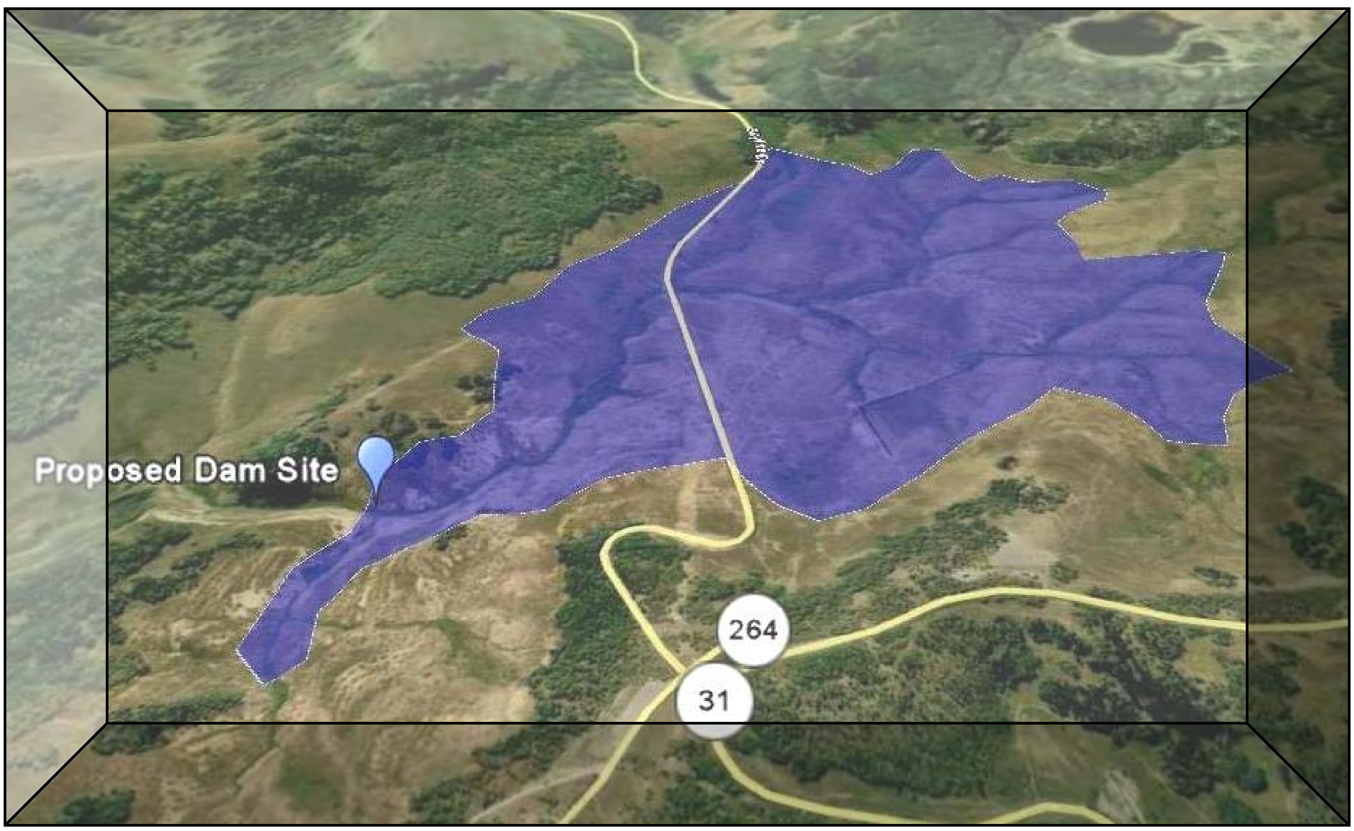
RECLAMATION
Managing Water in the West

Narrows Project Final Environmental Impact Statement

Narrows Project, Sanpete County, Utah



U.S. Department of the Interior
Bureau of Reclamation
Upper Colorado Region
Provo Area Office
Provo, Utah

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Mission Statements

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Narrows Project
Final Environmental Impact Statement

Lead Agency: United States Department of the Interior, Bureau of Reclamation

Cooperating Agencies: United States Department of Agriculture, Forest Service
United States Department of the Army, U.S. Army Corps of Engineers

Abstract:

The Bureau of Reclamation (Reclamation), the Federal agency with administrative authority under the Small Reclamation Projects Act (SRPA), in cooperation with the U.S. Department of Agriculture Forest Service and U.S. Army Corps of Engineers, has prepared this final environmental impact statement (FEIS) pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended, and the Council on Environmental Quality (CEQ) and U.S. Department of the Interior (Interior) regulations implementing NEPA. This FEIS updates a previously released draft environmental impact statement (EIS) and describes the effects of granting a SRPA loan and authorizing use of withdrawn lands to the Sanpete Water Conservancy District (SWCD) to construct the non-Federal Narrows Dam and Reservoir and to rehabilitate the existing Narrows Tunnel. The purpose of SWCD's proposal is to develop an existing non-Federal Narrows Project water right of 5,400 acre-feet of water.

If the SRPA loan is approved and funds are obtained, through construction of the Narrows Dam and Reservoir, SWCD would implement its plan to develop a supplemental water supply for agriculture and municipal and industrial water use in northern Sanpete County, Utah. This FEIS updates data and analyses from the 1998 draft EIS, for the Proposed Action Alternative, action alternatives, and the No Action Alternative and outlines mitigation measures that would be implemented as part of the Proposed Action.

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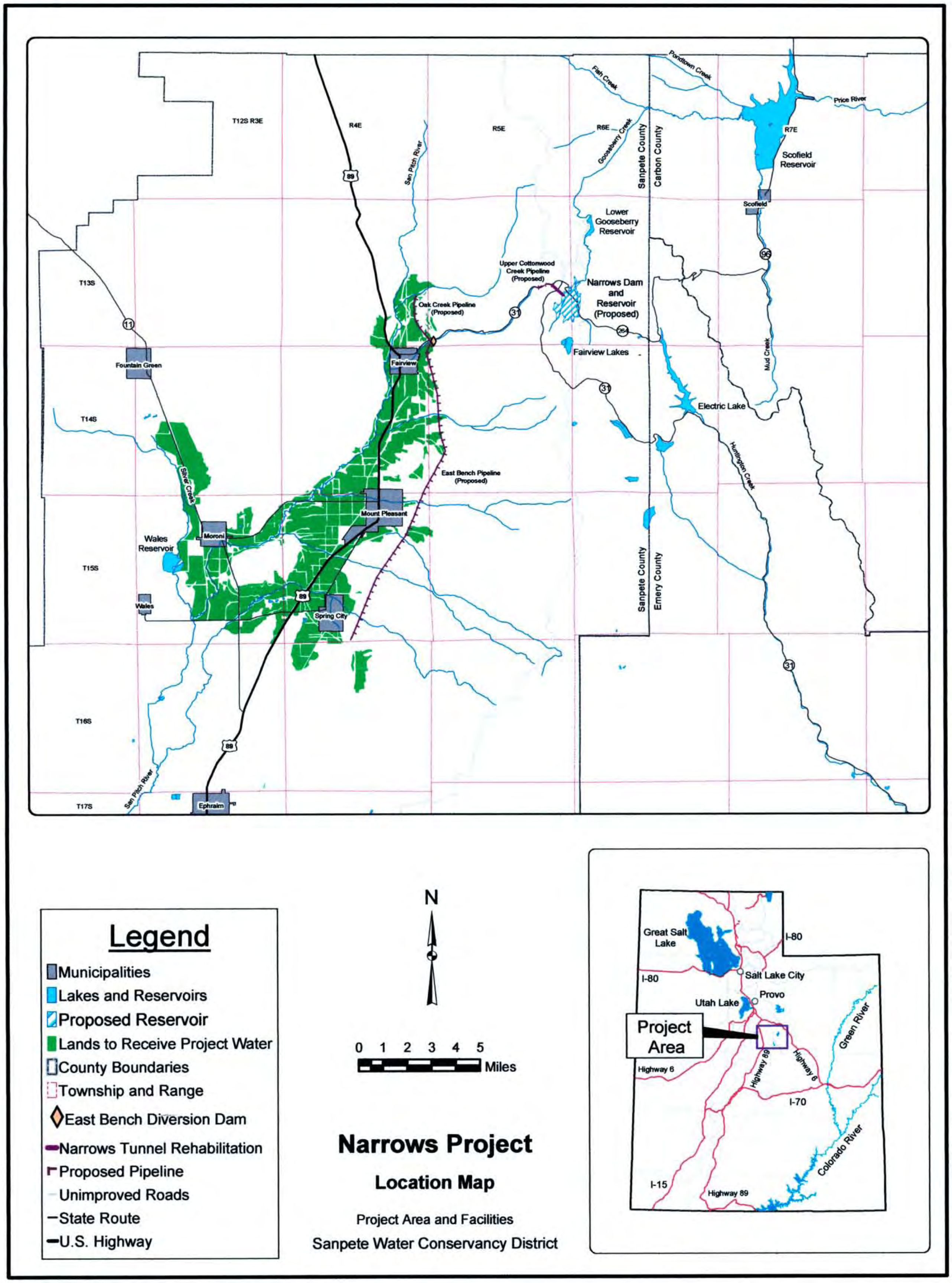
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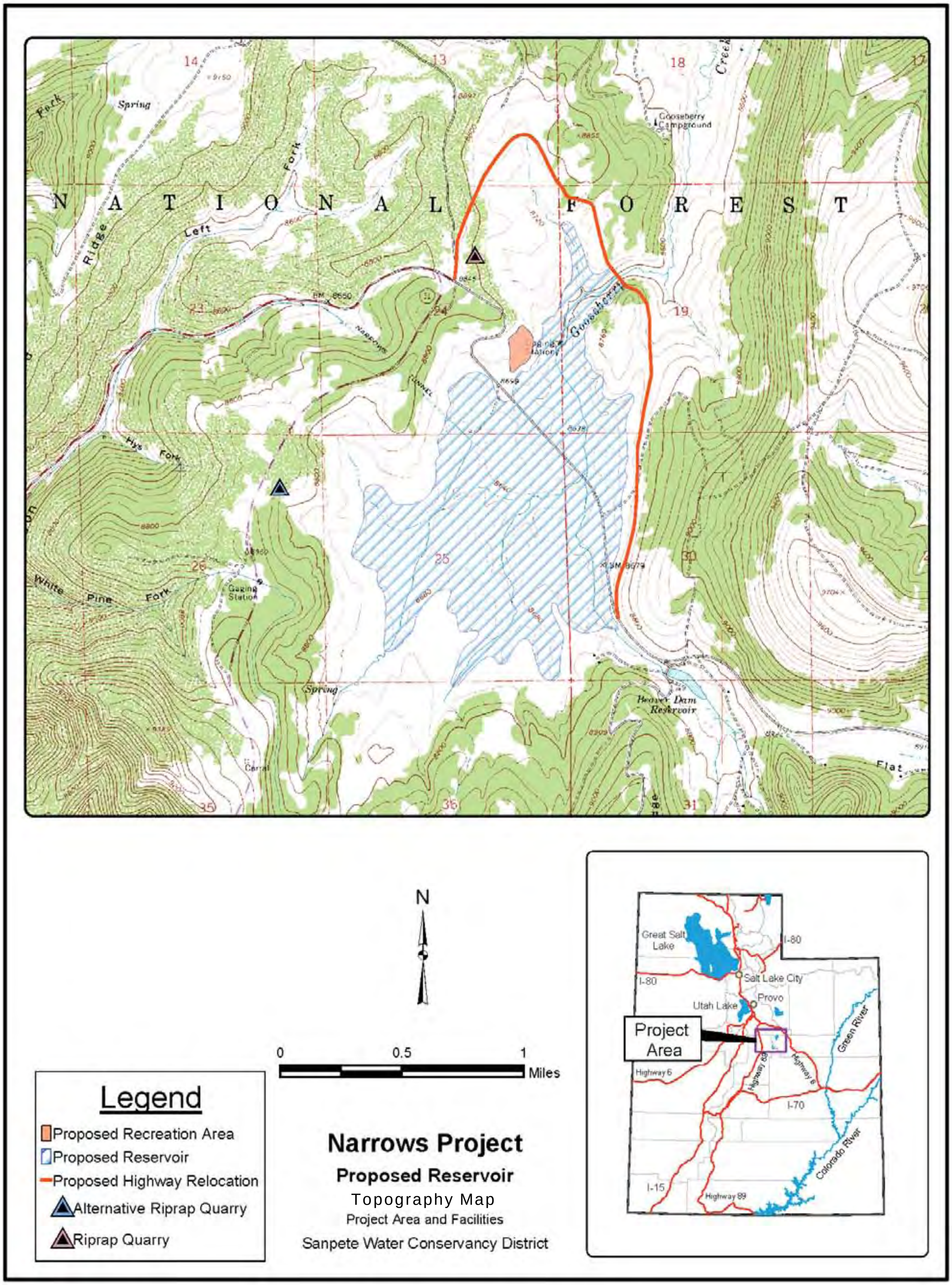
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EXECUTIVE SUMMARY

Narrows Project
Final Environmental Impact Statement

S1.0 INTRODUCTION

The Narrows Project, Utah, (Narrows Project) final environmental impact statement (FEIS) updates information and analyses contained in the *Supplemental Draft Environmental Impact Statement, Narrows Project* (DES-09-55) published in March 2010 (SDEIS) and the *Draft Environmental Impact Statement, Narrows Project* (DES-98-10) published in March 1998 (1998 DEIS). The FEIS discloses the direct, indirect, and cumulative effects of the non-Federal Narrows Project as proposed by Sanpete Water Conservancy District (SWCD). This is an executive summary of the FEIS.

S1.1 THE PROPOSED ACTION ALTERNATIVE

The SWCD has applied to the Bureau of Reclamation (Reclamation) for a Small Reclamation Projects Act (SRPA) loan to help finance construction of a private reservoir and related facilities. SWCD also has requested authorization to use federally administered withdrawn lands as the site for dam construction. Most of the reservoir basin would be located on adjacent, privately owned land. The proposed Federal action is that Reclamation will: 1) approve or deny the SRPA loan application and 2) determine whether to allow the SWCD to use 304.5 acres of Reclamation withdrawn land. If SWCD obtains its requisite financing, either through the SRPA loan or from other private funding source(s), and if Reclamation approves the land use a supplemental water supply would be developed for presently irrigated lands and municipal and industrial (M&I) water users in northern Sanpete County. To develop this supplemental water supply a dam and reservoir would be constructed on Gooseberry Creek, and water would be diverted through an existing tunnel and a proposed pipeline to Cottonwood Creek; the existing tunnel would be rehabilitated. Pipelines would be constructed to deliver the water to existing water distribution systems. Recreation facilities would be developed, and a minimum pool for fish habitat would be provided. The resulting water storage and delivery system would be a non-Federal project owned and operated by SWCD.

Mitigation measures would be implemented to offset adverse impacts. Water conservation measures would be implemented independent of the Proposed Action. To be eligible to receive water from the Narrows Project, water users would be required to use, or agree to implement, conservation measures.

S1.2 LEAD AND COOPERATING AGENCIES

Reclamation is the lead agency in preparing the FEIS. The two cooperating agencies are the U.S. Department of Agriculture Forest Service (USDA Forest Service) and the U.S. Army Corps of Engineers (USACE).

S1.3 DECISIONS TO BE MADE BASED ON THIS ANALYSIS

Based on the analysis documented in the FEIS, the responsible official for Reclamation will make the following decisions:

- Should Reclamation approve SWCD's application for a SRPA loan to construct the Narrows Project?[1]
- Should Reclamation approve SWCD's use of Reclamation withdrawn lands for the Narrows Project, in accordance with Reclamation law?
- Under what terms and conditions (of a local supplemental agreement between Reclamation and the USDA Forest Service) should the agencies administer resources within the total areas of project influence?

In addition, the cooperating agencies may use the FEIS to aid them in making the following decisions:

- Should the USDA Forest Service:
  1. Amend the 1986 Forest Land and Resource Management Plan for the Manti-La Sal National Forest (Forest Plan) to reflect Narrows Project land use changes
  2. Authorize mitigation measures on USDA Forest Service administered lands outside the Reclamation withdrawn lands
  3. Issue necessary easements to the Utah Department of Transportation (UDOT) for relocating State Route (SR) 264
  4. Accept responsibility for management of the recreation facilities
  5. Sign various agreements, such as memoranda of understanding (MOU), easements, and rights-of-way (ROW)
  6. Amend grazing permits and allotment management plans
- Should the USACE approve SWCD's application for a Clean Water Act Section 404 permit authorizing the placement of discharged dredge or fill material into waters of the United States for constructing the Narrows Dam and other features of the Narrows Project
  1. Identify the Least Environmentally Damaging Practicable Alternative (LEDPA) based on reservoir size

S1.4 PURPOSE AND NEED

Because Reclamation administers the Federal Reclamation laws, including the Small Reclamation Projects Act of 1956 and the Reclamation Project Act of 1939, particularly Section 10, Reclamation's purpose and need is considering approval of SWCD's SRPA loan application to build the Narrows Project and SWCD's request for authorization to use withdrawn lands to construct and operate the proposed dam and reservoir. This SRPA loan application is appended to the FEIS (appendix J).

By way of background, SWCD's purpose for the Narrows Project is to enable development of an irrigation and M&I water supply source for users in north Sanpete County, Utah. Its

[1] There are six indicators that will be used to determine the overall loan risk and category assignments. These indicators are described in the economic section of this FEIS.

need is to reduce the average annual shortages to irrigators in Sanpete County as nearly as possible to 5 percent (%), which is considered full irrigation supply.

Specifically, the following are SWCD's water-related needs addressed by the proposed project:

- Demand for municipal water for present and future use exceeds the currently available supply. The proposed Narrows Project would develop, through exchange, an additional supply of municipal water to offset current shortages and accommodate anticipated population growth in Sanpete County.
- The current water supply for agricultural irrigation does not provide adequate supply and storage at the needed times—typically in July, August, and September of each year. The proposed Narrows Project would provide late season irrigation water to offset some of the current shortages.

In addition to its primary purpose of supplying water to Sanpete County, SWCD believes the project would have the additional benefit of providing reservoir-based recreation and fishery opportunities in Sanpete County.

It is important to note that Reclamation's purpose and need for action is limited to responding to the loan application and the request to use Federal land for the Narrows Project (see figure 1-1).

Due to USACE's need to determine the LEDPA, three reservoir sizes were analyzed.

S1.5 Relationship to Other Projects

This section describes other Federal actions that are considered for past, present and cumulative impact analyses in chapter 3. Construction and operation of the proposed project would reflect consideration of, and cooperation with, the following existing projects described in the FEIS:

- Central Utah Project
- Scofield Project
- Fairview Lakes, Gunnison Reservoir, Wales Reservoir
- Price-San Rafael Rivers Unit, Colorado River Salinity Control Program
- Upper Colorado River Endangered Fish Recovery Program
- Forest Plan

S1.6 Environmental Issues Associated with the Proposed Action Alternative

The issues identified through the initial scoping effort are listed below. The issues are phrased as questions. Chapter 2 of the FEIS contains a comparison summary of the alternatives and their responses to the issues.[2] Chapter 3 presents the existing environment and the environmental consequences as they relate to the resource issues.

Issue No. 1 – How would threatened and endangered species be affected by the Narrows Project?

Issue No. 2 – How would the Narrows Project affect wildlife resources?

Issue No. 3 – What effects would there be on water resources from the Narrows Project?

[2] References to chapters, tables, and figures within the Executive Summary are to the respective chapter, table, or figure within the main portion of the FEIS.

Issue No. 4 – How would the Narrows Project affect the fishery resource?

Issue No. 5 – How would water quality be affected by the Narrows Project?

Issue No. 6 – What would the effect be on wetland resources from the Narrows Project?

Issue No. 7 – What would the effect be on aquatic and riparian resources from the Narrows Project?

Issue No. 8 – How would the Narrows Project affect the recreation and visual resources within the project area?

Issue No. 9 – What effect would there be on cultural resources from the Narrows Project?

Issue No. 10 – What social and economic effects would be expected from the Narrows Project?

Issue No. 11 – What effect would there be on existing land uses, rights-of-way, and potential mineral leasing?

Issue No. 12 – What effects on public safety would there be from the Narrows Project?

Issue No. 13 – What would be the effects upon air quality associated with constructing the Narrows Project?

Issue No. 14 – Would the slopes of Fairview Canyon be affected by construction and operation of the Narrows Project? What effects will there be on channel stability from the Narrows Project?

Issue No. 15 – What would the geologic hazards and earthquake hazards be from the Narrows Project?

Issue No. 16 – What would the effect be upon the soils of the area from the Narrows Project?

Issue No. 17 – What would the effect be upon levels of trace elements in the ground water supply from constructing the Narrows Project?

Issue No. 18 – What would the impact of the Narrows Project be on Indian trust assets (ITAs)?

Issue No. 19 – What would the impact of the Narrows Project be on environmental justice?

Issue No. 20 – What climate change and greenhouse gas emission issues might affect, or be affected by, the Proposed Action?

S1.7 PERMITS, AUTHORIZATIONS, AND AGREEMENTS

Implementation of the Proposed Action could require a number of authorizations or permits from State and Federal agencies. These are summarized below.[3]

- Reclamation approval of the SRPA loan and congressional approval of the necessary funds to construct the Narrows Project.
- Reclamation authorization for SWCD use of withdrawn lands to construct and operate Narrows Dam and Reservoir.
- Utah Division of Water Quality authorization needed for a Storm Water Discharge Permit (Section 402 of the Clean Water Act, as amended).
- A USACE permit in compliance with Section 404 of the Clean Water Act, as amended, or Utah Department of Natural Resources authorization for a State

[3] Before beginning activities under the Proposed Action, SWCD would consult with both USACE and the Utah Department of Natural Resources to determine which permits would be necessary.

Stream Alteration Permit (Section 404 of the Clean Water Act, as amended).

- Utah Division of Water Quality authorization for a Utah Pollution Discharge Elimination Permit (Section 402 of the Clean Water Act, as amended).
- Reclamation consultation with the State Historic Preservation Office (SHPO).
- Utah Division of Water Quality authorization needed for 401 Certification following a Level II Antidegradation Review.
- Utah Division of Water Quality authorized needed for State Water Quality Certification pursuant to Section 401 of the Clean Water Act.
- Utah Division of Water Quality authorization needed for Utah Pollutant Discharge Elimination System General Permit for Construction Dewatering if dewatering is required.

S2.0 THE ALTERNATIVES CONSIDERED INCLUDING THE PROPOSED ACTION ALTERNATIVE

As the lead Federal agency for the FEIS, Reclamation's action under review is that Reclamation will: 1) approve or deny the SRPA loan application and 2) determine whether to allow SWCD to use 304.5 acres of Reclamation withdrawn land. The USACE and USDA Forest Service also must make decisions based on the FEIS. To fully explore the effects of the proposed action and possible alternate courses of action, the SWCD, working with Reclamation and the other cooperating agencies, developed an array of alternatives to answer the issues raised in chapter 1.

S2.1 DESCRIPTION OF ALTERNATIVES

S2.1.1 No Action Alternative

The No Action Alternative represents the conditions of the affected area if Reclamation does not approve the SRPA loan and use of withdrawn lands by SWCD for the non-Federal Narrows Project (figure 2-1). It establishes the baseline for evaluating the environmental impacts of providing a supplemental water supply to north Sanpete County. It also establishes anticipated conditions in the affected two-county areas without further development and assumes that irrigation operations would continue according to historic use.

Under this alternative, the Narrows Dam and Reservoir would not be constructed. Without the dam construction, there would be no need to relocate SR-264; and there would be no recreational facilities constructed at the reservoir site. The East Bench, Oak Creek, and Upper Cottonwood Creek Pipelines would not be built. The demand on municipal water supplies in Fairview, Mount Pleasant, Spring City, and Moroni would continue to increase as supplies for outdoor municipal uses run short and as the population increased. Most likely, there would be a conversion of agricultural water to municipal use as the demand for municipal water increased with a growing population.

Water conservation measures would continue to be implemented. These conservation measures would reduce average shortages on irrigated farmland to about 29.5% or about 15,250 acre-feet per year. Implementing new conservation measures most likely would reduce irrigation return flows now supplying wetlands, aquatic habitat, and downstream users by an estimated 3,500 acre-feet per year.

There would be no wetlands, wildlife, or fisheries mitigation measures implemented under the No Action Alternative because there would be no impact to existing wetlands and wildlife habitat. Streamflows in Gooseberry and Fish Creeks would remain unaltered from their present state. Under this Plan, no flat water fishery would be developed in the proposed reservoir basin.

S2.1.2 Proposed Action Alternative

If SWCD obtains its requisite financing, either through the SRPA loan or from other private funding source(s), and if Reclamation approves the land use, a supplemental water supply may be developed for presently irrigated lands and M&I water users in north Sanpete County under the Proposed Action. This additional water supply would satisfy the 1984 Compromise Agreement.

The Proposed Action would provide funding for and authorize the use of Federal lands by SWCD to build a private dam and reservoir to provide north Sanpete County an average annual supply of 4,281 acre-feet of supplemental irrigation water for 15,420 acres of presently irrigated farmland and 855 acre-feet of water for municipal use. The project facilities would include construction of the 17,000-acre-foot Narrows Dam and Reservoir on Gooseberry Creek, pipelines to deliver the water to existing water distribution systems, rehabilitation of the existing 3,100-foot Narrows Tunnel to control releases, and relocation of 2.9 miles of SR 264. The dam would be 120 feet high with a crest length of 550 feet and crest width of 30 feet.

SWCD's non-Federal Narrows Project would include a transmountain diversion of water from the Gooseberry Creek drainage of the Price-Green-Colorado River Basins to the San Pitch-Sevier River of the Great Basin. Geographically, the project facilities are located in close proximity to the drainage divide between the Price River system and the San Pitch River system. The general location is shown on the location map at the front of this document.

The Price River flows southeast to the Green River, a tributary of the Colorado River. The San Pitch River flows southwest to the Sevier River, which is completely consumed in the Bonneville Basin, a part of the arid Great Basin. The county line dividing Sanpete County and Carbon County is located more than 6 miles downstream from and about 3 miles east of the proposed Narrows damsite on Gooseberry Creek.

The proposed damsite, the transmountain Narrows Tunnel, and the project water distribution facilities are all located in Sanpete County. The source of the project water supply generally arises in Sanpete County and naturally flows into Carbon County and the Price River system, unless the flows are captured and diverted transmountain to Sanpete County. The service area of the Narrows Project would be situated in the San Pitch River drainage.

A dam and reservoir would be constructed on Gooseberry Creek, and water would be diverted through an existing tunnel to Cottonwood Creek. Pipelines would be constructed to deliver the water to existing water distribution systems located near Fairview, Utah. Recreation facilities would be developed at the reservoir, and a 2,500-acre-foot minimum pool for fish habitat would be maintained.

Mitigation measures would be implemented to offset adverse impacts to wetlands, terrestrial wildlife, and stream fisheries. In addition to mitigation measures to offset project impacts, other measures would be included to enhance or improve fish and wildlife habitat. Additional water conservation measures would be required independent of the Proposed Action. However, according to SWCD, only those water users who have implemented or would agree to implement water conservation measures would be eligible to receive project water. These practices would include improved water conveyances such as lined canals, pipelines, or improved irrigation practices such as sprinklers or gated pipe.

S2.1.3 Mid-Sized Reservoir Alternative

This alternative would be similar to the Proposed Action except that the reservoir capacity would be limited to 12,450 acre-feet. Of that amount, 9,950 acre-feet would be active capacity, and 2,500 acre-feet would be inactive storage. The 110-foot-high dam, with a crest length of 475 feet and crest width of 30 feet, would be in the same location as that for the Proposed Action (figure 2-3). Other features of the project would be the same as those for the Proposed Action and would include the construction of pipelines, rehabilitation of the existing Narrows Tunnel to control releases, relocation of SR-264 and would provide recreation opportunities. Exceptions and differences between this alternative and the Proposed Action are described below.

S2.1.4 Small Reservoir Alternative

This alternative would be similar to the Proposed Action except that the reservoir capacity would be limited to 7,900 acre-feet. Of that amount, 5,400 acre-feet would be active capacity, and 2,500 acre-feet would be inactive storage. The 100-foot-high dam, with a crest length of 425 feet and crest width of 30 feet, would be in the same location as that for the Proposed Action (figure 2-3). Other features of the project would be the same as those for the Proposed Action and would include the construction of pipelines, rehabilitation of the existing Narrows Tunnel to control releases, and the relocation of SR-264 and would provide recreation opportunities. Exceptions and differences between this alternative and the Proposed Action are discussed below.

S2.2 Alternatives Considered and Eliminated from the Study

Several alternatives considered were determined to be unviable. In general, alternatives considered and eliminated from further study did not meet Reclamation's criteria for providing a SRPA loan or licensing the use of Federal Land. It is important to note that, in addition to not meeting Reclamations purpose and need, these alternatives do not meet SWCD's water development objectives. Those alternatives are listed below and described in detail in the FEIS.

- Direct Diversion Without Reservoir Alternative
- Direct Diversion with Reservoir in Sanpete Valley Alternative
- Conservation Without Development of Other Water Supplies Alternative
- Mammoth Damsite Alternative
- Valley Damsite Alternative
- Skyline Mine Alternative
- Year-round Release with Ground Water Exchange and Pumping Alternative
- New Ground Water Development Alternative

- New Surface Water Development in Sanpete County Alternative
- Central Utah Project Water Alternative
- Conservation Through Retirement of Irrigation Lands Alternative
- Purchase of Sanpete County's Water Rights by Carbon County Water Interests Alternative
- Carbon County Proposed Recharge Alternative

S2.3 COMPARISON OF ALTERNATIVES

Table 2-8 compares the closely examined alternatives against the issues associated with the Proposed Action that are outlined in chapter 1. The scientific and analytical basis for these comparisons can be found in chapter 3.

S2.4 PREFERRED ALTERNATIVE

Based on the comparison of alternatives provided in the FEIS, Reclamation has selected the Proposed Action Alternative (the large reservoir) as the preferred alternative.

S3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section summarizes chapter 3, which discusses the affected environment and environmental consequences that would result from the construction, operation, and maintenance of the project features associated with the Proposed Action and alternatives of the Narrows Project should Reclamation approve the loan application and the use of the Federal land. The affected environment discussions describe existing conditions for resources within the project area. The impact analyses focus on potential direct, indirect, and cumulative impacts on these resources. Potentially significant impacts, together with criteria developed at the beginning of this study for assessing the significance of potential impacts, are identified. Resource specialists reviewed all data and results of the March 1998 DEIS analysis and updated information based on available data and the substantive public comments received, where appropriate, in the FEIS. Mitigation measures that would reduce or avoid certain adverse impacts or would compensate for some unavoidable adverse impacts also are identified.

S3.1 WATER RESOURCES

S3.1.1 Affected Environment

Water resources affected by the Proposed Action include Gooseberry Creek and its three unnamed tributaries located high in the Price River drainage. Gooseberry Creek, a tributary of Fish Creek, flows directly into Scofield Reservoir (see figure 1.1). Scofield Reservoir is included in the affected environment, as is the segment of the Price River immediately below the reservoir down to the first diversion at the town of Heiner, some 25 miles below the dam. Cottonwood Creek, located in the San Pitch River Basin, is located on the opposite side of the divide from Gooseberry Creek. The water from the Narrows Tunnel is diverted into Cottonwood Creek. Cottonwood Creek and the San Pitch River are located in the Sevier River subbasin of the Great Basin.

Typical of Wasatch Mountain streams, flows in these creeks are greatest in the spring, when snowmelt runoff is peaking. Peak flows during May and June are estimated to range from 15 to over 100 cubic feet per second (cfs) in Upper Gooseberry Creek near the proposed damsite. The flow declines considerably in late summer and reaches a minimum in late fall or winter. Late-season flows are estimated to be 1.5–5 cfs in Upper Gooseberry Creek.

The average annual natural runoff volume of Upper Gooseberry Creek, near the proposed damsite, is 9,032 acre-feet. Of this amount, an average of 1,815 acre-feet presently is stored in Fairview Lakes and diverted transmountain to Cottonwood Creek through the Narrows Tunnel. The remaining water continues down Gooseberry Creek to Fish Creek. An average of 35,800 acre-feet per year enters Scofield Reservoir from Fish Creek. The total annual inflow to Scofield Reservoir from all tributaries averages 57,500 acre-feet. The average total contents of Scofield Reservoir are about 42,360 acre-feet. Averages are based on the 1960–2002 hydrologic period of record.

The Price River below Scofield Reservoir, referred to as lower Fish Creek, has a wide range of flows that vary according to downstream water demands and hydrologic conditions. Releases consist of direct flow right bypasses and Scofield Reservoir storage deliveries for Scofield Project users. Spills occur when the reservoir is full and water flows over the spillway or when releases are made in excess of downstream demands. These total releases and spills have averaged 51,815 acre-feet for 1960–2002 but historically have varied from 13,762–154,475 acre-feet. Low flow conditions generally occur from November–March. There are no minimum flow requirements in the Price River, and it is not unusual for the flow below the dam to be completely shut off during winter months. Peak flows below the dam occur in wet years when the reservoir spills. While normal dam releases in June are about 150 cfs, the total releases with these spills have ranged up to more than 1,100 cfs. Because spills are in excess of downstream consumptive use requirements, they usually increase river flows throughout the lower Price River to the confluence with the Green River. From 1960–2002, the reservoir filled and spilled 17 times.

About 25 miles downstream from Scofield Reservoir near the small community of Heiner, the average annual flow of the Price River is about 74,800 acre-feet based on 1960–2002 data. Within 5 miles of Heiner, numerous diversions from the river occur. The largest diversion is the head of the Carbon and Price Wellington Canals, located about 1.5 miles south of Spring Glen. Except during high water conditions when the flow of the river exceeds the capacity of the canals, the river is essentially dry below this diversion. In addition to irrigation water, winter flows also are diverted for stock watering.

Irrigation return flows in this area discharge back to the river, and the flow of the river increases after passing through the Price-Wellington area. Near its confluence with the Green River, measured at the Price River at Woodside, the average annual flow of the river is 94,929 acre-feet, based on 1960–92 records. The stream gauging station on the Price River at Woodside was discontinued in September 1992 and renewed in July 2000.

Operation of the Narrows Project would affect streamflows in Gooseberry Creek, Lower Fish Creek, Scofield Reservoir, Price River to Heiner, Cottonwood Creek, and about 3 miles of the San Pitch River. Table 3-1 provides a comparison of average monthly streamflows under the four project alternatives evaluated. Monthly streamflow data were used to develop this table because reliable daily streamflow data were not available.

Impacts to Lower Gooseberry Creek and Fish Creek would occur primarily during the spring snowmelt period as water is stored in Narrows Reservoir for release later in the summer. Impacts to Lower Gooseberry Reservoir would consist of reduced inflow. However, the effect would be negligible because the reservoir is not operated as a storage reservoir. As a result, the outflow would be reduced in the same proportion as the inflow would be reduced. Impacts to Scofield Reservoir would be in the form of reduced inflows, resulting in a lowering of the average reservoir storage. Impacts to regulated releases from Scofield Reservoir for Scofield Project use would occur only during multiple successive drought years, such as occurred in the early 1960s, early 1990s, and the early 2000s. Impacts to the Price, Green, and Colorado Rivers would result primarily in reduced spills from Scofield Reservoir.

The impacts of the Narrows Project on water resources are most pronounced near the reservoir. About 1 mile of Upper Gooseberry Creek and 4.3 miles of small streams in the proposed reservoir basin would be inundated by the reservoir. In addition, annual flows in the middle 3 miles of Gooseberry Creek between Narrows Reservoir and inflow into Lower Gooseberry Reservoir would be reduced by about 74%. Under the Proposed Action, a 1.0-cfs minimum flow would be made from Narrows Reservoir to Gooseberry Creek to provide a 1.5-cfs minimum flow at the USDA Forest Service campground ⅛ mile downstream from the proposed damsite. If the 1.5-cfs flow at the campground is not met, up to an additional 0.25 cfs would be released from the reservoir to meet the required flow. Minimum streamflow releases from Narrows Reservoir would eliminate periodic dry stream channels in the Middle Gooseberry Creek segment. An average of 300 acre-feet per year also would be released for channel maintenance or other instream flow purposes.

Flows in Cottonwood Creek would increase during the irrigation season, with the import of project water through the Narrows Tunnel. However, during the irrigation season, these flows would be less than peak flows that occur naturally during the spring snowmelt period. The Upper Cottonwood Creek Pipeline would convey these increased flows outside the stream channel between the tunnel outlet and the confluence with Left Hand Fork. About 300 feet below the Left Hand Fork confluence, the project flows would be discharged to the stream. At this point, the increase in average July and August flows from current conditions would be about 200%.

Depletions to the Price River drainage would average 5,597 acre-feet per year. This amount would consist of 5,227 acre-feet of transbasin diversions and 370 acre-feet of increased evaporation in the Price River Basin. When measured in Gooseberry Creek below Narrows Reservoir, the reduction in annual streamflow varies between 1,760 and 10,200 acre-feet, depending on the storage level of Narrows Reservoir and the magnitude of the streamflow into the reservoir. As shown in table 3-1, the greatest impact would occur during the spring snowmelt runoff period. Releases from Narrows Reservoir to Gooseberry Creek would remain at a minimum of 1.0 cfs; and when the reservoir is spilling or when flushing releases are made, the flow would be greater.

As a result of constructing Narrows Reservoir, the operation of Scofield Reservoir would be altered within the normal historic range. Scofield Reservoir would operate at a lower level with implementing the Proposed Action, as shown in figure 3-1. Under project conditions, the average total contents of Scofield Reservoir would be reduced from about 42,400 acre-feet to about 31,900 acre-feet. Average reduction in storage releases to irrigators in the Price area would be about 753 acre-feet per year. Total depletions to the Price River drainage would average 5,597 acre-feet per year. Both the volume and frequency of spills from the reservoir would be reduced. With the no action alternative, the average reservoir surface area would be reduced from 2,370 acres to about 2,125 acres. This is about a 10% reduction or about 245 acres of the surface area of the No Action Alternative.

Since Scofield Reservoir would operate at a lower level, there is an increased potential for the reservoir to be drained to the bottom of its active storage. The frequency of this occurrence increases from 3 times in 43 years for the No Action Alternative to 12 times in 43 years with the Proposed Action.

During most years, controlled releases from Scofield Reservoir to meet Scofield Project demands would remain unaltered.

In summary, the residual impacts (after mitigation) of the Proposed Action include the inundation of 1.0 mile of Gooseberry Creek and 4.3 miles of unnamed tributaries. Flows in Gooseberry Creek below Narrows Reservoir, Fish Creek, and the Price River would be reduced as shown in table 3-1. The flow in Cottonwood Creek below the confluence with Left Hand Fork would be increased during the nonrunoff portions of the irrigation season. Scofield Reservoir would operate at a lower level in most years; and reductions in storage releases to irrigators in the Price area would occur only after several successive years of drought and would average about 753 acre-feet per year. However, on the average, these reductions would be about 1,500 acre-feet less than the reductions that would have occurred if Scofield Reservoir had not been enlarged to accommodate the Gooseberry Project (Narrows Project).

S3.2 WATER RIGHTS

S3.2.1 Affected Environment

Utah water use is governed by the prior appropriation doctrine. Under this doctrine Utah’s water resources are owned by the State for the welfare of the public and individuals, corporations, and public entities can acquire conditional rights to beneficial use this resource. Water rights are established either through historic water use prior to the enactment of State water laws or through an application to appropriate water. All water rights are assigned a priority date based upon when the water right was first established, either by use or by application. In times of water shortages water is allocated to water rights based on their priority dates with senior rights being able to divert ahead of junior water rights—hence, the maxim “first in time, first in right.” In river systems, a water right can typically only divert water when all downstream senior water rights have all the water they currently need or are entitled to.

SWCD holds Water Right Numbers (Nos.) 91-130(A14025), 91-131(A14026), and 91-132 (A14477) for the Narrows Project. These water rights were established by Applications to Appropriate Nos. A14025, A14026, and A14477 filed by Reclamation in January and September of 1941. Reclamation later transferred these applications, still unapproved, to SWCD in July 1975 for use in the Narrow project. These applications have been involved in several agreements, the most significant of which is the 1984 Compromise Agreement that was mediated by the Utah State Engineer. The conditions of the 1984 Compromise Agreement, which were incorporated into the January 7, 1985, approval of these applications to appropriate, subordinated certain Price River Water Users Association’s water rights to the Narrows Project, limited the annual transbasin diversion and storage allowed by the Narrows Project, and specified how stored water from Scofield reservoir would be used to satisfy the downstream water rights that are senior to the Narrows Project.

S3.2.2 Environmental Consequences

S3.2.2.1 No Action Alternative

The North Sanpete water users would continue to hold valid water rights in Gooseberry Creek and would be entitled to develop these rights under Utah water law. If the Narrows Project water rights were amended to allow their development without Federal approval, they could be developed outside the scope of the FEIS. Whether or not the Narrows Project is constructed, the distribution of water between the Carbon and Sanpete water users will be based on the priority dates of the individual water rights (except as stipulated in the 1984 Compromise Agreement) that each water user holds.

S3.2.2.2 Proposed Action Alternative

Sanpete County's water rights would be allowed to divert water in accordance to their respective priority dates and according to the terms of the 1984 Compromise Agreement. Sanpete County is allowed to develop their approved water rights even if doing so impairs previously developed junior water rights.

Although the development of the Narrow's Project could impair junior Carbon County water rights holders, it is anticipated that this impairment would be minimal. First, the 5,400-acre-foot annual depletion of the Narrows water rights represents only about 6.6% of the average annual yield of the Price River above the city of Price. Secondly, the Proposed Action should have no or minimal effect because of how Scofield Reservoir is operated (i.e., it is shut off completely for flood control when the White River is running high and then opened as needed to meet the downstream agricultural demands). Scofield Reservoir was enlarged in 1946 by 35,000 acre feet of additional storage, in part at Federal expense, to offset or provide a buffer to the potential effects of the proposed development of Gooseberry Creek to benefit Sanpete Valley. The two facilities were originally conceived as components of a single project. The Scofield Reservoir enlargement was intended as compensatory storage for the anticipated effects of the transbasin diversion to the Sanpete Valley. Therefore, because of this additional storage in Scofield Reservoir, there should be limited adverse impacts to the direct flow water right holders in the Price River system.

S3.2.2.3 Mid-Sized Reservoir Alternative

This alternative is nearly identical to the Proposed Action, except Narrows Reservoir is limited to 10,000 acre-feet. The effects to other water right holders are nearly identical to the Proposed Action except that the potential impairment to Carbon County water users would be slightly less than that of the full size reservoir.

S3.2.2.4 Small Reservoir Alternative

This alternative is nearly identical to the Proposed Action except Narrows Reservoir is limited to 5,400 acre-feet. The effects to other water right holders are also nearly identical to the Proposed Action except that the potential impairment to Carbon County water users would be slightly less than that of the Mid-Sized Reservoir.

S3.3 WATER QUALITY

S3.3.1 Upper Gooseberry Creek

On the basis of data collected from Upper Gooseberry Creek and Cottonwood Creek, where much of the flow is from Gooseberry Creek through the Narrows Tunnel, the water is considered very good quality. As shown in table 3-2, the dominant chemical constituents are calcium and bicarbonate, with other common ions being minor in concentration. Total dissolved solids (TDS) are low, ranging from 184–258 milligrams per liter (mg/L) in Gooseberry Creek and 160–316 mg/L in Cottonwood Creek. Trace elements are very low in concentration, with most below detection limits.

