a threshold has been passed, an impact is considered to be significant. Therefore, based on the accepted significance criteria, the significance of the total impacts would generally be the same as stated for the individual project features.

3.10.6.3.11 Mitigation. Mitigation measures are intended to reduce or avoid impacts or to compensate for impacts that cannot be avoided. These measures focus on compensation for impacted wildlife habitat accounted for during the HEP study (dams, reservoirs, and canals) and actions intended to reduce or avoid impacts on big game, sage grouse, and raptors during canal rehabilitation and pipeline construction and operation.

3.10.6.3.11.1 Wildlife Habitat Mitigation Strategies. Mitigation strategies intended to avoid or minimize impacts on wildlife or habitat, shorten the duration of land-disturbing impacts, or compensate for impacts that cannot be avoided are presented in Appendix B. Appendix B includes discussion of wildlife habitat mitigation strategies, site-specific application of strategies at mitigation sites, habitat improvement and development methods, HEP analysis procedures, operation and maintenance activities, monitoring and reporting requirements, and contingency plans for wildlife habitat. The results of the HEP analysis of impacts and mitigation are presented in the corresponding mitigation section for each alternative. The reader is referred to the conceptual Mitigation Plan included in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g) for a more detailed presentation of the Mitigation Plan.

Specific mitigation requirements for impacts on wetland and upland habitats from irrigation of idle lands and land retirement would be determined in consultation with the Ute Tribe, State and Federal resource agencies, COE, and DOI. Potential mitigation measures are discussed in Appendix B.

The suitability of retirement lands for implementation of mitigation measures will be assessed after the Record of Decision when the resources present on these lands and mitigation requirements are known.

3.10.6.3.11.2 Mitigation Measures to Avoid or Minimize Impacts on Big Game, Sage Grouse, and Raptors. Several measures would be implemented during canal rehabilitation, pipeline construction, and idle lands conversion to avoid or minimize impacts on big game, sage grouse, and raptors. These measures include field surveys, restrictions on construction and maintenance periods, impact avoidance features, access road closures, and reclamation activities. They would be implemented on a selective basis in or near sensitive habitats as determined by the project biologist. Detailed descriptions of these mitigation measures are included in Appendices A and B.

3.10.6.3.11.3 Specific Mitigation Measures for the Proposed Action – Talmage. Mitigation measures intended to compensate for impacts on wildlife habitat that cannot be avoided would be implemented at the Brotherson, Clay Basin, and Lake Fork mitigation sites, along canals, and at retirement lands that are suited for this purpose for the Proposed Action. Habitat improvement and development would be implemented as described above and as indicated in Table 3.10-6. The changes in AAHUs that would result from implementation of mitigation measures at the mitigation sites and along canals as well as the net changes comparing impacts of dams, reservoirs, and canals to mitigation measures were presented in Table 3.10-5. Mitigation measures focus on increasing AAHUs for wetland and riparian cover types and there would be a net gain for these cover types. Mitigation measures described above and in Appendix B would be implemented during canal rehabilitation and pipeline construction and maintenance to avoid or minimize impacts on big game, sage grouse, and raptors. No sage grouse surveys would be conducted along the proposed Big Sand Wash Feeder Pipeline since there is no suitable or classified habitat along the route. Riparian habitat improvement would be implemented at all new or rehabilitated diversion dams.

Mitigation measures intended to compensate for impacts on wildlife habitat located on idle lands would be implemented at the mitigation sites identified in Table 3.10-6 and on retirement lands designated as suitable for habitat improvement and development. Surveys and mitigation measures to reduce or avoid impacts on idle lands would be implemented during conversion of idle lands to irrigated lands.

3.10.6.3.12 Unavoidable Adverse Impacts.

3.10.6.3.12.1 Overview of Potential Unavoidable Adverse Impacts. Unavoidable adverse impacts are those that both cannot be avoided by implementation of the mitigation measures and for which the proposed mitigation measures do not fully compensate for the impact. Five general categories of unavoidable adverse impacts that may occur for the Upalco Unit alternatives have been identified. The first four are expected to occur under some or all of the Upalco Unit alternatives and will be addressed as appropriate. They include 1) loss of critical big game winter range at reservoir sites; 2) potential indirect impacts on wetlands and riparian communities resulting from reduced peak flows below dams and from changes in the availability of secondary irrigation water; 3) the lack of full compensation for impacts on certain upland cover types; and 4) canal rehabilitation, pipeline construction, and conversion of idle lands to irrigated lands impacts on sage grouse and raptors and their habitat. The fifth category has a very low probability of occurrence but is equally likely to occur for all alternatives that include onstream reservoirs. It involves the possible extirpation of species from above onstream reservoirs, which was discussed under the Upalco Unit Proposed Action.

Critical Big Game Winter Range. The vegetation cover types impacted by reservoirs were included in the HEP assessment. These habitat losses were compensated by the proposed wildlife habitat mitigation strategies. However, for a variety of reasons, mitigation sites are generally located at least 10 miles from impact areas and are located in lower valued big game winter range areas than the impact areas. While the habitat would be replaced at the mitigation site, the big game winter range in

Table 3.10-6
Upalco Unit Mitigation Sites and Acreage on Which Habitat Improvement and Habitat Development Measures Would Be Implemented[a]

Mitigation Site/Cover Type	Existing Acres[b]	Future Treatment of Existing Acres: Habitat Improvement Acres	Future Treatment of Existing Acres: Habitat Development Acres
Brotherson			
Forested riparian	99	99	–
Shrub riparian	142	142	–
Wet meadow	39	39	–
Sagebrush/grass	210	110	100 acres developing to shrub riparian at TY 10 and to forest riparian at TY 25; includes 50 mesic acres and 50 more xeric acres
Evans			
Irrigated	143	–	143 acres developing into sagebrush/grass at TY 3
Clay Basin			
Irrigated	155	–	155 acres of irrigated lands at the end of TY 3 that would be converted to 145 acres of wet meadow and 10 acres of emergent wetland by TY 10.
Lake Fork[c]			
Irrigated[c]	722	-	100 acres to shrub riparian at TY 10 and forest riparian at TY 25; 250 acres to shrub riparian at TY 10; 272 acres to sagebrush/grass; and 100 acres wet meadow

Notes:

Following the classification protocols set forth in Cowardin et al. (1979), an area with >30 percent canopy cover of hydrophytic shrubs would be classified as a scrub/shrub wetland or riparian community. An area with >30 percent canopy cover of cottonwood trees would be classified as a forested wetland or riparian community. Areas with a combined hydrophytic shrub and cottonwood canopy of >30 percent would be classified as scrub/shrub.

[a]Potential mitigation measures on retirement lands would be determined in consultation with the Ute Tribe and state and federal resource agencies. Such measures are not included on this table.

[b]Existing acres represent the current total area on each site that would be subject to habitat improvement and habitat development measures.

[c]The Lake Fork mitigation site includes both Tribal and non-Tribal lands. No existing irrigated Tribal trust land or Tribal trust lands within the Uintah Indian Irrigation Project will be used for wildlife mitigation. Lands of similar current habitat values would be identified, evaluated, and used for mitigation.

the impact area would be lost with no possibility for replacement in the immediate area.

Indirect Wetland and Riparian Community Impacts. Potential indirect impacts on wetlands and riparian communities resulting from reduced peak flows for some alternatives, delayed peak flows, reduced secondary water availability, land retirement, and idle lands irrigation will be monitored. Potential impacts on wetland and riparian communities could be significant for all alternatives, far exceeding currently projected impacts. Depending on the magnitude of the impact, fully mitigating additional substantial losses of wetlands and riparian communities may not be possible.

Full Compensation for Upland Cover Type Losses. As previously described, the HEP team determined acceptable compensation for losses of existing cover types if full in-kind compensation was not possible (Table 3.10-7). Net gain and loss are defined as the sum of the change in AAHUs resulting from project features and mitigation measures. Generally, the largest net losses would result from the loss of irrigated lands and sagebrush/grass communities and the net gains would occur in wetland and riparian cover types. An undetermined portion of the habitat value lost in sagebrush/grass communities would be regained on irrigated lands that are retired from production. The best use of retired lands in terms of upland habitat development potential would be determined in conjunction with resource agencies following project authorization. Management plans for specific parcels of retired lands would be developed with the agencies.

Canal Rehabilitation, Pipeline Construction, and Conversion of Idle Lands Impacts on Sage Grouse, Raptors, and their Habitat. Mitigation measures intended to reduce these impacts will not eliminate all potential impacts on these species. Sage grouse breeding complexes could be impacted to the point of abandonment, depending on the location of pipelines and pipeline maintenance roads and levels of human activity during sensitive periods. Sage grouse brood survival may be impacted by the loss of wet meadows associated with canal rehabilitation, reduced availability of secondary irrigation water, and conversion of idle lands. Despite mitigation measures, some raptor nest trees would be lost during construction along canals and pipelines, and some nest abandonment may occur as a result of human activities along new pipeline maintenance roads following construction.

3.10.6.3.12.2 Upalco Unit Proposed Action Unavoidable Adverse Impacts. Critical elk and mule deer winter range and critical moose year-long range would be lost at the site of the proposed Crystal Ranch Reservoir, all significant impacts. Reductions in secondary water availability, delayed peak flows, idle land conversion, and land retirement under the Proposed Action could have significant unavoidable impacts on wetland and riparian communities. There would be a large unavoidable net loss of AAHUs attributed to loss of irrigated lands and sagebrush/grass communities under the Proposed Action, which would be partially compensated by land retirement. Wet meadows used by sage grouse broods would be impacted by canal rehabilitation. Canal rehabilitation and pipeline construction would result in some loss of raptor nest trees. There would be a net loss of 1,429 acres of wetland and riparian communities considering proposed mitigation measures.

3.10.6.3.13 Cumulative Impacts.

3.10.6.3.13.1 Overview of Potential Cumulative Impacts. Cumulative impacts were assessed by considering impacts on wildlife or wildlife habitat of the Upalco Unit plus the impacts of the Proposed Action of the Uintah Unit. In most cases, the cumulative impacts are simply the additive impacts of the two alternatives. This does not suggest that impacts on wildlife are minor but, rather, that most impacts would be spread over such a large area as to rule out most possibilities of greater than additive effects. Four possible exceptions include significant losses of critical big game winter range, effects on moose population trends, effects on sage grouse populations, and general wildlife impacts related to the loss of wetland and riparian habitat resulting from changes in peak discharge volume and timing, canal rehabilitation, land retirement, idle lands conversion, and reduced application of irrigation water.

Table 3.10-7
Acceptable Compensation for Existing Cover Types if Full In-Kind Compensation is Not Possible*

Existing Cover Type	Acceptable Compensation Cover Type
Confer	Forest riparian
Mixed forest	Forest riparian
Aspen/hardwood	Forest riparian
Sagebrush/grass	Forest or shrub riparian, juniper
Juniper	Sagebrush/grass (preferred), forest or shrub riparian
Irrigated lands	Sagebrush/grass (preferred), juniper, wet meadow
Open water	Beaver pond, emergent wetland, forest or shrub
Wet meadow	Emergent wetland, forest or shrub riparian
Forest riparian	No acceptable substitute
Shrub riparian	No acceptable substitute
Emergent wetland	No acceptable substitute

*Inclusion of a particular cover type as acceptable compensation for loss of another cover type in this table does not imply that each of these changes in cover type are included in the proposed mitigation or that each is biologically feasible. It only implies that such a change of cover type was determined to be acceptable by the HEP team. For instance, sagebrush/grass would not be converted to juniper.

3.10.6.3.13.2 Upalco Unit Proposed Action Cumulative Impacts. Table 3.10-8 presents cumulative changes in AAHUs by cover type for the combined Proposed Actions of the Upalco Unit and Uintah Unit. Large net losses of AAHUs are predicted for the irrigated and sagebrush/grass cover types.

The two Proposed Actions would result in two reservoirs constructed within critical mule deer and elk winter range, both significant impacts. Together, these reservoirs would not be expected to have measurable effects on deer or elk herd size in the upper Uinta Basin.

Implementation of the Proposed Actions of both units would result in construction of one major onstream reservoir in critical year-long moose range and another on the boundary of this moose range classification and, consequently, a substantial loss of habitat, especially during certain winters. While the existing moose population might not be impacted by construction of both reservoirs, this habitat loss could slow the rate of herd growth in this portion of the southern Uinta Mountains.

Potential cumulative impacts on sage grouse leks are not likely to be any greater than described for canal rehabilitation under the Upalco Unit Proposed Action and the Lower Uintah Proposed Action in the Uintah Unit because of constructing the Ouray Park Feeder Pipeline. Canal rehabilitation within year-long sage grouse range in both units may have a long-term impact on sage grouse brood survival and the extent of occupied sage grouse range.

Based on the stated assumptions, all project features and actions would result in known and estimated cumulative losses of 5,188 acres of wetland and riparian communities with an estimated 2,627 acres resulting from implementation of the Uintah Unit Replacement Project. These impacts on wetland and riparian communities may be greater than the sum of the affected acreage for the reasons discussed in Section 3.10.6.3.10 Total Impacts.

The potential for extirpating a species from river bottom cover types upstream from the Crystal Ranch and/or Lower Uintah Dams would increase following construction, as described for the Upalco Unit Proposed Action. This would be a significant impact if it occurred. However, the likelihood of such an occurrence above either of these reservoirs is very low.

3.10.6.4 Cow Canyon Alternative

3.10.6.4.1 Dams and Reservoirs. The acreage of each cover type that would be impacted by the Cow Canyon Alternative was presented in Table 3.10-2. Significant impacts on wetland and riparian communities would occur at the Upper Yellowstone Reservoir site.

3.10.6.4.1.1 Wildlife Habitat. Impacts of the Upper Yellowstone and Big Sand Wash Reservoirs determined through the HEP study are presented in Table 3.10-9. The largest losses of AAHUs would occur in the sagebrush/grass cover type, followed by aspen, mixed deciduous/conifer, forest riparian, and conifer.

3.10.6.4.1.2 Big Game. No moose were seen near the Upper Yellowstone Reservoir site during winter aerial surveys. However, moose and moose tracks were observed in the proposed reservoir area during the summer and the area is considered to be critical year-long moose range. This loss would be significant.

3.10.6.4.2 River Corridors. Upper Yellowstone Dam and Reservoir could have the same potential impacts on semiaquatic mammals, certain small mammals, and amphibians as described for Crystal Ranch Dam under the Proposed Action. The potential extirpation of a species upstream from Upper Yellowstone Dam would be a significant impact if it occurred. The probability of such an occurrence is believed to be very low. The expected 1- to 2-week delay in the timing of peak flows below dams may impact the long-term viability of downstream forest riparian communities, resulting in a gradual decline in the extent of cottonwood forest as described for the Proposed Action.

3.10.6.4.3 Diversion Dams. Impacts at diversion dams would be limited to the immediate areas around the dams and site access roads. Potential

Table 3.10-8
Net Change in AAHUs for Dams, Reservoirs, and Canals for the Upalco Unit and Uintah Unit Proposed Actions Combined

Cover Type	Non-Tribal			Tribal		
	Change from Feature	Change from Mitigation	Net Change	Change from Feature	Change from Mitigation	Net Change
Beaver pond	0.00	-0.06	-0.06	0.00	0.00	0.00
Conifer	0.00	0.00	0.00	-10.20	0.00	-10.20
Deciduous/conifer mix	0.00	0.00	0.00	0.00	0.00	0.00
Emergent wetland	-19.78	27.43	7.65	0.00	0.00	0.00
Forest riparian	-91.15	429.97	338.82	-949.39	1,311.88	362.49
Irrigated lands	-112.37	-275.83	-388.20	0.00	-3,565.86	-3,565.86
Juniper	-76.61	-40.08	-116.69	0.00	34.10	34.10
Open water	332.41	4.32	336.73	242.80	0.00	242.80
Shrub riparian	-267.10	38.02	-229.08	-992.79	1,253.88	261.09
Sagebrush/grass	-686.06	-324.12	-1,010.18	-1,490.51	277.36	-1,213.15
Upland aspen/hardwoods	0.00	0.00	0.00	0.00	0.00	0.00
Wet meadow	-257.15	252.34	-4.81	-9.88	198.33	188.35

*Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availability of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in Section 3.9 Wetland and Riparian Resources.

Table 3.10-9
Net Change in AAHUs by Cover Type for Dams, Reservoirs, and Canals for the Cow Canyon Alternative*

Cover Type	Non-Tribal		
	Change from Feature	Change from Mitigation	Net Change
Beaver pond	-8.98	0.00	-8.98
Conifer	-71.96	0.00	-71.96
Deciduous/conifer mix	-103.39	0.00	-103.39
Emergent wetland	-19.78	27.43	7.65
Forest riparian	-97.66	207.78	110.12
Irrigated lands	-26.54	-1,724.33	-1,750.87
Juniper	-76.61	0.00	-76.61
Open water	363.78	0.00	363.78
Shrub riparian	-42.40	418.66	376.26
Sagebrush/grass	-640.30	168.01	-472.30
Upland aspen/hardwoods	-157.74	0.00	-157.74
Wet meadow	-6.61	416.55	409.94

*Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availability of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in Section 3.9 Wetland and Riparian Resources.

impacts at diversion dams are the same as for the Proposed Action and include the temporary, but long-term loss of wetland and riparian communities.

3.10.6.4.4 Fish and Wildlife Enhancement and Recreation Developments. Big game would benefit from the purchase and elimination of grazing from the 160-acre Fisher property on the Lake Fork River. Stream improvements would improve the condition of riparian communities along selected rivers where livestock grazing is not a problem.

Potential direct and indirect impacts on other wildlife species and wildlife habitat from campground development and improvement would be the same as for the Proposed Action. However, campground improvements would be implemented at the Bridge Campground, Swift Creek Campground, and ATV Trailhead instead of at the locations listed under the Proposed Action. Each of these sites would impact less than 2 acres of primarily upland cover types. The Fish Creek Trail development and improvement would impact about 5 acres of upland cover types.

3.10.6.4.5 Land Retirement. Impacts of land retirement on wildlife habitat would be the same as for the Proposed Action. The best use of retired lands in terms of upland habitat development potential would be determined in conjunction with resource agencies following project authorization. Management plans for specific parcels of retired lands would be developed with the agencies.

3.10.6.4.6 Secondary Irrigation Water-Supported Wetlands. Potential indirect impacts on wildlife and their habitat would generally be the same as for the Proposed Action except that the reduction in the estimated surface runoff portion of secondary irrigation consumptive use would be 17,900 acre-feet instead of 18,000 acre-feet for the Proposed Action. Under the assumptions stated for the Proposed Action, losses of wetland and riparian areas would be significant with an estimated 1,989 acres affected if all of this surface water runoff supports wetland and riparian communities (Section 3.9).

3.10.6.4.7 Tribal Idle Lands. Impacts from conversion of idle lands would be the same as described for the Proposed Action.

3.10.6.4.8 Total Impacts. It is unlikely that the total direct and indirect impacts of most project features on wildlife habitat would be greater than the sum of impacts of individual project features described above for the Cow Canyon Alternative since 1) project features are widely separated; 2) there would be no canal rehabilitation; and 3) there would be only one new pipeline. However, total indirect impacts on wetland and riparian cover types from reduced irrigation could cause an impact on wildlife, especially deer and elk, that would be greater than indicated by the sum of the acreage of the individual impacts. The reasons for this potential synergistic impact were discussed under the Proposed Action. Potential impacts related to habitat fragmentation would not occur because of the large areas of unaltered landscape in the vicinity of many of the project features.

3.10.6.4.9 Mitigation. The Clay Basin and Lake Fork mitigation sites would be used under the Cow Canyon Alternative. Mitigation measures described in Appendix B would be implemented. As with the Proposed Action, mitigation measures focus on increasing AAHUs for wetland and riparian cover types and there are net gains for each of these types (Table 3.10-9). The greatest net losses would occur in the irrigated land and sagebrush/grass cover types. There would be net AAHU gains for riparian and wetland cover types. Pipeline mitigation measures would be implemented as described for the Proposed Action. Riparian habitat improvement would be implemented at all new or rehabilitated diversion dams.

3.10.6.4.10 Unavoidable Adverse Impacts. Reductions in secondary water availability under the Cow Canyon Alternative could have significant unavoidable impacts on wetlands and riparian communities. There would be a large unavoidable net loss of AAHUs for irrigated lands and sagebrush/grass communities under this alternative, which would be partially compensated by land retirement. Pipeline construction would result in some loss of raptor nest trees. There would be a net loss of 1,690 acres of wetlands and riparian areas comparing all known and estimated impacts with gains from habitat improvement and development for proposed mitigation. There is a very low likelihood that semiaquatic species could be extirpated from above the Upper Yellowstone Dam.

3.10.6.4.11 Cumulative Impacts. Table 3.10-10 shows the cumulative impact on AAHUs of the Cow Canyon Alternative and the Uintah Unit Proposed Action. The cover types that would be most impacted by these combined alternatives include irrigated lands and sagebrush/grass.

Lower Uintah Reservoir would be constructed in critical deer and elk winter range, a significant impact. Implementation of these alternatives would result in construction of two major onstream reservoirs in critical year-long moose range and a substantial loss of habitat, especially during certain winters. While the existing moose population might not be impacted by construction of these reservoirs, construction could slow the rate of herd growth in this portion of the southern Uinta Mountains.

Potential cumulative impacts on sage grouse are not likely to be any greater than stated for the Uintah Unit Proposed Action because of construction of the Ouray Park Feeder Pipeline and from canal rehabilitation and associated loss of wet meadows discussed under the Upalco Unit Proposed Action.

Based on the stated assumptions, all project features and actions would result in known and estimated cumulative losses of 4,922 acres of wetland and riparian communities with an estimated 2,627 acres resulting from implementation of the Uintah Unit Replacement Project. As discussed for the Upalco Unit Proposed Action, the overall impact on wildlife could be greater than indicated by the sum of the acres of wetland and riparian cover types impacted.

The potential for extirpating a species from river bottom cover types upstream from the Upper Yellowstone and/or Lower Uintah Dams would increase following construction, as described for the Proposed Action. This would be a significant impact if it occurred, but the likelihood of this occurrence above both dams would be very low.

3.10.6.5 Crystal Ranch Alternative

3.10.6.5.1 Dams and Reservoirs. Potential impacts of Crystal Ranch Reservoir on wildlife habitat, big game, sage grouse, raptors, and other wildlife under the Crystal Ranch Alternative are the same as described for Crystal Ranch Reservoir under the Proposed Action. The acreage of cover types that would be impacted is shown in Table 3.10-3. The number of AAHUs that would be impacted by dams and canal rehabilitation are shown in Table 3.10-11. The greatest impacts would occur in the forest and shrub riparian and sagebrush/grass cover types. Mitigation measures to avoid or reduce impacts are presented in Appendices A and B.

3.10.6.5.2 River Corridors. Large, onstream water storage reservoirs in the arid West are typically designed to store high flows associated with spring runoff. They do this by intercepting and storing runoff peaks, thereby reducing seasonal high flows downstream. These same high flows are required to maintain and perpetuate wetland and riparian communities that occur on floodplains downstream from the water storage site (Mahoney and Rood 1993). The well-documented impact of intercepting and storing peak flows is the reduced health, productivity, extent, and long-term viability of wetlands and riparian communities on floodplains downstream of dams (Fenner, Brady, and Patton 1985; Rood and Mahoney 1990; Rood and Heinze-Milne 1989; Stromberg, Patton, and Richter 1991). These effects may be observed for many miles below a dam. The effects of these changes on wildlife are to reduce the overall value and area of wetland and riparian habitat types available for wildlife, thereby reducing wildlife populations and eliminating wildlife use of some areas (Carothers 1977; Gaines 1977; Hehnke and Stone 1979).

Floodplains downstream from proposed onstream reservoirs are generally wide and support extensive wetland and riparian communities. Therefore, the potential exists for proposed onstream dams to

Table 3.10-10
Net Change in AAHUs for Dams, Reservoirs, and Canals for the Cow Canyon Alternative and Uintah Unit Proposed Action Combined*

Cover Type	Non-Tribal			Tribal		
	Change from Feature	Change from Mitigation	Net Change	Change from Feature	Change from Mitigation	Net Change
Beaver pond	-8.98	0.00	-8.98	0.00	0.00	0.00
Conifer	-71.96	0.00	-71.96	-10.20	0.00	-10.20
Deciduous/conifer mix	-103.39	0.00	-103.39	0.00	0.00	0.00
Emergent wetland	-19.78	27.43	7.65	0.00	0.00	0.00
Forest riparian	-105.98	342.18	236.20	-640.48	1,104.09	463.61
Irrigated lands	-26.54	-1,724.33	-1,750.87	0.00	-2,081.84	-2,081.84
Juniper	-76.61	-17.13	-93.74	0.00	34.10	34.10
Open water	363.78	0.00	363.78	187.09	0.00	187.09
Shrub riparian	-42.40	440.93	398.53	-884.83	835.20	-49.62
Sagebrush/grass	-640.30	20.91	-619.39	-879.69	109.35	-770.35
Upland aspen/hardwoods	-157.74	0.00	-157.74	0.00	0.00	0.00
Wet meadow	-6.61	415.91	409.30	0.00	0.00	0.00

*Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availability of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in Section 3.9 Wetland and Riparian Resources.

Table 3.10-11
Net Change in AAHUs by Cover Type for Dams, Reservoirs, and Canals for the Crystal Ranch Alternative*

Cover Type	Non-Tribal			Tribal		
	Change from Feature	Change from Mitigation	Net Change	Change from Feature	Change from Mitigation	Net Change
Beaver pond	0.00	-0.06	-0.06	0.00	0.00	0.00
Conifer	0.00	0.00	0.00	0.00	0.00	0.00
Deciduous/conifer mix	0.00	0.00	0.00	0.00	0.00	0.00
Emergent wetland	0.00	0.00	0.00	0.00	0.00	0.00
Forest riparian	-79.68	293.83	214.15	-308.41	207.78	-101.13
Irrigated lands	-85.30	-35.52	-120.81	0.00	-1,484.02	-1,484.02
Juniper	0.00	-22.96	-22.96	0.00	0.00	0.00
Open water	100.27	4.32	104.59	55.71	0.00	55.71
Shrub riparian	-249.77	15.51	-234.26	-107.96	418.67	310.71
Sagebrush/grass	-155.42	-117.48	-332.44	-610.82	168.01	-442.81
Upland aspen/hardwoods	0.00	0.00	0.00	0.00	0.00	0.00
Wet meadow	-158.59	16.96	-141.63	-9.88	198.33	188.45

*Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availability of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in Section 3.9 Wetland and Riparian Resources.

impact these communities and the wildlife habitat they provide. Potential indirect impacts on wildlife habitat, especially wetlands and riparian communities, were assessed using surface hydrology data. Hydrologic studies described in the Water Resources Technical Report (CH2M HILL/Horrocks 1996e) investigated potential project effects on surface and groundwater hydrology downstream from project features. Hydrologic impact assessment methods are reported in CH2M HILL/Horrocks (1996e). Detailed accounts of expected changes in peak flows and potential impacts on wetlands and riparian communities resulting from reservoir operations for each of the Upalco Unit alternatives are presented in the Wetland/Riparian Resource Technical Report (CH2M HILL/Horrocks 1996f).

Decreased peak flows on the Lake Fork River would reduce establishment and recruitment of wetland and riparian species along the entire length of the river. This would likely result in a long-term decline in the quality and area of wetland and riparian communities along the Lake Fork River floodplain.

The expected 1- to 2-week delay in the timing of peak flows below dams may impact the long-term viability of downstream forest riparian communities, resulting in a gradual decline in the extent of cottonwood forest as described for the Proposed Action.

Potential impacts on semiaquatic mammals, certain small mammals, and amphibians were described for Crystal Ranch Dam under the Proposed Action. The extirpation of a species upstream from the dam would be a significant impact if it occurred. However, the probability of such an occurrence is believed to be very low.

3.10.6.5.3 Diversion Dams. Impacts at diversion dams would be limited to the immediate areas around the dams and site access roads and are expected to be less than 2 acres per site, with wetlands and riparian areas affected. The types of impacts, measures to minimize impacts, and mitigation of unavoidable impacts at diversion dams would be the same as for the Proposed Action.

3.10.6.5.4 Canals. Impacts associated with rehabilitation of Farnsworth Laterals No. 1, No. 2, and No. 3 that were assessed through the HEP study were presented in Table 3.10-11. Table 3.10-3 presents the acres of wetland and riparian cover types potentially impacted by canal rehabilitation under the Crystal Ranch Alternative. Impacts of these losses and any habitat gains that would result from mitigation are included in the HEP analysis. Construction timing restrictions for big game, raptors, and sage grouse described for the Proposed Action and in Appendix A also apply to the Crystal Ranch Alternative. Losses of wet meadows could impact sage grouse brood survival and grouse distribution over the long term.

3.10.6.5.5 Fish and Wildlife Enhancement and Recreation Developments. Impacts and potential benefits of range improvements and water development on Towanta Flats and Monarch Bench would be the same as for the Proposed Action. Potential benefits to big game from the Fisher property and the Red Rocks/Duchesne drainage area habitat acquisitions would be the same as for the Cow Canyon Alternative. Stream improvements would improve the condition of riparian communities along selected rivers where livestock grazing is not a problem. Potential direct and indirect impacts on other wildlife species and wildlife habitat resulting from campground development and improvement were described under the Proposed Action or Cow Canyon Alternative.

3.10.6.5.6 Secondary Irrigation Water-Supported Wetlands. Expected indirect impacts on wildlife and their habitat would generally be the same as for the Proposed Action. Secondary consumptive surface water availability would be reduced by 19,200 acre-feet, similar to the Proposed Action, with a crude estimated loss of 2,133 acres of wetlands and riparian communities and wildlife habitat (Section 3.9).

3.10.6.5.7 Land Retirement. Impacts of land retirement would be the same as for the Proposed Action. The best use of retired lands in terms of upland habitat development potential would be determined in conjunction with resource agencies following project authorization. Management plans for specific parcels of retired lands would be developed with the agencies.

3.10.6.5.8 Tribal Idle Lands. Impacts from conversion of idle lands to agriculture would be the same as described for the Proposed Action.

3.10.6.5.9 Total Impacts. It is unlikely that total direct impacts on wildlife habitat from project features would be greater than impacts of individual features since they would be widely separated. However, for the reasons discussed under the Proposed Action, total indirect impacts on wildlife, especially big game, from reduced irrigation could be greater than indicated by the affected acreage alone if this results in significant losses of wetlands and riparian habitat. Habitat fragmentation would not occur as a result of the project.

3.10.6.5.10 Mitigation. The Crystal Ranch Alternative would use the Brotherson and Lake Fork sites and canal areas for mitigation. Mitigation measures described for the Proposed Action (Tables 3.10-6 and 3.10-7) and in Appendices A and B would be implemented. There would be gains in AAHUs at the mitigation sites as well as net gains for wetland and riparian cover types and net losses for irrigated lands and sagebrush/grass (Table 3.10-11). Canal rehabilitation measures would be implemented as described for the Proposed Action. Riparian habitat improvement would be implemented at all new or rehabilitated diversion dams.

3.10.6.5.11 Unavoidable Adverse Impacts. Reductions in secondary water availability under the Crystal Ranch Alternative would have significant unavoidable impacts on wetlands and riparian communities. There would be a large unavoidable net loss of AAHUs attributed to loss of irrigated lands and sagebrush/grass communities under this alternative. Critical deer and elk winter range would be lost at the Crystal Ranch Reservoir site. Canal rehabilitation would result in some loss of raptor nest trees and wet meadows used by sage grouse broods. There would be a net loss of 1,634 acres of wetland and riparian communities considering proposed mitigation measures.

3.10.6.5.12 Cumulative Impacts. Table 3.10-12 presents cumulative changes in AAHUs for the combined Crystal Ranch Alternative and Uintah Unit Proposed Action. The greatest impacts are projected for the forest and shrub riparian and sagebrush/grass cover types. Net increases in AAHUs following mitigation are predicted for forest riparian, shrub riparian, wet meadow, and open water cover types. Irrigated lands and sagebrush/grass areas would have the greatest net decrease in AAHUs following implementation of mitigation measures.

Based on the stated assumptions, all project features and actions would result in known and estimated cumulative losses of 5,231 acres of wetland and riparian communities with an estimated 2,627 acres resulting from implementation of the Uintah Unit Replacement Project. As discussed for the Upalco Unit Proposed Action, the overall impact on wildlife could be greater than indicated by the sum of the acres of wetland and riparian cover types impacted.

The potential for extirpating a species from river bottom cover types upstream from the Crystal Ranch and Lower Uintah Dams would increase following construction as described for the Proposed Action. This would be a significant impact if it occurred, but the likelihood of this occurrence above both dams would be very low.

3.10.6.6 Twin Pots Alternative

3.10.6.6.1 Dams and Reservoirs. Potential impacts of enlarging Big Sand Wash Reservoir on big game, sage grouse, raptors, and other wildlife under the Twin Pots Alternative are the same as described for Big Sand Wash Reservoir under the Proposed Action. The number of AAHUs that would be impacted by Big Sand Wash Reservoir and canal rehabilitation under the Twin Pots Alternative are presented in Table 3.10-13. Sagebrush/grass cover types would be most affected by project development while open water areas would increase at the offstream reservoir site.

3.10.6.6.2 River Corridors. Summer flows would decrease substantially on the Lake Fork

Table 3.10-12
Net Change in AAHUs by Cover Type for Dams, Reservoirs, and Canals for the Crystal Ranch Alternative and Uintah Unit Proposed Action Combined*

	Non-Tribal			Tribal		
Cover Type	**Change from Feature**	**Change from Mitigation**	**Net Change**	**Change from Feature**	**Change from Mitigation**	**Net Change**
Beaver pond	0.00	-0.06	-0.06	0.00	-0.06	-0.06
Conifer	0.00	0.00	0.00	-10.20	0.00	-10.20
Deciduous/conifer mix	0.00	0.00	0.00	0.00	0.00	0.00
Emergent wetland	0.00	0.00	0.00	0.00	0.00	0.00
Forest riparian	-88.00	428.23	340.23	-949.39	1,311.88	362.49
Irrigated lands	-85.30	-35.52	-120.81	0.00	-3,565.86	-3,565.86
Juniper	0.00	-40.08	-40.08	0.00	34.10	34.10
Open water	100.27	4.32	104.59	242.80	0.00	242.80
Shrub riparian	-249.77	37.78	-211.99	-992.80	1,253.88	261.09
Sagebrush/grass	-155.42	-324.12	-479.54	-1,490.51	277.36	-1,213.15
Upland aspen/hardwoods	0.00	0.00	0.00	0.00	0.00	0.00
Wet meadow	-158.59	16.32	-143.27	-9.88	198.33	188.45

*Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availability of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in Section 3.9 Wetland and Riparian Resources.

Table 3.10-13
Net Change in AAHUs by Cover Type for Dams, Reservoirs, and Canals for the Twin Pots Alternative*

Cover Type	Non-Tribal			Tribal		
	Change from Feature	Change from Mitigation	Net Change	Change from Feature	Change from Mitigation	Net Change
Beaver pond	0.00	0.00	0.00	0.00	0.00	0.00
Conifer	0.00	0.00	0.00	0.00	0.00	0.00
Deciduous/conifer mix	0.00	0.00	0.00	0.00	0.00	0.00
Emergent wetland	-19.78	27.43	7.65	0.00	0.00	0.00
Forest riparian	-3.45	47.00	43.56	-8.97	0.00	-8.97
Irrigated lands	-26.54	-275.39	-301.93	0.00	0.00	0.00
Juniper	-76.61	-22.96	-99.57	0.00	0.00	0.00
Open water	232.14	0.00	232.14	0.00	0.00	0.00
Shrub riparian	-29.96	2.12	-27.84	-1.45	0.00	-1.45
Sagebrush/grass	-530.64	979.32	448.68	0.00	0.00	0.00
Upland aspen/hardwoods	0.00	0.00	0.00	0.00	0.00	0.00
Wet meadow	-72.62	253.08	180.46	-7.34	0.00	-7.34

*Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availability of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in Section 3.9 Wetland and Riparian Resources.

River, with potentially significant impacts on wetland and riparian communities.

3.10.6.6.3 Diversion Dams. Impacts at diversion dams would be limited to the immediate areas around the dams and site access roads, estimated to be less than 2 acres per site, including wetland and riparian communities. The types of impacts, avoidance measures, and mitigation at diversion dams would be the same as for the Proposed Action.

3.10.6.6.4 Canals. Impacts associated with rehabilitation of Farnsworth Laterals No. 1, No. 2, and No. 3 were assessed through the HEP study and are presented in Table 3.10-13 along with reservoir impacts. Table 3.10-4 presents acres of wetland and riparian cover types potentially impacted by canal rehabilitation under the Twin Pots Alternative. Wet meadows potentially used by sage grouse broods would revert to uplands following canal rehabilitation, with possible impacts on brood survival and sage grouse distribution in occupied areas.

3.10.6.6.5 Pipelines. The Farnsworth Lateral No. 1 and Big Sand Wash Feeder Pipelines were discussed under the Proposed Action. In addition to these, the Lake Fork-Yellowstone Pipeline would be constructed under the Twin Pots Alternative. The general types of impacts described for pipelines would also be the same, including the permanent loss of wildlife habitat in areas occupied by access roads along pipeline routes. No significant impacts are expected from construction of the Big Sand Wash-Roosevelt Pipeline since it would be contained primarily within highway right-of-ways.

3.10.6.6.5.1 Sage Grouse. The Lake Fork-Yellowstone Pipeline would be constructed entirely within classified year-long sage grouse range. The Lake Fork-Yellowstone Pipeline has the potential of impacting two sage grouse breeding complexes within about 0.75 mile of the proposed route. This proximity suggests there is a relatively high likelihood of an impact on one or both of these breeding complexes from pipeline construction, maintenance activities, and new public access along the maintenance road. Potential impacts could include loss of nesting areas or possible abandonment of a breeding complex, a significant impact. The exact location of the breeding complexes relative to the surveyed pipeline route would be determined as described in Section 3.10.6.3.11 Mitigation. The pipeline route would be adjusted to the extent practicable while still meeting water delivery requirements to reduce potential impacts on sage grouse. Mitigation measures described in Appendix B would be implemented to avoid the impact or reduce its severity or duration.

3.10.6.6.6 Fish and Wildlife Enhancement and Recreation Developments. Range improvement and water development on Towanta Flats and Monarch Bench, the Red Rocks/Duchesne drainage habitat acquisition, and Twin Pots Reservoir improvement would also be implemented under the Twin Pots Alternative with the same potential impacts and benefits described for the Proposed Action.

3.10.6.6.7 Secondary Irrigation Water-Supported Wetlands. Based on the same assumptions, potential effects of reduced secondary water availability on wetlands and riparian communities would be similar to those described for the Proposed Action. Secondary surface water runoff would be reduced by an estimated 19,400 acre-feet under the Twin Pots Alternative, possibly impacting an estimated 2,156 acres of wetland and riparian communities. All of these areas would not likely be completely dried up since some would still receive irrigation runoff, only in lesser amounts.

3.10.6.6.8 Land Retirement. Impacts of land retirement on wildlife would be the same as for the Proposed Action. The best use of retired lands in terms of upland habitat development potential would be determined in conjunction with resource agencies following project authorization. Management plans for specific parcels of retired lands would be developed with the agencies.

3.10.6.6.9 Tribal Idle Lands. Impacts from conversion of idle lands to agriculture would be the same as described for the Proposed Action.

3.10.6.6.10 Total Impacts. It is unlikely that total direct impacts of project features on wildlife habitat would be greater than the impacts of individual features since they would be widely separated. For the reasons discussed under the Proposed Action, total indirect impacts on big game from reduced secondary water availability could be greater than indicated by the affected acreage alone if reduced irrigation causes significant losses of wetlands and riparian habitat.

3.10.6.6.11 Mitigation. The Evans and Clay Basin sites would be used as mitigation for the impacts of the Twin Pots Alternative. Mitigation measures described for the Proposed Action (Tables 3.10-6 and 3.10-7) and in Appendices A and B would be implemented. There would be net losses of AAHUs for shrub riparian, irrigated lands, and juniper and net gains for forest riparian, sagebrush/grass, and wet meadow cover types (Table 3.10-13). Riparian cover type net losses and gains in AAHUs would be about even. Mitigation measures intended to reduce impacts from canal rehabilitation and pipeline construction and operation would be implemented as described for the Proposed Action. Riparian habitat improvement would be implemented at all new or rehabilitated diversion dams.

3.10.6.6.12 Unavoidable Adverse Impacts. Reductions in secondary water availability under the Twin Pots Alternative could have significant unavoidable impacts on wetlands and riparian communities. Canal rehabilitation and pipeline construction would probably result in some loss of raptor nest trees. Two sage grouse breeding complexes could be impacted by construction of the Lake Fork-Yellowstone Pipeline, maintenance activities along the pipeline, and the new public access provided by the pipeline maintenance road. Canal rehabilitation and pipeline construction would result in some loss of raptor nest trees. There would be a net loss of 2,121 acres of wetland and riparian cover types comparing known and estimated losses with gains from habitat improvement and development from proposed mitigation.

3.10.6.6.13 Cumulative Impacts. Table 3.10-14 presents cumulative changes in AAHUs for the combined Twin Pots Alternative and Uintah Unit Proposed Action. The largest project-related losses of AAHUs are predicted for forest and shrub riparian and sagebrush/grass cover types. Irrigated lands and sagebrush/grass areas would have the greatest net decrease in AAHUs.

Implementation of the Twin Pots Alternative and the Uintah Unit Proposed Action would result in construction of one major onstream reservoir (Lower Uintah) in critical deer and elk winter range, a significant impact. Lower Uintah Reservoir would also be located in critical yearlong moose range, resulting in a substantial loss of moose habitat, especially during certain winters. The single reservoir would probably have little, if any, effect on the moose herd in this portion of the southern Uinta Mountains.

Potential cumulative impacts on sage grouse breeding complexes and populations in the Uinta Basin could be very significant. The Lake Fork-Yellowstone Pipeline could impact two breeding complexes in addition to the two that could be impacted by the Ouray Park Feeder Pipeline in the Uintah Unit.

Based on the stated assumptions, all project features and actions would result in known and estimated cumulative losses of 5,048 acres of wetland and riparian communities with an estimated 2,627 acres resulting from implementation of the Uintah Unit Replacement Project.

The potential for extirpating a species from river bottom cover types upstream from the Lower Uintah Dam would increase following construction, as described for the Proposed Action. This would be a significant impact if it occurred, but the likelihood of this occurrence would be very low.

3.10.6.7 No Action Alternative

3.10.6.7.1 Trends. Wildlife populations and wildlife use of particular sites vary over time because of natural or human-caused changes in habitat conditions; plant community succession; human management of wildlife populations; and human population increases, activity patterns, and

Table 3.10-14
Net Change in AAHUs by Cover Type for Dams, Reservoirs, and Canals for the Twin Pots Alternative and Uintah Unit Proposed Action Combined*

Cover Type	Non-Tribal			Tribal		
	Change from Feature	Change from Mitigation	Net Change	Change from Feature	Change from Mitigation	Net Change
Beaver pond	0.00	-0.06	-0.06	0.00	0.00	0.00
Conifer	0.00	0.00	0.00	-10.20	0.00	-10.20
Deciduous/conifer mix	0.00	0.00	0.00	0.00	0.00	0.00
Emergent wetland	-19.78	27.43	7.65	0.00	0.00	0.00
Forest riparian	-11.77	181.40	169.64	-649.45	1,104.09	454.65
Irrigated lands	-26.54	-275.39	-301.93	0.00	-2,081.84	-2,081.84
Juniper	-76.61	-40.08	-116.69	0.00	34.10	34.10
Open water	232.14	0.00	232.14	187.09	0.00	187.09
Shrub riparian	-29.96	24.39	-5.57	-886.28	835.20	-51.08
Sagebrush/grass	-530.64	832.23	301.59	-879.69	109.35	-770.35
Upland aspen/hardwoods	0.00	0.00	0.00	0.00	0.00	0.00
Wet meadow	-72.62	252.44	179.81	-7.34	0.00	-7.34

*Impacts from pipelines, diversion dams, land retirement, future irrigation of Tribal idle lands, and reduced availability of secondary irrigation water were not evaluated using HEP and are not included in this table. See text for explanation. Acres that would be impacted by these project features and actions are included in other tables in Section 3.9 Wetland and Riparian Resources.

associated disturbance levels. In the Uinta Basin, known population trends for species addressed in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g) are 1) sage grouse are generally declining in numbers throughout the basin; and 2) moose and elk numbers are generally increasing slowly along the south slope of the Uinta Mountains.

Habitat-related trends that affect wildlife within the Uinta Basin and along the south slope of the Uinta Mountains include the following:

- The extent of juniper forest is expanding slowly.
- Climax conifer species are invading some mature aspen stands.
- Human activities, such as oil and gas exploration/extraction and road construction, continue to impact relatively small, but increasing, areas of primarily sagebrush/grass and juniper.
- Range conditions and riparian plant communities on FS lands are fairly stable.
- Range conditions are generally better on Tribal than private lands and are expected to also be better in the future.
- Wetland and riparian communities located on river floodplains are periodically changed by large runoff events but over the long term are fairly stable on a river basin scale, barring human disturbance.

3.10.6.7.2 Future Conditions. The analysis of impacts and evaluation of mitigation strategies for the HEP study projected future conditions for a variety of subject areas that affect the value of wildlife habitat. These are discussed in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996g). The general conclusion of the HEP study regarding future conditions relative to wildlife habitat was that on a scale encompassing the Uinta Basin, current wildlife habitat values are expected to remain relatively unchanged over the life of the project.

3.10.6.7.3 Consequences of Not Meeting Project Needs. None of the potential impacts attributed to the Proposed Action or alternatives would occur if the No Action Alternative was selected. Significant impacts that would not occur under the No Action Alternative are listed in Table 4.1 in Chapter 4 of this Draft EIS. Similarly, the minor project-related benefits that would result from big game range improvements and habitat acquisition would not occur. The impacts on wildlife from these benefits not occurring would be very minor. Improvement of habitat values on mitigation sites would also not occur. However, these improvements would not be necessary because there would be no need to compensate for project impacts on wildlife and wildlife habitat.

3.11 Threatened and Endangered Species

3.11.1 Introduction

This analysis summarizes the existing condition of, and potential impacts on, the following from implementation of the Proposed Action or alternatives of the Upalco Unit: federal threatened, endangered, and candidate species; federally designated or proposed critical habitat; and FS sensitive species and their habitat. Official correspondence from the FWS indicating potential species occurrence in the project area is included in Appendix C. Conservation measures are identified that would minimize or avoid impacts. Detailed information on these species can be found in the Threatened and Endangered Species (T&E) Technical Report (CH2M HILL/Horrocks 1996d) and the Biological Assessment (BA) (CH2M HILL/Horrocks 1996b).

3.11.2 Issues Eliminated from Further Analysis

All threatened or endangered species issues identified during public scoping have been analyzed. All category 2 candidate species listed in

FWS letters (Appendix C) were removed from consideration because of the recent FWS decision to eliminate this category. There are a number of project features that would have some effect on these species of concern or critical habitat, but they would not result in significant impacts (e.g., result in a loss of individuals or threaten population viability). These areas of no impact or low probability of impact are listed below and are not discussed further in this document; they are described in detail in the T&E Technical Report (CH2M HILL/Horrocks 1996d) and the BA (CH2M HILL/Horrocks 1996b). These areas include the following:

High Mountain Lakes—There is suitable, unoccupied habitat for lynx, wolverine, northern goshawk, three-toed woodpeckers, boreal and great gray owls, and spotted bats that would be unavailable during construction.