Although most of the phosphate levels in these samples were considerably less than 0.05 mg/L, previous studies conducted by the Utah Division of Wildlife Resources (UDWR) indicate that the 0.05-mg/L guideline for streams is often exceeded in Cottonwood Creek. Existing soil and rock erosion may be the major sources of phosphates exceeding this pollution indicator, with livestock grazing, recreation, and wildlife also contributing. At levels of 0.05 mg/L or greater, the Utah Department of Environmental Quality (UDEQ) indicates that investigations should be conducted to develop more information concerning phosphate sources.

S3.3.2 Lower Gooseberry Reservoir

The Utah Division of Water Quality completed a limnological assessment of Lower Gooseberry Reservoir that indicates it is a fairly stable mesotrophic (moderate levels of organic and mineral nutrients) system with good water quality (UDEQ, Division of Water Quality, 2008). The only parameters to exceed State water quality standards for defined beneficial uses are phosphorus, pH, and dissolved oxygen (DO). The average concentration of total phosphorus in the water column has not exceeded the recommended pollution indicator for phosphorus of 0.025 mg/L; but occasionally, higher values are reported at various depths in the water column. Occasionally, DO levels and pH values have violated State standards near the bottom of the reservoir, mainly during winter ice coverage. The extensive macrophyte coverage of the bottom of the reservoir is the primary factor in the reservoir responsible for this phenomenon. The reservoir is shallow, with a mean depth of 3.7 feet; has good light penetration throughout the water column; and does not stratify. The UDWR has expressed concern about nutrient loading of Lower Gooseberry Reservoir and its effect upon DO levels in the reservoir. The oxygen depletion of the reservoir during the winter is believed to result from low winter inflows combined with decomposition of organic material resulting from the extensive macrophyte growth during the summer, as mentioned above.

S3.3.3 Scofield Reservoir

Recent water quality assessment indicates that Scofield Reservoir is mesotrophic in its present state. Data collected in 1990 and 1991 depicted the reservoir as hypereutrophic, while data in 1992, after treatment and eradication of trash fish, indicated a moderately eutrophic system.

Data collected between 1992–2007 indicate an overall mesotrophic system (UDEQ, Division of Water Quality, 2010). Eutrophication is a term applied to the organic degradation of a body of water and is associated with elevated levels of carbon, nitrogen, phosphorus, and other inorganic nutrients. The degree of eutrophication generally is exhibited by the growth and appearance of large colonies of algae in highly eutrophic waters, coupled with a green cast or color to the water. This generally occurs during the warm summer months.

Trophic State Index (TSI) is a general measure of the level of eutrophication in a reservoir. The Carlson TSI is determined using measures of secchi depth, chlorophyll, and phosphorus (Carlson, 1977). TSI values greater than 50 are indicative of a eutrophic system, and TSI values between 40–50 are indicative of a mesotrophic system. The average TSI value for Scofield Reservoir of 53.3 (for 1979–80) was reported by UDEQ in a report entitled *Scofield Reservoir Restoration Through Phosphorus Control*. For 1981–2007, the average TSI value was computed to be 47.1 (see figure 3-4).

Scofield Reservoir typically does not stratify during the summer and only weakly when it does stratify. Stratification in Scofield is largely influenced by its shallow depth (mean depth of 26 feet) and reservoir operations, which withdraw water from near the bottom of the reservoir. For these reasons, Scofield Reservoir is often mixed from top to bottom. During periods of weak stratification, oxygen levels near the bottom of the reservoir become depleted. Low dissolved oxygen increases phosphorus leaching from the bottom sediments (Judd, 1992).

The water quality of Scofield Reservoir is considered fair. Average constituent levels of the reservoir and its tributaries are listed in table 3-3. The average detention time is about 1.4 years. The maximum depth is 66 feet, and the mean depth is 26 feet. The shallow areas with water less than about 15 feet deep normally are covered with extensive macrophyte growth, although these are normally submergent. This adds to the oxygen deficit problem during parts of the year.

The principal pollutants are nutrients, sediments, and trace elements associated with erosion and mining and nonpoint sources such as construction of roads and mine portals, domestic waste disposal, animal grazing, and natural deposits of rock containing phosphates (table 3-3).

Several independent water quality studies of Scofield Reservoir (listed in the "Bibliography") show that phosphorus is the limiting nutrient. This means that all available phosphorus is used up in producing algae or other cell bodies, while there remains a surplus of carbon, nitrogen, and other nutrients. Thus, without the input of additional phosphorus into the system, no additional algal cells can form. About 53% of the phosphorus loading to Scofield Reservoir enters from Fish Creek, according to a 1983 Utah Department of Health study. Indications are that the source of most of the phosphorus consists of naturally occurring, phosphorus-laden soils in the upper watershed.

Fishkills in Scofield Reservoir have been reported during 14 of the 46 years from 1960–2005. These fishkills are minor and generally occur in late summer. They are an indicator of water quality problems with low DO levels being the most probable cause of the fish dying.

In 1984, UDEQ received a Clean Lakes Phase II grant pursuant to the Clean Water Act, Section 314, to rehabilitate Scofield Reservoir through a program to reduce total phosphorus loading to the reservoir. UDEQ had concluded that:

> "the most pragmatic and effective means to control the further eutrophication of Scofield Reservoir, or possibly to effect a moderate reversal of the eutrophication process, appears to be a reduction of the phosphorus load to the lake."

The restoration project consisted of installing stream revetments and checkdams, revegetating denuded streambanks, replacing water diversion systems for irrigation, providing a fish cleaning station, and developing a public awareness and education program to alert people of the pollution problem and solicit their support in reducing phosphorus loads to the reservoir. Streambank rehabilitation activities occurred on segments of Mud Creek and Fish Creek. The overall streambank work was designed to reduce stream sediments and erosion through streambank stabilization and revegetation of denuded soils in highly eroded areas.

A postproject monitoring program indicated that the project was initially effective. Streambank stabilization and revegetation occurred in the project area. Visual observations indicated that sediments were being removed from the streams. Although there is insufficient empirical data to conclusively support the effects of the implementation effort, the data indicated a decline in total phosphorus concentrations. However, many aspects of the project were voluntary on the part of the landowners. Since project completion, many of the project measures have not been maintained. In particular, one aspect included fencing Mud Creek to prevent cattle from entering the stream, damaging the streambanks, and defecating in the stream. This was initially effective, but the landowners currently keep the gates open, thus allowing cattle access to the stream.

Total organic carbon (TOC) data collected by the Utah Division of Water Quality from 1979–1991 indicated higher concentrations were present in the reservoir during 1980–1981 and 1984–1985 when the reservoir was near capacity. Data collected during 1989–1991 when the reservoir's capacity was much less have lower TOC concentrations. Similar patterns for TOC data are observed for data collected from the Price River above Willow Creek (STORET ID 7932810).

Utah Division of Water Quality officials believe that the presence of "rough fish," such as carp and suckers, also contribute to the water quality problems in Scofield Reservoir. These fish feed on the reservoir bottom and stir up sediments. This agitation could increase the internal phosphorus loading of the reservoir. In critical water quality years, removal of these fish species might improve the water quality of the reservoir. For example, 1992 was a critical year for Scofield Reservoir operation. Reservoir levels were extremely low, and fishkills were anticipated. However, a fish eradication program was conducted the previous year that killed the undesirable fish. No fishkills were observed in 1992, even though water levels were critically low.

During the 1992 drought year, residents of Price asked the State of Utah to investigate an apparent increase in gastrointestinal disease. Residents believed the increase in disease was caused by either residual bacterial coliforms in the treated water or the superchlorination that was necessary to render the water safe. The State thoroughly reviewed all the required monitoring (chlorine residual and coliform counts) by the water treatment entities. There were no documented problems with the treated water, nor was the water superchlorinated, because it was not needed. Likewise, neither the State nor local Health Departments documented any increased gastrointestinal illnesses during that time period.

In 2000, the Utah Department of Water Quality submitted, and the U.S. Environmental Protection Agency (EPA) approved, a phosphorus total maximum daily load (TMDL) for Scofield Reservoir (UDEQ, Division of Water Quality, 2000). The TMDL identifies total phosphorus and DO as pollutants of concern that have attributed to the impairment Scofield Reservoir's Class 3A beneficial use for cold water species of game fish. The TMDL focuses on total phosphorus as the pollutant of concern because low DO is linked to high phosphorus levels. The loading assessment quantified the current total phosphorus load to the reservoir at 6,723 kilograms per year (kg/yr). The TMDL identified three endpoints to improve reservoir water quality:

1. Shift in phytoplankton dominance from blue-green algae
2. DO level of no less than 4.0 mg/L in 50% of water column
3. TSI values between 40 and 50

These endpoints are to be met by reducing the total phosphorus load to the reservoir by 1,881 kg/yr.

S3.3.4 Price River

Water in the Price River suffers major water quality deterioration as the stream crosses the irrigated sectors of the river basin. The deterioration results from both geologic and human factors. From about November–April, little water is released from Scofield Reservoir, and the upper portion of the basin contributes little water to the river. During this period, irrigation return flow is not significantly diluted by better quality water. Although major releases are made from Scofield Reservoir from May–October, a large part of the flow is diverted during this period into major irrigation canals in the upstream part of the basin. Significant amounts of poor quality irrigation return flow enter the river downstream from points where most of the flow is diverted from the river.

Accordingly, during most of the year, the flow in Price River in the central basin is composed of relatively small amounts of good quality water from the upper basin and variable amounts of irrigation return flow and natural flow from tributaries that drain the marine shales. This increases the TDS level from about 300 mg/L to about 2,000 mg/L as measured above and below the areas of principal use. Although some deterioration in the chemical quality of the Price River probably would occur in the absence of stream regulation and irrigated agriculture in the central basin, deterioration is intensified with the presence of both.

From its confluence with the Green River upstream to its confluence with Soldier Creek, the Price River is listed as impaired for TDS. A TMDL has been completed and approved for these segments (UDEQ, Division of Water Quality, 2004). The TMDL established target daily TDS concentrations of 1,200 mg/L for all flow regimes.

S3.3.5 Colorado River Salinity

At its headwaters in the mountains of north-central Colorado, the Colorado River has a salinity concentration of 50 mg/L. As a tributary to the Colorado River, the Price River contributes to the salinity load of the river system. The concentration progressively increases downstream as a result of water diversions and salt contributions from a variety of sources. Near Yuma, Arizona, the Imperial Dam, built in the 1930s, diverts Colorado River water into three different canals and holds the river water until it can be directed into a desilting plant. Annual salinity concentrations at Imperial Dam are expected to decrease from the 2007 measured average level of 702 mg/L, assuming continuing successful implementation of the salinity control program (Colorado River Basin Salinity Control Forum, 2008). Congress established the Colorado River Water Quality Improvement Program, which includes numerous salinity control projects to mitigate the salinity impacts of water development as the Upper Basin States develop their existing Compact apportionments and water supplies.

S3.3.6 Cottonwood Creek and San Pitch River

As indicated above, Cottonwood Creek has good water quality and generally meets all of its present beneficial use classifications. The San Pitch River is also generally good quality water above Fairview. However, the San Pitch River degrades downstream since most of the water is diverted; and near Moroni, the river is composed mostly of return flows from irrigation and municipal waste water. However, the TDS levels are generally below 500 mg/L in this reach, and the water is very suitable for irrigation. Most of the water is diverted from the stream about 2.5 miles west of Mt. Pleasant. Table 3-4 summarizes the water quality in this reach of the San Pitch River. Levels of trace elements (metals) in both streams are normally below detection levels.

Table 3-5 summarizes the water quality in the lower section of the San Pitch River and in Sixmile Creek near the mouth. Water in Sixmile Creek is very good quality with TDS levels averaging about 350 mg/L. Waters in the lower San Pitch River consist of mostly return flows and are further degraded below the proposed project area. The average TDS in the San Pitch River above Gunnison Reservoir is about 1,050 mg/L and 1,635 mg/L below Gunnison Reservoir, respectively. The recommended TDS criterion for irrigation water is 1,200 mg/L. The San Pitch River from its confluence with the Sevier River upstream to the U132 crossing was listed as impaired for TDS. A TMDL has been completed and approved for these segments (UDEQ, Division of Water Quality, 2003). The TMDL determined that cause of impairment was natural sources and that current TDS criteria could not be obtained. The TMDL further recommended site-specific criteria and that the impaired status be removed. Levels of trace elements (metals) in both streams are normally below detection levels.

S3.3.7 Environmental Consequences

Under the Proposed Action, there could be some water quality impacts during construction; however, measures would be implemented to minimize those impacts. The contractor would be required to comply with applicable Federal and State laws, orders, and regulations concerning the control and abatement of water pollution. The contractor’s construction activities would be performed by methods that would prevent solid matter, contaminants, debris, and other objectionable pollutants and wastes from entering or accidentally spilling into streams, lakes, and underground water sources. Sanitary wastes would be disposed of by approved methods.

The construction contract would require the contractor to develop and implement a Water Quality Management Plan (Erosion Control Plan) and a Storm Water Pollution Prevention Plan. The contractor also would be required to implement the best management practices specified in the *Nonpoint Source Water Pollution Control Plan for Hydrologic Modifications in Utah*, which is an addendum to the *Utah Nonpoint Source Management Plan*. Specifically, applicable sections, such as Hydromod Planning Process, Measures to Control Construction Activities, and Impoundments, would be followed and implemented. Implementation of these measures would be expected to limit construction-related impacts on water quality to temporary sediment and turbidity impacts. Under a worst case scenario, if sediment control facilities temporarily failed and any stream sections were significantly impaired, remediation/restoration work would be implemented to the satisfaction of the appropriate government agencies.

Any construction work occurring in streams or associated wetlands would be conducted in compliance with USACE's 404 Permit and/or the Utah State Engineer's stream alteration permit, which would include the State 401 certification process.

S3.3.7.1 Lower Gooseberry Reservoir

The average annual inflow (based on 1978–2005 data) to Lower Gooseberry Reservoir would be reduced by 40%. The average annual phosphorus load levels below the proposed Narrows Reservoir would be reduced by about 113 kg/yr, resulting from phosphorus export and uptake in the Narrows Reservoir. This would result in a 45% reduction in the average nutrient load in the total inflowing water. The average in-lake phosphorus concentration would be reduced from 0.0131 to 0.0119 mg/L, and the probability of eutrophication would be reduced from 24.3 to 19.7%. Because the DO levels are greatest near the stream inlet, a decrease in inflow is expected to decrease the overall DO level of the reservoir in winter during iced-over conditions, thus increasing the potential for fish kills, unless mitigation is implemented. Mitigation for this would include minimum streamflow releases as discussed in section 3.10, "Fisheries."

S3.3.7.2 Scofield Reservoir

As a result of the Proposed Action, the inflow to Scofield Reservoir would be reduced by an annual average of 5,726 acre-feet (about 9.2%). This means that Scofield Reservoir generally would operate at a lower elevation and smaller surface area.

Shallower conditions in Scofield Reservoir would decrease periods of weak stratification, and reservoir turnover would occur earlier in the fall. Water temperatures at the surface of the reservoir, which is a function of solar input and wind mixing, would not be expected to change. Water temperature throughout the water column would increase slightly as the volume of water in the hypolimnion, or bottom temperature zone in the water column, would be reduced. Oxygen depletion at depth in the reservoir would occur less frequently due to shallower depths and increased mixing. Shallower conditions may lead to reduced water clarity as a result of wind-induced mixing.

The results of the eutrophication study (Franson-Noble Engineering) (appendix F) with the Narrows Dam and Reservoir show that, under the Proposed Action, there would be a reduction of average annual phosphorus mass loading into Scofield Reservoir (105 kg/yr) and an increase by 10.8% in phosphorus in-lake concentration from 0.0279 to 0.0309 mg/L. The reduction in phosphorus loading results from basin export and uptake in Narrows and Lower Gooseberry Reservoirs. The increase in phosphorus in-lake concentrations results from decreased dilution caused by water depletion from the Proposed Action. Figure 3-5 shows a comparison of the future without project and project phosphorus level in Scofield Reservoir based on external loading.

Increased phosphorus concentrations would be expected to lead to increased algal blooms, particularly blue-green algae, and increased eutrophication. The overall probability of eutrophication for the period studied shows an increase from 68.3 to 73.5% (about a 5.2% increase). The probability of eutrophication was increased every year except 1984.

Increased algal blooms also may lead to increased organic matter in the reservoir and in releases. Significant increases in organic matter would impact drinking water treatment processes.

The increase of in-lake phosphorus concentration and increased probability of eutrophication indicates that the overall water quality in Scofield Reservoir would be degraded by the Proposed Action without mitigation. Mitigation measures to offset these potential impacts are described in section 3.3.3.2.6.

S3.3.7.3 Proposed Narrows Reservoir

The overall water quality in the proposed Narrows Reservoir is projected to be good. The probability of eutrophication would be about 12% (compared to 73.5% for Scofield Reservoir and 19.7% for Lower Gooseberry Reservoir). The proposed Narrows Reservoir is not expected to strongly stratify due to its shape, water budget, and location. The active pool (the storage above the inactive pool) would only be 45 feet deep, with an average drawdown of 9 feet during the recreation season and 12 feet annually. The proposed plan is to have three outlets spaced 20 feet apart, at elevations 8,640; 8,660; and 8,680 feet, respectively. The normal water surface elevation is 8,690 feet. If a mild thermocline develops, it normally would start at about 16–20 feet and, over the summer season, migrate down to a depth of 32–45 feet, depending upon the release pattern, level of water withdrawn, and type of year. Once the reservoir was constructed, filled, and operated for several years, an operating plan would be developed jointly with the State and Federal agencies to enhance habitat for fish and wildlife downstream. As a result of the small releases and stream channel conditions downstream, the water would reach ambient conditions within the first ¼ to 2 miles downstream, relative to temperature and dissolved oxygen, even if conditions were less than optimal in waters released. Releases from the Narrows Reservoir would be expected to meet or exceed water quality standards of the State of Utah as found in Utah Administrative Code R317-2 for downstream designated beneficial uses.

Water quality at the proposed Narrows Reservoir would be protected by establishing protection zones adjacent to the reservoir. Within these protection zones, land use practices would be restricted to eliminate activities that would impact reservoir water quality.

S3.3.7.4 Price and Colorado Rivers

The Narrows Project would have virtually no effect on the lower Price River water quality during the November–April high TDS period because the effects of depletions caused by the proposed Narrows Project would consist primarily of reduced spills from Scofield Reservoir during the snowmelt runoff period.

Reduced spills from Scofield Reservoir would slightly increase exceedances of the TMDL established for TDS on the lower Price River (UDEQ, Division of Water Quality, 2004).

Implementing the Proposed Action would have a slight detrimental impact on Colorado River salinity. While operation of the proposed Narrows Dam and Reservoir would remove about 1,520 tons of salt per year from the Colorado River system, depletions from the project would increase salinity concentrations. The project would cause a depletion of about 5,597 acre-feet of water, which would result in an increase in salinity concentration by about 0.54 mg/L at Imperial Dam.

S3.3.7.5 Cottonwood Creek and San Pitch River

The overall water quality of Upper Gooseberry Creek is better than that of Cottonwood Creek (see table 3-2), so the additional water imported to Cottonwood Creek would improve its quality slightly. The exception may include temporary periods of slightly higher turbidity from the increased summer flows. Flows in Cottonwood Creek (below Left Hand Fork) would increase in July and August due to the increased irrigation releases, but these flows would be significantly less than peak flows that naturally occur during the spring snowmelt period. As discussed in Section 3.5, “Slope and Channel Stability,” the Narrows Tunnel operating gate would be automated to regulate releases through the tunnel so that, even during thunderstorms, the channel forming discharge would not increase above historical conditions. Consequently, even though the Proposed Action would increase the summer base flow, it would have no effect on Cottonwood Creek channel stability because the increase would be well below the 50-year channel forming discharge.

Except during spring runoff and winter conditions, flows in the San Pitch River below the project area consist mostly of return flows from irrigation and municipal waste water. The project would increase the volume of return flows from both of these sources; however, since no new lands receive project water, the quality of return flows would be similar to existing flows or possibly would be of slightly better quality because lands would receive a more complete water supply. Consequently, the concentration of dissolved salts should be more diluted in the increased volume of return flows. The potential decrease in irrigation return flows, resulting from increasing agricultural efficiencies, would be offset by the increase of return flow from the additional project irrigation water. Even if the overall volume of return flow were reduced significantly due to increased efficiencies, the quality of the return flows probably would not change significantly, nor would the existing quality of the San Pitch River change significantly since it mostly is composed already of return flows.

As shown in table 3-5, the salinity of lower San Pitch River is about 1,150–1,635 mg/L TDS compared to about 350 mg/L in Sixmile Creek. If the Manti Meadows Alternative wetland mitigation area is selected, and if water is delivered from Sixmile Creek and replaced with project return flows delivered to Gunnison Reservoir in exchange, there could be some impact to affected irrigated lands.

Diversions to the wetland area would have to be timed to not significantly affect the exchanged irrigation water supply, or replacement waters would need to be blended with higher quality Sixmile water to avoid impact to crops using the water. Under worst case conditions, an agreement with the Manti Irrigation Company might be needed, and minimal compensation might be required.

S3.4 AIR QUALITY RESOURCES

Utah air quality is monitored by UDEQ, Division of Air Quality, but there are no existing monitoring sites near the proposed Narrows Project located in Sanpete County. The closest monitoring station is located in Utah County, which has poor air quality in terms of carbon monoxide, nitrogen dioxide, and particulate matter (www.epa.gov/air/data).

Under the 1970 Clean Air Act, EPA established National Ambient Air Quality Standards (NAAQS) for particulate matter and five other criteria pollutants considered harmful to public health and the environment. The NAAQS specify maximum concentrations below which the air quality is considered acceptable, meaning an area below these thresholds are “in attainment” for EPA standards.

Sanpete County is generally in attainment for all but 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). The impact indicator for this issue is the number of days the project would exceed NAAQS for particulate matter (PM_{10} levels).[4]

Typical PM_{10} emissions associated with construction activities described in the Proposed Action were estimated, using emission factors from the EPA’s *Compilation of Air Pollutant Emission Factors* (EPA, 1985). Approximately 232 pounds per day (lb/day) of construction dust PM_{10} emissions would be produced from activities described in the Proposed Action.

Most of these emissions would be from vehicle and equipment travel over unpaved roads or direct disturbance of the soil by excavating, grading, and compacting. Application of standard dust suppression techniques (for example, soil stabilization or watering of stockpiled materials) would reduce daily PM_{10} emissions from 232 lb/day to less than the national standard of 150 lb/day. Short-term increases of particulate matter would occur during construction of the Proposed Action. Fugitive dust emissions and emissions from internal combustion engines would be generated by excavation and earth-moving vehicle traffic on unpaved surfaces. The contractor would be required to meet all applicable regulations concerning exhaust and dust control.

Following construction, long-term impacts on air quality would include some increased vehicle emissions and campfires due to additional recreational facilities that would result from the project. This, along with the increased use associated with project operation and maintenance (O&M), would contribute to some increased level of air pollutants. This impact would not be expected to exceed NAAQS in the Narrows Project area.

Wherever and whenever necessary, the contractor would be required to comply with all Federal regulations and take proper and efficient measures to reduce dust and exhaust pollution that might originate from construction to prevent it from becoming a nuisance to people or causing damage to crops, cultivated fields, or dwellings. The contractor would be required to control particle pollution resulting from the manufacture of concrete aggregate or excessive exhaust pollution resulting from improperly tuned engines or improperly equipped vehicles and equipment.

S3.5 Slope and Channel Stability

Fairview Canyon, which contains Cottonwood Creek, is a steep, narrow canyon located east of Fairview, Utah. Highway SR-31 is located in the canyon. The canyon is approximately 7 miles long. The stream elevation at the mouth of the canyon is about 6,300 feet and about 8,800 feet near the summit. Typical slopes of the canyon wall are 2:1 to 2.5:1 (ratio of horizontal to vertical distance). Numerous landslides are located throughout the canyon on both sides. In several places, continual

[4] PM_{10} is particulate matter of 10 microns in diameter or smaller

road maintenance is required to repair damage caused by landslides.

A total of 104 landslides were identified from aerial photographs and during a 1991 field review along the slopes of a 6-mile reach of Cottonwood Creek. The review team was comprised of individuals from various government agencies and private consulting firms. The review was to determine the impact of projected flow increases from Narrows Tunnel on adjacent slopes of Cottonwood Creek. The state of activity of the slides was noted with 85 slides classified as “active” and 19 classified as “dormant.” The certainty of landslide identification included 89 slides as “definite,” 13 as “probable,” and 2 as “questionable.” The distances of the landslides from the tunnel portal ranged from 0.3 mile to 6.1 miles. Dominant types of slope movement of the 104 landslides are shown in table 3-7.

Based on observations during the review, it was determined that landslide activity is not related to stream channel stability or the flow in Cottonwood Creek but is caused by saturation from water sources on the hillsides.

Under the Proposed Action, increased flows in Cottonwood Creek will occur due to releases from Narrows Reservoir through the Narrows Tunnel and Upper Cottonwood Creek Pipeline. These increased flows will occur below Left Hand Fork where the Upper Cottonwood Creek Pipeline will discharge into the creek. Figure 3-7 is a hydrograph based on daily flow data that compares present, or No Action Alternative, flows in Cottonwood Creek with flows that will occur under the Proposed Action. The figure is based on 1968 data, which is an average year. As shown in the figure, the peak discharge of about 112 cfs occurs during the snowmelt runoff period. Presently, summer base flows are about 18 cfs. Under the Proposed Action, the summer base flows would increase to about 50 cfs. The maximum flow possible through the tunnel was increased in 2011 by 45 cfs, from a capacity of 15 cfs to a capacity of 60 cfs.

The 50-year rainfall peaks expected in the canyon range from 330 cfs below Left Fork to 570 cfs near the mouth of the canyon. The possible maximum increase in tunnel flows is less than 15% of the rainfall peaks. The snowmelt peak is not a consideration because the tunnel will not operate during the snowmelt runoff. Based on the physical characteristics of Cottonwood Creek and the impacts of the proposed project on the flow characteristics, the project is unlikely to have a significant impact on the stability of the creek. To ensure that the tunnel releases will not cause an impact, the measures described below will be implemented.

As described in chapter 2, remote control of the Narrows Tunnel operating gate would be provided to automatically regulate the releases through the tunnel. These controls would be coupled to an automated stream gauging station on Cottonwood Creek near the mouth of the canyon. The streamflow in Cottonwood Creek would be constantly monitored by these controls. As the streamflow increases during high runoff events such as thunderstorms, the tunnel operation would be discontinued when the flow exceeds 100 cfs. The project releases would not resume until after the flows drop below 100 cfs. Under this operating regime, the project flows through the tunnel would not increase streamflows above what is considered safe for channel stability. Increased flows under project conditions would be well below the 50-year channel-forming discharge.

Erosion along the banks of Cottonwood Creek would be carefully monitored, especially during the first year of operation, to verify that the project has no effect on Cottonwood Creek channel stability. Appropriate action would be taken if additional erosion above background levels is observed during project operation. Remedial actions could include placing additional armoring materials in the channel or along the bank or revising project operation to avoid more widespread stability problems.

S3.6 Geologic Resources

The reservoir basin lies within a high elevation, shallow valley in the Wasatch Plateau subprovince of the Colorado Plateau. This subprovince represents the transition between the Colorado Plateau to the east and the Basin and Range Province to the west. Several ridges isolate the valley basin, which lies about 8,680 feet above sea level.

The proposed Narrows Dam and Reservoir area is underlain by the Cretaceous age North Horn Formation. This formation consists primarily of interbedded sandy, clayey siltstone, silty claystone, silty sandstone, and limestone with occasional thin seams of coal. Bedrock crops out on the steeper slopes of the left abutment and in the drainage located immediately upstream of the left abutment. There is less exposure of bedrock on the right abutment. Unconsolidated sediments overlying bedrock consist primarily of a mixture of residual soil (weathered rock) and colluvium that generally consists of silty sand with some fine to coarse gravel. A geologic study performed by SWCD indicates that there is low potential for reservoir-induced landslide activity in the reservoir basin.

The North Horn Formation is overlain by the Flagstaff Limestone Formation that consists primarily of microcrystalline limestone with thinly bedded shale and silty claystone. Abundant fossils are common within the limestone, and the boundary between the formations is transitional. The Flagstaff Limestone Formation generally is present in the higher elevations and beyond the actual limits of the proposed dam and reservoir. The Flagstaff Limestone Formation is present at the downstream portal area of the existing Narrows Tunnel.

Bedrock generally is covered by a mantle of residual soils and/or colluvium. These unconsolidated sediments are about 5–10 feet thick with some areas in excess of 27 feet. The unconsolidated sediments are composed of a mixture of clay, silt, and sand with minor amounts of organic deposits. Within the active stream channel of Gooseberry Creek and its tributaries, there are limited deposits of recent alluvial sand and gravel.

The structure of the Wasatch Plateau is dominated by a series of north-trending faults across the broad, west-dipping monocline of the plateau. The Sevier fault zone lies closest to the damsite at a distance of about 20 miles. The local structure is dominated by north-trending faulting around the site area. The dam and reservoir sites are located entirely on a down-dropped block between two fault traces, which is known as the Gooseberry Graben. Variation in orientation of beds indicates that the dam area is located on a westward-plunging synclinal fold with the axis running about 1,000 feet south of the proposed dam axis.

Three faults have been mapped in the vicinity of the Narrows Project. These faults, shown in figure 3-8, are all north-trending normal faults; and the West Gooseberry Fault, the Fairview Lakes Fault, and the East Gooseberry Fault are from west to east.

Observed earthquakes in the region of the Narrows damsite date back to 1853, giving a historical database of about 158 years. A network of seismograph stations throughout the region currently provides the accurate location of any seismic event. Geologic evaluation of the Wasatch Plateau area indicates that existing faults are not active. Maximum seismic events for the area are, therefore, projected to be controlled by random background earthquakes—that is, events not attributable to specific faults or geologic structures.

The largest earthquake recorded in the Wasatch Plateau Province is a magnitude 4.9 event. The maximum random earthquake event postulated for the Wasatch Plateau is a 5.5 event, occurring beneath the site at a depth of 3 miles. Such an event would produce a maximum acceleration of approximately 0.35 g (acceleration of gravity). Seismic activity related to mining activities would not be expected to produce events that exceed magnitude 4.5 and, therefore, would not produce the maximum earthquake. Earthquake epicenters are shown on figure 3-9.

From a geoseismic standpoint, the recommended Narrows damsite is suitable for construction. No significant geologic hazards were found in the embankment or reservoir area, and no seismic activity would be expected to occur from or be induced by this reservoir. Faults that occur in the site vicinity are believed to be inactive. However, design of project facilities would be based on a "maximum credible earthquake" (MCE). Preliminary studies indicate that the appropriate MCE would be of magnitude 5.5. Further review of the appropriate MCE would be performed prior to final design of the dam.

Additional geologic field evaluation and assessment of the dam and reservoir site would be completed that addresses the proximal active faults associated with the site, and further characterizes the earth materials underlying the dam site, reservoir, and reservoir rim to evaluate their engineering properties to ensure adequate design of features associated with the dam and reservoir. Designs would incorporate maximum accelerations associated with natural and or manmade seismic events that are determined or probable that could potentially occur in the area. Mitigation for other potential geologic hazards also would be integrated into design.

During construction, detailed observations of the subsurface conditions would be monitored by qualified personnel.

There would be no residual geology or seismicity impacts under the Proposed Action. There would be no geology or seismicity mitigation measures under the Proposed Action.

S3.7 PALEONTOLOGICAL RESOURCES

Paleontological resources are defined as any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth. Section 6302 of the Paleontological Resources Preservation Act (PRPA) of 2009 (Sections 6301–6312 of the Omnibus Land Management Act of 2009 [Public Law 111-11 123 Stat. 991-1456]) requires the Secretary of the Interior to manage and protect paleontological resources on Federal land using scientific principles and expertise.

Reclamation will be responsible for ensuring the completion of paleontological resource compliance, as stated in the environmental commitments (see appendix G), as a means to fulfill the requirements of the PRPA. The commitment requires a paleontological literature search through the Utah Geological Survey (UGS). This process involves a search of the statewide paleontological resource locality database as well as an examination of geologic maps of the area of potential effects (APE) and its immediate vicinity. Through the literature search process, the UGS will determine the potential for discovering paleontological resources as a result of the Proposed Action. Based on the determined potential, the UGS will either make a determination of no effect or require that a paleontological survey be conducted.

Environmental consequences to paleontological resources as a result of the Proposed Action will be determined following the paleontological literature search and survey of the APE and its immediate vicinity.

S3.8 SOIL RESOURCES

Soils in the project service area and along the Oak Creek and East Bench Pipelines alignments have developed under semiarid conditions. They are highly calcareous, are high in inherent plant nutrients, have weak to moderate developed soil profiles, and have a wide range of soil textures. They are derived principally from both old and recent alluvial materials eroded from geologic materials of the Wasatch Plateau. The lands are found on benches and terraces formed by the coalesced alluvial fans of the streams tributary to the San Pitch River. A broad area of valley fill material of deeper soils is found west of Mount Pleasant and in small cove areas at the base of the large alluvial fans. Valley fill also is found in the flat valley or river bottom areas west and southwest of Moroni.

Soils within the vicinity of the proposed Narrows Reservoir are formed mostly in colluvial, alluvial, and residuum materials weathered from sedimentary rocks, limestone, sandstone, and shale. Soils on the high ridges along the west side of the area are formed in materials derived primarily from limestone, while soils in the central and eastern sections of the project area are formed in materials dominated by sandstone, (silty) shale, and some limestone.

Soils are dark colored, rich in bases, freely drained, and cold. Mean annual soil temperature is less than 47 degrees Fahrenheit (°F), and the mean summer soil temperature is less than 59 °F. Average annual precipitation ranges from 20–25 inches, and the growing season is approximately 90–100 days. All but two of the soil series described are in the Cryoboroll Great Group, Boroll Suborder, and Mollisol Order of soil classification. The two exceptions, Fairview and Gooseberry series, are classified as being in the Cryaquoll Great Group, Aquoll Suborder, and Mollisol Order.

The erosion hazard for the soils within the vicinity of the proposed reservoir ranges from severe to low with over 80% of the area being classified as having a moderate or low erosion potential. Precipitation runoff rates range from rapid to slow, with most of the area having a moderate to slow runoff rate. Average sediment yields in the vicinity of the proposed reservoir are estimated to be 73 tons per square mile per year. With a drainage area of about 5.5 square miles, there is an estimated sediment load of 400 tons per year at the proposed damsite. This drainage area excludes the area that drains into Fairview Lakes.

Under the Proposed Action, about 604 acres of land would be inundated by Narrows Reservoir. An additional 32.4 acres would be disturbed by construction of the SR-264 relocation and the recreation area. Development of a rockfill material source area outside of the reservoir basin would disturb another 2.0 acres. Earthfill material source areas would be developed within the reservoir basin, and contractor staging areas and tunnel spoil areas also would be located below the low water level of the reservoir basin.

The alignment of the proposed highway relocation crosses relatively gentle terrain, and cut and fill slopes would be minimal. All cut and fill slopes would be revegetated to minimize erosion. Roadways in the recreation area would be paved to minimize dust and soil erosion. Following construction, the rockfill material source area would be recontoured, topsoil would be replaced, and the area would be revegetated. Virtually all runoff from disturbed areas would flow into Narrows Reservoir that would act as a trap for all upstream sediment. The current sediment load in Gooseberry Creek downstream from the proposed Narrows Reservoir would be reduced by about 400 tons per year with construction of the Proposed Action. This sediment would accumulate in the reservoir.

The Upper Cottonwood Creek Pipeline would be constructed in a previously disturbed area along the shoulder of SR-31. Construction of the Oak Creek and East Bench Pipelines would disturb about 30 acres. As part of the construction process, the ground would be recontoured and revegetated with native plants to minimize erosion and to restore the natural appearance.

Mitigation for disturbances to soils under the Proposed Action would be accomplished by revegetating all cut and fill slopes to minimize erosion. Roadways in the recreation area would be paved to minimize dust and soil erosion. Following construction, the rockfill material source area would be recontoured, topsoil would be replaced, and the area would be revegetated.

Residual impacts to soils under the Proposed Action would include inundating 604 acres by Narrows Reservoir and the 32.4 acres that would be covered by relocating SR-264.

S3.9 TRACE ELEMENTS

A trace element survey was conducted in accordance with current Reclamation practices to identify where concentrations of potentially toxic elements, such as selenium, arsenic, and mercury, likely would be to occur in irrigation return flows under project conditions. Accumulations of these substances can be harmful to humans and wildlife. A total of 11 soil samples, collected in 1990, were analyzed by the U.S. Geological Survey. The results are shown in table 3-8 for arsenic, mercury, and selenium from three representative sites in the project area.

Study results indicate that all three elements analyzed are present in low to moderate concentrations; therefore, further testing for these elements was not considered necessary.

Data also was gathered from the National Geochemical Database that contained extensive information on soils in the vicinity of the survey area. Most of the data was from the National Uranium Resource Evaluation Surveys conducted from 1976–80. The primary objective of these surveys was to prospect for uranium; however, many other trace elements also were analyzed in the survey. From this, 59 soil sampling sites were located in the vicinity of the survey area. Almost all sites were in Quaternary alluvium.

The data indicate that most trace elements are present in concentrations within the common range for western soils. Cobalt was the only element consistently present in concentrations outside the common range; however, the levels observed were trace amounts. Cobalt in nature at levels observed in the National Uranium Resources Evaluation Survey for the area is considered a nutrient and nonhazardous. Limited water analysis data indicate cobalt was not detected in the San Pitch River.

Table 3-9 summarizes the number of soil samples with noteworthy concentrations of trace elements. Although these elements were found at elevated concentrations at scattered sites, it appears that none of the elements are present in concentrations of concern in the existing project return flows.

The data indicate that trace elements are present in low concentrations in ground water in or near the proposed Narrows Project. A review of the STORET data for the San Pitch River indicated low concentrations of the same trace elements present in the surface water in the Narrows Unit.

The data presented in table 3-11, from the EPA STORET database, indicate that water quality of the San Pitch River in the project area is generally acceptable. The San Pitch River shows some improvement in water quality through the project area, possibly due to high quality inflows from the Manti-La Sal drainage.

Lands in the project area have been irrigated for more than 50 years, and the results of the data gathered showed no significant quantities of trace or toxic elements in the ground water and in the San Pitch River; therefore, no increase of potentially toxic trace elements is anticipated under project conditions. There would be no residual impacts associated with potentially toxic trace elements under the Proposed Action.

S3.10 FISHERIES

Most of the Narrows Project alternatives have the potential to affect aquatic resources in Gooseberry Creek, Fish Creek, three unnamed headwater tributaries to Gooseberry Creek, Cottonwood Creek, Lower Gooseberry Reservoir, Fairview Lakes, and Scofield Reservoir (see the location map). Cottonwood Creek is in the San Pitch River Basin, whereas all of the others are in the Price River drainage. Cottonwood Creek flows into the San Pitch River downstream from Fairview, Utah; but the San Pitch River, within the project area, does not support a sport fishery because of low summer flows.

Flows in Gooseberry Creek, its unnamed tributaries, and Cottonwood Creek presently are affected by the operation of Fairview Lakes, which store water during spring runoff. Water from the lakes is delivered during the irrigation season via one of the unnamed tributary streams and a canal to the Narrows Tunnel that discharges into Cottonwood Creek. The released water then is diverted for irrigation in Sanpete County.

Lower Gooseberry Creek and Fish Creek downstream from the confluence with Gooseberry Creek also are affected by the operation and limited regulation offered by Fairview Lakes. If the project is approved, an operating agreement would have to be negotiated between SWCD and Cottonwood-Gooseberry Irrigation Company to regulate seasonal releases from Fairview Lakes in connection with downstream discharges from the Narrows Reservoir.

Cutthroat trout (*Oncorhynchus clarkii*) exist within the streams potentially affected by the proposed project. Identification of these populations to the subspecies level is problematic. It is clear that various non-native subspecies of cutthroat trout as well as rainbow trout (*Oncorhynchus mykiss*), which interbreed with cutthroat trout, have been transplanted and stocked in these drainages in the past. Also, fish eradication activities have been carried out in the past. No genetic analysis has been attempted to determine the level of hybridization found in the current fish assemblages. Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*are) are endemic to Gooseberry Creek. Bonneville cutthroat trout (*Oncorhynchus clarki utah*) are endemic to Cottonwood Creek.

Cutthroat trout within the Gooseberry Drainage are predominantly Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*). The Bear Lake strain of Bonneville cutthroat trout (*Oncorhynchus clarki utah*) also have been transplanted into Scofield Reservoir. These fish spawn in Fish Creek and Gooseberry Creek and likely have hybridized with other subspecies present. Both Yellowstone and Bear Lake cutthroat trout are not native to these drainages.

Upper Cottonwood Creek does not support a self-sustaining trout population. Lower Cottonwood Creek may contain endemic Bonneville cutthroat trout; however, genetic analysis to determine the degree of hybridization within this population has not been done.

The existing Lower Gooseberry Reservoir acts as a fish barrier that helps to limit the occurrence of transbasin cross breeding between the populations.

Diseases may be spread between the basins within the project area. Currently, these drainages are not known to be infected with whirling disease.

The transbasin diversion has been functioning for decades, and any diseases or fish species present could have crossed the divide between the drainages in either direction numerous times in the past. The proposed project likely would not increase the occurrence of these events and may act as a barrier to these events.

Aquatic resources vary considerably between the different reservoirs and stream segments that could be affected by the Narrows Project. Fish habitat study reaches are shown in figure 3-10.

Under the Proposed Action, the State Engineer stipulates that a minimum of 1.0 cfs is to be released downstream from the proposed Narrows Dam; and, if the flow is not 1.5 cfs at the Gooseberry campground, ⅛ mile downstream from the proposed damsite, SWCD is required to release 1.25 cfs from the dam. It also is stipulated that the dam be constructed by SWCD with a multiple-level outlet to regulate water temperature for the trout located downstream from the dam.

The proposed project would cause flow reductions in Gooseberry and Fish Creeks as shown in table 3-1. Flows in Middle Gooseberry Creek immediately downstream from the proposed dam would be expected to be reduced on average by 74%, whereas flows downstream from Lower Gooseberry Reservoir would be expected to be reduced by 43%. In Fish Creek, flows would be expected to be reduced approximately 15%.

The 5,400-acre-feet diversion of project water into Cottonwood Creek would cause about a 200% increase in the base summer flow in Upper Cottonwood Creek (table 3-1). As shown, the base summer flows in Lower Cottonwood Creek would be increased by about 160%. However, the increased flows would occur only during the July–October period and not during the peak runoff or the low flow months (November–April). Additionally, these base summer flows would be less than the peak flows that currently shape the stream channel. Therefore, the stream channel itself would remain stable.

Providing a 2.0-cfs winter release through the Narrows Tunnel is expected to greatly increase the weighted usable area for all fish species in Cottonwood Creek. This increased flow particularly would benefit the upper reaches of the creek and would be expected to facilitate the overwintering of fish.

The length of time required initially to fill Narrows Reservoir would, of course, depend on hydrologic conditions in the basin. During wet years, the reservoir could fill during a single spring runoff. For more normal conditions, if no diversions were made to Cottonwood Creek until the reservoir filled, it likely would fill in 2 years—almost certainly within 3 years. Under dry conditions, if diversions to Cottonwood Creek did occur during the filling period, it could take 5–15 years to fill Narrows Reservoir. Due to these hydrologic uncertainties, there is no firm filling schedule for the reservoir.

At maximum storage, the proposed Narrows Reservoir would inundate about 1 mile of Upper Gooseberry Creek and approximately 4.3 miles of the three headwater tributaries with permanent flows that join to form Gooseberry Creek.

Based on the stream habitat that would be inundated by the proposed reservoir, it is expected that 1.3 and 2.1 acres of stream-based aquatic habitat would be lost in Gooseberry Creek and the tributaries, respectively. Using the standing crop estimates, approximately 230 pounds of stream-based cutthroat trout would be lost, of which 22% would occur in Gooseberry Creek and 78% would occur in the tributary streams, although the trout biomass likely would be converted into a flat-water equivalent.

The UDWR does not recognize the creation of a reservoir fishery as adequate compensation for the loss of stream aquatic resources. Creating an additional reservoir fishery would compensate for adverse effects that may occur on Lower Gooseberry Reservoir and Scofield Reservoir. This would represent a cumulative beneficial project impact to reservoir fishery.

In summary, the Proposed Action would result in loss of cutthroat trout stream habitat attributable to reservoir inundation and flow alteration. The project also would result in more reservoir habitat for cutthroat trout. The reservoir cutthroat trout habitat that would be created by the project would compensate for any adverse impacts that may occur on Gooseberry or Scofield Reservoirs. Therefore, mitigation for reservoir habitat has not been proposed.

A total of 11 fishery improvement and mitigation measures have been proposed by SWCD to compensate for the adverse aquatic impacts that have been identified with the proposed project. To the extent possible, an attempt was made to mitigate "in place" and "in kind." These measures have been developed in coordination with various Federal and State agencies and were described in detail in chapter 2, section 2.2.2.2.1. Table 3-20 is a summary of the aquatic impacts and proposed improvement and mitigation commitments for the Proposed Action.

The intent of the aquatic mitigation measures is to provide full mitigation for all adverse impacts resulting in no residual cumulative or overall impacts.

S3.11 WILDLIFE

The study, *Vegetation and Wildlife Impacts from the Narrows Project*, states that wildlife species found in the general project area are common in the Great Basin Desert valleys and Rocky Mountain Range. There are about 364 species of terrestrial vertebrates that may inhabit the project area. Approximately 88 bird species and 33 mammal species use the habitats that would be disturbed by the proposed project (Mt. Nebo Scientific, 1992).

Table 3-23 summarizes the impacts to wildlife habitat that would result from construction of the Proposed Action. In an assumed worst-case situation where the most habitat would be lost at one time, it would take the reservoir 2 years to fill to capacity. The *1994 Fish and Wildlife Coordination Act Report* evaluates the impacts of the proposed Narrows Project on fish and wildlife resources and recommends appropriate mitigation (see appendix D).

A wildlife mitigation program has been designed to provide at least full mitigation for each impacted species. Because the wetland and upland wildlife mitigation measures are intended to provide full mitigation for project impacts, there would be no residual impacts.

S3.12 Threatened and Endangered Species

No plant species currently receiving protection under the Endangered Species Act are known to exist in the project area/action area.

A biological assessment of potential effects on endangered, threatened, and candidate wildlife and fish species was conducted in October 1991 and was amended three times, in July 1994, March 1997, and February 1999 for the Narrows Project in compliance with Section 7(c) of the Endangered Species Act of 1973 (appendix C). Federally listed or otherwise protected species addressed in the assessment included: bald eagle (*Haliaeetus luecocephalus*); greater sage-grouse (*Centrocercus urophasianus*), Colorado pikeminnow, (*Ptychocheilus lucius*); bonytail (*Gila elegans*); humpback chub (*Gila cypha*); and razorback sucker (*Xyrauchen texanus*).

The U.S. Fish and Wildlife Service (Service) issued a final biological opinion on August 24, 2000, (appendix C) finding that the proposed project would have no effect upon the bald eagle, which was subsequently delisted in 2007. The Service believes that the southwestern willow flycatcher (SWWF) found at the Fish Creek site is not the endangered subspecies; therefore, no discussion was offered specifically in reference to the SWWF. The Service concluded, however, that the project and associated depletion of water from the Colorado River system is likely to jeopardize the continued existence of four endangered Colorado River fishes and to destroy or adversely modify designated critical habitat in the Green and Colorado Rivers from the confluence of the Price and Green Rivers downstream to Lake Powell. The Recovery Implementation Program for the Upper Colorado River Basin Endangered Fish Species serves as the reasonable and prudent alternative to avoid the likelihood of jeopardizing the continued existence of these listed species or the destruction of adverse modification of their habitat. Measures are implemented to offset project impacts (i.e., payment of a one-time financial contribution by SWCD).

S3.13 Vegetative Resources

Major plant communities occurring in the project area have been mapped (see figure 3-11) and include vasey sagebrush, silver sagebrush, and wetlands. Wetlands are discussed separately below.

There are also areas within the basin that have been disturbed previously by diverting water to Cottonwood Canyon through the existing Narrows Tunnel. In addition, there are those disturbed areas associated with SR-264 that cross the north end of the basin.

The areas that are disturbed during project construction have a high probability of being infested by noxious weed species. People using the area may spread the weeds by carrying the seeds on their person or on their vehicles. Seeds will get into the water and be spread downstream in both Gooseberry Creek and Cottonwood Creek. Control of noxious weeds as part of the Narrows Project would be the responsibility of SWCD.

Areas along the foothills of the west side of the Wasatch Plateau would be dissected with the diversion pipelines. Plant communities such as big sagebrush, (*Artemisia tridentata var. tridentata*), gamble oak (*Quercus gambelii*), grasslands, and mountain brush communities along with their associated wildlife species would be disturbed by the conveyance pipelines. These disturbances, however, would be only temporary because the pipelines would be buried. Revegetation that reflects the existing plant community would be accomplished with a mixture of grasses, forbs, and shrubs. A total of 30 acres along a 17-mile-long alignment would be disturbed by the pipeline construction.

The reservoir basin was identified to receive the most significant impact by the proposed project. For this reason, the reservoir basin was studied in greater detail than the other areas associated with the project. The affected wetlands in this area occur in a dendritic pattern in the riparian zones along small drainages. As shown in table 3-26, plant communities that would be highly impacted by reservoir inundation include vasey sagebrush, silver sagebrush, and wetlands. All vegetation in the 604 acres listed in the table would be inundated by the reservoir.

S3.14 WETLAND RESOURCES

The wetland community lies near the bottom of the basin and comprises 17% of the basin. The wetlands affected by the project are not unique to the area, consisting of wetland plant communities common to high elevation mountain areas. Cattle and sheep were introduced into the area in the 1800s and, subsequently, overgrazed the vegetation to the extent that rangeland restoration was necessary. In 1908, the USDA Forest Service established a controlled grazing plan for rangelands on the Manti-La Sal National Forest. Cattle and sheep grazing are still allowed in this area under USDA Forest Service control.

Within the proposed reservoir basin, water collects and forms meadows, wetlands, and, ultimately, small creeks that converge to Gooseberry Creek. Wetland communities are composed of wet meadows, riparian sedge, and willow thickets. The wet meadows are formed in topographic depressions located adjacent to some of the streamside vegetation and on higher ridges where seeps occur. They consist of plant species such as rushes (*Juncus* spp.), sedges (*Carex* spp.), and various hydric grasses, including tufted hairgrass (*Deschampsia caespitosa*). Similar in species and composition are the riparian sedge communities, which occur in a dendritic pattern along small drainages. They also consist of various rushes, sedges, and grass species, which form narrow bands (usually 3–6 feet wide) of streamside vegetation common to the area. Less common in the reservoir basin are willow thickets, occurring primarily in the upper reaches of the proposed inundation level, usually along stream channels in the basin and along Gooseberry Creek and in Cottonwood Creek. Willow species include Drummond's willow (*Salix drummondiana*), Booth willow (S. *boothii)*, and Wolf willow (*S. wolfii*).

The proposed Narrows Reservoir would inundate 89 acres of wetlands.

Hydrologic and hydraulic studies were conducted to determine the potential impacts to the riparian and wetlands vegetation of Gooseberry Creek resulting from decreased flows. Flow measurements conducted by the Utah Division of Water Rights indicate that the stream is a "gaining stream." This means that the stream flow increases as it moves downstream because the stream is being fed by the adjacent ground water aquifer. Because the stream is serving as a drain for the ground water system, an increase or decrease in stream water level would result in a corresponding increase or decrease in the elevation of the ground water table adjacent to the stream.

Water surface profile studies were conducted to determine the depth of flow in Gooseberry Creek between the Narrows damsite and Lower Gooseberry Reservoir. The studies indicated that, with the reduced flows proposed by the Proposed Action and with the existing stream cross section, the depth of flow would decrease by 6–11 inches under worst case conditions. However, the project plan includes proposed modifications to this portion of the Gooseberry Creek channel. These modifications include narrowing the channel to maintain the depth of flow. In designing the stream channel modifications, the intent would be to create a stream channel that is more naturally suited to the new flow regime and that will have the same depth of flow as under baseline conditions. Therefore, the depth of ground water adjacent to the stream would not decrease, nor would there be any adverse effects on riparian and wetland vegetation adjacent to the stream. If anything, it is entirely possible that the wetland communities would be enlarged as a result of the project impacts; the current outer bounds of those communities likely would be unchanged as a result of the shallow ground water flowing toward the stream, but the wetlands likely would be increased precisely to the degree that the stream channel itself (or at least, the open water surface of the stream) narrows.

The process of narrowing the stream, as described in the FEIS, is planned so that the configuration of the narrowed streambanks would conform to that of the original streambank with respect to slope, materials, material size, and frequency as well as the water depth. The only change would be in the width of the channel and available open water surface. The result is that the same opportunity for overbank flows and wetted perimeter would exist as in the natural configuration. The gaining nature of the stream in this reach means that ground water is flowing toward and into the stream channel and that the stream does not provide the primary supply for the riparian community. The "wetted perimeter," therefore, should continue to be supplied from this source; and the stream will continue to gain as it flows. Bank saturation will not be affected here, as it would on many streams, because the direction of the ground water flows into the stream rather than away from it. While overbank flows may be reduced in frequency, such flows, for this same reason, also are not critical to the bank saturation that supports the riparian community.

About 160 square feet (0.004 acre) of wetlands adjacent to Cottonwood Creek would be impacted by constructing the discharge structure at the end of the Upper Cottonwood Creek Pipeline. The other proposed pipelines would not affect wetlands.

Wetland mitigation measures are included in the project alternatives to compensate for impacts to wetlands. The wetland mitigation measures would provide similar wildlife habitat values for those potentially lost due to the proposed inundation of the reservoir should the project be built.

S3.15 RECREATION AND VISUAL RESOURCES

S3.15.1 Recreation Resources

According to the Utah Division of Parks and Recreation's *2009 State Comprehensive Recreation Plan*, the most popular outdoor individual recreational activity in Utah is walking for pleasure or exercise, followed by picnicking. The third most popular activity in most districts was swimming, though camping was the third in the six-county and southeastern planning districts. As with other major reservoirs along the Wasatch Front, Lower Gooseberry Reservoir, Beaver Dam Reservoir, and Fairview Lakes are heavily fished and overcrowded. Boating also ranks as a popular outdoor recreation activity in Utah.

High priority needs for new facilities are mostly new parks, new facilities at existing parks, new ballfields, new motorized trails, and facilities.

Beaver Dam is a heavily used day-use area for anglers near the proposed project, and there are several developed USDA Forest Service campground facilities in close proximity to the project area. The Lower Gooseberry Reservoir (16 units), Gooseberry (10 units), Flat Canyon (13 units), and Lake Campground (51 units) are all fee areas, with a 92-day season of use from June 15–September 15. Water, sanitation facilities, tables, and fire grills are provided. Also in the area is Boulger Reservoir, a nondeveloped, dispersed camping area equipped with vault toilet facilities. These campgrounds (with the exception of Boulger) are typically full on weekends and one-third full on weekdays throughout their season of use.

The proposed reservoir area is known as a very popular location for snowmobile enthusiasts. The USDA Forest Service and UDOT maintain unloading, parking, and sanitation facilities along SR-31, immediately west of the proposed reservoir area, from which snowmobiles embark for travel along groomed trails following Skyline Drive and SR-31, as well as in the proposed reservoir area itself.

Whitewater boating is limited mostly to a relatively short season when flows are peaking, coinciding with the high flows from the White River, when the gates at Scofield Reservoir are closed. In wet years, spills from Scofield may contribute to the peak. When Scofield releases again are started up to supply irrigation demands downstream, the level of boating falls off significantly. The segment of the river between Scofield Reservoir and the picnic area above Price Canyon Dam (approximately 15 river miles) contains Class I–III rapids. The segment of the river between the picnic area above Price Canyon to Castle Gate (approximately 8.5 river miles) contains Class III–V rapids. This segment of the river is more challenging and requires skill and careful maneuvering to avoid the hazards of the narrow canyon. The segment of the river between Woodside to the confluence with Green River receives the greatest use due to the flow regime and the wilderness setting of the river segment. This segment of the river also contains Class III–V rapids.

Under the Proposed Action Alternative, recreation facilities, including a 24-unit campground, boat ramp, boat ramp parking area for 26 vehicles with trailers, 14 picnic sites, and a corresponding number of restroom facilities, would be provided at the proposed Narrows Reservoir. The recreation facilities would draw heavy use from not only Sanpete, Carbon, and Emery Counties but also from the Provo/Orem and metropolitan Salt Lake City areas. The proposed Narrows Project would help meet the demand for additional boating facilities in the area. In addition, it is expected that the reservoir would develop into an excellent flat-water fishery. A conservation pool would be provided to ensure successful overwintering of fish.

The proposed Narrows Reservoir would increase the State and regional inventory for fishing, boating, and water play. At the top of the active capacity water level for the Proposed Action, the proposed project's facilities are expected to attract a total of 46,930.8 additional recreation days per year of total developed recreation use. These use rates are based on use rates of Scofield, Huntington North, Millsite, Piute, and Otter Creek Reservoirs. Construction of the proposed Narrows Project and its associated recreation facilities would cause the loss of 237 acres of "Roaded Natural" dispersed recreation on Reclamation withdrawn lands and 466 acres on private lands. It is estimated that these 703 acres would provide approximately 910 visitor days at 1980 levels of use and would provide about 2,670 visitor days of use in 2030. This reduction in dispersed use would be offset by the new facilities that would act as an attraction to local communities and individuals from the Wasatch Front who already contribute above 60% of the use on the Manti-La Sal National Forest. It is anticipated that the 46,930.8 recreation days of newly developed recreation use would be paralleled by an equal amount of dispersed recreation in the reservoir vicinity within the first 5 years of operation. This growth in recreation use would be a direct effect of the project and would require more intensive management in the area surrounding it (approximately, the area 8–10 miles in each direction).

At times when this newly developed recreation site and others in the area are at capacity (most of the summer season and particularly holiday weekends), users would move into nearby nondeveloped or dispersed areas. Some reservoir users actually would prefer dispersed sites regardless of developed site availability, and others would use dispersed sites to avoid associated fees.

The amount of dispersed use within 8–10 miles of the proposed reservoir is already at a level considered to be crowded during holidays and big game hunting seasons. The additional attraction of the new flat-water fishery in this area is expected to increase dispersed use to a point that the USDA Forest Service would need to place restrictions on areas available for this type of use. Such restrictions may include special measures for sensitive areas such as wetlands. In addition to increased resource protection and rehabilitation costs, conflicts among such activities as ice fishing and snowmobile use, hiking, and all terrain vehicle (ATV) users could be expected.

Along with increased, dispersed use in the area, nearby developed recreation facilities would be impacted. Gooseberry Campground and the Lower Gooseberry Reservoir units are immediately adjacent to the proposed reservoir, as is the Scenic Byway and snowmobile parking area. Skyline Drive, Flat Canyon Campground, and the limited facilities at Beaver Dam and Boulger Reservoirs are also within reasonably close proximity.

Implementing the Proposed Action would cause Scofield Reservoir to operate at a slightly lower level, thus reducing the surface area. Based on current recreation use at varying water levels, it is anticipated that there would be no impact to the recreation visits annually. Reclamation data is referenced in table 3-27. Based on use rates obtained in 2005 and 2007 creel surveys by UDWR, there would be a loss of 3,239 angler days of fisherman use. The aquatic mitigation measures of restoring year-round flows in two small tributaries to Gooseberry Creek and maintaining Fairview Lakes at a higher elevation during the prime summer recreational season also would provide angler benefits to the area.

Under the Proposed Action, more frequent fishkills and accelerated eutrophication also could degrade the park. However, water quality mitigation has been provided. Whereas the total inventory of water-based recreation may be increased, some of it would be offset by a downgraded State park at Scofield. The higher elevation of the proposed Narrows Reservoir would have a shorter season of use at an elevation of more than 8,600 feet than would the Scofield Reservoir at about 7,600 feet. Greater snow cover would probably occur at elevation 8,600 feet, causing less access because of deep snow and later snowmelt.

Depending on the type of hydrologic year, water levels in Narrows Reservoir would fluctuate between 25–75% of the full pool area during the recreation period—25% on average and up to 75% in an extended drought cycle. Recreation action may be affected, particularly for those using the boat dock at maximum drawdown.

S3.15.2 Visual Resources

The project features would be located within the Manti-La Sal National Forest on the Wasatch Plateau. The dam and diversion works would be located in the Gooseberry Valley, a tributary to the Price River, at about 9,000 feet elevation.

The characteristic landscape is consistent with typical high elevation mountain areas. The topography on top of this plateau is rolling and contains shallow basins covered with sage/grass communities bordered by spruce/fir, interspersed with aspen.

The Narrows damsite is within 2 miles of the intersection of two State highways, SR-31 and SR-264. Both highways have been designated as National and State Scenic Byways. SR-31 connects Fairview in the Sanpete Valley with Huntington in Emery County. SR-264 connects Scofield with SR-31 at Skyline Drive. These are major commuter routes for miners from the Sanpete Valley working in the coal mines on the east side of the Wasatch Plateau. In addition to commuting and recreation traffic, SR-31 serves as a route for hauling livestock from the Sanpete Valley to summer ranges.

It should be emphasized that scenery is an important natural resource and recreational element in this part of the forest. It is primarily through the visual sense that most visitors perceive the forest and its interrelated components. There is additional visual sensitivity here due to the adjacent Scenic Byway, which serves as a forest gateway/viewing corridor for many recreationists.

Under the Proposed Action, temporary and permanent landscape disturbances would be apparent from the placement of project features such as the re-routing of SR-264 and construction of the Narrows Dam structure. These more permanent features would be acceptable in this area of partial retention, especially in the long term. The dam would be within the setting of other dams in the area, and the rerouted portion of the Scenic Byway would serve as a viewing corridor and not a dominant element. Maintaining views within the parameters of partial retention would be contingent upon successful restoration/revegetation of the old highway alignment and any scarred areas associated with the dam. Care would need to be taken in developing any associated recreation facilities to ensure their design is subordinate to the surrounding landscape.

The Narrows Reservoir would be the most noticeable feature. The reservoir would have a surface area of 604 acres when full. However, during the recreation season, the surface area would average 454 acres. A body of water is generally considered to be aesthetically pleasing. However, as the reservoir is drawn down, exposed mud flats around the more shallow parts of the reservoir may be visually detractive but should remain naturally appearing as they follow the natural line of the reservoir's shore. Although viewed from the Scenic Byway and the reservoir itself, these mud flats primarily would be located on private lands that have no Visual Quality Objective designation. However, it is anticipated that these areas would become more naturally appearing over time; and the additional variety provided by the new water body would well offset any negative effect. In the short term, it is anticipated that the visual impact of exposed mud flat or shoreline would be negligible due to steeper topography and the duration and angle of view.

The aquatic mitigation measures of restoring year-round flows in two small tributaries to Gooseberry Creek and maintaining Fairview Lakes at a higher elevation during the prime summer recreational season also would provide aesthetic benefits to the area.

During project construction, increased human activity, heavy machinery, and surface excavation would temporarily detract from the scenery. Such detractions would be visible in localized areas where construction would occur. Minor disruption of traffic on SR-264 would be expected since the existing road would not be inundated until dam construction was completed and the relocated road is serviceable. Temporary disruption on SR-31 is expected.

S3.16 CULTURAL RESOURCES

Cultural resources are defined as places, natural features, structures, buildings, landscapes, districts, and objects that are significant in history, architecture, archeology, engineering, community, or culture. Cultural resources are protected by a number of statutes, regulations, and policies that must be taken into consideration during the NEPA process. Of particular importance is section 106 of the National Historic Preservation Act (NHPA), which mandates that Federal agencies take into account the potential effects of a proposed Federal undertaking (the Proposed Action Alternative) on historic properties and afford the Advisory Council on Historic Preservation the opportunity to comment. In compliance with the NHPA, historic properties are defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the *National Register of Historic Places*.

The affected environment for cultural resources corresponds to the APE as defined in the regulations implementing Section 106 of the NHPA (36 Code of Federal Regulations [CFR] Part 800).

> "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist." [36 CFR 800.16(d)]

The APE for the Proposed Action includes the areas impacted by construction activities associated with the construction of the dam and the land areas eventually inundated by the reservoir pool area. Also included would be any disturbed areas associated with the construction of a proposed pipeline to Cottonwood Creek as well as additional pipelines to deliver water to existing water distribution systems. Finally, impacts from the proposed rehabilitation of an existing tunnel to Cottonwood Creek, the development of recreation facilities, staging areas, access roads, borrow areas, and any other ancillary facilities linked to the Proposed Action would be included in the APE.

Under the Proposed Action Alternative, should the project be built, then the responsible Federal agency would have to work with the SWCD and other consulting parties to comply with the procedures outlined at 36 CFR 800. The regulatory requirements would be as follows:

- Determine whether the project constitutes a Federal undertaking.
- Identify the State Historic Preservation Officer and other consulting parties, including Indian tribes.
- Define the APE.
- Identify any historic properties within the APE.
- Apply the criteria of adverse effect to any historic properties.

- Assusming adverse effects, resolve adverse effects to historic properties as a result of the Federal undertaking per 36 CFR 800.6.

Based on the three sites (1,514 acres) inventoried, there is a low density of sites in the APE, and historic properties eligible to the *National Register of Historic Places* are expected to be few in number. Furthermore, consultation with Indian tribes that might attach religious or cultural significance to these sites or that might have sacred sites (as defined in Executive Order 13007) in this area indicates that such sites are not present.

Reclamation and the other consulting parties could either enter into a programmatic agreement to stipulate how these or alternative procedures would be carried out for the undertaking, or the parties could elect to follow the regulatory process at 36 CFR 800 and enter into a memorandum of agreement to resolve effects.

S3.17 Economic and Social Resources

Sanpete and Carbon Counties are considered the affected environment for this analysis.

In 2009,[5] population in Carbon County was 19,989 and Sanpete County was 25,946 (i.e., the total county region contained 45,935 persons.) From 1990–2009, Carbon County has the smallest population change, (-0.8%), while Sanpete had an increase of 58.9%. Ethnically, both counties are unusual by United States standards with 91.1% of Carbon County identifying themselves as white and 92.4% of Sanpete County; the median family income in Carbon County was $40,900 in the year 2000, while Sanpete was $37,796.[6] In 2000, Carbon County has 13.4% of its population below the poverty threshold, while Sanpete has a larger share of individuals living below the poverty threshold at 15.9%. In 2000, the United States percentage was 12.4.

For both counties combined, 49.6% of the land is owned by the Federal Government. This high percentage of Federal land is important to socioeconomic analysis because these lands play a role in local employment by providing for commodity extraction, as well as opportunities for travel and tourism. In 2009, mining accounted for 13.8% of the jobs in Carbon County and 0.2% in Sanpete County; agriculture accounted for 2.3% of the jobs in Carbon County and 9.1% in Sanpete. The travel and tourism industry accounted for 13.4% of the jobs in Carbon County and 11.4% in Sanpete. In 1998, travel and tourism accounted for 15.99% of the total employment, and in 2009, 12.63%.

From 1970–2009, farm employment in both counties shrank from 1,641 to 1,332 jobs, an 18.8% decrease.[7] During this same period, nonfarm employment grew by 144.7%. By farms, we include all forms of agricultural production, including livestock operations. In 2007, Carbon County had 294 farms with 215,557 acres devoted to agriculture; while Sanpete had 879 farms with 311,551 acres in agriculture. Some 22.8% of the land area in Carbon County was used for farms and 30.7% in Carbon County.[8] Table 3-31 shows that both counties have the greatest amount of land devoted to raising beef cattle.

[5] U.S. Department of Commerce, 2011. Bureau of Economic Analysis, Regional Economic Information System.

[6] U.S. Department of Commerce, 2011. Census Bureau, American Community Survey Office.

[7] U.S. Department of Commerce, 2011. Bureau of Economic Analysis, Regional Economic Information System, Tables CA25 and CA25N.

[8] U.S. Department of Agriculture, 2009, National Agricultural Statistics Service, Census of Agriculture, table 8.

Under existing conditions in Sanpete County, two crops of alfalfa are harvested each year; and in some years (less than 25% of the time) when weather conditions are favorable, a small third crop is harvested. One crop of meadow hay normally is harvested, and the aftermath is used as late summer and fall pasture. Small grains are used as rotation crops for hay and pasture. Small grains also sometimes are used as a “nurse” or companion crop for alfalfa. The most common small grain crop is barley. Corn silage, which makes up less than 1% of the irrigated area, is raised primarily by dairymen and livestock feeding operations. Present and projected project crop distribution and yields in Sanpete County are summarized in table 3-32.

S3.17.1 Methodology

There are two main methods of analysis for the economics of the Narrows Project. The first method is the modeling of regional economic effects; the second is the application of six indicators by Reclamation’s loan engineer who will make the decision to approve or deny the loan application from SWCD.

S3.17.1.1 IMPLAN Modeling

The modeling package used in this study to assess the regional economic effects of construction of each alternative is IMpact Analysis for PLANning (IMPLAN). IMPLAN is an economic input-output modeling system that estimates the effects of economic changes in an economic region.

IMPLAN data files are compiled for the study area from a variety of sources, including the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor, and the U.S. Census Bureau. This analysis used 2004 IMPLAN data for Utah’s Sanpete County, where most of the construction activity would occur for the regional impact analysis.

The expenditures associated with construction were placed into categories that represent different sectors of production in the economy. The expenditures that are made inside the study region were considered in the regional impact analysis. Expenditures made outside the study area were considered “leakages” and would have no impact on the local economy. Some construction items (specialized equipment and skilled labor) more likely are to be purchased outside the region and brought to the construction site because of their high cost and lack of availability in the region.

Because of the scale of the construction project, it was assumed that local suppliers and contractors would be able to supply only a portion of the necessary construction, equipment, supplies, and expertise. The regional impact analysis assumed that approximately 50% of the labor wages would be spent locally, and approximately 45% of the construction equipment and supplies would be purchased locally.

This analysis also assumed that the majority of the construction expenditures will be funded from sources outside the study area. Money from outside the region that is spent on goods and services within the region would contribute to regional economic impacts, while money that originates from within the study region is much less likely to generate regional economic impacts. Spending from sources within the region represents a redistribution of income and output, resulting in a negligible increase in economic activity.

For the purpose of this study, the construction costs allocated to labor and construction materials spent in the region were used to measure the overall regional impacts. These overall impacts would be spread over the construction period and would vary year by year proportionate to actual expenditures.

S3.17.1.2 Indicators for the Loan Application

Reclamation has not had an active small loan program since the 1990s. However, as mentioned previously, the Narrows Project was “grandfathered in” with the understanding that the factors that would be used to analyze the loan are those in effect in 1991. At that time, the Credit Reform Act of 1990 had been passed by Congress; this, coupled with the Office of Management and Budget’s Circular A-11, modified how loans were to be made under the SRPA. In accordance with the Credit Reform Act and OMB requirements, Reclamation was directed to compute loan risks tied to computing loan subsidy and to adjust cash inflows from scheduled principal and interest payments for estimating defaults or deferrals. The six indicators that were established in 1991 to determine the overall loan risk and category assignment were:

- Debt/revenue ratio
- Debt/repayment ratio
- Interest/debt ratio
- Expenditures/cash and securities
- Quality of investments
- Bond rating (Moody’s)

For the Narrows Project (and other SRPA loan applications), the results of these six financial indicators will be compared against national averages (standards) to determine the loan’s overall classification assignment. In gleaning out this financing and accounting information, the SWCD’s audit reports and balance sheets may need to be supplemented and revised to fully evaluate and measure the indicators. The audit report formation and content now required in all loan application reports generally will not cover the entities’ bonding status or authority, and this additional information will need to be provided. It is believed that at least four of the six proposed indicators would need to be presented and weighted in determining an overall risk profile and assignment for each loan.

Under the Proposed Action, the number of jobs created in Sanpete and Carbon Counties during construction of the Narrows Project would not be significant based on a regional impact analysis conducted for this study’s action alternatives. At the regional level, the project would cause positive economic output to the study area. Potentially, the most significant short-term impact would occur from construction activities.

It was estimated that the regional impacts on employment, regional output, and income would be less than 1% of the study area’s base employment, output, and income (see table 3-33).

The regional impacts from the construction costs for all the alternatives would be similar in that the impacts would be less than 1% of the regional employment, output, and income

These regional construction impacts would be lost after construction was completed. A small amount of regional impacts related to O&M activities would be expected but would not significantly impact the overall regional economy in the study area. The additional water amount provided by each of the alternatives would support the existing community lifestyles and social structure in the study area.

S3.18 LAND RESOURCES

The proposed non-Federal Narrows Project is located within the exterior boundaries of the Manti-La Sal National Forest. The proposed

Federal action is that Reclamation will: 1) approve or deny the SRPA loan application and 2) determine whether to allow the SWCD to use 304.5 acres of Reclamation withdrawn land. SWCD has acquired 366 acres of private lands for project uses from owners by perpetual easement or in fee. SWCD would need to purchase 1,340 additional acres of private and State School Trust lands for project needs (table 2-4). It is important to note that there may be no SRPA loan, but construction may proceed on Reclamation land with other sources of funding.

While there are some private in-holdings, the majority of the lands located within the Manti-La Sal National Forest boundary is federally owned and is administered by the USDA Forest Service pursuant to specific authorities granted by Congress to the Secretary of Agriculture and pursuant to the public land laws.

Lands within forest reserves may, however, be withdrawn and used for irrigation works constructed under authority of Section 3 of the Reclamation Act of 1902 (32 Statute 388). Therefore, by Secretarial Order dated April 1, 1941, Reclamation withdrew certain forest lands from public entry under the first form of withdrawal (as provided in Section 3 of the 1902 Act). These lands were withdrawn for the Federal Gooseberry Project, which, as originally planned, was never constructed. However, a portion of the original project was constructed as the Scofield Project. The Narrows Project is presently proposed as a private project by SWCD. Their proposal is to use 304.5 acres of the 6,728 acres of the lands originally withdrawn by Reclamation for the Gooseberry Project.

The 1941 Reclamation withdrawal of lands within the Manti-La Sal National Forest created the potential for two Federal agencies—Reclamation and the USDA Forest Service—to have overlapping jurisdiction on the same lands. However, the authority of the Secretary of the Interior under the 1902 Act to withdraw and administer lands for Reclamation purposes is limited to the specific water projects provided for in that Act—that is, Reclamation projects.

At present, both Reclamation and the USDA Forest Service have administrative authority over the withdrawn lands—but each for activities related only to its own mission. Thus, Reclamation has jurisdiction over the withdrawn lands for uses associated with water resources, while the USDA Forest Service has jurisdiction over the withdrawn lands for uses related to their mission. If the non-Federal Narrows Project were constructed, the Reclamation withdrawal would be revoked for all but the 304.5 acres that would be licensed to SWCD under the authority of Section 10 of the 1939 Act for the proposed non-Federal Narrows water project.

Land ownership and use characteristics of Sanpete and Carbon Counties are summarized in tables 3-34 and 3-35, respectively. An inventory of prime and unique farmland (Public Law 95-87) did not reveal any prime or unique farmland in the project area, but as described under the Economic and Social Resources section, in 2007, Carbon County had 215,557 acres devoted to agriculture, while Sanpete had 311,551 acres

Lands approximately 3 miles east of the project area are under a Federal coal lease and currently are being mined. Additional mineable coal reserves are believed to exist beneath lands east of the East Gooseberry Fault approximately 1 mile east of the project area. A nearby landowner with both land and mineral rights to the east of the proposed reservoir, between the proposed dam and the currently operating Skyline mine, expressed to Reclamation in April 2009 his intent to mine his coal, but exact plans and timing are unknown at this time. Lands immediately adjacent to the project area (within the

Gooseberry Graben) are not believed to have mineable coal reserves due to an offset of several hundred feet within the Gooseberry Graben area.

Agricultural land use within the project area is based on the livestock economy of the area—principally, cattle and sheep operations and a number of Grade A dairies. Other land uses include the turkey industry, large garden spots, potatoes, raspberries, and conifer or deciduous trees.

The majority of the land area that would be inundated by the reservoir is privately owned; the dam, however, would be on Federal land. Some of the private land near the proposed dam and reservoir within the national forest boundary has been subdivided for summer homes and recreation development. Such development must comply with the zoning and building codes of the Sanpete County Commission and the sanitation requirements of the Utah Department of Environmental Quality. The area adjacent to the proposed Narrows Reservoir is county-owned and is zoned as Forest Watershed 1–10 (one dwelling per 10 acres). The primary areas now under development include the area approximately 2 miles east of Lower Gooseberry Reservoir and the area on the north side of privately owned Fairview Lakes.

The Fairview Lakes development contains approximately 150–200 memberships in the privately owned Fairview Lakes Association. The memberships include the right to use a specific lot in the area north and east of Fairview Lakes and south of the project area to park a trailer or construct a cabin. This area has been rezoned, and the one dwelling per 10 acres development ratio does not apply to this area. As a result, it has been developed with lots every 1+ acre each. About 50 cabins have been constructed within the past 5 years. The cabins are used during the winter as well as the summer, since the general area is a popular cross-country skiing and snowmobiling area. Many of the other lots have one to three trailers parked on them for the summer season (June–September). The private landowners allow their members to use some of the area southwest of Fairview Lakes for recreation use.

Portions of three grazing allotments occur within the project area. They include Swen's Canyon allotment, the Gooseberry-Cottonwood allotment, and the Beaver Dams-Boulger allotment.

Additional allotments that may be impacted by the mitigation measures include the Fairview, Cabin Hollow, and Pondtown allotments.

Swen's Canyon allotment is located in two watershed drainages. That portion, which is located in the same drainage as the proposed Narrows Dam and Reservoir, consists of 583 acres, of which all is suitable for grazing land in fair range condition. Grazing capacity of that portion is about 115 animal unit months (AUMs).

The Beaver Dams-Boulger allotment is a combination of two allotments. Grazing use includes 1,200 head of sheep with a season of July 6–October 5. It is grazed with a rest rotation grazing system where part of the allotment is rested each year.

The Cottonwood-Gooseberry allotment is grazed by 900 head of sheep with a season of July 6–September 30 using a rest rotation grazing system. Suitable grazing land was determined during a range analysis conducted during 1976.

A summary of information concerning the three grazing allotments and four grazing permits is presented in table 3-36. Range conditions and grazing are discussed in the vegetation section of chapter 3.

S3.18.1 Environmental Consequences

If an action alternative were selected and a non-Federal Narrows Project were constructed (see action alternatives below), the Reclamation withdrawal would be revoked for all but the 304.5 acres, which would be licensed to SWCD under the authority of Section 10 of the 1939 Act for the proposed non-Federal water project. Direct effects of this license on withdrawn lands within the area of the dam and reservoir are described in chapter 3 of the FEIS. Reclamation may license the 304.5 acres to SWCD regardless of SWCD's source of financing for the non-Federal water project. Consequently, these effects remain the same whether the construction of the dam is financed under a SRPA loan or some other mix of public and private financing.

Under the Proposed Action, major changes in land use in the area surrounding the dam and reservoir are not anticipated. Construction of summer homes outside of platted subdivisions might be accelerated but would be limited by zoning restrictions of one dwelling per 10 acres. Development of the Fairview Lakes complex would continue as previously planned although build-out may occur earlier. Narrows Reservoir, SR-264 and forest development roads relocation, the recreation area, and the conservation easements adjacent to the reservoir would reduce the available grazing area by 856 acres. This area is about 10% of the suitable grazing acreage in the area. The Proposed Action may result in the direct loss of 114 AUM grazing use (856 project acres per 1.5 acres per sheep month = 571 sheep months per 5 sheep months per AUM = 114 AUM); however, indirect loss of grazing (estimated to be about 1,014 acres) may occur on adjacent areas around the reservoir, between the highway and the reservoir, and around camping and residence areas. The total grazing impact is estimated to be 249 AUM (1,870 acres per 1.5 acres per sheep month = 1,247 sheep months per 5 sheep per AUM = 249 AUM). This impact of grazing includes both private and Federal lands. Restrictions on the number of sheep and cattle allowed and/or realignment of grazing allotments may be required due to implementing the Proposed Action.

As the recreation use increased and summer home development proceeded, there could be additional areas in the upper Gooseberry drainage that would not be available for livestock grazing due to anticipated or existing livestock-people conflicts. For every 7 to 10 acres of additional land that cannot be grazed due to conflicts with traffic and/or people, there may be a loss of 1 AUM (5 sheep months) grazing use. Grazing permits and allotment boundaries may need to be adjusted. Land use in the *Manti-La Sal National Forest Land and Resource Management Plan* would change to reflect project implementation.

No reduction of acres of mineable coal reserves is anticipated under the Proposed Action

S3.19 PUBLIC HEALTH AND SAFETY

Two public health and safety issues were raised related to development of the Narrows Project. The first issue deals with increases in recreational traffic, while the second is the public's concern with drinking water quality from Scofield Reservoir. The latter issue is covered in detail in the Water Quality section, but a summary of effects by alternatives is included here.

As to the traffic issue, the area adjacent to the proposed Narrows Reservoir is served by two State highways, SR-31 and SR-264. These two-lane roads are narrow and winding. Both highways are maintained for year-round use by the Utah Department of Transportation. Average daily traffic (ADT) numbers for these roads are listed in table 3-37.

ADT values shown in the table are based on UDOT traffic counts taken in 2000.

As shown in table 3-37, ADT on SR-31 would increase by 252 or 16% under the Proposed Action. ADT on SR-264 would increase by 31%. However, even with these increases, both roads still would be well within their design capacity. To increase safety, additional turning lanes with adequate sight distance would be provided at recreation area entrances and exits.

With respect to public health and drinking water quality, as mentioned under Water Quality, in 1992 and subsequently, the State of Utah investigated alleged correlations between drought, gastrointestinal illnesses, and chlorination at the city of Price water treatment plant. No correlations were found. Therefore, due to the lack of correlation, the reduction in water availability in Scofield Reservoir should not lead to any public health effects in Price or homes served by the local water treatment plant. Public health should be unaffected by the proposal.

S3.20 Indian Trust Assets

The United States has a trust responsibility to protect and maintain rights reserved by, or granted to, American Indian tribes or individuals by various treaties, statutes, and Executive orders. These rights are sometimes further interpreted through court decisions and regulations. This trust responsibility requires that agencies, such as Reclamation, take actions reasonably necessary to protect these trust assets.

Reclamation policy is to reasonably protect ITAs from adverse impacts of its programs and activities. ITAs are property interests held in trust by the United States for the benefit of Indian tribes or individuals.

No Indian trust assets have been identified in or near the affected area; therefore, implementation of the Proposed Action would have no foreseeable negative impacts on ITAs.

S3.21 Environmental Justice

On February 11, 1994, the President issued Executive Order 12898 on Environmental Justice in Minority Populations and Low Income Populations. As a result of that Executive order, each Federal agency is required to analyze the environmental effects, including human health, economic, and social effects, of Federal actions, including effects on minority communities and low-income communities.

In the project area, there are no minority or low-income populations; and, therefore, there are no environmental justice effects.

S3.22 Related Laws, Rules, Regulations, and Executive Orders

The Council of Environmental Quality (CEQ) regulations (40 CFR 1500.2 and 1502.25) encourage related environmental laws, rules, regulations, and Executive orders to be integrated concurrently to the fullest extent possible in an environmental impact statement (EIS).

The following environmental laws, rules, regulations, and Executive orders have been considered during the preparation of the FEIS. It has been determined that the Narrows Project would have no adverse effect upon them.

- Executive Order 11988 (Flood Plain Management).
- Wild and Scenic Rivers Act, Public Law 90-542. In 2007, the USDA Forest Service and Bureau of Land Management evaluated thousands of river miles for potential inclusion in the National Wild and Scenic Rivers System. In determining suitability, a key question was, does the river segment have Outstanding Remarkable Values. The USDA Forest Service conducted an environmental impact statement to evaluate the suitability of 86 eligible river segments (840 miles) including 21 miles of Fish Creek and Gooseberry Creek. The Record of Decision, signed November 2008, determined that Fish Creek and Gooseberry Creek were not suitable to be designated by Congress as components of the National Wild and Scenic Rivers System. All the nonsuitable river segments are no longer afforded agency interim protection under the Wild and Scenic Rivers Act and continue to be managed under the direction of the respective agencies.

S3.23 Cumulative Impacts

S3.23.1 Cumulative Resource Issues

Cumulative impacts are the effects on the environment that result from the impact of implementing the Proposed Action in combination with other actions. The CEQ regulations for implementing NEPA define cumulative impacts as: "…the impact on the environment, which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1500-1508)

S3.23.2 Cumulative Impact Area and Reasonably Foreseeable Actions

After a careful review of the resources or components of the environment analyzed in chapter 3 of the FEIS, Sanpete and Carbon Counties are considered the affected environment for this cumulative impact analysis. The cumulative impacts area is Sanpete and Carbon Counties or within the watershed potentially affected by the Narrows Project.

Following U.S. Department of the Interior regulations at 43 CFR 46.30, reasonably foreseeable future actions include all Federal and non-Federal activities not yet undertaken, but sufficiently likely to occur, within the cumulative impact area. These activities include activities for which there are existing decisions, funding, or proposals identified by bureaus or local governments. Plans and environmental decisions of the Bureau of Land Management's (BLM's) Richfield Field Office, the Price Field Office, and the Manti-LaSal National Forest were reviewed to identify any existing decisions, funded projects, or proposals that should be analyzed for their cumulative impacts. For the BLM, all documents posted to their online environmental notification bulletin board were checked to see if actions approved in findings of no significant impact or records of decision would add cumulative impacts to the resources in chapter 3. No decisions were found that would affect any of the resources affected by the Narrows Project.

For the USDA Forest Service, the Manti-LaSal Forest Plan and related social and economic assessment were the main reasonably foreseeable actions that are considered here. The Narrows Project was planned in conformance with the Forest Plan. Multiple environmental assessments of the USDA Forest Service were checked, but no specific action was identified that meets the definition of a reasonably foreseeable future action for the Narrows Project.

Nor were reasonably foreseeable actions identified by Sanpete or Carbon Counties. Thus, there are no single or specific actions to be analyzed for cumulative effects. Instead, the direct and indirect impacts of the Narrows Project that might contribute to a cumulative impact on identified resources in chapter 3 are summarized below. The action alternatives are grouped for this analysis.