Dams and Reservoirs—Onstream reservoir construction would eliminate suitable foraging habitat for the bald eagle; peregrine falcon; great gray, flammulated, and boreal owls; lynx and wolverine; spotted and Townsend's bats; and northern goshawk. Only the bald eagle, goshawk, and flammulated owl are known to occur in the affected river corridor reaches. This habitat is not officially designated as critical for any of the above species. Although the habitat is suitable for Colorado River cutthroat trout, the likely persistence of rainbow trout and other cutthroat trout strains eliminates this habitat from being important to the continued survival of Colorado River cutthroat trout. Big Sand Wash Reservoir enlargement would remove potential bat roosting habitat, but alternative habitat exists in the area. Construction of all reservoirs would provide foraging opportunities for bald eagles (during late fall before freeze-up) and bats.

Diversion Dams—Foraging bald eagles and goshawks would be temporarily displaced during construction if they were present in the vicinity.

Canal Rehabilitation—There could be some temporary displacement of foraging bald eagles and roosting bats, if present in the vicinity, during construction.

Pipelines—Foraging bald eagles and roosting bats, if present, may be temporarily displaced during construction. The Big Sand Wash Feeder Pipeline corridor has not been surveyed for Uinta Basin hookless cactus but would be cleared prior to design.

Land Retirement—More water left in rivers would improve conditions for fish species of concern and Ute ladies'-tresses orchids, as well as all species that rely on riverine habitat. Bald eagle foraging would improve as irrigated land reverts to natural vegetation, with a subsequent increase in prey diversity. Some bat roost trees may die as water is removed from fields, but the snags would continue to provide roosting opportunity.

Fish and Wildlife Enhancement and Recreation Developments—There would be temporary disruptions during construction. Use of marginal foraging habitat by goshawk at Crystal Ranch Campground may decrease with more people using the area.

Trible Idle Lands—Conversion of Tribal idle lands to irrigated lands would alter or eliminate suitable foraging habitat for bald eagle, peregrine falcon, northern goshawk, and ferruginous hawk. Some bat roost trees might also be eliminated. Potentially affected habitats in the Upalco Unit are not designated as critical for any of the above species. Suitable foraging habitat for raptors is widespread in the Uinta Basin, as are roost sites for bats. Potential habitat for mountain plover, white-faced ibis, and migrating whooping cranes occurs on some idle lands in the Upalco Unit, particularly near the Duchesne River. However, ample alternative habitat for these bird species is widespread within the Uinta Basin.

3.11.3 Issues Addressed in the Impact Analysis

Significant impacts on federal threatened, endangered, candidate, and FS sensitive species predicted to occur as a result of implementing the Upalco Unit Proposed Action or alternatives were determined through application of the significance criteria to each predicted impact. The lower Duchesne River has been officially designated as critical habitat for the razorback sucker; no critical habitat has been officially designated for terrestrial species. Only significant impacts are addressed in the analysis in this document and include the following:

- Effect of reduced winter flows on fish in the lower Duchesne River (Proposed Action and all alternatives)

- Effect of changed (increased and decreased) Duchesne River flows in spring and summer months (Proposed Action and all alternatives)

- Effect of increased flows in the middle and lower reaches of the Lake Fork River on Ute ladies'-tresses orchid (Proposed Action, Cow Canyon Alternative, Twin Pots Alternative)

- Effect of reduced peak flows in the Lake Fork River on Ute ladies'-tresses orchid (Crystal Ranch Alternative)

- Effect of water conservation on Ute ladies'-tresses orchid

- Effect of converting idle land to irrigated land on Ute ladies'-tresses orchid

3.11.4 Description of Area of Influence

The Upalco Unit project area is shown on Map 1-1 in Chapter 1. The area of influence for this section includes the Upalco Unit plus the Duchesne River from the Lake Fork River to its confluence with the Green River.

3.11.5 Affected Environment

The affected environment is described below for federally listed threatened, endangered, and candidate species, and for FS sensitive species in the Upalco Unit. Table 3.11-1 lists the endangered, threatened, candidate, and sensitive species in the Upalco Unit project area.

3.11.5.1 Proposed Action–Talmage

3.11.5.1.1 River Corridors. Species whose habitat may be affected by hydrologic changes downstream of proposed dams and reservoirs include Colorado squawfish and razorback sucker (both are endangered species), which are found in the lower Duchesne River. Also, Ute ladies'-tresses orchids (threatened species) are distributed along the Lake Fork River from its confluence with the Yellowstone River to a point approximately 5 miles upstream from its confluence with the Duchesne River. One orchid was found along the Yellowstone River just upstream from its confluence with the Lake Fork River. Orchids have also been found on floodplain terraces where soils are saturated by non-riverine water, such as irrigation return flows and leaking canal water. All potential habitat supported by non-riverine water has not been surveyed, particularly wet meadow habitat supported by leaking canals.

3.11.5.1.2 Tribal Idle Lands. Systematic surveys for Ute ladies'-tresses orchid have not been conducted on idle lands. However, suitable habitat for the plant occurs in the Upalco Unit on Tribal idle lands containing riparian and wet meadow habitats, particularly on active floodplains of lands containing stream and river corridors.

3.11.5.2 Cow Canyon Alternative

Threatened, endangered, candidate, and sensitive species resources associated with this alternative are the same as described for the Proposed Action (Section 3.11.5.1).

3.11.5.3 Crystal Ranch Alternative

Threatened, endangered, candidate, and sensitive species resources associated with this alternative are the same as described for the Proposed Action (Section 3.11.5.1).

3.11.5.4 Twin Pots Alternative

Threatened, endangered, candidate, and sensitive species resources associated with this alternative are

Table 3.11-1
Endangered, Threatened, Candidate, and FS Sensitive Species in the Upalco Unit Project Area*

Common Name	Scientific Name
Endangered Species	
Peregrine falcon	*Falco peregrinus*
Whooping crane	*Grus americanus*
Black-footed ferret	*Mustela nigripes*
Colorado squawfish	*Ptychocheilus lucius*
Humpback chub	*Gila cypha*
Bonytail chub	*Gila elegans*
Razorback sucker	*Xyrauchen texanus*
Threatened Species	
Bald eagle	*Haliaeetus leucocephalus*
Uinta Basin hookless cactus	*Sclerocactus glaucus*
Ute ladies'-tresses orchid	*Spiranthes diluvialis*
Candidate Species	
Mountain plover	*Chardrius montanus*
Forest Service Sensitive Species	
Colorado River cutthroat trout	*Oncorhynchus (=Salmo) clarki pleuriticus*
Lynx	*Felis lynx canadensis*
Wolverine	*Gulo gulo luscus*
Spotted bat	*Euderma maculatum*
Townsend's big-eared bat	*Plecotus townsendii pallescens*
Three-toed woodpecker	*Picoides tridactylus*
Boreal owl	*Aegolius funereus*
Great gray owl	*Strix nebulosa*
Flammulated owl	*Otus flammeolus*
Northern goshawk	*Accipiter gentilis*
Graham's columbine	*Aguilegia grahamii*
Petiolate wormwood	*Artemesia campestris*
Brownie lady's-slipper orchid	*Cypripedium fasciculatum*
Untermann's fleabane	*Erigeron untermanii*
Goodrich's blazing-star	*Mentzelia goodrichii*
Alpine poppy	*Papaver radicatum*
Stemless beardtongue	*Penstemon acaulis*
Dorn's greenthread	*Thelesperma caespitosum*

*Species provided by FWS and FS.

the same as described for the Proposed Action (Section 3.11.5.1).

3.11.6 Impact Analysis

The environmental consequences of the Proposed Action and alternatives are described for each main project feature for which significant impacts may occur. Detailed methodology used to analyze impacts on aquatic and terrestrial species of concern is described in the T&E Technical Report (CH2M HILL/Horrocks 1996d).

For aquatic species, FWS has provided preliminary flow recommendations for the Duchesne River based solely on hydrologic records from before 1965. Since no empirical information has been collected to define monthly flow requirements or habitat needs of aquatic species, it is not possible to quantitatively evaluate potential impacts on these species. Furthermore, it is likely that some of the available water from unallocated storage in Starvation Reservoir and perhaps additional purchased water will be used in the future to augment flows in the Duchesne River as part of the recovery efforts for the Colorado River endangered fishes. Because of the uncertainties associated with the magnitude of future flows, this impact analysis is based on predicted changes in baseline (existing) flows in the lower Duchesne River that would result from the Proposed Action and alternatives.

3.11.6.1 Significance Criteria

Potential impacts on federal endangered, threatened, candidate, and FS sensitive species would be considered significant if a project action is determined to have an adverse effect on any endangered, threatened, candidate, or FS sensitive species or designated critical habitat. In other words, if construction or operation of a project feature results in the loss of an individual or population, reduces population viability, or results in the loss of habitat designated as critical by FWS, the impact would be significant.

3.11.6.2 Proposed Action–Talmage

3.11.6.2.1 River Corridors.

Endangered Species. Implementation of the Upalco Unit Proposed Action generally would result in lower Duchesne River flows in the winter and higher flows in the spring and summer (Table 3.11-2). Autumn flows would remain essentially the same.

On average, winter flows (November through March) in the Duchesne River would be reduced by 7 percent in wet years, 18 percent in average years, and 23 percent in dry years. It is not known whether these reduced winter flows would adversely affect the endangered fish species because there currently is no evidence that these fish overwinter in the Duchesne River. However, most fish tend to be inactive and only use low-velocity habitat during the winter. This suggests that reduced winter flows may not be a problem for these species, even if they do over-winter in the Duchesne River.

Duchesne River flows during the important spawning and pre-spawning months (April, May, and June) would increase slightly in all 3 months during dry and average years and in April and May of wet years (Table 3.11-2). Although these flow increases would contribute toward Basin-wide efforts to recover upper Colorado River endangered fish species, any benefits gained from the small flow increases would be insignificant in light of the fact that existing baseline flows are already substantially diminished compared to the historical flows upon which the FWS based their recommendations. The Lake Fork River is an example of how historical depletions of Duchesne River tributaries have greatly diminished Upalco Unit flows. Eighty-eight percent (169,000 acre-feet) of the total Lake Fork River flow (192,000 acre-feet) is diverted for irrigation, with only 10,700 acre-feet returning as return flows (see Section 3.6.5.1.1 of this Draft EIS). Similarly, the reduced flows predicted for June of wet years would not likely be significant since the flow change would only be about 8 percent of the recommended flow for this condition.

Table 3.11-2
Changes in Duchesne River Flows at Randlett (Below Uinta River Confluence) Resulting from the Upalco Unit Proposed Action

	Percent Exceedance											
	25 (Wet)				50 (Average)				75 (Dry)			
	Baseline*	With Proposed Action	Change	Percent Change	Baseline*	With Proposed Action	Change	Percent Change	Baseline*	With Proposed Action	Change	Percent Change
Oct	329	329	0	0%	127	127	0	0%	83	83	0	0%
Nov	482	482	0	0%	110	140	0	0%	88	88	0	0%
Dec	502	483	-19	-4%	200	200	0	0%	102	102	0	0%
Jan	466	400	-66	-14%	110	119	-61	-34%	105	50	-55	-53%
Feb	435	373	-62	-14%	200	143	-57	-28%	139	84	-51	-38%
Mar	603	577	-26	-4%	240	188	-52	-22%	139	138	-1	11%
Apr	378	399	21	5%	250	257	7	3%	50	57	7	14%
May	980	987	7	1%	110	117	7	6%	60	67	7	12%
Jun	946	720	-226	-24%	110	121	7	6%	92	99	7	8%
Jul	202	209	7	3%	95	102	7	7%	62	69	7	11%
Aug	180	187	7	3%	95	102	7	7%	51	58	7	14%
Sep	253	260	7	3%	97	104	7	7%	70	77	7	10%

Notes:
Flows in cfs.
*USGS gage data at Randlett, 1985-1994.

Threatened Species. Ute ladies'-tresses orchid is the only threatened species that could be impacted through operation of Crystal Ranch and Big Sand Wash Reservoirs. Locations in the upper, middle, and lower reaches of the Lake Fork River were chosen to evaluate potential impacts. Changes in the 2-, 5-, 10-, and 20-year peak flows (habitat maintenance and creation flows), and changes in July and August water surface elevations (critical life-stage periods) were evaluated. The Water Resources Technical Report (CH2M HILL/ Horrocks 1996e) and the T&E Technical Report (CH2M HILL/Horrocks 1996d) provide details on the analysis and results, which are summarized below.

Increased water surface elevations in dry years (90 percent exceedance) would benefit the orchid through improved access to saturated soil during droughts where competitive conditions are favorable (Table 3.11-3). This is particularly true in the lower reach, where increases of up to 0.8 foot would benefit orchids in this frequently dry-dammed reach. In the lower and upper river reaches, the orchid would not be affected by slight changes in water surface elevations during an average water year or during wet years. However, in the middle river reach, some orchids may be inundated during all water years. While some individual orchids in the middle reach may be inundated, the overall population is expected to continue to survive, and possibly expand as additional habitat is created through higher flows.

Potential stream improvement actions, such as installing streambank wing structures, would encourage channel scour, point bar formation, and other conditions that could serve to maintain and develop new orchid habitat.

Reduction in secondary irrigation flows to floodplain terraces from canal rehabilitation and water conservation could result in desiccation of suitable orchid habitat that is being supported by these non-riverine water sources.

3.11.6.2.2 Tribal Idle Lands.

Threatened Species. Ute ladies'-tresses orchids could be impacted by conversion of suitable habitat to irrigated pasture or cropland. Conversion of Tribal idle lands to irrigated lands likely would occur on an incremental basis following reductions of secondary irrigation return flow waters.

3.11.6.2.3 Conservation Measures.

Endangered Species. Conservation measures for endangered fish involve avoidance of stream sedimentation. This would be accomplished by following best management practices and erosion control procedures described as part of project design (Appendix A). High-risk construction activities that could be impacted by peak flows (3 to 4 weeks duration annually) would be timed to avoid this period.

Threatened Species. Proposed diversion structure locations would be surveyed for Ute ladies'-tresses orchids in August prior to final design and all populations would be mapped or marked. When possible, structure placement and related construction activities would be in areas not occupied by the orchid. Following clearance surveys, riparian habitat improvement structures also would be placed in areas unoccupied by the orchid when possible to avoid impacts; however, pools created behind diversion or habitat improvement structures may inundate orchids or habitat. If it is not possible to avoid orchids when placing a new diversion or habitat improvement structure or during construction activities, FWS would be consulted to determine appropriate conservation measures. Qualified biologists would work with the construction crews to avoid occupied habitat. Potential impacts on existing populations from Crystal Ranch Reservoir operations would be documented by 1) permanent photo points at several known orchid locations along the Lake Fork and Yellowstone Rivers; 2) hydrologic measurements to monitor water surface elevation changes at the selected colonies; 3) appropriate measures of colony vigor; and 4) measurement of competing vegetation. CUWCD, BIA, and the Tribe would work with FWS to design appropriate monitoring

Table 3.11-3
Changes in Water Surface Elevation in the Lake Fork River During July and August

	July				August			
	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Water Year	Elevation Change (ft)				Elevation Change (ft)			
Upstream of the "C" Canal								
Dry	0.1	0.1	0	0.1	0.2	0.2	0.2	0.2
Average	-0.4	-0.4	0	-0.4	-0.4	-0.4	0.1	-0.4
Wet	0	0	-0.1	0	-0.1	-0.1	0	-0.4
Downstream of the South Boneta Canal								
Dry	0.3	0.3	-0.1	0.3	0.7	0.7	0	0.7
Average	0.3	0.3	0	0.2	0.5	0.5	0	0.5
Wet	1.0	1.0	0	0.9	1.0	1.0	0	0.7
Upstream of the Hamilton-Knudsen Canal								
Dry	0.2	0.2	0.2	0.2	0.8	0.8	0.8	0.8
Average	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Wet	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

strategies. The perimeter around each occupied site would be marked before taking photographs, and dimensions of each occupied site would be measured and marked on a map. Surveys at new diversion sites and in riparian habitat improvement reaches would be conducted for 2 years prior to construction of any onstream structure to locate occupied habitat, site structures to avoid direct impacts, and determine if any impacts would occur.

Wet meadow habitat being supported by irrigation return flow or leaking canals would be surveyed in August. If orchid populations are found, they would be mapped and marked by a qualified biologist. If impacts would occur with implementation of water conservation measures, the FWS will be consulted to develop conservation measures.

Idle lands retaining suitable Ute ladies'-tresses orchid habitat would be surveyed in August prior to irrigation conversion. All populations discovered during the surveys would be mapped and marked by a qualified biologist. If conversion-related impacts on orchids are unavoidable, consultation with FWS will be initiated.

Previously surveyed and unsurveyed habitat for Uinta Basin hookless cactus would be surveyed during its flowering period to ensure no plants were missed during previous surveys conducted in non-flowering periods or are present in areas not surveyed. FWS will be consulted, if the cactus is found, to avoid impacts.

FS Sensitive Species. Roosting surveys for spotted and Townsend's big-eared bats would be conducted in suitable habitat the first year following project authorization. Occupied roost sites at non-reservoir features would be marked to avoid impacts on the bats.

3.11.6.2.4 Total Impacts.

Endangered Species. On the basis of the predicted overall flow changes in the Duchesne River, the Proposed Action would not provide significant opportunity to contribute additional water toward meeting the FWS preliminary flow recommendations for recovery of upper Colorado River endangered fish species. Current baseline flows in the Duchesne River upstream of the Lake Fork River confluence are severely depleted compared to historical flows, and the small increases and decreases (depending on month and water year-type) that would result from the Proposed Action would not significantly change this depleted flow condition.

Threatened Species. Increased water surface elevations in the middle reach of the Lake Fork River may inundate some individual orchids. The overall effect of more water in the river, particularly in the dry-dammed lower reaches, should be beneficial to the population as a whole.

Potential habitat desiccation associated with reduction of secondary irrigation return flows and conversion of idle lands to irrigated lands might have adverse impacts on populations of orchids not closely associated with riverine water.

FS Sensitive Species. If spotted or Townsend's big-eared bat roost sites are located in the Crystal Ranch or Big Sand Wash Reservoir inundation zones, they would be lost with project implementation. Bat roost sites might also be lost with conversion of idle land to irrigated land, particularly during conversion of forest riparian habitat.

3.11.6.2.5 Cumulative Impacts. Potential cumulative impacts on FS sensitive species would be no greater than the combined potential impacts of the Upalco and Uintah Units' Proposed Actions. Potential impacts of the Uintah Unit Proposed Action are described in the Uintah Unit Draft EIS.

Endangered Species. Changes in Duchesne River flows resulting from development of both Proposed Actions would be minimal. In general, flows would increase slightly in the spring and summer and remain unchanged in the autumn (Table 3.11-4). Winter flow reductions from the Upalco Unit Proposed Action would be largely offset by flow increases expected with the Uintah Unit Proposed Action. Although the Proposed Actions would not adversely affect endangered fish

Table 3.11-4 Changes in Duchesne River Flows at Randlett (Below Uinta River Confluence) Resulting from the Upalco and Uintah Unit Proposed Actions												
	Percent Exceedance											
	25 (Wet)				50 (Average)				75 (Dry)			
	Baseline*	With Proposed Action	Change	Percent Change	Baseline*	With Proposed Action	Change	Percent Change	Baseline*	With Proposed Action	Change	Percent Change
Oct	329	323	-6	-2%	127	127	0	0%	83	84	1	1%
Nov	482	469	-13	-3%	180	137	-3	-2%	88	89	1	1%
Dec	502	530	28	4%	200	250	50	25%	102	100	12	-2%
Jan	466	438	-28	-6%	180	160	-20	-11%	105	98	-7	-6%
Feb	435	399	-36	-6%	200	160	-20	-10%	135	130	-5	-4%
Mar	603	594	-9	-2%	200	233	57	-3%	139	185	46	33%
Apr	378	456	78	21%	250	307	57	23%	50	93	43	86%
May	980	1,132	152	-6%	114	159	49	45%	60	74	10	-6%
Jun	946	561	-385	-41%	114	114	0	0%	92	103	11	12%
Jul	202	209	7	3%	95	105	10	11%	62	74	12	19%
Aug	180	187	7	4%	95	105	10	11%	51	63	12	24%
Sep	253	262	9	4%	97	109	12	12%	70	82	12	17%

Notes:
Flows in cfs.
*USGS gage data at Randlett, 1985-1994.

species, the flows would not contribute significant amounts of water toward their recovery.

Threatened Species. Uintah Unit Proposed Action impacts would include reduction in the 2-, 5-, 10-, and 20-year peak flows in the East Channel of the Uinta River. This would result in reduced channel (habitat) maintenance and creation of new Ute ladies'-tresses orchid habitat. No Ute ladies'-tresses orchids have been located on the Duchesne River downstream of the Lake Fork River confluence. However, there are pockets of suitable habitat (Coyner 1995). Operation of the Uintah and Upalco Units may interact to modify flows in the Duchesne River and potentially impact individual orchids, if any are present.

3.11.6.3 Cow Canyon Alternative

Project feature impacts, Duchesne River flow impacts (Tables 3.11-5 and 3.11-6), total impacts, cumulative impacts, and conservation measures associated with this alternative would be similar to those reported for the Proposed Action (Section 3.11.6.2).

3.11.6.4 Crystal Ranch Alternative

Project feature impacts, Duchesne River flow impacts (see Tables 3.11-5 and 3.11-6), cumulative impacts, and conservation measures associated with this alternative would be similar to those reported for the Proposed Action (Section 3.11.6.2), except that Big Sand Wash Reservoir would not be enlarged and orchids would not be inundated in the middle reach of the Lake Fork River.

3.11.6.4.1 River Corridors. The return frequency of baseline peak flows would decrease for the 2-, 5-, 10-, and 20-year return periods at all three stations (Table 3.11-7). Channel maintenance flows (2- to 3-year peak) would occur less frequently than current conditions in all reaches of the Lake Fork River. This would likely have an impact on development of new and maintenance of existing Ute ladies'-tresses orchid habitat. Increased periods of time between 5-, 10-, and 20-year peak flows relative to existing conditions in all reaches would likely result in encroachment of riparian vegetation into the active floodplain and reduce fluvial processes. The result would be further degradation of habitat suitable for the orchid. Since the orchid can colonize new habitat as it develops more slowly with the new streamflows, the impact on the continued existence of the orchid cannot be determined. However, currently occupied habitat would likely become less favorable as riparian vegetation encroaches on it.

3.11.6.4.2 Total Impacts. Impacts on endangered, threatened, candidate, and FS sensitive species would be similar to those reported for the Proposed Action (Section 3.11.6.2.4), except existing Ute ladies'-tresses orchid habitat would be degraded, and no orchids would be inundated along the Lake Fork River.

3.11.6.4.3 Cumulative Impacts. Potential cumulative impacts would be no greater than the combined potential impacts of the Cow Canyon Alternative and the Uintah Unit Proposed Action. Additional cumulative impacts on Ute ladies'-tresses orchid relative to the Uintah Unit Proposed Action (discussed in Section 3.11.6.2.5) apply to this alternative as well.

3.11.6.5 Twin Pots Alternative

Project feature impacts, Duchesne River flow impacts (see Tables 3.11-5 and 3.11-6), total impacts, cumulative impacts, and conservation measures associated with this alternative would be the same as reported for the Proposed Action (Section 3.11.6.2) except as noted below.

3.11.6.5.1 River Corridors. The impact on endangered fish would be similar to that described for the Proposed Action (Section 3.11.6.2.1).

3.11.6.5.2 Cumulative Impacts. Potential cumulative impacts would be no greater than the combined potential impacts of the Twin Pots Alternative and the Uintah Unit Proposed Action. Additional cumulative impacts on Ute ladies'-tresses orchid relative to the Uintah Unit Proposed Action (discussed in Section 3.11.6.2.5) apply to this alternative as well.

	Percent Exceedance														
	25 (Wet)					50 (Average)					75 (Dry)				
Month	Baseline*	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots	Baseline*	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots	Baseline*	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots
Oct	329	329	329	329	329	127	127	127	127	127	83	83	83	83	83
Nov	482	482	482	482	482	102	102	102	140	930	60	88	88	88	58
Dec	502	483	483	483	483	200	200	200	200	200	102	102	102	102	102
Jan	466	400	466	466	466	102	180	102	156	-19	105	80	80	88	58
Feb	435	373	373	482	435	200	143	143	140	143	135	83	83	121	58
Mar	603	577	573	543	610	200	180	102	185	246	139	138	138	138	139
Apr	378	399	399	466	415	250	257	257	261	261	50	88	57	88	57
May	980	102	987	987	987	102	987	117	117	117	60	88	88	88	57
Jun	930	720	728	756	814	102	121	121	121	121	92	69	69	69	99
Jul	202	209	209	209	200	95	102	102	102	402	92	69	69	69	99
Aug	980	102	987	187	987	95	102	102	102	102	51	58	88	88	58
Sep	253	260	260	260	260	97	104	104	104	104	70	97	77	97	77

Table 3.11-5
Baseline and Proposed Duchesne River Flows at Randlett (Below Uinta River Confluence) Resulting from the Upalco Unit Proposed Action and Alternatives

Notes:
Flows in cfs.
*USGS gage data at Randlett, 1985-1994.

Table 3.11-6
Changes in Duchesne River Flows at Randlett (Below Uinta River Confluence) Resulting from the Upalco Unit Proposed Action and Alternatives

	Percent Exceedance														
	25 (Wet)					50 (Average)					75 (Dry)				
		Change from Baseline					Change from Baseline					Change from Baseline			
Month	Baseline Flow*	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots	Baseline Flow*	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots	Baseline Flow*	Proposed Action	Cow Canyon	Crystal Ranch	Twin Pots
Oct	329	0	0	0	0	127	0	0	0	0	83	0	0	0	0
Nov	482	0	0	0	0	130	0	0	0	0	60	0	0	0	0
Dec	502	-18	-19	-19	-19	209	0	0	0	0	102	0	0	0	0
Jan	466	-66	-66	-6	-66	180	-51	-51	-24	-61	105	-55	-55	-18	-55
Feb	435	-62	-62	-3	0	209	-57	-57	-24	-57	135	-51	-51	-14	-51
Mar	603	-26	-30	-66	7	209	-52	-52	-55	0	139	-1	-1	-1	0
Apr	378	21	21	22	37	250	7	7	-1	-1	60	7	7	7	7
May	980	7	7	7	7	180	7	7	7	7	60	7	7	7	7
Jun	930	-226	-218	-190	-132	180	7	7	7	7	92	7	7	7	7
Jul	202	7	7	7	7	95	7	7	7	7	92	7	7	7	7
Aug	180	7	7	7	7	95	7	7	7	7	51	7	7	7	7
Sep	253	7	7	7	7	97	7	7	7	7	70	7	7	7	7

Notes:
Flows in cfs..
*USGS gage data at Randlett, 1985-1994.

Table 3.11-7
Changes in the 2-, 5-, 10-, and 20-Year Peak Flows with Implementation of the Upalco Unit Proposed Action and Alternatives

Return Period (yr)	Baseline (cfs)	Proposed Action* (cfs)		Cow Canyon Alternative (cfs)		Crystal Ranch Alternative (cfs)		Twin Pots Alternative (cfs)	
"C" Canal Diversion Inflow									
2	829	580	(2.9)	583	(2.9)	546	(3.3)	664	(2.5)
5	1,363	1,364	(7.6)	1,365	(6.7)	1,176	(9.0)	1,422	(6.2)
10	1,943	1,884	(13.3)	1,901	(13.3)	1,501	(14.8)	1,915	(11.0)
20	2,167	2,130	(22.6)	2,131	(22.4)	2,060	(35.0)	2,141	(24.6)
South Boneta Diversion Bypass									
Return Period (yr)	**Baseline (cfs)**	**Proposed Action* (cfs)**		**Cow Canyon Alternative (cfs)**		**Crystal Ranch Alternative (cfs)**		**Twin Pots Alternative (cfs)**	
2	489	558	(1.8)	561	(1.8)	207	(3.2)	643	(1.6)
5	1,106	1,345	(4.1)	1,345	(4.1)	868	(7.6)	1,399	(3.5)
10	1,624	1,863	(8.6)	1,879	(8.4)	1,241	(13.5)	1,893	(7.6)
20	1,771	2,108	(8.9)	2,109	(8.9)	1,721	(24.5)	2,120	(8.4)
Hamilton-Knudsen Diversion Inflow									
Return Period (yr)	**Baseline (cfs)**	**Proposed Action* (cfs)**		**Cow Canyon Alternative (cfs)**		**Crystal Ranch Alternative (cfs)**		**Twin Pots Alternative (cfs)**	
2	445	124	(3.1)	124	(3.0)	161	(3.2)	361	(2.4)
5	1,061	960	(5.2)	961	(5.2)	825	(7.6)	1,026	(5.1)
10	1,580	1,480	(10.6)	1,499	(10.4)	1,198	(13.6)	1,598	(9.6)
20	1,726	1,804	(14.6)	1,805	(14.6)	1,677	(24.6)	1,847	(14.7)

*The numbers in parentheses indicate the new return frequency for the baseline peak flow.

3.11.6.6 No Action Alternative

3.11.6.6.1 Trends. If the project is not implemented, the rivers would continue to be operated the same as at present. No project features would be constructed or implemented. Some flood irrigation may be converted to sprinkler irrigation and the Ute Tribe may continue to develop its water rights.

Little development affecting threatened, endangered, candidate, or FS sensitive species is being conducted in the Uinta Basin. Continued oil and gas development may affect mountain plovers in those few areas where they occur. As the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin proceeds, more flow should become available to endangered fish in the Duchesne River. This should allow for a gradual recovery of those species. Peregrine falcon and bald eagle populations are experiencing an increase on a national basis. This trend should apply to the Uinta Basin as well.

Any species for which a recovery plan is in process or is being planned would be expected to show recovery, provided the FWS designs an effective plan. Species without a recovery plan may or may not recover depending on how environmental conditions change.

3.11.6.6.2 Future Conditions. If the project is not implemented, the habitat and distribution of endangered, threatened, candidate, and FS sensitive species would remain essentially the same as current conditions, depending on environmental conditions that cannot be predicted. Exceptions to the above statement are that populations of bald eagle, peregrine falcon, and endangered fish in the lower Duchesne River should be higher than current levels as recovery efforts for these species proceed.

3.11.6.6.3 Consequences of Not Meeting Project Needs. None of the impacts attributed to the Upalco Unit Proposed Action or alternatives would occur if the No Action Alternative was selected. Similarly, project-related benefits that would result from fish and wildlife enhancements and recreation developments would not occur. However, the improved river flow regimes that would improve Ute ladies'-tresses orchids habitat in July and August would not occur either.

3.12 Land Use Plans Conflict

3.12.1 Introduction

This section addresses potential conflicts with land use plans resulting from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit. The analysis focuses on potential conflicts with existing land use plans.

3.12.2 Issues Eliminated from Further Analysis

All land use plans issues identified during public scoping were analyzed. None were eliminated.

3.12.3 Issues Addressed in the Impact Analysis

Issues addressed in the impact analysis include potential conflicts with existing land use plans.

3.12.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the project feature sites for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

3.12.5 Affected Environment

Since the Upalco Unit falls within both Duchesne and Uintah Counties, as well as within the Uintah Ouray Indian Reservation, adopted plans of these three jurisdictions must be considered in terms of project features proposed within each jurisdiction. Uintah County has adopted a land use plan only for the eastern part of the county, essentially excluding the entire Upalco Unit project area (Page-Allen 1995). Zoning has been adopted for the entire county, however. Zoning in the project area consists of four zoning districts: Agricultural (A-1), Commercial (C-1), Recreation, Forestry, and Mining (RF&M), and Mining and Grazing (M&G-1). The Ute Tribe has no adopted land use plan currently in effect (Hugie 1995b).

The Duchesne County Master Plan, adopted in 1983, sets forth several broad goals for the county, along with more specific objectives. Objectives relevant to the proposed project features include providing adequate recreational facilities for residents, ensuring economy in governmental expenditures, fostering the county's agricultural base, encouraging development of industries in the county to broaden its economic base, and maintaining the natural beauty of the environment.

The Master Plan also provides for four classifications (densities) of residential development based on the type of water and wastewater services available. The Plan calls for the county to provide incentives to farmers to keep their land under cultivation, particularly in areas of intensive agricultural use away from urban centers. Farmland is to be preserved in areas where soils are most arable and water is plentiful. Commercial use is to be limited in unincorporated areas of the county to small clusters of neighborhood or service establishments along major arterials. Recreational opportunities are to be accommodated in areas of the county where residential growth should not occur, i.e., where water and/or wastewater services are not available or in areas of prime agricultural lands that should be preserved (Duchesne County 1983). The Master Plan is implemented through the county's zoning and subdivision ordinances.

3.12.6 Impact Analysis

3.12.6.1 Significance Criteria

Potential conflicts with land use plans are considered significant if the following conditions exist:

1. Any conflicts are identified between proposed project facilities or activities and land use plans, regulations, or controls (adopted or under official consideration by local, state, and federal governments)

There would be no significant conflicts with land use plans resulting from the Proposed Action or alternatives.

3.12.6.2 Potential Impacts Eliminated from Further Analysis

No potential conflicts with land use plans have been eliminated from further analysis.

3.12.6.3 Proposed Action—Talmage

Stabilization of 10 high mountain lakes would be consistent with objectives and policies of the Duchesne County Plan since the storage eliminated would be replaced in the constructed and enlarged reservoirs proposed in the Proposed Action. Constructing Crystal Ranch Reservoir, enlarging Big Sand Wash Reservoir, and constructing the related Big Sand Wash Feeder Pipeline would be consistent with the Plan objectives of fostering agriculture and making available additional water in the Uinta Basin for future industrial and/or residential development.

Since the proposed rehabilitation of diversion dams and canals would improve the efficiency of these facilities, this action would appear to be consistent with the Duchesne County Plan by making more water available for agriculture or environmental purposes.

Proposed fish and wildlife enhancements and recreation developments, including stabilization of Twin Pots Reservoir and rehabilitation of the fishery, stream improvements, improvement of big game winter range, habitat acquisition, Clay Basin Pond improvements, and development of Crystal Ranch Campground, would help provide adequate recreational facilities for county residents and encourage development of the recreation industry in the county to broaden its economic base.

While proposed retirement of agricultural lands by purchasing water rights may appear to conflict with the Plan policies of fostering the county's agricultural base and providing incentives to farmers to keep their land under cultivation, the Plan also specifies that such lands to be kept under cultivation should be "...particularly in areas of intensive agricultural use away from urban centers." It also calls for farmland to be preserved in areas where soils are most arable and water is plentiful. Since, by its soils classification, land to be retired is less arable and is being retired to provide increased water resources to lands with better soils or for fish and wildlife resources, the proposed land retirement would appear to be consistent with the Plan's intent.

There would be no cumulative impacts resulting from the Upalco Unit Proposed Action and the Uintah Unit Proposed Action, which is addressed in the Uintah Unit Draft EIS, since both Proposed Actions would be consistent with existing plans.

3.12.6.4 Cow Canyon Alternative

Stabilization of 10 high mountain lakes would be consistent with the Duchesne County Plan, the same as described for the Proposed Action. Construction of Upper Yellowstone Reservoir, enlargement of Big Sand Wash Reservoir, and construction of the related pipeline would foster agriculture and therefore be consistent with the Plan, the same as described for the Proposed Action. Diversion dam rehabilitation would enhance irrigation efficiency and save water for agriculture and fish and wildlife purposes and would therefore be consistent with the Plan.

Proposed fish and wildlife enhancements and recreation developments, including the improvement and extension of Fish Creek Trail near Moon Lake Reservoir, improvement of Bridge and Swift Creek Campgrounds, stream improvement, and habitat acquisition, would provide recreation opportunities for local residents. This would enhance the recreation industry and help broaden the economy of the region, consistent with the Plan. Land retirement would also be consistent with the Plan, the same as described for the Proposed Action. There would be no cumulative impacts since this alternative and the Uintah Unit Proposed Action would both be consistent with existing plans.

3.12.6.5 Crystal Ranch Alternative

Stabilization of 10 high mountain lakes, construction of Crystal Ranch Reservoir, rehabilitation of diversion dams and canals, and retirement of lands from agriculture would be consistent with the Duchesne County Plan, the same as described for the Proposed Action. In addition, proposed fish and wildlife enhancements and recreation developments, including big game winter range improvements, stream improvements, habitat acquisition, Bridge Campground improvement, and development of Crystal Ranch Campground, would be consistent with the objectives of providing adequate recreation for residents and broadening the county's economy. There would be no cumulative impacts since this alternative and the Uintah Unit Proposed Action would both be consistent with existing plans.

3.12.6.6 Twin Pots Alternative

Stabilization of 14 high mountain lakes might not be considered consistent with the Duchesne County Plan since the proposed reservoir replacement would barely be sufficient to replace the high mountain irrigation storage eliminated. The enlargement of Big Sand Wash Reservoir would be responsive to agricultural needs. Proposed rehabilitation of diversion dams and canals, construction of water-conveyance pipelines, and land retirement would be consistent with the Plan. The proposed fish and wildlife enhancements, including Twin Pots Reservoir stabilization and fishery improvement, habitat acquisition, and big game winter range improvement, would be consistent with the Plan since they would improve recreational opportunities for residents and broaden the county's economy. Because of the smaller reservoir size, cumulative beneficial impacts based on consistency with the Duchesne County Plan would be less under this alternative.

3.12.6.7 No Action Alternative

Impacts of the No Action Alternative are not expected to differ significantly from existing conditions. None of the agriculture and recreation benefits associated with project features described for the Proposed Action and alternatives, which are consistent with the County Plan, would be realized under the No Action Alternative. Growth and maintenance of land under cultivation would be limited without the proposed project.

3.13 Transportation

3.13.1 Introduction

This section addresses potential direct, indirect, total, and cumulative impacts on transportation resources of the Uinta Basin resulting from the construction, operation, and maintenance of the Proposed Action and alternatives of the Upalco Unit.

3.13.2 Issues Eliminated from Further Analysis

Rail service was eliminated from further analysis because there is no direct rail service serving the Uinta Basin.

3.13.3 Issues Addressed in the Impact Analysis

No transportation resource issues were identified during public scoping. However, based on discussions with the Utah Department of Transportation (UDOT), the following transportation resource issues are addressed:

1. Direct physical effects on roads in the affected area from the transport of heavy equipment and project construction materials
2. Indirect physical effects on transportation systems in the affected area as a result of project driven changes in population, recreation visitation, etc.
3. Potential traffic delays because of project construction activities
4. Effects on existing levels of service (LOS) on roads in the affected area during and after project construction
5. Direct physical effects of permanent project features on the transportation resources of the affected area (e.g., inundation of roads, etc.)

3.13.4 Description of Area of Influence

The direct area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit and Uinta Basin, areas of influence include roads, several airports, urban transit systems, and oil and gas pipelines. Major roads in the Upalco Unit are shown on Maps 2-1, 2-11, 2-13, and 2-14.

3.13.5 Affected Environment

3.13.5.1 Air Transport

The Uinta Basin has three airports: Vernal, Roosevelt Municipal, and Duchesne Municipal. Each year, there are approximately 12,850 takeoffs/landings at these airports, with 10,000 of these at Vernal Airport. Local airport managers anticipate that over the next 10 years general operations and the number of planes based at these airports will increase by 50 percent (Foy 1995; Wardell 1995).

3.13.5.2 Public Transportation

Public transportation in the Uinta Basin is provided by both private and government agencies. Greyhound Bus and Wilkins Transportation are the private carriers. Public transportation, including services for the elderly and handicapped, is operated by the Uintah Basin Association of Governments, Uintah Senior Citizens Development Center, various senior citizens groups, and the BIA.

3.13.5.3 Pipelines

Natural gas transmission in the Uinta Basin is handled by the Mountain Fuel Supply Company. Their pipeline runs from Duchesne to Fort Duchesne, initially along U.S. Highway 40 and then parallel to Urban Route (UR) 264 to Fort

Duchesne. Koch Oil transports crude oil from Sink Draw, which is west of the study area, towards Roosevelt through a line that runs parallel and north of U.S. 40. Questar operates the largest oil pipeline in the area, a 20-inch line originating in Colorado and running to Salt Lake City along the southern portion of the project's area of influence (Blackham 1995). Two smaller pipelines originating in Altamont and Bluebell connect to this pipeline south of Myton.

3.13.5.4 Roads

3.13.5.4.1 Existing Roads. Of the many roads within the Upalco Unit, U.S. 40 and State Secondary Route (SR) 87 carry the majority of traffic. U.S. 40 is a two-lane asphalt facility that includes sections widened to three and four lanes at certain intersections and points of congestion. UDOT has identified a number of sections of U.S. 40 with high traffic volumes, substandard shoulders, poor pavement conditions, and poor curve alignment (Conti 1995; UDOT 1994e).

SR 87 extends north from U.S. 40 in Duchesne, turns east at its junction with County Road (CR) 113, and runs through the town of Altamont before heading back to U.S. 40 just west of Roosevelt. SR 87 is a two-lane asphalt facility. There is rutting, map cracking, and extensive patching over more than 50 percent of the road's surface. From CR 113 to just before Altamont, this distress is so severe that traffic must slow down (Conti 1995; Fillingham 1995).

County-maintained roads potentially affected by the project include state-designated URs 113, 114, and 252. These roads are narrow, have no shoulders, poor sight distances, and are subject to rutting, map cracking, and patching to varying degrees (Conti 1995; Fillingham 1995). On the Uintah and Ouray Reservation, UR 114 is surfaced with dirt and gravel. This route crosses the Yellowstone River on a BIA bridge that cannot support the weight of loaded three-axle logging trucks. There are no immediate plans to rehabilitate or reconstruct this bridge. Most other local roads in the study area are either dirt, gravel, "native asphalt," or a combination of materials (Floyd 1995).

There are also several FS roads that could be affected by implementation of the Upalco Unit alternatives, including FS routes 119, 124, and 131 and trails 056, 057, and 058. Because the bridge over the Lake Fork River on FS route 119 is only a 15-foot-wide wood structure, the FS fords the river whenever heavy equipment must be moved onto the National Forest (Allred 1995; Reese 1995).

3.13.5.4.2 Traffic. Through the first half of the 1990s, average daily traffic on U.S. 40 between Duchesne and Vernal steadily increased. In 1993, traffic along the section of U.S. 40 passing through Vernal alone averaged more than 20,000 vehicles per day. By the year 2015, traffic is projected to increase on U.S. 40 between Roosevelt and its junction with SR 88 by about 22 percent and between SR 88 and Vernal by about 96 percent (UDOT 1994e). Recreation visitation has accounted for much of the growth in traffic volume in the Uinta Basin. On SR 87, traffic has steadily increased from Duchesne to the junction with UR 113 connecting to the Ashley National Forest. Continuing on SR 87 east towards Vernal, traffic declined between 1993 and 1994 (UDOT 1994e).

Since 1991, average daily traffic on local routes in the Basin increased substantially. For example, between 1991 and 1994, annual traffic volume increased by 46 percent on UR 252, which runs through the towns of Altamont and Upalco, mostly because of visitation to Big Sand Wash Reservoir (UDOT 1994e).

During 1993, up to 7 percent of the traffic on U.S. 40 was generated by trucks (UDOT 1994b). Table 3.13-1 lists LOS conditions on U.S. 40 in 1992. U.S. 40 operates between LOS B and LOS E. All other road facilities in the Uinta Basin operate at LOS B (UDOT 1994e).

LOS A is a condition described as "free-flow," which is associated with low volumes and high speeds. LOS B occurs in a zone of stable flow, with operating speeds beginning to be restricted by traffic conditions. LOS C is also a situation of stable flow, but speeds and maneuverability are more closely controlled by higher volumes. LOS D approaches unstable flow, with tolerable operating

Table 3.13-1 U.S. 40 Traffic Level of Service in the Uinta Basin		
Section of Road	Milepost Reference	1992 Level of Service
Heber to Duchesne	19.18-88.47	C
Duchesne to Roosevelt	88.47-116.49	B
Roosevelt to Jct. SR 88	116.49-142.69	C
Jct. SR 88 to Vernal	142.69-147.28	Not available
Source: Utah Department of Transportation (1994e).		

speeds being maintained, though considerably affected by changes in operating conditions. At LOS E, operating speeds are greatly restricted as traffic demand approaches the physical capacity of the roadway. Minor disturbances at LOS E can lead to breakdown of flow and LOS F. LOS F describes a forced flow or "stop and go" operation with speeds and volumes varying greatly from one moment to the next.

3.13.6 Impact Analysis

3.13.6.1 Significance Criteria

Impact significance criteria are based on professional judgment, federal and state regulations and standards, and contacts with state and county officials. The following impacts on transportation systems would be considered significant if they occurred:

1. Road travel delays of longer than 15 minutes

2. A change in the LOS provided by an existing road

3. Elimination of any route or branch of any transportation system for which there is no alternative

4. Physical damage to transportation systems that is not repaired

Significant impacts on transportation resources predicted to occur as a result of implementing the Upalco Unit Proposed Action or alternatives are addressed in the impact analysis and include the following:

1. Real decline in LOS provided by roads in the affected area during project construction because of truck transport of equipment/ materials and commute of project labor

3.13.6.2 Potential Impacts Eliminated from Further Analysis

Potential impacts on transportation systems that have been eliminated from further analysis because they are not expected to occur include the following:

1. Travel delays of longer than 15 minutes at any one time. (All construction activities that affect roads would be carried out in accordance with the "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," which requires that traffic delays because of construction activities are no longer than 15 minutes.)

2. Direct physical effects on roads in the affected region from heavy equipment and other project construction traffic. (It is assumed that any physical damage to area roads from project construction activities would be repaired as part of the project and, therefore, no permanent impacts would occur.)

3. Indirect physical effects on roads in the affected region during and after project construction (e.g., recreation traffic, etc.)

4. Direct and indirect physical effects on transportation systems other than roads during and after project construction

5. The unmitigated elimination of existing components of the region's transportation system

6. Reduction in LOS provided by roads following project completion

3.13.6.3 Proposed Action–Talmage

Table 3.13-2 shows the estimated project-associated average truck activity on U.S. 40 and SR 87 during the 7 years of construction of the Proposed Action. This truck activity would likely reduce the LOS B or C to an LOS C or D on certain sections of these roads such as U.S. 40 in Roosevelt and SR 87 between Duchesne and Boneta. In addition, the LOS on local roads discussed in Section 3.13.5.4.1 would likely decline from B to C during project construction. During peak project construction (summertime), the transport of construction workers to project feature sites is expected to temporarily reduce the LOS on local roads from B to C during commute hours. It is not expected that this small-vehicle traffic would conflict with project-associated truck traffic.

3.13.6.3.1 Mitigation. Any physical damage to area roads directly attributable to project construction activities would be repaired as part of the project.

3.13.6.3.2 Unavoidable Adverse Impacts. Project-associated truck traffic would result in unavoidable traffic congestion on the area's major and many minor roads. Problems would be greatest in urban and residential areas, and on narrow or winding roads (such as some of the BIA and FS routes in the northern portion of the study area).