Resource issues have been affected by past Reclamation developments and would be affected by the proposed project; thus, they have the potential to contribute to cumulative (additive) impacts within Sanpete and Carbon Counties. These issues involve stream depletions that can impact fisheries, endangered native fishes, and change salt loading within the Colorado River. These issues are treated below under the headings of water resources, use, and quality; water rights; paleontological resources; fisheries; wildlife; threatened and endangered species; wetlands; recreation and visual; and cultural resources.

S3.23.2.1 Water Resources

As described in chapter 3, a long-term diversion of water by the Narrows Project to the Cottonwood Creek and San Pitch River watersheds would permanently reduce flows downstream from the project. The lowered reservoir storage would increase the potential of reaching dead storage in Scofield Reservoir by 20%. Decreased reservoir storage in Scofield Reservoir also would result in reduced spills from the reservoir, which would, in turn, impact the Price, Green, and, ultimately, the Colorado Rivers.

Approximately 5 miles of small streams or creeks, including 1 mile of Upper Gooseberry Creek, would be inundated by Narrows Reservoir. Middle Gooseberry Creek, between the proposed Narrows Reservoir and Lower Gooseberry Reservoir, would see a 74% reduction in annual flows; but the minimum flow requirements from the Narrows Project would eliminate historic periods of dry stream channels. Mitigation measures could include 300 acre-feet of water to be managed for water quality and aquatic biological resources.

Another water resources effect would be that a transbasin diversion through the Narrows Tunnel to Cottonwood Creek would result in lower peak flows during the spring runoff period, offset by higher flows during the irrigation season.

S3.23.2.2 Water Quality

Carbon County has identified water quality in the Price River and watershed as a major concern, largely because the county's ground water is unusable due to high salinity. The county has formed a Carbon Water Committee that has and will continue to investigate uses to which the Price River are applied. County planning will continue to attempt to provide a land use and water quality scheme that is viable and in conformance with USDA Forest Service and BLM plans.

If one of the action alternatives is selected, timing of flows, temperature, turbidity, and ecological composition of the rivers and streams would be affected; and water quality downstream from the project would be more sensitive to future activities that degrade or improve water quality. These include phosphorus load increases and reduction efforts in the Scofield Reservoir drainage and salinity control efforts in the Price River watershed.

Proposed mitigation measures to reduce phosphorus loading in Scofield Reservoir as part of the Narrows Project may impact the ability to meet the target phosphorus load reduction through stream restoration identified in the Scofield Reservoir TMDL. Mitigation measures implemented as part of the Narrows Project may be the most cost effective, most easily implemented, and maintained. This may result in less effective load reduction measures available for implementation as part of the Scofield Reservoir TMDL. A great deal of uncertainty exists surrounding this potential impact though, as specific mitigation measures through stream restoration have not been identified for either the Scofield Reservoir TMDL or the Narrows Project. It is possible that measures are available to satisfy the reduction target of both efforts or that the mitigation from both efforts will not overlap. SWCD is required to mitigate impacts to water quality in Scofield Reservoir and to ensure that it does not deteriorate due to the Narrows Project. Mitigation measures are designed to maintain Scofield Reservoir at its existing condition.

Under a water quality protection program, water quality at the proposed Narrows Reservoir would be protected by meeting State and Federal requirements and establishing protection zones adjacent to the reservoir. Within these protection zones, land use practices would be restricted to eliminate activities that would impact reservoir water quality.

S3.23.2.3 Water Rights

If the Narrows Project is built, Water Right Nos. 91-130, 91-131, and 91-132 would be developed and would increase the water depletions in the Gooseberry Creek basin up to 5,400 acre-feet per year. The Narrows water right represents about 6.6% of the average annual yield of the Price River above the city of Price. Although these are valid water rights, their development would incrementally decrease the water available in the Gooseberry, Price, Green, and Colorado River systems. The 1948 Colorado River Compact gives Utah 23% of the Colorado River (and all tributaries) water allocated to the Upper Basin States, which is estimated at approximately 1.3 million acre-feet (maf) of depletion annually. Utah is currently depleting 1.0 maf per year of Colorado River water, and this project would bring Utah closer to using its entire allocation. Once Utah reaches full allocation, there would be a greater likelihood that some water rights would need to be curtailed to ensure that Utah does not exceed its allotment.

S3.23.2.4 Paleontological Resources

Under the No Action Alternative, the existing conditions in the APE would remain intact, and paleontological resources likely would not be impacted. No past, present, or reasonably foreseeable actions are expected to result in cumulative effects to fossil resources. Thus, there would be no cumulative effects to paleontological resources from the No Action Alternative.

Under the action alternatives, should paleontological resources located directly within or adjacent to the Narrows Reservoir pool area be present, the lowered reservoir pool could result in damage to or theft of fossil resources due to increased public visitation. This increased visitation, in the form of recreation and residential development, for example, has the potential to cause cumulative impacts to paleontological resources. Therefore, cumulative effects to cultural resources are likely under the action alternatives.

S3.23.2.5 Fisheries

Past and future water diversions and depletions have affected and will continue to affect the sport fishery and native species. The analysis in chapter 3 shows that the Narrows Project will have minor impacts on flows below Scofield Reservoir. Mitigation measures are designed to help reduce impacts.

S3.23.2.6 Wildlife

If one of the action alternatives is selected, and the reservoir is built, then there will be a future loss of vegetation and wildlife habitat; and the quality of the habitat could be degraded from development around the reservoir. This could increase forage competition among grazing animals. Habitats may be unavailable to wildlife because of human disturbance factors (e.g., traffic or noise during sensitive time periods such as winter, birthing, nesting, and early rearing of young). Impacts on wildlife could result if increased development and surface disturbance altered existing migration corridors where access to important habitat areas would be greatly reduced. Mitigative efforts have reduced these effects or they have improved habitat conditions for these species in various areas.

The additive effects of the Proposed Action, in conjunction with the past action have resulted in irreversible and irretrievable impacts to wildlife. Mitigation measures have been designed to mitigate these impacts to the extent possible.

Conservation species, such as the Columbia spotted frog, roundtail chub, bluehead sucker, flannelmouth sucker, as well as other sensitive species identified in the FEIS, have experienced cumulative effects from loss of habitat from development and construction projects over the years. These species rely on natural water systems for their habitat. The proposed project identifies reasonable actions to reduce or eliminate impacts to these species.

S3.23.2.7 Threatened, Endangered, Conservation, and Other Special Species

Under past and ongoing actions, the Colorado pikeminnow, bonytail, razorback sucker, and humpback chub are endangered, in the Colorado River Basin including the Green, Yampa, Gunnison, and San Juan, Rivers. These species evolved in the Colorado River and its larger tributaries under conditions of warm water, large seasonal flow fluctuations, heavy sediment loads, extreme turbulence, and a wide range of dissolved solids concentrations. These conditions have been altered by human activities, and all four species have experienced population declines. The Upper Colorado River Endangered Fish Recovery Program was established as the major offset for the impacts of historic and future water development projects in the basin.

To minimize the possible adverse effects of the Narrows Project on the Colorado pikeminnow, bonytail, humpback chub, and razorback sucker, SWCD would participate in the Recovery Program as described in the FEIS, which includes a one-time depletion fee payment.

S3.23.2.8 Wetlands and Riparian

The proposed Narrows Reservoir would permanently inundate approximately 89 acres of wetlands. Proposed modifications to portions of the Gooseberry Creek include narrowing the channel to maintain the depth of flow. Flows in the middle portion of Gooseberry Creek between the proposed dam and Lower Gooseberry Reservoir would decrease the average current flow by about 73.1%. The reduced magnitude and duration of flood flows would have the potential to impact the riparian area along Gooseberry and Fish Creeks. The riparian vegetation communities of sedges, rushes, and hydric grasses found as bands and small pockets along the banks of the stream may be reduced in quantity and quality by the proposed action. Willow thickets along Gooseberry and Fish Creeks could be reduced in quantity and quality. This reduction of the quantity and quality of riparian and wetland systems is likely to continue. Implementation of recommended flows by the Utah Division of Wildlife Resources and the gaining stream status of Gooseberry Creek could result in positive changes for riparian and wetland vegetation.

S3.23.2.9 Recreation and Visual

S3.23.2.9.1 Recreation

As discussed in chapter 3, travel and tourism employment has decreased from 1998 to 2009 in Sanpete and Carbon Counties by 5.8%. Over the same time period, nontravel and tourism employment has grown from 8,299 to 10,298 jobs, a 24.1% increase. This trend is likely to continue into the future, although there could be some increase in visitor use due to the Narrows Project.

ATVs are popular within the project area for agricultural and recreational use. The Arisen Trail System, a joint effort of Federal, State, and local agencies and communities, is an extensive trail system south of the project area that links Federal- and State-managed public lands with communities. There are areas of intensive ATV use throughout the project area, particularly around some of the communities, where soils, vegetation, and scenic values are being affected. Should the project be implemented, dispersed recreational activity would not change. There would be some changes in recreational use; however, these are disclosed in section 3.15.

S3.24 OTHER NEPA CONSIDERATIONS

S3.24.1 Irreversible and Irretrievable Commitments of Resources

Renewable and nonrenewable resources would be irreversibly or irretrievably committed by construction and operation of the Narrows Project. Although it would be theoretically possible to reverse commitments of some of these resources, the Council on Environmental Quality has stated that "... construction and facility uses are basically irreversible since a large commitment of resources makes removal or nonuse thereafter unlikely." This section briefly describes these commitments for all alternatives, with the exception of the No Action Alternative. Under that plan, there would be no commitment of resources other than moneys already spent.

S3.24.1.1 Water Resources

The Narrows Project would commit up to 5,400 acre-feet of water from Upper Gooseberry Creek and its tributaries, which are located in the Price River drainage, to project purposes. Initially, about 4,900 acre-feet would be used for irrigation, and 500 acre-feet would be designated for municipal use in the northern Sanpete County area. As the need arises, the balance between M&I and irrigation water will change. As the demand for M&I use increases, M&I use will increase, and irrigation use will decrease. The conversion of water from irrigation to M&I use will occur in stages.

Under present Utah water law and the 1984 Compromise Agreement, commitments of water resources essentially would remain permanent, provided that they are beneficially used. Although the area's water resources would not be irretrievably or irreversibly committed, use of the project water would be long term in nature.

S3.24.1.2 Fish, Wildlife, and Grazing Habitat

The inundation by the reservoir of about 1 mile of UDWR Class 3B-Unique stream fishery in Upper Gooseberry Creek and 4.3 miles of cutthroat trout spawning and rearing habitat in the Gooseberry Creek tributaries would be essentially irreversible.

The commitment of land in the reservoir pool for water storage and around the reservoir to recreation uses would be essentially irreversible, since to do otherwise could jeopardize the water quality of the reservoir as well as the proposed wildlife mitigation plan. Streamflow patterns resulting from project operation would be subject to change should water needs in service areas change, but current trends indicate that the proposed operational criteria would be long term and would constitute a basically irreversible commitment. The loss of grazing AUMs also would be considered an irreversible commitment of resources.

S3.24.1.3 Land

Narrows Reservoir and other project features (damsite, recreation facilities, and road relocations) would permanently alter use on about 786 acres of the 1,931 acres needed for the project. The land currently functions primarily as recreation, rangeland, and wildlife habitat. The remaining 1,145 acres for the project will, over time, be restored to original functions as rangeland and wildlife habitat. Geologic studies of the reservoir and damsite have not identified any critical mineral resources within the reservoir basin or damsite.

S3.24.1.4 Construction Materials

About 375,000 cubic yards of permeable and impermeable earth material, gravel, cobble, and riprap would be irretrievably committed to use in the dam embankments and associated features. Much smaller amounts of concrete aggregate would be used in the dam and project features. Imported cement and manufactured materials would be irretrievably committed to the project features. Fuels, explosives, and electrical power would be consumed during project construction.

S3.24.1.5 Aesthetics

Narrows Project would irreversibly alter the scenery of the feature sites by the building of structures, excavation of landscape, and inundation of the reservoir. The construction scars would be revegetated where practical; but the visual impact, which would be unattractive to some people, would be permanent.

S3.24.2 Short-Term Uses and Long-Term Productivity

The CEQ regulations for implementing NEPA at 40 CFR 1502.16 require analysis of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity.

S3.24.3 Action Alternatives

Short-term losses from the action alternatives, as described in sections 3.23 and 3.24.1, would include construction impacts such as increased noise, traffic delays, or detours. Air quality would be worse during construction. These temporary environmental impacts would be balanced through mitigation and avoidance as much as is reasonably possible.

Short-term benefits would include increased jobs from construction and revenue generated during construction.

Long-term losses from the action alternatives would include the permanent loss of approximately 1,145 acres of rangeland and wildlife habitat, displacement of wildlife and fish, loss of grazing habitat, reduction of water flows below the dam, visual impacts, possible loss of paleontological resources, and recreational impacts such as access inconveniences.

Long-term benefits would include that the reservoir would make it possible to store water from spring runoff for use during the drier summer months. This would allow local farmers the opportunity to have a longer, more productive growing season. The reservoir also would provide a habitat for sport fish and provide water for the nearby wildlife. Below the dam, a minimum flows requirement would provide year-round flows in Gooseberry Creek and Cottonwood Creek. These stream segments historically have been dewatered at times of the year. Although primarily intended as a measure to facilitate winter survival of fish, this requirement also would have some beneficial effects on the riparian and wetland areas adjacent to the creeks. Providing flows in summer months also would stimulate the growth of riparian and wetland vegetation.

S3.24.4 No Action Alternative

This alternative would offer none of the benefits or have any of the losses listed above. It would not meet SWCD's proposal or need for additional water for irrigated agriculture.

S4.0 CONSULTATION AND COORDINATION

This section details the consultation and coordination between Reclamation and other State, Federal, and local agencies; Native American tribes; and the public in preparation of the FEIS, the SDEIS, and the DEIS published in 1998, which the FEIS updates and supplements. Throughout the EIS process dating back to 1990, input has been actively solicited from a broad range of public constituencies as part of the ongoing public involvement process. Comments and involvement in the planning for and preparing of the Narrows Project generally were sought through two broad efforts: communication and consultation with a variety of Federal, State, and local agencies; Native American tribes; and interest groups and the formal FEIS scoping process and comment process, both of which invited input from the general public.

S4.1 SUMMARY OF INTER-AGENCY COORDINATION 1996–2003

In 1996, Reclamation invited a number of State and Federal agencies to become cooperating agencies in preparation of the DEIS. The two agencies that agreed to become cooperating agencies for the EIS process, including the FEIS, are the USDA Forest Service and U.S. Army Corps of Engineers. In addition to these two agencies, the following agencies had representation on the interdisciplinary team led by Reclamation that prepared the DEIS published in 1998:

- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency
- Utah Division of Wildlife Resources

- Utah Division of Water Quality
- U.S. Department of the Interior, Office of the Solicitor
- Sanpete Water Conservancy District

Reclamation hosted periodic cooperating agency meetings and interdisciplinary team meetings throughout preparation of the 1998 DEIS and the SDEIS to ensure that all of the agencies were informed of, and involved in, the issues and analyses related to the FEIS.

S4.2 PUBLIC INVOLVEMENT AND SCOPING

The scoping process for the SDEIS was conducted by Reclamation beginning in November 2003 to provide the general public, organizations, State and local governments, and affected Federal agencies an opportunity to identify issues and concerns they believe should be studied early in preparing the SDEIS. "Scoping" is the public involvement process required by the Council on Environmental Quality regulations to help Federal agencies determine issues and alternatives analyzed in the EIS. Results of the scoping meetings and comments received during the scoping process were used to establish the scope of the SDEIS and focus the environmental analysis on the important issues and concerns.

The original scoping process for the Narrows Project began with scoping meetings held at Fairview and Price, Utah, on October 3 and 4, 1990, respectively. Notice of the scoping meetings was given through a *Federal Register* Notice dated September 7, 1990, and through a news release dated September 24, 1990. In addition, 32 letters were sent to State and Federal agencies and environmental groups giving notice of the meetings. Three newspapers—the Salt Lake Tribune, the Mt. Pleasant Pyramid, and the Sun Advocate—published articles regarding the project and the upcoming scoping meetings. Concerned citizens were encouraged to attend the scoping meetings or express their concerns in writing.

After the 1995 Record of Decision was rescinded, a new DEIS was prepared, beginning in 1996, and was published in 1998. Comments were received on that DEIS (and public hearings were held to receive comments); those comments were analyzed and responded to, and the 1998 DEIS was revised based on input from those comments. Since a decision was made in 2003 to prepare this SDEIS in lieu of publishing a FEIS based on the 1998 DEIS, it should be noted that the SDEIS does capture revisions made earlier based on public comments and input.

After the decision was made to prepare the SDEIS, public meetings to inform the public and to share information were held in Price and Manti, Utah, in September 2003. On November 25, 2003, a *Federal Register* Notice was published to serve as an official notice that Reclamation intended to prepare a supplemental draft environmental impact statement for the Narrows Project. Public hearings were held again in Price and Manti, Utah, in April 2010 during a 63-day comment period ending June 2010. Reclamation received 693 comment documents, and formal responses to substantive comments were published in appendix H of the FEIS. Comments received in response to the *Federal Register* Notice also were taken into consideration, along with all prior public comments in preparing the FEIS.

Section 1.3 provides further information on the scoping process for the FEIS.

S4.3 DOCUMENT AVAILABILITY

Those who were on the mailing list for the 1998 DEIS, or who asked to be added to the mailing list in response to the SDEIS in 2010, were provided notification of document availability along with other environmental groups; Federal, State, and local government agencies; and other interested parties. Over 400 notifications of the FEIS have been mailed to interested agencies, organizations, and individuals. The FEIS is available online at www.usbr.gov/uc/envdocs/index.html.

CHAPTER 1

Purpose of and Need for the Project

1.0 INTRODUCTION

This Narrows Project, Utah, final environmental impact statement (FEIS) updates information and analyses contained in the *Supplemental Draft Environmental Impact Statement, Narrows Project* (DES-09-55) published in March 2010 (SDEIS) and the *Draft Environmental Impact Statement, Narrows Project* (DES-98-10) published in March 1998 (1998 DEIS). This FEIS discloses the direct, indirect, and cumulative effects of the non-Federal Narrows Project as proposed by Sanpete Water Conservancy District (SWCD).

1.1 THE PROPOSED ACTION ALTERNATIVE

The SWCD has applied to the Bureau of Reclamation (Reclamation) for a Small Reclamation Projects Act (SRPA) loan to help finance construction of a private reservoir and related facilities. SWCD also has requested authorization to use federally administered withdrawn lands as the site for dam construction. Most of the reservoir basin would be located on adjacent, privately owned land. The proposed Federal action is that Reclamation will: 1) approve or deny the SRPA loan application and 2) determine whether to allow the SWCD to use 304.5 acres of Reclamation withdrawn land. If SWCD obtains its requisite financing, either through the SRPA loan or from other private funding source(s), and if Reclamation approves the land use, a supplemental water supply may be developed for presently irrigated lands and municipal and industrial (M&I) water users in north Sanpete County. To develop this supplemental water supply, a dam and reservoir would be constructed on Gooseberry Creek, and water would be diverted through an existing tunnel and a proposed pipeline to Cottonwood Creek; the existing tunnel would be rehabilitated. Pipelines would be constructed to deliver the water to existing water distribution systems. Recreation facilities would be developed, and a minimum pool for fish habitat would be provided. The resulting water storage and delivery system would be a non-Federal project owned and operated by SWCD.

Mitigation measures would be implemented to offset adverse impacts. Water conservation measures would be implemented independent of the Proposed Action. To be eligible to receive water from the Narrows Project, water users would be required to use, or agree to implement, conservation measures.

1.2 LEAD AND COOPERATING AGENCIES

Reclamation is the lead agency in preparing this FEIS. The two cooperating agencies are the U.S. Department of Agriculture Forest Service (USDA Forest Service) and the U.S. Army Corps of Engineers (USACE).

1.3 DECISIONS TO BE MADE BASED ON THIS ANALYSIS

Based on the analysis documented in this FEIS, the responsible official for Reclamation will make the following decisions:

- Should Reclamation approve SWCD's application for a SRPA loan to construct the Narrows Project?[1]

- Should Reclamation approve SWCD's use of Reclamation withdrawn lands for the Narrows Project, in accordance with Reclamation law?

- Under what terms and conditions (of a local supplemental agreement between Reclamation and the USDA Forest Service) should the agencies administer resources within the total areas of project influence?

In addition, the cooperating agencies may use this FEIS to aid them in making the following decisions:

- Should the USDA Forest Service:

    1. Amend the 1986 Forest Land and Resource Management Plan for the Manti-La Sal National Forest (Forest Plan) to reflect Narrows Project land use changes?

    2. Authorize mitigation measures on USDA Forest Service administered lands outside the Reclamation withdrawn lands?

    3. Issue necessary easements to the Utah Department of Transportation (UDOT) for relocating State Route (SR) 264?

    4. Accept responsibility for management of the recreation facilities?

    5. Sign various agreements, such as memoranda of understanding (MOU), easements, and rights-of-way (ROW)?

    6. Amend grazing permits and allotment management plans?

- Should the USACE approve SWCD's application for a Clean Water Act Section 404 permit authorizing the placement of discharged dredge or fill material into waters of the United States for constructing the Narrows Dam and other features of the Narrows Project?

    1. Identify the Least Environmentally Damaging Practicable Alternative (LEDPA) based on reservoir size.

1.4 HISTORY AND BACKGROUND OF THE NARROWS PROJECT

The history of the Narrows Project, as defined in this document, began in the early 1900s with early efforts to appropriate Gooseberry Creek water and transport it to use in north Sanpete County. In 1924, predecessors to SWCD filed an application with the Utah State Engineer to appropriate 15,000 acre-feet of Gooseberry Creek water and deliver it via a transmountain tunnel to Sanpete County.

In the 1930s, Reclamation, the Utah Water Storage Commission, and local Sanpete County interests undertook cooperative studies to formulate a water development plan and enhance water supplies in Sanpete County. The first published cooperative study, undertaken by Reclamation and released in May 1933, outlined what would

[1] There are six indicators that will be used to determine the overall loan risk and category assignments. These indicators are described in the economic section of this FEIS.

become known as the Gooseberry Project Plan. This report defined the Gooseberry Project as:

- ♦ Construction of a reservoir on Gooseberry Creek with an active capacity of 15,000 acre-feet and an annual yield of 9,400 acre-feet.
- ♦ Construction of a transmountain tunnel.
- ♦ Construction of feeder canals to deliver waters from other streams to the dam for transmountain diversion.

In September 1940, Reclamation released another cooperative study that revised the original plan and included expanding Scofield Reservoir as a principal feature of the Gooseberry Project. On November 2, 1940, the Utah Water Storage Commission recommended construction of the Gooseberry Project, defined as:

- ♦ Construction of a dam on Gooseberry Creek providing an annual average yield of 10,800 acre-feet to Sanpete County.
- ♦ Construction of a transmountain tunnel to deliver the water.
- ♦ Construction of feeder canals.
- ♦ Enlargement of Scofield Reservoir to provide exchange water for the unrestricted diversion of Gooseberry Creek water to Sanpete County.

Although the Federal Gooseberry Project, as described in the Gooseberry Project Plan, was not authorized by Congress, on March 6, 1941, the lands necessary to complete the Gooseberry Project were withdrawn from public entry under a first form Reclamation withdrawal, 32 Statutes-at-Large (Stat.) 388; 43 United States Code (U.S.C.) Section (§) 372, et seq.

On January 2, 1942, Reclamation released a draft report outlining the Gooseberry Project Plan, including constructing an additional 43,000 acre-feet of storage capacity in Scofield Reservoir to support the unrestricted transmountain diversion of Gooseberry Creek water to Sanpete County.

In 1943, the United States decided that the Scofield Dam and Reservoir portion of the Gooseberry Project Plan should be completed first because of the hazardous conditions the existing structure posed to the war effort and the health, welfare, and safety of Carbon County residents. As described in further detail below, reconstruction of Scofield Dam began the same year and was completed in 1946.

On October 11, 1943, and February 28, 1944, the United States entered into reconstruction and repayment contracts on Scofield Dam and Reservoir with local sponsors. The October 11, 1943, contract has subsequently become known as the “Tripartite Agreement.” Among the conditions identified for reconstructing and enlarging Scofield Dam and Reservoir, the agreement:

- ♦ Described the United States’ intent to construct and operate the remaining Gooseberry Project works.
- ♦ Stipulated that the Gooseberry Project has the right to divert and store all flows of Gooseberry Creek at or above the confluence with Cabin Hollow.
- ♦ Stipulated that Carbon County’s storage rights in Scofield Reservoir are subordinate to those of the Gooseberry Project.

On April 11, 1956, Congress enacted the Colorado River Storage Project (CRSP) Act. Planning was authorized for the Gooseberry Project at 43 U.S.C. § 620a.

In September 1961, the Soil Conservation Service of the U.S. Department of Agriculture proposed the North Sanpete Watershed Work Plan to complete the 1942 Gooseberry Project Plan.

In 1962, the USDA Forest Service issued a Special Use Permit to the Gooseberry Project Plan sponsors to construct, operate, and maintain a tunnel and appurtenances for transmountain diversion of water from the proposed Narrows Reservoir in Gooseberry Creek to Cottonwood Creek for irrigation purposes.

In the 1970s, SWCD proposed constructing the Narrows portion of the Gooseberry Project Plan as a non-Federal project. On July 22, 1975, with the Federal Gooseberry Project not built, Reclamation assigned the Narrows' portion of the Gooseberry Project water right to SWCD to complete the Narrows portion of Gooseberry Project Plan as a non-Federal project.

On March 13, 1981, SWCD filed a notice of intent (NOI) to apply for a SRPA loan to help finance the non-Federal Narrows Project. The project would include:

- The Narrows Reservoir with a capacity of 17,000 acre-feet (10,000 acre-feet active storage and 7,000 acre-feet for fish and recreation).
- Two hydropower plants to provide power for project purposes.
- Improved flows in the San Pitch River by improving select facilities to allow more reliable exchanges without interfering with existing water rights.
- An additional 10 to 12 exchange wells in the San Pitch River Basin to provide exchange water to municipalities.
- Rehabilitation of the existing Gooseberry (Narrows) Tunnel.

On June 28, 1984, Reclamation approved the 1984 Compromise Agreement by and among the SWCD, the Price River Water Users' Association, and the Carbon Water Conservancy District (CWCD) (appendix A). According to the agreement's terms, among other things, SWCD:

- Relinquished and withdrew certain water rights.
- Agreed to a much lower transmountain diversion figure than previously contemplated (reduced to 5,400 acre-feet per year).
- Restricted sources of the water supply by excluding certain stream sources of water from the project plan.
- Limited the active and inactive storage capacity of the reservoir.
- Agreed to locate the dam and reservoir site further up the drainage of the Narrows Project site, thereby relinquishing the historic Mammoth Dam site.

On November 1, 1984, SWCD filed an amended NOI to apply for a SRPA loan. The project had been reformulated in response to the 1984 Compromise Agreement. Specifically, SWCD proposed to:

- Construct the Narrows Reservoir to a capacity of 14,500 acre-feet of active storage and 2,500 acre-feet of dead storage for fish and recreation purposes.
- Construct four hydropower plants to provide power for project purposes.
- Improve flows of the San Pitch River by improving select facilities that would

allow more reliable exchanges without interference with existing water rights.

- Drill 5 to 10 exchange wells in the San Pitch River Basin to provide exchange water to municipalities and irrigation companies.
- Rehabilitate the existing Gooseberry Tunnel.
- Enlarge the existing Gunnison Reservoir by at least 5,400 acre-feet.

On January 7, 1985, the Utah State Engineer approved both the non-Federal Narrows Project water rights and Scofield portion of the Federal Gooseberry Project Plan water rights. With respect to the Narrows Project water rights, among other things, the approval:

- Set the approximate physical location of the Narrows damsite and its active storage capacity (14,500 acre-feet).
- Reduced the amount of an annual transmountain diversion to 5,400 acre-feet.
- Set the instream flow requirements.
- Restricted the sources of water supply that could be used for the Narrows Project purposes.

With respect to the Scofield Project water rights, the approval provided the legal authority to use 43,000 acre-feet of additional storage water in Scofield Reservoir. Both approvals were expressly made subject to the terms of the 1984 Compromise Agreement.

The effect of this decision was to give SWCD the right to divert the first 5,400 acre-feet of water occurring in Gooseberry Creek at the Narrows damsite. The decision also established a Scofield Project water right for the additional 43,000 acre-feet of storage capacity in the enlarged Scofield Reservoir. Of the 43,000 acre-feet, 8,000 acre-feet is for fish propagation. The remaining 35,000 acre-feet of capacity is for Scofield Project purposes (i.e., project water for use in Carbon County), subject only to an obligation to satisfy early water rights that otherwise would be impaired by the diversion and storage of the Narrows Project. Because Scofield Project water rights are junior to Narrows Project water rights, delays in beginning the construction of the Narrows Project temporarily increased the yield of Scofield Project water rights for storage in Scofield Reservoir. At this time, the proposed hydropower plants, exchange wells, and expansion of Gunnison Reservoir were dropped as part of the Gooseberry Project Plan because of the technical and financial infeasibility of these components.

On March 7, 1985, the USDA Forest Service notified the Utah State Engineer of its claim to Federal reserved water rights in the Gooseberry Creek drainage. On July 13, 1989, the United States and SWCD agreed to a water use plan to allow continued development of the Gooseberry Project Plan because of potential conflict between water use under the Federal reserved water rights and the Gooseberry Project water rights. This agreement stipulated that all Federal reserved water rights, which fall within the Gooseberry Creek drainage, shall be subordinate to the Gooseberry Project water rights.

On July 20, 1990, SWCD filed a second amended NOI to apply for a SRPA loan. The project had been further reformulated to conform to the agreements and stipulations contained in the 1984 Compromise Agreement and the State Engineer's Memorandum Decision. SWCD proposed to:

- Construct the 17,000-acre-foot Narrows Reservoir with an active capacity of

14,500 acre-feet supporting an annual transmountain diversion of 5,400 acre-feet.

- ♦ Rehabilitate the existing 3,100-foot-long Narrows Tunnel to control releases from Narrows Reservoir.
- ♦ Relocate about 2.9 miles of State highway around the Narrows Reservoir.

On May 19, 1992, the draft SRPA Loan Application Report and Environmental Report were submitted to Reclamation for review and comment.

On September 20, 1993, Reclamation released a draft environmental impact statement (DEIS) for public review and comment. Approximately 60 comment documents were received from various Federal, State, and local agencies as well as members of the public. These comments and accompanying responses were included in the January 1995 FEIS.

On December 23, 1994, SWCD submitted the final Loan Application Report for processing. On January 23, 1995, Reclamation filed the 1995 FEIS with the United States Environmental Protection Agency (EPA).

On May 8, 1995, Reclamation's Upper Colorado Regional Director signed a Record of Decision (ROD). The ROD's recommendation was to proceed with the recommended plan identified in the 1995 FEIS.

On July 28, 1995, a Complaint was filed in the United States Federal District Court, District of Utah, by the Carbon Water Committee, Utah Rivers Conservation Council, Utah Wilderness Association, and three individuals (collectively Plaintiffs) against the U.S. Department of the Interior (Interior), Bureau of Reclamation alleging that Reclamation failed to comply with the National Environmental Protection Act (NEPA) in preparing the 1995 FEIS.

In response, Reclamation hired the Environmental Chemical Corporation (ECC), an environmental consultant, to conduct an independent review of the 1995 FEIS. ECC concluded that "the Narrows Project FEIS was complete and technically complied with NEPA, fulfilling most requirements of the Council on Environmental Quality (CEQ), Reclamation, and Department of the Interior guidelines."

In September 1995, a Civil Complaint was filed in the Sixth Judicial District Court of Sanpete County, State of Utah by SWCD (Plaintiff) against Carbon Water Conservancy District and PacifiCorp, also known as Utah Power and Light (Defendants). The Plaintiffs alleged a breach of contract by the Defendants by willfully interfering and hindering the Plaintiff's attempts to develop its Gooseberry Creek water rights and construct the Narrows Project. In June 1999, the court dismissed the suit, and SWCD appealed to the Tenth Circuit Court of Appeals of the United States. The court of appeals upheld the original district court ruling.

On September 11, 1995, Reclamation published a *Federal Register* Notice for rescission of the ROD on the 1995 FEIS for the Narrows Project, due to certain procedural errors in the FEIS process.

On February 8, 1996, Reclamation published a *Federal Register* NOI to prepare a new DEIS, wherein it announced that a new 1996 DEIS and subsequent FEIS would supersede the 1995 FEIS. Reclamation said it would use the 1995 FEIS, along with other materials submitted by SWCD, as the basis for preparing the new 1996 DEIS.

Reclamation's new 1996 DEIS was published in March 1998. Comments were received by mail and at public hearings in Price and Mount Pleasant, Utah, on April 22 and 23, 1998, respectively.

The present document is a new FEIS developed through Reclamation's own analysis of the environmental impacts of the Proposed Action. A NOI to prepare the SDEIS was published in the *Federal Register* on November 25, 2003. Based on scoping results, discussions with interested parties and cooperating agencies, existing laws and regulations, and comments on the 1998 DEIS, Reclamation updated or added the hydrology, water quality, population and demographics, water usage, recreation, discussion regarding Skyline Mine water development, fisheries, project cost estimates, wetlands delineations, Wild and Scenic Rivers, and Endangered Species Act (ESA) compliance in this FEIS. Resources, issues, and concerns identified during the process of completing this FEIS were fully considered, and changes were made to this document as appropriate. Formal responses to comments received on the SDEIS are published in appendix H of this FEIS.

1.5 Purpose and Need

Because Reclamation administers the Federal Reclamation laws, including the Small Reclamation Projects Act of 1956 and the Reclamation Project Act of 1939, particularly Section 10, Reclamation's purpose and need is considering approval of SWCD's SRPA loan application to build the Narrows Project and SWCD's request for authorization to use withdrawn lands to construct and operate the proposed dam and reservoir. This SRPA loan application is appended to this FEIS (appendix J).

By way of background, SWCD's purpose for the Narrows Project is to enable development of an irrigation and M&I water supply source for users in north Sanpete County, Utah. Its need is to reduce the average annual shortages to irrigators in Sanpete County as nearly as possible to 5 percent (%), which is considered full irrigation supply.

Specifically, the following are SWCD's water-related needs addressed by the proposed project:

- Demand for municipal water for present and future use exceeds the currently available supply. The proposed Narrows Project would develop, through exchange, an additional supply of municipal water to offset current shortages and accommodate anticipated population growth in Sanpete County.
- The current water supply for agricultural irrigation does not provide adequate supply and storage at the needed times—typically in July, August, and September of each year. The proposed Narrows Project would provide late season irrigation water to offset some of the current shortages.

In addition to its primary purpose of supplying water to Sanpete County, SWCD believes the project would have the additional benefit of providing reservoir-based recreation and fishery opportunities in Sanpete County.

It is important to note that Reclamation's purpose and need for action is limited to responding to the loan application and the request to use Federal land for the Narrows Project (see figure 1-1).

Due to USACE's need to determine the LEDPA, three reservoir sizes were analyzed.

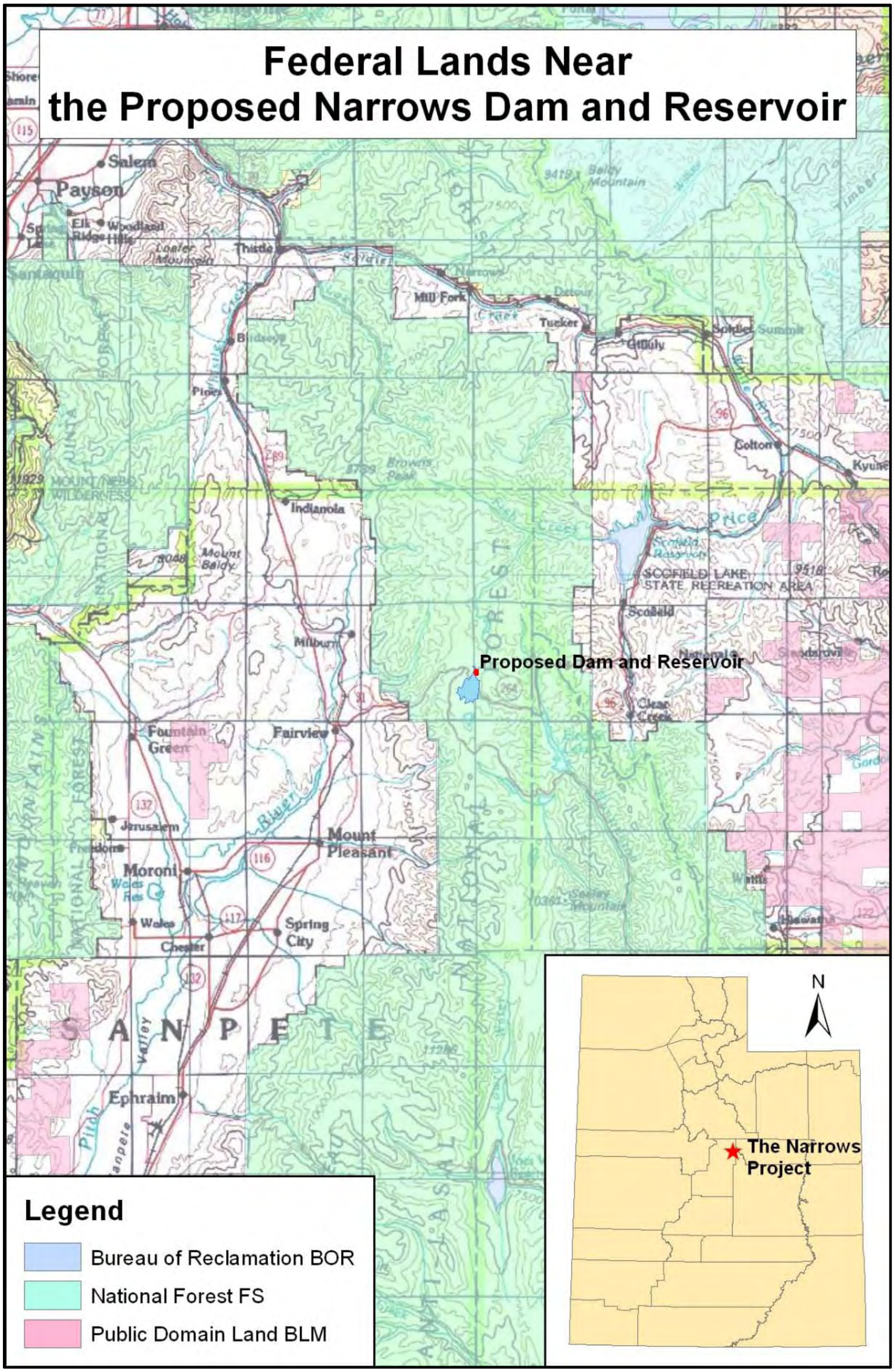

Figure 1-1.—Federal Lands near the Proposed Narrows Dam and Reservoir.

1.5.1 Municipal and Industrial

Under the current Utah State Water Plan that is intended to guide and direct Utah's water related planning into the next century (Utah Division of Water Resources, 2001). Water needs for M&I uses are projected.

Table 1-1 contains the per capita use rates of public community and secondary water systems from the Utah State Water Plan. Comparison of potable and nonpotable water use contained in table 1-1 shows that considerable water saving could be achieved through implementing conservation measures.

Table 1-1. Public Community System and Secondary System Water Use (gallons per capita per day)

Water Use	West Colorado River	Sevier River	Total/ Average
Potable Uses:			
Residential	186	171	178.5
Commercial	25	30	27.5
Institutional	29	44	36.5
Industrial	9	22	15.5
Total Potable	249	267	258
Nonpotable Uses:			
Residential	91	87	89
Commercial	0	0	0
Institutional	26	21	23.5
Industrial	0	0	0
Total Nonpotable	117	108	112.5
Total Use by Category:			
Residential	277	258	267.5
Commercial	25	30	27.5
Institutional	55	65	60
Industrial	9	22	15.5

Source: Department of Natural Resources, Division of Water Resources, 2001, table 8.

Table 1-2 shows projections of water use by major river basins included in the study area for the years 2020 and 2050 based upon present use rates and future population.

Table 1-2. Present and Projected Total M&I Water Use by Basin (acre-feet per year)

Basin	Present	2020	2050
West Colorado River	51,000	55,000	62,000
Sevier River	48,000	55,000	64,000
Total	99,000	110,000	126,000
Average	49,500	55,000	63,000

Source: Department of Natural Resources, Division of Water Resources, 2001, table 7.

1.5.2 Agricultural Water Supply

The existing water supply for agricultural irrigation does not provide an adequate supply at the times when it is needed. An additional and dependable irrigation water supply is needed to stabilize and improve the agricultural component of the Sanpete County economy. Successful crop production in north Sanpete County depends on irrigation because the average rainfall during the growing season is approximately 4 inches. The present irrigation water supply consists primarily of runoff from the previous winter snowpack.

The amount of annual runoff varies widely because of natural precipitation patterns during the winter. The greatest volume of runoff occurs in the early part of the growing season. Although irrigation water users have made numerous improvements to their existing water distribution systems in the past (such as canal lining, piped distribution systems, and conversion to sprinkler irrigation), water shortages still occur.

There are 15,420 acres of lands eligible to receive project water. The eligible lands are classified as Class I, II, or III lands according to Reclamation's land classification system. The remaining lands are considered Class VI (ineligible) lands because of poor soil, inadequate drainage, or topographic characteristics.

In determining water requirements, the project lands were divided into three groups representing similar water supplies and irrigation practices. These groups are described below.

Group 1 lands include the areas serviced by the Cottonwood-Gooseberry, Birch Creek, Spring Canyon, North Creek, Pleasant Creek, and Oak Creek Irrigation Companies. Of the 9,777 acres of presently irrigated lands, 5,705 acres are eligible to receive project water. Water is delivered to Group 1 lands through pipeline systems. These lands currently are irrigated by sprinkler systems.

Group 2 lands include the areas served by the Horseshoe, Cedar Creek, and Twin Creek Irrigation Companies. Group 2 contains 6,407 acres of farmland, of which 4,644 acres are eligible to receive project water. Water is delivered to these lands through open canals and ditches. At present, these lands mostly are flood irrigated.

Group 3 lands use the San Pitch River as their principal water supply and are served by numerous irrigation companies. There are 6,996 acres of irrigated land in this group, of which 5,071 acres are eligible for project water. Group 3 lands receive water through open canals and ditches. These lands currently are irrigated with a combination of flood and sprinkler methods. Principal crops grown in the project area include pasture, alfalfa, grass hay, and small grains. The consumptive use requirements are based on the Utah State University Agriculture Experiment Station *Research Report No. 145*.

Consumptive use estimates were computed for the principal crops found in each of the groups. The estimates are based on the crop distribution of each group. Average monthly estimates were computed for April–October, as appropriate for each crop. These estimates represent net irrigation requirements since *Research Report 145* deducts effective precipitation from total consumptive use. Curve No. 1 (crop consumptive use), shown in figure 1-2, presents the monthly net irrigation requirements for the 15,420 acres of project-eligible lands. The average net irrigation requirement is approximately 30,400 acre-feet per year.

The net irrigation requirement is the amount of water that must be artificially applied by irrigation and must be present in the root zone and available for evapotranspiration by the plants for normal plant growth and development. It is not the amount that must be diverted into the irrigation system. Because of inevitable inefficiencies of the delivery, distribution, and application systems, a larger quantity of water must be diverted into the irrigation system to meet actual crop needs. Some of the factors contributing to these inefficiencies include seepage and evaporation from the carriage system, evaporation of applied water, deep percolation of excess applied water, and runoff of excess water. The lack of uniformity in applying irrigation water is the major cause of deep percolation and runoff. Traditionally, flood irrigation is the least uniform, and microirrigation systems are the most uniform. The application systems with the highest uniformity generally also have the highest capital and operating costs. Based on the delivery system conditions and application methods in use, the diversion requirement was computed to be an average

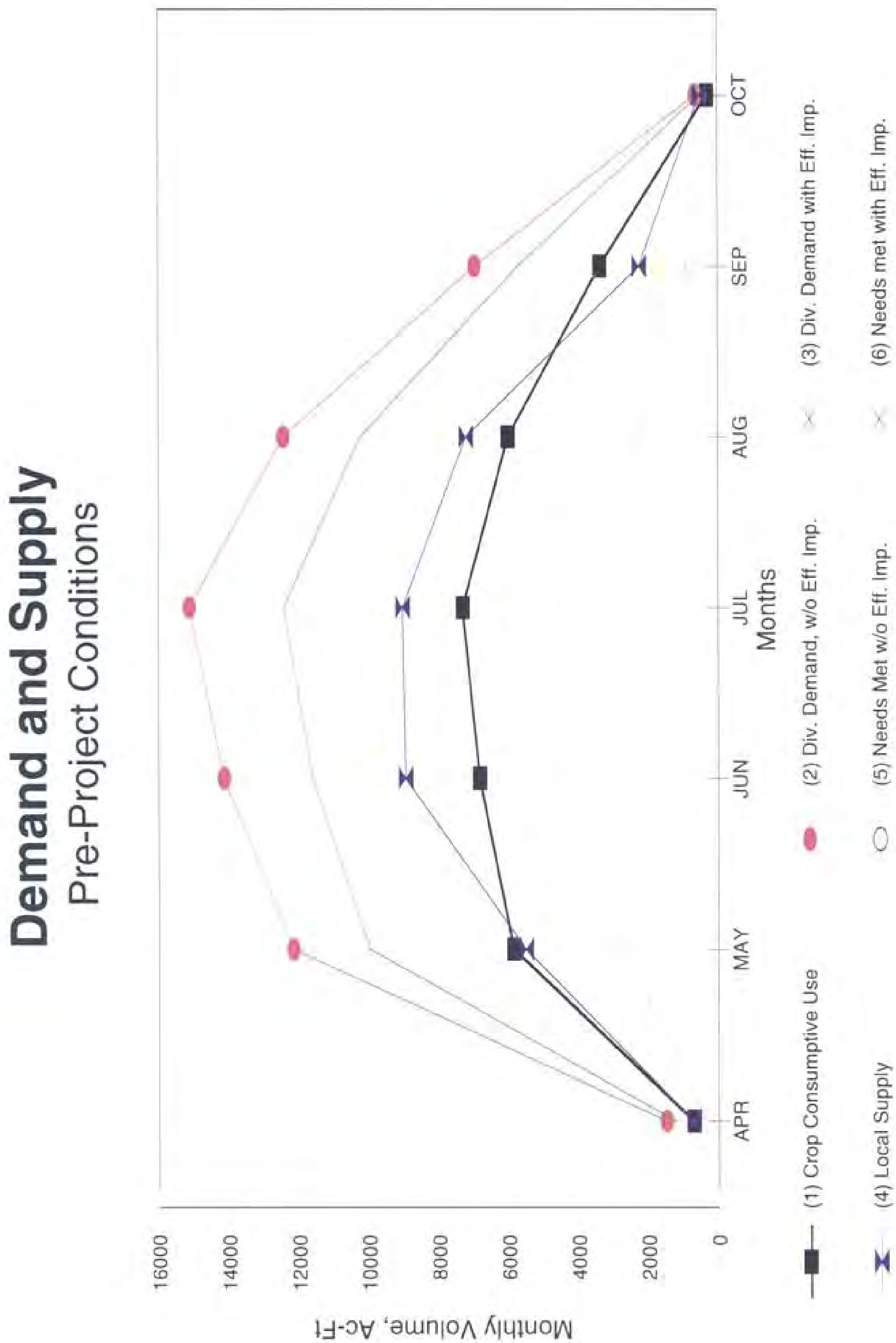

Figure 1-2.—Narrows Project Demand and Supply, Preproject Conditions.

of about 62,900 acre-feet per year for the project-eligible lands. This demand is shown as Curve No. 2 (diversion demand without efficiency improvements) in figure 1-2.

Data gathering efforts, conducted during the planning stages of the project, identified private parties and canal companies that were planning to install, or were currently installing, a variety of efficiency improvements (efficiency improvement, conservation measures). These improvements consist mainly of pipe delivery and sprinkler irrigation systems. More precise application methods, such as drip irrigation and microspray systems, are not cost effective. These efficiency improvements are expected to be in place by the time project water would become available. Thus, all calculations of project diversion demands made and discussed herein are based on the increased efficiencies produced by these improvements.

Curve No. 3 (diversion demand with efficiency improvements) in figure 1-2 shows the reduced diversion requirement (or demand) of 51,700 acre-feet per year on the average. The efficiency improvements would result in an 11,200-acre-foot reduction in the diversion demand. It should be emphasized that the reduced diversion requirement is the effect efficiency improvements would have, not a development of a new water supply. The same irrigated lands require less in physical diversion to receive full irrigation. The efficiency improvements also will mean that a larger percentage of diverted water would become available for plant evapotranspiration.

Local water supplies in the project area consist of a small amount of effective precipitation during the growing season, a small amount of storage, and direct runoff from the snowpack. Curve No. 4 (local supply) in figure 1-2 shows the 34,200 acre-feet (spread over the irrigation season) diverted annually to meet the crop water needs. Curve No. 4 is based on long-term historical diversions. It does not include effective precipitation, which is already accounted for in the net irrigation requirement shown in Curve No. 1. As can be seen from figure 1-2, the local supply is considerably less than the reduced diversion demand (Curve No. 3). This shortage is approximately 17,500 acre-feet on an average annual basis (total volume difference between Curve Nos. 3 and 4).

Research Report 145 indicates that about 3.5 inches of effective precipitation occur during the nongrowing season. Some portion of this effective precipitation would accumulate in the root zone and be available to augment the local supply during the first few weeks of the growing season. There could be as much as 4,500 acre-feet of moisture stored in the soil profile at the beginning of the growing season.

The exact amount of soil moisture has not been determined. In reality, the shortage, therefore, most likely would range between 13,000 and 17,500 acre-feet per year. Assuming that one-half of this precipitation still would be in the root zone at the beginning of the growing season, the average shortage would be about 15,250 acre-feet per year. This represents a 29.5% shortage relative to the diversion demand.

Depending on the efficiency scenario being examined (with or without efficiency improvements), Curve Nos. 5 (needs met without efficiency improvements) and 6 (needs met with efficiency improvements) show that significant soil moisture deficits would occur throughout much of the growing season. With the expected moisture available in the root zone at the beginning of the growing season, the early-season deficits probably would not be as severe, as shown by the graphs. However, serious soil moisture deficits occur throughout much of the latter part of the growing season. This would result in prolonged or frequent water stress for the crops involved. Consequences of this water stress include reduced crop yield, reduced quality, and poor plant vigor. For example, there should be three good cuttings of alfalfa under adequate water supply conditions. Currently, the first cutting is good, the second is mediocre, and the third generally never occurs. Further, evidence of reduced crop vigor was noted during a Reclamation field tour of the project service area. A large number of fields were noted to have unusually high infestations of weeds. Typically, lower water-use weeds quickly infest a field when the crop is seriously water stressed. This problem is exacerbated in north Sanpete County because the short water supply prevents normal crop rotations that help control weeds and maintain field productivity (because rotation crops have higher water requirements).

As previously noted, only a portion of the water diverted for irrigation would be available for crop use. The remaining portion would be lost through evaporation, seepage losses, deep percolation, and runoff. Except for the amount lost through evaporation, these losses either become part of the water supply for the shallow water table or become return flows to the natural surface streams. These losses support wetlands and aquatic habitat and become part of the water supply for downstream users. Total losses from local supplies would amount to an estimated 17,600 acre-feet per year before efficiency improvements were implemented. The losses would be expected to be reduced to about 14,100 acre-feet per year with implementing efficiency improvements. Thus, efficiency improvements would result in a combined loss reduction of about 3,500 acre-feet per year.

1.5.3 Recreation Opportunities

In addition to the primary purpose of supplying water to Sanpete County, a secondary purpose is maintaining or increasing recreational opportunities in Sanpete County. The demand for outdoor recreation is increasing throughout Utah.

The 2009 Utah State Comprehensive Recreation Plan (SCORP) has outdoor camping listed among the highest recreation-based uses in Sanpete County.

The 1986 Forest Plan states that:

> ". . .the demand for developed recreation sites is expected to triple over the next 50 years. At this rate, demand on the Manti-La Sal National Forest is expected to exceed supply at some sites starting in the year 1990."

The Forest Plan also states that:

> "Some lands, especially those next to reservoirs on the Forest, possess a high recreational value."

Developed camping sites around the Narrows Reservoir would help to meet this public purpose.

1.6 Relationship to Other Projects

This section describes other Federal actions that are considered for past, present and cumulative impact analyses in chapter 3. Construction and operation of the proposed project would reflect consideration of, and cooperation with, the following existing projects.

1.6.1 Central Utah Project

As part of the master water development plan for Sanpete County, the Narrows Project is intended to provide a supplemental water supply for the northern part of the county. Central Utah Project (CUP) water, delivered by the Sevier River, originally was planned to provide a supplemental supply for the southern portion of the county. However, the Central Utah Project Completion Act (CUPCA), which authorized completion of the remaining features of the CUP, restricted CUP development to the Wasatch Front area of central Utah if construction of facilities did not begin within 5 years of the enactment of the legislation. Sevier and Millard Counties withdrew from the Central Utah Project, and plans to deliver CUP water to the Sevier River Basin have been dropped. The 5-year authorization window has since expired; therefore, delivery of CUP water to the Sevier River Basin and, consequently, to Sanpete County will not occur.

To compensate for the CUP water supply loss, Section 206 of the CUPCA was designed to provide some funding for supplemental projects in Sanpete County. Section 206 is intended for counties within the Central Utah Water Conservancy District (CUWCD) that were originally planned to receive CUP water but will not (as explained above). These counties are eligible to receive a rebate of the taxes paid to the CUWCD. This rebate may be used for local water projects such as potable water distribution and treatment, wastewater collection and treatment, and agricultural water management. Participating counties will receive a rebate from the CUWCD of ad valorem tax contributions paid, with interest, but less any benefits or administrative expenses. Under Section 206, this rebate represents a 35% local cost share; and a Federal grant from Interior constitutes the remaining 65% of the project cost.

Through 1996, Sanpete County had paid nearly $2.4 million in ad valorem taxes to the CUWCD, which established the maximum amount of the rebate under CUPCA Section 206. Based on a 65% match, the corresponding amount of matching Federal grant money is approximately $4.4 million. These two sums provide a total Section 206 amount of $6.8 million that could be used to fund water development/conservation projects in Sanpete County.

To use these funds more effectively, in June 2000, SWCD completed the Sanpete County Water Resources Master Plan (Master Plan) for managing, developing, and conserving the limited water resources of the county. The plan was intended to evaluate and prioritize several water management and/or conservation projects that potentially would be funded by SWCD for implementation. The Master Plan clearly places the Narrows Project as its primary objective in obtaining supplemental water to meet shortages in north Sanpete County. However, other water development/conservation projects would be needed to further alleviate shortages that occur throughout Sanpete County. Since 1996, Sanpete County has approved approximately $4.8 million in projects to further develop/conserve its water resources using CUPCA Section 206 funds.

1.6.2 Scofield Project

The Scofield Project, authorized on June 24, 1943, arose out of the remnants of various private dams that either failed or never lived up to expectations. The new Scofield Dam and Reservoir replaced the rapidly deteriorating, old Scofield Dam, built by the Price River Water Conservation District. The Scofield Project eventually irrigated area lands that originally were to be served by Mammoth Dam and later by the defunct Gooseberry Project. Mammoth Dam failed in 1917, before its completion. While the Scofield Project evolved out of the Gooseberry Project, the need to protect vital rail lines from flood damage during World War II was a key to the Scofield Dam construction. Although World War II prompted suspension of construction on most Reclamation projects, the fear that the existing Scofield Dam might fail and cause millions of dollars of damage and disrupt transportation influenced the Federal Government to proceed with the Scofield Project.

The Scofield Project included 30,000 acre-feet of replacement storage capacity (replacing the then existing 30,000-acre-foot structure), 8,000 acre-feet of inactive or dead pool storage (conservation pool), and 35,000 acre-feet of exchange capacity to support the transmountain diversion of Gooseberry Creek water at or near the Narrows damsite. The near doubling in size of Scofield Reservoir was originally accomplished (1943–1946) because of hazardous conditions with the existing structure, the threat it posed to the war effort, and the reservoir's role in accomplishing a portion of the Gooseberry Project Plan, which included an early version of the Narrows Project.

1.6.3 Fairview Lakes, Gunnison Reservoir, Wales Reservoir

Through a proposed operating agreement associated with the Narrows Project, releases would be made from the privately owned Fairview Lakes to re-establish minimum instream flows in two small tributaries to Gooseberry Creek above the Narrows Reservoir site (see location map). Wales Reservoir is a small, privately owned reservoir that stores winter runoff from the Upper San Pitch River drainage. Gunnison Reservoir is a storage facility, located southwest of Manti, that stores water from the San Pitch River drainage (Wales Reservoir is located about 19 miles upstream of Gunnison Reservoir on Silver Creek, which is a tributary of the San Pitch River).

1.6.4 Price-San Rafael Rivers Unit, Colorado River Salinity Control Program

The principal objective of the Colorado River Basin Salinity Control Program is to meet the water quality standards for salinity adopted by the Basin States while the Upper Basin States continue to develop their water. The Price-San Rafael Rivers Unit of the Colorado River Water Quality Improvement Program under the Colorado River Salinity Control Act would reduce salt contribution to the Colorado River by about 161,000 tons annually through a system of on-farm and off-farm irrigation improvements. The Narrows Project would divert water from the Price-San Rafael River Basins to develop a supplemental irrigation water supply of 5,400 acre-feet per year for municipal use and for approximately 15,420 acres of presently irrigated land in north Sanpete County, Utah. The transbasin diversion of 5,400 acre-feet under the Narrows Project would not affect salt load reduction accomplishments or opportunities of the Price-San Rafael Rivers Unit.

1.6.5 Upper Colorado River Endangered Fish Recovery Program

A coalition of agencies and organizations came together in 1988 to recover endangered Colorado River Basin fish and provide for future water development for agricultural, hydroelectric, and municipal uses.

Called the Recovery Implementation Program (RIP) for Endangered Fish Species in the Upper Colorado River (Recovery Program), this effort involves Federal, State, and private organizations and agencies in Colorado, Utah, and Wyoming. The Recovery Program complies with all applicable laws, including the Federal Endangered Species Act, State water laws, river laws, and interstate water compacts.

Recovery strategies include conducting research, improving river habitat, providing adequate streamflows, managing nonnative fish, and raising endangered fish in hatcheries for stocking. Ongoing activities include the development of recommended flow regimes for the Price River to benefit endangered fish populations. As of August 2009, the Recovery Program is in the final stages of developing these flow recommendations.[2]

1.6.6 Forest Plan

The 1986 Forest Land and Resource Management Plan for the Manti-La Sal National Forest, as amended, provides direction and standards for managing lands in and adjacent to the proposed Narrows Project. In fact, the Narrows Project is specifically mentioned and, in 2003, amended to the plan, along with a reference that water is the top concern of the residents of Sanpete and other counties included in the planning effort.

1.7 Environmental Issues Associated with the Proposed Action Alternative

The issues identified through the initial scoping effort are listed below. The issues are phrased as questions. Following a brief description of the issue, indicators or measures are suggested that may be used to compare how the alternatives answer the question. Indicators measure change from the present condition. Chapter 2 contains a comparison summary of the alternatives and their responses to the issues. Chapter 3 presents the affected environment and the predicted effects as they relate to the resource issues.

Issue No. 1 – How would threatened and endangered species be affected by the Narrows Project?

The project area and potentially affected offsite areas contain the habitat for several federally listed endangered and threatened species, including the Colorado pikeminnow, bonytail, humpback chub, razorback sucker, Canada lynx, Utah prairie dog, black-footed ferret, yellow-billed cuckoo, southwestern willow flycatcher, greater sage-grouse, heliotrope milk-vetch, Graham beard tongue, and the Uinta Basin hookless cactus. Due to the listing of these species as threatened, endangered, candidate, or proposed, the protection of a sensitive species habitat has become a matter of concern to the U.S. Fish and Wildlife Service (Service) and to the public.

[2] http://www.coloradoriverrecovery.org/general-information/about.html.

Indicators for this issue:

- ♦ Acre-feet of water annually depleted from the Colorado River system
- ♦ Loss of potential southwestern willow flycatcher habitat

Issue No. 2 – How would the Narrows Project affect wildlife resources?

The project area provides habitat for a wide variety of wildlife species ranging from deer and elk to birds and small mammals. There is concern that the proposed project may disrupt the migration routes and feeding areas for some small animal and bird species, including some neotropical species.

Indicators for this issue:

- ♦ Number of habitat units lost for specific indicator wildlife species (i.e., ungulates, small mammals, neotropical migrants, and Utah State sensitive species)

Issue No. 3 – What effects would there be on water resources from the Narrows Project?

The public expressed concerns about the hydrology, water yield, and supply of the Price River as well as whether the winter releases and instream flows from Scofield Reservoir would be affected as a result of current or future use.

Indicators for this issue:

- ♦ Acre-feet of depletion from the Price River drainage
- ♦ Acre-feet of water available to San Pitch River drainage

Issue No. 4 – How would the Narrows Project affect the fishery resource?

The public expressed concern about the loss of Yellowstone cutthroat trout spawning habitat caused by inundation from the Narrows Project. Changes in the flow regime may cause increased water quality problems and, subsequently, affect the fisheries.

Concern for the fishery below Scofield Reservoir was expressed, and the question was asked if instream flows would be altered and if minimum flows would be required below Narrows Dam and Scofield Dam.

Indicators for this issue:

- ♦ Percent change in weighted usable area in fish habitat as measured by instream flow incremental methodology (IFIM)[3]
- ♦ Change in surface area in Scofield Reservoir
- ♦ Change in species composition above, below, and within Scofield Reservoir and the proposed reservoir
- ♦ Change in species composition and in population dynamics of existing species

Issue No. 5 – How would water quality be affected by the Narrows Project?

Accelerated sedimentation (over natural levels of sediment production) is the most likely factor to affect water quality. Land-disturbing activities, such as road construction and dam building, usually increase sedimentation, at least in the short term.

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[3] IFIM is a standard for measuring habitat.

Concerns were expressed over how the Proposed Action may affect the water quality as measured by phosphorus loading downstream.

The addition of many new recreationists to the Gooseberry Valley could create additional pollution from problems with trash and sewage. Additionally, road material (from rerouting SR-264) may have a temporary and adverse effect on riparian systems.

Indicator for this issue:

- Change in average phosphorus level in Scofield Reservoir based on external phosphorus loading

Issue No. 6 – What would the effect be on wetland resources from the Narrows Project?

Construction of the Narrows Project would inundate existing wetlands. Change in flow (decrease or increase) may change the composition and structure of other existing wetlands.

Indicators for this issue:

- Acres of wetlands lost (function and value)
- Function and values measured by habitat evaluation procedures (HEP) analysis in terms of habitat units
- Change in species composition in wetland habitats

Issue No. 7 – What would the effect be on aquatic and riparian resources from the Narrows Project?

Construction of the Narrows Project would inundate and affect wetlands and riparian areas. A decrease in flow may change the wetlands and lower the water table. High flows are needed to re-establish the riparian communities. Concern was expressed about the possibility of high peak flows causing a blowout of the stream channel (Cottonwood Creek).

Indicators for this issue include:

- Change in species composition in aquatic and riparian habitats
- Number of miles of stream lost due to inundation of the reservoir
- Number of miles of stream affected by increase in flow and decrease in flow

Issue No. 8 – How would the Narrows Project affect the recreation and visual resources within the project area?

Currently, the area receives light, nonmotorized, dispersed recreation during the summer and fall, primarily from stream anglers. Moderate levels of winter recreation also occur. If the project is implemented, the nature of the recreational experience may be affected. Motor boating and related water sports, overnight family camping, large group reservation camping, all terrain vehicle (ATV) use, and reservoir fishing activities may replace the current recreation experience in the area inundated by the reservoir.

The surrounding USDA Forest Service lands in this area have been designated by the Forest Plan to have the visual quality objective (VQO) of Partial Retention. One concern is that, with developing the recreational area, associated gravel pits and soil scars may affect the visual quality of the area.

Indicators for this issue:

- ♦ Increase in developed recreation visitor days at Narrows (including fishing)
- ♦ Increase in dispersed recreation visitor days at Narrows (including fishing)
- ♦ Change in projected fisherman days
- ♦ Change in VQOs

Issue No. 9 – What effect would there be on cultural resources from the Narrows Project?

Class I and Class III cultural resource inventories were conducted for the "primary impact area" of the proposed Narrows Dam and Reservoir in 1979 (Singer, 1979). As a result of the 1979 inventory, three cultural resource sites were identified. The sites, however, were not evaluated for *National Register of Historic Places* (NRHP) eligibility. Further, since the 1979 inventory, the design and, therefore, the area of potential effects (APE) associated with the Proposed Action has changed. These changes include the addition of the Upper Cottonwood Creek, Oak Creek, and East Bench pipeline alignments, new road alignments, borrow areas, staging areas, recreation facilities, marinas, wetland mitigation areas, haul roads, and other potential ancillary facilities associated with the Proposed Action. Prior to initiation of final design and construction, Class I and Class III cultural resource inventories of the entire APE, as well as consultations with various consulting parties, including Indian tribes, would need to be completed before a determination of effects to cultural resources from the Narrows Project could be made.

Indicators for this issue:

- ♦ Number of cultural resources inundated or otherwise impacted by construction of the reservoir and ancillary facilities
- ♦ Potential tribal concerns regarding traditional cultural properties or sacred sites within the APE

Issue No. 10 – What social and economic effects would be expected from the Narrows Project?

Reclamation recognizes that implementing the alternatives may result in impacts on the local residential community in the vicinity of the Narrows damsite. Aside from the environmental issues previously identified above, local communities often are concerned with intangible quality of life impacts that implementing the alternatives may present. Key community concerns frequently include impacts downstream from Scofield Reservoir and the social and economic effects on Carbon and Sanpete Counties.

Indicators for this issue:

- ♦ Number of jobs (Carbon and Sanpete Counties) created during construction
- ♦ Change in farm income
- ♦ Change in available water supply in Sanpete and Carbon Counties

Issue No. 11 – What effect would there be on existing land uses, rights-of-way, and potential mineral leasing?

Since more than half of the shoreline of the proposed reservoir would be on private land, there would be potential for development of the private land including subdivisions, roads, summer homes, lodges, and utilities. Development of this land could cause problems such as erosion and ground and surface water pollution.

The project would be located within the boundaries of four USDA Forest Service grazing allotments. The reservoir, campgrounds, and additional roads may decrease available forage for livestock and wildlife.

Since the proposed dam and reservoir are in the vicinity of known mineable coal reserves, the project could affect the mineability of Federal and private coal resources.

Indicators for this issue:

- Percentage of shoreline in private ownership
- Change in number of animal unit months (AUMs) of forage use
- Acres of mineable coal reserves not available for mining

Issue No. 12 – What effects on public safety would there be from the Narrows Project?

The finished reservoir would be an attraction to the public, which may increase recreational traffic on SR-31, SR-264, and local USDA Forest Service roads in the vicinity, leading to possible congestion and accidents. Local USDA Forest Service roads may need reconstruction to a higher standard if traffic levels increase appreciably.

Indicator for this issue:

- Percent of expected change in the volume of traffic in the project area

Issue No. 13 – What would be the effects upon air quality associated with constructing the Narrows Project?

The Narrows Project is located in a remote and rugged mountainous terrain. The air quality associated with this area is generally excellent. Noise in the proposed project area is generally low and not disturbing. The construction activities potentially may affect the air quality of the Narrows basin during construction activities.

Indicator for this issue:

- Number of days project will exceed National Ambient Air Quality Standards (NAAQS) for particulate matter
- Noise indicator

Issue No. 14 – Would the slopes of Fairview Canyon be affected by construction and operation of the Narrows Project? What effects will there be on channel stability from the Narrows Project?

Concern was expressed about the potential impacts from additional flows through Cottonwood Creek to the already unstable Fairview Canyon. Several landslides have been identified in the canyon. Concern was expressed about the adjacent slopes in Cottonwood Creek.

Indicators for this issue:

- Frequency of exceeding the 50-year channel-forming discharge
- Lateral and vertical slope degradation

Issue No. 15 – What would the geologic hazards and earthquake hazards be from the Narrows Project?

The dam and reservoir would lie on the North Horn Formation and colluvium. The dam location and design must ensure long-term stability based on geologic conditions, including seismicity of the area, foundation conditions, permeability of the surrounding materials, and land stability.

Indicator for this issue:

- ♦ Number and severity of known geologic hazards within vicinity of dam and reservoir

Issue No. 16 – What would the effect be upon the soils of the area from the Narrows Project?

Concern was expressed about soil erosion in the project area and sediment loads transported in Gooseberry Creek.

Indicators for this issue:

- ♦ Acres of new soil disturbance
- ♦ Change in sediment loads in Gooseberry Creek

Issue No. 17 – What would the effect be upon levels of trace elements in the ground water supply from constructing the Narrows Project?

Concern was expressed about the salt pickup from the dissolution of salts from the soil and subsurface materials. Deep percolation from irrigation dissolves salts from the soils and shales and conveys them to natural drainages.

Indicator for this issue:

- ♦ Increase in levels of select trace elements in ground water

Issue No. 18 – What would the impact of the Narrows Project be on Indian trust assets (ITAs)?

The United States has an Indian trust responsibility to protect and maintain rights reserved by, or granted to, Indian tribes or Indian individuals by treaties, statutes, and Executive orders, which rights are sometimes further interpreted through court decisions and regulations. This trust responsibility requires that all Federal agencies, including Reclamation, take all actions reasonably necessary to protect Indian trust assets.

Indicator for this issue:

- ♦ Number of ITAs affected

Issue No. 19 – What would the impact of the Narrows Project be on environmental justice?

According to Executive Order No. 12898, agencies are required to analyze the environmental effects, including human health and economic and social effects of Federal actions, and effects on minority communities and low income communities.

Indicator for this issue:

- ♦ Number of low income or minority communities disproportionately affected by the Narrows Project

Issue No. 20 – What climate change and greenhouse gas emission issues might affect, or be affected by, the Proposed Action?

Since publication of the DEIS in 1998, issues associated with climate change have received dramatically increasing national and international attention; and, in recent years, there has been increased research and an increasing database on the topic of how climate change might affect, or be affected by, water supply systems and projects. The USGS report (2009) summarizes the issue as follows:

> "Observational evidence shows that many natural systems are being affected by regional climate changes, particularly temperature increases…Climate change is but one of many dynamic processes impacting water resources management. Other processes (for example, change in population size and location, economic development and land use, aging infrastructure, ground-water development, and changing social values) also have major influences on water resources and must be considered along with climate change in a holistic approach to water resources management. Climate change has the potential to affect many sectors in which water resource managers play an active role, including water availability, water quality, flood risk reduction, ecosystems, coastal areas, navigation, hydropower, and other energy sectors. These changes may have adverse or positive impacts on one or more sectors. Any or all of these changes could occur gradually or abruptly."[4]

In April 2011, Reclamation released its first report under the authorities of the SECURE Water Act and presents the current information available for the Colorado River Basin. Future reports will build upon the level of information currently available and the rapidly developing science relevant to address the authorities within the SECURE Water Act. Based on this and other climate change studies, we can expect much of the Western United States to experience warming with central estimates varying from roughly 5–7 degrees Fahrenheit (°F). As related to precipitation, the Colorado River Basin is projected to have roughly equal chances of becoming wetter or drier. With respect to this project, no models are currently available that would have sufficient detail or sensitivity to capture the future climate for the proposed Narrows Project, which involves storage and distribution of 5,400 acre-feet of water per year. Historic Utah records indicate that both temperatures and precipitation in Utah (http://www.ncdc.noaa.gov/oa/climate/research/cag3/ut.html) have been increasing. However, without verified models addressing climate change at this project level, Reclamation concludes that, at this time, data and modeling tools are not yet developed to the point that meaningful analysis of a small project can be achieved.

1.8 Permits, Authorizations, and Agreements

Implementation of the Proposed Action could require a number of authorizations or permits from State and Federal agencies. These are summarized below.[5]

- Reclamation approval of the SRPA loan and congressional approval of the necessary funds to construct the Narrows Project.
- Reclamation authorization for SWCD use of withdrawn lands to construct and operate Narrows Dam and Reservoir.
- Utah Division of Water Quality authorization needed for a Storm Water

[4] *Climate Change and Water Resources Management: A Federal Perspective*, Circular 1331, U.S. Geological Survey, Reston, Virginia, 2009. p. 1.

[5] Before beginning activities under the Proposed Action, SWCD would consult with both the USACE and Utah Department of Natural Resources to determine which permits would be necessary.

Discharge Permit (Section 402 of the Clean Water Act, as amended).

- A USACE permit in compliance with Section 404 of the Clean Water Act, as amended, or Utah Department of Natural Resources authorization for a State Stream Alteration Permit (Section 404 of the Clean Water Act, as amended).
- Utah Division of Water Quality authorization for a Utah Pollution Discharge Elimination Permit (Section 402 of the Clean Water Act, as amended).
- Reclamation consultation with the State Historic Preservation Office (SHPO).
- Utah Division of Water Quality authorization needed for 401 Certification following a Level II Antidegradation Review.
- Utah Division of Water Quality authorization needed for State Water Quality Certification pursuant to Section 401 of the Clean Water Act.
- Utah Division of Water Quality authorization needed for Utah Pollutant Discharge Elimination System General Permit for Construction Dewatering if dewatering is required.

1.9 DOCUMENT ORGANIZATION

This document follows the requirements established in the CEQ regulations (40 Code of Federal Regulations [CFR] 1502.10 and the Interior NEPA regulations, 46 CFR Subpart E). The document consists of the following main chapters:

- Executive Summary
- Chapter 1 – Purpose of and Need for the Action
- Chapter 2 – The Alternatives Considered Including the Proposed Action Alternative
- Chapter 3 – Affected Environment and Environmental Consequences
- Chapter 4 – Consultation and Coordination
- Chapter 5 – List of Preparers
- Chapter 6 – Bibliography, Glossary of Terms, and List of Acronyms and Abbreviations
- Chapter 7 – Index
- Appendix A – 1984 Compromise Agreement
- Appendix B – Identification and Evaluation of Potential Damsites
- Appendix C – Biological Opinion for the Proposed Narrows Project – A Small Reclamation Project Act (SRPA) Loan
- Appendix D – Fish and Wildlife Coordination Act Report
- Appendix E – Cultural Resource Coordination
- Appendix F – 2006 Eutrophication Study
- Appendix G – Environmental Commitments
- Appendix H – Comments and Responses
- Appendix I – Narrows Environmental Impact Statement Modeling Methodology
- Appendix J – Small Reclamation Projects Act Loan Application
- Appendix K – Section 404(B)(1) Analysis Narrows Project, San Pete Water Conservancy District

CHAPTER 2

The Alternatives Considered, Including the Proposed Action Alternative

2.0 INTRODUCTION

As the lead Federal agency for this FEIS, Reclamation's action under review is that Reclamation will: 1) approve or deny the SRPA loan application and 2) determine whether to allow SWCD to use 304.5 acres of Reclamation withdrawn land. The USACE and USDA Forest Service also must make decisions based on this FEIS. To fully explore the effects of the proposed action and possible alternate courses of action, the SWCD, working with Reclamation and the other cooperating agencies, developed an array of alternatives to answer the issues raised in chapter 1. In chapter 2, you will find:

- A description of the Proposed Action and the other alternatives that were analyzed.
- A comparison of how the alternatives would achieve the purpose of and need for the action.
- A comparison of how the alternatives address the issues identified in chapter 1.

2.1 THE PROCESS USED TO DEVELOP THE ALTERNATIVES

The National Environmental Policy Act requires all agencies to write a detailed statement for major Federal actions having a significant effect on the environment, which must include a discussion of alternatives to the proposed action (see section 102(2)(c) of NEPA). In addition, all Federal agencies must study, develop, and describe appropriate alternatives to recommended courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources. To be considered reasonable, each alternative in the array (except "no action") must meet the proposal objectives (chapter 1) and the environmental standards (selection criteria).

Reclamation, as the lead agency, formed an interdisciplinary team that consisted of various Federal and State agencies and the SWCD. This team was formed to develop a set of selection criteria that could be used to formulate alternatives to the Narrows Project that would meet the purpose of and need for the proposed non-Federal Narrows Project. The selection criteria are:

1. The project must include an agricultural and municipal irrigation water supply as a project purpose and provide expected project benefits for at least the duration of the loan repayment period.
2. The project must provide an additional water supply to north Sanpete County during the season when it is needed.
3. The project must comply with all statutory and regulatory requirements and guidelines including Section 404 of the Clean Water Act, the National Historic Preservation Act (NHPA), and the Endangered Species Act.
4. The project must satisfy Small Reclamation Project Act requirements. The SRPA requires that a project be technically and financially feasible and in

compliance with environmental requirements. To be considered financially feasible, the following would apply:

- ♦ The project sponsor should pay a minimum of 25% of the project costs at the time of construction.
- ♦ Loan repayment must use 100% of the project's irrigation amortization capacity (with certain exceptions), and repayment must be completed in 40 years or less. The amortization capacity is a measure of farmers' and ranchers' ability to repay.
- ♦ The loan factor (a measure of Federal interest subsidy) for the project must be 0.5 or less.

SRPA allows some flexibility in meeting the financial feasibility requirement. In some situations, the irrigation amortization capacity may result in a repayment period extending beyond 40 years or a loan factor that exceeds 0.5. The sponsor, at its discretion, may use other financial assets to either increase the annual payment or increase the upfront cost share to reduce the amount of the loan. Either, or a combination, of these options may reduce the repayment period and the loan factor to acceptable levels. In other words, the sponsor may contribute funds in excess of its ability to pay, relying then on a "willingness to pay" to ensure financial feasibility.

This willingness to pay component recognizes the limitations placed by Reclamation on computing the agricultural benefits component of the farm budget.[1] The farm budget limitations may underestimate the sponsor's irrigation amortization capacity, suggesting that the farmer's ability to repay the loan may be less than is actually the case. Willingness to pay also allows the sponsor to consider other intrinsic values of the water that normally would not be considered or would be difficult to consider in an economic evaluation (benefit-cost analysis). The sponsor is responsible to determine if the value of the water benefits justifies its cost. In SRPA cases, where Reclamation's involvement is limited to making a loan, use of willingness to pay is an appropriate approach. The SRPA requires the sponsor to demonstrate only that additional financial assets exist and that the sponsor commits to using these assets for the project.

5. The project must divert and store water under legal claim of right and priority in full compliance with State law.

2.2 Detailed Description of Alternatives

2.2.1 No Action Alternative

The No Action Alternative represents the conditions of the affected area if Reclamation does not approve the SRPA loan and use of withdrawn lands by SWCD for the non-Federal Narrows Project (figure 2-1). It establishes the baseline for evaluating the environmental impacts of providing a supplemental water supply to north Sanpete County. It also establishes anticipated conditions in the affected two-county area without further development and assumes that irrigation operations would continue according to historic use.

[1] The farm budget is used to compute the irrigation amortization capacity.

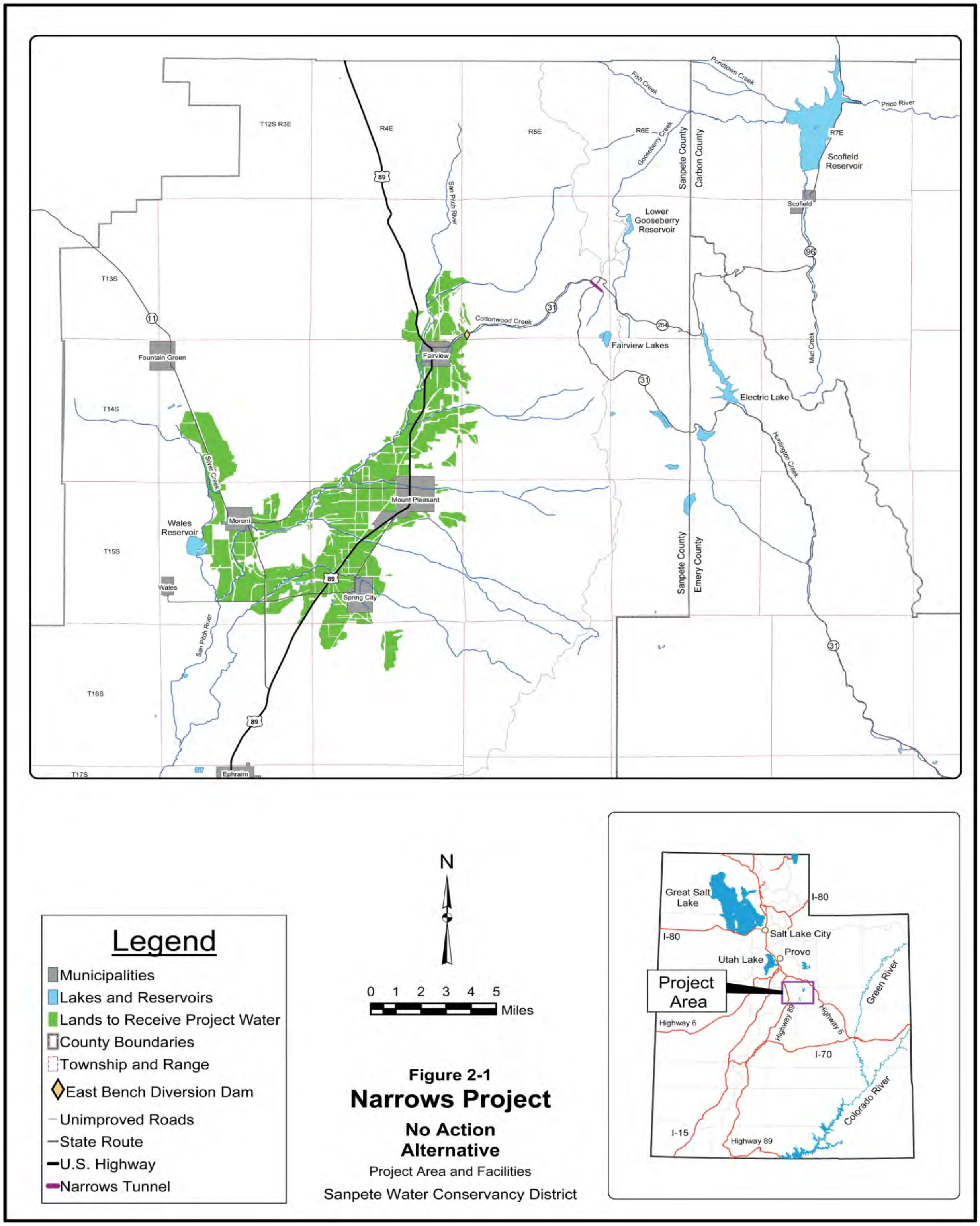


Figure 2-1.—Narrows Project, No Action Alternative, Project Area and Facilities.

Under this alternative, the Narrows Dam and Reservoir would not be constructed. Without the dam construction, there would be no need to relocate SR-264; and there would be no recreational facilities constructed at the reservoir site. The East Bench, Oak Creek, and Upper Cottonwood Creek Pipelines would not be built. The demand on municipal water supplies in Fairview, Mount Pleasant, Spring City, and Moroni would continue to increase as supplies for outdoor municipal uses run short and as the population increased. Most likely, there would be a conversion of agricultural water to municipal use as the demand for municipal water increased with a growing population.

Water conservation measures would continue to be implemented. These conservation measures would reduce average shortages on irrigated farmland to about 29.5% or about 15,250 acre-feet per year. Implementing new conservation measures most likely would reduce irrigation return flows now supplying wetlands, aquatic habitat, and downstream users by an estimated 3,500 acre-feet per year.

There would be no wetlands, wildlife, or fisheries mitigation measures implemented under the No Action Alternative because there would be no impact to existing wetlands and wildlife habitat. Streamflows in Gooseberry and Fish Creeks would remain unaltered from their present state. Under this plan, no flat water fishery would be developed in the proposed reservoir basin.

2.2.2 Proposed Action Alternative

If SWCD obtains its requisite financing, either through the SRPA loan or from other private funding source(s), and if Reclamation approves the land use, a supplemental water supply may be developed for presently irrigated lands and M&I water users in north Sanpete County. This additional water supply would satisfy the 1984 Compromise Agreement.

The Proposed Action would provide funding for and authorize the use of Federal lands by SWCD to build a private dam and reservoir to provide north Sanpete County an average annual supply of 4,281 acre-feet of supplemental irrigation water for 15,420 acres of presently irrigated farmland and 855 acre-feet of water for municipal use. The project facilities would include construction of the 17,000-acre-foot Narrows Dam and Reservoir on Gooseberry Creek, pipelines to deliver the water to existing water distribution systems, rehabilitation of the existing 3,100-foot Narrows Tunnel to control releases, and relocation of 2.9 miles of SR-264. The dam would be 120 feet high with a crest length of 550 feet and crest width of 30 feet.

SWCD's non-Federal Narrows Project would include a transmountain diversion of water from the Gooseberry Creek drainage of the Price-Green-Colorado River Basins to the San Pitch-Sevier River of the Great Basin. Geographically, the project facilities are located in close proximity to the drainage divide between the Price River system and the San Pitch River system. The general location is shown on the location map at the front of this document.

The Price River flows southeast to the Green River, a tributary of the Colorado River. The San Pitch River flows southwest to the Sevier River, which is completely consumed in the Bonneville Basin, a part of the arid Great Basin. The county line dividing Sanpete County and Carbon County is located more than 6 miles downstream from and about 3 miles east of the proposed Narrows damsite on Gooseberry Creek.

The proposed damsite, the transmountain Narrows Tunnel, and the project water distribution facilities are all located in Sanpete County. The source of the project water supply generally arises in Sanpete County and naturally flows into Carbon County and the Price River system, unless the flows are captured and diverted transmountain to Sanpete County. The service area of the Narrows Project would be situated in the San Pitch River drainage.

A dam and reservoir would be constructed on Gooseberry Creek, and water would be diverted through an existing tunnel to Cottonwood Creek. Pipelines would be constructed to deliver the water to existing water distribution systems located near Fairview, Utah. Recreation facilities would be developed at the reservoir, and a 2,500-acre-foot minimum pool for fish habitat would be maintained.

Mitigation measures would be implemented to offset adverse impacts to wetlands, terrestrial wildlife, and stream fisheries. In addition to mitigation measures to offset project impacts, other measures would be included to enhance or improve fish and wildlife habitat. Additional water conservation measures would be required independent of the Proposed Action. However, according to SWCD, only those water users who have implemented or would agree to implement water conservation measures would be eligible to receive project water. These practices would include improved water conveyances such as lined canals, pipelines, or improved irrigation practices such as sprinklers or gated pipe.