3.13.6.4 Cow Canyon Alternative

Table 3.13-3 shows the estimated project-associated average truck activity on U.S. 40 and SR 87 during the 6 years of construction of the Cow Canyon Alternative. The expected LOS impacts are similar to those of the Proposed Action (see Section 3.13.6.3).

Mitigation measures and unavoidable adverse impacts would be the same as described for the Proposed Action in Sections 3.13.6.3.1 and 3.13.6.3.2.

3.13.6.5 Crystal Ranch Alternative

Table 3.13-4 shows the estimated project-associated average truck activity on U.S. 40 and SR 87 during the 6 years of construction of the Crystal Ranch Alternative. Expected LOS impacts are similar to those of the Proposed Action (see Section 3.13.6.3) except on SR 87 from its junction with UR 252 to its junction with UR 114 where no LOS impacts are anticipated.

Table 3.13-2
Construction Truck Traffic Volume–Proposed Action

Highway or Road	Estimated Average Annual Truck Round Trips	Estimated Peak Annual Truck Round Trips
U.S. 40	1,800	3,990
SR 87 (Duchesne to Jct. UR 252)	1,575	3,990
SR 87 (Jct. UR 252 to Jct. UR 114)*	820	1,135

*Only during 2 years of construction.

Table 3.13-3 Construction Truck Traffic Volume–Cow Canyon Alternative		
Highway or Road	**Estimated Average Annual Truck Round Trips**	**Estimated Peak Annual Truck Round Trips**
U.S. 40	1,650	3,280
SR 87 (Duchesne to Jct. UR 252)	1,380	3,280
SR 87 (Jct. UR 252 to Jct. UR 114)*	820	1,135
*Only during 2 years of construction.		

Table 3.13-4 Construction Truck Traffic Volume–Crystal Ranch Alternative		
Highway or Road	**Estimated Average Annual Truck Round Trips**	**Estimated Peak Annual Truck Round Trips**
U.S. 40	1,385	2,555
SR 87 (Duchesne to Jct. UR 252)	1,380	2,550
SR 87 (Jct. UR 252 to Jct. UR 114)*	8	9
*Only during the first and last years of construction.		

Mitigation measures and unavoidable adverse impacts would be the same as described for the Proposed Action in Sections 3.13.6.3.1 and 3.13.6.3.2.

3.13.6.6 Twin Pots Alternative

Table 3.13-5 shows the estimated project-associated average truck activity on U.S. 40 and SR 87 during the 5 years of construction of the Twin Pots Alternative. The expected LOS impacts are similar to those of the Proposed Action (see Section 3.13.6.3).

Mitigation measures and unavoidable adverse impacts would be the same as described for the Proposed Action in Sections 3.13.6.3.1 and 3.13.6.3.2.

3.13.6.7 No Action Alternative

Transportation resources of the Uinta Basin would not be affected under the No Action Alternative. These resources would be the same as described in Section 3.13.5 Affected Environment.

3.13.7 Cumulative Impacts

Cumulative impacts on Uinta Basin transportation resources during construction of the Upalco Unit Proposed Action or alternatives and the Uintah Unit Proposed Action would be similar. LOS on U.S. 40 would be expected to decline from B or C to D or F during periods of simultaneous construction. The greatest cumulative impact on LOS would likely be on U.S. 40 in Roosevelt at its intersection with 200 North Street (Milepost 115.89–the point where trucks for the Uintah Unit would access SR 121)

Table 3.13-5 Construction Truck Traffic Volume—Twin Pots Alternative		
Highway or Road	**Estimated Average Annual Truck Round Trips**	**Estimated Peak Annual Truck Round Trips**
U.S. 40	2,100	2,925
SR 87 (Duchesne to Jct. UR 252)	1,260	1,540
SR 87 (Jct. UR 252 to Jct. UR 114)*	270	475
*Only during the first 4 years of construction.		

with the potential for gridlock conditions. All other roads affected by construction in the Upalco Unit would be different from those of the Uintah Unit.

3.14 Soils

3.14.1 Introduction

This section addresses potential impacts on soils resulting from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit. The analysis focuses on direct, indirect, total, and cumulative potential impacts on soil erosion and productivity. Mitigation measures that would minimize or prevent impacts, or that would compensate for unavoidable adverse impacts, are described.

3.14.2 Issues Eliminated from Further Analysis

Four soils issues have been eliminated from further analysis. These issues and the reasons for their elimination follow:

1. **Erosion during construction activities.** The following potential short-term impacts resulting from construction activities and methods to minimize or prevent these impacts are discussed in Appendix A:

   - Landscape preservation
   - Erosion and sediment control
   - Site restoration and revegetation
   - Prevention of water pollution

   Construction specifications would require contractors to exercise the necessary care and apply necessary soil, landscape, and vegetation conservation and restoration measures so that no discernible sediments leave construction sites (NRCS Planning Quality Criteria for Soils).

2. **Erosion during operation and maintenance activities.** As with construction activities, project design and operation and maintenance procedures would be conducted in a manner that avoids significant impacts resulting from soil erosion. Streambanks would be stabilized and would not be subject to erosion under average flow conditions of the associated stream. Average flow takes into account a single storm event of a 1-year, 24-hour frequency, and normal spring runoff (NRCS Planning Quality Criteria for Soils).

3. **Impacts resulting from changes in irrigation methods.** No changes in irrigation methods are included in the Proposed Action or alternatives. Future changes in irrigation methods in the project area would depend more on the maintenance of government programs that encourage irrigation system conversions rather than proposed project features.

4. **Impacts from project features other than reservoirs and diversion dams.** No

significant soils impacts were identified for project features except reservoirs and diversion dams. Therefore, other project features have been eliminated from further analysis and are not addressed below.

3.14.3 Issues Addressed in the Impact Analysis

Issues identified during public scoping include the following:

1. Disturbance of soils resulting from project construction activities and other factors, such as increased motor vehicle use and the erosive effects of stored or transported water, may cause increased soil erosion.
2. Alkalinity and minerals may build up in soils because of the potential for sprinkler irrigation and cause reduced soil productivity.

Most of these issues were eliminated from further analysis for the reasons described in Section 3.14.2.

3.14.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the reservoir and diversion dam sites for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

3.14.5 Affected Environment

3.14.5.1 Proposed Action–Talmage

3.14.5.1.1 Dams and Reservoirs. Crystal Ranch Reservoir would cover 562 acres of land. The enlarged Big Sand Wash Reservoir would cover an additional 282 acres of land.

3.14.5.1.2 Diversion Dams. Small riparian areas and other lands are present around the proposed sites of diversion dam pools. Riparian lands are described in Section 3.9 Wetland and Riparian Resources of this Draft EIS.

3.14.5.2 Cow Canyon Alternative

3.14.5.2.1 Dams and Reservoirs. Upper Yellowstone Reservoir would cover 361 acres of land. The enlarged Big Sand Wash Reservoir would cover an additional 282 acres of land.

3.14.5.2.2 Diversion Dams. The affected environment at diversion dams is identical to that described for the Proposed Action.

3.14.5.3 Crystal Ranch Alternative

The affected environment for this alternative is identical to that described for the Proposed Action, except that Big Sand Wash Reservoir would not be enlarged and the new Big Sand Wash Feeder Pipeline diversion dam would not be constructed.

3.14.5.4 Twin Pots Alternative

The affected environment for this alternative is identical to that described for the Proposed Action, except that Crystal Ranch Reservoir would not be constructed, a new diversion dam would be constructed for the Lake Fork-Yellowstone Pipeline, and Big Sand Wash Reservoir would be enlarged 12,000 acre-feet rather than 9,000 acre-feet.

3.14.6 Impact Analysis

3.14.6.1 Significance Criteria

The following criterion is used to evaluate the significance of impacts:

1. Soil productivity is lost because of flooding.

Significant soils impacts resulting from the Proposed Action or alternatives would include flooding of land by reservoirs and diversion dam pools.

3.14.6.2 Potential Impacts Eliminated from Further Analysis

Several potential impacts were eliminated from further analysis in Section 3.14.2, in part because the NRCS Planning Quality Criteria for Soils would be met in project construction, operation, and maintenance specifications.

3.14.6.3 Proposed Action–Talmage

3.14.6.3.1 Dams and Reservoirs. Crystal Ranch Reservoir would inundate 562 acres of land. The enlarged Big Sand Wash Reservoir would inundate an additional 395 acres of land. Soils impacts would include the loss of soil productivity at these sites because of flooding. These losses would extend over the life of the reservoirs.

3.14.6.3.2 Diversion Dams. Small areas would be flooded during the irrigation season at each rehabilitated and new diversion dam. No other significant impacts on soils or soil productivity would occur for the reasons stated in Section 3.14.2.

3.14.6.3.3 Total Impacts. Crystal Ranch Reservoir would inundate 562 acres of land and the Big Sand Wash Reservoir enlargement would inundate an additional 282 acres of land. Significant impacts would include the loss of soil productivity for the life of the reservoirs. Small areas near diversion dams would be flooded during the irrigation season.

3.14.6.3.4 Mitigation. Lost soil productivity would be mitigated through improved irrigation practices and increased productivity on irrigated project lands.

3.14.6.3.5 Unavoidable Adverse Impacts. These would include the flooding and loss of soils at the Crystal Ranch and Big Sand Wash Reservoir sites and at diversion dam pool sites.

3.14.6.3.6 Cumulative Impacts. These would consist of the total soils impacts for the Upalco Unit Proposed Action in addition to those of the Uintah Unit Proposed Action, which are described in the Uintah Unit Draft EIS. A total of 1,587 acres of land would be inundated.

3.14.6.4 Cow Canyon Alternative

Significant soils impacts would be the same as described for the Proposed Action, except that Upper Yellowstone Reservoir would be constructed (inundation of 361 acres of land) and Crystal Ranch Reservoir would not be constructed.

3.14.6.4.1 Total Impacts. Upper Yellowstone Reservoir would inundate 361 acres of land. An additional 282 acres of land would be inundated as a result of enlarging Big Sand Wash Reservoir. Significant impacts would include the loss of soil productivity for the life of the reservoirs. Small areas near diversion dams would be flooded during the irrigation season.

3.14.6.4.2 Mitigation. Mitigation measures would be the same as described for the Proposed Action.

3.14.6.4.3 Unavoidable Adverse Impacts. These would include the flooding and loss of soils at the Upper Yellowstone and Big Sand Wash Reservoir sites and at diversion dam pool sites.

3.14.6.4.4 Cumulative Impacts. These would consist of the total soils impacts for the Cow Canyon Alternative in addition to those of the Uintah Unit Proposed Action. A total of 1,386 acres of land would be inundated.

3.14.6.5 Crystal Ranch Alternative

Significant soils impacts would be the same as described for the Proposed Action, except that Big Sand Wash Reservoir would not be enlarged and the new Big Sand Wash Feeder Pipeline diversion dam would not be constructed.

3.14.6.5.1 Total Impacts. Crystal Ranch Reservoir would inundate 562 acres of land. Significant impacts would include the loss of soil productivity for the life of the reservoir. Small areas near diversion dams would be flooded during the irrigation season.

3.14.6.5.2 Mitigation. Mitigation measures would be the same as described for the Proposed Action.

3.14.6.5.3 Unavoidable Adverse Impacts. These would include the flooding and loss of soils at the Crystal Ranch Reservoir site and at diversion dam pool sites.

3.14.6.5.4 Cumulative Impacts. These would consist of the total soils impacts for the Crystal Ranch Alternative in addition to those of the Uintah Unit Proposed Action. A total of 1,305 acres of land would be inundated.

3.14.6.6 Twin Pots Alternative

Significant soils impacts would be the same as described for the Proposed Action, except that Crystal Ranch Reservoir would not be constructed, a new diversion dam for the Lake Fork-Yellowstone Pipeline would be constructed, and Big Sand Wash Reservoir would be enlarged 12,000 acre-feet.

3.14.6.6.1 Total Impacts. The enlargement of Big Sand Wash Reservoir would inundate an additional 395 acres of land. Significant impacts would include the loss of soil productivity for the life of the reservoir. Small areas near diversion dams would be flooded during the irrigation season.

3.14.6.6.2 Mitigation. Mitigation measures would be the same as described for the Proposed Action.

3.14.6.6.3 Unavoidable Adverse Impacts. These would include the flooding and loss of soils at Big Sand Wash Reservoir and at diversion dam pool sites.

3.14.6.6.4 Cumulative Impacts. These would consist of the total soils impacts for the Twin Pots Alternative in addition to those of the Uintah Unit Proposed Action. A total of 1,138 acres of land would be inundated.

3.14.6.7 No Action Alternative

Soil productivity would remain unchanged under the No Action Alternative. Productivity of currently irrigated lands would not increase.

3.15 Health and Safety

3.15.1 Introduction

This section addresses potential direct, indirect, total, and cumulative impacts on public health and safety resulting from the construction, operation, and maintenance of the Proposed Action and alternatives of the Upalco Unit. The analysis focuses on ways in which implementation of the project may increase the threat to human health and safety from hazards associated with dam, pipeline, or canal failure and construction-related accidents.

3.15.2 Issues Eliminated from Further Analysis

1. Site-specific hazards from potential failure of diversions, pipelines, and canals have been eliminated from further analysis because these hazards would not change from current conditions.

3.15.3 Issues Addressed in the Impact Analysis

No issues or concerns regarding health and safety were identified during public scoping. However, the following health and safety issues were identified by the CUWCD:

1. What would be the consequences of dam failure on individuals living in the area?

2. Are there conditions relating to the project features or area that would pose a greater than average risk of construction accidents (including transportation)?

3.15.4 Description of Area of Influence

The immediate areas of influence include the project feature sites for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2. Additional areas of influence include the roads that would be used by trucks to access proposed project feature sites.

Major roads in the Upalco Unit are shown on Maps 2-1, 2-11, 2-13, and 2-14.

3.15.5 Affected Environment

3.15.5.1 Flood Hazards

Potentially affected structures within the inundation zone, if Crystal Ranch Dam were to fail, are fairly dispersed but include 64 inhabited structures in Myton (U.S. Department of Housing and Urban Development 1977; Federal Emergency Management Agency 1988). They are discussed further in the impact analysis. Overall, the probability of any dam failing is estimated to be quite low. The expected failure rate is 1 percent for large and small dams. Failure rates for larger and newer containment dams (such as those proposed for the project), while not available, are believed to be substantially lower than 1 percent.

3.15.5.2 Construction Accidents

In 1993, the nationwide non-fatal occupational injury incidence rates per 100 full-time contractors and truckers were 12.6 and 13.5, respectively. In 1992, the construction sector in Utah compared unfavorably to the nation with a 19.6 injury incidence rate, while the transportation sector compared favorably with an 11.8 injury incidence rate. During the last 10 years, the overall rates of injury and illness for Utah workers have exceeded national rates (U.S. Department of Labor 1994, 1995; The Industrial Commission of Utah 1991, 1992).

Most automobile traffic within the Upalco Unit is on U.S. Highway 40, connecting Salt Lake City to the Uinta Basin, and on State Route (SR) 87. From 1989 to 1993, 184 accidents occurred on U.S. 40 between Duchesne and Myton. The greatest number of accidents within the unit occur between U.S. 40's junction with SR 87 and where local roads intersect with U.S. 40 outside of Myton. The average accident rate over this same 5-year period on the section of U.S. 40 just west of Vernal was about 1.6 accidents per one million vehicle miles traveled. From 1990 through 1992, the average annual accident rate on U.S. 40 between Roosevelt and Duchesne was about 1.9 per million vehicle miles traveled (UDOT 1993, 1994c, 1994d, 1994e).

Based on statewide statistics for similar roads, the 1993 estimated truck accident rate on U.S. 40 was about 0.7 per million vehicle miles traveled. For roads similar to SR 121, the statewide truck accident rate in 1993 was about 3.1 per million vehicle miles traveled (UDOT 1994a, 1994f).

3.15.6 Impact Analysis

3.15.6.1 Significance Criteria

Potential impacts of the project on health and safety are considered significant if the following conditions exist:

1. Any people or structures would be threatened in the unlikely event of dam failure.

2. Construction workers on the project would face a greater than average risk of injury.

3. Automobile or truck accident rates would increase by 10 percent or more.

Significant impacts on health and safety that are predicted to occur as a result of implementing the Proposed Action or alternatives are addressed in the impact analysis and include the following:

1. Increased risk of loss of life from flooding caused by sudden or gradual dam failure

2. Greater than 10 percent increase in expected truck accident rates on roads within the project's area of influence during construction

3.15.6.2 Potential Impacts Eliminated from Further Analysis

Impacts on health and safety that were eliminated from further analysis include the following:

1. Project-associated dilapidation of road conditions. (Impacts on roads would be continuously assessed and repaired during project construction.)

2. Onsite construction work. (Safety hazards faced by workers during construction of the project could be expected to correspond generally with national and state labor statistics reported for Construction Workers, Special Trade Contractors and Transportation Workers, Trucking Warehousing.)

3.15.6.3 Proposed Action–Talmage

Most of the area within the floodplain below the proposed Crystal Ranch Dam and Reservoir is Tribal land. Therefore, in the extremely unlikely event of the dam's failure, injury or loss of life of Ute Tribal members in areas along the Lake Fork and Duchesne Rivers would be possible.

Table 3.15-1 lists the communities and number of structures downstream from the Crystal Ranch Dam site that would most likely be affected in the unlikely event of complete dam failure (assuming the reservoir is at full capacity). The town of Upalco is built atop a mesa; therefore, its populace and roadways would likely not be at risk. No precise information is available on the number of people living and working in the structures that would be at risk.

Depending on its location, Crystal Ranch Campground could be completely inundated if the dam failed, endangering any individuals present at the time. Failure of the dam may also pose a threat to several bridges.

Failure of the enlarged Big Sand Wash Dam could inundate more than 95 structures in and near the Uintah and Ouray Reservation towns of Ouray and Randlett. (Information to determine the number of people at risk in the area is not available.) On the other hand, proposed improvements at Twin Pots Reservoir would reduce the risk of dam failure-associated flooding in downstream communities.

Traffic accidents on U.S. 40 between Salt Lake City and Bridgeland, as well as on the entire length of SR 87, would be expected to increase because of project construction-associated truck activity. Potential trouble spots during construction include those road sections previously identified as hazardous, including the junction of U.S. 40 and SR 87, where the highest number of accidents occur in the unit each year. Truck-related accident rates on U.S. 40 are expected to increase by 28 percent, from 0.91 to 1.17 accidents per one million vehicle miles traveled, during peak construction activity. No significant impacts on truck-accident rates during off-peak construction periods are expected. No significant change in truck-related accidents on SR 87 is anticipated at any time during project construction. Overall, during construction, the Proposed Action would be expected to result in the occurrence of two additional truck-related accidents in the Uinta Basin. While truck accident rates on smaller local roads would also be expected to increase, no baseline truck traffic and accident rate data are available to assess the magnitude of these changes.

Table 3.15-1
Crystal Ranch Dam Anticipated Inundation Effects

Key Location	Approximate River Miles from Dam Site	Estimated Number of Affected Structures
Myton, Utah	31	64
Duchesne River	30	0
U.S. 40	30	*
Ouray, Utah	54	5

Source: Dornbusch & Company (1995a).
*Average annual daily traffic in 1993 was 3,215 but would vary by season and time of day.

For similar reasons, no assessment was possible of the project's potential impact on automobile accidents in the Basin.

3.15.6.3.1 Mitigation. To minimize potential project-related increases in vehicle accident rates during project construction, signage would be used to warn vehicles operating in the areas where project-associated truck activity may cause problems. Employee awareness programs would also be provided.

3.15.6.3.2 Unavoidable Adverse Impacts. Despite mitigation measures, construction and operation of the Proposed Action would increase the threat to health and safety by increasing the possibility of dam-failure-induced flooding and motor vehicle accidents in the Uinta Basin.

3.15.6.4 Cow Canyon Alternative

It is estimated that general impacts on public health and safety in the event of failure or overtopping of Upper Yellowstone Dam would be similar to those of Crystal Ranch Reservoir (except for impacts on Crystal Ranch Campground described in Section 3.15.6.3). Damage to downstream structures and communities, although similar, would be expected to be less than for the Crystal Ranch Dam because the Upper Yellowstone Dam would be farther from the potentially impacted communities. Additional at-risk areas would include seven buildings at Yellowstone Ranch and Bridge Campground. Potential impacts of this alternative on vehicle accidents in the Uinta Basin would be similar to the Proposed Action (Section 3.15.6.3).

3.15.6.4.1 Mitigation. Mitigation measures would be the same as those described for the Proposed Action (Section 3.15.6.3.1).

3.15.6.4.2 Unavoidable Adverse Impacts. Unavoidable adverse impacts would be the same as those described for the Proposed Action (Section 3.15.6.3.2).

3.15.6.5 Crystal Ranch Alternative

This alternative would have health and safety implications similar to those of the Proposed Action (Section 3.15.6.3).

3.15.6.5.1 Mitigation. Mitigation measures would be the same as those described for the Proposed Action (Section 3.15.6.3.1).

3.15.6.5.2 Unavoidable Adverse Impacts. Unavoidable adverse impacts would be the same as those described for the Proposed Action (Section 3.15.6.3.2).

3.15.6.6 Twin Pots Alternative

Section 3.15.6.3 discusses potential impacts associated with the Big Sand Wash Reservoir enlargement and improvements at Twin Pots Reservoir. Potential impacts of this alternative on vehicle accidents in the Uinta Basin would be similar to those of the Proposed Action (Section 3.15.6.3).

3.15.6.6.1 Mitigation. Mitigation measures would be the same as those described for the Proposed Action (Section 3.15.6.3.1).

3.15.6.6.2 Unavoidable Adverse Impacts. Unavoidable adverse impacts would be the same as those described for the Proposed Action (Section 3.15.6.3.2).

3.15.6.7 No Action Alternative

Risks to public health and safety would remain as discussed in Section 3.15.5 Affected Environment.

3.15.7 Cumulative Impacts

Implementation of the Uintah Unit Proposed Action, in addition to the Upalco Unit Proposed Action or alternatives, would have a cumulative impact on the threat from dam-failure-induced flooding of five structures in the town of Ouray. (It is not possible to quantify the risk nor the number of people potentially at risk.) Other communities and structures potentially most at risk from project dams proposed for the Upalco Unit would not be additionally affected by the water impoundment features of the Uintah Unit Proposed Action.

There would be a large increase in truck traffic on U.S. 40, SRs 87, 88, and 121, and County Roads 253, 113, and 114 (among others) during project construction. While construction in the two units would have a cumulative effect on truck traffic on U.S. 40, the impact on accident rates would not be expected to be any higher than if only the Upalco Unit were implemented. Because of the specific locations of the different project features of each unit, no cumulative increase in truck trips (and therefore accidents) would be expected on SRs 121, 88, and 87 or on the area's smaller roads. Overall, the two projects together would be expected to result in the occurrence of about five additional truck-related accidents on the area's roads during project construction.

3.16 Cultural Resources

3.16.1 Introduction

This analysis addresses potential impacts on cultural and paleontological resources resulting from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit. The analysis focuses on direct, indirect, total, and cumulative potential impacts on cultural and paleontological resources. An intensive Class III survey of all features within the selected alternative, followed by an approved mitigation plan, must be completed prior to construction taking place.

3.16.2 Issues Eliminated from Further Analysis

No cultural resources issues identified during public scoping were eliminated from analysis. However, certain project features may have an effect on some aspects of the paleontological or cultural resources of concern but would not result in significant impacts. These particular areas of no impact or low probability of impact are listed below and not discussed further in this document. They are described in detail in the Cultural Resources Technical Report (Sagebrush Archaeological Consultants 1996) and include the following:

Canal Rehabilitation—Rehabilitation by lining short segments with clay or concrete, placing short segments in pipe, constructing drop structures, replacing head or side gates, widening short segments, or removing vegetation would have "no effect" on the characteristics that contribute to the historic significance of canals, integrity of location, setting, feeling, and association.

Diversion Dams—Replacement of diversion dams, though some are determined eligible for the National Register of Historic Places (NRHP), would have "no adverse effect" on the characteristics that contribute to the historic significance of the associated canals.

River Corridors—Cultural and paleontological resources in river corridors downstream of proposed dam sites would not be affected by dam operation since the range of future river flows and the potential for channel scour and possible channel movement would be similar to existing conditions.

Land Retirement—Since no construction activities are planned for land retirement, there would be "no effect" on any resources that may be found in those areas.

3.16.3 Issues Addressed in the Impact Analysis

Study objectives were as follows:

1. Determine the extent and type of cultural resources in the project area.

2. Estimate the probability of significant resources occurring within the area of, and potentially being impacted by, proposed project features.

3. Locate and record any potentially impacted prehistoric and historic sites and determine their eligibility to the NRHP, using as

guidelines the NRHP according to 36 CFR 60.4.

4. Locate the ethnographic, traditional, and religious use areas and determine their eligibility to the NRHP, using as guidelines National Historic Register Bulletin 38; the American Indian Religious Freedom Act, PL 95-341; and the Native American Graves Protection and Repatriation Act of 1990, PL-101-601.

5. Record the extent and significance of paleontological resources in the project area and determine their potential for being impacted by the proposed project features.

3.16.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the project feature sites for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

3.16.5 Affected Environment

This section presents a broad overview of cultural and paleontological resources in the Uinta Basin, followed by a discussion of the affected environment for the Proposed Action and each alternative. A detailed overview of cultural and paleontological resources in the Uinta Basin is presented in the Cultural Resources Technical Report (Sagebrush Archaeological Consultants 1996).

The fossil record of the Uinta Mountains/Uinta Basin extends from Precambrian (Middle Proterozoic) time to Quaternary time, a period of about 1 billion years. The rock record of this area extends back another 1.5 billion years. The Uinta Mountains and Basin are the result of processes occurring over the last 2 billion years and more.

The prehistory of the project area is complex and poorly understood because of the area's location near the contact zone of the Great Basin, Colorado Plateau, and Northern Plains cultures. The prehistory of the Uinta Basin is a meld of these traditions, which has resulted in the identification of many enigmatic archaeological sites. Despite this mix of archaeological traits, the general model of prehistory for the eastern Great Basin and Northern Colorado Plateau is believed to be most prominent in the Uinta Basin and was therefore followed in this study. The series of cultural changes in these areas is classified into five general chronological periods as defined by Jennings (1986). These periods include Paleo-Indian, Desert Archaic, Formative, Post-Formative, and Contact. Within each of these major periods are a number of separate phases. Marked by a distinct lifeway, each period or phase is characterized by associated significant traits, characteristics, and artifacts.

The prospect of profitable fur trapping in the Uinta Basin provided the initial attraction for non-Indians. However, the presence of the Ute Tribe and the discovery and development of minerals and petroleum resources provided the impetus for European-American activity in the area. In this analysis, the area's history was divided into eight distinct periods of time associated with significant developments since the arrival of European-Americans. These periods include: Exploration, Trapping, and Trading (1776-1852); Early Settlement (1853-1861); Reservation Period (1862-1868); Secondary Settlement and Early Irrigation (1869-1885); Mineral Development (1886-1904); Land Rush and Water Development (1905-1927); Drought, Depression, and World War II (1928-1945); and Post-War (1946-Present).

3.16.5.1 Proposed Action–Talmage

3.16.5.1.1 High Mountain Lakes. No prehistoric sites have been documented on the margins of the 10 high mountain lakes proposed for stabilization. However, surveys at nearby high mountain lakes indicate a high potential for finding other prehistoric sites. Previous surveys by the USBR of Milk Lake Dam, Water Lily Lake Dam, and Farmers Lake Tunnel determined these reservoirs were eligible for the NRHP. East Timothy Lake Dam will be reanalyzed. The scarcity of fossils in Precambrian rocks from the Uinta Group gives them low potential for paleontological material, although there is a slight possibility of finding Pleistocene fossils in these areas.

3.16.5.1.2 Dams and Reservoirs. There is potential for finding prehistoric sites at the Big Sand Wash Reservoir enlargement site, though none have been located there. Two historic sites, 42Dc364 (a small historic bridge and fence) and the Crystal Ranch Homestead, were determined eligible for the NRHP. It is probable that other related historic sites would be discovered at the Crystal Ranch Reservoir site, as well. Ethnographic resources associated with construction of the proposed Crystal Ranch Dam and Reservoir include a free-flowing reach of the Yellowstone River that provides some fishing for the Ute, and adjacent lands that provide habitat and migration corridors for deer and elk. Also, there may be a burial ground above Altonah, though it has not been confirmed. The proposed Crystal Ranch Reservoir and Big Sand Wash Reservoir enlargement sites contain Holocene paleontological resources and perhaps Pleistocene fossils.

3.16.5.1.3 Diversion Dams. There is low potential for prehistoric sites along canals and probably at associated diversion dam sites in the Uinta Basin. Areas along the Yellowstone Feeder Canal were reported to contain important patches of sumac and serviceberry that are heavily used by the Ute today. There is a slight possibility of encountering Pleistocene fossils in glacial tills and Eocene vertebrates in the Duchesne River Formation.

3.16.5.1.4 Canal Rehabilitation. There may be a few significant prehistoric sites along canals with enough integrity to be determined eligible for the NRHP, though it is unlikely because of the amount of construction and maintenance of canals over the years. Historic canals associated with this alternative would most likely be ineligible for the NRHP, though other significant historic sites related to homesteads or farmsteads (e.g., fences, sheds, trash scatters) are likely to be encountered. There is a slight possibility of encountering Pleistocene fossils in glacial tills and Eocene vertebrates in the Duchesne River Formation.

3.16.5.1.5 Pipelines. There are two historic homes near the proposed Big Sand Wash Feeder Pipeline corridor, but is it is not known if they are eligible for the NRHP. There is a slight possibility of encountering Pleistocene fossils in glacial tills along the pipeline corridor and Eocene vertebrates in the Duchesne River Formation.

3.16.5.1.6 Fish and Wildlife Enhancement. The only known historic site associated with proposed fish and wildlife enhancements under the Proposed Action is the Twin Pots Dam, which was determined eligible for the NRHP. Ethnographic resources used by Ute Indian Tribe members include berries (Twin Pots area), deer and elk (Towanta Flats and Monarch Bench), fishing (Lake Fork River), and clays used in making pottery (Clay Basin Pond). There is a slight possibility of finding Pleistocene fossils in glacial tills at Twin Pots Reservoir.

3.16.5.1.7 Recreation Developments. No known cultural or paleontological resources would be affected by recreation developments under the Proposed Action.

3.16.5.1.8 Tribal Idle Lands. There may be a few significant prehistoric and historic sites near permanent and semi-permanent water sources (rivers, streams, and drainages) on Tribal idle lands. During the 20 percent sample survey of idle lands in the Upalco Unit, one significant historic site (42Dc1044) was found near a historic canal. Other significant sites related to homesteads and farmsteads may be located near historic canals as well. Two fossil localities (gastropod and turtle shells) were encountered on Tribal idle lands in the southern part of the Upalco Unit during the sample survey. There is a high potential for encountering additional Eocene fossils in that area. Also, there is a slight chance of finding Pleistocene fossils and a moderate chance of finding Eocene fossils in outcrops of the Eocene Duchesne River Formation in the northern part of the Upalco Unit.

3.16.5.2 Cow Canyon Alternative

Prehistoric, historic, ethnographic, and paleontological resources at high mountain lake, diversion dam, Tribal idle lands, and pipeline sites would be the same as described for the Proposed Action (see Section 3.16.5.1). The affected environment at other project features sites is described below.

3.16.5.2.1 Dams and Reservoirs. The Upper Yellowstone Reservoir site could contain historic Forest Service-related structural remains or temporary campsites and trash scatters. The Yellowstone Hydroelectric Power Plant is also located in the area and has been determined eligible for the NRHP.

3.16.5.2.2 Fish and Wildlife Enhancement. No known cultural resources are present at the habitat acquisition site (Fisher Property). No paleontological data have been gathered at this site.

3.16.5.2.3 Recreation Developments. No known cultural resources are present at the proposed recreation development sites. No paleontological data have been gathered at these sites.

3.16.5.3 Crystal Ranch Alternative

Prehistoric, historic, ethnographic, and paleontological resources at all project feature sites associated with the Crystal Ranch Alternative were described under the Proposed Action (see Section 3.16.5.1) or the Cow Canyon Alternative (see Section 3.16.5.2).

3.16.5.4 Twin Pots Alternative

Prehistoric, historic, ethnographic, and paleontological resources at project features sites were described under the Proposed Action (see Section 3.16.5.1) or Cow Canyon Alternative (see Section 3.16.5.2), except as noted below.

3.16.5.4.1 High Mountain Lakes. Three of the four additional high mountain lake dams (Island, Kidney, and Clements) included under this alternative were determined eligible for the NRHP.

3.16.5.4.2 Pipelines. No known cultural resources are present in the proposed Lake Fork-Yellowstone Pipeline corridor, although it is likely some historic archaeological sites (fences, sheds, foundations, trash scatters) would be found. Ute Tribal members expressed concern that the pipeline would cross migratory paths of deer and elk (Albers and Lowry 1995). There is a slight possibility of finding Pleistocene fossils in glacial tills along the Lake Fork-Yellowstone Pipeline corridor. No known cultural or paleontological resources are present in the proposed Big Sand Wash-Roosevelt Pipeline corridor. This corridor would be almost entirely within existing highway right-of-ways.

3.16.6 Impact Analysis

Potential impacts on cultural and paleontological resources from construction and operation of the Upalco Unit Proposed Action or alternatives are not completely known. However, the combined results of the 20 percent sample survey and the file searches provide sufficient information to predict effects and potential effects on cultural and paleontological resources.

3.16.6.1 Significance Criteria

Determination of effects on eligible cultural resources is guided by federal implementing regulation 36 CFR 800, which states that cultural resource assessments of federal "undertakings" on eligible properties should result in one of three determinations: 1) no effect; 2) no adverse effect, i.e., one or more historic properties will be affected but the historic qualities making them significant will not be harmed; or 3) adverse effect, i.e., the undertakings will cause harm to one or more historic properties. These guidelines are used to determine effects and possible effects on eligible cultural resources associated with the Proposed Action and alternatives. Impacts on historic and prehistoric sites not eligible for the NRHP are not considered an effect on cultural resources.

Potential impacts on paleontological resources from construction and operation of the Proposed Action and alternatives are addressed using the following guidelines. Impacts are considered significant if project implementation results in adverse effects on Type 1 or 2 paleontologically sensitive geological formations or in adverse effects on Class 1, 2, or 3 paleontologically sensitive fossil localities. Type 1 or 2 formations and Class 1, 2, and 3 (critical, significant, important) sensitive fossil localities are defined in Section 1, Chapter G-2, 2.2.2 of the Cultural Resources Technical Report (Sagebrush Archaeological Consultants 1996).

Significant impacts on cultural and paleontological resources predicted to occur as a result of implementing the Upalco Unit Proposed Action or alternatives are addressed in the impact analysis and include the following:

- Water Lily Lake Dam, Milk Lake Dam, and Farmers Lake Tunnel would be adversely affected (Proposed Action and all alternatives).
- Island, Kidney, and Clements Lake Dams would be adversely affected (Twin Pots Alternative).
- The historic Crystal Ranch Homestead and a small historic bridge and fence would be adversely affected (Proposed Action, Crystal Ranch Alternative).
- The historic Yellowstone Hydroelectric Power Plant would be adversely affected (Cow Canyon Alternative).
- Ethnographic impacts would include inundation of fishing areas on the Yellowstone River and adjacent lands that provide habitat and migration corridors for deer and elk (Proposed Action, Crystal Ranch Alternative).
- The historic component of site 42Dc1044 would be adversely affected if Tribal idle land irrigation activities significantly alter the terrain (e.g., leveling or trenching of land).

Adverse effects on prehistoric and historic cultural resources would be alleviated by implementing mitigation measures discussed below. Impacts on ethnographic resources would be considered "unavoidable adverse impacts" unless the Ute Tribe states otherwise and allows mitigation.

3.16.6.2 Potential Impacts Eliminated from Further Analysis

Cultural and paleontological resources not affected or not adversely affected are not discussed further. Only resources adversely affected or potentially adversely affected are included in the following discussion. All impacts, including resources not adversely affected, are discussed in the Cultural Resources Technical Report (Sagebrush Archaeological Consultants 1996).

3.16.6.3 Proposed Action–Talmage

3.16.6.3.1 High Mountain Lakes. There is high potential for finding prehistoric sites on the margins of high mountain lakes. Therefore, construction and operation of the Proposed Action may potentially have adverse affects on any prehistoric cultural resources found near these lakes. Properties that would be adversely affected include Milk Lake Dam, Water Lily Lake Dam, and Farmers Lake Tunnel. In addition, lowering East Timothy Lake Dam 15 feet would be an adverse affect if this dam is determined eligible for the NRHP. The scarcity of fossils in Precambrian rocks gives them low potential for paleontological material. Therefore, the potential for impacts on paleontological resources would probably be minimal. However, any Precambrian fossils found would be of critical importance.

3.16.6.3.2 Dams and Reservoirs. Two historic sites, 42Dc364 (a small historic bridge and fence) and the Crystal Ranch Homestead, were determined eligible for the NRHP. They would be adversely affected under the Proposed Action. Impacts on ethnographic resources from the construction of Crystal Ranch Dam and Reservoir would include the inundation of a free-flowing reach of river that provides some fishing for the Ute, and inundation of adjacent lands that provide habitat and migration corridors for deer and elk. There is a possible burial ground near Altonah, but it is not located near Crystal Ranch Reservoir's area of impact. The proposed Crystal Ranch Reservoir and Big Sand Wash Reservoir enlargement sites may contain Pleistocene fossils that may be adversely affected if encountered during construction.

3.16.6.3.3 Diversion Dams. There is a slight possibility of finding Pleistocene fossils in glacial tills and Eocene vertebrates in the Duchesne River Formation. These fossils may be adversely affected if encountered during construction.

3.16.6.3.4 Canal Rehabilitation. There may be a few significant prehistoric sites along canals with enough integrity to be determined eligible for the NRHP, though no data have been collected. There is a good possibility that historic archaeological sites, such as homestead- and farmstead-related sites, would be found along the canals. If determined eligible for the NRHP, the sites may be adversely affected by construction. There is a slight possibility of finding Pleistocene fossils in glacial tills and Eocene vertebrates in the Duchesne River Formation. These fossils may be adversely affected if encountered during construction.

3.16.6.3.5 Pipelines. There are two historic homes near the Big Sand Wash Feeder Pipeline corridor, but is it is not known if they are eligible for the NRHP or would be affected by pipeline construction. There is a slight possibility of finding Pleistocene fossils in glacial tills and Eocene vertebrates in the Duchesne River Formation during construction. These fossils may be adversely affected if encountered during construction.

3.16.6.3.6 Fish and Wildlife Enhancement. Stabilization of Twin Pots Dam, which was determined eligible for the NRHP, could have an adverse effect on this historic property. Fish and wildlife enhancement areas impacted directly by excavation and construction may contain paleontological resources that may be adversely affected.

3.16.6.3.7 Recreation Developments. Recreation development areas impacted directly by excavation and construction may contain paleontological resources that may be adversely affected.

3.16.6.3.8 Tribal Idle Lands. There is one significant historic site (42Dc1044) on Tribal idle lands that may be adversely affected by irrigation activities if the terrain is altered significantly (e.g., trenching or leveling of land). Other significant historic sites related to the construction of historic canals, homesteading, and farming may be encountered near historic canals. No significant prehistoric sites were located during the 20 percent sample survey. However, the presence of prehistoric artifacts in some areas indicates the likelihood of encountering significant prehistoric sites near permanent and semipermanent water sources. If significant sites are found, they may be adversely affected if the terrain is altered significantly.

Two fossil localities (gastropod and turtle shells) were encountered on Tribal idle lands in the southern part of the Upalco Unit during the sample survey. There is a high potential for encountering additional Eocene fossils in that area. Also, there is a slight chance of finding Pleistocene fossils and a moderate chance of finding Eocene fossils in outcrops of the Eocene Duchesne River Formation in the northern part of the Upalco Unit. Any fossil localities encountered would be adversely impacted if irrigation activities significantly alter the terrain.

3.16.6.3.9 Total Impacts. Six historic sites determined eligible for the NRHP would be adversely affected by construction of project features associated with the Proposed Action. They include the Crystal Ranch Homestead, site 42Dc364 (a small historic bridge and fence), site 42Dc1044, Water Lily Lake Dam, Milk Lake Dam, and Farmers Lake Tunnel. Two historic homes may be affected by construction of the Big Sand Wash Feeder Pipeline. Historic archaeological sites, such as trash scatters, camp sites, fences, outbuildings, and other homestead- and farmstead-related structures, may be found near the canals, lakes, and Crystal Ranch Reservoir site. Any NRHP-eligible historic sites found may be adversely affected if disturbed by construction activities.

The potential is high to find prehistoric resources associated with the high mountain lakes and moderate near natural water sources on Tribal idle lands. There is also some potential to find prehistoric resources at the Big Sand Wash Reservoir enlargement site. Any prehistoric sites found may be adversely affected if disturbed by construction activities. Potential impacts on ethnographic resources include inundation of a free-flowing reach of the Yellowstone River that provides some fishing for the Ute, and inundation of adjacent lands that provide habitat and migration corridors for deer and elk.

3.16.6.3.10 Mitigation. Once a Class III survey for cultural resources is complete and, assuming that properties eligible for the NRHP are identified, it would be necessary to develop a plan for review and approval by the State Historic Preservation Officer (SHPO) for either avoidance or data recovery of the affected properties. Depending on the type of resources identified, data recovery could take the form of additional recordation and excavation for prehistoric and historic archaeological sites, or Historic American Building Survey (HABS) or Historic American Engineering Record (HAER) level documentation for standing historic buildings or engineering structures. An intensive survey for paleontological resources would also be required. It would then be necessary to develop a plan for either avoidance or data recovery of the affected resources.

3.16.6.3.11 Unavoidable Adverse Impacts. Ethnographic resources impacted by project construction and operation would be considered "unavoidable adverse impacts" unless the Ute Tribe states otherwise and allows mitigation.

3.16.6.3.12 Cumulative Impacts. Cumulative impacts would consist of the total impacts of the Proposed Action plus the total impacts of the Uintah Unit Proposed Action, which are described in the Uintah Unit Draft EIS. Because cultural and paleontological resources are spatially confined, impacts would be additive rather than synergistic. No other proposed projects would contribute to significant cumulative impacts on cultural or paleontological resources.

3.16.6.4 Cow Canyon Alternative

Potential effects on prehistoric, historic, ethnographic, and paleontological resources at high mountain lake, diversion dam, Tribal idle lands, and pipeline sites would be the same as described for the Proposed Action (see Section 3.16.6.3). Impacted resources at other project features are described below.

3.16.6.4.1 Dams and Reservoirs. Construction of Upper Yellowstone Reservoir would have an adverse effect on the Yellowstone Hydroelectric Power Plant, which has been determined eligible for the NRHP.

3.16.6.4.2 Fish and Wildlife Enhancement. It is not likely that cultural or paleontological resources would be adversely affected by the proposed habitat acquisition.

3.16.6.4.3 Recreation Developments. A file search revealed little information to help assess possible impacts on cultural and palentological resources from construction of recreation developments.

3.16.6.4.4 Total Impacts. Five historic sites determined eligible for the NRHP would be adversely affected by construction of project features associated with the Cow Canyon Alternative. They include site 42Dc1044, Milk Lake Dam, Water Lily Lake Dam, Farmers Lake Tunnel, and the Yellowstone Hydroelectric Power Plant. In addition, if East Timothy Lake Dam and the two historic homes near the proposed Big Sand Wash Feeder Pipeline corridor are determined eligible for the NRHP, they would be adversely affected. There is some potential for finding significant historic sites near the high mountain lakes and near the proposed Upper Yellowstone Reservoir site. There is also potential for prehistoric sites near the margins of high mountain lakes, at the Big Sand Wash Reservoir enlargement site, and near natural water sources on Tribal idle lands.

3.16.6.4.5 Mitigation. Mitigation for the Cow Canyon Alternative would be the same as described for the Proposed Action (see Section 3.16.6.3.10).

3.16.6.4.6 Unavoidable Adverse Impacts. Ethnographic resources impacted by project construction and operation would be considered "unavoidable adverse impacts" unless the Ute Tribe states otherwise and allows mitigation.

3.16.6.4.7 Cumulative Impacts. Cumulative impacts would consist of the total impacts of the Cow Canyon Alternative plus the total impacts of the Uintah Unit Proposed Action. Because cultural and paleontological resources are spatially confined, impacts would be additive rather than synergistic. No other proposed projects would contribute to significant cumulative impacts on cultural and paleontological resources.

3.16.6.5 Crystal Ranch Alternative

Potential effects on prehistoric, historic, ethnographic, and paleontological resources at all project feature sites associated with the Crystal Ranch Alternative were described under the Proposed Action (see Section 3.16.6.3) or the Cow Canyon Alternative (see Section 3.16.6.4).

3.16.6.5.1 Total Impacts. Six historic sites determined eligible for the NRHP would be adversely affected by construction of project features associated with the Crystal Ranch Alternative. They include Milk Lake Dam, Water Lily Lake Dam, Farmers Lake Tunnel, the Crystal Ranch Homestead, and site 42Dc364 (a small bridge and historic fence), and site 42Dc1044. In addition, if East Timothy Lake Dam is determined eligible for the NRHP, it would be adversely affected. There is some potential for finding significant historic sites near the canals, high mountain lakes, on Tribal idle lands, and at the Crystal Ranch Reservoir site. There is high potential for finding prehistoric sites near the high mountain lakes. Potential impacts on ethnographic resources include inundation of a free-flowing reach of the Yellowstone River that provides some fishing and inundation of adjacent lands that provide habitat and migration corridors for deer and elk.

3.16.6.5.2 Mitigation. Mitigation for the Crystal Ranch Alternative would be the same as described for the Proposed Action (see Section 3.16.6.3.10).

3.16.6.5.3 Unavoidable Adverse Impacts. Ethnographic resources impacted by project construction and operation would be considered "unavoidable adverse impacts" unless the Ute Tribe states otherwise and allows mitigation.

3.16.6.5.4 Cumulative Impacts. Cumulative impacts would consist of the total impacts of the Crystal Ranch Alternative plus the total impacts of the Uintah Unit Proposed Action. Because cultural and paleontological resources are spatially confined, impacts would be additive rather than synergistic. No other proposed projects would contribute to significant cumulative impacts on cultural and paleontological resources.

3.16.6.6 Twin Pots Alternative

Potential effects on prehistoric, historic, ethnographic, and paleontological resources at project feature sites were described under the Proposed Action (see Section 3.16.6.3) or Cow Canyon Alternative (see Section 3.16.6.4), except as noted below.

3.16.6.6.1 High Mountain Lakes. Three additional dams (Island, Kidney, and Clements) determined eligible for the NRHP would be adversely affected under this alternative.

3.16.6.6.2 Pipelines. Environmental consequences associated with pipeline construction include those for the Proposed Action (see Section 3.16.6.3.5), plus the effects resulting from construction of the Lake Fork-Yellowstone and Big Sand Wash-Roosevelt Pipelines. The Ute expressed concern that the Lake Fork-Yellowstone Pipeline not impact the migration of deer and elk through this area to major wintering grounds on Towanta Flats, an important hunting area (Albers and Lowry 1995). There is a slight possibility of finding, and perhaps impacting, Pleistocene fossils in glacial tills and Eocene vertebrates in the Duchesne River Formation along this pipeline corridor.