SWCD would develop a comprehensive mitigation plan including environmental monitoring and maintenance programs that would ensure that aquatic and wildlife habitat replacement needs are met.

2.2.2.1 Water Supply and Use

The non-Federal Narrows Project water supply would come from Upper Gooseberry Creek and its tributaries. The Upper Gooseberry Creek drainage (including Fairview Lakes) has an average inflow of about 9,200 acre-feet of water. Of that amount, 2,300 acre-feet are diverted transmountain through the existing Narrows Tunnel by the Cottonwood-Gooseberry Irrigation Company (CGIC). This diversion consists of 1,900 acre-feet from Gooseberry Creek and 400 acre-feet from Boulger Canyon. The Fairview Lakes water (2,300 acre-feet) is not considered part of the Narrows Project water. The majority of the flow in Upper Gooseberry Creek comes from direct snowmelt. Peak flows in May and June are several times greater than flow during the remainder of the year.

Under existing water rights agreements, a maximum of 5,400 acre-feet per year of project water would be released through the Narrows Tunnel. The reservoir would provide long-term carryover storage for consecutive drought years. With the long-term carryover storage, the Proposed Action would produce an annual average yield of 5,136 acre-feet per year. Table 2-1, Water Allocation and Use for the Narrows Project, shows the allocation of project yield between irrigation and M&I uses.

Table 2-1.—Water Allocation and Use for the Narrows Project

Water Source or Use	Acre-feet
Gooseberry Creek drainage	5,136
M&I[1]	855
Irrigation[1]	4,281

[1] It is estimated that the balance between M&I and irrigation water will change as the demand for M&I use increases (M&I use will increase, and irrigation use will decrease).

For purposes of this EIS, the average annual M&I delivery is projected to be 855 acre-feet per year, although initially, it would be a lesser amount (probably 500 acre-feet per year) for the M&I allotment. Of the 5,136-acre-foot average annual project yield, 855 acre-feet would be used for the M&I allotment and the remaining 4,281 acre-feet for the irrigation allotment. Future requirements for additional M&I water could be as high as 2,800 acre-feet per year.

The Narrows Project irrigation supplies, along with present irrigation supplies, are expected to be used primarily for production of crops such as alfalfa and grass hay to support beef and dairy enterprises. The Narrows Project irrigation supplies would be used primarily in the latter part of the growing season when existing water shortages are the most critical.

Figure 2-2 shows how the proposed Narrows Project's water supply would be used to augment existing local agricultural supplies. Curve 1 (crop consumptive use) shows the net irrigation requirement (crop water needs) for the project-eligible lands. This is the same as Curve 1 in figure 1-2. Curve 2 (diversion demand with efficiency improvements) shows the diversion demand that would result after implementing the planned efficiency improvements. (See Curve 3 in figure 1-2.) Curve 3 (local supply) shows the local supply, and Curve 4 (local and project supply) shows the local supply augmented by the project supply. Curves 5 (needs met local supply) and 6 (needs met local and project supply) show how the crop water needs would be satisfied by local supplies and local supplies augmented by project supplies. (Curve 5 is the same as Curve 6 in figure 1-2.)

As noted in section 1.5.2, under implementation of the Narrows Project, there would be an estimated 15,250-acre-foot average annual shortage in the diversion demand, assuming a portion of the nongrowing season precipitation was retained in the soil root zone to help meet early-season water needs. With the project water, the annual average shortage could be reduced to about 10,969 acre-feet per year or 21.1% of the diversion demand. With below average precipitation, the remaining shortage would be about 29,698 acre-feet per year or about 57.5%. In either case, the remaining shortage still would be considerably greater than the optimal 5% used for a planning target. Likewise, Curve 6 shows that, even though project supplies would provide additional water, significant soil moisture deficits still would be a serious concern. The remaining shortage is great enough to warrant the pursuit of other measures to further improve irrigation efficiencies or augment water supplies.

Section 1.5.2 discusses how implementing efficiency improvements would reduce the amount of irrigation water losses. The efficiency improvements would be expected to reduce water available to wetlands, aquatic habitat, and downstream users by up to 3,500 acre-feet per year. However, inefficiencies in project water would offset the 3,500-acre-foot-per-year reduction by about 1,820 acre-feet per year. This would result in a net loss to wetlands, aquatic habitat, and downstream users of about 1,680 acre-feet per year.

2.2.2.2 Construction Features and Project Operations

2.2.2.2.1 General

The principal construction features of the Narrows Project would consist of one reservoir and three pipelines. Narrows Dam and Reservoir (figure 2-3) would be constructed on Gooseberry Creek and would provide storage for the project water supply. Oak Creek Pipeline would convey water from an existing diversion dam located on Cottonwood Creek northward to the Oak Creek Irrigation Company, north of the community of Fairview. The East Bench Pipeline would convey project water from the same existing diversion dam on Cottonwood

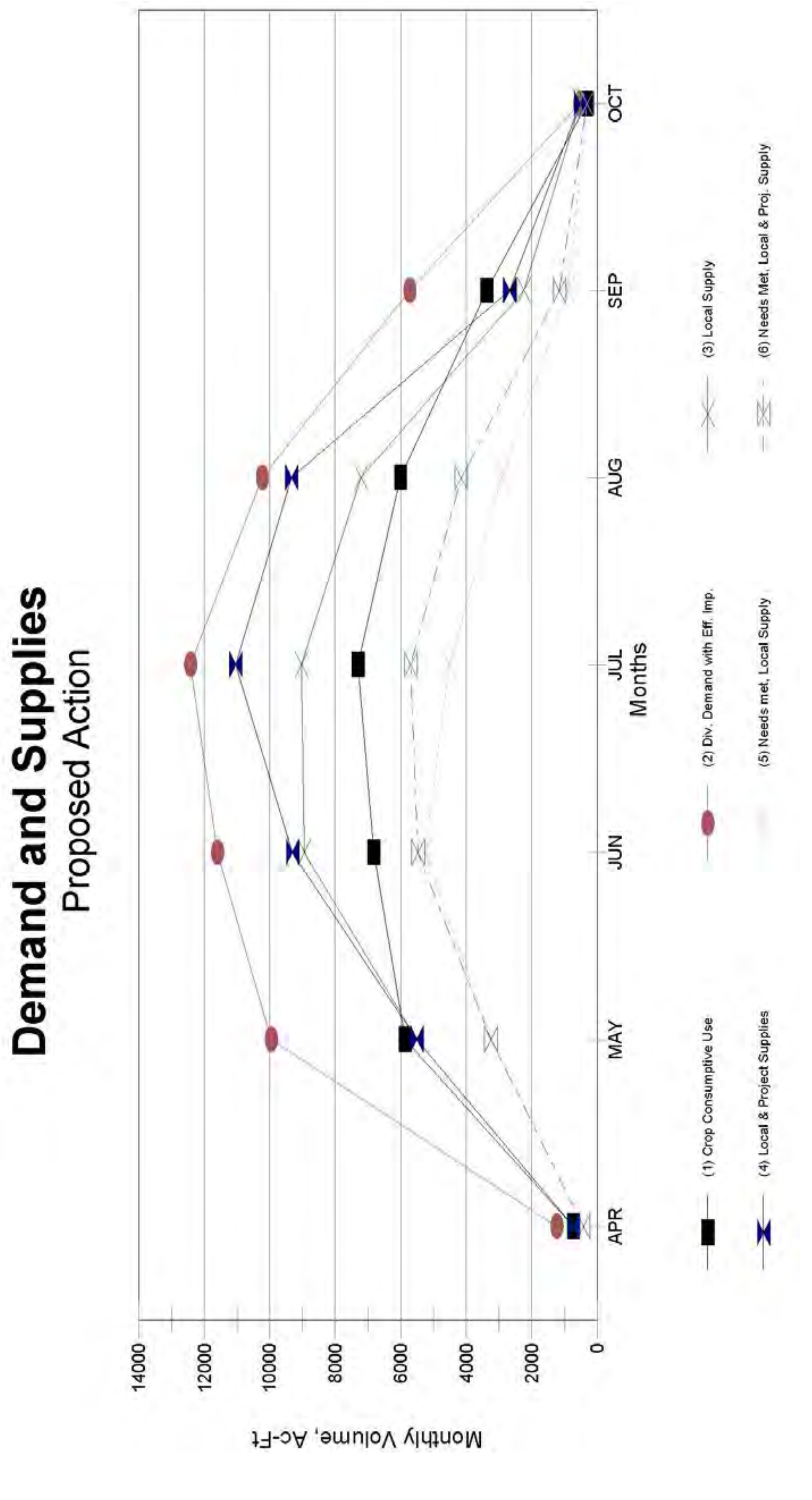


Figure 2-2.—Demand and Supplies, Proposed Action.

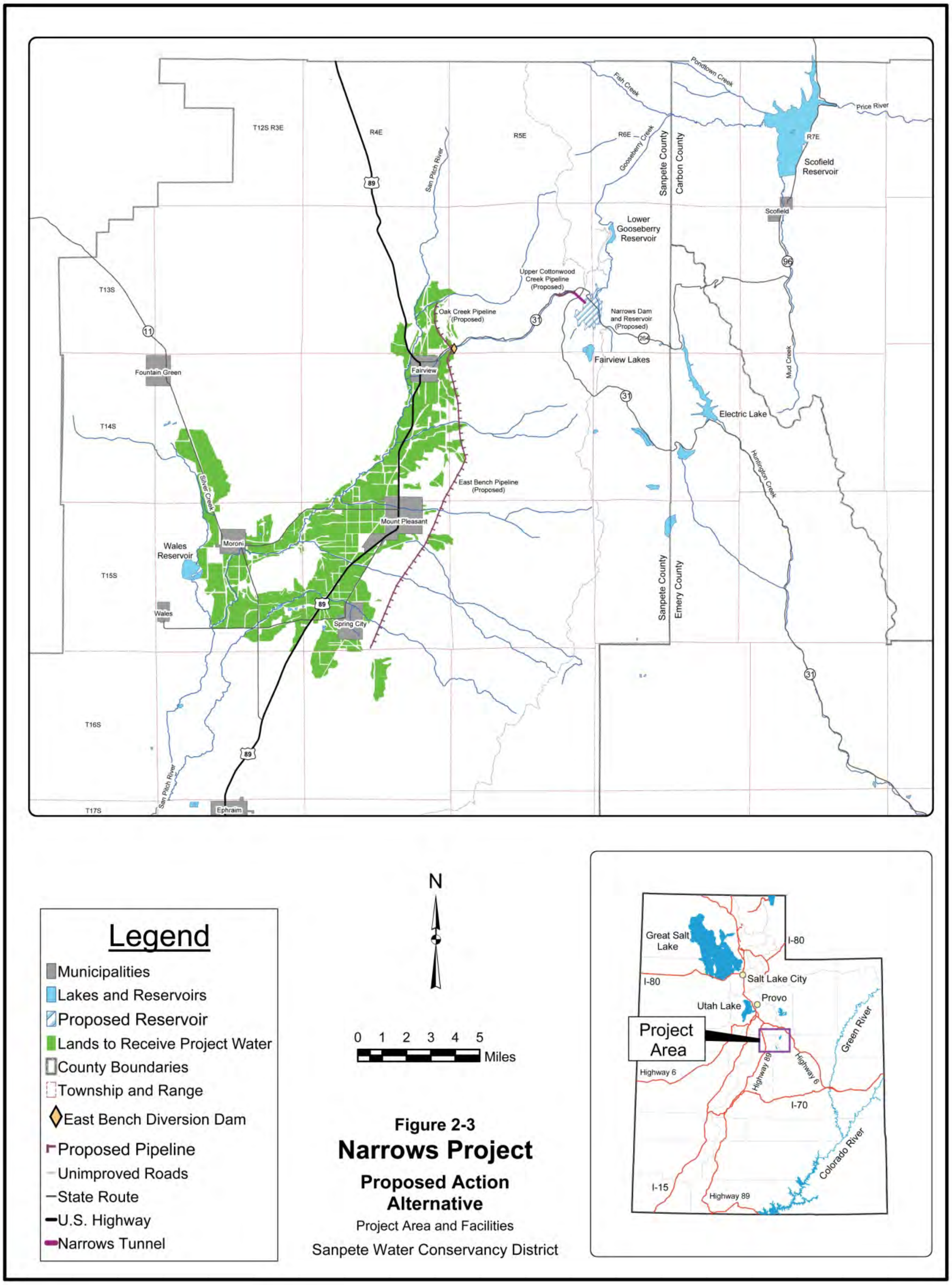


Figure 2-3.—Narrows Project, Proposed Action, Project Area and Facilities.

Creek southward to areas of use along the east bench. Upper Cottonwood Creek Pipeline would carry project water from the Narrows Tunnel outlet to a point 300 feet downstream from the confluence of Cottonwood Creek and Left Hand Fork to protect the stream channel above that point from increased flows that would occur without the pipeline.

Other important features of the project would include rehabilitating the existing Narrows Tunnel to control releases; relocating SR-264; modifying parts of Forest Development Road (FDR) Nos. 50124, 50150, and 50225; and modifying the snowmobile parking area along FDR No. 50150. Recreation facilities, primarily for boating, fishing, camping, and picnicking, would be provided at Narrows Reservoir to help satisfy projected recreation needs in the area. Title to the dam and appurtenant water facilities would be in the name of SWCD. Title to the land underlying those facilities and associated recreation facilities would remain in the name of the United States and under Reclamation management.

Specific proposed fish and wildlife mitigation measures include the following:

- Restoring year-round flows in two small tributaries to Gooseberry Creek (above the proposed Narrows Reservoir); providing minimum instream flows of 1.0 cfs in Gooseberry Creek below Narrows Dam.
- Providing a multiple-level outlet at Narrows Dam to regulate the temperature of releases to Gooseberry Creek from Narrows Reservoir.
- Modifying and/or stabilizing streambanks and associated riparian zones along Middle Gooseberry Creek.
- Providing releases from the Narrows Reservoir into Gooseberry Creek for flushing flows.
- Acquiring and/or improving stream channel for fish habitat (Middle Gooseberry Creek).
- Providing winter releases to Cottonwood Creek.
- Providing summer flows in lower Cottonwood Creek.
- Constructing a pipeline in the Upper Cottonwood Creek area to convey project water outside the stream channel (from the tunnel outlet to a point 300 feet downstream from the confluence of Cottonwood Creek and Left Hand Fork).
- Providing a minimum 2,500-acre-foot conservation pool in Narrows Reservoir for fish.
- Reducing external phosphorus loading to Scofield Reservoir.
- Providing mitigation and enhancement of upland habitat (quantified in terms of mule deer and Brewer's sparrow habitat units, each of which represent other wildlife species dependent on similar habitat) in the following ways:
  - Acquiring conservation easements around the Narrows Reservoir.
  - Acquiring and fencing land adjacent to the Price River below Scofield Reservoir to protect wildlife habitat.
  - Creating new wetlands and enhancing existing wetlands to mitigate for 100 acres of wetlands areas inundated by the reservoir and affected by changes in the stream channels.

2.2.2.2.2 Design and Operation

2.2.2.2.2.1 Narrows Dam and Reservoir.— Narrows Dam and Reservoir would be constructed on Gooseberry Creek, about 9 miles east of Fairview, Utah (see figure 2-3). The dam would be a zoned earthfill embankment structure using locally available earth material. The surface elevation of the proposed reservoir would be at 8,690 feet mean sea level (msl). The embankment would have 3:1 (horizontal to vertical) slopes upstream and downstream. The proposed crest width of 30 feet would allow SR-264 to cross the dam. The embankment zones would consist of a relatively impervious core, a random zone both upstream of and downstream from the core, and a rockfill zone on the upstream face for slope protection. The embankment would contain an estimated total volume of 363,000 cubic yards of material. The dam would be designed to withstand effects induced by seismicity associated with mining of the coal reserves east of the East Gooseberry Fault (approximately 1 mile away).

Narrows Reservoir would have two main outlets—the Gooseberry Creek outlet and the Narrows Tunnel outlet. The Gooseberry outlet would be constructed through the dam to provide downstream releases for fisheries and emergency evacuation of reservoir water. This outlet would have a 305-cubic-foot-per-second (cfs) capacity. Multiple intakes would be provided to allow temperature control of water released to Gooseberry Creek. The Narrows Tunnel outlet would control releases through the mountain ridge for the transmountain diversion.

Preliminary designs for the dam call for separate low flow intakes at three different levels within the reservoir. These intakes would have their own gates and would be able to deliver up to a 10-cfs release each, even when the main outlet was being inspected or maintained.

The spillway would be a drop inlet (morning glory, so called because of its resemblance to the shape of the flower) structure and would have a 775.0-cfs discharge capacity. The probable maximum thunderstorm flood could be safely stored in the reservoir without overtopping the dam. However, the spillway capacity, combined with that of the two outlet works, would protect the dam against the 100- and 10,000-year snowmelt floods.

The reservoir formed behind the dam would extend about 2 miles up Gooseberry Creek and would have a total capacity of 17,000 acre-feet and a water surface area of about 604 acres. All of the average annual storable flows (excluding Fairview Lakes) to the reservoir, about 8,185 acre-feet, would come from the Gooseberry Creek drainage.

Narrows Reservoir's active capacity, or that portion of stored water that would be used to satisfy project water needs, would consist of 14,500 acre-feet. Of this amount, 4,500 acre-feet would be dedicated to providing instream flows in Gooseberry Creek below the dam. The dead and inactive capacities of about 2,500 acre-feet would form the reservoir's minimum pool and would not be drawn upon to benefit recreation and fishing use at the reservoir (the 2,500 acre-feet of storage is inactive because it is below the elevation of the tunnel and cannot be diverted to Sanpete Valley).

The proposed reservoir is designed for long-term carryover storage. The dead and inactive storage would be more than adequate to store the 100-year inflow of sediment into the reservoir. Less than 20 acre-feet of sediment would accumulate in a 100-year period, which is less than 1% of the inactive capacity. A summary of the design data for the proposed Narrows Dam and Reservoir, two structural alternatives, and the No Action Alternative is shown in table 2-2.

Narrows Reservoir would fluctuate on a seasonal basis as water is released during the irrigation season. The drawdown would average 9 feet annually. On an average basis, the exposed shoreline area would be 113 acres. This is the difference between the average annual high water surface area and the average annual low water surface area.

Automated flow measurement devices would be installed to collect data in real time using radio or satellite communications. These devices would measure flow at the following locations:

- Discharges from Fairview Lakes
- Discharge from Narrows Dam to Gooseberry Creek
- Flow of Gooseberry Creek at USDA Forest Service campground
- Discharge from Narrows Tunnel
- Flow of Cottonwood Creek near the mouth of the canyon

These data would be made available to the public on an Internet Web site.

2.2.2.2.2.2 Oak Creek Pipeline.—The Oak Creek Pipeline would be a 10-inch-diameter polyvinyl chloride (PVC) buried pipeline with a capacity of 2.5 cfs and a length of 2.5 miles. The pipeline would convey water from an existing diversion dam on Cottonwood Creek to the Oak Creek Irrigation Company, north of Fairview. A right-of-way, 30 feet wide and 2.5 miles long, would be required.

2.2.2.2.2.3 East Bench Pipeline.—The East Bench Pipeline would convey project water from an existing diversion dam on Cottonwood Creek southward to areas of use along the east bench. The pressurized pipeline would have a total length of 13.5 miles (see figure 2-3) and would have a 21.5-cfs capacity at its head. The pipeline would include 1.4 miles of reinforced concrete pipe, 4.2 miles of concrete cylinder pipe, and 7.9 miles of PVC pipe. Pipe diameters would range from 27–18 inches.

The pipeline would deliver water to the Spring Creek, Birch Creek, North Creek, Pleasant Creek, Twin Creek, Cedar Creek, and Horseshoe Irrigation Companies. Water delivered to each irrigation company would be discharged from the pipeline into the existing regulating pond for each company's pressurized irrigation system. This pipeline also would have a 30-foot-wide right-of-way.

2.2.2.2.2.4 Upper Cottonwood Creek Pipeline.—A 50.0-cfs capacity, reinforced concrete pipeline would be constructed from the existing transmountain Narrows Tunnel outlet to a point 300 feet downstream from the confluence of Cottonwood Creek and Left Hand Fork. The 30-inch-diameter pipeline would carry project water outside the stream to prevent damage to the channel. The pipeline would be constructed in the shoulder of SR-31 and would have a length of about 0.8 mile.

At the Narrows tunnel outlet, a control structure would divide the flow, allowing releases into Cottonwood Creek to maintain minimum instream flows and improve the fishery, while the remainder of the flow would be conveyed to the pipeline. The pipeline flow would be discharged into Cottonwood Creek 300 feet downstream from the confluence with Left Hand Fork, where an energy dissipation structure would be constructed to reduce flow velocity and control streambed degradation. Energy dissipation would be provided before flows were discharged into Cottonwood Creek. A highway right-of-way 30 feet wide and 0.8 mile long would be required. About half of this right-of-way would be on Reclamation withdrawn lands and the other half on privately owned lands.

Table 2-2.—Summary of Design Data for Narrows Project for All Alternatives

Item	Unit	No Action	Proposed Action	Mid-Sized Reservoir	Small Reservoir
Dam					
Height	feet	N/A	120	110	100
Crest length	feet	N/A	550	475	425
Crest width	feet	N/A	30	30	30
Material volume	cubic yards	N/A	363,000	292,000	220,000
Discharge capacity					
Outlet works	cfs	N/A	305	258	210
Spillway	cfs	N/A	775	775	775
Spillway elevation	msl	N/A	8,690	8,680	8,670
Reservoir capacity					
Active storage	acre-feet	N/A	14,500	9,950	5,400
Inactive and dead storage	acre-feet	N/A	2,500	2,500	2,500
Total	acre-feet	N/A	17,000	12,450	7,900
Surface area					
At top of active capacity	acres	N/A	604	489	362
At top of inactive and dead capacity	acres	N/A	144	144	144
Average during recreation season	acres	N/A	454	277	238
Drawdown					
Average annual	feet	N/A	9	11	14
Average during recreation season	feet	N/A	8	10	11
Maximum	feet	N/A	26	30	22
Average annual	acre-feet	N/A	3,974	3,773	3,478
Average during recreation season	acre-feet	N/A	3,512	3,300	3,007
Pipelines					
Oak Creek					
Length	miles	N/A	2.5	2.5	2.5
Capacity	cfs	N/A	2.5	2.5	2.5
Diameter	inches	N/A	10	10	10
East Bench					
Length	miles	N/A	13.5	13.5	13.5
Capacity	cfs	N/A	21.5	21.5	21.5
Diameter	inches	N/A	27–18	27–18	27–18
Upper Cottonwood Creek					
Length	miles	N/A	0.8	0.8	0.8
Capacity	cfs	N/A	50	50	50
Diameter	inches	N/A	30	30	30
Narrows Tunnel rehabilitation					
Length	feet	N/A	3,100	3,100	3,100
Capacity	cfs	N/A	60	60	60
Diameter	inches	N/A	36	36	36
SR-264 relocation					
Length	miles	N/A	2.9	2.9	2.9
Width	feet	N/A	24	24	24

The possibility of extending Upper Cottonwood Creek Pipeline the entire length of the canyon was also explored; but, due to the topography and geology of the canyon, such a pipeline would be infeasible and potentially environmentally damaging. A total of 104 landslides, most of which are active, have been mapped in the canyon. The topography of the canyon suggests that the most likely location for the pipeline would be within the existing highway alignment. However, due to the landslides, the highway has continual stability problems; and repairs are needed on an annual basis. This instability would present unacceptable safety and maintenance problems for the high-pressure pipeline. Construction of the pipeline also would increase significantly project costs and costs to water users.

2.2.2.2.2.5 Narrows Tunnel Rehabilitation.—The Narrows Tunnel is an existing water conveyance tunnel approximately 3,100 feet long. The 8-foot-diameter tunnel, which was completed in 1968, was constructed to divert irrigation water to the Fairview area and eventually to serve as the outlet for Narrows Reservoir. The tunnel was not concrete-lined as planned; and since its construction, the tunnel has experienced severe stability problems. Steel sets with wooden lagging were installed in selected areas of the tunnel to support the unstable areas. The steel sets, however, were widely spaced; and loose rubble significantly loaded the wooden lagging between sets. With time, the lagging began to fail, permitting roof and rib sloughing over significant portions of the tunnel. When it became evident that the tunnel could eventually close, a 36-inch corrugated metal pipe was installed through the least stable tunnel sections to maintain a waterway. This measure is considered to be only a temporary fix because the corrugated metal pipe (CMP) eventually would collapse due to rust or excessive earth loads.

The tunnel was rehabilitated in 2011 to have a 60-cfs discharge capacity. A control gate would be installed near the tunnel inlet to regulate releases through the tunnel. Remote control of the Narrows Tunnel operating gate would be provided to regulate automatically the releases through the tunnel. These controls would be coupled to an automated stream gauging station on Cottonwood Creek. The streamflow in Cottonwood Creek would be monitored constantly by these controls. As the streamflow increased during high runoff events such as thunderstorms, the tunnel operation would be discontinued when the flow exceeded 100 cfs near the mouth of the canyon. An automated gauging station would measure flow data and communicate with an automated gate controller at the tunnel. Under this operating regime, the project flows through the tunnel would not increase streamflows above what is considered safe for channel stability. Increased flows under project conditions would be well below the 50-year channel-forming discharge.

2.2.2.2.2.6 State Route 264 Relocation.— Narrows Reservoir would inundate about 0.8 mile of SR-264, which provides access between Fairview and Scofield, Utah. Under the proposed project, this road would be routed around the perimeter of the existing snowmobile parking area. The road would be relocated to include 0.3 mile of FDR No. 50150 and No. 50124 (gravel road) to Lower Gooseberry Reservoir and by constructing 2.6 miles of new road and providing asphalt surfacing for the entire length of the relocation. This new road would cross Narrows Dam. The road relocation would increase the travel distance between Fairview and Scofield by 1.2 miles. The relocated road would have a total pavement width of 24 feet and would be designed to the same standard as the existing road.

2.2.2.2.2.7 Recreation Facilities.—Public recreation facilities for the Narrows Project would be located along the northwest shore of Narrows Reservoir (see figure 2-3). The facilities would include a boat ramp, boat slips, a day use area with 10 picnic sites, restroom facilities, and a 60-unit campground. Access for the handicapped would be provided. All recreation facilities and water systems (nonsurface source) would be constructed to USDA Forest Service standards. The water source for the recreation facilities would be required to meet State of Utah drinking water standards. Although a formal agreement has not been reached, it is anticipated that USDA Forest Service would administer the recreation facilities at the Narrows Reservoir under an operation agreement with SWCD and Reclamation. Title to the recreation facilities would remain in the name of the United States.

2.2.2.2.3 Fishery Mitigation Measures

A total of 11 fishery mitigation measures have been included in the project to mitigate for adverse impacts. To the extent possible, an attempt was made to mitigate "in place" and "in kind."

2.2.2.2.3.1 Restore Streamflow in Gooseberry Creek Tributaries.—Implementing this aquatic mitigation procedure would consist of altering the release of water from Fairview Lakes, which are owned and operated by CGIC. Presently, during the spring runoff period, water is stored in Fairview Lakes and released for irrigation use in the Fairview area. This release is a transbasin diversion of water to the San Pitch River drainage. With the historic operational pattern, the small unnamed tributaries to Gooseberry Creek located downstream from Fairview Lakes are dry several months each year. This mitigation measure involves providing year-round releases, averaging about 2.6 cfs, from Fairview Lakes into two of these tributaries to Gooseberry Creek. This amounts to a 1.3-cfs average flow per channel. The total annual amount of water that is released from Fairview Lakes would not be changed. However, the flow would be dispersed during the entire year rather than the present 18- to 20-week discharge period, resulting in a higher water level in the lakes for more of the irrigation season.

Water released from Fairview Lakes during the year would be captured and stored in Narrows Reservoir. Upon notification by CGIC, the Fairview Lakes water in Narrows Reservoir would be released through the Narrows Tunnel to the San Pitch River drainage.

This mitigation measure would provide not only aquatic mitigation benefits to the Narrows Project but also both aesthetic and recreational benefits to Fairview Lakes. These benefits would be a result of CGIC being able to maintain the lakes at higher water levels during more of the prime summer recreational season.

SWCD would be responsible for entering into operating agreements necessary to implement these year-round releases. SWCD also would ensure that the releases were made according to environmental commitments. Approval of a loan under the SRPA would be contingent upon securing these agreements with CGIC and an endorsement of the environmental commitments by SWCD.

Implementing this mitigation measure would result in creating approximately 2.3 stream miles of spawning and rearing habitat for cutthroat trout.

2.2.2.2.3.2 Provide Minimum Flows Below Narrows Dam.—The project plan calls for a 1.0-cfs minimum year-round release from Narrows Reservoir to Gooseberry Creek.

That flow, combined with flows from springs located immediately below the dam, would be expected to produce a streamflow of at least 1.5 cfs at the Gooseberry Campground. If the flow at the campground is less than the expected 1.5 cfs, then up to an additional 0.25 cfs would be released to help achieve that flow rate.

2.2.2.2.3.3 Provide a Multiple-Level Intake at Narrows Dam.—A multiple-level intake would be provided at Narrows Dam to regulate the temperature of water released to Gooseberry Creek. Each of the three intakes, planned at elevations 8,640; 8,660; and 8,680 feet, respectively, would be designed with a 10.0-cfs capacity.

2.2.2.2.3.4 Stabilize Streambanks Along Middle Gooseberry Creek.—This mitigation measure would involve modifying Gooseberry Creek channel between Lower Gooseberry Reservoir and Narrows Dam to provide better habitat with the reduced flows. It is expected that the channel eventually would narrow by itself due to the decreased flow. However, to expedite the process, certain manmade improvements would be made.

Two alternative methods of accomplishing this mitigation measure were considered. The first method, which was eliminated from consideration due to its more invasive approach, would involve using earthmoving equipment to place fill material within the existing high water line of the stream to narrow the channel.

The second and selected alternative method would involve a less intrusive approach, which would consist of installing a variety of fish habitat enhancement structures in the existing stream channel. These structures could include cover logs, depositional structures, organic riprap treatments, rock clusters, rock deflectors, and rock weirs. Example sketches of several of these enhancement structures are shown in figures 2-4 to 2-7. The objectives of these various structures would be to provide new pool habitat, hiding cover, high flow refuge area, scour holes, and spawning habitat for trout as well as a minimum level of channel erosion control.

Prior to SWCD constructing these improvements, SWCD would coordinate with the USDA Forest Service, Service, USACE, Utah Division of Wildlife, and Utah Division of Water Rights (UDWR). A qualified fluvial geomorphologist would develop a detailed plan based on the second alternative described above. A 200-foot-wide right-of-way corridor also would be acquired where the stream runs through private land. Fencing also would be provided where needed to protect the stream from livestock. Middle Gooseberry Creek would be used as spawning and rearing habitat for cutthroat trout.

2.2.2.2.3.5 Provide Flushing Flows and Other Releases to Gooseberry Creek.— The project would provide releases from Narrows Reservoir to Gooseberry Creek in excess of the minimum 1.0-cfs release described above. These additional releases would be used to provide additional instream flows or to flush accumulated silt and fine sediments from the streambed to enhance spawning habitat. UDWR has expressed interest in using this water to provide additional inflow to Lower Gooseberry Reservoir during the critical winter period when dissolved oxygen (DO) levels in the reservoir are low. The project would provide an average of 300 acre-feet per year of additional water from carryover storage in Narrows Reservoir for release to Gooseberry Creek. While this water could be used to either augment instream flows or flush sediment, the environmental effects analyses in chapter 3 assumes the entire volume is used annually for flushing the downstream channel.

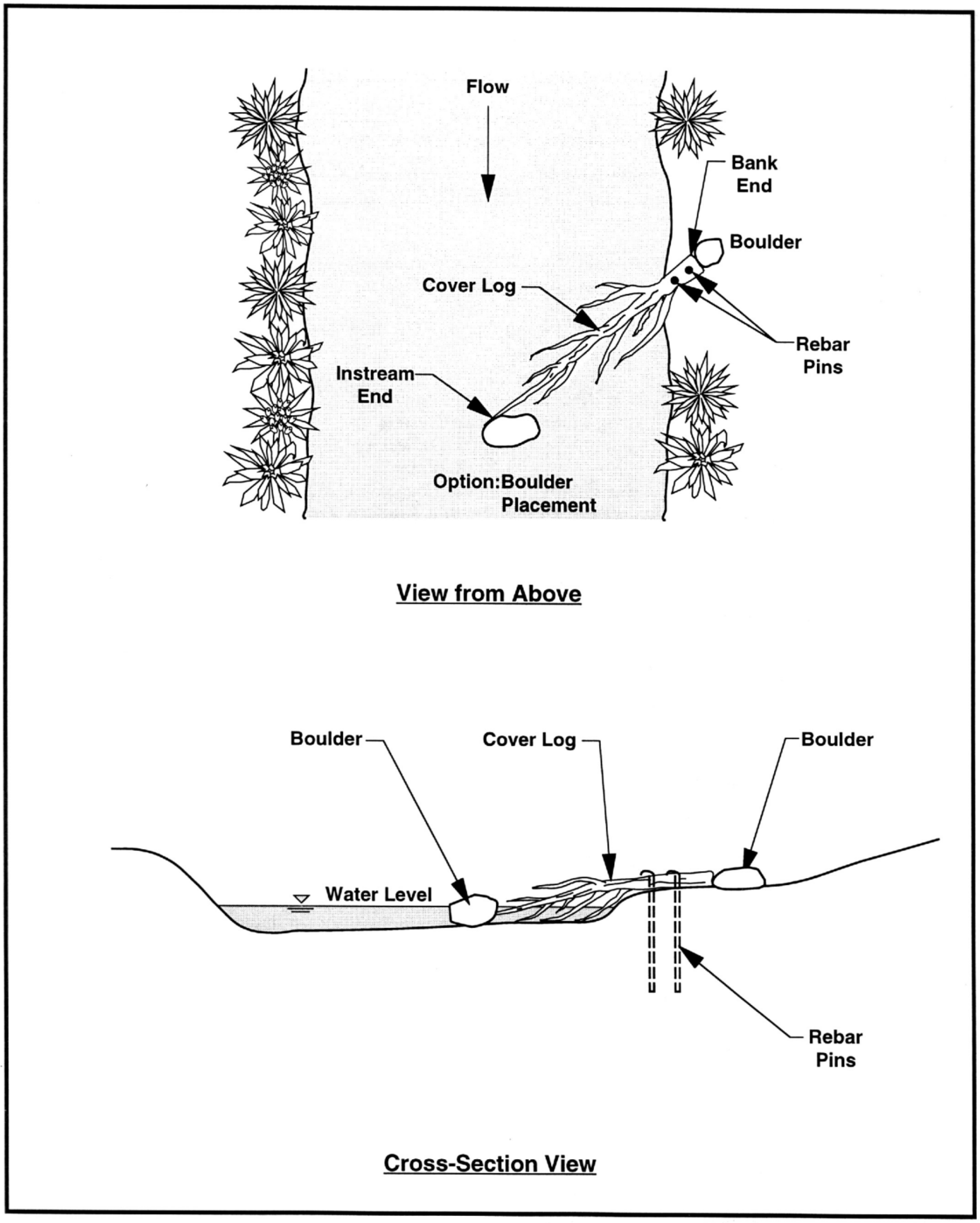


Figure 2-4.—Schematic of Cover Log Structure.

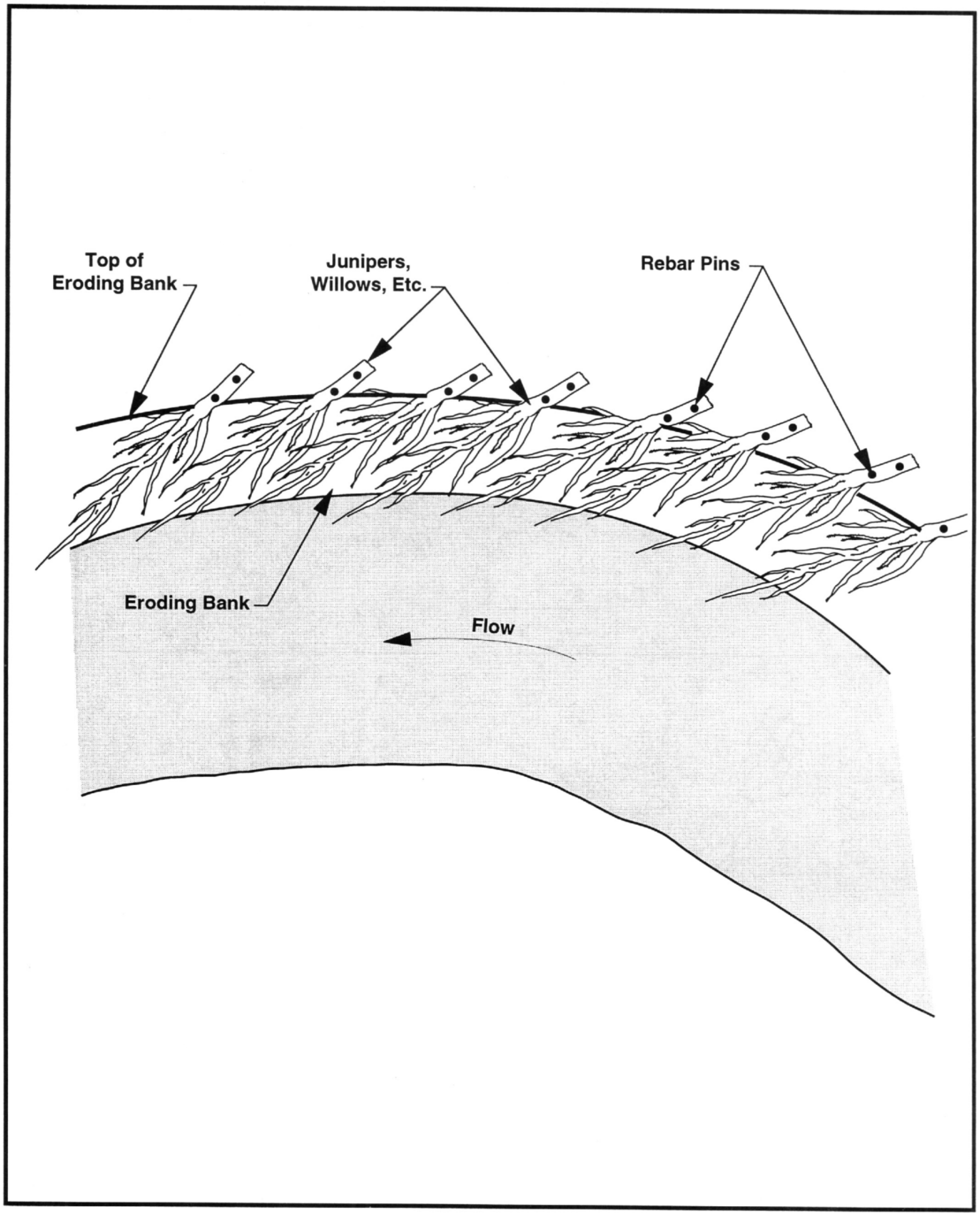


Figure 2-5.—Schematic of Organic Riprap.

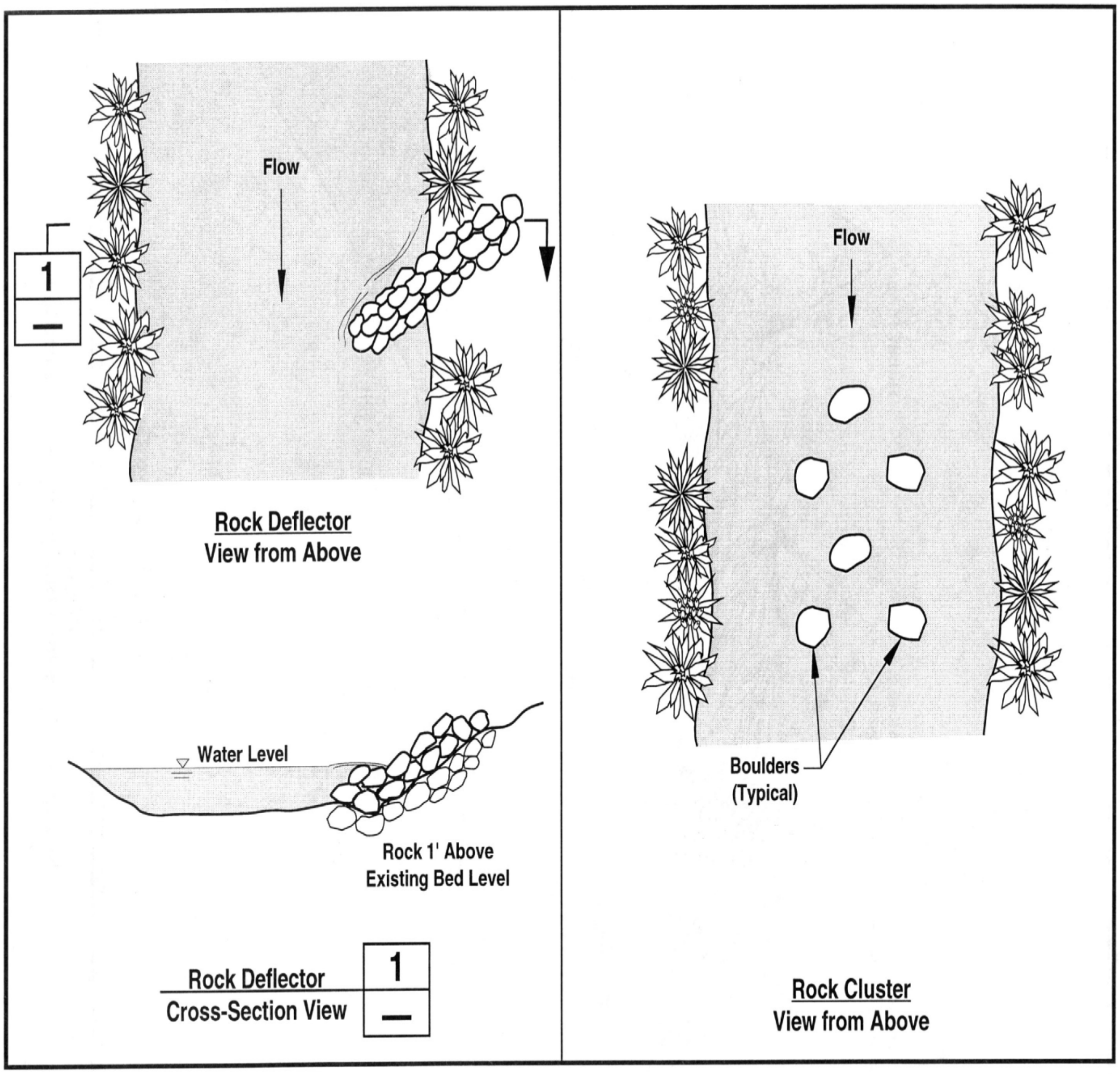


Figure 2-6.—Schematic of Rock Deflector and Rock Cluster.

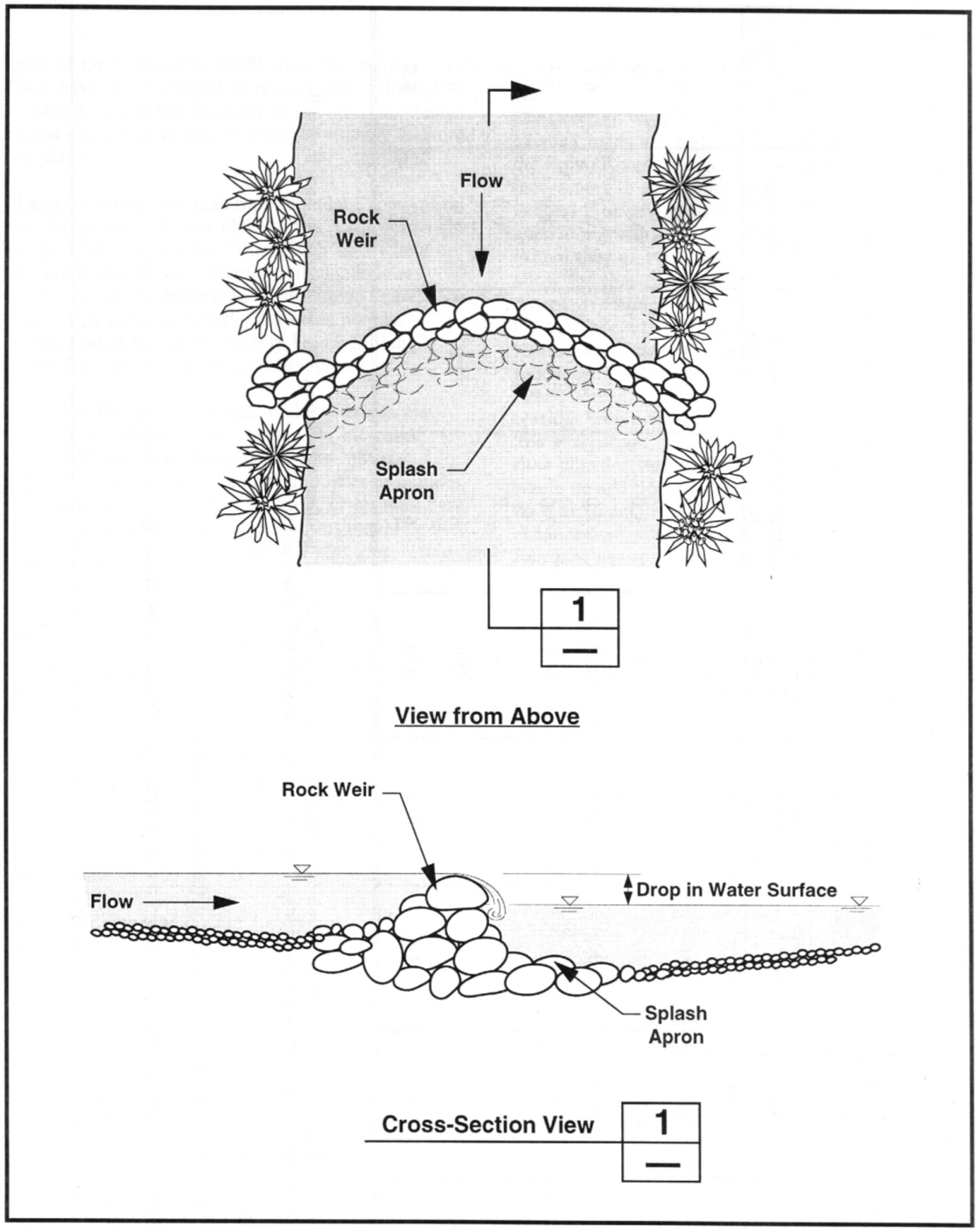


Figure 2-7.—Schematic of Rock Weir.

Therefore, the potential benefits of the flushing flows are claimed while the potential benefits from providing additional instream flows are not claimed. The ultimate use of the 300 acre-feet of water will be determined by SWCD in cooperation with UDWR and would likely be a combination of flushing releases and instream flows that would vary according to conditions and needs.

For the sediment flushing flow, the annual volume of 300 acre-feet could be released each year in a single event, or the water could be stored in the reservoir for multiple years to provide a larger magnitude or longer duration flush. In cooperation with UDWR, SWCD would determine the timing and quantity of water to be released each year. Because this water would be released to

Gooseberry Creek, it would not count against the 5,400-acre-foot maximum transbasin diversion.

2.2.2.2.3.6 Acquire and/or Improve Stream Segments.—This measure would involve improving fishery habitat and/or fencing 11.5 miles of stream in the Price River drainage. Most of these stream segments are on private land; therefore, approximately 206 acres of right-of-way, a corridor averaging approximately 200 feet wide, would need to be acquired. Fishery habitat improvements such as riparian plantings and some minor channel work would be performed. As part of the 11.5 miles of habitat improvement, about 2 miles of stream would be improved in conjunction with the wetland restoration; and 1 mile of stream would be improved by providing fencing in conjunction with acquiring 640 acres of wildlife habitat adjacent to the Price River below Scofield Reservoir. The various parcels of land would be contiguous with other public lands and would be managed in conjunction with those public lands. Memoranda of agreement (MOAs) would be required between the SWCD and the managing agencies.

Where appropriate, the corridor would be fenced with a four-strand, barbed wire fence, topped with a rail to protect the streambanks and riparian zone from damage caused by grazing. Where the adjacent land is used for grazing, selected stream access points for livestock watering or other alternative livestock watering means would be provided. Stream crossings also would be provided as needed. Table 2-3 lists stream segments that have been recommended for this measure and the proposed managing agencies. If necessary, additional parcels would be identified and evaluated to achieve the mitigation goal. The streams improved and protected under this measure would provide habitat for all life stages of cutthroat, rainbow, and/or brown trout. The improvements also would enhance wildlife habitat and water quality. A monitoring program would be established to ensure that the stream segments were acquired, improved, fenced, and maintained as planned.

Table 2-3.—Stream Segments To Be Acquired and/or Improved for Fishery Habitat Proposed Action

Stream Reach	Length of Stream (miles)	Proposed Managing Agency
Price River Basin		
Mud Creek	4.0	UDWR
Winterquarters Creek	2.5	UDWR
Pondtown Creek	2.0	USDA Forest Service
Fish Creek above Scofield Reservoir	1.0	USDA Forest Service
Price River below Scofield Reservoir	2.0	UDWR

2.2.2.2.3.7 Provide Winter Releases to Cottonwood Creek.—A release sufficient to provide a 2.0-cfs minimum flow at the confluence of Cottonwood Creek and Left Hand Fork would be made from Narrows Reservoir to Cottonwood Creek to increase the available fish habitat. Water released during the winter months would be stored in Wales Reservoir on a space-available basis. Wales Reservoir is a small reservoir that stores winter runoff from the Upper San Pitch River drainage, including Cottonwood Creek drainage.

2.2.2.2.3.8 Provide Summer Flows in Lower Cottonwood Creek.—Water would be released in Lower Cottonwood Creek at the Cottonwood Canyon mouth to provide 2.0-cfs minimum instream flows at that location. This measure would provide year-round flows in the stream that would support fish habitat, create a fishery, and enhance the wetland and riparian corridor. In the past, this segment of stream historically has been dewatered during the irrigation season.

2.2.2.2.3.9 Construct Upper Cottonwood Creek Pipeline.—Upper Cottonwood Creek Pipeline would be constructed as described in the previous section 2.2.2.2.2.4.

2.2.2.2.3.10 Provide a 2,500 acre-feet Minimum Conservation Pool in Narrows Reservoir.—A minimum pool of 2,500 acre-feet with a surface area of 144 acres would be provided in Narrows Reservoir for fish habitat and propagation. This pool would not be drawn upon for project use. At minimum pool, the reservoir would have a maximum depth of 58 feet; and approximately 53 acres of the reservoir would be at least 20 feet deep.

2.2.2.2.3.11 Reduce External Phosphorus Loading to Scofield Reservoir.—This measure would help improve water quality in Scofield Reservoir by reducing phosphorus loading and would be implemented in conjunction with improving stream segments on tributary streams above Scofield Reservoir. About 9.5 miles of stream segments would be improved. The improvements would consist of bank stabilization, primarily through riparian plantings. Where grazing would occur, the stream segments would be fenced to protect them from potential impacts.

This measure would reduce the amount of sediment and animal waste and, hence, the amount of phosphorus flowing into the reservoir. Historically, fish kills have occurred in Scofield Reservoir due to poor water quality. Phosphorus has been identified as the limiting nutrient in the eutrophication of the reservoir. Phosphorus loading occurs from several factors, including inflow of sediments that are naturally high in phosphorus and animal waste. In a report entitled *Scofield Reservoir Restoration Through Phosphorus Control*, the Utah Division of Water Quality concluded that:

> "The most pragmatic and effective means to control the further eutrophication of Scofield Reservoir, or possibly to effect a moderate reversal of the eutrophication process, appears to be a reduction of the phosphorus load to the lake."

SWCD would have primary responsibility for implementing all fishery measures described above. SWCD would be responsible for funding and acquiring all lands and rights-of-way and would fund and construct all improvements, such as fencing and stream channel improvements. SWCD would provide water from its water rights or enter into operating agreements for all instream flows described above. This work would be performed concurrently with construction of other project facilities such as the dam, tunnel rehabilitation, and pipelines. All lands and rights-of-way would be acquired, and initial construction of fishery measures would be completed prior to initial filling of the reservoir. SWCD would be responsible to fund all operation and maintenance (O&M) costs of mitigation facilities. SWCD would be responsible to enter into a MOA with UDWR and other appropriate agencies for all fishery measures. The MOA would define clearly the roles and responsibilities of SWCD, UDWR, and other parties for implementing, monitoring, and maintaining the fishery measures.

2.2.2.2.4 Wetland Measures

Wetland measures would be included in the project to mitigate unavoidable adverse impacts to wetlands that have been identified with the project. Four alternative wetland mitigation sites have been identified. The actual mitigation that is implemented could be from one alternative or a combination of alternatives. Proposed wetland mitigation areas are shown in figures 2-8, 2-9, and 2-10.

A brief description of each alternative follows. Alternatives are listed in order of priority.

2.2.2.2.4.1 Enhance, Restore, and Create Wetlands Adjacent to Mud Creek Near Scofield Reservoir.—This measure includes the purchase of approximately 220 acres of private land adjacent to Mud Creek, south of Scofield Reservoir. The approximate elevation of this site is 7,700 feet. Some of this land consists of former wetlands damaged by cattle, and the remainder is upland habitat. Existing wetland portions would revert to their natural wetland condition by removing the cattle and allowing the vegetation to grow. The remaining wetlands would be created by other methods (e.g., construction).

To implement wetland mitigation at the Mud Creek site, a preliminary study of the site would use the following steps:

1. Perform wetland delineation mapping of the site to determine the location and quantity of existing wetlands.
2. Install piezometers to determine ground water levels.
3. Install a temporary check dam with a series of piezometers to determine the effectiveness of using check dams to raise ground water levels.
4. Excavate test pits to determine soil types and stratification of soils.
5. Design mitigation measures based on data collection.
6. Perform HEP analysis to quantify premitigation habitat.

The proposed design concept is to raise ground water levels by installing a series of check dams as explained in step 3. If the preliminary study shows that this is not a feasible option, reverse underdrains (buried perforated pipes) may be needed. This would expand the extent of saturated soils. Some minor recontouring may be required at this site. Also, wetland vegetation growth would be encouraged by transplanting suitable wetland species. All or a portion of the required mitigation could be performed at this site. The wetland area would be maintained by SWCD under a MOA with UDWR (see figure 2-8).

2.2.2.2.4.2 Area West of Lower Gooseberry Reservoir.—This alternative would be developed near Lower Gooseberry Reservoir with an approximate elevation of 8,600 feet above msl. Approximately 120 acres of private land would be acquired west of the reservoir. The land currently is used for grazing sheep, and there are few existing wetlands. Water would be diverted from an existing diversion structure on Cabin Hollow, transported to the site through an existing open ditch, and would cause no additional adverse impacts to Cabin Hollow Creek.

The water planned for mitigation purposes is an existing diversion now used for pasture irrigation at the same site. The water would be diverted from the ditch at several locations and allowed to flow across the uplands and the surrounding wetlands. The existing wetlands on this site appear to have been created and maintained by the existing irrigation system.

Some earth work would need to be done to create small berms and swales that would create cells of wetlands. The area around the perimeter would be excavated somewhat deeper and to a 20-foot-minimum width (and a wider width in some areas) so that the edge of the swale is not abrupt but serpentine. This deeper area would allow willows and other shrubs to be planted to create a vegetation barrier to the interior wetlands. The area still would be available for grazing and wildlife use. However, sheep would be deterred from

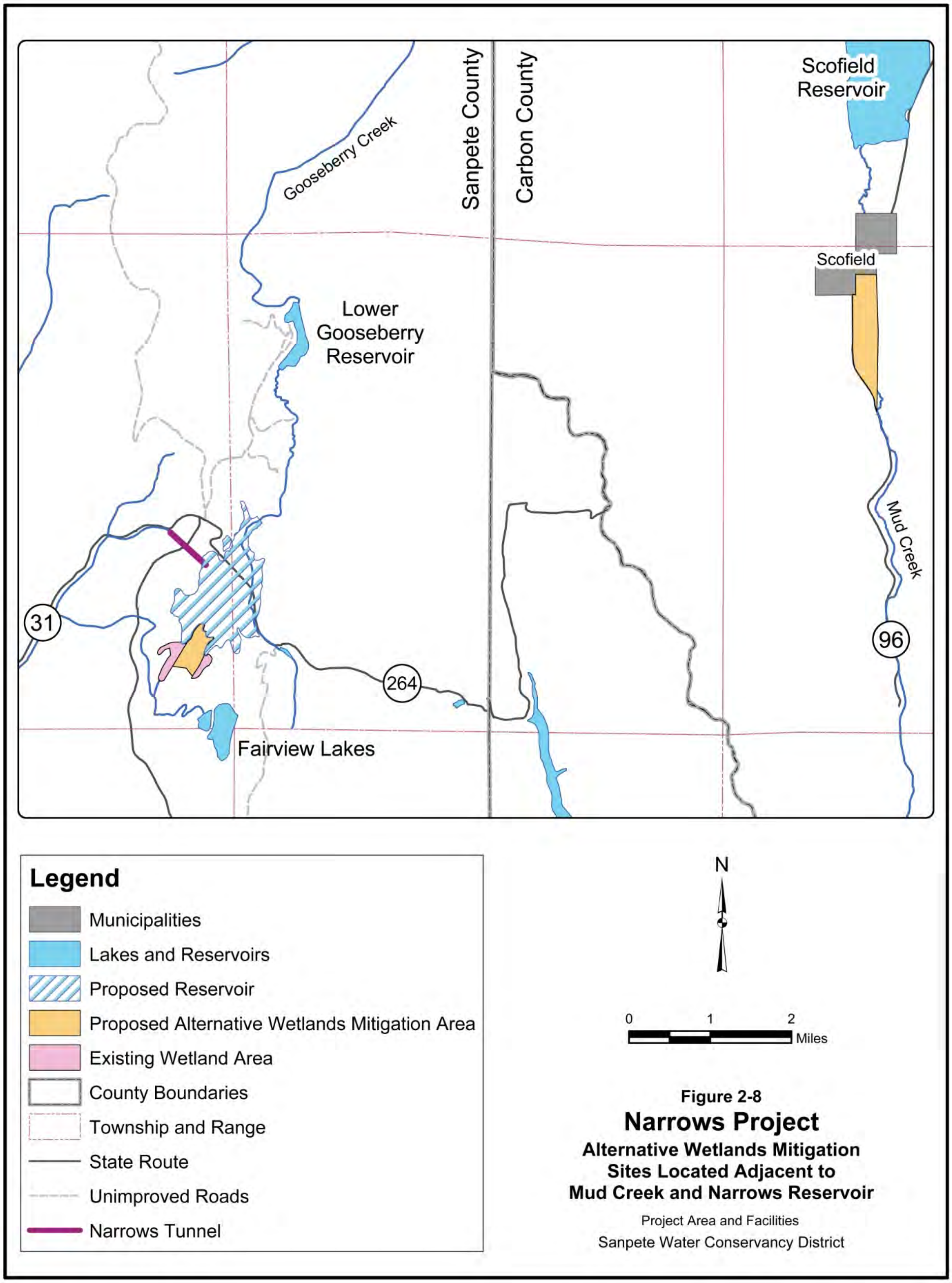


Figure 2-8.—Alternative Wetlands Mitigation Sites Located Adjacent to Mud Creek and Narrows Reservoir.

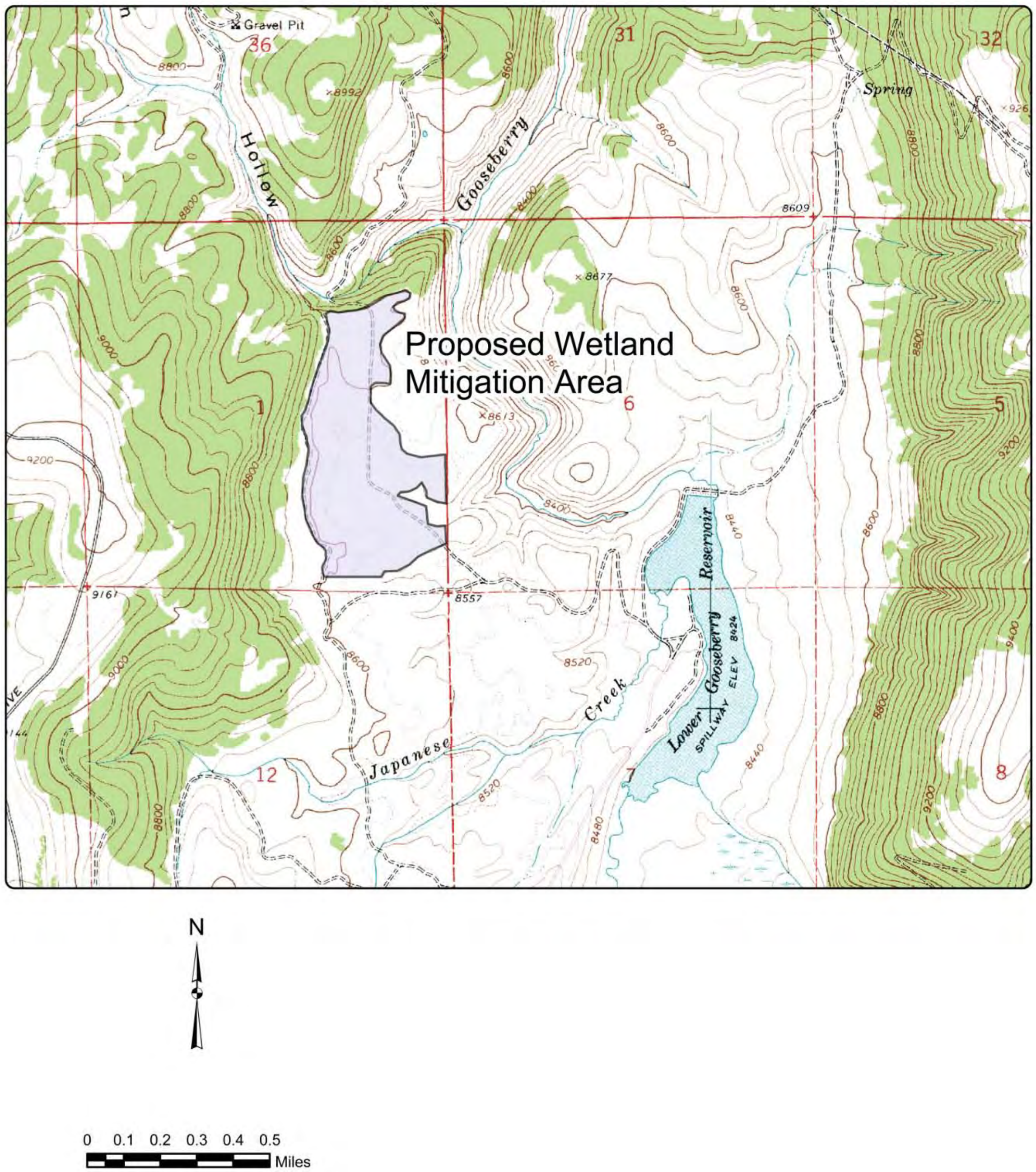


Figure 2-9

Narrows Project

Alternative Wetland Mitigation Area
West of Lower Gooseberry Reservoir

Project Area and Facilities

Sanpete Water Conservancy District

Figure 2-9.—Alternative Wetland Mitigation Area West of Lower Gooseberry Reservoir.

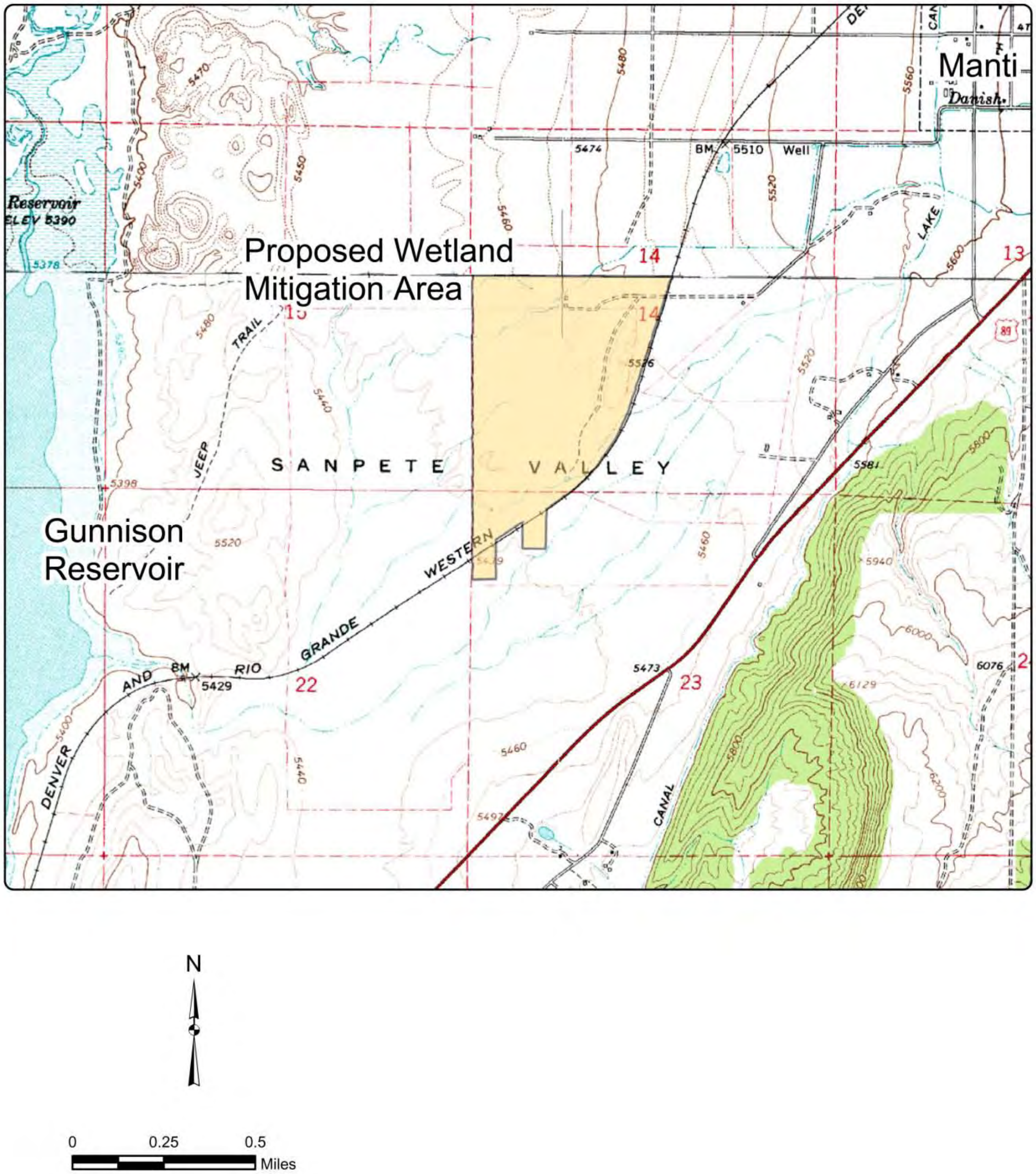


Figure 2-10

Narrows Project

Alternative Wetland Mitigation Area
Manti Meadows

Sanpete Water Conservancy District

Figure 2-10.—Alternative Wetland Mitigation Area Manti Meadows.

entering the wetland by perimeter swale, which would eliminate the need for fencing the area and would allow access for wildlife.

This wetland would be maintained by SWCD under a MOA with UDWR, USACE, and USDA Forest Service.

2.2.2.2.4.3 Enlarge and Create New Wetlands Adjacent to Narrows Reservoir.—This alternative would include enlarging existing wetlands areas and creating new wetlands adjacent to Narrows Reservoir. Elevation of this site is approximately 8,800 feet above msl. At least 100 acres of new wetlands would be created adjacent to Narrows Reservoir by releasing water from Fairview Lakes to irrigate lands adjacent to existing wetlands. A new outlet from Fairview Lakes would be provided. The outlet would be designed to begin releasing water automatically once Fairview Lakes reached a certain level. The releases would stop as the water level receded in the fall. SWCD and CGIC jointly would develop a policy establishing how seasonal releases from Fairview Lakes would be coordinated to optimize system benefits. The water would be conveyed to and distributed within the wetland area by a system of open ditches. Some recontouring would be performed to ensure that the soils became saturated. All or a portion of the required wetland mitigation could be performed at this site alone. This wetland area would be maintained by SWCD under a MOA with UDWR and CGIC.

2.2.2.2.4.4 Manti Meadows.—Under this alternative, return flows from the Narrows Project in the San Pitch River drainage would be made available to UDWR to use at the Manti Meadows Waterfowl Management Area located southwest of Manti. The elevation of this site is approximately 5,460 feet above msl. The water would be delivered by diverting Sixmile Creek water, which belongs to the Gunnison Irrigation Company and flows into Gunnison Reservoir, and delivering it to the Manti Meadows area through existing facilities belonging to the Manti Irrigation and Reservoir Company. Narrows Project return flows arising in the San Pitch River would be delivered to Gunnison Reservoir in exchange for the water delivered to Manti Meadows. The water would be used to create at least 100 acres of new wetlands and to improve wetland habitat values of existing wetlands in the area. Some excavation and ground recontouring of existing uplands would be required to control drainage and encourage wetland development.

Wetland mitigation sites would provide similar functional value to that provided by the 100 acres of wetlands that would be inundated by the reservoir. Careful monitoring of the mitigation sites would be conducted to ensure that the value of the mitigation sites was similar in function and equal in value to the wetlands lost. The method to determine this would be using HEP analyses or equivalent for the sites and comparing habitat values. The wetland monitoring plan would need to be designed to be re-evaluated after 4 years and continued for as long as necessary to ensure that, at a minimum, a replacement of lost habitat values had occurred.

SWCD would have primary responsibility for implementing wetland measures described above. SWCD would be responsible for funding and acquiring all lands and rights-of-way. SWCD would provide and transplant any plantings needed. SWCD would be responsible to ensure that all fences are in good repair and are maintained properly. SWCD also would be responsible to install and maintain any diversion and/or irrigation facilities. This work would be performed concurrently with construction of other project facilities such as the dam, tunnel rehabilitation, and pipelines. All lands and rights-of-way would be acquired, and initial construction of wetland measures would be completed prior to initial filling of the reservoir. SWCD also would be responsible to fund the monitoring of the wetland mitigation. SWCD would be responsible to enter MOAs with UDWR, USACE, and other appropriate agencies for all wetland measures. The MOAs would define clearly the roles and responsibilities of the SWCD, UDWR, USACE, and other parties for implementing and maintaining the wetland measures, including timeframes for future commitments such as fence maintenance. The MOAs would be required to be in place before the SRPA construction funds were dispersed.

2.2.2.2.5 Wildlife Mitigation Measures

The wetland measures previously described would offset any losses to wetland habitat caused by inundation. Impacts to upland habitat (mule deer and Brewer's sparrow habitat) would be mitigated by SWCD in the following ways:

- ♦ Acquisition of 150 acres of conservation easements adjacent to the Narrows Reservoir. These easements would impose restrictions on land use that would benefit impacted species. In addition, the conservation easements would provide a setback of about 500 feet on the west side of the reservoir for any new development or construction on private land adjacent to the reservoir. The USDA Forest Service administers lands on the north and east side of the reservoir, and private developed lands are on the south side of the reservoir.

- ♦ Acquisition of 640 acres of private land adjacent to the Price River below Scofield Reservoir. Wildlife values would be enhanced by providing 4 miles of fencing to protect the land from livestock grazing.

As with fishery mitigation, the goal of the wildlife mitigation would be to provide at least full mitigation for each impacted species.

As part of the conservation easements for the 150 acres adjacent to Narrows Reservoir, certain restrictions on the landowners' use of their lands would be needed. These restrictions would include prohibiting actions such as further construction of residential structures; commercial uses such as motels, cafes, hunting or fishing clubs, subdivisions, including constructing sewers and septic tanks; livestock grazing; and storage or use of pesticides, herbicides, or chemical agents, either directly or indirectly lethal to wildlife. In addition, many of these lands would be made available to the general public for hunting, fishing, or other recreational uses without permit or fees charged by the landowners. Specific measures or restrictions would be developed individually as part of the easement negotiation process with each involved landowner.

As part of the wildlife mitigation plan, a monitoring program would be developed. Existing wildlife values on mitigation lands would be identified using the same models that were used to identify project impacts. These same models also would be used to measure the success of any wildlife mitigation programs. If the proposed mitigation programs are not as successful as anticipated, additional mitigation could be required. This procedure would apply to both wetland and upland wildlife habitat.

SWCD would have primary responsibility for implementing all wildlife measures described above. SWCD would be responsible for funding and acquiring all lands and easements. SWCD would provide native seed to supplement the USDA Forest Service-recommended seed mixture for the watershed and range improvement projects. SWCD would fund, construct, and maintain all improvements such as fencing. This work would be performed concurrently with construction of other project facilities such as the dam, tunnel rehabilitation, and pipelines. All lands and rights-of-way would be acquired, and initial construction of wildlife measures would be completed prior to initial filling of the reservoir. SWCD also would be responsible for funding the mitigation monitoring. SWCD would be responsible for entering into MOAs with UDWR, USDA Forest Service, and other appropriate agencies for all wildlife measures. The MOAs would clearly define the roles and responsibilities of SWCD, UDWR, USDA Forest Service, and other parties for implementing and maintaining the wildlife measures. All parties would be required to sign the MOAs before SRPA construction funds were dispersed.

2.2.2.2.6 Construction Materials

Locations of materials necessary for constructing Narrows Dam and Reservoir are shown in figure 2-3. Most of the embankment material for the Narrows Dam would be obtained from the reservoir basin. Rockfill material for upstream slope protection would be obtained from an existing quarry on Reclamation withdrawn land near SR-264. An alternative rockfill material quarry site is located on private land. Granular material for drains within the dam would be hauled from commercial pits in Sanpete Valley near Wales, Utah. Concrete for the outlet works, spillway, and other structures would be batched in Sanpete Valley and hauled to the damsite in transit mixers. Other materials such as pipe, steel gates and structures, electric motors, and operating and control equipment would be manufactured or processed outside the project area. The materials would be hauled to the construction sites by truck.

2.2.2.2.7 Lands for Project Features and Relocation

About 1,931 acres of land would be required for project features, wetland mitigation, fish and wildlife enhancement and mitigation, and material source areas. About 0.8 mile of SR-264 would be inundated by Narrows Reservoir, as described in section 2.2.2.2.2.6. The amounts of land by present ownership or administration and proposed project use are shown in table 2-4.

There would be no relocation of persons, families, businesses, farms, or nonprofit organizations resulting from construction of the Narrows Project.

Approximately 304.5 acres of Reclamation withdrawn land would be used for project purposes. SWCD has acquired 366 acres of private lands for project uses from owners by perpetual easement or in fee. SWCD would purchase 1,340 additional acres of private and State School Trust lands for project needs.

The conservation area adjacent to the reservoir would be created through conservation easements. These lands would be administered by SWCD under a cooperative agreement with UDWR. To ensure proper management of easement lands needed to mitigate fish and wildlife losses attributed to the project, certain restrictions on the landowners' use of their lands would be needed. Specific measures or restrictions, including those to protect fish and wildlife values, would be developed by UDWR as part of the easement negotiation process with each involved landowner. If adequate easements cannot be secured, a fee-title acquisition of the lands would be made.

Table 2-4.—Proposed Action Right-of-Way Requirements for Project Features

Project Feature Type of Acquisition	Ownership or Administration		
	Private (acres)	Reclamation Withdrawal (acres)	Total (acres)
Narrows Dam and Reservoir	349	255	604
East Bench Pipeline			
Perpetual easement	51	0	51
Oak Creek Pipeline			
Perpetual easement	9	0	9
Upper Cottonwood Creek Pipeline	1.5	1.5	3
SR-264 relocation	0	34	34
Recreation area	0	12	12
Fishery mitigation			
Perpetual conservation easement	206	0	206
Wildlife mitigation			
Fee title purchase of fish and wildlife enhancement area	640	0	640
Perpetual conservation easement adjacent to reservoir	150	0	150
Wetlands mitigation			
Perpetual easement or fee title	220	0	220
Materials source area[1]	0	2	2
Total	1,626.5	304.5	1,931

[1] Embankment material for the dam would be obtained from the reservoir basin. Rockfill material for upstream slope protection would be obtained from an existing quarry located on withdrawn land. An alternative rockfill material quarry site may be located on private land.

2.2.2.2.8 Access to Features

Construction access is fairly good for all project features. The proposed damsite is near an existing paved highway. This highway would be adequate for hauling materials and equipment to the site. Temporary haul roads would need to be constructed within the reservoir basin to move material from the borrow area to the damsite.

2.2.2.2.9 Construction Program

Construction of the Narrows Project would be under the supervision of SWCD. All recreational facilities would be built by SWCD. Temporary construction offices would be located within the proposed reservoir basin.

2.2.2.2.10 Water Quality Protection Program

Several water quality permits must be obtained prior to construction of the project. The Clean Water Act of 1972 (Public Law 95-217), as amended in 1977, requires that Section 402 permits be obtained from the State or EPA for the discharge of any waste water or process water into a waterway. A Section 402 permit would be required for storm water runoff or dewatering during construction of the dam. A storm water pollution prevention plan also would be developed as a requirement of the storm water permit. In accordance with Section 404 of Public Law 95-217, permits must be obtained from USACE to discharge dredge and fill material below the normal high water level of streams, associated wetlands, and other water bodies as well as dam construction. A Section 404 permit would be required for construction of the project. SWCD has applied for that permit (Section 404(B)(1) Analysis, appendix K).

Approval by the Utah Division of Water Quality is required before installing any sanitary or industrial pollution control facilities, including turbidity control equipment. This approval also would be obtained before dewatering, diversion, and other such facilities could be constructed. In addition, a temporary waiver of the turbidity standard would be requested from the Utah Division of Water Quality during those periods of construction when it is physically impossible to provide turbidity control. A State Engineer's permit to alter a natural stream channel also would be requested for the proposed dam. Driving, fueling, and parking of heavy equipment would be controlled so as to avoid wetland and stream areas, precluding downstream sedimentation and other water quality impacts.

2.2.2.2.11 Public Safety

The final design of Narrows Dam would be based on additional and extensive geologic investigation and would include full consideration of such factors as seismic history, geology, induced seismicity from coal mining, and the dam's material composition. In addition, final design data and specifications for the dam would be reviewed by Reclamation and the State Engineer to ensure that it would be a safe and well-designed structure, fitting geological conditions of the site.

During construction, excavations would be mapped and studied to determine whether geologic conditions were the same as had been indicated from preliminary subsurface investigations. If actual geologic conditions were found to differ from what previously had been predicted, designs would be changed to accommodate the existing conditions. Also, geologists and inspectors would report such hazardous conditions as potential slide or slump areas that might pose a danger to workers and equipment. All hazardous areas would be roped off, and appropriate signs would be displayed to prevent accidents.

SWCD would develop a safety of dams program that would satisfy the State of Utah requirements. SWCD, with supervision by the State Engineer, would be responsible for monitoring structural performance and conducting safety inspections during construction and initial filling of the reservoir. Criteria would be developed and strictly followed for filling the reservoir and monitoring the safety of the dam. Marker buoys and float lines would be installed around spillway intake structures and other areas that might be hazardous to boaters. In accordance with State Engineer requirements, a standard operating procedure would be prepared to ensure that the dam was operated in a safe manner. In addition, an emergency action plan would be prepared and distributed to public safety officials. This plan would describe procedures to be followed if an emergency involved the dam.

2.2.2.3 Costs and Financing

The Proposed Action would cost approximately $36.2 million and would be funded by SWCD, the State of Utah, and a loan from the Federal Government. Of the $36.2-million cost, about $5.3 million would be allocated to fish and wildlife enhancement and recreation (table 2-5). These costs are anticipated to be

Table 2-5.—Narrows Project Cost Comparison of Storage Alternatives Evaluated in Detail[1]

	Proposed Action	Mid-Sized Reservoir Alternative	Small Reservoir Alternative
Narrows Dam and Reservoir	$ 12,292,000	$ 10,752,000	$ 9,212,000
Upper Cottonwood Creek Pipeline	677,000	677,000	677,000
Oak Creek Pipeline	341,000	341,000	341,000
East Bench Pipeline	7,997,000	7,997,000	7,997,000
Recreation area	1,065,000	937,000	801,000
Highway SR-264 relocation	3,292,000	3,292,000	3,292,000
Wetlands, wildlife, and fishery mitigation	4,274,000	4,274,000	4,147,000
Reclamation participation (EIS and planning)	950,000	950,000	950,000
SWCD's costs to date	2,818,000	2,818,000	2,818,000
Total construction cost	$33,706,000	$32,038,000	$30,235,000
Estimated interest during construction (IDC)	2,528,000	2,447,000	2,386,000
Total project costs	$36,234,000	$34,485,000	$32,621,000
Average annual water yield of project (acre-feet)	5,308	5,171	4,935
Capital cost per acre-foot of yield	$7,584	$7,447	$7,425

[1] Cost estimates have been indexed from July 2006 to 2008.

nonreimbursable to the project sponsor. Total financing would be through provisions of the SPRA.

2.2.2.4 Project Administration

On completion of construction, the Narrows Project would be administered by SWCD. SWCD would have overall responsibility for administration and would contract with the water users for repayment of reimbursable project costs.

Although a formal agreement has not been reached, it is anticipated that the USDA Forest Service would administer the recreation facilities at the Narrows Reservoir under an operation agreement with SWCD and Reclamation.

A fishery management plan also would be developed, and a MOA would be agreed to between SWCD, USDA Forest Service, Reclamation, and UDWR. This plan would outline goals for fish species and angling opportunities that would be provided by the proposed reservoir and determine funding sources or contributions needed for reservoir fishery management. Any fish species released into the reservoir eventually could escape downstream. These species must not interfere with downstream fisheries. Species native to the Gooseberry drainage or that have already been introduced to this drainage would be acceptable for introduction into the proposed reservoir.

2.2.3 Mid-Sized Reservoir Alternative

This alternative would be similar to the Proposed Action except that the reservoir capacity would be limited to 12,450 acre-feet. Of that amount, 9,950 acre-feet would be active capacity, and 2,500 acre-feet would be inactive storage. The 110-foot-high dam, with a crest length of 475 feet and crest width of 30 feet, would be in the same location as that for the Proposed Action (figure 2-3). Other features of the project would be the same as those for the Proposed Action and would include the construction of pipelines, rehabilitation of the existing Narrows Tunnel to control releases, relocation of SR-264 and would provide recreation opportunities. Exceptions and differences between this alternative and the Proposed Action are described below.

2.2.3.1 Water Supply and Use

The average annual water supply under the Mid-Sized Reservoir Alternative would be reduced to 4,964 acre-feet because there would be less carryover storage. In years with average or above average precipitation, the full 5,400-acre-foot water right would be available. In 10 of 46 years studied, this alternative could not provide the full 5,400 acre-feet of water supply. However, in years with below average precipitation, the available water supply could be reduced by as much as 79% because of the reduced long-term carryover storage. This means less than 1,138 acre-feet of water could be available for transmountain diversion during those years when the water is needed most.

Of the average annual yield of 4,964 acre-feet, 855 acre-feet would be used for M&I purposes, and the remaining 4,109 acre-feet would be used for agriculture. As noted in section 1.5.2, there would be an estimated 15,250-acre-foot average annual shortage in the diversion demand assuming a portion of the nongrowing season precipitation was retained in the soil root zone to help meet early season water needs. On the average, the Mid-Sized Reservoir Alternative would reduce the average annual shortage to about 11,141 acre-feet per year or 21.6% of the diversion demand. With below average precipitation, the remaining shortage would be about 30,017 acre-feet per year or 58.1%. In either case, shortages still would be considerably greater than the 5% optimum shortage for irrigation projects.

As with the Proposed Action, local water users would be expected to employ efficient water use practices or agree to implement them as a condition for receiving project water.

2.2.3.2 Construction Features and Project Operations

2.2.3.2.1 General

As in the Proposed Action, construction features of the Mid-Sized Reservoir Alternative would include one reservoir, three pipelines, rehabilitation of the existing Narrows Tunnel to control releases, the relocation of SR-264, and the relocation of some FDRs. Recreation facilities also would be provided at Narrows Reservoir. Design data for the construction features were presented earlier in table 2-2 for this alternative. The changes that would occur are depicted in table 2-2 and are described in more detail in section 2.2.3.2.2.

Specific fish and wildlife measures under the Mid-Sized Reservoir Alternative would remain the same as those stated under the Proposed Action.

Additionally, mitigation and enhancement of upland habitat would be the same as that described for the Proposed Action. New wetlands totaling about 81 acres would be created to mitigate for wetlands areas inundated by the reservoir rather than the 100 acres under the Proposed Action.

2.2.3.2.2 Design and Operation

2.2.3.2.2.1 Narrows Dam and Reservoir.— The design of Narrows Dam under the Mid-Sized Reservoir Alternative would be similar to that of the Proposed Action, but the height of the dam would be 10 feet lower. The embankment would contain an estimated total volume of 292,000 cubic yards of material.

Narrows Reservoir still would have two main outlets. A stream-level outlet would be constructed through the dam to provide downstream releases for fisheries and emergency evacuation of the reservoir. This outlet would have a 258-cfs capacity. The existing transmountain Narrows Tunnel, with the 60.0-cfs capacity, would serve as the other reservoir outlet and would accommodate releases through the mountain ridge for the transmountain diversion. The outlets would be designed and operated the same as in the Proposed Action.

The reservoir formed behind the dam would have a total capacity of 12,450 acre-feet and a water surface area of about 489 acres.

The reservoir's active capacity, or that portion of stored water that would be used to satisfy project water needs, would be 9,950 acre-feet. In all other respects, the Mid-Sized Reservoir would be designed and operated in the same manner as the Proposed Action.

2.2.3.2.2.2 Oak Creek Pipeline.—Under this alternative, this feature is identical to the same feature as that described in the Proposed Action.

2.2.3.2.2.3 East Bench Pipeline.—Under this alternative, this feature is identical to the same feature as that described in the Proposed Action.

2.2.3.2.2.4 Upper Cottonwood Creek Pipeline.—Under this alternative, this feature is identical to the same feature as that described in the Proposed Action.

2.2.3.2.2.5 Narrows Tunnel Rehabilitation.—Under this alternative, this feature is identical to the same feature as that described in the Proposed Action.

2.2.3.2.2.6 SR-264 Relocation.—Under this alternative, this feature is identical to the same feature as that described in the Proposed Action.