3.16.6.6.3 Total Impacts. Seven historic sites determined eligible for the NRHP would be adversely affected by construction of project features associated with the Twin Pots Alternative. They include the dams at Water Lily, Milk, Island, Kidney, and Clements Lakes, Farmers Lake Tunnel, and site 42Dc1044. Two historic homes may be affected by construction of the Big Sand Wash Feeder Pipeline. Historic archaeological sites, such as trash scatters, camp sites, fences, outbuildings, and other homestead- and farmstead-related structures, may be found near the canals and high mountain lakes. Any NRHP-eligible historic sites found may be adversely affected if disturbed by construction activities.

The potential is high to find prehistoric resources associated with the high mountain lakes, and there is some potential to find prehistoric resources on Tribal idle lands and at the Big Sand Wash Reservoir enlargement site. Any prehistoric sites found may be adversely affected if disturbed by construction activities. Ute Tribal members expressed concern that the Lake Fork-Yellowstone Pipeline not impact deer and elk migrations through this area to Towanta Flats, a major wintering ground and important hunting area.

3.16.6.6.4 Mitigation. Mitigation for the Twin Pots Alternative would be the same as described for the Proposed Action (see Section 3.16.3.6.10).

3.16.6.6.5 Unavoidable Adverse Impacts. Ethnographic resources impacted by project construction and operation would be considered "unavoidable adverse impacts" unless the Ute Tribe states otherwise and allows mitigation.

3.16.6.6.6 Cumulative Impacts. Cumulative impacts would consist of the total impacts of the Twin Pots Alternative plus the total impacts of the Uintah Unit Proposed Action. Because cultural and paleontological resources are spatially confined, impacts would be additive rather than synergistic. No other proposed projects would contribute to significant cumulative impacts on cultural and paleontological resources.

3.16.6.7 No Action Alternative

Because no construction is proposed under the No Action Alternative, there would be no project-related impacts on those cultural and paleontological resources at project feature sites (see Section 3.16.5 Affected Environment for a description of these resources).

3.17 Recreation Resources

3.17.1 Introduction

This section addresses potential direct, indirect, total, and cumulative impacts on recreation and recreation resources in the Uinta Basin resulting from the construction, operation, and maintenance of the Proposed Action and alternatives of the Upalco Unit. The impact analysis considers how the project would either eliminate or alter existing recreation sites as well as create new ones, and assesses the effects of these changes on recreation visitation in the Uinta Basin.

3.17.2 Issues Eliminated from Further Analysis

All recreation issues identified during public scoping were analyzed. None were eliminated.

3.17.3 Issues Addressed in the Impact Analysis

Issues and concerns identified during public scoping are addressed in the impact analysis and include the following:

1. Would existing recreation opportunities and facilities in the Uinta Basin be protected and preserved both during and after project construction?

2. Would the project provide new recreation opportunities and facilities within the Uinta Basin?

3.17.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the project feature sites for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

3.17.5 Affected Environment

The Uinta Basin is highly regarded for its significant and varied outdoor recreation resources, including numerous campgrounds, trails, streams, rivers, reservoirs, and remote areas for hunting. These resources are located on lands administered by the FS, the Bureau of Land Management (BLM), and the State of Utah as well as by the Ute Indian Tribe on the Uintah and Ouray Reservation.

The HUW lies in the northernmost part of this region. An estimated 108,000 recreational visitor days (RVDs) were spent in the HUW in 1994. The FS reports recreation visitation to the National Forest both in the number of visitors and in RVDs. An RVD is the equivalent of 12 hours spent by an individual in an area. The Ashley National Forest (ANF), which separates the Uintah and Ouray Reservation from the HUW, spans the entire Uinta Basin and extends into Wyoming. An estimated 3,748,000 people visited the ANF in 1994 (FS 1994a).

The Uintah and Ouray Reservation is directly south of the ANF. There are a number of sites on the Reservation where Tribal members, as well as non-Indians, fish and participate in other forms of outdoor recreation (including Big Springs and Coyote Basin Ponds). Access to the Uintah and Ouray Reservation is restricted and non-Indians are required to purchase Tribal permits for fishing and hunting.

A number of important recreation destinations in the basin are located on public lands east and west of the Reservation and along U.S. Highway 40, which transects the basin. State-administered reservoirs in the region that experience significant annual visitation and summertime overcrowding include Steinaker, Red Fleet, and Starvation. Starvation Reservoir alone had about 118,000 visitors in 1994 (Utah Division of Parks and Recreation 1995).

Dinosaur National Monument and Flaming Gorge National Recreation Area (NRA) Dam and Reservoir are just east and northeast of the Uinta Basin. The influence of these two recreation destinations on recreational activity in the Uinta Basin is significant. Dinosaur National Monument drew about 535,000 visitors in 1993 and about 481,000 in 1994 (Moses 1995). Flaming Gorge NRA hosted about 2,461,000 and about 1,980,000 visitors in 1992 and 1993, respectively (USBR 1993; FS 1994). Another visitor attraction in the area is the Utah State Field House of Natural History in Vernal. Most visitors to the Field House originate from outside the Uinta Basin.

3.17.5.1 High Mountain Lakes

There are 92 lakes in the upper Yellowstone River drainage, 38 of which are capable of supporting fish. All lakes potentially affected by the project support fish. Visitors accessing the lakes mostly walk or ride horseback along Swift Creek. Fishing pressure on these lakes has either remained steady or increased over the last 10 years (Giantino 1995; Sears 1995). Estimates of fishing pressure and success rates are only available for some of these lakes (see Table 3.17-1).

The Lake Fork River drainage is the largest and least visited drainage in the HUW. This is partially because there are fewer lakes per square mile than in other areas (thus attracting fewer anglers). The drainage features 22 lakes and ponds, only 8 of which support fish. Staff from the Roosevelt Ranger District estimated that 1,376 people visited the Brown Duck Creek/Lake Fork River area in 1993 (FS 1995b). No estimates are available on fishing pressure or success rates for the lakes in the Lake Fork River drainage potentially affected by the project.

3.17.5.2 National Forest Campgrounds

The Yellowstone and Lake Fork River watersheds feature six developed National Forest campgrounds. The Moon Lake Campground on the Lake Fork River at Moon Lake Reservoir has 51 sites. The Yellowstone, Bridge, Reservoir, Riverview, and Swift Creek Campgrounds on the Yellowstone River have a total of 53 sites (all 5 are within walking distance of fishing areas). These campgrounds, together with 3 along the Uinta River drainage, comprise the developed camping facilities

Table 3.17-1 Fishing Pressure and Catch Success Rates at Affected High Mountain Lakes		
Lake	**Fishing Pressure***	**Success Rate* (Fish per Hour)**
Bluebell	Moderate	2.87
Drift	Light to moderate	3.36
Five Point	Heavy	1.05
Superior	Moderate	1.97
Milk	Light to moderate	1.79

Source: Utah Division of Wildlife Resources (1986b).
*Fishing pressure and success rate estimates from 1986 (most recent available).

of the Roosevelt Ranger District. The Moon Lake area along the Lake Fork River was the most heavily visited site in the District (106,000 RVDs in 1994), which can be attributed to several factors including excellent paved road access and boat ramps on the reservoir (FS 1995a).

3.17.5.3 Big Sand Wash Reservoir

Annual visitation to Big Sand Wash Reservoir, based on its size and lack of facilities, is estimated at 10,000 visitors per year (Dornbusch & Company 1995b). Because of its accessibility, winter ice-fishing has become popular at the reservoir, attracting hundreds of people on busy days. Creel census data from Memorial Day weekend, 1993, indicated fishing success rates of 0.36 fish per hour from shore and 1.13 fish per hour from boats (Crosby 1993). The reservoir is administered from Starvation State Park.

3.17.5.4 Twin Pots Reservoir

During dry years when Moon Lake Reservoir does not spill, Twin Pots can drop to below the level necessary to maintain a conservation pool, thus prohibiting any fishing, and rendering the site unattractive to potential visitors. Tribal creel censuses at Twin Pots recorded fishing success rates of 0.73 fish per hour in 1993 and 1.07 fish per hour in 1994 (Ute Indian Tribe Fish and Wildlife Department 1994).

3.17.5.5 Clay Basin Pond

This site is primarily used for fishing (including a fair amount of winter ice-fishing) and occasionally camping. Despite its remote Reservation location, visitation at this pond is fairly heavy. In 1993, an estimated 5,718 angler hours were spent at the pond, with an average fishing success rate of 0.65 fish per hour. A 1994 survey showed a slightly higher success rate of 0.78 fish per hour (Ute Indian Tribe Fish and Wildlife Department 1994).

3.17.5.6 Stream Fishing

The reach of the Lake Fork River between Moon Lake Dam and Farnsworth Canal has been classified by the State of Utah as Class 4, meaning it is of limited fishery value. The most recent creel census in this reach, taken in 1984, showed a fishing success rate of 0.95 fish per hour (Crosby 1984). The reach of Lake Fork River on the Uintah and Ouray Reservation has not been classified.

The reach of the Yellowstone River potentially affected by this project has been classified as Class 3. The most recent creel census was conducted in 1982 from the confluence of Swift Creek with the Yellowstone River downstream to the Yellowstone Hydroelectric Power Plant. The river was being planted with 5,000 rainbow trout annually at that time (no longer the case). A catch rate of 0.64 fish per hour was recorded (Bingham 1982). Reaches of the Yellowstone River on the Uintah and Ouray Reservation have not been classified by the state. Recent Tribal surveys indicate low rates of fishing success. While the Tribe recorded a success rate of 1.50 fish per hour in 1978, a 1993 survey estimated 408 angler hours were spent fishing the river on the Reservation with a success rate of zero fish per hour. A 1994 2-day survey found no anglers present (Ute Indian Tribe Fish and Wildlife Department 1993, 1994).

3.17.5.7 Hunting

As part of efforts to increase big game herds, Wildlife Resources has placed a cap on hunting permits issued for public lands within the project's area of influence. These restrictions are a response to recent declines in herd sizes because of a prolonged drought followed by a severe winter in 1992-93. Therefore, at present, the number of deer hunters afield is significantly below levels of just a few years ago: in 1992 there were 6,206 hunters who harvested 1,766 animals; in 1993, these numbers dropped to 2,461 and 476, respectively. By 1994, only 1,896 hunters were afield. Final harvest numbers for 1994 were not available at the time of this study. Hunting on the Reservation is allowed by Tribal permit only. The Tribe also offers guided hunts (Wildlife Resources 1994).

3.17.6 Impact Analysis

3.17.6.1 Significance Criteria

Potential impacts on recreation resources are considered significant if the following conditions exist:

1. Any free-flowing reach of the Uinta, Whiterocks, Lake Fork, or Yellowstone Rivers would be eliminated.
2. A potential increase/decrease of 10 percent or more in recreation visitor use days spent stream fishing in the project area
3. A potential increase/decrease of 10 percent or more in recreation visitor use days spent hunting in the project area
4. A potential increase/decrease of 10 percent or more in RVDs spent on the Uintah and Ouray Reservation
5. Recreation opportunities eliminated by the project would result in the demand for remaining facilities exceeding their capacities

Significant potential impacts on recreation resources that would result from implementing the Upalco Unit Proposed Action or alternatives are addressed in the impact analysis and include the following:

1. The permanent elimination of 2.6 miles of the free-flowing Yellowstone River under the Proposed Action and Crystal Ranch Alternative and 2.0 miles of the Yellowstone River under the Cow Canyon Alternative
2. A greater than 10 percent increase in recreation visitor days spent on the Uintah and Ouray Reservation under the Proposed Action and the Cow Canyon and Crystal Ranch Alternatives

3.17.6.2 Potential Impacts Eliminated from Further Analysis

Potential impacts on recreation by the following were eliminated from further analysis because they are not significant based on the above criteria:

1. Stream fishing
2. Hunting
3. Elimination of existing recreation resources
4. Big Sand Wash Reservoir enlargement
5. High mountain lakes stabilization
6. Canal, pipeline, and diversion dam work
7. Stream improvement
8. Habitat acquisition
9. Fish Creek Trail improvement

10. Big game winter range improvement
11. Land retirement

The following impact analysis, therefore, only addresses those recreational facilities or activities that would be significantly affected by the Proposed Action or alternatives. By comparison, the Project feasibility Study, which only addresses the Proposed Action, considers all project effects on recreational facilities or activities, not just the significant effects.

3.17.6.3 Proposed Action–Talmage

3.17.6.3.1 Crystal Ranch Reservoir and Campground. At full capacity, Crystal Ranch Reservoir would inundate about 2.6 free-flowing miles of the Yellowstone River. Visitation to the reservoir is expected to reach about 7,750 RVDs per year. It is anticipated that half, or about 3,875, of these RVDs would be spent at already existing reservoirs within the Uinta Basin if the Crystal Ranch site was not made available. The proposed campground development should provide adequate accommodations for existing and new overnight visitors to the area.

3.17.6.3.2 Twin Pots Reservoir. The proposed stabilization of Twin Pots Reservoir would bring water levels to near full capacity, increasing its average surface area from 73 acres to nearly 200 acres. This augmented surface acreage would enhance the flat-water recreation potential of Twin Pots and lengthen its current recreation season. These improvements would be expected to result in an increase of about 900 RVDs spent at Twin Pots each year. Without the proposed stabilization, approximately half of this visitation would be expected to occur at other flat-water destinations in the area.

3.17.6.3.3 Improvements at Clay Basin Pond. This site receives only moderate year-round use and would benefit from the proposed improvements, including fish habitat enhancement, installation of a fishing pier, and leveled picnic sites. Flow-through minimum flows would be piped a sufficient distance to keep livestock away from the pond. In the event cattle disturb Clay Basin Pond, its banks would be fenced. Commitment of up to 3 cfs of water for the pond from May through October would also render the site more attractive to new visitors. The likely increase in visitation is estimated at about 1,025 RVDs annually. Without the proposed improvements, approximately half of this visitation would be expected to occur at other flat-water destinations in the area.

3.17.6.3.4 Total Impacts. Implementation of the Proposed Action would not only provide new recreational opportunities for individuals who would otherwise participate in outdoor recreation within the project area (helping to alleviate overcrowding at other sites), but also lead to an increase in outdoor recreation participation within the Uinta Basin. As Table 3.17-2 shows, the predicted net increase in recreation visitation in the Basin generated by the project would be about 4,835 RVDs annually.

Although precise estimates of current recreation activity on the Reservation are not available, given the current lack of opportunities, it appears that the increases in visitation predicted to occur if the Proposed Action were implemented (+4,835 RVDs) should exceed 10 percent of current levels, a significant impact.

3.17.6.3.5 Forest Recreation Sites. Current funding and personnel shortages have made it difficult for the FS to implement much needed repairs and improvements at many ANF facilities (e.g., campgrounds). Project-associated visitation increases to the National Forest along the Yellowstone River drainage may further tax already overextended facilities and personnel. Therefore, mitigation of potential negative impacts of the project through enhancement would include improvements to bathrooms and water systems at Yellowstone and Bridge Campgrounds.

3.17.6.3.6 Unavoidable Adverse Impacts. Inundation of 2.6 miles of the Yellowstone River following construction of Crystal Ranch Dam would represent an unavoidable adverse impact on the region's recreation resources.

Table 3.17-2 Net Impacts on Recreation Visitation in the Uinta Basin from the Proposed Action		
Project Feature	**Net Change in Visitation (Annual Number of Visitors)**	**Net Change in Visitation (Recreational Visitor Days)***
Uintah and Ouray Reservation		
Crystal Ranch Reservoir and Campground	+8,550	+3,875
Twin Pots Reservoir	+1,000	+450
Clay Basin Pond	+1,[illegible]	+510
Total Net Change	+10,675	+4,835

Source: Dornbusch & Company (1995b).
*Figures based on FS assumption that about 2.2 visitors represent 1 RVD.

3.17.6.4 Cow Canyon Alternative

3.17.6.4.1 Upper Yellowstone Reservoir. At full capacity, Upper Yellowstone Reservoir would inundate about 2.0 free-flowing miles of the Yellowstone River as well as Riverview and Reservoir Campgrounds. Visitation to the reservoir is expected to reach about 9,225 RVDs per year. It is anticipated that half, or about 4,615, of these RVDs would be spent at existing reservoirs within the Uinta Basin if the Upper Yellowstone site was not made available.

3.17.6.4.2 Improvements to Bridge and Swift Creek Campgrounds. Improvements proposed for Bridge and Swift Creek Campgrounds should help provide overnight accommodations for visitors to the new Upper Yellowstone Reservoir. However, expected demand for developed camping in the area following completion of the reservoir would likely exceed supply.

3.17.6.4.3 Total Impacts. Implementation of the Cow Canyon Alternative would not only provide new recreational opportunities for individuals who would otherwise participate in outdoor recreation within the project area (helping to alleviate overcrowding at other sites), but also lead to an increase in outdoor recreation participation within the Uinta Basin. As Table 3.17-3 shows, the predicted net increase in recreation visitation in the Basin generated by the project would be about 4,615 RVDs annually. The increased demand for developed camping facilities along the Yellowstone River is expected to exceed demand despite proposed improvements at Bridge and Swift Creek Campgrounds.

3.17.6.4.4 Forest Recreation Sites. Current funding and personnel shortages have made it difficult for the FS to implement much needed repairs and improvements at many of their ANF facilities (e.g., campgrounds). Project-associated visitation increases and the inundation of existing sites in the National Forest along the Yellowstone River drainage may further tax already overextended facilities and personnel. Therefore, efforts to mitigate potential negative impacts of the project through enhancement would include improvements to campsites, interior roads, bathrooms, and water systems at Yellowstone and Bridge Campgrounds.

3.17.6.4.5 Unavoidable Adverse Impacts. Inundation of 2.0 miles of the Yellowstone River following construction of Upper Yellowstone Dam would represent an unavoidable adverse impact on the region's recreation resources.

Table 3.17-3 Net Impacts on Recreation Visitation in the Uinta Basin from the Cow Canyon Alternative		
Project Feature	**Net Change in Visitation (Annual Number of Visitors)**	**Net Change in Visitation (Recreational Visitor Days)***
Public Access Lands		
Upper Yellowstone Dam and Reservoir	+10,150	+4,615
Improvements to Bridge and Swift Creek Campgrounds	Included above	Included above
Total Net Change	+10,150	+4,615

Source: Dornbusch & Company (1995b).
*Figures based on FS assumption that about 2.2 visitors represent 1 RVD.

3.17.6.5 Crystal Ranch Alternative

3.17.6.5.1 Crystal Ranch Reservoir and Campground. The reservoir and campground were discussed under the Proposed Action (see Section 3.17.6.3.1).

3.17.6.5.2 Improvements to Bridge Campground. Additional sites and other improvements at Bridge Campground would further help accommodate overnight visitors to Crystal Ranch Reservoir.

3.17.6.5.3 Total Impacts. Implementation of the Crystal Ranch Alternative would not only provide new recreational opportunities for individuals who would otherwise participate in outdoor recreation within the project area (helping to alleviate overcrowding at other sites), but also lead to an increase in outdoor recreation participation within the Uinta Basin. As Table 3.17-4 shows, the predicted net increase in recreation visitation in the Basin generated by the project would be about 3,875 RVDs annually. The increased demand for developed camping facilities along the Yellowstone River is expected to exceed demand despite proposed campground improvements.

Although precise estimates of current recreation activity on the Reservation are not available, given the current lack of opportunities, it appears that the increases in visitation predicted to occur if this alternative were implemented (+3,875 RVDs) should exceed 10 percent of current levels, a significant impact.

3.17.6.5.4 Forest Recreation Sites. Mitigation would be the same as described for the Proposed Action (see Section 3.17.6.3.5).

3.17.6.5.5 Unavoidable Adverse Impacts. Unavoidable adverse impacts would be the same as described for the Proposed Action (see Section 3.17.6.3.6).

3.17.6.6 Twin Pots Alternative

3.17.6.6.1 Twin Pots Reservoir. The reservoir was discussed under the Proposed Action (see Section 3.17.6.3.2).

3.17.6.6.2 Total Impacts. Stabilization of Twin Pots Reservoir would be expected to increase the annual number of visitors to the Uinta Basin by about 1,000 (spending about 450 RVDs). Therefore, this alternative does little to augment Indian-administered recreation facilities and would not significantly affect the recreation resources of the Basin (see Table 3.17-5).

Table 3.17-4
Net Impacts on Recreation Visitation in the Uinta Basin from the Crystal Ranch Alternative

Project Feature	Net Change in Visitation (Annual Number of Visitors)	Net Change in Visitation (Recreational Visitor Days)*
Public Access Lands		
Improvements to Bridge Campground	Included below	Included below
Uintah and Ouray Reservation		
Crystal Ranch Reservoir and Campground	+8,550	+3,875
Total Net Change	+8,550	+3,875

Source: Dornbusch & Company (1995b).
*Figures based on FS assumption that about 2.2 visitors represent 1 RVD.

Table 3.17-5
Net Impacts on Recreation Visitation in the Uinta Basin from the Twin Pots Alternative

Project Feature	Net Change in Visitation (Annual Number of Visitors)	Net Change in Visitation (Recreational Visitor Days)*
Uintah and Ouray Reservation		
Twin Pots Reservoir Stabilization	+1,000	+450
Total Net Change	+1,000	+450

Source: Dornbusch & Company (1995b).
*Figures based on FS assumption that about 2.2 visitors represent 1 RVD.

3.17.6.6.3 Unavoidable Adverse Impacts. This alternative would have no unavoidable adverse impacts.

3.17.6.7 No Action Alternative

Recreation resources of the Uinta Basin would not differ significantly from existing conditions. If no new reservoir-based recreation opportunities are created within the Uinta Basin in the future, existing reservoirs such as Starvation and Steinaker could face even greater overcrowding problems.

A large number of the recreation resources that would be developed under the Upalco Unit Proposed Action and alternatives would be located on the Uintah and Ouray Reservation. Failure to implement any of these developments would leave many of the existing sites in varying states of disrepair and fail to satisfy general Tribal desires to increase on-Reservation recreation opportunities.

3.17.7 Cumulative Impacts

3.17.7.1 Proposed Action–Talmage and Uintah Unit Proposed Action–Lower Uintah

The Proposed Actions of the Upalco and Uintah Units would have a cumulative beneficial impact on recreation in the Uinta Basin, particularly on the Uintah and Ouray Reservation. Taken together, the two units would be expected to result in a net increase of over 22,000 recreation visits in the basin annually (about 9,945 RVDs).

3.17.7.2 Cow Canyon Alternative and Uintah Unit Proposed Action–Lower Uintah

While the cumulative impacts on recreation visitation in the Basin under this combination of alternatives would be similar to the combined Proposed Actions of both units, the recreation benefits to the Tribe would be much less. Taken together, these two alternatives would be expected to result in a net increase of about 21,670 recreation visits in the Uinta Basin annually (about 9,725 RVDs).

3.17.7.3 Crystal Ranch Alternative and Uintah Unit Proposed Action–Lower Uintah

This combination of alternatives would not be as beneficial to Indian-run recreation as would the combination of the two Proposed Actions. Taken together, these two alternatives would be expected to result in a net increase of about 20,070 recreation visits in the Uinta Basin annually (about 8,985 RVDs).

3.17.7.4 Twin Pots Alternative and Uintah Unit Proposed Action–Lower Uintah

The Twin Pots Alternative would not be as beneficial to Indian-run recreation as either the Upalco Unit Proposed Action or Crystal Ranch Alternative since no large reservoir would be constructed on the Reservation. If this alternative is implemented in conjunction with the Uintah Unit Proposed Action, it would have the smallest cumulative impact on Basin recreation. Taken together, these two alternatives would be expected to result in a net increase of about 12,520 recreation visits in the Uinta Basin annually (about 5,560 RVDs).

3.18 Wilderness Areas

3.18.1 Introduction

This section addresses potential impacts on the HUW resulting from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit. The analysis focuses on potential impacts on the wilderness from stabilization of high mountain lakes and from project features located adjacent to the HUW. Mitigation measures are discussed that would minimize or avoid impacts on the wilderness.

3.18.2 Issues Eliminated from Further Analysis

All wilderness area issues identified during public scoping were analyzed. None were eliminated.

3.18.3 Issues Addressed in the Impact Analysis

Issues addressed in the impact analysis include the following:

1. Project facilities or activities that may encroach into the HUW

3.18.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include those high mountain lakes in the HUW that are proposed for stabilization and other project features adjacent to the wilderness area.

These features and the HUW boundary are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

The HUW was established by Congress under Public Law 98-428 in 1984. It encompasses 460,000 acres and is the largest wilderness in Utah. The HUW affected is part of the Ashley National Forest and is managed by the Roosevelt Ranger District.

The HUW has outstanding wilderness qualities. The Uinta Mountain range is the most prominent east-west range in the United States, other than Alaska, and is the highest mountain range in Utah. Approximately 40 inches of precipitation fall annually, mostly as snow, and the growing season is short. About one-half of the area is forested. Coniferous trees occur in large stands on lower slopes. Quaking aspen occur in scattered patches throughout the lower elevations of the area. Isolated meadows and willow fields occur throughout the timber. The remaining area consists of boulder fields and water (lakes, rivers, streams).

The 1964 Wilderness Act defines wilderness as a place affected primarily by nature, where people are visitors who do not remain, and where natural ecological processes operate freely. Outstanding opportunities for solitude and primitive recreation should be available in wilderness areas. As human use increases and the demand for this type of opportunity grows, some areas in the HUW no longer possess these wilderness attributes. Other more remote areas are at risk of losing existing wilderness qualities.

In order to meet the intent of the 1964 and 1984 Wilderness Acts, the Roosevelt Ranger District is proposing to amend the Ashley and Wasatch-Cache Forest Plans to define resource, social, and managerial desired conditions to: a) maintain a wilderness where ecosystems are influenced primarily by the forces of nature; and b) consistent with a) above, provide a diversity of opportunities for public use, enjoyment, and understanding of wilderness so a high quality wilderness resource is preserved for present and future generations.

3.18.5 Affected Environment

3.18.5.1 Proposed Action–Talmage

3.18.5.1.1 High Mountain Lakes. Ten high mountain lakes in the HUW would be stabilized. These lakes are currently used for irrigation storage and are routinely drawn down toward the end of the irrigation season. The resulting low water levels often leave visually unattractive mud flats around the perimeters of the lakes.

3.18.5.1.2 Adjacent Project Features. Crystal Ranch Reservoir would be constructed under the Proposed Action. This reservoir would be on the Yellowstone River, approximately 5 miles south of the wilderness boundary.

3.18.5.2 Cow Canyon Alternative

3.18.5.2.1 High Mountain Lakes. Ten high mountain lakes in the HUW would be stabilized, the same as described for the Proposed Action.

3.18.5.2.2 Adjacent Project Features. Upper Yellowstone Reservoir would be constructed under the Cow Canyon Alternative. It would be on the Yellowstone River approximately 1 mile from the Swift Creek Campground and the nearly adjacent wilderness boundary. Of all the adjacent project features considered within the Upalco Unit, this reservoir would be the closest to the HUW.

3.18.5.3 Crystal Ranch Alternative

3.18.5.3.1 High Mountain Lakes. Ten high mountain lakes in the HUW would be stabilized, the same as described for the Proposed Action.

3.18.5.3.2 Adjacent Project Features. Crystal Ranch Reservoir would be constructed, the same as described for the Proposed Action.

3.18.5.4 Twin Pots Alternative

3.18.5.4.1 High Mountain Lakes. Fourteen high mountain lakes in the HUW would be stabilized under this alternative. These lakes are currently used for irrigation storage, the same as described for the Proposed Action.

3.18.5.4.2 Adjacent Project Features. No project features of the Twin Pots Alternative would be adjacent to the HUW.

3.18.6 Impact Analysis

3.18.6.1 Significance Criteria

Potential impacts on the HUW were determined to be significant if the following conditions exist:

1. Any project component crosses the boundary of the HUW, causing permanent and substantially noticeable intrusions upon wilderness characteristics.
2. Permanent and substantially noticeable intrusions occur for recreational users pursuing solitude or primitive opportunities in the HUW.

No significant impacts on the wilderness area are predicted to occur as a result of implementing the Proposed Action or alternatives.

3.18.6.2 Proposed Action–Talmage

3.18.6.2.1 High Mountain Lakes. Stabilization of the high mountain lakes would have some temporary impact on the HUW. The lakes are an important feature of the wilderness area. During construction or retrofitting of the dams, some temporary noise and water quality impacts would be expected. After the lakes have been stabilized, they would return to a more natural-looking state since there would no longer be dramatic water fluctuations. Ultimately, habitat for plant and animal species would improve. Recreational use at the stabilized lakes may increase as wilderness users discover that the lakes are visually more attractive.

3.18.6.2.2 Adjacent Project Features. Crystal Ranch Reservoir would be the project feature nearest the HUW. Because it would be approximately 5 miles downstream of the wilderness boundary, construction and operation of this reservoir would not be anticipated to impact the HUW.

3.18.6.2.3 Total Impacts. No significant impacts on the wilderness are anticipated as a result of high mountain lakes stabilization and construction of Crystal Ranch Reservoir. Construction activities at high mountain lakes would cause some temporary noise increase.

3.18.6.2.4 Mitigation. All FS guidelines and standards for the management of wilderness areas would be met during stabilization of the high mountain lakes.

3.18.6.2.5 Unavoidable Adverse Impacts. There would be no unavoidable adverse impacts on the HUW from the Proposed Action.

3.18.6.2.6 Cumulative Impacts. Plans for high mountain lakes stabilization are consistent with the goals for the HUW being prepared by the FS. No significant cumulative impacts on the HUW are anticipated from implementing the Upalco Unit Proposed Action and the Uintah Unit Proposed Action, which is discussed in the Uintah Unit Draft EIS.

3.18.6.3 Cow Canyon Alternative

3.18.6.3.1 High Mountain Lakes. Impacts from stabilizing high mountain lakes would be the same as described for the Proposed Action.

3.18.6.3.2 Adjacent Project Features. Of all the project features within the Upalco Unit, the proposed Upper Yellowstone Reservoir would be the closest reservoir to the HUW. During construction, noise levels would be elevated above background levels, potentially causing a slight impact on wilderness area users and animals. No noise impacts would exist during operation of the reservoir. In addition, some air quality impacts may occur from fugitive dust emissions during dam construction. However, these slightly elevated emissions would not be expected to reach or impact the wilderness area. Since the reservoir would be downstream of the wilderness boundary, there would be no impacts on water quality in the wilderness area.

3.18.6.3.3 Total Impacts. No significant impacts on the wilderness are anticipated as a result of high mountain lakes stabilization and construction of Upper Yellowstone Reservoir. There would be some temporary noise increase during reservoir construction and lakes stabilization.

3.18.6.3.4 Mitigation. All FS guidelines and standards for the management of wilderness areas would be met during stabilization of the high mountain lakes. During construction of Upper Yellowstone Reservoir, noise mitigation measures described in Section 3.22 Noise would be used to minimize impacts on the HUW.

3.18.6.3.5 Unavoidable Adverse Impacts. Construction of Upper Yellowstone Reservoir would slightly elevate noise above background levels. However, construction would be of short duration.

3.18.6.3.6 Cumulative Impacts. No significant cumulative impacts on the HUW would occur as a result of implementing this alternative and the Uintah Unit Proposed Action.

3.18.6.4 Crystal Ranch Alternative

3.18.6.4.1 High Mountain Lakes. Impacts from stabilizing high mountain lakes would be the same as described for the Proposed Action.

3.18.6.4.2 Adjacent Project Features. No impacts would be expected from constructing and operating Crystal Ranch Reservoir.

3.18.6.4.3 Total Impacts. No significant impacts on the wilderness are anticipated as a result of high mountain lakes stabilization and construction of Crystal Ranch Reservoir. There would be some temporary noise increase during high mountain lakes stabilization.

3.18.6.4.4 Mitigation. All FS guidelines and standards for the management of wilderness areas would be met during stabilization of the high mountain lakes.

3.18.6.4.5 Unavoidable Adverse Impacts. There would be no unavoidable adverse impacts on the HUW from implementation of this alternative.

3.18.6.4.6 Cumulative Impacts. No significant cumulative impacts on the HUW would occur as a result of implementing this alternative and the Uintah Unit Proposed Action.

3.18.6.5 Twin Pots Alternative

3.18.6.5.1 High Mountain Lakes. Impacts from stabilizing high mountain lakes would be the same as described for the Proposed Action, although 14 rather than 10 lakes would be stabilized.

3.18.6.5.2 Adjacent Project Features. There are no project features adjacent to the HUW under the Twin Pots Alternative.

3.18.6.5.3 Total Impacts. No significant impacts on the wilderness are anticipated as a result of high mountain lakes stabilization and other project features included in this alternative. There would be some temporary noise increase during high mountain lakes stabilization.

3.18.6.5.4 Mitigation. All FS guidelines and standards for the management of wilderness areas would be met during stabilization of the high mountain lakes.

3.18.6.5.5 Unavoidable Adverse Impacts. No unavoidable adverse impacts on the HUW are expected under the Twin Pots Alternative.

3.18.6.5.6 Cumulative Impacts. No significant cumulative impacts on wilderness would occur as a result of implementing this alternative and the Uintah Unit Proposed Action.

3.18.6.6 No Action Alternative

Under the No Action Alternative, high mountain lakes in the HUW would not be stabilized. The lakes would continue to be used for irrigation storage with humans controlling the outlets. As such, human intervention in the wilderness area would continue, a situation that is incompatible with the goals of the 1964 Wilderness Act and the goals of the Roosevelt Ranger District for management of the HUW. Impacts of the No Action Alternative would not be expected to differ significantly from existing conditions.

3.19 Visual Resources

3.19.1 Introduction

This section addresses potential direct, indirect, total, and cumulative impacts on visual quality resulting from implementing the Proposed Action and alternatives of the Upalco Unit. The current visual quality of proposed project feature sites and the potential project-associated impacts on visual quality are assessed using the visual quality evaluation system developed by the FS.

3.19.2 Issues Eliminated from Further Analysis

No visual quality issues or concerns were identified during public scoping.

3.19.3 Issues Addressed in the Impact Analysis

The following visual quality issues are addressed:

1. Compliance with FS Visual Quality Objectives (VQOs) in the Ashley National Forest (ANF)
2. Project effects on visually important landmarks and other features outside the ANF, particularly on Tribal lands (using the visual quality assessment system employed by the FS)

3.19.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the project feature sites and immediately adjacent areas for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

3.19.5 Affected Environment

3.19.5.1 Proposed Action–Talmage

3.19.5.1.1 High Mountain Lakes. High mountain lakes in the HUW have a VQO of preservation, which provides for ecological change only. In other words, the lakes have high scenic value, and management activities of any type should be minimal and unnoticeable.

3.19.5.1.2 Dam and Reservoir Sites. The characteristic landscape of the Crystal Ranch Reservoir site is a basin floor surrounded by steep hills. Because many recreational and management facilities are nearby, there is frequent traffic to the area and the sensitivity level is quite high. The VQOs for the area call for retention and partial retention of the landscape character. Retention generally means human activities are not evident to the casual visitor while partial retention generally means human activities may be evident but must remain subordinate to the characteristic landscape.

Land around Big Sand Wash Reservoir is mostly flat and undulating, and long distances can be viewed. The FS VQO is for modification of the landscape character in the area. Modification means human activities may dominate the characteristic landscape but must, at the same time, use naturally established form as a natural occurrence when viewed in the foreground and middleground.

3.19.5.1.3 River Corridors. The FS VQOs are retention and partial retention along the Yellowstone River, partial retention downstream along the Lake Fork River, and modification near the Big Sand Wash Reservoir area. After leaving the Ashley National Forest (ANF), access to the Yellowstone River is limited until its confluence with the Lake Fork River. From that point downstream, many roads provide close access to the Lake Fork River. As the roads and rivers run south, intrusions by man-made elements in the landscape are increasingly evident, and viewers become desensitized to alterations in the scenery. Hence, the sensitivity level varies from high to average to low as one moves south.

3.19.5.1.4 Diversion Dam, Canal, and Pipeline Sites. The FS VQOs along the Yellowstone and Lake Fork Rivers where diversion dam construction or replacement would occur are for partial retention or modification of the landscape character. For areas where canal rehabilitation would occur, the FS VQO are partial retention and modification. The FS VQO for the proposed Big Sand Wash Pipeline corridor is modification.

3.19.5.1.5 Fish and Wildlife Enhancement and Recreation Developments. The FS VQOs at those recreation development and fish and wildlife enhancement sites in the High Uintas foothills and close to the Lake Fork or Yellowstone Rivers call for retention and partial retention of the natural landscape. The vegetative patterns and landforms of Twin Pots Reservoir are very similar to those of the Crystal Ranch Reservoir site and are classified under the VQO of retention. The FS VQOs for the rest of these sites call for partial retention of the landscape character.

3.19.5.1.6 Land Retirement. The VQOs for proposed land retirement sites are for partial retention or modification of the landscape.

3.19.5.2 Cow Canyon Alternative

Visual quality at high mountain lakes, along river corridors, and at diversion dam, pipeline, and land retirement sites is the same as described for the Proposed Action (see Section 3.19.5.1).

3.19.5.2.1 Dam and Reservoir Sites. While the Upper Yellowstone Reservoir site is farther north on the Yellowstone River than the Crystal Ranch Reservoir site (included in the Proposed Action), the visual quality assessment for the two areas is generally similar (see Section 3.19.5.1.2). The FS VQO at the Upper Yellowstone Reservoir site is retention. The visual quality assessment for the Big Sand Wash Reservoir area is also described in Section 3.19.5.1.2.

3.19.5.2.2 Fish and Wildlife Enhancement and Recreation Developments. Fish and wildlife enhancement and recreation development sites are all in the High Uintas foothills or close to the Lake Fork or Yellowstone Rivers. The FS VQOs in these areas call for retention and partial retention of the natural landscape.

3.19.5.3 Crystal Ranch Alternative

Visual quality at project feature sites associated with this alternative is the same as described for the Proposed Action (see Section 3.19.5.1).

3.19.5.4 Twin Pots Alternative

Visual quality at dam and reservoir sites, along river corridors, and at fish and wildlife enhancement, recreation development sites associated with this alternative is described under the Proposed Action (see Section 3.19.5.1).

3.19.5.4.1 High Mountain Lakes. Under this alternative, 14 high mountain lakes would be stabilized, 10 of which are the same as under the Proposed Action. Visual quality at the 4 additional lakes (preservation) is the same as at the other 10 (see Section 3.19.5.1.1).

3.19.5.4.2 Diversion Dam, Canal, and Pipeline Sites. The FS VQO for the area potentially affected by the Lake Fork-Yellowstone Diversion Dam and Pipeline ranges from retention to partial retention. A visual quality assessment of other areas affected by the diversion dam, canal, and pipeline features of this alternative is presented in Section 3.19.5.1.4.

3.19.6 Impact Analysis

3.19.6.1 Significance Criteria

Potential impacts on visual quality are considered significant if any of the following conditions exist:

For sites on the ANF and on Tribal land, resulting alterations would exceed the minimum standards of the VQO in the affected area.

Significant impacts on visual quality predicted to occur as a result of implementing the Proposed Action or alternatives include the following:

Some exceedance of FS VQOs on the ANF and on Tribal land primarily because of the proposed construction and operation of dams on the Yellowstone River (Proposed Action, Cow Canyon Alternative, Crystal Ranch Alternative)

3.19.6.2 Potential Impacts Eliminated from Further Analysis

Potential impacts on visual quality from the construction and operation of the following project features were eliminated from further analysis because they would not be located on the ANF or Tribal land or would not have significant impacts on the visual resources of the area of influence:

1. Stabilization of high mountain lakes (vegetation would reclaim exposed shoreline areas)

2. Big Sand Wash Reservoir enlargement

3. New pipelines (except for Lake Fork-Yellowstone)

4. Fish and wildlife enhancements (except Clay Basin Pond)

5. Elimination and replacement of diversion dams

6. Bridge and Swift Creek Campground improvements

7. Rehabilitation of canals

8. Fish Creek Trail improvement

9. Land retirement

3.19.6.3 Proposed Action–Talmage

3.19.6.3.1 Dams and Reservoirs. Alterations to visual quality as a result of construction and operation of Crystal Ranch Dam and Reservoir would exceed the limits of the VQOs of retention and partial retention in the affected area. While construction-associated structures and facilities would be temporary, they would be highly visible during construction and would detract from the natural scenic quality of the area during that time. Following completion of dam construction, most of these alterations would be covered by water as the reservoir fills. In addition, if soil conditions remain the same, native brush should revegetate the impacted areas above the reservoir water line.

Permanent structures that include the dam, control tower, and spillway would be dominant and highly visible features, contrasting sharply with the surrounding vegetated topography. The dam's significant visual impact would exceed the area's VQO, which requires management activities to be visually subordinate to the existing landscape.

When full, Crystal Ranch Reservoir would represent a major enhancement to the scenic quality of the area. However, because of reservoir fluctuation, unsightly mud flats would appear along the water's edge, particularly in late summer. The native ground vegetation is neither high enough nor dense enough to shield this effect. The mud flats would be highly visible to individuals and would exceed the area's VQO.

3.19.6.3.2 Fish and Wildlife Enhancement and Recreation Developments. Improvements and development at Crystal Ranch Campground would not meet the VQO of retention for this area since the addition of campsites, toilets, and roads would be visually evident during and after construction. In addition, proposed fencing at Clay Basin pond, although partially offset by elimination of some roads, would be visually evident and exceed that area's VQO of partial retention.

While structures and facilities associated with construction work at Twin Pots Reservoir would be temporary, they would be highly visible and would detract from the natural scenic quality of the area during the construction period. Following completion of dam construction, most of these alterations would be covered by the reservoir. In addition, if soil conditions remain the same, native brush should revegetate the impacted areas above the reservoir water line.

No long-term adverse impacts on visual quality are anticipated because a dam already exists at the Twin Pots site. In fact, stabilization of water levels should reduce the seasonal exposure of mud from drawdown and enhance the area's visual quality.

3.19.6.3.3 Total Impacts. Crystal Ranch Dam would be comprised of highly visible and accessible structures. The embankment, control tower, and spillway would have the most significant visual impact of all features comprising this alternative because they would dominate a landscape with few existing man-made structures. The intimate scale of the dense conifer and aspen woods surrounding the proposed dam and reservoir sites would be replaced by a large lake during winter and spring, but by large areas of mud in late summer and fall. Both situations present focalizing elements that would not be overlooked by the average observer.

Although some of the landscape alterations that would accompany implementation of the Proposed Action would change the landform variety classifications and viewer sensitivity ratings of the areas being developed, overall VQO classifications of the project sites are unlikely to change as a result.

3.19.6.3.4 Mitigation. The visual quality impacts of Crystal Ranch Reservoir would be mitigated by grading and restoring vegetation in exposed borrow areas and other areas disturbed by construction that would not be inundated. Areas disturbed by pipeline placement and other construction work that may have an adverse impact on visual quality would be revegetated.

3.19.6.3.5 Unavoidable Adverse Impacts. Despite the proposed mitigation measures, neither the strong contrast of Crystal Ranch Dam to the area's natural landscape nor the creation of unsightly mud flats from reservoir drawdown would be fully mitigated. These impacts would therefore represent unavoidable adverse impacts on the visual quality of the project's area of influence.

3.19.6.4 Cow Canyon Alternative

3.19.6.4.1 Dams and Reservoirs. Alterations to visual quality as a result of construction and operation of Upper Yellowstone Dam and Reservoir would exceed the limits of the VQO of retention in this area. Permanent structures that include the dam, control tower, and spillway would be highly visible as a man-made modification and would detract from the natural scenic quality of the area. Once the dam is operational, the reservoir would inundate much of the adverse visual effects caused by construction activities. Visual quality impacts associated with operation of Upper Yellowstone Dam would be similar to those predicted to occur at the Crystal Ranch Dam site (see Section 3.19.6.3.1 for a more detailed description).

3.19.6.4.2 Total Impacts. Total impacts would be the same as described for the Proposed Action except that impacts would result from Upper Yellowstone Dam and Reservoir—not Crystal Ranch Dam and Reservoir (see Section 3.19.6.3.3).

3.19.6.4.3 Mitigation. Mitigation measures would be the same as described for the Proposed Action (see Section 3.19.6.3.4).

3.19.6.4.4 Unavoidable Adverse Impacts. Unavoidable adverse impacts would be the same as described for the Proposed Action (see Section 3.19.6.3.5).

3.19.6.5 Crystal Ranch Alternative

Impacts on visual quality at the Crystal Ranch Dam site and at fish and wildlife enhancement and recreation development sites would be the same as described for the Proposed Action (see Section 3.19.6.3).

3.19.6.5.1 Total Impacts. Total impacts on visual quality under the Crystal Ranch Alternative would ostensibly be the same as those of the Proposed Action (see Section 3.19.6.3.3).

3.19.6.5.2 Mitigation. Mitigation measures would be the same as described for the Proposed Action (see Section 3.19.6.3.4).

3.19.6.5.3 Unavoidable Adverse Impacts. Unavoidable adverse impacts would be the same as described for the Proposed Action (see Section 3.19.6.3.5).

3.19.6.6 Twin Pots Alternative

3.19.6.6.1 Pipeline Construction. During construction of a new diversion for the Lake Fork-Yellowstone Pipeline and the pipeline itself, the affected area's VQOs of retention and partial retention would be exceeded. Construction activities would require clearances for heavy equipment and staging areas, which would create strong contrasts to the natural landscape. Because the new pipeline would be underground, the potential visual impacts would mostly be temporary.

3.19.6.6.2 Fish and Wildlife Enhancement and Recreation Developments. Visual quality impacts for these project features were described under the Proposed Action (see Section 3.19.6.3.2).

3.19.6.6.3 Total Impacts. Potential visual quality impacts of this alternative would primarily be temporary, occurring during project construction. Following construction, the minimal impact of project features on the area's visual quality would not result in a change in VQO classification.

3.19.6.6.4 Mitigation. Mitigation measures would be the same as described for the Proposed Action (see Section 3.19.6.3.4).

3.19.6.6.5 Unavoidable Adverse Impacts. No significant unavoidable adverse impacts on visual quality would be associated with the Twin Pots Alternative.

3.19.6.7 No Action Alternative

Potential impacts of implementing the No Action Alternative include general adverse visual quality impacts from the continued degradation of man-made features that may be rehabilitated under the action alternatives. The visual quality of the potentially affected high mountain lakes and sites proposed for reservoirs and pipeline construction would not change from their current status under the No Action Alternative.

3.19.7 Cumulative Impacts

There would be no cumulative visual quality impacts anticipated from construction and operation of the Upalco and Uintah Unit projects because of the site-specific nature of potential visual quality impacts.

3.20 Mineral and Energy Resources

3.20.1 Introduction

This section addresses potential impacts on mineral and energy resources resulting from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit. The analysis focuses on potential direct, indirect, total, and cumulative impacts on existing or planned oil and gas wells, mines, and hydroelectric facilities, and on known undeveloped concentrations of mineral resources. Mitigation measures are identified that would minimize or avoid impacts.

3.20.2 Issues Eliminated from Further Analysis

All mineral or energy resource issues identified during public scoping were analyzed. None were eliminated.

3.20.3 Issues Addressed in the Impact Analysis

Issues addressed in the impact analysis include the following:

1. The project's effect on the existing and future production of mineral or energy resources in the area of influence

3.20.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the project feature sites for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

The Uinta Basin covers approximately 23,000 square miles and is the second largest basin in Utah. It contains one of the world's largest storehouses of energy resources. The Uinta Basin is unique for its varied minerals and extensive resources of hydrocarbons, bitumen, and fossil fuels. Gilsonite, tar sands, oil shale, and coal are found in abundance within Cretaceous and Tertiary sedimentary rocks.

3.20.5 Affected Environment

3.20.5.1 Proposed Action–Talmage

3.20.5.1.1 High Mountain Lakes. The 10 high mountain lakes proposed for stabilization lie within the HUW. Mineral extraction is generally not an allowable use in a wilderness area. As such, there are no oil wells, gas wells, mines, or hydroelectric facilities near these high mountain lakes.

3.20.5.1.2 Dams and Reservoirs. The Crystal Ranch Reservoir site does not lie above a major gas or oil reserve. There are no known oil or gas wells in the vicinity of the reservoir site. However, Big Sand Wash Reservoir lies above a major oil production field–the Greater Altamont-Bluebell field. Over 123 million barrels of oil have been produced from the Bluebell field since it was discovered in 1948. Data from the early 1990s indicate there are approximately 300 active wells in the field. More oil has been produced from the Bluebell field than from any other field in the Uinta Basin and it ranks third statewide in the amount of oil produced. There are seven oil wells within a half-mile radius of the existing Big Sand Wash Reservoir. There is also a small hydroelectric plant at the upstream end of Big Sand Wash Reservoir.

3.20.5.1.3 River Corridors. The Yellowstone River and Lake Fork River corridors pass through the Greater Altamont-Bluebell oil field area.

3.20.5.1.4 Other Project Features. There are no known mineral or energy resources at the proposed locations of other project features, including diversion dams, canal rehabilitation, pipelines, fish and wildlife enhancements, recreation developments, and land retirement.

3.20.5.2 Cow Canyon Alternative

3.20.5.2.1 High Mountain Lakes. The affected environment is the same as described for the Proposed Action.

3.20.5.2.2 Dams and Reservoirs. The Upper Yellowstone Reservoir site does not lie above a known oil or gas reserve, and there are no known oil or gas wells in the vicinity. The Big Sand Wash Reservoir site is the same as described for the Proposed Action.

3.20.5.2.3 River Corridors. The diversion dam for the Yellowstone Hydroelectric Power Plant is within the Upper Yellowstone Reservoir site. The power plant is well downstream of the Upper Yellowstone Dam site and would not be affected.

3.20.5.2.4 Other Project Features. There are no known mineral or energy resources at the proposed locations of other project features, including diversion dams, pipelines, fish and wildlife enhancements, recreation developments, and land retirement.

3.20.5.3 Crystal Ranch Alternative

3.20.5.3.1 High Mountain Lakes. The affected environment is the same as described for the Proposed Action.

3.20.5.3.2 Dams and Reservoirs. The affected environment at the Crystal Ranch Reservoir site is the same as described for the Proposed Action. Big Sand Wash Reservoir would not be enlarged under this alternative.

3.20.5.3.3 River Corridors. The affected environment is the same as described for the Yellowstone River under the Proposed Action.

3.20.5.3.4 Other Project Features. There are no known mineral or energy resources at the proposed locations of other project features, including diversion dams, canal rehabilitation, pipelines, fish and wildlife enhancements, recreation developments, and land retirement.

3.20.5.4 Twin Pots Alternative

3.20.5.4.1 High Mountain Lakes. The description of mineral and energy resources in the HUW presented for the Proposed Action also applies to the 14 high mountain lakes proposed for stabilization under this alternative.

3.20.5.4.2 Dams and Reservoirs. The affected environment at Big Sand Wash Reservoir is the same as described for the Proposed Action.

3.20.5.4.3 River Corridors. River corridors would not be affected since no main stem reservoirs are proposed under this alternative.

3.20.5.4.4 Other Project Features. There are no known mineral or energy resources at the proposed locations of other project features, including diversion dams, canal rehabilitation, pipelines, fish and wildlife enhancements, and land retirement.

3.20.6 Impact Analysis

3.20.6.1 Significance Criteria

Potential impacts on mineral and energy resources are considered significant if the following conditions exist:

1. Project implementation results in an activity that disturbs an existing oil well, pipeline, or mineral resource area such that the disturbance affects the current or future operation of the source.

2. Project implementation results in any decrease in the production of the Yellowstone Hydroelectric Power Plant on the Yellowstone River.

3. Other known, but undeveloped, mineral and energy resources are precluded from recovery because of project implementation.

There would be a significant impact on energy resources under the Cow Canyon Alternative from decommissioning the Yellowstone Hydroelectric Power Plant.

3.20.6.2 Potential Impacts Eliminated from Further Analysis

There are no known mineral or energy resources at the proposed locations of the following project features: diversion dams, canal rehabilitation, pipelines, fish and wildlife enhancements, recreation developments, and land retirement. Therefore, no impacts on mineral or energy resources would be expected for these project features and they are not discussed below.

3.20.6.3 Proposed Action—Talmage

The following impact assessment is based on the locations of known mineral and energy resources and project features, and on the potential for impacting the production of developed resources or the recovery of known undeveloped resources.

3.20.6.3.1 High Mountain Lakes. The Proposed Action would not adversely impact the development or operation of mineral and energy resource recovery since such activity is generally not permitted in a wilderness area. Future development of such resources would be incompatible with the goals of the FS for the HUW.

3.20.6.3.2 Dams and Reservoirs. Construction and operation of Crystal Ranch Reservoir would not adversely impact mineral or energy resources since there are no known major resources in the area. Enlargement of Big Sand Wash Reservoir would not impact existing oil wells in the vicinity. No adverse impacts on current or future production of mineral resources are anticipated. The existing hydroelectric power plant at Big Sand Wash Reservoir would be relocated. The plant currently generates 600,000 kilowatt hours per year and the new plant would increase the opportunity for energy production.

3.20.6.3.3 River Corridors. Mineral and energy resources along river corridors would not be impacted by project features.

3.20.6.3.4 Total Impacts. There would be no adverse impacts on known mineral and energy resources resulting from construction, operation, and maintenance activities associated with all of the project features for the Proposed Action. No known oil or gas wells would be taken out of production.

3.20.6.3.5 Mitigation. No mitigation measures would be required since there would be no adverse impacts.

3.20.6.3.6 Unavoidable Adverse Impacts. There would be no unavoidable adverse impacts.

3.20.6.3.7 Cumulative Impacts. Cumulative impacts from implementation of the Upalco Unit Proposed Action and the Uintah Unit Proposed Action, which is described in the Uintah Unit Draft EIS, would include decommissioning of the Uintah Hydroelectric Power Plant on the Uinta River.

3.20.6.4 Cow Canyon Alternative

3.20.6.4.1 High Mountain Lakes. There would be no impacts on mineral and energy resources.

3.20.6.4.2 Dams and Reservoirs. Upper Yellowstone Reservoir would inundate the Yellowstone Hydroelectric Power Plant diversion dam. The diversion dam and 900-kW power plant would be purchased, decommissioned, and water previously diverted to the power plant would be left in the Yellowstone Reservoir. Construction and operation of Upper Yellowstone Dam and Reservoir would not adversely impact other mineral or energy resources. Impacts of enlarging Big Sand Wash Reservoir would be the same as described for the Proposed Action.

3.20.6.4.3 River Corridors. No other mineral and energy resources along river corridors would be impacted by project features.

3.20.6.4.4 Total Impacts. Adverse impacts on known mineral and energy resources resulting from construction, operation, and maintenance activities associated with the Cow Canyon Alternative would include the decommissioning of the Yellowstone Hydroelectric Power Plant. No known oil or gas wells would be taken out of production.

3.20.6.4.5 Mitigation. The Moon Lake Electric Company would be compensated monetarily for the decommissioning of the Yellowstone Hydroelectric Power Plant.

3.20.6.4.6 Unavoidable Adverse Impacts. These would include the decommissioning of the Yellowstone Hydroelectric Power Plant.

3.20.6.4.7 Cumulative Impacts. Cumulative impacts from implementation of this alternative and the Uintah Unit Proposed Action would include the decommissioning of the Yellowstone and Uintah Hydroelectric Power Plants.

3.20.6.5 Crystal Ranch Alternative

3.20.6.5.1 Total Impacts. There would be no adverse impacts on mineral and energy resources resulting from construction, operation, and maintenance of any of the Crystal Ranch Alternative project features. No known oil or gas wells would be taken out of production.

3.20.6.5.2 Mitigation. No mitigation measures would be required since there would be no adverse impacts.

3.20.6.5.3 Unavoidable Adverse Impacts. There would be no unavoidable adverse impacts.

3.20.6.5.4 Cumulative Impacts. Cumulative impacts from implementation of this alternative and the Uintah Unit Proposed Action would include the decommissioning of the Uintah Hydroelectric Power Plant on the Uinta River.

3.20.6.6 Twin Pots Alternative

3.20.6.6.1 Total Impacts. There would be no adverse impacts on known mineral and energy resources resulting from construction, operation, and maintenance of any of the Twin Pots Alternative project features except for Big Sand Wash Reservoir enlargement, which was described under the Proposed Action. No known oil or gas wells would be taken out of production.

3.20.6.6.2 Mitigation. No mitigation measures would be required since there would be no adverse impacts.

3.20.6.6.3 Unavoidable Adverse Impacts. There would be no unavoidable adverse impacts.

3.20.6.6.4 Cumulative Impacts. Cumulative impacts from implementation of the Twin Pots Alternative and the Uintah Unit Proposed Action would include the decommissioning of the Uintah Hydroelectric Power Plant on the Uinta River.

3.20.6.7 No Action Alternative

The No Action Alternative would have no project-related impacts on mineral and energy resources. Impacts of the No Action Alternative would not differ significantly from existing conditions.

3.21 Air Quality

3.21.1 Introduction

This section addresses potential impacts on air quality and its related values resulting from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit. The analysis focuses on the applicability of regulations promulgated to protect the health, welfare, and environmental quality of the residents, wildlife, vegetation, and protected environments of the project area and on the potential for exceeding federal, state, and local air quality standards. Standards are based on the Clean Air Act, the Utah State Implementation Plan, and the requirements of the Ute Tribe Air Quality Management.

The Utah Air Conservation Act and the rules adopted by the Air Quality Board constitute the basis for control of air pollution sources in the state. These rules apply and are enforced throughout the state, and are recommended for adoption in local jurisdictions where environmental specialists are available to cooperate in implementation.

National Ambient Air Quality Standards (NAAQS), New Source Performance Standards (NSPS) for major stationary sources, Prevention of Significant Deterioration (PSD) standards for air quality, and the National Emission Standards for Hazardous Air Pollutants (NESHAP) apply throughout the nation and are legally enforceable in Utah (Utah Air Conservation Rules, R307-1-1 Foreword and Definitions).

Mitigation measures are identified that would minimize or avoid adverse impacts or are required by applicable regulations.

3.21.2 Issues Eliminated from Further Analysis

Emissions associated with the project would be limited to those generated during construction of water storage and conveyance structures. Primary pollutants would be particulate matter from open burning during land-clearing operations and fugitive dust from earth-moving activities. In addition, none of the construction activities would result in remedial action of any hazardous waste activity. Under the criteria established in the Clean Air Act, EPA regulations and the State of Utah statute and regulations, these emission sources do not meet the criteria designation as a major stationary source. As a result, construction of project features would not be subject to NSPS, PSD, or NESHAP requirements (Utah Air Conservation Rules, R307-1-1 Foreword and Definitions, "Major Modification" and "Major Source"). Completion of the Proposed Action or alternatives would not result in the construction, modification, or operation of a major air pollution source for either criteria or hazardous air pollutants.

Project construction activities would occur within 50 miles of the HUW. However, this wilderness area is classified as a Class II PSD area. Therefore, the only requirement is that completion of the project would not exceed the Class II increments for PM_{10} (particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers). Other air quality related values, including visibility impairment (Utah Air Conservation Rules, R307-1-3.6.10 Visibility, R307-1-3.6.1 Prevention of Significant Deterioration of Air Quality [PSD]), would not affect project construction or operation. Therefore, visibility impact analysis is not a requirement for assessing the environmental impact of the Proposed Action or alternatives on the HUW.

3.21.3 Issues Addressed in the Impact Analysis

Any source constructed or modified in a PSD area must meet all applicable requirements of the Utah Air Conservation Rules and the Utah State Implementation Plan. A proposed source or modification that is not a major source or major modification may be approved without meeting the requirements for "Major Source and Major Modification Review," provided the source meets all other applicable requirements of the rules (Utah Air Conservation Rules, R307-1-3.6.5 PSD Areas – New Sources and Modifications).

The primary air quality requirement is that the project must not exceed the NAAQS for particulate matter. The standards for particulate matter, expressed as micrograms per cubic meter ($\mu g/m^3$), are as follows:

150 $\mu g/m^3$ (24-hour)
50 $\mu g/m^3$ (Annual Arithmetic Average)

For the purposes of determining the attainment status of the standards, particulate matter is measured in the ambient air as PM_{10} (40 CFR 50.6 National Primary and Secondary Ambient Air Quality Standards for Particulate Matter).

In addition to the NAAQS requirement, project operation and maintenance must not exceed the PSD increments for particulate in a Class II area. Increases in PM_{10} concentration over baseline concentration shall be limited to the following:

30 $\mu g/m^3$ (24-hour)
17 $\mu g/m^3$ (Annual Arithmetic Average)
(40 CFR 52.21 Prevention of Significant Deterioration of Air Quality)

The two air conservation rules that affect the project are related to construction activities. Fugitive dust and open burning emissions are regulated by the rules. Fugitive dust from the storage and handling of aggregate materials, construction and demolition activities, and construction or maintenance of roadways associated with the project must comply with specific mitigation measures associated with these activities (Utah Air Conservation Rules, R307-1-4.5 Fugitive Emissions and Fugitive Dust).

Open burning for the purpose of clearing vegetation for construction is regulated under the burning provisions of the rules requiring approval of the Executive Secretary of the Air Quality Board (Utah Air Conservation Rules, R307-1-2.4.5 Special Conditions).

3.21.4 Description of Area of Influence

Air quality does not recognize physical boundaries as do streams or water impoundments. Air quality is influenced by air basins that are generally affected by area features, including mountains, valleys, watersheds, soils, vegetation, and large water bodies. For the purposes of this analysis, the area of influence is the entire Uinta Basin and includes both the Upalco and Uintah Units. Both units are shown on Map 1-1 in Chapter 1.

3.21.5 Affected Environment

Review of the meteorological parameters measured at the Whiterocks Air Monitoring Station indicates that more than 90 percent of the time the project activities would be downwind of the HUW, the most air quality sensitive area. The few instances that the wind blows from the proposed project activity areas toward the wilderness area are coincidental to precipitation events in the winter season, when little construction would be underway.

Particulate matter is also measured at the Whiterocks Air Monitoring Station. Table 3.21-1 presents a summary of the air quality data. These data were collected in accordance with the methods for total suspended particulates (TSP), which includes particulate matter greater than 10 micrometers in size. As a result, the annual average is expressed as a geometric mean because of the mass weight characteristics of particles. However, as a worst-case scenario, if it is assumed that all particulate matter collected was PM_{10}, the arithmetic average would represent the annual average. Data indicate that the present air quality is well below the NAAQS annual (50 $\mu g/m^3$) and 24-hour (150 $\mu g/m^3$) levels.

3.21.5.1 Proposed Action–Talmage, Cow Canyon Alternative, Crystal Ranch Alternative, and Twin Pots Alternative

Data presented in Table 3.21-1 are representative of the air quality present in the areas that would be affected by the Proposed Action and alternatives.

3.21.6 Impact Analysis

3.21.6.1 Significance Criteria

Potential impacts on air quality would be considered significant if the following conditions exist:

1. The NAAQS and/or the Utah ambient air quality standards are exceeded during construction of the project
2. The NAAQS and/or the Utah ambient air quality standards are exceeded during operation and maintenance of the project
3. The PSD increments are exceeded during operation and maintenance of the project

There would be no significant impacts on air quality as a result of implementing the Proposed Action or alternatives.

Table 3.21-1
Whiterocks Total Suspended Particulates (TSP) Measurements (1992-1994)

Year	Geometric Mean	Arithmetic Mean	Highest Value	Second Highest Value
1992	8	10	23	22
1993	9	12	36	34
1994	9	12	39	35

3.21.6.2 Potential Impacts Eliminated from Further Analysis

As described in Section 3.21.2, the following potential impacts have been eliminated from further analysis: PSD increment impacts during project construction and visibility impacts during project construction, operation, and maintenance.

3.21.6.3 Proposed Action–Talmage

3.21.6.3.1 High Mountain Lakes. Stabilization of the 10 high mountain lakes would occur in the HUW. The minimum tools concept would be used at nine lakes and result in no significant air quality impact. The motorized/mechanized tools approach would be used at East Timothy Lake and also result in no significant air quality impact because of the small area that would be disturbed during this activity. Since stabilization would return these lakes to their natural state, there would be no air quality impact upon completion.

3.21.6.3.2 Dams and Reservoirs. The Proposed Action would include construction of Crystal Ranch Dam and Reservoir and enlargement of Big Sand Wash Dam and Reservoir. Fugitive dust would be emitted during the following construction activities at Crystal Ranch and Big Sand Wash Dam and Reservoir sites:

- Constructing temporary haul roads
- Preparing borrow areas for material extraction and processing
- Operating rock crushers and sorters in staging or borrow areas for aggregate sizing
- Operating a batch plant for roller compacted concrete (RCC) processing in staging areas (Big Sand Wash only)
- Constructing and using settling ponds for cleaning fines from crushed aggregate
- Stockpiling and mixing aggregate in staging areas
- Placing additional earth fill on the existing dam and combined east dikes (Big Sand Wash only)
- Excavating the existing west dike and replacing it with RCC (Big Sand Wash only)
- Excavating the dam foundation and installing a cutoff trench and drainage system (Crystal Ranch only)
- Constructing an earth and rock fill dam (Crystal Ranch only)
- Constructing the outlet works

Mitigation measures to protect air quality are included as part of the project design and are therefore considered in the analysis of impacts of project features. Based on the mitigation measures in Section 3.21.6.3.5, there would be no significant air quality impacts during construction activities. In addition, no significant air quality impacts would result from the operation and maintenance of Crystal Ranch and Big Sand Wash Reservoirs.

3.21.6.3.3 Other Project Features. There would be no significant air quality impacts associated with construction along river corridors or at sites of other project features, including diversion dam and canal rehabilitation, new pipelines, fish and wildlife enhancements, recreation developments, and land retirement.

3.21.6.3.4 Total Impacts. Fugitive dust would be emitted during construction of project structures, operation of vehicles, and during burning operations to clear vegetation. Based on the extent and duration of planned construction activities, and the implementation of required mitigation measures, it is anticipated that no significant ambient air impact would occur as a result of the Proposed Action. There would be no significant impacts on air quality during the operation and maintenance of Proposed Action project features.

3.21.6.3.5 Mitigation. Mitigation measures that would be implemented to control dust during construction are required by the Utah Air

Conservation Rules. Fugitive dust requirements are regulated under Section 4.5 Fugitive Emissions and Fugitive Dust of the Code. These regulations cover the following activities:

- Storage and handling of aggregate materials
- Construction/demolition activities
- Roadways

Open burning is regulated under Section 2.4 General Burning of the Code. Requirements for burning that would occur under the Proposed Action are described under Section 2.4.4 Permissible Burning.

3.21.6.3.6 Unavoidable Adverse Impacts. There would be no significant unavoidable adverse impacts on air quality associated with activities of the Proposed Action because of implementation of the mitigation measures.

3.21.6.3.7 Cumulative Impacts. Because of the nature of the projects and the mitigation measures, there would be no significant cumulative air quality impacts resulting from the construction, operation, and maintenance of the project features of the Upalco Unit Proposed Action and the Uintah Unit Proposed Action, which is described in the Uintah Unit Draft EIS.

3.21.6.4 Cow Canyon Alternative

Air quality impacts and mitigation measures associated with the Cow Canyon Alternative would be the same as described for the Proposed Action. There would be no significant unavoidable adverse impacts, and there would be no significant cumulative air quality impacts resulting from the implementation of this alternative and the Uintah Unit Proposed Action.

3.21.6.5 Crystal Ranch Alternative

Air quality impacts and mitigation measures associated with the Crystal Ranch Alternative would be the same as described for the Proposed Action. There would be no significant unavoidable adverse impacts, and there would be no significant cumulative air quality impacts resulting from the implementation of this alternative and the Uintah Unit Proposed Action.

3.21.6.6 Twin Pots Alternative

Air quality impacts and mitigation measures associated with the Twin Pots Alternative would be the same as described for the Proposed Action. There would be no significant unavoidable adverse impacts, and there would be no significant cumulative air quality impacts resulting from the implementation of this alternative and the Uintah Unit Proposed Action.

3.21.6.7 No Action Alternative

Air quality in the project area under the No Action Alternative would be similar to existing conditions (see Section 3.21.5 Affected Environment). Future activities in the project area under this alternative would not be expected to result in significant adverse impacts on air quality.

3.22 Noise

3.22.1 Introduction

This section addresses potential noise impacts resulting from the construction, operation, and maintenance of project features associated with the Proposed Action and alternatives of the Upalco Unit. Local, state, and federal noise regulations were reviewed to determine applicability to the project and to assess potential impacts. Mitigation measures were identified when necessary.

3.22.2 Issues Eliminated from Further Analysis

All noise issues identified during public scoping were analyzed. None were eliminated.

3.22.3 Issues Addressed in the Impact Analysis

Issues addressed in the impact analysis include the following:

1. Potential temporary noise impacts related to construction

2. Potential noise impacts from postconstruction operation and maintenance

3.22.4 Description of Area of Influence

The area of influence, shown on Map 1-1 in Chapter 1, includes the Upalco Unit in northeastern Utah. Within the Upalco Unit, immediate areas of influence include the project feature sites for the Proposed Action and alternatives, which are shown on Maps 2-1, 2-11, 2-13, and 2-14 in Chapter 2.

3.22.5 Affected Environment

3.22.5.1 Proposed Action–Talmage

3.22.5.1.1 High Mountain Lakes. Noise levels in wilderness areas, where the high mountain lakes are located, vary measurably because the types of nearby activities differ. Typical noise levels in wilderness areas range between 25 and 35 decibel A-rated (dBA). However, noise levels may increase to as much as 10 to 15 dBA above these levels (e.g., near a stream or river). Within the same general areas, noise levels do not vary significantly between day and night hours.

The State of Utah has no noise regulations for wilderness areas. The FS (1986) has noise ordinances that apply strictly to recreational areas and are intended for nuisance noise control (e.g., park maintenance during heavy public use). Therefore, these ordinances would not apply to construction or postconstruction noise from the proposed project.

3.22.5.1.2 Other Project Features. Noise levels and applicable regulations described above also apply to the following project features: dams and reservoirs, diversion dams, canals, pipelines, fish and wildlife enhancements, recreation developments, and land retirement areas since these features would be located in rural or remote areas with little human activity.

3.22.5.2 Cow Canyon Alternative

Noise levels and applicable regulations in the affected environment for this alternative would be similar to the Proposed Action.

3.22.5.3 Crystal Ranch Alternative

Noise levels and applicable regulations in the affected environment for this alternative would be similar to the Proposed Action.

3.22.5.4 Twin Pots Alternative

Noise levels and applicable regulations in the affected environment for this alternative would be similar to the Proposed Action.

3.22.6 Impact Analysis

3.22.6.1 Significance Criteria

Potential impacts from noise are considered significant if the following conditions exist:

- Decibel levels during construction exceed the Occupational Safety and Health Administration (OSHA) standards for workers, specifically, a peak of 110 decibels and a time-weighted average of 90 decibels.

- Increases in postconstruction noise levels exceed the existing noise level by 10 or more decibels.

- Decibel levels during construction exceed FS guidelines for noise at campgrounds and recreation areas, as determined for each specific campground and recreation area. The FS may develop noise level guidelines for the Ashley National Forest and the various campgrounds in the project area.

- Local noise ordinances in Roosevelt and Vernal are violated. However, these ordinances exempt construction noise during the day when all project construction activities would take place.

There would be no significant noise impacts as a result of implementing the Proposed Action or alternatives, although construction activities would substantially increase noise levels.

3.22.6.2 Proposed Action–Talmage

Noise levels listed in Tables 3.22-1 through 3.22-5 are conservative. Additional attenuation would occur because of atmospheric absorption and topographic features, such as hills, that would physically block the transmission of noise waves.

3.22.6.2.1 High Mountain Lakes. Stabilization of 10 high mountain lakes would cause localized, temporary increases in noise levels during construction. Noise levels resulting from construction activities would vary because of differences in the type of equipment used, the number of concurrent activities, the distance to a particular receptor, and the intervening topographic features between construction and receptor. Nighttime noise levels normally would be unaffected because work would be limited to daylight hours.

Construction at nine of the high mountain lakes would be accomplished using the minimum tools concept described in Chapter 2. This concept involves using explosives and hand tools. All equipment would be transported to construction sites at these lakes on horseback, and no mechanized or power equipment would be used.

Blasting at the nine high mountain lakes would cause noise, as well as vibration. Impacts from blasting can range from perceptible vibrations to structural damage to buildings. The severity of the blasting noise and vibration impacts depends on the distance between the blast and the receptor, the size and number of explosives, and the geologic characteristics of the surroundings. Noise from hand tool work would not be audible beyond the immediate vicinity of construction.

Table 3.22-1 lists typical construction equipment that would be used in the motorized/mechanical tools approach at East Timothy Lake (the tenth high mountain lake) and associated noise levels. All equipment, materials, supplies, and laborers would be transported by helicopter from a site outside the wilderness area boundary to the East Timothy Lake dam site. Approximately 50 helicopter flights would be required. Flights would be made during off-peak recreation hours and as far away from trails as possible. Construction personnel operating heavy equipment or present during blasting would be required to wear hearing-protection devices to comply with OSHA significance criteria.

Once the dams are stabilized, there would be no operation or maintenance requirements, and noise levels would return to preconstruction levels. There would be no long-term noise impacts.

3.22.6.2.2 Dams and Reservoirs. The Proposed Action involves construction of Crystal Ranch Dam and Reservoir and enlargement of Big Sand Wash Dam and Reservoir. Enlargement and construction of the dams and reservoirs would cause localized, temporary increases in noise levels. There would be no long-term noise impacts from construction of the proposed dams and reservoirs. Noise levels resulting from construction activities would vary because of differences in the type of equipment used, the number of concurrent activities, the distance to a particular receptor, and the intervening topographic features between construction and receptor. Nighttime noise levels normally would be unaffected because work would be limited to daylight hours.

Table 3.22-2 lists typical construction equipment and associated noise levels for the enlargement of Big Sand Wash Dam and Reservoir.

The typical construction equipment and associated noise levels for the construction of Crystal Ranch Dam and Reservoir would be the same as shown in Table 3.22-2 plus additional noise levels from reservoir clearing and logging (Table 3.22-3).

Once construction of Crystal Ranch Dam and enlargement of Big Sand Wash Dam are completed, noise levels would return to preconstruction levels. There would be no long-term noise impacts.

Table 3.22-1 Typical Noise Levels During Construction at East Timothy Lake					
		dBA Level at Specified Distance from Equipment*			
Construction Stage	Loudest Equipment	500 Feet	1,000 Feet	2,000 Feet	1 Mile
Clearing and grading	Backhoe, loader	56	50	44	35
Earthwork	Backhoe, loader	56	50	44	35
Transportation	Helicopter	91	85	79	71

Source: U.S. Environmental Protection Agency (1971).
*Attenuation resulting from distance and foliage was assumed.

Table 3.22-2 Typical Noise Levels During Construction of Big Sand Wash Dam and Reservoir					
		dBA Level at Specified Distance from Equipment*			
Construction Stage	Loudest Equipment	500 Feet	1,000 Feet	2,000 Feet	1 Mile
Concrete preparation	Truck, mixer	62	85	56	44
Aggregate processing	Scraper, truck	64	57	51	42
Foundation grouting	Mixer, truck	62	56	50	44
Dam construction	Truck, roller, grader	64	56	52	43

Source: U.S. Environmental Protection Agency (1971).
*Attenuation resulting from distance and foliage was assumed.

Table 3.22-3 Typical Noise Levels During Construction of Crystal Ranch Dam and Reservoir					
		dBA Level at Specified Distance from Equipment*			
Construction Stage	Loudest Equipment	500 Feet	1,000 Feet	2,000 Feet	1 Mile
Logging	Truck, loader	64	58	58	44
Reservoir clearing	Bulldozers	53	47	41	33

Source: U.S. Environmental Protection Agency (1971).
*Attenuation resulting from distance and foliage was assumed.

Table 3.22-4
Typical Noise Levels During Canal Construction

Construction Stage	Loudest Equipment	dBA Level at Specified Distance from Equipment*			
		500 Feet	2,000 Feet	2,000 Feet	1 Mile
Lining	Truck, backhoe, excavator	63	57	51	42
Enlargement	Excavator	55	49	44	36
Structure rehabilitation	Excavator, backhoe	58	52	46	38

Source: U.S. Environmental Protection Agency (1971).
*Attenuation resulting from distance and foliage was assumed.

Table 3.22-5
Typical Noise Levels During Pipeline Construction

Construction Stage	Loudest Equipment	dBA Level at Specified Distance from Equipment*			
		500 Feet	1,000 Feet	2,000 Feet	1 Mile
Clearing and grading	Bulldozer, backhoe	56	50	44	36
Trenching and earthwork	Bulldozer, backhoe	56	50	44	34
Pile driving	Hammer	56	50	44	38
Positioning pipe	Crane, loader	56	48	42	34
Backfilling	Backhoe, loader	56	50	44	35

Source: U.S. Environmental Protection Agency (1971).
*Attenuation resulting from distance and foliage was assumed.

3.22.6.2.3 Diversion Dams. Construction of diversion dams would cause localized, temporary increases in noise levels.

Typical construction equipment and associated noise levels for construction of diversion dams are the same as those presented in Tables 3.22-2 and 3.22-3. Once construction of the diversion dams is completed, noise would return to preconstruction levels. There would be no long-term noise impacts.

3.22.6.2.4 Canals. The proposed lining, enlargement, and structure rehabilitation of canals would cause localized, temporary increases in noise levels. There would be no long-term noise impacts from the proposed canal rehabilitation. Table 3.22-4 lists typical canal construction equipment and associated noise levels.

3.22.6.2.5 Pipelines. Pipeline construction would cause localized, temporary increases in noise levels. Table 3.22-5 lists typical pipeline construction equipment and associated noise levels.

3.22.6.2.6 Fish and Wildlife Enhancement and Recreation Developments. Increases in noise levels can be expected from construction of these features. A trackhoe or backhoe would be used for excavation and rock placement. Noise levels for backhoes are shown in Table 3.22-5.

Increased noise levels associated with stream improvement can be expected from construction on river corridors. These noise increases would be temporary; noise would return to preconstruction levels upon completion of these activities.

3.22.6.2.7 Land Retirement. No measurable noise level increases are expected to occur from land retirement.

3.22.6.2.8 Total Impacts. No long-term noise impacts are expected under the Proposed Action. As discussed above, noise levels would increase during construction. Postconstruction operation and maintenance noise levels are expected to be no higher than preconstruction levels.

3.22.6.2.9 Mitigation. Several mitigation measures would be implemented to minimize noise during construction, including the following:

- Enforcement of OSHA noise regulations to protect construction personnel from excessive noise exposure
- Use and maintenance of low-velocity equipment, lead-shielded equipment, mufflers, and quieting devices wherever possible
- Use of stockpiles as effective noise barriers when feasible
- Scheduling of construction activities for daytime hours
- Selection of construction truck routes to minimize exposure of sensitive receptors
- Placement of stationary construction equipment as far from nearby noise-sensitive areas as possible
- Shutdown of idling equipment

Postconstruction noise levels are expected to be the same as preconstruction levels; therefore, no mitigation is required.

3.22.6.2.10 Unavoidable Adverse Impacts. Construction activities would substantially increase noise levels, but these would not be significant impacts. These increases would be short term, and noise would return to preconstruction levels on completion of construction. No unavoidable adverse impacts are expected to occur from operation and maintenance of the Proposed Action.

3.22.6.2.11 Cumulative Impacts. Noise levels would increase as a result of construction activities associated with this project and the Uintah Unit Proposed Action, which is discussed in the Uintah Unit Draft EIS. However, these increases would be temporary, and noise would return to preconstruction levels on completion of construction. Therefore, no cumulative long-term noise impacts are expected.

3.22.6.3 Cow Canyon Alternative

Noise impacts and mitigation under this alternative are expected to be similar to those described under the Proposed Action. There would be no significant unavoidable adverse noise impacts, and there would be no significant cumulative noise impacts resulting from the implementation of this alternative and the Uintah Unit Proposed Action.

3.22.6.4 Crystal Ranch Alternative

Noise impacts and mitigation under this alternative are expected to be similar to those described under the Proposed Action. There would be no significant unavoidable adverse noise impacts, and there would be no significant cumulative noise impacts resulting from the implementation of this alternative and the Uintah Unit Proposed Action.

3.22.6.5 Twin Pots Alternative

Noise impacts and mitigation under this alternative are expected to be similar to those described under the Proposed Action. There would be no significant unavoidable adverse noise impacts, and there would be no significant cumulative noise impacts resulting from the implementation of this alternative and the Uintah Unit Proposed Action.

3.22.6.6 No Action Alternative

Noise in the project area under the No Action Alternative would be similar to existing conditions (see Section 3.22.5 Affected Environment). Future activities in the project area under this alternative would not be expected to result in significant adverse noise impacts.

3.23 Irreversible and Irretrievable Commitment of Resources

3.23.1 Introduction

This section describes the irreversible and irretrievable commitment of resources and the potential for conservation that would occur under the Proposed Action and alternatives.

3.23.2 Proposed Action – Talmage

There would be no irreversible and irretrievable commitment of the following resources under the Proposed Action:

- Socioeconomics
- Water Quality and Contaminants
- Threatened and Endangered Species
- Land Use Plans Conflict
- Transportation
- Health and Safety
- Wilderness Areas
- Air Quality
- Noise

There would be an irreversible and irretrievable commitment of mineral and energy resources from construction and operation of the Proposed Action. These commitments consist of the following:

- 4,638,000 cubic yards of borrow materials from onsite borrow areas for construction of dams and access and maintenance roads

- 2,631,850 gallons of petroleum products (diesel, gasoline, and grease) for construction activities

Increased recreational traffic also would increase fuel consumption, but the amount is not readily available.

Some project area lands would be permanently encumbered because of project features (see Table 2-16 in Chapter 2). These are lands whose use would be limited by permanent acquisition such as ownership, right-of-ways, or easements. Permanently encumbered lands under the Proposed Action would total 1,851.8 acres and consist of 748.9 acres of Tribal land and 1,102.9 acres of non-Tribal land.

Funds used for construction, operation, and maintenance of the Proposed Action would be permanently committed to the project and not be available for other purposes. The estimated capital cost would be $103,851,000 and the estimated annual operation and maintenance cost would be $302,000.

Under the Proposed Action, water would be conserved because of canal rehabilitation, land retirement, and the diversion of water to more closely match crop consumptive use. These actions would increase the amount of project water available for project purposes, including irrigation, instream flows, wetland and riparian habitat preservation, and water quality improvement in the lower Lake Fork River.

There would be some additional irreversible and irretrievable commitment of resources under the Proposed Action, as follows:

- Sociocultural Resources – Inundation of 2.6 miles of the Yellowstone River by Crystal Ranch Dam and Reservoir may contradict Ute Tribe traditional beliefs regarding the flow of water.

- Agriculture – Commitments would include the permanent encumbrance of lands because of project features (acres listed above), retirement of 1,300 acres of irrigated lands, and the conversion of non-Tribal irrigated lands for mitigation.

- Water Resources and Hydrology – About 2.6 miles of the free-flowing Yellowstone River would be inundated by Crystal Ranch Dam and Reservoir.

- Aquatic Resources – Habitat and biota in 2.6 miles of the Yellowstone River would be replaced by aquatic resources associated with Crystal Ranch Reservoir. Crystal Ranch Dam would block upstream fish passage.

- Wetland and Riparian Resources – There would be a net loss of 1,429 acres of existing wetland and riparian communities following implementation of mitigation measures.

- Wildlife Resources – There would be a net loss of 1,794 AAHUs of upland and open water habitat from dam, reservoir, and canal impacts and losses of 281 acres of critical deer winter range, 190 acres of critical elk winter range, 171 acres of critical moose year-long range, and loss of 817 acres of native uplands on Tribal idle lands.

- Soils – There would be a loss of productivity on 844 acres of land because of dam and reservoir construction and/or enlargement.

- Cultural Resources – Six known properties at high mountain lakes and the Crystal Ranch Reservoir site would be adversely affected. Ute Tribe fishing areas on the Yellowstone River and adjacent lands used by deer and elk would be inundated by Crystal Ranch Dam and Reservoir.

- Recreation Resources – Recreation opportunities on or along a portion of free-flowing river would be lost with the inundation of 2.6 miles of the Yellowstone River.

- Visual Resources – Construction and operation of Crystal Ranch Reservoir, particularly during reservoir drawdown, would cause a departure from natural visual conditions.

- Mineral and Energy Resources – The irreversible and irretrievable commitment of these resources was described above.

3.23.3 Cow Canyon Alternative

There would be no irreversible and irretrievable commitment of the following resources under the Cow Canyon Alternative:

- Sociocultural Resources
- Socioeconomics
- Water Quality and Contaminants
- Threatened and Endangered Species
- Land Use Plans Conflict
- Transportation
- Health and Safety
- Wilderness Areas

- Air Quality
- Noise

The irreversible and irretrievable commitment of mineral and energy resources under the Cow Canyon Alternative would consist of the following:

- 6,780,000 cubic yards of borrow materials from onsite borrow areas for construction of dams and access and maintenance roads

- 2,844,850 gallons of petroleum products (diesel, gasoline, and grease) for construction activities

Increased recreational traffic also would increase fuel consumption, but the amount is not readily available.

Permanently encumbered lands under the Cow Canyon Alternative would total 731.6 acres and consist of 5.3 acres of Tribal land and 726.3 acres of non-Tribal land (see Table 2-22 in Chapter 2).

Funds used for construction, operation, and maintenance of the Cow Canyon Alternative would be permanently committed to the project and not be available for other purposes. The estimated capital cost would be $106,703,000 and the estimated annual operation and maintenance cost would be $285,000.

Under the Cow Canyon Alternative, water would be conserved in the same manner and be available for the same project purposes as described for the Proposed Action.

There would be some additional irreversible and irretrievable commitment of resources under the Cow Canyon Alternative, as follows:

- Agriculture—Commitments would include the permanent encumbrance of lands because of project features (acres listed above), retirement of 1,300 acres of irrigated lands, and the conversion of non-Tribal irrigated lands for mitigation.

- Water Resources and Hydrology—About 2.0 miles of the free-flowing Yellowstone River would be inundated by Upper Yellowstone Dam and Reservoir.

- Aquatic Resources—Habitat and biota in 2.0 miles of the Yellowstone River would be replaced by aquatic resources associated with Upper Yellowstone Reservoir. Upper Yellowstone Dam would block upstream fish passage.

- Wetland and Riparian Resources—There would be a net loss of 1,690 acres of wetlands.

- Wildlife Resources—There would be a net loss of 1,564 AAHUs of upland and open water habitat from dam, reservoir, and canal impacts and a loss of 361 acres of critical moose year-long range, and loss of 817 acres of native uplands on Tribal idle lands.

- Soils—There would be a loss of productivity on 643 acres of land because of dam and reservoir construction and/or enlargement.

- Cultural Resources—Five known properties at high mountain lakes and the Upper Yellowstone Reservoir site would be adversely affected.

- Recreation Resources—Recreation opportunities on or along a portion of free-flowing river would be lost with the inundation of 2.0 miles of the Yellowstone River as would the FS's Reservoir and Riverview Campgrounds.

- Visual Resources—Construction and operation of Upper Yellowstone Reservoir, particularly during reservoir drawdown, would cause a departure from natural visual conditions.

- Mineral and Energy Resources—The irreversible and irretrievable commitment of these resources was described above.

3.23.4 Crystal Ranch Alternative

There would be no irreversible and irretrievable commitment of the following resources under the Crystal Ranch Alternative:

- Socioeconomics
- Water Quality and Contaminants
- Threatened and Endangered Species
- Land Use Plans Conflict
- Transportation
- Health and Safety
- Wilderness Areas
- Air Quality
- Noise

The irreversible and irretrievable commitment of mineral and energy resources under the Crystal Ranch Alternative would consist of the following:

- 3,800,000 cubic yards of borrow materials from onsite borrow areas for construction of dams and access and maintenance roads

- 2,265,000 gallons of petroleum products (diesel, gasoline, and grease) for construction activities

Increased recreational traffic also would increase fuel consumption, but the amount is not readily available.

Permanently encumbered lands under the Crystal Ranch Alternative would total 706.7 acres and consist of 344 acres of Tribal land and 362.7 acres of non-Tribal land (see Table 2-27 in Chapter 2).

Funds used for construction, operation, and maintenance of the Crystal Ranch Alternative would be permanently committed to the project and not be available for other purposes. The estimated capital cost would be $82,248,000 and the estimated annual operation and maintenance cost would be $252,000.

Under the Crystal Ranch Alternative, water would be conserved in the same manner and be available for the same project purposes as described for the Proposed Action.

Additional irreversible and irretrievable commitment of resources under the Crystal Ranch Alternative would be the same as described for the Proposed Action, except as follows:

- Agriculture – Commitments would include the permanent encumbrance of lands because of project features (acres listed above), retirement of 1,300 acres of irrigated lands, and the conversion of non-Tribal irrigated lands for mitigation.

- Wetland and Riparian Resources – There would be a loss of 1,634 acres of existing wetland and riparian communities following implementation of mitigation measures.

- Wildlife Resources – There would be a net loss of 1,241 AAHUs of upland and open water habitat from dam, reservoir, and canal impacts and losses of 281 acres of critical deer winter range, 190 acres of critical elk winter range, 171 acres of critical moose year-long range, and loss of 817 acres of native uplands on Tribal idle lands.

- Soils – There would be a loss of productivity on 562 acres of land because of dam and reservoir construction.

- Mineral and Energy Resources – The irreversible and irretrievable commitment of these resources was described above.

3.23.5 Twin Pots Alternative

There would be no irreversible and irretrievable commitment of the following resources under the Twin Pots Alternative:

- Sociocultural Resources
- Socioeconomics
- Water Resources and Hydrology
- Water Quality and Contaminants
- Aquatic Resources
- Threatened and Endangered Species
- Land Use Plans Conflict
- Transportation
- Health and Safety

- Recreation Resources
- Wilderness Areas
- Visual Resources
- Air Quality
- Noise

The irreversible and irretrievable commitment of mineral and energy resources under the Twin Pots Alternative would consist of the following:

- 1,033,000 cubic yards of borrow materials from onsite borrow areas for construction of dams and access and maintenance roads

- 491,650 gallons of petroleum products (diesel, gasoline, and grease) for construction activities

Increased recreational traffic also would increase fuel consumption, but the amount is not readily available.

Permanently encumbered lands under the Twin Pots Alternative would total 562.5 acres and consist of 30.5 acres of Tribal land and 532 acres of non-Tribal land (see Table 2-36 in Chapter 2).

Funds used for construction, operation, and maintenance of the Twin Pots Alternative would be permanently committed to the project and not be available for other purposes. The estimated capital cost would be $48,359,000 and the estimated annual operation and maintenance cost would be $149,000.

Under the Twin Pots Alternative, water would be conserved in the same manner and, except for instream flows, be available for the same project purposes as described for the Proposed Action.

There would be some additional irreversible and irretrievable commitment of resources under the Twin Pots Alternative, as follows:

- Agriculture—Commitments would include the permanent encumbrance of lands because of project features (acres listed above), retirement of 1,300 acres of irrigated lands, and the conversion of non-Tribal irrigated lands for mitigation.

- Wetland and Riparian Resources—There would be a net loss of 2,121 acres of wetlands.

- Wildlife Resources—There would be a net loss of 827 AAHUs of upland and open water habitat from dam, reservoir, and canal impacts, and the possible abandonment of two sage grouse leks near a pipeline corridor, and loss of 817 acres of native uplands on Tribal idle lands.

- Soils—There would be a loss of productivity on 395 acres of land because of dam and reservoir enlargement.

- Cultural Resources—Seven known properties at high mountain lakes would be adversely affected.

- Mineral and Energy Resources—The irreversible and irretrievable commitment of these resources was described above.

Chapter 4
Comparative Analysis of Impacts of the Proposed Action and Alternatives

4.1 Introduction

This chapter summarizes potential impacts of the Proposed Action (Talmage), Cow Canyon Alternative, Crystal Ranch Alternative, Twin Pots Alternative, and the No Action Alternative. Additional information regarding the impacts of the Proposed Action and alternatives is provided in Chapter 3 and in the Draft Environmental Impact Statement (Draft EIS) technical reports and background documents. Section 4.2 in this chapter describes the consequences of the No Action Alternative, and Section 4.3 compares the impacts of the Proposed Action and the action alternatives by resource topic. The impacts summarized in this chapter are the impacts that would occur on baseline conditions. Information on baseline conditions is presented in each resource section of Chapter 3.

4.2 No Action Alternative

The No Action Alternative would result in the continuation of baseline conditions described in each Affected Environment section of Chapter 3. The No Action Alternative would result in the following consequences compared to the Proposed Action:

- Runoff from the Uinta Mountains that is used by Tribal and non-Tribal irrigators would not be stored or distributed on a schedule that better matches the consumptive use of their crops.

- Early and late season irrigation water would typically not be available for distribution to Tribal or non-Tribal irrigators.

- Improved water conservation and management associated with the construction of dams and reservoirs, rehabilitation of canals and diversion dams, and construction of pipelines would not occur.

- Water would not be available to meet municipal and industrial needs of the City of Roosevelt, which is projected to experience water shortages in summer months by the year 2000.

- A number of environmental, fish and wildlife, and recreation needs that have been identified would not be met, including improved instream flow regimes, habitat, and targeted summer and winter instream flows for fish; improved natural winter range habitat for big game that would reduce big game dependence on agricultural lands; improved fish passage at diversion dams and prevention of the entrainment of juvenile and adult fish from rivers into irrigation canals; and improved recreation facilities and opportunities on Tribal and non-Tribal lands.

- Impacts on environmental, fish and wildlife, and recreation resources resulting from numerous baseline activities would continue, including annual drawdown of high mountain lakes in the High Uintas Wilderness (HUW); widely fluctuating stream flows (naturally occurring) and habitat available to fish; recurring instream activities such as rebuilding irrigation diversions, channelization, and bank maintenance with adverse effects on aquatic resources; and low or no flows in river reaches, adversely affecting the Ute Tribe's belief in the sanctity of flowing waters.

4.3 Comparison of Impacts

Table 4-1 (at the end of this chapter) summarizes significant impacts (based on significance criteria described in Chapter 3) and, where appropriate, mitigation, net effects, and project benefits associated with the Proposed Action and each action alternative. Adverse impacts that would not be significant are discussed for each resource topic in Chapter 3. Sections 4.3.1 through 4.3.20 briefly describe for each resource topic the information summarized in Table 4-1.

4.3.1 Sociocultural Resources

Overall project effects on the Ute Tribe's sociocultural resources would range from beneficial under the Proposed Action to adverse (+) under the Cow Canyon Alternative. Overall project effects on the non-Indians' sociocultural resources would range from beneficial (+) under the Proposed Action to neutral (-) under the Twin Pots Alternative. Considered together, overall project effects on Tribal and non-Indian sociocultural resources would be most favorable under the Proposed Action and least favorable under the Twin Pots Alternative.

4.3.2 Socioeconomics

The Proposed Action and Cow Canyon and Crystal Ranch Alternatives would result in similar increases in construction sector earnings for Duchesne County; the increase for the Twin Pots Alternative would be less. The Proposed Action and Crystal Ranch Alternative would result in substantially greater total earnings for Ute Tribal members during the construction period than would the other alternatives. Home and rental prices are projected to increase by more than 10 percent in Altamont and Duchesne for all of the alternatives. Roosevelt schools would have to accommodate from 12 to 29 more students, depending on the alternative.

4.3.3 Agriculture

The Proposed Action and Cow Canyon Alternative would result in the greatest potential increase in the value of agricultural production, and both would result in a greater than 10 percent increase in crop production within the Upalco Unit Replacement Project area. Potential increases in the annual value of agricultural production for the Crystal Ranch and Twin Pots Alternatives would be about $129,000 and $157,000 less, respectively, than the potential increases for the Proposed Action and the Cow Canyon Alternative, which are the same.

4.3.4 Water Resources and Hydrology

No significance criteria were developed for water resources and hydrology. Instead, results of the hydrologic analysis were used to determine direct, indirect, total, and/or cumulative impacts on water quality, environmental contaminants, and biological resources (i.e., threatened and endangered species, wetland and riparian resources, aquatic resources, and wildlife resources). Refer to the above-mentioned resources to ascertain hydrologic effects of the Proposed Action and alternatives.

4.3.5 Water Quality and Contaminants

Significant but localized adverse impacts under the Proposed Action and each alternative would include potential occasional exceedances of agricultural water quality criteria for total dissolved solids (TDS) in localized areas near the lower Lake Fork River and the Duchesne River. These exceedances may result in slight localized restrictions on the use of this river water for irrigation. Project benefits under the Proposed Action and each alternative would include a salinity (salt load) reduction of 0.1 percent in the Colorado River at Imperial Dam, settling of sediment and associated phosphorus and metals in constructed or enlarged reservoirs, reduced shoreline erosion of high mountain lakes, and reestablishment of natural hydrographs in outlet streams of high mountain lakes that would be stabilized.

4.3.6 Aquatic Resources

Significant adverse impacts would include the inundation of 2.6 miles of the Yellowstone River under the Proposed Action and Crystal Ranch Alternative (2.0 miles would be inundated under the Cow Canyon Alternative), loss of the existing river fishery in these reaches, and blockage of upstream fish passage at the dams. There would be a reduction in trout habitat in some reaches of the Lake Fork and Yellowstone Rivers under the Proposed Action and each alternative. However, overall trout habitat would increase for all lifestages in a dry water year (except under the Crystal Ranch Alternative) and for all or some life stages in a normal water year (except under the Cow Canyon and Crystal Ranch Alternatives). Examples of other project benefits to fish under the Proposed Action and each alternative would include stabilization of high mountain lakes, providing fish passage and fish screens at rehabilitated diversion dams, establishment or maintenance of conservation pools for fish in constructed and/or enlarged reservoirs, and improved instream flow regimes for trout.

4.3.7 Wetland and Riparian Resources

Known and estimated losses of wetland and riparian areas would include 2,561 acres for the Proposed Action, 2,295 acres for the Cow Canyon Alternative, 2,609 acres for the Crystal Ranch Alternative, and 2,421 acres for the Twin Pots Alternative. Mitigation measures include improving habitat values on existing wetlands and riparian areas as well as developing new areas. Considering all lands involved in mitigation and the known and estimated impacts, there would be net increases in wetland and riparian area acreage for the Proposed Action and Crystal Ranch Alternative and net losses in acreage for the Cow Canyon and Twin Pots Alternatives. Changes in peak flows and reduced summer flows would likely result in additional losses of wetlands on the Lake Fork River for the Crystal Ranch and Twin Pots Alternatives, respectively. Changes in the timing of peak flows would impact wetland and riparian communities for the Proposed Action and all alternatives.

4.3.8 Wildlife Resources

Wildlife habitat loss associated with direct and indirect impacts on wetlands was noted in Section 4.3.7. Both the Proposed Action and Crystal Ranch Alternative would result in the loss of critical deer and elk winter range and critical year-long moose range; the Cow Canyon Alternative would result in the loss of critical year-long moose range. In addition to wetland losses, conversion of Tribal idle lands would result in the loss of 817 acres of native uplands, consisting mostly of sagebrush/grass, for the Proposed Action and each alternative. The Crystal Ranch Alternative would result in less direct loss of upland habitat types than the other alternatives. Substantial upland area would be converted to wetlands for mitigation for the Proposed Action and the Cow Canyon and Crystal Ranch Alternatives, with a large trade-off of upland habitat units for wetland habitat units. The net loss of upland habitat types because of direct impacts and conversion to wetlands for mitigation would be greatest for the Proposed Action, followed by the Cow Canyon and then the Crystal Ranch Alternatives. The lowest net loss of uplands would occur under the Twin Pots Alternative. Two sage grouse leks could be abandoned because of pipeline construction under the Twin Pots Alternative.

4.3.9 Threatened and Endangered Species

The Proposed Action and alternatives would not be expected to adversely affect razorback sucker. The small flow increases and decreases in the Duchesne River (depending on month and water-year type) that would result from the project would not significantly change the current depleted flow condition nor contribute significant amounts of water toward endangered fish recovery. Project impacts on Ute ladies'-tresses would be the same for the Proposed Action, the Cow Canyon Alternative, and the Twin Pots Alternative. Impacts would include inundation of some Ute ladies'-tresses along the Lake Fork River. Potential habitat desiccation associated with reduction of secondary irrigation return flows and conversion of Tribal idle lands to irrigated lands might have adverse impacts on populations of orchids not closely associated with riverine water. The Crystal Ranch Alternative would cause degradation of some Ute ladies'-tresses habitat because of changes in peak flows. Project benefits for Ute ladies'-tresses on the Lake Fork River during dry years would be the same for all alternatives.

4.3.10 Land Use Plans Conflict

No significant conflicts with land use plans would result from the Proposed Action or alternatives. Project benefits associated with the Proposed Action and each alternative would include increased recreation and enhanced agricultural efficiency as mandated in county plans.

4.3.11 Transportation

Significant adverse impacts would include a decline in the level of service on several major and many minor project area roads during construction. These impacts would be the same and slightly greater under the Proposed Action, Cow Canyon Alternative, and Crystal Ranch Alternative than under the Twin Pots Alternative. Peak annual truck round trips on U.S. Highway 40 would be highest under the Proposed Action (3,990 trips) and lowest under the Crystal Ranch Alternative (2,555 trips).

4.3.12 Soils

Significant adverse impacts would include the loss of productivity on 844 acres (Proposed Action), 643 acres (Cow Canyon Alternative), 562 acres (Crystal Ranch Alternative), and 395 acres (Twin Pots Alternative) because of dam and reservoir construction and/or enlargement. Loss of productivity at diversion dams would also be a significant impact. These project-related losses would be offset by improved irrigation practices and increased productivity of irrigated lands.

4.3.13 Health and Safety

There would be an increased risk of loss of life from flooding caused by dam failure under the Proposed Action and each alternative, although it is extremely unlikely such an event would occur. The number of structures potentially affected by flooding total 164 under the Proposed Action, 171 under the Cow Canyon Alternative, 69 under the Crystal Ranch Alternative, and 95 under the Twin Pots Alternative. Improvements at Twin Pots Dam under the Proposed Action and Twin Pots Alternative would reduce the risk of loss of life caused by dam failure and flooding.

4.3.14 Cultural Resources

The number of known historic properties that would potentially be adversely affected total six each under the Proposed Action and Crystal Ranch Alternative, five under the Cow Canyon Alternative, and seven under the Twin Pots Alternative. These significant impacts would be mitigated by avoiding (if possible) or data recovery of the affected resources. Significant ethnographic impacts would occur under the Proposed Action and Crystal Ranch Alternative and consist of inundation of Tribal fishing areas on the Yellowstone River and adjacent lands used by deer and elk. These impacts would be unavoidable unless the Ute Tribe states otherwise and allows mitigation.

4.3.15 Recreation Resources

Significant adverse impacts would include the inundation of 2.6 miles of the Yellowstone River under the Proposed Action and Crystal Ranch Alternative and 2.0 miles of the Yellowstone River under the Cow Canyon Alternative. Evaluation of other significant impacts indicated that recreation visitor days spent on the Uintah and Ouray Reservation would increase by 4,835 under the Proposed Action, 4,615 under the Cow Canyon Alternative, 3,875 under the Crystal Ranch Alternative, and 450 under the Twin Pots Alternative. Recreation benefits would be greatest under the Proposed Action and least under the Twin Pots Alternative.

4.3.16 Wilderness Areas

There would be no significant adverse impacts on the High Uintas Wilderness (HUW) under the Proposed Action or any of the alternatives. Project benefits resulting from lake stabilization would include improved wilderness values at 10 high mountain lakes under the Proposed Action, Cow Canyon Alternative, and Crystal Ranch Alternative and improved wilderness values at 14 high mountain lakes under the Twin Pots Alternative.

4.3.17 Visual Resources

Significant adverse impacts would include some exceedance of visual quality objectives because of construction and operation of Crystal Ranch Dam and Reservoir (Proposed Action, Crystal Ranch Alternative) on the Uintah and Ouray Reservation and Upper Yellowstone Dam and Reservoir (Cow Canyon Alternative) on the Ashley National Forest.

4.3.18 Mineral and Energy Resources

There would be a significant adverse impact on energy resources under the Cow Canyon Alternative from decommissioning the Yellowstone Hydroelectric Power Plant.

4.3.19 Air Quality

There would be no significant adverse impacts on air quality under the Proposed Action or any of the alternatives.

4.3.20 Noise

There would be no significant adverse noise impacts under the Proposed Action or any of the alternatives, although construction activities would substantially increase noise levels.

Table 4-1
Comparison of Significant Impacts[a], Mitigation[b], Net Effects[c], and Project Benefits[d]

Resource Topic	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Sociocultural Resources				
Significant Impacts				
Ute Tribe				
Resource Control	Beneficial	Very Adverse	Beneficial	Neutral
Economic Development	Very Beneficial	Beneficial	Beneficial	Beneficial
Water	Adverse	Adverse	Adverse	Neutral
Overall	Beneficial	Adverse (+)	Neutral (+)	Neutral (+)
Non-Indians				
Resource Control	Beneficial	Neutral	Neutral	Neutral
Economic Development	Very Beneficial	Beneficial	Beneficial	Neutral
Water	Beneficial	Beneficial	Beneficial	Adverse
Overall	Beneficial (+)	Beneficial (-)	Beneficial (-)	Neutral (-)
Socioeconomics				
Significant Impacts	75 percent increase in Duchesne County construction sector earnings $6 million total earnings for Ute Tribal members Greater than 10 percent increase in home and rental prices in Altamont and Duchesne 28 more students in Roosevelt schools	80 percent increase in Duchesne County construction sector earnings $2.7 million total earnings for Ute Tribal members Greater than 10 percent increase in home and rental prices in Altamont and Duchesne 29 more students in Roosevelt schools	70 percent increase in Duchesne County construction sector earnings $6.8 million total earnings for Ute Tribal members Greater than 10 percent increase in home and rental prices in Altamont and Duchesne 18 more students in Roosevelt schools	50 percent increase in Duchesne County construction sector earnings $1.8 million total earnings for Ute Tribal members Greater than 10 percent increase in home and rental prices in Altamont and Duchesne 12 more students in Roosevelt schools

[a]Significant impacts can be adverse or beneficial. They are based on the established significance criteria and are discussed for each resource area in Chapter 3.
[b]Mitigation includes actions taken to avoid or minimize significant impacts or to compensate for unavoidable adverse impacts. Mitigation measures do not include Standard Operating Procedures (SOPs) or Best Management Practices (BMPs), as described in Appendix A.
[c]Net effects include positive and negative impacts expected to remain following implementation of mitigation measures.
[d]Project benefits include benefits from implementation of project features but do not include positive net effects that would result from implementation of mitigation measures, which are described under net effects.
[e]Wetlands include both wetland and riparian communities.

Table 4-1
Comparison of Significant Impacts[a], Mitigation[b], Net Effects[c], and Project Benefits[d]

Resource Topic	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Agriculture				
Significant Impacts	Potential annual increase of $1,475,726 in the value of agricultural production Greater than 10 percent increase in crop production within the Upalco Unit project area	Same as Proposed Action	Potential annual increase of $1,346,987 in the value of agricultural production	Potential annual increase of $1,318,297 in the value of agricultural production
Water Resources and Hydrology				
No significance criteria were developed for water resources and hydrology. Instead, results of the hydrologic analysis were used to determine direct, indirect, total, and/or cumulative impacts on water quality, environmental contaminants, and biological resources (i.e., threatened and endangered species, wetland and riparian resources, aquatic resources, and wildlife resources). Refer to the above-mentioned resources to ascertain hydrologic effects of the Proposed Action and alternatives.				
Water Quality and Contaminants				
Significant Impacts	Slight restriction on irrigation use of Lake Fork River water from increased TDS Localized TDS agricultural water quality criteria exceedances in lower Lake Fork/Duchesne River	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Project Benefits	0.1 percent salt load decrease in Colorado River Reduced shoreline erosion at high mountain lakes Reestablishment of natural hydrographs in streams below high mountain lakes Reduced agricultural return flow in lower Lake Fork River from land retirement Settlement of sediments with associated phosphorus and metals in Crystal Ranch and Big Sand Wash Reservoirs Cumulative impact-salt load reduction in the Colorado River of 0.1 percent	Same as Proposed Action, except that sediment, phosphorus, and metal settlement would occur in Upper Yellowstone and Big Sand Wash Reservoirs	Same as Proposed Action, except that sediment, phosphorus, and metal settlement would occur in Crystal Ranch Reservoir only	Same as Proposed Action, except that sediment, phosphorus, and metal settlement would occur in Big Sand Wash Reservoir only

Table 4-1
Comparison of Significant Impacts[a], Mitigation[b], Net Effects[c], and Project Benefits[d]

Resource Topic	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Aquatic Resources				
Significant Impacts	Inundation of 2.6 miles of the Yellowstone River with subsequent loss of the existing fishery and blockage of upstream fish passage Reduction in "effective stream habitat" in some reaches of the Lake Fork and Yellowstone Rivers	Inundation of 2 miles of the Yellowstone River with subsequent loss of the existing fishery and blockage of upstream fish passage Reduction in "effective stream habitat" in some reaches of the Lake Fork and Yellowstone Rivers	Same as the Proposed Action	Reduction in "effective stream habitat" in some reaches of the Lake Fork and Yellowstone Rivers
Change in September Instream Trout Habitat:				
Normal Water Year				
Fry (%; sq ft)	-5.1; -154,361	-4.7; -142,461	-8.5; -258,718	+3.7; +113,169
Juvenile (%; sq ft)	-1.2; -19,943	-3.1; -51,151	-4.9; -82,464	+1.1; +18,454
Adult (%; sq ft)	+0.4; +6,894	-0.8; -15,340	-5.3; -97,727	+2.1; +38,498
Dry Water Year				
Fry (%; sq ft)	+2.5; +75,096	+4.6; +138,044	-2.5; -74,126	+9.9; +295,884
Juvenile (%; sq ft)	+40.8; +440,102	+39.9; +430,048	+34.1; +368,063	+35.3; +380,497
Adult (%; sq ft)	+46.7; +531,609	+46.4; +528,693	+37.3; +425,209	+42.2; +480,925
Change in Winter Instream Trout Habitat:				
Normal Water Year (%; sq ft)	-0.6; -743	-1.6; -2,179	-2.4; -2,815	+1.9; +2,207
Dry Water Year (%; sq ft)	+4.0; +4,519	+3.1; +4,035	+2.1; +2,446	+4.9; +5,526
Project Benefits				
Instream Flow	April-September: 56 cfs in Yellowstone River below dam October-March: 24 cfs in Yellowstone River below dam	Same as Proposed Action	Same as Proposed Action	No main stem dams proposed

Table 4-1
Comparison of Significant Impacts[a], Mitigation[b], Net Effects[c], and Project Benefits[d]

Resource Topic	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Aquatic Resources (continued)				
Project Benefits (continued) Other Benefits	Upstream fish passage facilities and fish screens added to 6 diversion dams New put-grow-and-take fishery in Crystal Ranch Reservoir Enhanced fish production in Twin Pots Reservoir and Clay Basin Pond Enhanced habitat at 10 high mountain lakes and outlet streams Two miles of "new" trout habitat below the "C" Canal diversion Enhanced fish habitat from stream improvements Water temperature would be cooler below Crystal Ranch Reservoir in summer 2,400 ac-ft conservation pool in Crystal Ranch Reservoir	Upstream fish passage facilities and fish screens added to 6 diversion dams New put-grow-and-take fishery in Upper Yellowstone Reservoir Enhanced habitat at 10 high mountain lakes and outlet streams Two miles of "new" trout habitat below the "C" Canal diversion Enhanced fish habitat from stream improvements Water temperature would be cooler below Upper Yellowstone Reservoir in summer 2,500 ac-ft conservation pool in Upper Yellowstone Reservoir	Upstream fish passage facilities and fish screens added to 5 diversion dams New put-grow-and-take fishery in Crystal Ranch Reservoir Enhanced habitat at 10 high mountain lakes and outlet streams Two miles of "new" trout habitat below the "C" Canal diversion Enhanced fish habitat from stream improvements Water temperature would be cooler below Crystal Ranch Reservoir in summer 2,400 ac-ft conservation pool in Crystal Ranch Reservoir	Upstream fish passage facilities and fish screens added to 7 diversion dams Enhanced fish production in Twin Pots Reservoir Enhanced habitat at 14 high mountain lakes and outlet streams Two miles of "new" trout habitat below the "C" Canal diversion
Wetland and Riparian Resources[e]				
Significant Impacts	Loss of approximately 1,097 wetland AAHUs (364 acres) from dams, reservoirs, and canals Land retirement, water conservation, and irrigation of Tribal idle lands could impact 2,212 acres of wetlands	Loss of approximately 167 wetland AAHUs (109 acres) from dams, reservoirs, and canals Land retirement, water conservation, and irrigation of Tribal idle lands could impact 2,201 acres of wetlands	Loss of approximately 915 wetland AAHUs (267 acres) from dams, reservoirs, and canals Reduced peak flows and land retirement would potentially impact wetlands Land retirement, water conservation, and irrigation of Tribal idle lands could impact 2,342 acres of wetlands	Loss of approximately 144 wetland AAHUs (91 acres) from dams, reservoirs, and canals Reduced summer flows and land retirement would potentially impact wetlands Land retirement, water conservation, and irrigation of Tribal idle lands could impact 2,330 acres of wetlands

Table 4-1

Comparison of Significant Impacts[a], Mitigation[b], Net Effects[c], and Project Benefits[d]

Resource Topic	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Wetland and Riparian Resources (continued)				
Mitigation	Gain of approximately 1,416 wetland AAHUs (1,132 developed or improved acres) Potential wetland impacts from land retirement would be monitored and all unavoidable impacts would be mitigated	Gain of approximately 1,070 wetland AAHUs (605 developed or improved acres) Potential wetland impacts from land retirement would be monitored and all unavoidable impacts would be mitigated	Gain of approximately 1,151 wetland AAHUs (975 developed or improved acres) Potential wetland impacts from reduced peak flows and land retirement would be monitored and all unavoidable impacts would be mitigated	Gain of approximately 330 wetland AAHUs (299 developed or improved acres) Potential wetland impacts from reduced summer flows and land retirement would be monitored and all unavoidable impacts would be mitigated
Net Effects	Loss of approximately 1,429 acres of wetlands after mitigation	Loss of approximately 1,690 acres of wetlands compared to mitigation	Loss of approximately 1,634 acres of wetlands after mitigation	Loss of approximately 2,121 acres of wetlands compared to mitigation
Wildlife Resources				
Significant Impacts	Loss of approximately 1,080 upland and open water AAHUs (753 acres) from dams, reservoirs, and canals Loss of 817 acres of uplands (mostly sagebrush/grass) on idle lands plus wetlands Loss of 281 acres of critical deer winter range preferred habitat Loss of approximately 190 acres of critical elk winter range preferred habitat Loss of approximately 171 acres of critical moose year-long range preferred habitat Sage grouse leks within 2 miles of Farnsworth Laterals See Wetlands section for wetland habitat impacts	Loss of approximately 713 upland and open water AAHUs (664 acres) from dams, reservoirs, and canals Loss of 817 acres of uplands (mostly sagebrush/grass) on idle lands plus wetlands Loss of approximately 364 acres of critical moose year-long range preferred habitat See Wetlands section for wetland habitat impacts	Same as the Proposed Action, except: Loss of approximately 696 upland and open water AAHUs (355 acres) from dams, reservoirs, and canals Sage grouse leks within 2 miles of Farnsworth Laterals See Wetlands section for wetland habitat impacts	Loss of approximately 402 upland and open water AAHUs (751 acres) from dams, reservoirs and canals Loss of 817 acres of uplands (mostly sagebrush/grass) on idle lands plus wetlands Sage grouse leks within 2 miles of Farnsworth Laterals Two sage grouse leks within 0.75 mile of a pipeline could be abandoned See Wetlands section for wetland habitat impacts

Table 4-1
Comparison of Significant Impacts[a], Mitigation[b], Net Effects[c], and Project Benefits[d]

Resource Topic	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Wildlife Resources (continued)				
Mitigation	Loss of approximately 1,789 upland AAHUs (931 acres) See Wetlands section for wetland mitigation	Loss of approximately 1,556 upland AAHUs (877 acres) See Wetlands section for wetland mitigation	Loss of approximately 1,547 upland AAHUs (776 acres) See Wetlands section for wetland mitigation	Gain of approximately 681 upland AAHUs, but a loss of 76 acres through development or improvement of other habitat See Wetlands section for wetland mitigation
Net Effects	Net loss of approximately 2,869 upland and open water AAHUs (1,794 acres) from dams, reservoirs, and canals Loss of 817 acres of uplands (mostly sagebrush/grass) on idle lands plus wetlands See Wetlands section for net effects on wetlands	Net loss of approximately 2,269 upland and open water AAHUs (1,564 acres) from dams, reservoirs, and canals Loss of 817 acres of uplands (mostly sagebrush/grass) on idle lands plus wetlands See Wetlands section for net effects on wetlands	Net loss of approximately 2,243 upland and open water AAHUs (1,241 acres) from dams, reservoirs, and canals Loss of 817 acres of uplands (mostly sagebrush/grass) on idle lands plus wetlands See Wetlands section for net effects on wetlands	Net gain of approximately 279 upland and open water AAHUs but loss of 827 acres from dams, reservoirs, and canals Loss of 817 acres of uplands (mostly sagebrush/grass) on idle lands plus wetlands See Wetlands section for net effects on wetlands
Project Benefits	Big game winter range improvements on Monarch Bench and Towanta Flats Red Rocks/Duchesne Drainage habitat acquisition	Big game range improvement with removal of grazing on the 160-acre Fisher property	Big game winter range improvements on Monarch Bench and Towanta Flats Big game range improvement with removal of grazing on the 160-acre Fisher property Red Rocks/Duchesne Drainage habitat acquisition	Big game winter range improvements on Monarch Bench and Towanta Flats Red Rocks/Duchesne Drainage habitat acquisition
Threatened and Endangered Species				
Significant Impacts	Inundation of Ute ladies'-tresses orchids in middle reach of Lake Fork River	Same as Proposed Action	Degradation of Ute ladies'-tresses orchid habitat because of less frequent peak flows	Same as Proposed Action
Project Benefits	Increased water surface elevations in dry years on Lake Fork River (Ute ladies'-tresses orchids)	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action

Table 4-1
Comparison of Significant Impacts[a], Mitigation[b], Net Effects[c], and Project Benefits[d]

Resource Topic	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Land Use Plans Conflict				
Significant Impacts	None	None	None	None
Project Benefits	Increased recreation and enhanced agricultural efficiency as mandated in county plans	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Transportation				
Significant Impacts	The level of service (LOS) on U.S. Highway 40, two sections of State Secondary Route (SR) 87, and on many minor local roads would decline from B or C to C or D during project construction. Peak annual truck round trips on U.S. 40=3,990	Same as Proposed Action for LOS. Peak annual truck round trips on U.S. 40=3,280	LOS on U.S. 40, one section of SR 87, and on many minor local roads would decline from B or C to C or D during project construction. Peak annual truck round trips on U.S. 40=2,555	Same as Proposed Action for LOS. Peak annual truck round trips on U.S. 40=2,925
Soils				
Significant Impacts	Loss of productivity on 844 acres at Crystal Ranch and Big Sand Wash Reservoirs Loss of riparian habitat at diversion dams	Loss of productivity on 643 acres at Upper Yellowstone and Big Sand Wash Reservoirs Loss of riparian habitat at diversion dams	Loss of productivity on 562 acres at Crystal Ranch Reservoir Loss of riparian habitat at diversion dams	Loss of productivity on 395 acres at Big Sand Wash Reservoir Loss of riparian habitat at diversion dams
Mitigation	Improved irrigation practices and increased productivity of irrigated lands	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action
Net Effects	Mitigation would offset project-related losses	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action

Table 4-1
Comparison of Significant Impacts[a], Mitigation[b], Net Effects[c], and Project Benefits[d]

Resource Topic	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Health and Safety				
Significant Impacts	Increased risk of loss of life from flooding caused by failure of Crystal Ranch Dam and Big Sand Wash Dam (164 potentially affected structures primarily in and near Myton, Ouray, and Randlett). Greater than 10 percent increase in expected truck accident rates on project area roads during construction	Same as Proposed Action except 171 potentially affected structures below Upper Yellowstone Dam and Big Sand Wash Dam	Same as Proposed Action except 69 potentially affected structures below Crystal Ranch Dam primarily in and near Myton and Ouray	Same as Proposed Action except 95 potentially affected structures primarily in and near Ouray and Randlett
Project Benefits	Improvements at Twin Pots Dam would reduce the risk of loss of life caused by dam failure and flooding	None	None	Same as Proposed Action
Cultural Resources				
Significant Impacts	Water Lily Lake Dam, Milk Lake Dam, Farmers Lake Tunnel, the historic Crystal Ranch homestead, a small historic bridge and fence, and site 42DC1044 would be adversely affected Ute Tribe fishing areas on the Yellowstone River and deer and elk habitat on adjacent lands would be inundated	Water Lily Lake Dam, Milk Lake Dam, Farmers Lake Tunnel, the historic Yellowstone Hydroelectric Power Plant, and site 42DC1044 would be adversely affected	Same as Proposed Action	Water Lily, Milk, Island, Kidney, and Clements Lake Dams, Farmers Lake Tunnel, and site 42DC1044 would be adversely affected
Mitigation	Adverse effects on cultural and paleontological resources would be mitigated by avoiding (if possible) or data recovery of the affected resources Adverse ethnographic impacts would be considered unavoidable unless the Ute Tribe states otherwise and allows mitigation	Adverse effects on cultural and paleontological resources would be mitigated by avoiding (if possible) or data recovery of the affected resources	Same as Proposed Action	Adverse effects on cultural and paleontological resources would be mitigated by avoiding (if possible) or data recovery of the affected resources

Table 4-1
Comparison of Significant Impacts[a], Mitigation[b], Net Effects[c], and Project Benefits[d]

Resource Topic	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Recreation Resources				
Significant Impacts	Permanent elimination of 2.6 free-flowing miles of the Yellowstone River A greater than 10 percent increase in recreation visitor days (RVDs) spent on the Uintah and Ouray Reservation. Increase of 4,835 RVDs	Permanent elimination of 2.0 free-flowing miles of the Yellowstone River A greater than 10 percent increase in recreation visitor days (RVDs) spent on the Uintah and Ouray Reservation. Increase of 4,615 RVDs on the Reservation	Same as Proposed Action except an increase of 3,875 RVDs on the Reservation	Increase of 450 RVDs on the Reservation
Wilderness Areas				
Significant Impacts	None	None	None	None
Project Benefits	Improved wilderness values at 10 high mountain lakes	Same as Proposed Action	Same as Proposed Action	Improved wilderness values at 14 high mountain lakes
Visual Resources				
Significant Impacts	Some exceedance of visual quality objectives on the Uintah and Ouray Reservation because of construction and operation of Crystal Ranch Dam and Reservoir	Some exceedance of visual quality objectives on the Ashley National Forest because of construction and operation of Upper Yellowstone Dam and Reservoir	Same as Proposed Action	None
Mineral and Energy Resources				
Significant Impacts	None	Decommissioning of the Yellowstone Hydroelectric Power Plant	None	None
Air Quality				
Significant Impacts	None	None	None	None

Table 4-1
Comparison of Significant Impacts[a], Mitigation[b], Net Effects[c], and Project Benefits[d]

Resource Topic	Proposed Action	Cow Canyon Alternative	Crystal Ranch Alternative	Twin Pots Alternative
Noise				
Significant Impacts	None, although substantial increase in noise levels during construction	Same as Proposed Action	Same as Proposed Action	Same as Proposed Action

[a]Significant impacts can be adverse or beneficial. They are based on the established significance criteria and are discussed for each resource area in Chapter 3.
[b]Mitigation includes actions taken to avoid or minimize significant impacts or to compensate for unavoidable adverse impacts. Mitigation measures do not include Standard Operating Procedures (SOPs) or Best Management Practices (BMPs), as described in Appendix A.
[c]Net effects include positive and negative impacts expected to remain following implementation of mitigation measures.
[d]Project benefits include benefits from implementation of project features but do not include positive net effects that would result from implementation of mitigation measures, which are described under net effects.
[e]Wetlands include both wetland and riparian communities.

Chapter 5
Coordination and Consultation

5.1 Introduction

National Environmental Policy Act (NEPA) Regulations provided by the Council on Environmental Quality (CEQ) direct project sponsors to involve agencies and the general public in preparing Environmental Assessments (EAs) and Environmental Impact Statements (EISs). This chapter documents coordination and consultation that has occurred with agencies and the public throughout project planning and during scoping and development of this Draft EIS.

The Upalco Unit planning was undertaken by the Central Utah Water Conservancy District (CUWCD) with the mandate that public involvement be an integral part of project planning and implementation. Consequently, the CUWCD initiated a major effort in the early project stages to involve all local, State, and Federal agencies that had related responsibilities, the Ute Tribe, and those interest groups and the public who wished to participate in project development. The following describes the process of agency and general public involvement for the Upalco Unit.

5.2 Project Planning

Public input to the project began in mid-1991 with a random telephone survey within the project area to determine the level of public interest and support for the project (Dan Jones & Associates 1991). Survey results indicated a very high level of public desire for water development in the project area. In October 1991, field tours were conducted by the CUWCD and representatives from various agencies and interest groups to view locations of potential project features and general environmental conditions in the project area. Attending were members of the U.S. Forest Service (FS), U.S. Fish and Wildlife Service (FWS), U.S. Bureau of Indian Affairs (BIA), U.S. Army Corps of Engineers (COE), Utah Division of Wildlife Resources (Wildlife Resources), Ute Tribe, and Utah Outdoor Interests Coordinating Council (UOICC).

Very early in the Central Utah Project Completion Act (CUPCA) planning phase, the CUWCD arranged with key State and Federal agencies for representatives to be appointed for Central Utah Project (CUP) coordination. This coordination involved all of the CUPCA projects, including the Upalco Unit. The agencies had representatives duty stationed at the CUWCD's CUPCA office to facilitate coordination, and included FS, Wildlife Resources, and Natural Resources Conservation Service (NRCS) personnel.

Following the development of a Upalco Unit public involvement program, the CUWCD organized a Planning Team to participate in project planning. All local, State, and Federal agencies with responsibilities related to the project were invited to serve on the Planning Team, along with members of interest groups (environmental, recreation, etc.), the Ute Tribe, water user companies and associations, the news media, and the general public. The Planning Team held its first meeting in December 1991 in Duchesne to introduce members to the Upalco Unit project, planning process, and schedule. About 70 people were in attendance.

In January 1992, six public meetings were held to inform the public about the pending CUPCA legislation and to obtain public input on water needs and possible projects. Meetings were held in Altamont, Duchesne, Fort Duchesne, Roosevelt, Vernal, and Salt Lake City. Following these public meetings, the Planning Team held six meetings to begin planning the project. These were day-long meetings in which information was presented and participants were divided into work groups to accomplish the particular planning task. Tasks undertaken included consideration of physical, social, and economic conditions in the Uinta Basin relating to the project; identification of problems, needs, and opportunities relating to water development in the Basin; development of project goals and objectives; identification of general and site-specific project features that might meet the needs identified; and evaluation of the project features. An average of about 60 people attended each of these meetings, representing all of the groups identified above. Agencies with representation at nearly all of these meetings included the Department of the Interior (DOI), FS, FWS, EPA, U.S. Bureau of Reclamation (USBR), COE, BIA, NRCS, Utah Division of Water Resources (Water Resources), Wildlife Resources, and the State Engineer. Further information regarding the Planning Team meetings is presented in an initial scoping summary for the Upalco Unit (CH2M HILL/Horrocks 1993).

Following most of the Planning Team meetings, informal meetings were held with agency representatives in attendance to discuss results of the meetings and to identify issues requiring additional information. In one such meeting following the Planning Team workshop in March 1992, it became apparent that the public and agency personnel had many questions about the current operations of the river systems. Two public meetings were widely noticed and held in Duchesne on April 15 and in Salt Lake City on April 16, 1992, providing a presentation on the river operations and opportunity for questions and answers.

Beginning in September 1991, the CUWCD met monthly with members of the Duchesne County Water Resource Board at their scheduled Board meetings in Duchesne to inform the group of project status and to answer questions. The Board is appointed by the County Commissioners and is comprised of representatives of major irrigation companies and Basin representatives who serve on the CUWCD Board. These meetings will continue throughout the NEPA process. Numerous additional meetings have been held throughout the project with irrigators and water-user groups in the Uinta Basin, including representatives from the Moon Lake, Dry Gulch, Farnsworth, and Whiterocks user groups, to inform them of project status and to answer questions.

Since a major portion of the land within the project area is held in trust for the Ute Tribe and its members, the involvement of this group in the project has been essential. Two public meetings were held at Fort Duchesne during the planning period (January 28, 1992, and June 3, 1992), and an observer from the Tribe attended Planning Team meetings. The CUWCD communicated with the Tribal Business Council and Resource Officer during this time through letters and personal contacts to keep them informed of the project and to encourage their participation. Two meetings were held with the Tribal Council for that purpose in 1991. The Council declined to participate in the project at that time, but emphasized that if the project were to affect Tribal lands, it must provide significant benefits to the Tribe and the Tribe must have a management role in the project. Monthly meetings were held with the Tribal Resource Officer to report on project status. Coordination also occurred with Tribal resource staff members and representatives of Federal agencies to the Tribe, such as the DOI, FWS, and BIA, to obtain information regarding resource needs and objectives.

The CUWCD has also supported the participation in project planning of other groups important to the project. The CUWCD funded the participation of representatives from the UOICC and the Ute Tribe to ensure their perspectives were heard and incorporated into project planning. The UOICC is an informal organization made up of representatives from the Sierra Club, Audubon Society, several chapters of Trout Unlimited, Salt Lake County Fish and Game Association, Sundance, Utah Rivers Council, and others.

5.3 Scoping Process

Following publication of the Notice of Intent to prepare an EIS in December 1992, the first round of public scoping meetings on the project was held. Separate scoping meetings were held for the Upalco and Uintah Units, except for the Fort Duchesne meeting, when both units were combined. Meetings for the Upalco Unit were held at Altamont on January 20, 1993 (59 in attendance), Fort Duchesne on January 21 (44 in attendance), and Salt Lake City on January 28, 1993 (23 in attendance).

All relevant agency representatives, including those who participated on the Planning Team, received a personal invitation to the scoping meetings, as did others on the project mailing list. Information presented at the meetings included project status; a description of planning conducted during the previous year; project needs, goals, and objectives; and potential features to be combined into project alternatives. Oral and written comments were received. Details of these meetings relating to the Upalco Unit are presented in two scoping documents (CH2M HILL/Horrocks 1993, 1994).

After the January scoping meetings, several additional meetings were held with the Planning Team to consider input from the scoping meetings and to develop project alternatives. In addition, a steering committee composed of 13 members of the Planning Team met during the summer of 1993 to develop project alternatives. The steering committee included representatives of agencies with responsibility for project area resources, including the FS, FWS, COE, NRCS, BIA, Wildlife Resources, and Water Resources. Other interests represented were the UOICC, water users from both the Upalco and Uintah Units, and the CUWCD. The steering committee developed project alternatives and screened them, through a formal evaluation process and elimination of duplication, into a manageable number in a series of four day-long meetings. Preliminary and recommended alternatives were presented to the full Planning Team for their consideration, and modifications were made to the final alternatives to be considered in subsequent public scoping meetings.

The second series of scoping meetings was held in October 1993 to present the project alternatives and obtain comments on alternatives and issues that should be studied in this Draft EIS. Joint meetings for the Upalco and Uintah Units were held at Roosevelt on October 12 (64 in attendance), Salt Lake City on October 13 (26 in attendance), and Altamont on October 14 (33 in attendance). Oral and written comments were received. Details of these meetings relating to the Upalco Unit are presented in two scoping documents (CH2M HILL/Horrocks 1993, 1994).

Issues pertinent to NEPA and the Upalco Unit that were raised at the scoping meetings are summarized as follows:

- Onstream storage is needed for better management of the total water supply and to make the project successful.

- Onstream storage for flood control is needed, as are facilities to control high runoff impacts on project diversion structures.

- Rehabilitation of damaged streams and diversions for fish passage or blockage, maintenance, and flood control should be part of project design.

- Stabilization of high mountain lakes should be part of any alternative, especially for those lakes in the High Uintas Wilderness and/or those with a substantial fishery. In addition, it needs to be determined what stabilization actually means, the costs associated with it, and impacts.

- Questions were raised regarding the effect of lake stabilization on rivers and their fishery and maintaining adequate flows for fish.

- The development of recreation facilities together with long-term water storage was encouraged.

- Conservation measures must be optimized in all alternatives, including water delivery systems, education, cost-sharing of sprinkler systems, and determining adequacy of reservoir conservation pool size. Conservation pool size needs to balance fishery and water supply needs.

- The relationship and coordination of the Ute Compact and Upalco Unit, Tribal water rights and control of water and cost, benefits from the Upalco Unit, and potential impacts on Tribal fish and wildlife resources were noted. Comments were made about maintaining Tribal participation, and questions were raised about the adequacy of Tribal involvement in the process. Access to features passing through Tribal property was also identified as an issue, as was the determination of jurisdiction and management responsibility for the proposed Crystal Ranch Reservoir.

- A process is required to make sure there is a balance of interests, particularly between environmental enhancement and water supply.

- Minimum stream flow levels need to be defined by river reach and protected against appropriation for other uses.

- What is the effect of mitigation features (minimum stream flows) on water rights, and would private property rights be impacted by mitigation? There was concern about confiscation of water and facilities (grazing proposals) with resultant substantial impact on payees.

- How will the proposed land use changes impact outfitters and guides, grazing permittees, farmers, and ranchers?

- Recreation issues focused on the need to expand recreation to help the local economy, recreation management, and public access to rivers.

- The unique socioeconomic needs of the Basin and Ute Reservation should be recognized.

- Encroachment of new facilities on the High Uintas Wilderness was identified as a concern.

- Flow and groundwater level data by drainage basin are needed.

- Water loss is an issue, whether it is a groundwater loss because canals are lined or systems are pressurized, or whether water is lost because of evaporation or ground seepage.

- Will the projects be beneficial during extended drought periods?

- Wildlife species reintroduction should be done carefully and should not include non-native species.

- Wildlife concerns focused on the effects on wildlife/riparian zones resulting from canal rehabilitation and water storage; the potential loss of wildlife habitat (terrestrial and aquatic), in part the result of water conservation measures; and impacts on game and nongame species and travel corridors on the south slope of the Uinta Mountains.

- The siting, ownership, maintenance, and operation of recreation and mitigation features were identified as issues.

- Concern was expressed about the alkalinity of soils caused by a lack of return flows and the impacts of mineral buildup in soils resulting from reduced water application (sprinklers).

- Water quality impacts may occur because of the projects. Concern was raised about increased salinity in the Colorado River and the downstream impact of irrigation runoff on aquatic life.

- The geology of dam sites might become a fatal flaw.

- Culinary water supplies are needed along with irrigation water. How would existing culinary water supplies be impacted?

The five categories of issues and concerns mentioned most often in the January 1993 scoping meetings were, in descending order, project design, financing, relation of the project to the Ute Tribe, structure of project alternatives, and water rights. The top five issues and concerns mentioned in the October 1993 scoping meetings were, in descending order, project design, relation of the project to the Ute Tribe, project control, cost/benefits, and water rights. Written comments were received from the BIA, COE, EPA, FWS, DOI, and Wildlife Resources.

5.4 Coordination During Draft EIS Development

This Draft EIS has been developed through continued coordination efforts among the CUWCD project team, agencies, the Ute Tribe, and the Planning Team. Issues identified during scoping were incorporated into the Specialist Work Plans for collecting data to be analyzed in resource Technical Reports, which are the basis for preparing the Draft EIS. Participants on the Planning Team and the UOICC were provided with copies of the relevant draft Specialist Work Plans and Technical Reports for the Draft EIS for review. Their comments were received and incorporated into the final Specialist Work Plans and Technical Reports. The Specialist Work Plans and reviewing agencies are listed in Table 5-1.

Weekly meetings with agency personnel located at CUP headquarters were held by the CUWCD during Draft EIS development. Monthly coordination meetings with a broader group of agencies occurred for project planning and scoping purposes and to guide fieldwork efforts associated with the environmental data collection and evaluation. Participating in these meetings were the DOI, EPA, COE, FWS, Wildlife Resources, NRCS, FS, UOICC, and, later in the process, the Ute Tribe.

Technical committees were established during the Planning Team meetings to provide guidance on studies of terrestrial and aquatic biological resources. These committees were comprised of professional experts from State and Federal resource agencies, as well as the private sector. They provided input during technical committee meetings on the design of field studies and data collection and analysis methodologies, and they reviewed study findings. The Terrestrial Resources Technical Committee included representatives from the FS, Wildlife Resources, FWS, Ute Indian Tribe Fish and Wildlife Department, UOICC, BIA, COE, and NRCS. The Aquatic Resources Technical Committee included representatives from the same agencies and private groups, except for the NRCS.

Some special studies were requested by agencies as part of the NEPA compliance process. The EPA requested that investigations be conducted into the existence of toxic materials and/or wastes in the vicinity of proposed project features.

The FWS and Wildlife Resources requested that a Habitat Evaluation Procedure (HEP) study be conducted to determine habitat value at potentially impacted sites. This study was designed with the input of these agencies and other members of the Terrestrial Resources Technical Committee.

The Aquatic Resources Technical Committee requested that an Instream Flow Incremental Methodology (IFIM) study be conducted. The aquatic resources study also included habitat, fish population, and macroinvertebrate surveys, and an evaluation of channel-shaping flows. The committee also requested that reservoir conservation pool requirements and fish passage facilities be evaluated.

Major coordination efforts with the Ute Tribe also occurred during this period. Because of their concerns over potential conflicts with other issues, the Tribe's formal role in earlier project planning and scoping was as an observer only. During the development and conduct of Draft EIS studies, the Tribe hired a consultant to conduct Upalco Unit work on the Reservation and appointed a Water Board to manage the work and coordinate with the CUWCD and its consultant. Following this action, a series of meetings was held by the Tribal Water Board and CUWCD to develop the project relationship and to define and coordinate the division of work between the consultants. Between November 1995 and June 1996, biweekly or monthly meetings were held with the Ute Tribe, their representatives, and DOI to discuss allocation of project water and the status of the planning effort.

Special purpose meetings were held by the project team with a number of agencies during Draft EIS development. These included the following (no minutes were recorded at these meetings):

Week of October 4, 1993—with FWS and Wildlife Resources personnel to conduct field examination of streams and determine instream flow study methods to be used

Table 5-1
Specialist Work Plans and Reviewing Agencies

Biological Resources	Human and Socioeconomic Resources
U.S. Fish and Wildlife Service Utah Division of Wildlife Resources U.S. Forest Service Natural Resources Conservation Service U.S. Army Corps of Engineers U.S. Environmental Protection Agency U.S. Bureau of Indian Affairs U.S. Department of the Interior Utah Outdoor Interests Coordinating Council	U.S. Department of the Interior U.S. Forest Service U.S. Department of the Interior Utah Outdoor Interests Coordinating Council Utah Division of Parks and Recreation Utah Office of Planning and Budget
Cultural Resources	**Water Resources**
U.S. Bureau of Indian Affairs U.S. Forest Service U.S. Department of the Interior Utah Outdoor Interests Coordinating Council State Historic Preservation Office	U.S. Fish and Wildlife Service Utah Division of Wildlife Resources U.S. Forest Service Natural Resources Conservation Service U.S. Army Corps of Engineers U.S. Department of the Interior U.S. Bureau of Indian Affairs U.S. Environmental Protection Agency Utah Outdoor Interests Coordinating Council Utah Division of Water Resources State Engineer
Land and Physical Resources	
Utah Division of Wildlife Resources U.S. Forest Service U.S. Department of the Interior U.S. Environmental Protection Agency U.S. Bureau of Indian Affairs Utah Outdoor Interests Coordinating Council Natural Resources Conservation Service	

October 14, 1993—with Ute Indian Tribe Fish and Wildlife Advisory Committee, BIA, and FWS to tour proposed project feature sites

November 9 and 17, 1993—with FWS and U.S. Geological Survey (USGS) to discuss field sampling coordination for environmental contaminants study, cooperative agreement, and project status

November 16, 1993—with DOI to discuss project coordination with Ute Tribe

November 17, 1993—with Ute Indian Tribe Fish and Wildlife Advisory Committee to present proposed project alternatives

November 17, 1993—with Ute Indian Tribe Fish and Wildlife Department to discuss environmental contaminants study

November 23, 1993—with NRCS and USBR to discuss status of Salinity Control Program

December 28, 1993—with DOI to discuss project purpose and need

January 11, 1994—with FS and Wildlife Resources to discuss the aquatic resources study sampling plan

February 4, 1994—with various resource agencies (FS, FWS, etc.) to discuss environmental enhancement opportunities

February 17, 1994—with Wildlife Resources to refine enhancement features

February 17, 1994—with FWS on behalf of Ute Tribe to refine enhancement features

February 23, 1994—with FS (Ashley National Forest) to discuss FS role in Draft EIS

March 2, 1994—with FWS and Wildlife Resources to discuss handling Farnsworth Canal improvements under an EA

May 4, 16, and 27, and June 3, 1994—with NRCS to discuss "representative area" approach for assessing sprinkler irrigation impacts on farms

May 9, 1994—with USGS to discuss accuracy of recorded streamflow data

June 7, 1994—conference call with EPA and COE to discuss EPA's concern regarding use of HEP for wetland functional analysis

June 15 and 16, 1994—with resource agency working group to discuss using "representative area" approach for assessing sprinkler irrigation impacts on farms

June 20 and 21, 1994—with DOI and others to discuss using "representative area" approach

June 28, 1994—with FWS to discuss ongoing studies of threatened and endangered (T&E) fish

August 9, 1994—with FWS to discuss T&E fish issues and study progress

August 16, 1994—with DOI and USBR to review aerial photos and discuss approach to be used in land classification

September 9, 1994—with FS to discuss recreation opportunities associated with projects

October 4, 1994—with FS to develop recommended stabilization levels for high mountain lakes

October 17, 1994—with DOI and USBR to discuss field mapping for land classification

November 3, 1994—with DOI and USBR to discuss land suitability issues

November 22, 1994—with all interested agencies to discuss high mountain lakes stabilization

January 12, 1995—with FWS to discuss flow needs for T&E fish in the Duchesne River

January 19, 1995—with COE to discuss mitigation strategy for wetland impacts

January 20, 1995—with resource agencies, DOI, Ute Tribe, and Tribe's consultant to discuss potential impacts and project alternatives

February 27, 1995—with FWS to discuss T&E fish issues

March 28 and April 18, 1995—with FS to present high mountain lakes stabilization plans

April 20, 1995—with resource agencies, DOI, and Ute Tribe to present initial findings of impact assessment

April 21, 1995—with Utah Department of Dam Safety to present high mountain lakes stabilization plans

May 16 and 23, 1995—with BIA and River Commissioner to discuss irrigated acres

June 13, 1995—with Recovery Implementation Program Recovery Action Plan (RIPRAP) team to discuss scope of work to develop hydrology to protect T&E fish critical habitat flows in the lower Duchesne River

June 25, 1995—with FS to discuss bedload sediment transport

June 25, 1995—with FWS, BIA, Ute Tribe, and Wildlife Resources to discuss minimum instream flows in the various stream reaches

July 27, 1995—with resource agencies, DOI, Ute Tribe, and CUWCD to discuss IFIM results and T&E fish analysis

October 12, 1995—with DOI to discuss allocation of project water and status of planning effort, including schedule and project costs and benefits

October 13, 1995—with DOI and two Moon Lake Water Users Board members to discuss allocation of water and storage

December 11, 1995—with participating agencies' representatives to receive and review comments on Chapter 1 of the Draft EIS

December 12, 1995—with participating agencies' representatives to receive and review comments on the preliminary draft Water Resources Technical Report

Meetings were also held with various interest groups during this period.

Several additional meetings were held to inform and obtain input from the project Planning Team during Draft EIS development. On April 26, 1994, a meeting was held with the Planning Team to report on project status, including the development of Specialist Work Plans, field work underway, and work schedule. On January 31, 1995, a Planning Team meeting was held to review findings of field studies and to obtain the Team's input on the selection of the preferred alternative for the Draft EIS.

Draft technical reports were subsequently prepared for seven resource areas (water, aquatics, wildlife, threatened and endangered species, wetlands/riparian, environmental contaminants, and cultural), then reviewed and commented on by agency representatives, the Ute Tribe and their representatives, and the UOICC. Review comments were received by the CUWCD during late 1995/early 1996. Where appropriate, these comments were addressed in revised technical reports, which form the basis of the respective resource areas addressed in this Draft EIS.

5.5 Draft EIS Coordination

This section describes the coordination that will be achieved in reviewing the Draft EIS. A complete mailing list of all agencies, bureaus, organizations, groups, and individuals that will receive the Draft EIS is available upon request from:

Terry Holzworth, Project Manager
Central Utah Water Conservancy District
355 West 1300 South
Orem, Utah 84058-7303

5.5.1 Request for Official Comments

The following agencies, bureaus, groups, and organizations will receive the Draft EIS for review:

- U.S. Department of the Interior
- Ute Indian Tribe
- U.S. Bureau of Indian Affairs
- U.S. Fish and Wildlife Service
- U.S. Department of Agriculture, Forest Service – Ashley National Forest
- U.S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Environmental Protection Agency
- U.S. Army Corps of Engineers
- U.S. Bureau of Reclamation
- Utah Department of Natural Resources
- Utah Division of Wildlife Resources
- Utah Division of Water Resources
- Utah Division of Water Rights
- Utah Division of Parks and Recreation
- Utah Department of Environmental Quality, Division of Water Quality
- Utah State Engineer
- Duchesne County Water Users
- Duchesne County Soil Conservation District
- Moon Lake Water Users Association
- Dry Gulch Irrigation Company
- Uintah County Commission
- Duchesne County Commission
- City of Roosevelt
- City of Duchesne
- Utah Outdoor Interests Coordinating Council
- Trout Unlimited
- Salt Lake County Fish and Game Association
- Stonefly Society
- Sierra Club
- Utah Wildlife Board
- High Country Flyfishers
- Private individuals who have requested a copy

5.5.2 Public Hearings

Three public hearings will be held on the Draft EIS — one in Fort Duchesne, Utah, one in Salt Lake City, and one in Altamont, Utah, Following are the hearing dates, times, and locations:

Altamont Draft EIS Hearing

Date:	Wednesday, February 5, 1997
Time:	6:00 p.m.
Location:	Altamont High School Auditorium Highway 87 (north side) Altamont, Utah

Salt Lake City Draft EIS Hearing

Date:	Thursday, February 6, 1997
Time:`	6:00 p.m.
Location:	Salt Lake County Commission Chambers 2001 S. State Rm N1100 Salt Lake City, Utah

Fort Duchesne Draft EIS Hearing

Date:	Tuesday, February 11, 1997
Time:	1:00 p.m.
Location:	Ute Tribal Auditorium Tribal Headquarters Fort Duchesne, Utah

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Glossary

Alluvium. A general term for all deposits resulting from the operations of modern rivers, including the sediments laid down in riverbeds, floodplains, lakes, fans at the foot of mountain slopes, and estuaries.

Archaeology. The scientific study of past human life through material remains.

Bioaccumulation. The process of uptake (by eating or other exposure) and storage of environmental contaminants in the tissue of plants or animals.

Canopy cover. A measure of the percent of the ground covered by vegetation, rocks, bare ground, etc.

Conductivity or specific conductance. Water quality characteristic that estimates the total ion content of water by measuring its ability to conduct electrical charge.

Culture. All that is nonbiological and socially transmitted in a society, including artistic, social, ideological, and religious patterns of behavior, and the techniques for mastering the environment. The term culture is often used to indicate a social grouping that is smaller than a civilization.

Dry dam. An irrigation diversion dam that diverts all flow from a river and prevents water from moving downstream.

Ethnography. The study of individual cultures. It is primarily a descriptive and noninterpretive study.

Euphotic zone. The uppermost layer of a body of water in which there is sufficient light for photosynthesis.

Eutrophic. Pertaining to a type of lake or reservoir characterized by partial depletion or absence of oxygen in deeper waters in midsummer, rich nutrient supply, and abundant plankton populations.

Evaluation species. Wildlife species used in a Habitat Evaluation Procedure (HEP) study.

Floodplain. The portion of the floodway that is active and correlates to the bankfull stage discharge under today's hydrologic regime.

Floodway. The entire width of the alluvial bottomland inundated by floods of varying frequency. It is comprised of alluvial terraces (historic floodplains), old river channels, and the active floodplain.

Fluvial. Stream-related

Geology. The science that studies the earth, the rocks of which it is composed, and the changes it has undergone or is undergoing.

Habitat improvement. A mitigation strategy through which the wildlife habitat value of a vegetation or habitat type is improved.

Habitat fragmentation. A term used in the study of ecology to indicate an area that has been largely converted from natural vegetation types to human-created cover types such as farmland or urban areas. A fragmented landscape consists of a few remnant patches of natural habitat in a matrix of converted land.

Habitat variables. Physical or biological parameters measured to assess wildlife habitat value in a Habitat Evaluation Procedure (HEP) study.

Habitat value. A Habitat Evaluation Procedure (HEP) term that combines the measure of wildlife habitat quality and the area of a habitat type.

Habitat development. A mitigation strategy through which relatively high-value wildlife habitat types are developed from lower-value types.

Historic archaeological site. Historic manifestation of human activity, such as foundations and trash scatters.

Historic period. From the start of recorded history to 1955 (for this project).

Historic standing structure. A historic standing building with walls and roof still intact; also, intact engineering structures such as bridges and culverts.

Holocene. Recent, of the present geological time period (last 10,000 years).

Invertebrate. Species without a backbone or spinal column.

Littoral. Pertaining to the region of a lake between the shoreline and the outer limit of rooted, aquatic plants.

Mesotrophic. Category occasionally used to characterize lakes or reservoirs of intermediate productivity.

Oligotrophic. Pertaining to lakes or reservoirs without distinct oxygen stratification, poor nutrient supply, and sparse plankton populations.

Organochlorines. A class of potentially toxic, man-made, organic chemicals containing chlorine, including DDT, PCBs, and related compounds.

Paleontology. The scientific study of life in the geologic past.

Phreatophyte. Plant with extremely long roots reaching to the water table.

Pleistocene epoch. The earlier of the two epochs comprising the Quaternary period; also called glacial epoch and, formerly, the ice age.

Prehistory. The study of the life and activities of mankind up to the beginning of recorded history.

Seleniferous. Containing selenium.

Site. Any physical manifestation of human activity, especially archaeological.

Snags. Standing dead or partially dead trees.

Species composition. The plant or animal species that occupy an area or habitat type.

Traditional cultural properties. A property or place that is eligible for inclusion on the National Register of Historic Places (NRHP) because of its association with cultural practices and beliefs that are rooted in the history of a community and are important in maintaining the continuity of that community's traditional beliefs and practices.

Vegetation condition. The relative value of vegetation for wildlife within a cover type or area.

Vertebrate. Species possessing a spinal column and more or less bony parts of an internal skeleton.

Weir. A stream flow-measuring device that measures water depth in a constructed channel; also, a dam in a stream to raise the water level or divert its flow.

Abbreviations and Acronyms

AAHUs	Average Annual Habitat Units
ACHP	Advisory Council on Historic Preservation
ANF	Ashley National Forest
ATV	All-terrain vehicle
BA	Biological Assessment
BIA	U.S. Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
BMPs	Best Management Practices
CEQ	Council on Environmental Quality
cfs	cubic feet per second
COE	U.S. Army Corps of Engineers
CR	County Road
CU	consumptive use
CUP	Central Utah Project
CUPCA	Central Utah Project Completion Act
CUWCD	Central Utah Water Conservancy District
CWA	Clean Water Act
D&MC	drainage and minor construction
dBA	decibel A-rated
DOI	U.S. Department of the Interior
EA	Environmental Assessment
EC	electrical conductivity
ECOTONE	ECOTONE Environmental Consulting, Inc.
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FHWA	Federal Highway Administration
FS	U.S. Forest Service
FSA	Food Security Act
FWCA	Fish and Wildlife Coordination Act
FWS	U.S. Fish and Wildlife Service
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HEP	Habitat Evaluation Procedure

HU	Habitat Units
HUW	High Uintas Wilderness
IFIM	Instream Flow Incremental Methodology
kW	kilowatt
LOS	level of service
MCLs	maximum contaminant levels
mg/L	milligrams per liter
mm	millimeters
MSDS	Material Safety Data Sheets
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
NCBP	National Contaminant Biomonitoring Program
nCi/L	nanocuries per liter
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PSD	Prevention of Significant Deterioration
RCC	roller-compacted concrete
RIPRAP	Recovery Implementation Program Recovery Action Plan
RM	river mile
ROD	Record of Decision
ROWs	right-of-ways
RVDs	recreational visitor days
SAR	sodium adsorption ratio
SCS	Soil Conservation Service
SHPO	State Historic Preservation Office
SPCC	Spill Prevention, Containment, and Countermeasure
SR	State Route; also Secondary Route
T&E	threatened and endangered
TDS	total dissolved solids
TSP	total suspended particulates
TSS	total suspended solids

UDOT	Utah Department of Transportation
UOICC	Utah Outdoor Interests Coordinating Council
UR	Urban Route
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Survey
VQOs	Visual Quality Objectives
$\mu g/m^3$	micrograms per cubic meter

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Appendix A
Standard Construction and Operating Requirements

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A number of standard requirements that are intended to reduce short- and long-term impacts would be implemented during construction and operation of all Upalco Unit Replacement Project project features. Certain procedures relate only to construction activities in the vicinity of waterways, wetlands, or other sensitive habitats, while others relate to stabilization and revegetation of disturbed uplands. This section also describes temporal restrictions that would be imposed on construction and operation activities in areas with sensitive wildlife habitat features.

Short-term impacts of dam and pipeline construction, canal rehabilitation, and diversion dam replacement would be reduced by following standard and project-specific environmental protection procedures for the following activities:

- Landscape preservation and impact avoidance
- Erosion and sediment control
- Pipeline construction through wetlands and riparian areas
- Biological and cultural resource site clearances
- Site restoration and revegetation
- Prevention of water pollution
- Prevention of noise and air pollution
- Hazardous material storage, handling, and disposal
- Miscellaneous measures

Each of these procedures would be incorporated into all construction specifications and contract documents, as appropriate, and all contractors would be required to follow them. An Environmental Compliance Officer (or Officers), employed by the Central Utah Water Conservancy District (CUWCD), would monitor and enforce the timely and effective application of these procedures. Environmental Compliance Officers would be on job sites during all critical periods which would be determined during final design. They would have the authority to enforce compliance with procedures described in this section and to halt work, if necessary, to remedy problems. They also would file monthly reports with the CUWCD, appropriate regulatory and land management agencies, and the U.S. Department of the Interior (DOI), documenting compliance with the requirements, problems encountered, correction measures, and monitoring results.

Landscape Preservation and Impact Avoidance

Construction specifications would require contractors to preserve the natural landscape and prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the work vicinity. All trees, native shrubbery, and other vegetation would be preserved and protected from construction operations and equipment except where clearing operations are required for permanent structures, approved construction roads, or excavation operations. All maintenance yards, field offices, and staging areas would be arranged to preserve trees and vegetation to the maximum practicable extent.

Clearing operations would be limited to that needed for construction and borrow material sites. In critical habitat areas, such as wetlands and riparian communities, clearing would be restricted to only a few feet beyond areas required for construction. Areas around structures would be backfilled and compacted, and all disturbed areas reclaimed to the native vegetation type.

Critical environmental areas (i.e., stream corridors, wetlands, riparian areas, Ute ladies'-tresses orchid habitat, and steep slopes) would not be used for equipment or material storage or stockpiling; construction staging or maintenance; field offices; hazardous material or fuel storage, handling, or transfer; or temporary access roads to reduce environmental damage. Excavated or graded materials would not be stockpiled or deposited on or within 100 feet of any streambanks (including seasonally active ephemeral streams without woody or herbaceous vegetation growing in the channel bottom), steep slopes, wetlands, or riparian areas. Damage to critical area vegetation would be strictly limited only to areas required for construction activities. Staging areas, access roads, and other site disturbances required for canal rehabilitation would be located in agricultural areas to reduce damage to natural plant communities.

Coordination with the U.S. Army Corps of Engineers (COE) and the Utah State Engineers' office would be maintained during stream improvement and other activities in jurisdictional wetlands and waterways. Section 404 and stream alteration permits would be required.

There is one exception to the restriction on using critical environmental areas for certain activities. Riparian areas that do not contain the sole source of revegetation materials and are located within future reservoir footprints may be used as equipment or material storage or stockpile areas or as construction staging areas when upland areas within the reservoir footprint are not available. Revegetation material would be reclaimed before use. Areas within reservoir footprints would not be used as hazardous material or fuel storage, handling, or transfer areas under any circumstances, and would not include any materials that could cause contamination of aquatic or terrestrial environments.

Final reservoir clearing operations would not occur until the last year of construction before reservoir fill-up. Final clearing would be done after August 1 to avoid most bird nesting losses.

Except in reservoir areas, all large trees greater than 10 inches in diameter also would be preserved to the extent practicable during all construction activities. This is especially important along canal and pipeline routes. Large trees and all wetland and riparian vegetation within a 100-yard radius of the large trees would not be disturbed, if possible.

Existing access roads would be used for all construction activities where possible. If new roads must be constructed, the width would be kept to the absolute minimum needed. Turnouts and staging areas would not be placed in wetlands. Access roads would be situated to avoid all trees where possible, but especially trees greater than 10 inches in diameter, and to limit disturbance to vegetation. Wetlands and riparian areas would be avoided where possible.

Where a new diversion structure is built, the old structure would be removed in a manner that minimizes disturbance to vegetation, especially to large trees. This may require removal of only the instream portions of diversion structures. Decisions to remove only the in-water portions of diversion dams would be made with interagency and Tribal consultation.

Erosion and Sediment Control

Several procedures would be used as necessary to prevent and minimize erosion and siltation during construction and during the period needed to reestablish permanent vegetative cover on disturbed sites. These include planting native grasses, forbs, trees, or shrubs beneficial to wildlife or placement of riprap, sand bags, jute, sod, erosion mats, bale dikes, mulch, or excelsior blankets.

Clearing schedules would be arranged to minimize the practical exposure of soils. Final erosion control and site restoration measures would be initiated as soon as an area is no longer needed for construction, stockpiling, or access.

Cuts and fills on relocated and new roads would be appropriately sloped to prevent landslides and to facilitate revegetation. Areas of slope instability in reservoir areas would be identified by additional field work during the final design phase. The identified areas would be stabilized or protected to prevent mass soil movement into reservoir pools.

Borrow areas would be contoured to prevent water from collecting, unless the borrow excavation is below groundwater level. Before borrow areas are abandoned, their sides would be brought to stable slopes with intersections shaped to carry the natural contour of adjacent undisturbed terrain into the borrow area.

No soil, rock stockpile, or excess soil materials would be placed near sensitive resource habitats, including water channels, wetlands, and riparian areas, where they may erode into these habitats, or where runoff from spoils could run into sensitive habitats. Waste piles would be revegetated after they are shaped to provide a natural appearance.

All construction activities for canal rehabilitation would be accomplished from an access road alongside the canal. Existing access roads would be used to the greatest extent possible. New access roads would avoid wetlands or riparian communities to the extent practicable. In sensitive habitat, construction would be done from the opposite side of the canal to the extent practicable. If this is not possible based on the judgment of the Environmental Compliance Officer, a road no more than 10 feet wide would be constructed.

Pipeline Construction through Wetlands and Riparian Communities

Wetlands and riparian areas are especially sensitive to direct and secondary construction impacts. Changes in ground surface elevation or surface or groundwater hydrology can create long-term impacts that extend well beyond direct surface disturbance. Construction practices intended to reduce direct impacts on wetlands would be determined in consultation with the COE, U.S. Fish and Wildlife Service (FWS), Utah Division of Wildlife Resources, the Ute Tribe, and other appropriate land management agencies during preparation of a Section 404 permit application. Restrictions described above would be adhered to without exception in wetlands and riparian communities along pipeline routes. These would apply to areas for equipment or material storage and stockpiling; construction staging; hazardous material or fuel storage, handling, and transfer; and temporary access roads. Construction right-of-ways through wetlands and riparian communities would be limited to the minimum practicable width not to exceed 25 feet.

Gravel material typically used for bedding and/or backfill material in pipeline trenches can act as a conduit for surface and shallow groundwater, transporting water away from an area and depriving downgradient wetlands and riparian communities of needed moisture. Special construction methods and materials would be used to avoid long-term impacts on site hydrology. Cutoff collars, or other appropriate methods determined during final design, would be used to prevent water from being drained away from wetlands and riparian areas.

If available, the upper 12 to 18 inches of soil would be removed from the trench area and stockpiled for later use. Excess material removed from trenches would not be stockpiled or disposed of in wetlands or riparian areas. Surface elevations would be returned to preproject conditions, taking into account expected settling. Excess soil material would not be disposed of in wetlands, riparian areas, or other native plant communities. Revegetation would follow the procedures described below.

Biological and Cultural Resource Site Clearances

Several project features would require clearances after project authorization but before the start of construction. Clearances would be conducted by qualified biologists or cultural resource specialists reporting directly to the Environmental Compliance Officer.

Biological Resource Clearances

The exact locations of canals to be rehabilitated and new pipelines were not known at the time of field surveys. Therefore, field surveys would be conducted in appropriate habitat types to identify sensitive areas that would be avoided by adjusting pipeline routes or service roads, staging areas, or construction timing or for which site-specific mitigation measures would be developed.

If at all possible, native plant community areas would not be used as staging areas. If native plant community areas must be used, site clearances must be obtained from a qualified biologist working with the Environmental Compliance Officer. Site clearances would only be conducted at the appropriate time of year for the species involved. Sensitive species clearances would be obtained for all new pipelines and canal rehabilitation, as stated in the Threatened and Endangered Species Technical Report (CH2M HILL/Horrocks 1996a) using procedures approved by the FWS.

A monitoring program for suitable Ute ladies'-tresses orchid (threatened species) habitat that would be disturbed would be initiated following the Record of Decision (ROD), assuming selection of the Proposed Action. Based on the results of the monitoring activity, appropriate design considerations or salvage of plants would be pursued.

Wetlands and riparian areas would not be used for construction staging areas except in the bottom of reservoir basins, nor would they be crossed by access roads unless unavoidable, and not until clearance is obtained by a qualified biologist and the Environmental Compliance Officer. The goal of the biologist in these situations would be to minimize impacts on Waters of the United States and special aquatic sites, including jurisdictional wetlands, in accordance with the Section 404(b)1 guidelines of the Clean Water Act (CWA).

Sensitive areas along canal banks that are not suitable for temporary storage or permanent disposal of excess soil materials would be clearly marked by the biologist before any construction activity.

All canal rehabilitation reaches would be surveyed in late spring and early summer for U.S. Forest Service (FS) sensitive candidate bat species roosting or nesting in trees. Roost sites would be protected from disturbance, to the degree possible. It will not be possible to avoid temporary disturbance to roosting bats, but nesting colonies would be avoided until nesting is complete.

All canal rehabilitation reaches and new pipeline corridors would be surveyed for nesting ferruginous hawks and other raptors. If nesting hawks are found, construction within 1 mile of the nest would be limited to the extent practicable between August 1 and March 1. All large trees greater than 10 inches in diameter and all vegetation within a 100-yard radius would be protected to the extent possible. Raptor clearance procedures and frequency are described in greater detail in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996b).

Surveys to locate sage grouse breeding complexes within 2 miles of all canal rehabilitation reaches and new pipeline corridors would be initiated as quickly as possible after project authorization. The lek will be considered the center of the breeding complexes, and avoidance of all disturbances to existing vegetation within a 2-mile radius of leks is preferred. Therefore, to the extent possible, no pipelines or service roads would be constructed within 2 miles of the lek. If canal rehabilitation or pipeline and service road construction is to occur between 3 and 4 miles from a lek, construction period restrictions would be in effect. Construction would occur during the fall/winter season when sage grouse are not in the area (mid-September through mid-February). Survey procedures are described in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996b).

A permanent access road along each pipeline would not be reclaimed. Access roads need not follow the pipeline route exactly and would be located at least 2 miles from any lek. Special attention would be paid to reclaiming disturbed sagebrush/grass and wet meadow communities in the pipeline right-of-way (ROW) that are within 4 miles of a lek.

Cultural and Paleontological Resource Clearances

All project features that have not had a Class III survey or been tested for the presence of cultural or paleontological resources would need to be inventoried and their eligibility determined. Cultural resources sites deemed eligible for the National Register of Historic Places (NRHP) and Significant and Critical paleontological localities also would need to be mitigated. A more detailed discussion of the status of cultural and paleontological resource data for project features is included in the Cultural Resources Technical Report (Sagebrush Archaeological Consultants 1996). Specific mitigation that would be conducted before surface disturbance would be determined as described in the draft Cultural Resources Programmatic Agreement (CUWCD 1995). All surveys, site documentation, and mitigation measures would be implemented before project construction.

Site Restoration and Revegetation

Upon completion of construction, all disturbed lands outside the limits of dams, reservoir pools, permanent roads, and other permanent facilities would be prepared for restoration. Erosion control measures would be initiated and final site restoration undertaken as soon as an area is no longer needed for construction, stockpiling, or access. Upon completion of construction, any land disturbed but not permanently occupied by new facilities would be graded to provide proper drainage and blend with the natural contours of the land, covered with topsoil stripped from construction areas, and revegetated with plants native to the area and beneficial to wildlife.

When abandoned, all yards, offices and construction buildings, including concrete footings and slabs, and all construction materials and debris would be removed from the site and the area would be revegetated at the next appropriate seeding time. Construction roads above the high-water elevation would be restored to the original contour and made impassable to vehicular traffic when no longer required by the contractor. Road surfaces, including all new access roads, would be scarified, as needed, to establish conditions suitable for reseeding or natural revegetation, proper drainage, and erosion prevention. Culverts would be removed, as appropriate, and road escarpments contoured and revegetated. Access roads would be blocked by either temporary or permanent means to permit planted vegetation to become established.

At all times, construction areas, including storage yards, would be kept free from accumulations of waste materials and trash. During the final phase of work, contractors would be required to remove all unused materials and trash, dump it in an approved sanitary landfill, and leave work areas neat to conform to the natural landscape.

The recommended composition of plant species, seeding rates, and planting dates would be determined in consultation with the Utah Division of Wildlife Resources (where applicable), FWS (where applicable), FS (where applicable), the Ute Tribe (where applicable), the Natural Resources Conservation Service (where applicable), the U.S. Bureau of Indian Affairs (BIA) (where applicable), and the Bureau of Land Management (BLM) (where applicable). The species to be used in site restoration and revegetation would be matched for soil drainage, climate, shading, resistance to erosion (slope of site), and vegetation management goals. Disturbed wetlands and riparian areas would be revegetated with wetland and riparian species. Uplands would be revegetated to the native vegetative community appropriate for the site's soil type, topographic position, and elevation. Trees and shrubs appropriate for site conditions and surrounding vegetation types also would be included in the reclamation plant list for uplands.

Prevention of Water Pollution

Contractors would be required to comply with all federal and state laws and regulations regarding control and abatement of water pollution. All waste materials and sewage from construction activities or project-constructed features would be disposed of as specified by federal and state health and pollution control regulations.

Contractors would be required to monitor water quality of discharges and receiving water (both background and below discharges) during any construction activities that could impact surface water quality. The Environmental Compliance Officer would have the ultimate responsibility to ensure adequate water quality monitoring and to see that monitoring results are distributed to appropriate parties. The Officer would determine the parameters to be monitored in coordination with the Utah Department of Environmental Quality–Water Quality Division as part of preparing a water quality monitoring plan.

Before discharging any wastewater or other pollutants from construction activities, contractors may be required to have a National Pollutant Discharge Elimination System (NPDES) permit as established under Public Law 92-500 and amended by the CWA (Public Law 95-217).

Cofferdams required for instream construction would be erected of clean, washed, crushed stone or other suitable materials free of contaminants that would not contribute significantly to the turbidity or siltation of streams or other watercourses. Use of easily erodible soils for cofferdam construction would be specifically prohibited.

Activities with a high potential for causing sediment, such as cofferdam placement or stream diversion, would not be conducted during the period of high runoff that typically occurs in June. Instream diversion work and river crossing installation would be conducted during low-flow seasons.

Turbidity levels caused by construction activities would be limited to the increases permitted under the guidelines issued by the U.S. Environmental Protection Agency (EPA) or the State of Utah for streams in the Uinta Basin. When necessary to perform required construction work in a stream channel, the prescribed turbidity limits may be exceeded for the shortest practical period required to complete such work, subject to permit conditions. Whenever practicable, machinery for instream construction work would operate from the streambank, not in the stream channel.

Construction specifications would require construction activities to be performed by methods that would prevent entrance or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into flowing or dry watercourses and underground water sources. Potential pollutants and wastes include refuse, garbage, cement, concrete, sewage effluent, industrial waste, oil and other petroleum products, aggregate processing tailings, mineral salts, and thermal pollution.

Disturbance of streambeds would be minimized and streambeds would be returned to their original condition as nearly as possible, or better. In all cases involving work in a stream outside the reservoir pool, every effort would be made to return disturbed portions to the highest possible standard for aesthetic value, water quality, and fish habitat. Damage to streambank vegetation would be minimized. Damaged streambanks outside reservoir areas would be revegetated using local native herbaceous and woody species that provide rapid bank stabilization.

Dewatering work for structure foundations or earthwork operations adjacent to, or encroaching on, stream or watercourses would be conducted to prevent muddy water and eroded materials from entering streams or watercourses. Intercepting ditches, bypass channels, barriers, settling ponds, or other approved means would be used as appropriate and as determined by the Environmental Compliance Officer.

Excavated materials would not be stockpiled or deposited near or on streambanks, wetlands, or other watercourse perimeters where they could be washed away by high water or storm runoff, or encroach upon the sensitive area.

Water pumped from behind cofferdams and wastewater from aggregate processing, concrete batching, or other construction operations would not enter streams, watercourses, or other surface waters without use of turbidity control methods. These may include settling ponds, gravel-filter entrapment dikes, approved flocculating processes that are not harmful to fish, recirculation systems for washing aggregates, or other approved methods. Any wastewater discharged into surface waters would be essentially free of settleable material.

Construction specifications would require riprap materials to be free of contaminants and not contribute significantly to the turbidity of the reservoir.

The contractor must have a permit issued by the COE to discharge any dredge or fill materials into navigable waterways or special aquatic sites, including jurisdictional wetlands, as provided in Section 404 of the CWA.

Prevention of Noise and Air Pollution

Contractors would be required to comply with applicable federal, state, and local laws and regulations concerning prevention and control of noise and air pollution. Utah Air Conservation Regulations require that the contractor apply for and receive an air quality approval order before starting construction activities and operating equipment that would result in atmospheric emissions. All approvals require best available control technology for all emission sources vented through stacks and vents and sources of fugitive dust emissions.

Contractors would be required to use reasonably available methods and devices to control, prevent, and reduce atmospheric emissions or discharges of atmospheric contaminants and noise. Equipment and vehicles that show excessive emissions of exhaust gases and/or noise because of poor engine adjustments or other inefficient operating conditions would not be operated until corrective repairs or adjustments were made.

Contractors would be required to reduce dust from construction operations and prevent it from damaging dwellings or causing a nuisance to people, using such measures as periodic wetting of exposed soils or roads where dust is generated by passing vehicles.

Emission of dust into the atmosphere would not be permitted during the manufacture, handling, and storage of concrete aggregates. The contractor would be required to use any necessary methods and equipment to collect, dispose of, or prevent dust during these operations. Dust abatement also applies to the contractor's methods of storing and handling cement and pozzolans.

Burning materials from clearing of trees and brush, combustible construction materials, and trash would be permitted only when atmospheric conditions are considered favorable by appropriate state or local air pollution or fire authorities. In lieu of burning, such combustible materials may be removed from the site, chipped or shredded, or buried, subject to approval of the Environmental Compliance Officer. Some woody material would be removed from construction sites and used at wildlife mitigation sites as described in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996b). Where open burning is permitted, burn piles would be constructed to reduce smoke, and in no case would the contractor burn unapproved materials such as tires, plastics, rubber products, asphalt products, or other materials that create heavy, black smoke or nuisance odors.

Open burning is prohibited throughout Utah from June 1 to October 31. If burning is performed during this period, the contractor would be required to obtain necessary permits and comply fully with their terms and conditions.

Hazardous Material Storage, Handling, and Disposal

Contractors would be required to comply with Utah Hazardous Waste Management Regulations established under the authority of the Federal Resources Conservation and Recovery Act of 1976 and the Utah Hazardous Waste Act of 1979.

The potential for adverse impacts from oil and fuel spills would be reduced through careful handling and designation of specific equipment repair and fuel storage areas.

Oil, petroleum waste products, chemicals, and hazardous or potentially hazardous wastes would not be drained onto the soil, but confined in sealed containers or sealed sumps for removal to approved disposal sites. They would be transported in accordance with all applicable state and federal safety standards.

The contractor would be required to prepare a Spill Prevention Containment and Control (SPCC) plan for any construction site where oil from an accidental spillage could reasonably be expected to enter wetlands, groundwater, navigable waters, or adjoining shorelines, and where aggregate oil storage exceeds 1,320 gallons or a single container can hold more than 660 gallons.

Waste materials known or found to be hazardous would be disposed of in approved treatment or disposal facilities in accordance with federal, state, and local regulations, standards, codes, and laws.

All hazardous materials used would be required to have a Material Safety Data Sheet (MSDS) filed onsite. A hazardous material safety and communication plan would be required from each contractor with special emphasis on preventing hazardous materials from entering wetlands and watercourses or contaminating the ground or groundwater.

Concrete trucks would not be washed at construction sites. All spilled concrete would be removed from construction areas and disposed of properly.

References Cited

Central Utah Water Conservancy District (CUWCD). 1995. Draft cultural resources programmatic agreement: draft programmatic agreement among the United States Department of Interior, the Central Utah Water Conservancy District, the Utah State Historic Preservation Officer, the Advisory Council on Historic Preservation, the Ashley National Forest, and the Tribal Business Committee of the Ute Indian Tribe of the Uintah and Ouray Reservation regarding treatment of cultural resources affected by the proposed Uinta Basin Water Replacement Project. Orem, Utah.

CH2M HILL/Horrocks. 1996a. Threatened and endangered species technical report, Upalco Unit Replacement Project and Uintah Unit Replacement Project, Central Utah Project.

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Sagebrush Archaeological Consultants. 1996. Cultural resources technical report, Upalco Unit Replacement Project and Uintah Unit Replacement Project, Central Utah Project. Ogden, Utah.

Appendix B
Wildlife Habitat Mitigation Plan

Appendix B
Wildlife Habitat Mitigation Plan

1.1 Introduction

This conceptual Mitigation Plan (also referred to as the Plan throughout the remainder of this document) discusses the general strategies that would be implemented to avoid impacts where possible and to mitigate the unavoidable loss of wildlife habitat, including wetlands and riparian communities, as a result of this project. A more detailed discussion of the Mitigation Plan is included in the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996b). Detailed plans and specifications and contract documents describing the implementation of this Plan would be developed after project authorization.

Habitat Evaluation Procedure (HEP) was selected as the primary tool for assessing impacts of many of the major project features on wildlife habitat by the Central Utah Water Conservancy District (CUWCD) and the resource and regulatory agencies involved with the project. Other potential project impacts on wetlands and riparian communities were not included in the HEP study. The impacts of land retirement and reduced availability of secondary irrigation water on wetlands and riparian communities could not be quantified at the time of the HEP study and currently consist of only rough estimates based on predicted changes in potential water availability for wetlands. The specific locations where impacts may occur because of these project features are also not known so no HEP field data could be collected. The need to assess the impacts of irrigating Tribal idle lands was not known until October 1996. Therefore, habitat values on these lands could not be determined during the available time frame for completion of the Upalco Unit Replacement Project Draft Environmental Impact Statement (Draft EIS). These impacts would be monitored and appropriate mitigation measures would be developed and implemented as needed in consultation with the Ute Tribe and resource and regulatory agencies.

Since HEP is a habitat-based method, the results of the HEP impact assessment assisted in determining mitigation requirements for impacts on wildlife habitat value (quantity and quality). Results of the HEP study provided direction regarding the selection of potential mitigation sites and the specific actions that would be necessary to compensate for unavoidable project impacts on wildlife habitat value. The HEP methodology was also used to establish baseline wildlife habitat value on most potential mitigation sites and to estimate predicted changes in wildlife habitat that would result from implementation of proposed mitigation measures.

Project impacts such as the loss of big game winter range were not directly assessed using HEP. However, to the degree impacts can presently be quantified, the mitigation strategies developed in the Mitigation Plan account for the predicted loss of wildlife habitat, regardless of the project feature or the specific wildlife use of an impact area. Therefore, while proposed mitigation strategies would not directly compensate for big game winter range losses in the immediate area of the impact, lost wildlife habitat values would be replaced at lower elevation mitigation sites.

Potential mitigation sites were selected and evaluated in terms of the presence and quality of existing cover types and the potential for improving habitat quality or developing new wetlands or riparian communities where none presently exist. Development of the plan considered both quality and extent of all cover types present on impact areas and mitigation sites. Predicted changes in habitat quality and/or area of each cover type on mitigation sites, including wetlands and riparian communities, form the basis for comparing project impacts with proposed mitigation.

1.2 CUWCD Commitments Regarding Land Acquisition, Water Rights, and Operation and Maintenance Costs

The CUWCD has committed to purchasing the land and water rights and implementing the actions necessary to fully mitigate impacts of the project on wildlife habitat, including wetland and riparian habitats. Full funding for all operation and maintenance activities associated with mitigation projects for the life of the project will be through the U.S. Department of the Interior (DOI).

1.3 Limitations to Providing Full In-kind Compensation for All Project-Induced Impacts

Only one limitation to providing full compensation for all project-induced impacts on wildlife habitat, including wetlands and riparian communities, has been identified. It is related to Utah Division of Wildlife Resources' (Wildlife Resources) position regarding mitigating impacts on public lands on other lands accessible to the public. The relatively high-elevation onstream reservoir sites on U.S. Forest Service (FS) lands support conifer, mixed deciduous/conifer, and aspen communities. Because of rapid declines in precipitation rates and increases in temperature with decreasing elevation, replacing these same communities would need to be undertaken at elevations similar to, or not much below, project site elevations.

There appear to be no significant opportunities to mitigate project impacts on suitable FS lands because of the difficulty of eliminating grazing from river bottom areas where the greatest mitigation potential exists. Eliminating grazing would be very difficult because of the administrative problems encountered by the FS in eliminating grazing from lands designated for multiple use under FS regulations. Forest Service lands are also less suitable for mitigation purposes than some private lands because many FS lands along the major Uinta Basin rivers are in better condition relative to wildlife habitat than are the private lands. Therefore, the potential for increasing habitat values on FS lands is less than on the private lands selected for mitigation. Because of the juxtaposition of FS and Indian lands, this essentially means that any impacts on FS lands would have to be mitigated on lands south of the Indian Reservation, which are much lower in elevation than where the impacts would occur.

The relatively low elevation of non-Tribal mitigation sites precludes the establishment and long-term survival of conifers and aspens. Compensation for losses of habitat value associated with conifer and aspen cover types, to the extent these types are impacted, would have to be accomplished through gains in habitat value for species that utilize the forest riparian cover type, which can be developed at lower elevation sites. This trade-off of aspen and conifer losses for gains in the less common forested riparian cover type was determined to constitute acceptable compensation by the HEP team. Subsequent discussion in this Mitigation Plan supports this conclusion.

Mitigation of impacts on upland cover types would be out-of-kind and out-of-place with most uplands replaced by riparian communities. Mitigation of impacts on wetlands and riparian communities would generally be in-kind and out-of-place except along canals, which would be partially in-place as well.

1.4 Conceptual Mitigation Plan Objectives

General objectives of the Mitigation Plan are based on U.S. Fish and Wildlife Service (FWS) and Wildlife Resources mitigation policies, Section 404(b)1 guidelines, and decisions reached by the HEP team regarding out-of-kind mitigation of wildlife habitat losses. These policies and guidelines, their relationship to wildlife and plant communities within the project area, and plan objectives include the following in order of priority:

- Avoid potential Resource Category 2 plant communities, which include wetlands and riparian communities, where possible; for wetlands and riparian communities, this involves development and consideration of alternatives that avoid or minimize impacts as well as avoidance of impacts through implementation of certain project features described in Section 1.5.1 Impact Avoidance.

- Provide full in-kind compensation for unavoidable project-induced impacts on potential Resource Category 2 plant communities.

- When possible, provide full in-kind compensation for unavoidable project-induced impacts on habitats not considered to be potential Resource Category 2.

- Provide out-of-kind equal or out-of-kind relative compensation for unavoidable project-induced impacts on communities not considered to be potential Resource Category 2 when in-kind compensation is not possible.

- Provide full replacement of wildlife habitat functional losses for wetland cover types.

The HEP team considered these goals and objectives and the limitations stated above in providing input on acceptable compensation for losses of different cover types in the area of each project feature. In-kind compensation was acceptable in all situations except for losses of agricultural lands, which the HEP team believed should be replaced by native plant communities. Table B-1 shows cover types that were determined by the HEP team to be acceptable as compensation for unavoidable impacts when full in-kind compensation is not possible. While acceptable to the HEP team, conversions from one natural upland cover type to another natural upland cover type is not included as part of this Mitigation Plan. Shrub and forest riparian and most wetland cover types are not listed in the table because these types would be mitigated in-kind.

As previously noted, the primary mitigation sites are located at lower elevations than the major reservoir impact areas. Mitigation sites generally receive less precipitation and are warmer than the reservoir sites. These climatic differences restrict the development of some of the upland cover types that would be impacted. The HEP team recognized this restriction and accepted certain trade-offs of one cover type for another as acceptable mitigation. Generally, the HEP team accepted the development of wetland or riparian cover types in place of impacted native or agricultural upland cover types. Therefore, this plan focuses on the development and improvement of wetland and riparian cover types at the mitigation areas and does not propose any in-kind mitigation of upland losses.

The best use of retired lands in terms of upland habitat development potential would be determined in conjunction with resource agencies following project authorization. Management plans for specific parcels of retired lands would be developed with the agencies.

Table B-1 Acceptable Compensation for Existing Cover Types if Full In-Kind Compensation is Not Possible*	
Existing Cover Type	**Acceptable Compensation Cover Type**
Conifer	Forest riparian
Mixed forest	Forest riparian
Aspen/hardwood	Forest riparian
Sagebrush/grass	Forest or shrub riparian, juniper
Juniper	Sagebrush/grass (preferred), forest or shrub riparian
Irrigated lands	Sagebrush/grass (preferred), juniper, wet meadow
Open water	Beaver pond, emergent wetland, forest or shrub
Wet meadow	Emergent wetland, forest or shrub riparian
Emergent wetland	No acceptable substitute
Shrub riparian	No acceptable substitute
Forest riparian	No acceptable substitute

*Inclusion of a particular cover type as acceptable compensation for loss of another cover type in this table does not imply that each of these changes in cover type is included in the proposed mitigation or that each is biologically feasible. It only implies that such a change of cover type was determined to be acceptable by the HEP team. For instance, sagebrush/grass would not be converted to juniper.

1.5 Conceptual Mitigation Plan Strategies

This Plan presents conceptual strategies intended to avoid impacts on Resource Category 2 habitats to the extent feasible and to fully compensate for unavoidable impacts on wildlife habitat, wetlands, and riparian communities. A detailed site-specific Mitigation Plan would be developed for project impacts of the Proposed Action after the Record of Decision and before application for a Section 404 permit.

Three distinct strategies have been developed to mitigate project-induced impacts on wildlife habitat, as documented through the HEP study and cover type mapping. The first strategy involves avoiding potential impacts on a portion of the potential Resource Category 2 habitats along canals to be lined. A second strategy (habitat improvement) includes measures designed to increase habitat values of existing cover types, but does not involve changes from one cover type to another. The third Mitigation Plan strategy (habitat development) involves measures intended to change an area from one cover type to another. Features of the Plan are intended to avoid, where possible, impacts on wildlife habitat, including wetlands and riparian communities, minimize unavoidable impacts, and to compensate for reductions in wildlife habitat value as well as losses of wetlands and riparian communities that result from unavoidable impacts.

1.5.1 Measures to Avoid or Minimize Impacts on Big Game, Sage Grouse, Raptors, and Wetland and Riparian Communities

Numerous measures intended to avoid disturbance, minimize immediate disturbance, or minimize the duration of disturbance of sensitive habitats or wildlife are described in Appendix A of the Draft EIS for the Upalco Unit Replacement Project. These measures are summarized below. Loss of habitat values, such as big game winter range or raptor foraging habitat features, were assessed during the HEP study and are addressed later in this Plan under the topics of habitat improvement and habitat development.

1.5.1.1 Impact Avoidance

Critical environmental areas (i.e., wetlands and riparian areas) would not be used as equipment or material storage or stockpile areas; construction staging or maintenance areas; field offices; hazardous material or fuel storage, handling, or transfer areas; or temporary access roads to minimize environmental damage. Excavated or graded materials would not be stockpiled or deposited on or within 100 feet of any stream banks, steep slopes, wetlands, or riparian areas. Damage to critical area vegetation would be strictly limited to only those areas required for construction activities. Staging areas, access roads, and other site disturbance required for canal rehabilitation would be located in agricultural areas to minimize damage to natural plant communities.

All large trees (>10 inches diameter breast high [dbh]) would be preserved to the extent practicable during all construction activities. This is especially important along canal and pipeline routes. Large trees and all vegetation within a 100-yard radius of large trees would not be disturbed if practicable.

Wherever possible, existing access roads would be used for all construction activities. If new roads must be constructed, the width would be kept to the absolute minimum needed. Turnouts and staging areas would not be placed in wetland or riparian areas. Access roads would be situated to avoid all trees where possible, especially trees >10 inches dbh, and to limit the amount of vegetation disturbed. Wetlands and riparian areas would be avoided where possible.

In situations where a new diversion structure would be built to replace an old one, the old structure would be removed in such a way as to minimize disturbance to vegetation around the old structure, in particular, to large trees. This may require removal of only the instream portions of diversion structures. Decisions to remove only the inwater portions of diversion dams would be made with interagency and Tribal consultation.

Wetlands and riparian areas are especially sensitive to both direct and secondary construction impacts. Changes in ground surface elevation or surface or groundwater hydrology can create long-term impacts that extend well beyond the physical extent of direct surface disturbance. Construction practices intended to minimize direct impacts on wetlands would be determined in consultation with the U.S. Army Corps of Engineers, FWS, Wildlife Resources, the Ute Tribe, and other appropriate land management agencies during preparation of a Section 404 permit application. Restrictions described above regarding equipment or material storage or stockpile areas; construction staging areas; hazardous material or fuel storage, handling, or transfer areas; or temporary access roads would be adhered to without exception in wetlands and riparian communities along pipeline routes. Construction rights-of-way through wetlands and riparian communities would be limited to 25 feet in width.

Gravel material typically used for bedding and/or backfill material in pipeline trenches, can act as a conduit for surface and shallow groundwater, transporting water away from an area and depriving down-gradient wetlands and riparian communities of needed moisture. Special construction methods and materials would be used to avoid this type of long-term impact on site hydrology. Cutoff collars, or other appropriate methods determined during final design, would be used to prevent water from being drained away from wetlands and riparian areas.

The upper 12 to 18 inches of soil would be removed from the trench area and stockpiled for later use. Excess material removed from trenches would not be stockpiled or disposed of in wetlands or riparian areas. The upper 12 to 18 inches of material removed from trenches would be used as the final backfill material. Surface elevations would be returned to pre-project conditions, taking into account expected settling. Excess soil material would not be disposed of in wetlands, riparian areas, or other native plant communities. Revegetation would be as described below in Section 1.5.1.3.

1.5.1.2 Biological Site Clearances and Design Changes to Avoid or Minimize Impacts

Several project features would require biological clearances following project authorization, but before the start of construction. Clearances would be conducted by qualified biologists reporting directly to the Environmental Compliance Officer.

The exact locations of canals to be rehabilitated, new pipelines, retirement lands, and Tribal idle lands were not known at the time of baseline study field surveys. Therefore, field surveys would be conducted in appropriate habitat types prior to construction or irrigation to identify sensitive areas that would either be avoided by adjusting pipeline routes or service roads, staging areas, or construction timings, or for which site-specific mitigation measures would be developed.

If at all possible, native plant community areas would not be used as staging areas. If native plant community areas must be used, site clearances must be obtained from a qualified biologist working with the Environmental Compliance Officer. Site clearances would only be conducted at the appropriate time of year for the species involved. Sensitive species clearances would be obtained for all new pipelines and canal rehabilitation, as stated in the Threatened and Endangered Species Technical Report (CH2M HILL/Horrocks 1996a).

Wetlands and riparian areas would not be used for staging areas or crossed by access roads unless unavoidable, and not until clearance has been obtained from a qualified biologist and the Environmental Compliance Officer. The goal of the biologist in these situations would be to minimize the extent of impacts on Waters of the United States or jurisdictional wetlands in accordance with the Section 404(b)1 guidelines of the Clean Water Act.

Sensitive areas along canal banks, including wetlands and riparian areas and native plant communities, that are not suitable for either temporary storage or permanent disposal of excess soil materials would be clearly marked by the biologist prior to any construction activity.

All canal rehabilitation reaches would be surveyed in late spring for FS sensitive bat species roosting or nesting in trees. To the degree possible, roost sites would be protected from disturbance. It will not be possible to avoid temporary disturbance to roosting bats, but nesting colonies would be avoided until nesting is complete.

All canal rehabilitation reaches and new pipeline corridors would be cleared for nesting ferruginous hawks and other raptors. If nesting hawks are found, construction within 1 mile of the nest would be limited to the period August 1 to March 1. Additionally, all large trees (> 10 inches dbh) would be preserved to the extent possible. Trees and all vegetation within a 100-yard radius would not be disturbed, if possible. Raptor clearance procedures and frequency are described in greater detail in CH2M HILL/Horrocks (1996b).

Canal rehabilitation and related activities would not occur between December 1 and April 15 in critical mule deer winter range unless clearance to do so is granted by Wildlife Resources. Clearance may be granted if deer do not typically winter along some canal sections, even though the canal is in critical winter range.

Retired lands that may be used for mitigation and Tribal idle lands that would be converted for agriculture would also require site clearances. Immediately before they are converted from idle lands to irrigated lands status, Tribal lands would be monitored to determine potential effects of the proposed conversion on wet meadow and/or riparian vegetation growing on them. If wetland or riparian vegetation habitat is likely to decline on these lands because of their conversion to irrigated status, then habitat would be developed as provided in this Mitigation Plan. Additional compensatory mitigation also may be provided in the forms of habitat development and/or habitat improvement at retirement lands that are suited to this purpose (see Wildlife Resources Technical Report Addendum: Evaluation of Idle Tribal Lands, North State Resources 1996).

1.5.1.3 Site Restoration and Revegetation to Minimize the Duration of Impacts

Upon completion of construction, all disturbed lands outside the limits of dams, reservoir pools, permanent roads, and other permanent facilities would be prepared for restoration. Erosion control measures would be initiated and final site restoration undertaken as soon as an area is no longer needed for construction, stockpiling, or access. Upon completion of construction, any land disturbed, but not permanently occupied by new facilities, would be graded to provide proper drainage and blend with the natural contours of the land, covered with topsoil that has been stripped from construction areas, and revegetated with plants native to the area and beneficial to wildlife.

The recommended composition of plant species, seeding rates, and dates of planting would be determined in consultation with Wildlife Resources (where applicable), FWS (where applicable), FS (where applicable), the Ute Tribe (where applicable), Natural Resources Conservation Service (where applicable), Bureau of Indian Affairs (where applicable), and the Bureau of Land Management (where applicable). The species to be used in site restoration and revegetation would be matched to site conditions in terms of soil drainage, climate, shading, and resistance to erosion (slope of site). Disturbed wetlands and riparian areas would be revegetated with the same species that occurred in the area prior to construction. Special care would be taken to revegetate sage brush areas within 2 miles of a sage grouse breeding complex. Uplands would be revegetated to the native vegetative community appropriate for the site's soil type, topographic position, and elevation.

1.5.1.4 Impact Avoidance along Canals

Canal rehabilitation is a prominent feature of most project Proposed Actions and alternatives. The intent is to stop canals from leaking so that saved water can be used for other purposes. Rehabilitation includes placing pipelines in, or adjacent to, canals or lining canals to reduce leakage; it is described in Chapter 2 of the Draft EIS.

Impacts on a portion of potential Resource Category 2 plant communities (wet meadows and shrub and forest riparian communities) along canals would be avoided in two ways. First, where feasible, construction would be accomplished from existing canal roads and the uphill side of the canal to minimize disturbance to habitat areas, which are generally downgradient from the canal. The primary factor limiting construction from only one side of the canal is canal width.

Second, a portion of the impacts that would otherwise result from removing the water source for wetland and riparian areas along canals would be avoided by providing an alternative water source for each area to be preserved. Forested riparian areas generally larger than about 2.5 acres and shrub riparian and wet meadow areas larger than about 5 acres would be preserved by providing this alternative water source. In some situations where several smaller areas occur near each other, these smaller areas would also be preserved. Figure B-1 depicts impact avoidance along a typical canal reach. Alternative irrigation systems are described in CH2M HILL/Horrocks (1996b).

1.5.2 Mitigation of Unavoidable Losses of Wildlife Habitat Including Wetlands and Riparian Areas

1.5.2.1 Mitigation Site Evaluation

Specific sites for implementing mitigation measures were initially identified through agency contacts, examination of aerial photographs, and reconnaissance-level field surveys. Twelve potential mitigation sites were visited to preliminarily assess their suitability and potential for achieving the required compensation. The following characteristics were evaluated to assess each site's potential as a mitigation area:

- Location relative to impact sites and other potential mitigation sites
- Size of the area (a few large sites were preferred over many smaller ones)
- Surrounding vegetation types (undeveloped native plant communities surrounding potential mitigation sites act as buffers by reducing human activity in the general area)
- Locations along natural drainages that provide connections to natural animal movement corridors
- Existing cover types on each site relative to impacted cover types
- Presence of undesirable vegetation such as Russian olive trees, which are difficult to eliminate
- Condition of vegetation (vegetation in excellent condition limits potential mitigation gains in wildlife habitat value)
- Potential for improving vegetation conditions of existing cover types in terms of wildlife habitat
- Potential for developing or improving cover types that provide high-quality hiding cover such as riparian areas

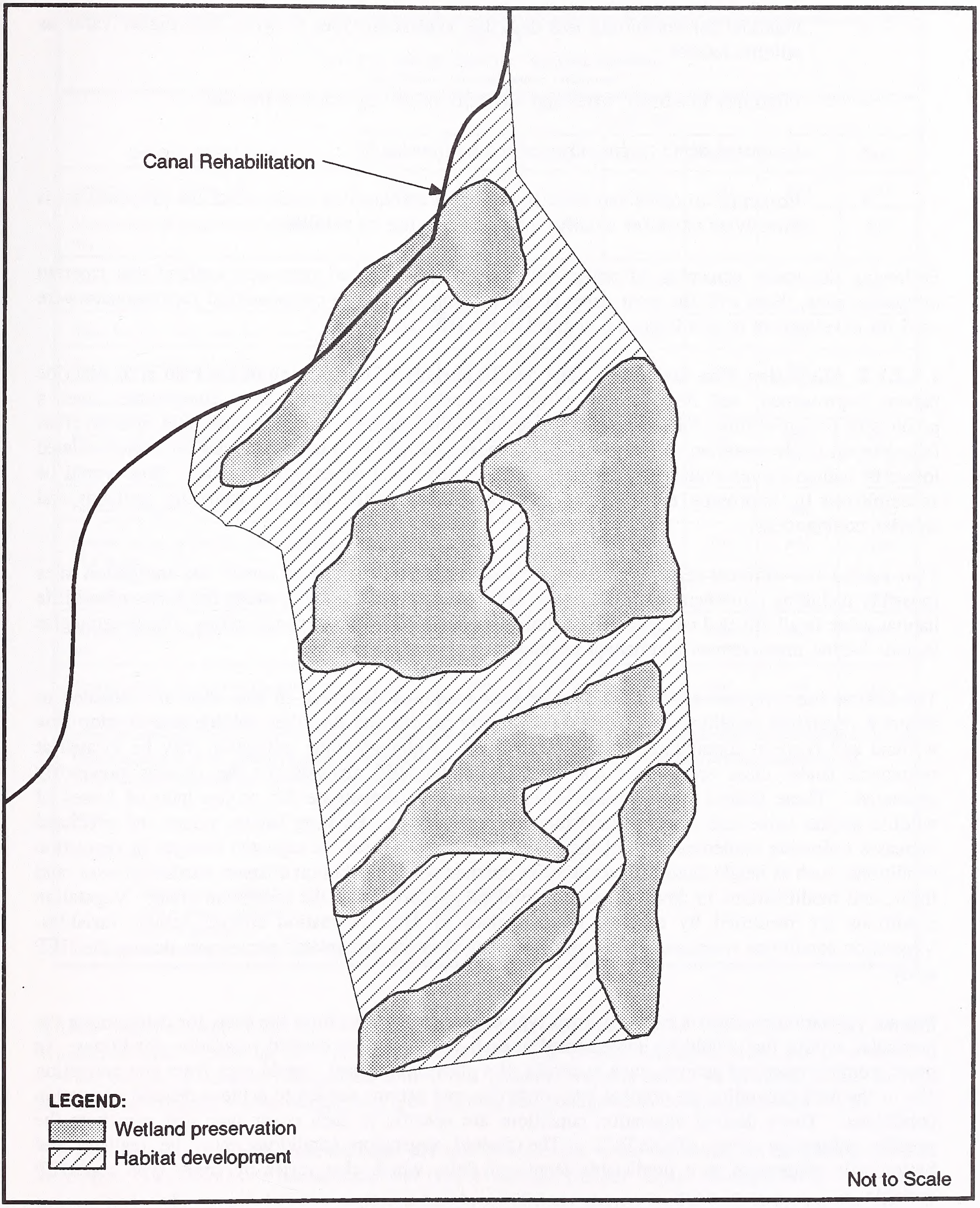

Figure B-1
Typical Canal Impact Avoidance and Mitigation

- Potential for converting less desirable vegetation types to types with higher value as wildlife habitat
- Proximity to surface water and difficulty of getting water to the site
- Estimated depth to groundwater and saturated soils
- Proximity to roads and sources of human activity that could affect the proposed areas directly or block (or modify) their effective use by wildlife

Following the initial screening of mitigation sites, which included proposed wetland and riparian mitigation sites, those with the most potential for meeting the needed compensation requirements were used for development of this Plan and included in the HEP analysis.

1.5.2.1.2 Mitigation Plan Strategies. The overall purpose of this portion of the Plan is to describe habitat improvement and development mitigation strategies that would fully compensate, over a predictable period of time, for unavoidable losses of wildlife habitat value, wetlands, and riparian areas from project implementation. The goal of the proposed mitigation is to compensate for project-related losses of habitat values evaluated through the HEP process and cover-type mapping. This would be accomplished by improving existing and developing new wildlife habitats, including wetlands and riparian communities.

Two related but different mitigation strategies would be implemented at canals and mitigation sites (possibly including retirement lands that are suited to this purpose) to compensate for losses of wildlife habitat value in all affected cover types, including wetlands and riparian communities. These strategies include habitat improvement and habitat development measures.

The habitat improvement and habitat development measures described in this Plan are intended to improve vegetation conditions for the HEP evaluation species and for other wildlife and develop new wetland and riparian communities at mitigation sites. Although some mitigation may be located at retirement lands, these areas were not included in the HEP analysis for the reasons previously presented. These actions will increase habitat value and compensate for project-induced losses of wildlife habitat value and other wetland functions and values. Existing habitat values and predicted increases following implementation of the Mitigation Plan are based on expected changes in vegetation conditions, such as height canopy cover, species composition; distribution of trees, shrubs, grasses, and forbs; and modifications to develop mesic conditions on portions of the mitigation areas. Vegetation conditions are measured by changes in the values of HEP evaluation species habitat variables. Vegetation conditions were assessed by measurement of vegetation-related parameters during the HEP study.

Present vegetation conditions for each cover type on mitigation sites form the basis for determining the particular actions that would be implemented at each site to achieve desired vegetation conditions. In other words, prescribed actions, such as details of a planting program, would vary from one mitigation site to the next depending on original site conditions and actions needed to achieve desired vegetation conditions. These desired vegetation conditions are specific to each cover type and constitute the specific mitigation goals (Table B-2). The desired vegetation conditions must be realistic and biologically achievable in a predictable length of time, which also varies by cover type and HEP variable.

Table B-2
Cover Type-Specific Goals for Vegetation Conditions
Using Habitat Improvement Measures*

Selected HEP Variables	Cover Type						
	FR	SR	S/G	JUN	WM	PEM	BP
Height of grass canopy (cm)	NM	NM	+10 cm	+10 cm	NM	NM	NM
Mean height of deciduous shrub canopy (m)	NM	+1.5 m	NM	NM	NM	NM	NM
Mean height of herbaceous (forb/grass) canopy (cm)	+10 cm	+10 cm	+10 cm	+10 cm	+5 cm	+25 cm	NM
Mean height of shrub and herb canopy	+1.5 m	+1.5 m	+.2 m	+.2 m	NM	NM	+1.6 m
Mean height of shrub canopy (m)	+1.5 m	+1.5 m	+.2 m	+.2 m	NM	NM	+1.6 m
Percent canopy cover of deciduous shrubs	+14%	+32%	NM	NM	NM	NM	+20%
Percent canopy of forbs	+10%	+10%	+10%	+10%	NM	NM	NM
Percent canopy cover of grasses	NM	NM	+10%	+10%	NM	NM	NM
Percent canopy cover of herbs	+28%	+28%	+15%	+15%	NM	NM	NM
Percent canopy cover of preferred shrubs <1.5 m tall	-7%	NM	+7%	+7%	NM	NM	NM
Percent canopy cover of shrubs	+10%	+10%	+7%	+7%	NM	NM	+25%
Percent canopy cover of shrubs <1.5 m tall	+5%	NM	+7%	+7%	NM	NM	NM
Percent canopy cover of shrubs and herbs	NM	NM	+10%	+15%	NM	NM	NM
Percent canopy cover of trees	+28%	+10%	NM	NM	NM	NM	NM

*See Appendix B of the Wildlife Resources Technical Report (CH2M HILL/Horrocks 1996b) for a detailed presentation of expected future physical and vegetative changes for all HEP variables.

Notes:

Cover types:
FR = Forest riparian
SR = Shrub riparian
S/G = Sagebrush/grass
JUN = Juniper
WM = Wet meadow
PEM = Emergent wetland
BP = Beaver pond

NM indicates that this habitat variable was not measured in this cover type as part of the HEP study.

Habitat improvement measures would be designed to not impact the Ute ladies'-tresses orchid. Mitigation areas would be surveyed for orchids following project implementation but prior to site-specific design of detailed mitigation plans so that potential impacts would be avoided. Field surveys and detailed mitigation plan design would be planned and conducted in consultation with FWS.

The time frame over which these expected changes would occur varies depending on the growth form of vegetation (tree, shrub, or herbaceous) and type of change (height versus canopy cover). Generally, grasses and forbs would achieve expected height conditions shown in Table B-2 during the first or second growing season following elimination of grazing and implementation of any required planting.

Achieving the desired grass/forb cover values would require up to 10 years and would vary depending on site conditions, precipitation, aspect, and planting requirements. Existing deciduous shrubs would generally reach their full height potential within about 10 years after fences are installed, while canopy cover would increase more slowly and over a longer period of time. Newly planted deciduous shrubs would require up to 25 years to reach their full growth potential. Planted upland shrubs, such as antelope bitterbrush (*Purshia tridentata*) or mountain mahogany (*Cercocarpus montanus*), may require 25 to 50 years or more to reach their full potential size and canopy cover, depending on site conditions and the extent of wildlife browsing. Newly planted narrowleaf cottonwood (*Populus angustifolia*) cuttings or suckers sprouting from roots of existing trees would grow vigorously during the first 25 years and require 40 to 50 years to reach maturity. Canopy cover would increase dramatically during the first 25 years, followed by a gradual decline as natural thinning occurs. On the average, riparian forest canopy cover is expected to stabilize well above current levels (Table B-2).

1.5.2.1 Habitat Improvement and Habitat Development Features of the Mitigation Plan

Specific mitigation measures that are the same for habitat improvement and habitat development follow:

- DOI funding of all activities related to impact avoidance, biological site clearances, pre-construction or pre-irrigation site characterization, impact assessment, and mitigation planning on Tribal lands

- Purchase of all privately owned mitigation sites, including suitable retirement lands and those along canals, by the CUWCD

- Acquisition by the CUWCD of adequate water rights to accomplish the mitigation measures needed to compensate for impacts on all Tribal and non-Tribal lands

- Transfer of title for all sites and water rights used to mitigate impacts on non-Tribal lands to the United States for management by a public agency such as Wildlife Resources

- Transfer of title for sites and water rights used to mitigate impacts on Tribal lands to the United States to be held in trust for the Ute Tribe

- DOI funding of all activities related to mitigation site planning, study, site preparation, fencing, planting, maintenance, monitoring, and reporting on Tribal and non-Tribal lands

- Fencing of all mitigation sites to permanently exclude livestock grazing

- Agreements for all mitigation sites recognizing management for the stated mitigation goals as the primary objective

- Temporary exclusion of recreational activities from mitigation sites for 3 years following implementation of mitigation measures to permit time for plant establishment

- DOI funding of all operation, maintenance, monitoring, and reporting costs and activities for the life of the project for all mitigation sites

Complete exclusion of livestock from all mitigation areas is essential to achieve general and cover type-specific mitigation goals using the acreage analyzed in the HEP study of proposed mitigation sites. Fences to exclude livestock and grazing would be installed around all mitigation areas during the first year of project construction. The expected benefits of this action include the following:

- Recruitment of young trees and shrubs into mature riparian communities
- Release of suppressed trees and shrubs to achieve their full growth potential
- Increased cover values and densities of trees and shrubs and increased average shrub height
- Improved bank cover and stability along rivers passing through mitigation sites, which will also improve aquatic habitat
- Increased height and cover values for grasses and forbs
- Higher incidence of native bunch grasses in herbaceous layer
- Increase nesting and escape cover for wildlife

Some depredation of new plants by wildlife would also occur. Measures to protect individual trees and shrubs from depredation during the initial years after planting would be developed as part of the final mitigation design. There are no plans to exclude wildlife from the mitigation areas during the first few years following implementation.

Planting as a habitat improvement measure would be implemented to achieve desired vegetation conditions on a selected basis. Planting local native trees, shrubs, grasses, and forbs to achieve desired increases in habitat value or to change from existing cover types to wetland or riparian communities is a central feature of habitat development; it is described later in this Plan. Subsequent planting would be implemented as needed to achieve the mitigation and management goals. Substitutions of different species would be considered if a particular species proves problematic.

Several methods are available and would be considered to assist in site evaluation to determine planting requirements. A method developed by Dawson (1984) to inventory vegetation distribution patterns in relatively undisturbed riparian communities and apply this information during the formulation of planting designs would be used in the development of site-specific Mitigation Plans. Jensen and Platts (1991) present an approach for developing restoration plans for degraded riparian habitat. A detailed study plan for developing site-specific Mitigation Plans using these or similar methods combined with the HEP goals for vegetation conditions would be prepared by the DOI within 6 months following project authorization. Detailed Mitigation Plans that address where, how many, and what species would be planted in each cover type at each mitigation site would also be developed by the DOI following project authorization. The detailed study plan as well as subsequent mitigation plan development would be prepared in consultation with FWS, the Ute Tribe, DOI, U.S. Army Corps of Engineers, and Wildlife Resources.

1.5.2.1.1 Habitat Improvement. The overall goal of habitat improvement is to increase habitat values of existing cover types without converting them to a different cover type. Habitat improvement measures would be implemented at mitigation sites and along canal wetlands and riparian areas that are preserved by providing alternative water supplies. Habitat improvement would result in increased wildlife habitat values because of fencing, livestock exclusion, and, where necessary, planting to achieve desired vegetation conditions.

A portion of the predicted increase in habitat value would result from the elimination of grazing, which would permit certain vegetation communities to mature, resulting in numerous changes in vegetation conditions. This would have positive benefits for wildlife. Habitat improvement would also include supplemental planting in two specific situations. Planting would occur where benefits of fencing alone do not achieve the desired cover type-specific goals for vegetation condition or where fencing cannot achieve goals within a reasonable length of time.

Table B-3 presents general planting procedures that would be used to achieve desired vegetation conditions in various cover types, along with reasons for implementing those actions. The particular species and planting methods used would vary for each cover type and plant species. All planting activities would be completed concurrent with dam construction and canal rehabilitation. Planting along specific canal sections would not be undertaken until land-disturbing activities are complete. Detailed discussion of habitat improvement for each affected cover type, including planting prescriptions and species selection, is presented in CH2M HILL/Horrocks (1996b).

Table B-3
Habitat Improvement Planting Procedures that Would Be Implemented as Needed to Achieve Desired Vegetation Conditions on Mitigation Sites

Planting Procedure[a]	Cover Types Where Applied[b]	Expected Result
Plant cottonwood pole cuttings	FR	Increased forest canopy cover. Increased tree density.
Plant riparian shrubs	FR, SR	Increased shrub canopy cover. Replaced lost shrub components.
Plant upland shrubs	S/G, JUN	Restored species diversity. Improved big game forage.
Seed grasses, forbs, and grass-likes	FR[c], SR[c], S/G, JUN	Improved ground cover values. Replaced lost components.

[a]Plant materials may consist of nursery-grown stock collected as described in the plan or may include riparian shrub root wads and cottonwood poles salvaged from impact areas.
[b]Cover type designations: FR = forest riparian, SR = shrub riparian, S/G = sagebrush/grass, JUN = juniper
[c]Grasses and forbs would be planted if exotic species are a problem in these cover types. Grasses and forbs would be planted anywhere they are necessary to meet vegetation condition goals.

1.5.2.1.1.1 Habitat Improvement Acreage. Table B-4 shows the mitigation sites and acreage on which habitat improvement and habitat development strategies would be implemented, depending on the requirements of each alternative. Potential mitigation on retirement lands is not included in Table B-4. Each mitigation site listed in Table B-4 would not be needed to compensate for unavoidable losses of wildlife habitat for each alternative since each would result in a different set of unavoidable impacts and associated compensation requirements. As shown in Table B-4, the acres of each cover type present and the way those acres would be treated are different for each mitigation site, resulting in varying degrees of compensation for impacted cover types. Table B-5 lists the sites on which mitigation measures would be implemented to compensate for unavoidable impacts on Tribal and non-Tribal lands for the Proposed Action and each alternative.

The acreage of habitat improvement and development that would be implemented in, and adjacent to, preserved wetlands and riparian areas along canals is discussed in CH2M HILL/Horrocks (1996b).

1.5.2.1.2 Habitat Development. The third mitigation strategy included in the conceptual wildlife/wetland Mitigation Plan involves development of, or conversion from, upland cover types to wetland or riparian cover types. This action is called habitat development to distinguish it from habitat improvement, which does not involve conversion from an existing cover type to a different one. Specifically, habitat development includes developing wet meadow, emergent wetland, shrub riparian, or forest riparian communities from agricultural, sagebrush/grass, and juniper cover types.

The overall goal of habitat development is to increase wildlife habitat values on mitigation sites through fencing to eliminate livestock grazing and conversion from abundant, relatively low wildlife value cover types to less abundant and relatively higher value wetland and riparian cover types. Future conditions predicted for mitigation sites assume grazing is eliminated and cover type conversions are successful within the predicted time frame.

Forest riparian cover types would be developed from sagebrush/grass and agricultural sites in areas of shallow groundwater at the Brotherson, Lake Fork, and Whiterocks mitigation sites (Table B-4) and possibly at suitable retirement lands. Conversion of sagebrush/grass and agricultural cover types to a forested riparian cover type would require lowering the ground surface closer to the groundwater. The change to forest riparian cover type would require a relatively long period of time and would transition through a third cover type. Planted cottonwood trees would take on a shrubby appearance for the first several years after planting. Sites planted with cottonwoods would look and function like shrub riparian areas for the first 10 years after planting. After this time, the plants would grow taller than 20 feet and the areas would begin to resemble riparian forests, the ultimate cover type.

Table B-4
Mitigation Sites and Acreage on which
Habitat Improvement and Habitat Development Measures Would be Implemented

Mitigation Site/Cover Type	Existing Acres[a]	Future Treatment of Existing Acres: Habitat Improvement Acres	Habitat Development Acres
Brotherson			
Forested riparian	99	99	–
Shrub riparian	142	142	–
Wet meadow	39	39	–
Sagebrush/grass	210	110	100 acres developing to shrub riparian at TY 10 and to forest riparian at TY 25; includes 50 mesic acres and 50 more xeric acres
Shiner			
Forested riparian	98	98	–
Sagebrush/grass	138	138	–
Juniper	59	59	–
Irrigated	1	–	1 acre of sagebrush/grass at TY 3
Evans			
Irrigated	143	–	143 acres developing into sagebrush/grass at TY 3
Clay Basin			
Irrigated	155	–	155 acres of irrigated lands at the end of TY 3 that would be converted to 145 acres of wet meadow and 10 acres of emergent wetland by TY 10.
Jenkins			
Forest riparian	11	11	-
Irrigated	124	0	124 acres to sagebrush/grass
Juniper	181	181	-
Shrub/riparian	50	50	-
Sagebrush/grass	130	130	-
Whiterocks			
Irrigated[b] (or similar)	944	-	472 acres to shrub riparian at TY 10 and forested riparian at TY 25, and 472 acres to shrub riparian at TY 10
Lake Fork[c]			
Irrigated[b] (or similar)	722	-	100 acres to shrub riparian at TY 10 and forest riparian at TY 25; 250 acres to shrub riparian at TY 10; 272 acres to sagebrush/grass; and 100 acres wet meadow

Notes:
Following the classification guidelines set forth in Cowardin et al. (1979), an area with >30 percent canopy cover of hydrophytic shrubs would be classified as a scrub/shrub wetland or riparian community. An area with >30 percent canopy cover of cottonwood trees would be classified as a forested wetland or riparian community. Areas with a combined hydrophytic shrub and cottonwood canopy of >30 percent would be classified as scrub/shrub.

[a]Existing acres represent the current total area on each site that would be subject to habitat improvement and habitat development measures.
[b]No existing irrigated Tribal trust land or Tribal trust lands within the Uinta Indian Irrigation Project will be used for wildlife mitigation. Lands of similar current habitat values would be identified and evaluated for mitigation.
[c]The Lake Fork mitigation site includes both Tribal and non-Tribal lands.

Table B-5
Alternative-Specific Sites on which Mitigation Measures Would be Implemented and Use of Each Site to Mitigate Impacts on Tribal (T) or Non-Tribal (N) Lands[a]

Upalco Unit Alternative	Mitigation Sites							
	Brotherson	Shiner	Evans	Clay Basin	Jenkins	Whiterocks	Lake Fork	Canals
Current Ownership[b]	N	N	N	N	N	T	N/T	N/T
Use for Mitigation								
Proposed Action—Talmage	T	-	-	N	N	-	T	N
Cow Canyon	-	-	-	N	-	-	N	-
Crystal Ranch	T	-	-	-	N	-	T	N
Twin Pots	-	-	N	N	-	-	-	-

Notes:
N = Site used to mitigate impacts on non-Tribal lands.
T = Site used to mitigate impacts on Tribal lands.

[a]Use of a particular site to mitigate impacts on either Tribal or non-Tribal lands varies for some mitigation areas depending on alternative specific mitigation requirements.
[b]Current ownership: N = non-Tribal, T = Tribal, N/T = mixed ownership

Generally, four combinations of mitigation measures and implementation sites would be used for habitat development. The first includes development of wet meadow, shrub riparian, and forest riparian cover types adjacent to existing areas of the same cover types along canals. The second combination involves development of wet meadow and emergent wetland cover types at the Clay Basin mitigation area. The third combination includes development of a sagebrush/grass cover type from irrigated land at the Evans mitigation site (Table B-4) and possibly at suitable retirement lands. The final combination involves development of forest riparian communities from irrigated land and from sagebrush/grass. Specific mitigation measures that would accomplish these changes are described in detail in CH2M HILL/Horrocks (1996b). Actions such as plant material collection and growing and planting procedures are described by cover type.

Briefly, habitat development of wetland and riparian cover types along canals involves providing irrigation water from rehabilitated canals or pipelines. About 4.5 acre-feet of water per acre for wetlands and riparian areas would be provided from canals or pipelines during the irrigation season. This is the same yearly length of time during which existing wetlands supported by leaking canals receive water.

Habitat development of wetland and riparian cover types at the mitigation sites involves altering the ground surface elevation on river floodplains so that the final ground surface elevation is close enough to the shallow groundwater for long-term survival of the desired species, followed by extensive planting. These actions are fully described in CH2M HILL/Horrocks (1996b).

1.5.3 Implementation of Mitigation Measures

Implementation of mitigation measures described in this Plan would require additional work following project authorization, including data collection, HEP analysis, design, and field marking of sensitive areas to be avoided during construction. Qualified biologists and other technical specialists would be involved in every aspect of this work. Biologists would also be actively involved in all pertinent construction phases of Plan implementation.

One-foot contour interval maps of all existing or future new or improved wetland and riparian cover type areas on mitigation sites would be developed. This would not be needed along canals except for irrigation system design. A grid of piezometers would be installed in all present and future wetland and riparian cover types to monitor groundwater levels for two growing seasons. Piezometer elevations would be surveyed so that seasonal groundwater profiles could be developed. Staff gages would be installed and surveyed along river reaches passing through the mitigation areas and stage/discharge curves would be developed. Staff gages would be monitored for the same two growing seasons as piezometers.

Seasonal groundwater levels would be correlated with river discharge through the mitigation areas. This correlation would be used to infer expected groundwater levels during periods of higher or lower runoff than would be observed during the 2 years of monitoring.

Major future activities that would be required to implement this Mitigation Plan and in which qualified biologists would be involved include the following:

- Conduct a HEP study of the Lake Fork Tribal mitigation site and additional river bottom areas on Tribal or non-Tribal lands if additional land is required to fully compensate for project impacts.

- Conduct a HEP or equivalent study before retiring lands and before conversion of Tribal idle lands to irrigation to define project-related losses of habitat units that require mitigation.

- Install and monitor shallow groundwater wells at potential emergent wetland development sites at Clay Basin.

- Install and monitor shallow groundwater wells in areas that may be converted to a forest riparian cover type at the Brotherson mitigation site and at the Lake Fork and Whiterocks Tribal mitigation sites.

- Install pilot irrigation systems for wetland and riparian habitat improvement areas along canals.

- Collect data at habitat development areas along canals.

- Conduct detailed mitigation site evaluations to determine planting requirements to achieve desired vegetation conditions.

- Develop detailed designs, plans, and specifications covering all aspects of the plan related to plants and construction, including control of undesirable plant and animal species.

- Locate suitable plant material collection sites.

- Interview and select a qualified nursery to collect and grow plant materials.

- Field identify and mark sensitive habitats to be avoided during construction and spoils placement.

- Conduct construction activities at mitigation sites, including earthwork and outlet structures (if used).

- Install erosion control measures at emergent wetlands.

- Identify, implement, and monitor best management practices to minimize runoff from construction sites.

- Fence all mitigation areas.

- Implement planting activities, including plant delivery, temporary storage, placement of plants, and short-term watering.

- Monitor reclamation activities and implement contingency measures as needed.

A progress report describing results of the above activities and plans for the next 6 months would be prepared by the DOI for interested agencies every 6 months, beginning after project authorization.

1.5.4 Operation and Maintenance

Three components of the Mitigation Plan would require operational input and/or maintenance by the DOI. These include temporary irrigation systems for riparian shrubs, water delivery systems along canals and at Clay Basin, and fences to exclude livestock. Temporary irrigation would require a full-time operator(s) during the first growing season. Water system turnouts, conveyance, distribution and delivery systems, as well as outlet structures, would require maintenance at regular intervals. Water systems would need to be turned on in the spring and off in the fall. Fence maintenance would occur annually. In addition, fences would be inspected biweekly when livestock are present near mitigation areas and along canals. Damaged fences would be repaired immediately. All operation and maintenance activities on Tribal or Tribal trust lands would be conducted with the consent of the Ute Tribe.

1.5.5 Monitoring

A monitoring program would be implemented by the DOI on non-Tribal lands and by the Ute Tribe on Tribal lands at mitigation sites and along canals to determine if goals and objectives of the Mitigation Plan are being met and to assess the need to implement contingency measures. Monitoring would be implemented by DOI on non-Tribal lands and by the Ute Tribe in cooperation with DOI on Tribal lands. Determining whether progress toward goals is being made would require monitoring at different scales and time frames. Specific questions to be answered by the monitoring program include the following:

- Are soil moisture conditions necessary for the desired wetland and riparian species being achieved?

- Is the planted vegetation alive, and what are the survival rates?

- Are there problems with particular species or sites?
- Are contingency measures achieving the desired results in terms of correcting problems?
- Are future vegetation conditions predicted during the HEP study being met within the expected time frame?
- Are the overall wildlife habitat compensation goals, as defined by the HEP study, being met?

Each question to be answered by monitoring requires specific actions, which are described below. Monitoring frequency and duration would vary, depending on the parameter. Generally, monitoring would be frequent enough to detect problems at an early stage so contingency measures could be implemented. Individual parameters would be monitored until Mitigation Plan goals are met to the satisfaction of interested agencies. Each of the above questions is restated and the specific monitoring methods to address each question are described below.

Are soil moisture conditions necessary for the desired wetland and riparian species being achieved?

The goal for wet meadow sites would be saturated soils within 6 inches of the soil surface May through July. A simple squeeze test could be used to determine saturation (i.e., water runs through your fingers when a handful of soil is squeezed). Forested and shrub riparian sites would be required to have the water table within the rooting zone of the target woody vegetation. Ideally, soil saturation would occur within 6 inches of the soil surface early in the growing season to discourage the establishment of upland vegetation. Surface water depths in emergent wetlands would be verified to make certain they are consistent with design parameters. This information would be combined with plant survival data discussed below to determine the need for changes in irrigation practices.

Is the planted vegetation alive, and what are the survival rates? Are there problems with particular species or sites?

Individual woody plants would be identified to species so that mortalities can be identified. Information on plant survival by species and site would be determined from data collected at each mitigation site. Plant survival would be monitored every September the first 5 years following planting.

A series of 0.1-acre circular plots (37.4-foot radius) would be located on all areas where trees or shrubs are planted. Sampling would be conducted at a rate of one plot for each 10 acres of a cover type present at a site or along a canal. At least one plot would be established in each cover type on each mitigation site or canal area where trees or shrubs are planted.

Plot center points would be permanently marked so the same areas are monitored each year. The numbers of planted trees and shrubs in each plot would be determined at the time of planting. During subsequent monitoring, the numbers of planted living trees and shrubs (those with nursery tags) would be counted by species and compared to the number planted. The calculated percent survival for each species would be averaged for all plots in each cover type on each mitigation site and along each individual canal.

Since the numbers of trees and shrubs to be planted would be 1.25 times the number required to meet desired vegetation conditions, up to 20 percent of any one species in a cover type at each site could die without jeopardizing the plan's goals. During the first 5 years after initial planting, mortality beyond 20 percent for any planted species in a cover type at a given site would require replanting. Substitutions of more suitable species may be necessary if a particular species does not do well in a cover type or at a given site.

Are future vegetation conditions predicted during the HEP study being met within the expected time frame?

Vegetation height and percent canopy cover would be measured in appropriate cover types for variables listed in Table B-2. Measurements would be made each September for at least 5 years. Variables for which field measures meet or exceed predicted vegetation conditions would not be monitored after the initial 5 years. Remaining variables would be measured every other year beginning in year 6. Following three more measurements, variables that meet predicted conditions would be dropped from the monitoring program. This would probably leave only those variables related to shrub or tree height or percent canopy, which would be monitored every 5 years until predicted vegetation conditions are met to the satisfaction of reviewing agencies.

Are the overall wildlife habitat compensation goals, as defined by the HEP study, being met?

The HEP study would be repeated on all mitigation sites at TY 10 and TY 25 to assess progress toward meeting the overall wildlife habitat compensation goals as defined by the HEP study.

A report would be prepared following each monitoring effort and include discussion of the following:

- A list of all monitoring activities and locations where monitoring occurred
- Results of the monitoring
- Problems encountered during the period since the previous monitoring effort, such as broken fences, etc., and the effect of the problem on achieving Mitigation Plan goals
- Corrective actions taken to resolve problems and the dates on which problems were discovered and corrected
- Progress toward achieving Mitigation Plan goals
- Corrective actions to be implemented if progress is not satisfactory
- A schedule for implementation of corrective actions
- Proposed modifications to the monitoring plan (e.g., to drop measurements for parameters whose goals have been met) or to continue or add measurements if it

is determined that additional or different data are required to fully evaluate implementation of the Mitigation Plan

The monitoring report would be sent to all interested land management, resource, and Tribal agencies for their review and comment. A meeting would be held following a brief review period to discuss report findings and reviewers' questions and comments. Proposed contingency measures and a schedule for their implementation or monitoring changes would be discussed and approved by the agency group.

1.5.6 Contingency Plans

Problems must be anticipated following any substantial effort to manipulate natural plant communities. Monitoring results would be used to evaluate the entire wildlife habitat mitigation program at various points following its implementation. Replanting may be required because of irrigation system failure along canals, site unsuitability for certain species, or because of broken fences that are not detected and repaired in a timely manner. Other Mitigation Plan features that are not functioning as intended would be corrected with funding from the DOI.

References

CH2M HILL/Horrocks. 1996a. Threatened and endangered species technical report, Upalco Unit Replacement Project and Uintah Unit Replacement Project, Central Utah Project.

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Appendix C
U.S. Fish and Wildlife Service Letters Concerning the Occurrence of Threatened, Endangered, and Candidate Species in the Upalco Unit Replacement Project Area

United States Department of the Interior

FISH AND WILDLIFE SERVICE

UTAH FIELD OFFICE
LINCOLN PLAZA
145 EAST 1300 SOUTH, SUITE 404
SALT LAKE CITY, UTAH 84115

In Reply Refer To
(ES)

February 24, 1995

Mr. Terry Holzworth, Project Manager
Uinta Basin Replacement Project
Central Utah Water Conservancy District
355 West 1300 South
Orem, Utah 84104-7303

Dear Terry:

Reference is made to the list of endangered, threatened, and candidate species for protection under the Endangered Species Act (ESA) which we provided to you on the Uinta Basin Replacement Project (UBRP) by letters dated October 19, 1993 and August 30, 1993.

No changes in the endangered and threatened species lists that were provided are needed at this time; however, the mountain plover *(Charadrius montanus)* has been upgraded from a Category 2 to a Category 1 candidate status, and several other changes need to be made in the Category 2 candidate list. The mountain plover is the only Category 1 candidate that may occur in the project area. An updated Category 2 candidate list is as follows:

CATEGORY 2 CANDIDATE SPECIES	
COMMON NAME	SCIENTIFIC NAME
Northern goshawk	*Accipiter gentilis*
Ferruginous hawk	*Buteo regalis*
White-faced ibis	*Plegadis chihi*
Flannel mouth sucker	*Catostomus latipinnis*
Roundtail chub	*Gila robusta*
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*
North American lynx	*Felis lynx canadensis*
North American wolverine	*Gulo gulo luscus*
Great Basin silverspot butterfly	*Speyeria nokomis nokomis*
Uinta mountainsnail	*Oreohelix eurekensis uinta*

Spotted bat	*Euderma maculatum*
Small-footed myotis	*Myotis ciliolabrum*
Long-eared myotis	*Myotis evotis*
Fringed myotis	*Myotis thysanodes*
Long-legged myotis	*Myotis volans*
Yuma myotis	*Myotis yumanensis*
Pale Townsend's (western) big-eared bat	*Plecotus towensendii pallescens*
Big-free-tailed bat	*Nyctinomops macrotis (=Tadarida m., T. molossa)*
Hamilton milkvetch	*Astragalus hamiltonii*
Flowers beardtongue	*Penstemon flowersii*
Goodrich beardtongue	*Penstemon goodrichii*

Mr. R. Douglas Stone, Coordinator, Utah Natural Heritage Program and Mr. Larry England, Botanist, of this office both agreed that the Hamilton milkvetch, Flowers beardtongue, and Goodrich beardtongue should be added to the above list of Category 2 candidates.

Sincerely,

CLARK D. JOHNSON

Reed E. Harris
Utah Field Supervisor

cc: Mr. R. Douglas Stone, Utah Natural Heritage Program, c/o Utah Division of Wildlife Resources, 1596 West North Temple, Salt Lake City, Utah 84116
Mr. Robert G. Valentine, Director, Utah Division of Wildlife Resources, 1596 West North Temple, Salt Lake City, Utah 84116
Mr. Walt Donaldson, Regional Supervisor, Northeastern Region, 152 East 100 North, Vernal, Utah 84078-2126
Mr. Buzz Cobell, Fish and Wildlife Management Assistance Office, 855 East 200 North (112-13), Roosevelt, Utah 84066
Mr. Harold N. Sersland, Central Utah Water Conservancy District, 355 West 1300 South, Orem, Utah 84058
Mr. Denny Mengel, CH2M Hill / Horrocks Engineers, One West Main, P.O. Box 377, American Fork, Utah 84003
Mr. Ronald Johnston, Program Manager, U.S. Department of the Interior, CUP Completion Act, P.O. Box 51338, Provo, Utah 84605
Assistant Regional Director, (Attn: Grady Towns), Ecological Services, U.S. Fish and Wildlife Service, Denver Federal Center, Mail Stop 60120, Denver, Colorado 80225

United States Department of the Interior
FISH AND WILDLIFE SERVICE
UTAH FIELD OFFICE
2060 ADMINISTRATION BUILDING
1745 WEST 1700 SOUTH
SALT LAKE CITY, UTAH 84104-5110

CH$_2$M HILL/HCE
OCT 21 1993
RECEIVED

In Reply Refer To

October 19, 1993

Mr. Terry Holzworth, Project Manager
Uinta Basin Replacement Project
Central Utah Water Conservancy District
355 West 1300 South
Orem, Utah 84104-0252

Dear Terry:

This is in response to your letter of August 13, 1993, advising us that you believe it is appropriate for the Central Utah Water Conservancy District (CUWCD) to re-initiate consultation in accordance with Section 7 of the Endangered Species Act because of execution of an August 11, 1993 agreement between the Secretary of the Department of the Interior and CUWCD. Your letter requested that this office provide a list of all Federally listed endangered, threatened, and proposed species of plants and animals within the study area; a list of all designated or proposed critical habitats within the study area; and the names, addresses, and telephone numbers of recovery team chairmen for the involved Federally listed species.

Following is a list of the threatened, endangered, and Category 2 Candidate species that may occur in the study area:

FEDERALLY LISTED ENDANGERED, THREATENED, AND CANDIDATE SPECIES	
COMMON NAME	**SCIENTIFIC NAME**
ENDANGERED SPECIES	
Bald eagle	*Haliaeetus leucocephalis*
Peregrine falcon	*Falco peregrinus*
Whooping crane	*Grus americanus*
Black-footed ferret	*Mustela nigripes*
Colorado squawfish	*Ptychocheilus lucius*
Humpback chub	*Gila cypha*

Bonytail chub	*Gila elegans*
Razorback sucker	*Xyrauchen texanus*
THREATENED SPECIES	
Uinta Basin hookless cactus	*Sclerocactus glaucus*
Ute ladies'-tresses	*Spiranthes diluvialis*
CATEGORY 2 CANDIDATE SPECIES	
Northern goshawk	*Accipiter gentilis*
Ferruginous hawk	*Buteo regalis*
Western snowy plover	*Charadrius alexandrinus nivosus*
Mountain plover	*Charadrius montanus*
Black tern	*Chlidonias niger*
Loggerhead shrike	*Lanius ludovicianus*
White-faced ibis	*Plegadis chichi*
Flannel mouth sucker	*Catostomus latipinnis*
Roundtail chub	*Gila robusta*
Colorado River cutthroat trout	*Oncorhynchus clarki pleuriticus*
North American lynx	*Felis lynx canadensis*
North American wolverine	*Gulo gulo luscus*
Spotted bat	*Euderma maculatum*
Great basin silverspot butterfly	*Speyeria nokomis nokomis*

Your letter mentioned a January 8, 1992 letter from CH2M Hill, which requested a list of threatened and endangered species from this office. We responded to this request by letter dated February 4, 1992. This response did not include the North American wolverine. I believe this species could occur in the high Uinta Mountains, and have therefore added it to the list of Category 2 Candidates that may be present. There is presently no Category 1 Candidates for Federal listing in the study area.

Areas proposed for designation as critical habitat for the Colorado squawfish, humpback chub, bonytail chub, and razorback sucker were identified in Federal Register / Vol. 58. No. 18, dated January 29, 1993 (copy enclosed). I expect that an administrative decision will be reached on this critical habitat proposal by March 15, 1994.

I request that you contact this office for information on Federally listed threatened and endangered species and proposed of listed critical habitats than the recovery teams.

Sincerely,

For Reed E. Harris
Field Supervisor

1: Enclosure

cc: Mr. Timothy Provan, Director **(Attn: Mark Holden)**, Utah Division of Wildlife Resources, 1596 West North Temple, Salt Lake City, Utah 84116

Mr. Walt Donaldson, Regional Supervisor, Northeastern Region **(Attn: Eric Larsen and Clay Perschon)**, 152 East 100 North, Vernal, Utah 84116

Mr. Buzz Cobell, Fish and Wildlife Management Assistance Office, U.S. Fish and Wildlife Service, 855 East 200 North (112-13), Roosevelt, Utah 84066

Mr. Harold N. Sersland, Central Utah Water Conservancy District, 355 West 1300 South, Orem, Utah

Mr. Denny Mengel, CH2M Hill / Horrocks Engineers, One West Main, P.O. Box 377, American Fork, Utah 84003

Mr. Charles L. Blair, CH2M Hill, 700 Clearwater Lane, P.O. Box 8748, Boise, Idaho 83707

Assistant Regional Director **(Attn: Grady Towns)**, Ecological Services, U. S. Fish and Wildlife Service, Mail Stop 60120, Denver Colorado

Public Hearings Registration Form

Public hearings will be held on the Upalco Unit/Uinta Basin Replacement Project. In order to be included as part of the hearing record, written testimony must be submitted at the time of the hearing. Verbal testimony will be limited to 5 minutes. Registration forms should be submitted to the Central Utah Water Conservancy District office by February 3, 1997.

Presenter: ____________________

Address: ____________________

City, State, Zip: ____________________

Representing: ____________________

I wish to appear at the (circle one):

Altamont Draft EIS Public Hearing

Date:	Wednesday, Feb. 5, 1997
Time:	6:00 p.m.
Location:	Altamont High School Auditorium Highway 87 (northside) Altamont, Utah

Salt Lake City Draft EIS Public Hearing

Date:	Thursday, Feb. 6, 1997
Time:	6:00 p.m.
Location:	SL County Commission Chambers Rm N1100 2001 S. State St. Salt Lake City, Utah

Fort Duchesne Draft EIS Public Hearing

Date:	February 11, 1997
Time:	1:00 p.m.
Location:	Ute Tribal Auditorium Tribal Headquarters Fort Duchesne, Utah

to express my views on the adequacy or accuracy of the Draft Environmental Impact Statement for the Upalco Replacement Project.

____
Signature

Forms will also be accepted at the door prior to each hearing.

Please address registration forms to:

Nancy Hardman
Central Utah Water Conservancy District
355 West 1300 South
Orem, Utah 84058-7303

Telephone: (801) 226-7187
Fax: (801) 226-7150