2.2.3.2.2.7 Recreation Facilities.—For this alternative, public recreation facilities would be similar to those provided for in the Proposed Action. The facilities would include a boat ramp, boat slips, and a day-use area. The day-use area would include 8 picnic sites, restroom facilities, and a 50-unit campground. USDA Forest Service would participate in the recreation facility design, and the facilities would be constructed to their standards. USDA Forest Service would operate and maintain the facilities under agreement with SWCD and Reclamation. Title to the recreation facilities would remain in the name of the United States.

2.2.3.2.3 Fishery Measures

A total of 11 fishery measures have been included in the project to mitigate for adverse impacts that have been identified with the project. To the extent possible, an attempt was made to mitigate "in place" and "in kind." Under this alternative, these measures are identical to the same measures as those described in the Proposed Action.

2.2.3.2.4 Wetland Measures

Wetland measures would be included in the project to mitigate for unavoidable adverse impacts to wetlands that have been identified with the project. Four alternative wetland mitigation sites have been identified. The actual mitigation that is implemented could be from one alternative or a combination of alternatives. Proposed wetland mitigation areas have been shown previously in figures 2-8, 2-9, and 2-10. A complete description of each alternative was provided in the discussion of the Proposed Action. Modifications unique to the Mid-Sized Reservoir Alternative are discussed below.

2.2.3.2.4.1 Wetlands Adjacent to Mud Creek Near Scofield.—This measure would entail purchasing about 190 acres of private land adjacent to Mud Creek, south of the town of Scofield, rather than the 220 acres described in the Proposed Action.

2.2.3.2.4.2 Area West of Lower Gooseberry Reservoir.—Under this alternative, about 105 acres of private land west of Lower Gooseberry Reservoir would be acquired, rather than the 120 acres under the Proposed Action. This land would be treated in the same manner as in the Proposed Action.

2.2.3.2.4.3 New Wetlands Adjacent to Narrows Reservoir.—This alternative would be identical to that described in the Proposed Action, except that the target acreage for mitigation would be reduced from 100 to 81 acres.

2.2.3.2.4.4 Manti Meadows.—This alternative would be identical to that described in the Proposed Action, except that the target acreage for mitigation would be reduced from 100 to 81 acres.

Wetland measures would be needed to provide similar wildlife values as those in the 81 acres of wetlands that would be inundated by the reservoir. Careful monitoring of the mitigation sites would be conducted to ensure that the value of the mitigation sites was at least equal to the value of the wetlands lost. This determination would be accomplished by performing HEP analyses of the sites and comparing habitat values.

SWCD would have primary responsibility for implementing the wetland measures described above and would assume all other responsibilities associated therewith, as described in connection with the Proposed Action.

2.2.3.2.5 Wildlife Measures

The wetland measures described above would offset any losses to wetland habitat caused by inundation. Impacts to upland habitat (mule deer and Brewer's sparrow habitat) were described earlier in connection with the Proposed Action, and the mitigation measures discussed there also would be implemented under the Mid-Sized Reservoir Alternative.

2.2.3.2.6 Construction Materials

Locations of materials necessary for constructing Narrows Dam and Reservoir are shown in figure 2-3. In all other respects, the description of the construction materials is the same for this alternative as that described in connection with the Proposed Action.

2.2.3.2.7 Lands for Project Features and Relocation

About 1,516 acres of land would be required for project features, wetland mitigation, fish and wildlife enhancement and mitigation, and material source areas. The amounts of land by present ownership or administration and proposed project use for this alternative are shown in table 2-6.

2.2.3.2.8 Construction Program

The construction program would be similar to that incorporated into the Proposed Action.

2.2.3.2.9 Water Quality Protection Program

The water quality protection program would be the same as that incorporated into the Proposed Action.

Table 2-6.—Mid-Sized Reservoir Alternative Right-of-Way Requirements for Project Features (Acres)

Project Feature Type of Acquisition	Ownership or Administration		
	Private	Reclamation Withdrawal	Total
Narrows Dam and Reservoir	234	255	489
East Bench Pipeline			
Perpetual easement	51	0	51
Oak Creek Pipeline			
Perpetual easement	9	0	9
Upper Cottonwood Creek Pipeline	1.5	1.5	3
SR-264 relocation	0	34	34
Recreation area	0	7	7
Fishery mitigation			
Perpetual conservation easement	206	0	206
Wildlife mitigation			
Fee title purchase of fish and wildlife enhancement area	385	0	385
Perpetual conservation easement adjacent to reservoir	150	0	150
Wetlands mitigation			
Perpetual easement or fee title	180	0	180
Materials source area[1]	0	2	2
Total	1,216.5	299.5	1,516

[1] Embankment material for the dam would be obtained from the reservoir basin. Rockfill material for upstream slope protection would be obtained from an existing quarry located on withdrawn land. An alternative rockfill material quarry site may be located on private land.

2.2.3.2.10 Public Safety

The public safety measures for this alternative would be the same as those incorporated into the Proposed Action.

2.2.3.3 Costs and Financing

The Mid-Sized Reservoir Alternative would cost about $34.5 million and would be funded by SWCD, the State of Utah, and a loan from the Federal Government (table 2-5). Of the $34.5-million cost, about $5.2 million would be for fish and wildlife enhancement and recreation. These costs are nonreimbursable to the project sponsors. Total financing would be through provisions of the SPRA. Because of a smaller storage capacity, the cost of project water would be approximately 31% higher than the Proposed Action.

2.2.3.4 Project Administration

Under the Mid-Sized Reservoir Alternative, project administration would be the same as that described for the Proposed Action.

2.2.4 Small Reservoir Alternative

This alternative would be similar to the Proposed Action except that the reservoir capacity would be limited to 7,900 acre-feet. Of that amount, 5,400 acre-feet would be active capacity, and 2,500 acre-feet would be inactive storage. The 100-foot-high dam, with a crest length of 425 feet and crest width of 30 feet, would be in the same location as that for the Proposed Action (figure 2-3). Other features of the project would be the same as those for the Proposed Action and would include the construction of pipelines, rehabilitation of the existing Narrows Tunnel to control releases, and the relocation of SR-264 and would provide recreation opportunities. Exceptions and differences between this alternative and the Proposed Action are discussed below.

2.2.4.1 Water Supply and Use

The average annual water supply under the Small Reservoir Alternative would be reduced to 4,710 acre-feet because there would be less carryover storage. In years with average or above average precipitation, the full 5,400-acre-foot water right would be available. In 17 of 46 years studied, this alternative could not provide the full 5,400-acre-foot water supply. However, in years with below average precipitation, the available water supply could be reduced by as much as 74% because of the lack of long-term carryover storage. This means that less than 1,427 acre-feet of water could be available for transmountain diversion during those years when the water is most needed.

Of the average annual 4,710-acre-foot yield, 855 acre-feet would be used for M&I purposes; and the remaining 3,105 acre-feet would be used for agriculture. As noted in section 1.5.2, there would be an estimated 15,250-acre-foot average annual shortage in the diversion demand, assuming a portion of the nongrowing season precipitation was retained in the soil root zone to help meet early-season water needs. On the average, the Small Reservoir Alternative would reduce the average annual shortage to about 11,395 acre-feet per year or 22.1% of the diversion demand. With below average precipitation, the remaining shortage would amount to 29,728 acre-feet per year or 57.5%.

In either case, shortages are still considerably greater than the 5% optimum shortage for irrigation projects.

As with the Proposed Action, local water users would be expected to employ efficient water use practices or agree to implement them as a condition for receiving project water.

2.2.4.2 Construction Features and Project Operations

2.2.4.2.1 General

As in the Proposed Action, construction features of the Small Reservoir Alternative would include one reservoir, three pipelines, rehabilitation of the existing Narrows Tunnel to control releases, the relocation of SR-264, and the relocation of some FDRs. Recreation facilities also would be provided at Narrows Reservoir. Design data for this alternative was presented earlier in table 2-2.

Of the 11 specific fish and wildlife measures included in the Proposed Action, 9 would be employed under the Small Reservoir Alternative. Those measures, some with modifications, include:

- Provide minimum flows of 1.0 cfs in Gooseberry Creek below Narrows Dam
- Provide a multiple-level outlet at Narrows Dam to regulate the temperature of releases to Gooseberry Creek from Narrows Reservoir
- Modify and/or stabilize streambanks and associated riparian zones along Middle Gooseberry Creek
- Acquire and/or improve stream segments to provide additional fish habitat
- Provide winter releases to Cottonwood Creek
- Provide summer flows in Lower Cottonwood Creek

- Construct a pipeline in the Upper Cottonwood Creek area to convey project water outside the stream channel
- Provide a minimum pool in Narrows Reservoir for fish
- Reduce external phosphorus loading to Scofield Reservoir

Because of the reduced reservoir capacity, there would not be enough storage to include the following measures that would be part of the Proposed Action:

- Provide year-round flows in two tributaries of Gooseberry Creek that are presently dewatered
- Provide an additional 300 acre-feet per year of releases from the Narrows Reservoir for channel maintenance and/or fish habitat

In lieu of providing year-round flows in the Gooseberry Creek tributaries, 1.8 miles of spawning and rearing habitat would be replaced. (This mitigation would require additional coordination with UDWR and the USDA Forest Service. If improvement of existing stream segments is used as the method of replacing the habitat, as much as 5.4 miles of stream may need to be improved.)

Mitigation and enhancement of upland habitat would be the same as that described for the Proposed Action. New wetlands totaling about 72 acres would be created to mitigate for wetlands areas inundated by the reservoir.

2.2.4.2.2 Design and Operation

2.2.4.2.2.1 Narrows Dam and Reservoir.— Under the Small Reservoir Alternative, the design of Narrows Dam would be similar to that of the Proposed Action; but the dam would be 20 feet lower in height. The embankment would contain an estimated total volume of 220,000 cubic yards of material.

Narrows Reservoir would have two main outlets. A stream-level outlet would be constructed through the dam to provide downstream releases for fisheries and emergency evacuation of the reservoir. This outlet would have a 210-cfs capacity. The existing transmountain Narrows Tunnel, with the 60.0-cfs capacity, would serve as the other reservoir outlet and would accommodate releases through the mountain ridge for the transmountain diversion. The outlets would be designed and operated the same as in the Proposed Action.

The reservoir formed behind the dam would have a total capacity of 7,900 acre-feet and a water surface area of about 362 acres.

The reservoir’s active capacity, or that portion of stored water that would be used to satisfy project water needs, would be 5,400 acre-feet. In all other respects, the Small Reservoir Alternative would be designed and operated in the same manner as under the Proposed Action.

2.2.4.2.2.2 Oak Creek Pipeline.—Under this alternative, this feature is identical to the same feature as described in the Proposed Action.

2.2.4.2.2.3 East Bench Pipeline.—Under this alternative, this feature is identical to the same feature as described in the Proposed Action.

2.2.4.2.2.4 Upper Cottonwood Creek Pipeline.—Under this alternative, this feature is identical to the same feature as described in the Proposed Action.

2.2.4.2.2.5 Narrows Tunnel Rehabilitation.—Under this alternative, this feature is identical to the same feature as described in the Proposed Action.

2.2.4.2.2.6 SR-264 Relocation.—Under this alternative, this feature is identical to the same feature as described in the Proposed Action.

2.2.4.2.2.7 Recreation Facilities.—For this alternative, public recreation facilities would be similar to those provided for in the Proposed Action. The facilities would include a boat ramp, boat slips, and a day-use area. The day-use area would include 6 picnic sites, restroom facilities, and a 40-unit campground. USDA Forest Service would participate in the recreation facility design, and the facilities would be constructed to their standards. USDA Forest Service would operate and maintain the facilities under agreement with SWCD and Reclamation. Title to the recreation facilities would remain in the name of the United States.

2.2.4.2.3 Fishery Measures

A total of nine fishery measures have been included in the project to mitigate for adverse impacts identified with this alternative for the project. These nine measures are the same as nine of the measures included as part of the Proposed Action. Two of the Proposed Action measures, however, would not be possible under the Small Reservoir Alternative. To the extent possible, an attempt was made to mitigate "in place" and "in kind." The two mitigation measures not included under this alternative are the restoration of streamflow in the Gooseberry Creek tributaries below Fairview Lakes and the provision for flushing flow releases to Gooseberry Creek below Narrows Reservoir. These two fishery mitigation measures could not be included due to the absence of capacity for carryover storage in the reservoir. If this alternative is chosen, additional mitigation measures would be developed in coordination with the Service and UDWR.

2.2.4.2.4 Wetland Measures

Wetland measures would be included in the project to mitigate for unavoidable adverse impacts to wetlands that have been identified with the project. Four alternative wetland mitigation sites have been identified. The actual mitigation that is implemented could be from one alternative or a combination of alternatives. Proposed wetland mitigation areas have been shown previously in figures 2-8, 2-9, and 2-10. A complete description of each alternative was provided in the discussion of the Proposed Action. Modifications unique to the Small Reservoir Alternative are discussed below. Alternatives listed are in order of priority.

2.2.4.2.4.1 Wetlands Adjacent to Mud Creek Near Scofield.—This measure would entail purchasing about 160 acres of private land adjacent to Mud Creek, south of the town of Scofield, rather than the 220 acres described in the Proposed Action.

2.2.4.2.4.2 Area West of Lower Gooseberry Reservoir.—Under this alternative, about 86 acres of private land west of Lower Gooseberry Reservoir would be acquired rather than the 120 acres under the Proposed Action. This land would be treated in the same manner as in the Proposed Action.

2.2.4.2.4.3 New Wetlands Adjacent to Narrows Reservoir.—This alternative would be identical to that described in the Proposed Action, except that the target acreage for mitigation would be reduced from 100 to 72 acres.

2.2.4.2.4.4 Manti Meadows.—This alternative would be identical to that described in the Proposed Action, except that the target acreage for mitigation would be reduced from 100 to 72 acres.

The wetland measures would need to include similar wildlife values as the 72 acres of wetlands that would be inundated by the reservoir. Careful monitoring of the mitigation sites would be conducted to ensure that the value of the mitigation sites is at least equal to the value of the wetlands lost. This determination would be accomplished by performing HEP analyses of the sites and comparing habitat values.

SWCD would have primary responsibility for implementing the wetland measures described above and would assume all other responsebilities associated therewith and described in connection with the Proposed Action.

2.2.4.2.5 Wildlife Measures

The wetland measures described above would offset any losses to wetland habitat caused by inundation. Impacts to upland habitat (mule deer and Brewer's sparrow habitat) were described earlier in connection with the Proposed Action, and the mitigation measures discussed there also would be implemented under the Small Reservoir Alternative.

2.2.4.2.6 Construction Materials

Locations of materials necessary for constructing Narrows Dam and Reservoir are shown in figure 2-3. In all other respects, the description of the construction materials is the same for this action as that described in connection with the Proposed Action.

2.2.4.2.7 Lands for Project Features and Relocation

About 1,345 acres of land would be required for project features, wetland mitigation, fish and wildlife enhancement and mitigation, and material source areas. The amounts of land by present ownership or administration and proposed project use for this alternative are shown in table 2-7.

Table 2-7.—Small Reservoir Alternative Right-of-Way Requirements for Project Features (Acres)

Project Feature Type of Acquisition	Ownership or Administration		
	Private	Reclamation Withdrawal	Total
Narrows Dam and Reservoir	108	255	363
East Bench Pipeline			
Perpetual easement	51	0	51
Oak Creek Pipeline			
Perpetual easement	9	0	9
Upper Cottonwood Creek Pipeline	1.5	1.5	3
SR-264 relocation	0	34	34
Recreation area	0	7	7
Fishery mitigation			
Perpetual conservation easement	206	0	206
Wildlife mitigation			
Fee title purchase of fish and wildlife enhancement area	385	0	385
Perpetual conservation easement adjacent to reservoir	150	0	150
Wetlands mitigation			
Perpetual easement or fee title	135	0	135
Materials source area[1]	0	2	2
Total	1,045.5	299.5	1,345

[1] Embankment material for the dam would be obtained from the reservoir basin. Rockfill material for upstream slope protection would be obtained from an existing quarry located on withdrawn land. An alternative rockfill material quarry site may be located on private land.

2.2.4.2.8 Access to Features

Construction access would be the same as that described for the Proposed Action.

2.2.4.2.9 Construction Program

The construction program would be similar to that incorporated into the Proposed Action.

2.2.4.2.10 Water Quality Protection Program

The water quality protection program would be the same as that incorporated into the Proposed Action.

2.2.4.2.11 Public Safety

The public safety measures for this alternative would be the same as those incorporated into the Proposed Action.

2.2.4.3 Costs and Financing

The Small Reservoir Alternative would cost about $32.6 million and would be funded by SWCD, the State of Utah, and a loan from the Federal Government (table 2-5). Of the $32.6-million cost, about $4.9 million is for fish and wildlife enhancement and recreation. These costs are nonreimbursable to the project sponsor. Total financing would be through provisions of the SPRA. Because of a smaller storage capacity, the cost of project water would be approximately 96% higher than the Proposed Action.

2.2.4.4 Project Administration

Under the Small Reservoir Alternative, project administration would be the same as that described for the Proposed Action.

2.3 Alternatives Considered and Eliminated from the Study

Several alternatives considered were determined to be unviable. In general, alternatives considered and eliminated from further study did not meet Reclamation's criteria for providing a SRPA loan or licensing the use of Federal land. It is important to note that, in addition to not meeting Reclamations purpose and need, these alternatives do not meet SWCD's water development objectives:

Those alternatives are summarized below.

2.3.1 Direct Diversion Without Reservoir Alternative

- The Direct Diversion Without Reservoir Alternative was formulated to avoid impacts to wetlands in the Narrows Reservoir basin and does not require constructing a dam and reservoir. Water would be diverted from Gooseberry Creek according to water demands within the project service area to the extent it is available in the natural runoff pattern (figure 2-11). Key features and elements of this alternative include: A diversion structure and pumping plant on Gooseberry Creek located about 1,000 feet downstream from the SR-264 highway crossing of Gooseberry Creek
- An electrical transmission line
- A 1,000-foot-long discharge pipeline
- An open canal about 0.8 mile long
- Narrows Tunnel rehabilitation
- Upper Cottonwood Creek Pipeline

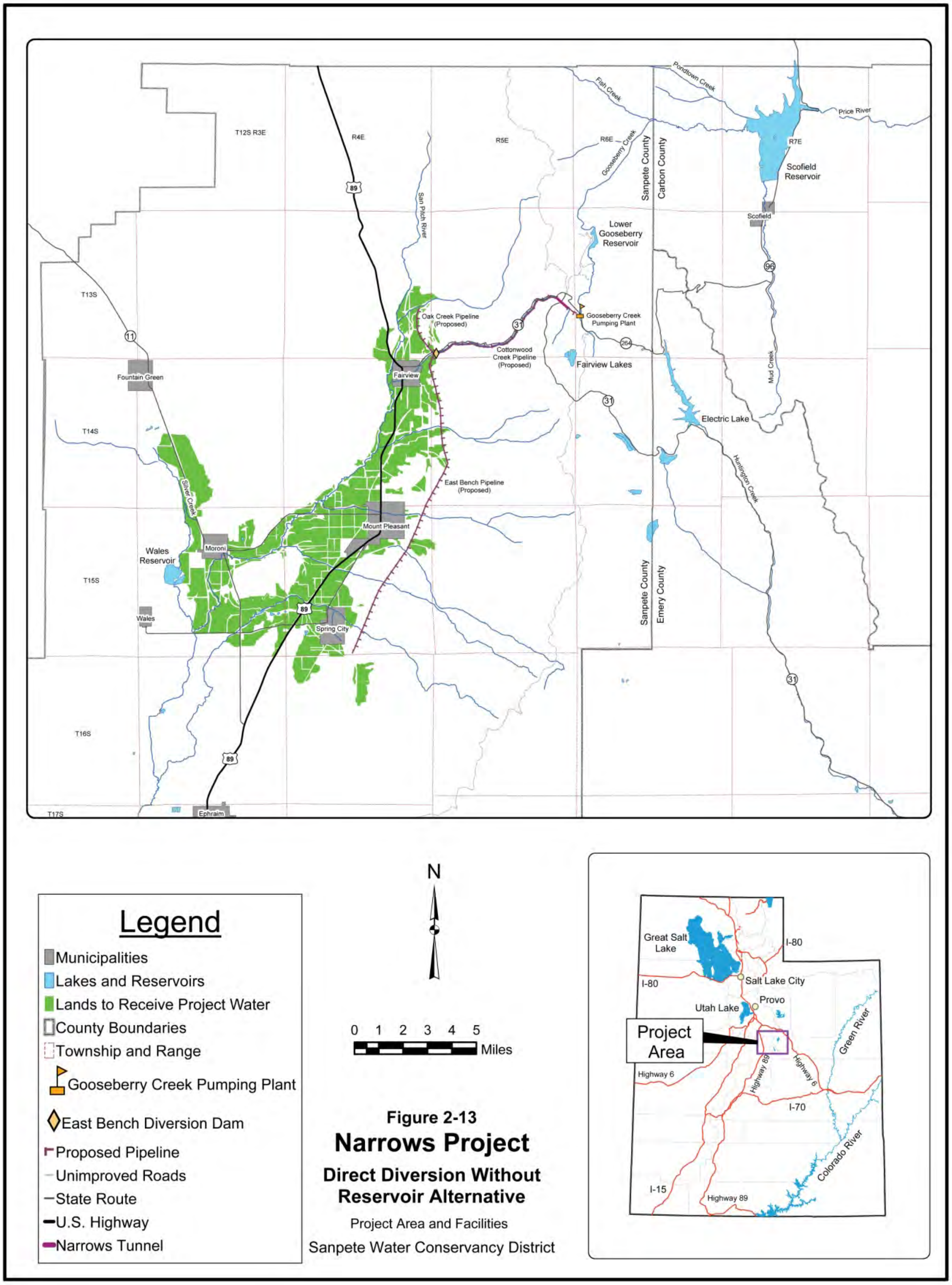


Figure 2-11.—Narrows Project, Direct Diversion Without Reservoir Alternative.

- Oak Creek Pipeline
- East Bench Pipeline

A hydrologic operation study indicates that an average of 1,373 acre-feet per year could be diverted from Gooseberry Creek to Cottonwood Creek. This analysis is based on 1960–92 flow records and takes into consideration the maximum annual transbasin diversion of 5,400 acre-feet, the 1.0-cfs minimum streamflow requirement at the Narrows damsite, and the demand for supplemental irrigation water. The majority of flow on Gooseberry Creek occurs in May and June. However, the demand for supplemental irrigation water generally occurs in July, August, and September. Therefore, the high flows of May and June would not be diverted because there would be no place to store the water to use later in the irrigation season. During low flow periods, natural flows in Gooseberry Creek would not be great enough to meet the 1.0-cfs minimum streamflow in Cottonwood Creek. Similarly, the project could not provide water as needed in the late irrigation season.

The total cost of the Direct Diversion Without Reservoir Alternative would be about $12.1 million. Since this alternative would provide neither recreation nor fish and wildlife benefits, there would be no grants available for those purposes; and the total project cost would be borne by the water users. In addition to capital costs, an annual pumping cost of about $7,200 would be incurred.

2.3.1.1 Reasons Eliminated from Further Consideration

For the following reasons, the Direct Diversion Without Reservoir Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal land and fails to meet the minimum requirements of SWCD's non-Federal water rights, making the project unviable and, therefore, ineligible for SRPA funding;

The Direct Diversion Without Reservoir Alternative does not supply irrigation water when it is needed during the mid- and late-summer months.

During low flow periods, this alternative cannot provide the 1.0-cfs minimum streamflow in Gooseberry Creek at the Narrows damsite as required by the project water rights.

Because this alternative would provide neither recreation nor fish and wildlife benefits for SWCD, there would be no grants available for those purposes that would offset some of the project costs.

2.3.2 Direct Diversion with Reservoir in Sanpete Valley Alternative

This alternative would include the same facilities in Gooseberry Creek as the Direct Diversion Without Reservoir Alternative, but a storage reservoir would be provided at a lower elevation in Sanpete Valley. The storage would allow the water to be delivered at times during the irrigation season when it is needed (figure 2-12).

A hydrologic operation study indicates that an average of 4,671 acre-feet per year could be diverted from Gooseberry Creek to Cottonwood Creek. This analysis is based on 1960–92 flow records and takes into consideration the maximum annual transbasin diversion of 5,400 acre-feet and the 1.0-cfs minimum streamflow requirement at the Narrows damsite. The majority of the divertible flow occurs in May and June. This flow would be added to the usual spring peak flows in Cottonwood Creek and could result in considerable degradation of the stream channel. During low flow periods, natural

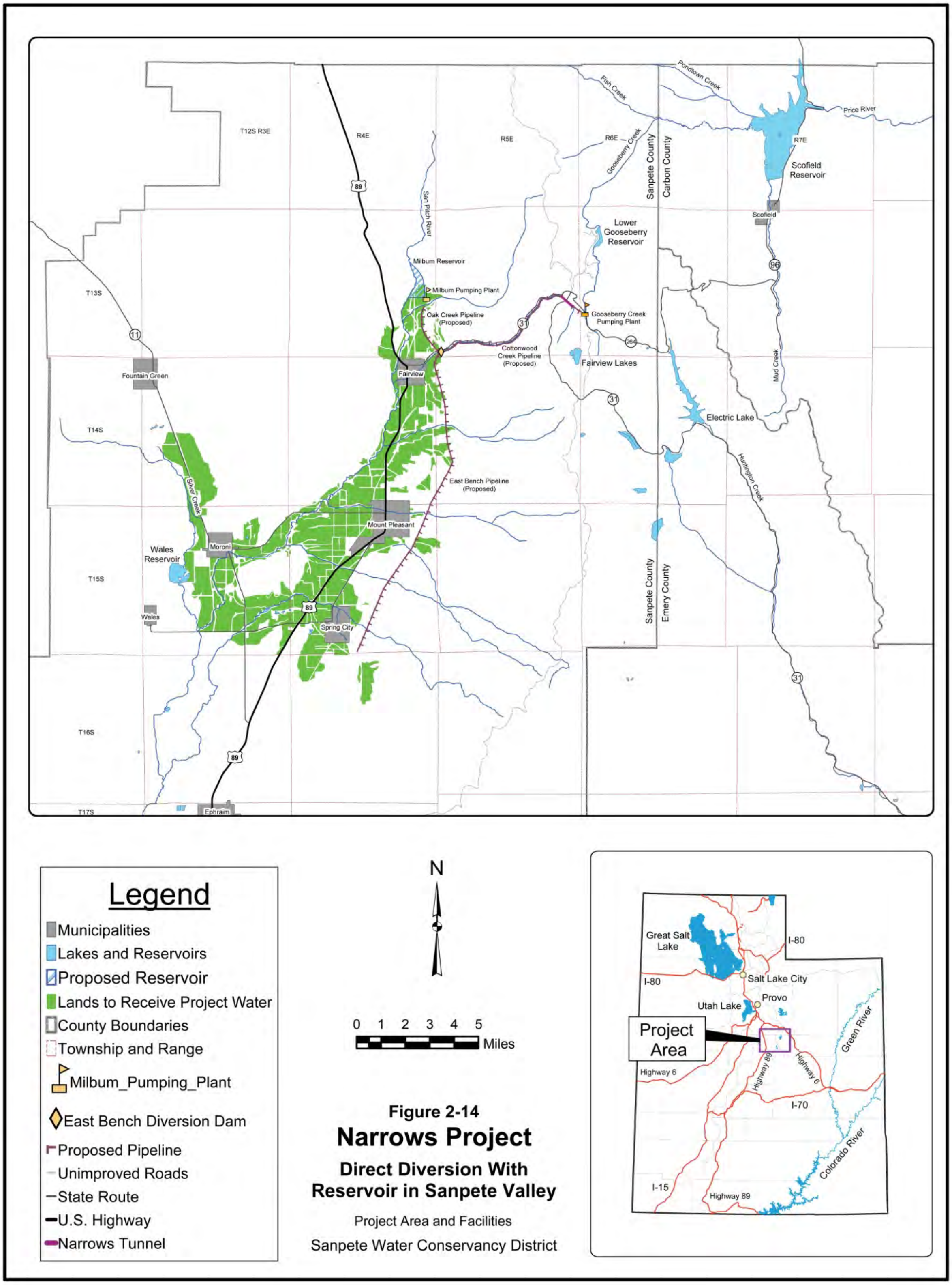


Figure 2-12.—Narrows Project, Direct Diversion with Reservoir in Sanpete Valley.

flows in Gooseberry Creek would not be great enough to meet the 1.0-cfs minimum streamflow in Gooseberry Creek or to provide the 2.0-cfs minimum year-round flow in Cottonwood Creek, as required by the 1984 Compromise Agreement.

To avoid severe degradation of the stream channel, the flow would need to be conveyed through a pipeline (the Cottonwood Creek Pipeline) for the entire length of the canyon. Proper placement of the pipeline is critical because a total of 104 landslides, most of which are active, have been mapped in the canyon. The topography of the canyon suggests that the most likely location for the pipeline would be within the existing highway alignment. However, due to the landslides, the highway has continual stability problems; and repairs are needed on an annual basis. The instability would present continual safety and maintenance problems for the high-pressure pipeline. The terminus of the Cottonwood Creek Pipeline would require a control/energy dissipation structure.

To identify the best damsite available, a reconnaissance-level study was performed in which all potentially practicable reservoir sites within the project area were identified (see appendix B). Preliminary estimates of storage capacity, dam height, and dam length were made. A total of 10 damsites were included in this evaluation. Of these damsites, a site located near Milburn appeared to be the most feasible. This determination was made based on the amount of embankment material required to construct the dam versus the volume of water that could be stored. The other damsites were eliminated because they were either technically or economically infeasible. The reservoir basin at the Milburn site contains about 60 acres of high quality wetlands, including willow thickets, cattails, and sedges that would be impacted.

In addition to the dam, the Oak Creek Pipeline would need to be enlarged to deliver water from the reservoir to the project area. A pumping plant also would be needed to lift the water into the pipeline. Key features and elements of this alternative include the following:

- A diversion structure and pumping plant on Gooseberry Creek located about 1,000 feet downstream from the SR-264 highway crossing of Gooseberry Creek.
- An electrical transmission line.
- A 1,000-foot-long discharge pipeline.
- An open canal about 0.8 mile long.
- Narrows Tunnel rehabilitation.
- Cottonwood Creek Pipeline.
- Milburn dam and reservoir (5,400-acre-foot capacity). The dam would have a maximum height of 64 feet and a crest length of 2,185 feet.
- A pumping plant near Milburn dam.
- An enlarged Oak Creek Pipeline.
- East Bench Pipeline.

Total project cost would be about $50 million or about $18.4 million higher than the Proposed Action. However, this alternative does not have any carryover storage and would not provide SWCD with recreation or fish and wildlife benefits. As a result, it would not be eligible for State or Federal grants for these purposes. All costs would be allocated to and repaid by the local water users. Costs allocated to the water users would be about 2.8 times those under the Proposed Action while the yield would be about 13% less than the Proposed Action. In addition, annual O&M costs would be increased by about $155,000 per year to provide for pumping power at two locations.

2.3.2.1 Reasons Eliminated from Further Consideration

For the following reasons, the Direct Diversion with Reservoir Alternative in Sanpete Valley fails to generate sufficient benefits to justify a SRPA loan and use of Federal lands, making the project unviable and, therefore, ineligible for SRPA funding;

The proposal is financially infeasible. With the substantially higher initial cost and higher annual costs, the sponsor lacks resources to meet SRPA cost-sharing requirements. In addition, annual costs exceed the sponsor's repayment capacity.

The feasibility of constructing the Cottonwood Creek Pipeline is highly doubtful due to the geologic instability of the canyon. The safety concerns and maintenance problems posed by this instability would be unacceptable.

The water right for this plan is questionable. During low flow periods, natural flow in Gooseberry Creek is insufficient to maintain the 1.0-cfs minimum streamflow required to establish and maintain the water right, as provided in the 1984 Compromise Agreement.

This proposal would still inundate about 60 acres of high quality wetlands.

2.3.3 Conservation Without Development of Other Water Supplies Alternative

Instead of developing new water supplies, implementing conservation measures has been suggested to extend existing water supplies. Under this alternative, the Narrows Dam and Reservoir would not be constructed. Without the dam construction, there would be no need to relocate SR-264; and there would be no recreational facilities constructed at the reservoir site. The East Bench, Oak Creek, and Upper Cottonwood Creek Pipelines would not be built. Irrigators in the project area have already implemented extensive efficiency improvements (conservation measures) to extend their scarce water supplies. Approximately 60% of the irrigated land within the project area is irrigated with sprinklers. About 75% of the land is served by improved conveyance facilities such as pipelines and lined canals and ditches. Based upon these conditions, the diversion requirement was computed to be an average of about 62,900 acre-feet per year for the 15,420 acres of project-eligible lands (see section 1.5.2). With average annual water supplies of 34,200 acre-feet per year, this would leave a shortage of about 28,700 acre-feet per year.

Because of this shortage, certain individuals and canal companies were planning to install, or were currently installing, a variety of efficiency improvements on much of the unimproved portions of project lands. These improvements would be expected to be in place by the projected date of completion for the proposed Narrows Project. These improvements would consist mainly of additional pipe delivery and sprinkler irrigation systems. Land leveling is often used as a technique to improve onfarm efficiency; however, due to the topography and shallow depth of soil, land leveling is generally not practical or economically feasible in the project area. Drip irrigation systems, which are highly efficient, are not considered practical for the alfalfa/grain rotation crops that are grown in the project area. With completion of these improvements, most of the cost-effective measures would have been implemented. There still could be limited opportunities for some localized improvements.

As a result of these efficiency improvements, diversion demands would be expected to be reduced from an average of 62,900 to about 51,700 acre-feet per year. This would be an average reduction in diversion demand of about 11,200 acre-feet per year. (In previous documents, this reduction has been reported to be 8,000 acre-feet per year but now has been revised based upon updated crop consumptive use data.) Even with these improvements in place, remaining shortages would be estimated at about 15,250 acre-feet per year. With this amount of shortage, significant soil moisture deficits would continue to seriously impact crop growth and production.

It should be noted that the 11,200-acre-foot reduction in diversion demand is not new water. New water would become available only if demands could be reduced below available supplies. In this case, efficiency improvements would make more use of the existing water supply available to the plants by reducing the amount of water lost to the plants because of evaporation, seepage, and spills from the carriage system; deep percolation through the root zone; and runoff from the ends of the fields. There would be two consequences of implementing efficiency improvements:

1. More of the existing water supplies would become available to support plant growth and development. Here, an additional 3,500 acre-feet per year of existing water supplies would be available to the plants.

2. Conversely, 3,500 acre-feet per year, less the amount previously lost by evaporation, no longer would be available as return flows to support wetlands, aquatic habitat, and downstream users.

As mentioned previously, most of the remaining cost-effective efficiency improvements would be implemented within a relatively short timeframe independent of the Narrows Project or any other organized program. In essence, their implementation would be a component of the No Action Alternative and would not satisfy the need for additional supplemental water.

2.3.3.1 Reasons Eliminated from Further Consideration

This is an ongoing activity that is a component of the No Action Alternative, the Proposed Action, and any other alternative that might be considered.

For the following reasons, the Conservation Without Development of Other Water Supplies Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal lands, making the project unviable and, therefore, ineligible for SRPA funding;

Implementing efficiency improvements does not adequately satisfy SWCD’s need for additional supplemental irrigation water.

Efficiency improvements do not provide SWCD with significant relief for water shortages during the late irrigation season when supplemental water is needed the most.

With implementing the planned efficiency improvements, the opportunity for additional large-scale conservation programs is nonexistent.

2.3.4 Mammoth Damsite Alternative

Several alternative damsite locations were evaluated and studied during the early stages of project planning. Because of the topography of many of these alternative damsites and technical difficulties relating to dam length and height and storage capacity, only two of the sites were further evaluated.

The first of these is the damsite contemplated in the original Gooseberry Project Plan.

The original Gooseberry Project Plan contemplated a reservoir site generally located in the south half of section 6 and part of sections 7 and 18, T. 13 S., R. 6 E., Salt Lake Base and Meridian, commonly referred to as the Mammoth reservoir site (figure 2-13). Through direct diversions and storage in the Mammoth reservoir, the original project plan contemplated a transmountain diversion of up to 30,000 acre-feet of water per year.

Through public reviews, the Service, among others, requested moving the Gooseberry damsite from the proposed Mammoth site to the proposed Narrows site to protect fishery values. In 1984, UDWR made a similar request and specifically requested the exclusion of Cabin Hollow Creek from the Gooseberry Project. Next, using Brooks Canyon Creek water became impractical because the existing wetlands are dependent upon its water supply. The amount of water available from this source did not justify the impact on the wetlands.

In 1984, Reclamation, SWCD, the Price River Water Users Association, and the Carbon Water Conservancy District entered into a Compromise Agreement that set forth conditions upon which water rights for both the Scofield Project and the Narrows Project would be established. The 1984 Compromise Agreement established priorities, quantities of flow, storage capacities, location of storage facilities, and points of diversion for these projects. The agreement recognized the above environmental concerns and expressly excluded the Mammoth damsite as a location for project storage facilities. The 1984 Compromise Agreement was a resolution of many years of disagreement between Carbon and Sanpete water interests over the Gooseberry Project. In 1985, the Utah State Engineer approved both the Narrows portion and the Scofield portion of the Gooseberry Project Plan water rights. Both approvals were expressly made subject to terms of the 1984 Compromise Agreement. Thus, no water right is now or likely would be approved in the future for a project constructed at the Mammoth damsite without amendment to the compromise agreement and approval of associated water right changes.

2.3.4.1 Reasons Eliminated from Further Consideration

For the following reasons, the Mammoth Damsite Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal land and fails to meet the minimum requirements of SWCD's non-Federal water rights, making the project unviable and, therefore, ineligible for SRPA funding;

The Mammoth damsite was specifically eliminated from consideration during negotiations leading to the 1984 Compromise Agreement because the environmental impacts of a project constructed at that location were unacceptable to the Service and UDWR.

The alternative is technically infeasible. The sponsor cannot secure the water rights necessary to establish project water supplies as required by SRPA.

2.3.5 Valley Damsite Alternative

Several alternative damsite locations were evaluated and studied. Because of the topography of many of these alternative damsites and technical difficulties relating to dam length and height as well as storage capacity, only two of the sites were further evaluated. The Valley damsite is the second of the two sites evaluated.

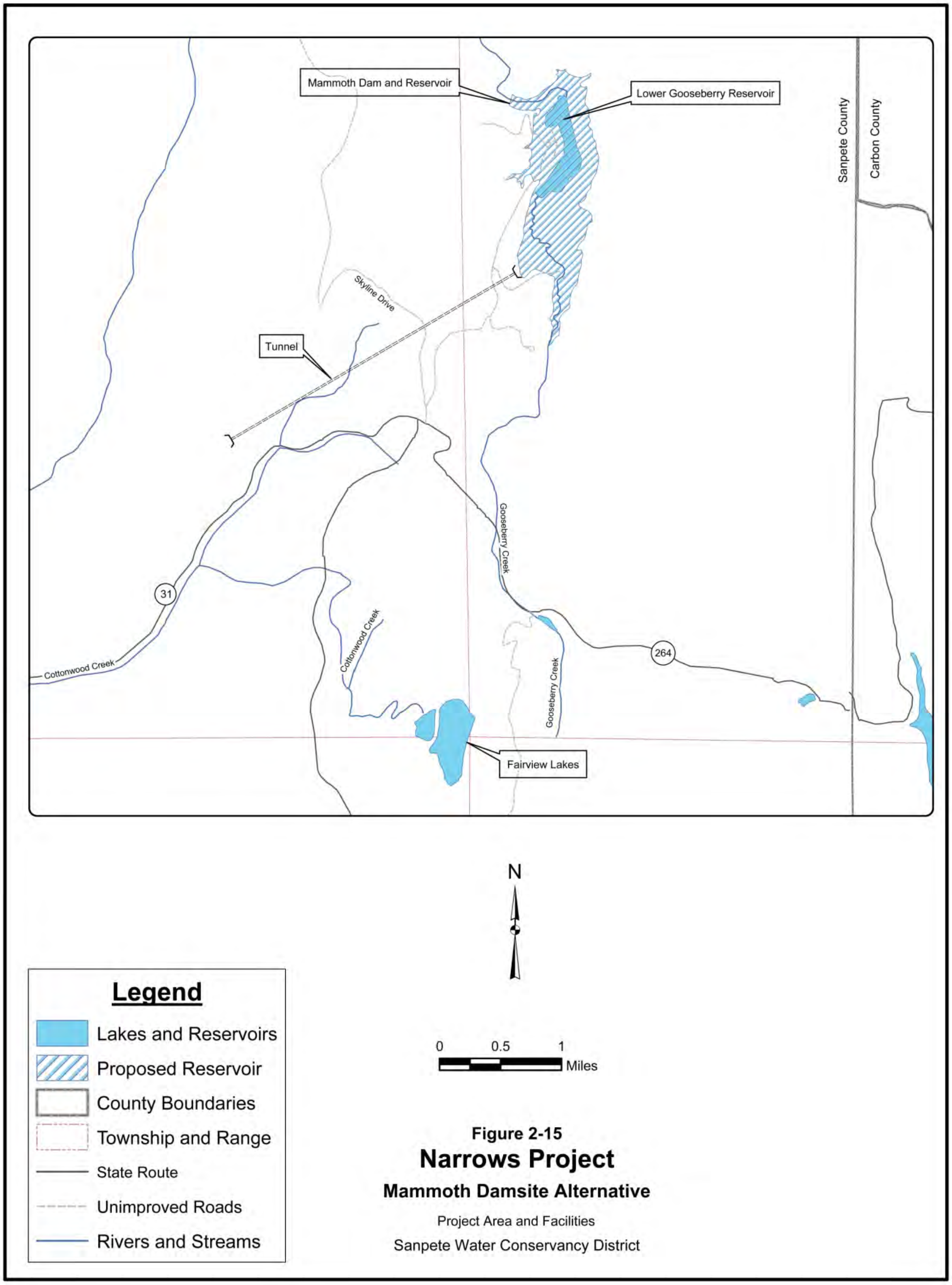


Figure 2-13.—Narrows Project Mammoth Damsite Alternative.

An alternative damsite for the Narrows Dam was evaluated and presented at the public scoping meetings. That dam would be located in the valley upstream of the Narrows damsite (figure 2-14). The dam, having a crest length of about 5,000 feet, would be located upstream of SR-264. The reservoir, with a 4,500-acre-foot capacity, would produce an annual average yield of about 4,376 acre-feet. This alternative would produce only about 82% of the yield of the Proposed Action. The dam and reservoir would be located off stream, so a diversion structure and feeder canal would be required to convey flows from Gooseberry Creek into the reservoir. The Narrows Tunnel would be required to convey project water transmountain into Cottonwood Creek. The East Bench and Oak Creek Pipelines would deliver water to the users. Total estimated cost of this alternative is about $31.1 million.

The reservoir would not have sufficient capacity for any carryover storage. Without the carryover storage, this alternative would not produce any of SWCD's recreation or fish and wildlife benefits; and the alternative would, therefore, be ineligible for grants for these purposes. SWCD would be responsible for the entire cost of the alternative. The lack of eligibility for grants increases the capital cost per acre-foot of yield attributed to SWCD to about 2.1 times the capital cost per acre-foot of yield of the Proposed Action. Based upon SRPA's financial feasibility requirements, SWCD would be eligible for a loan of about $16,900,000 and would be required to provide $7,200,000 in local funds toward project construction. The loan would be repaid in 30 years with annual payments of about $563,000.

This alternative does not conform to the terms of the 1984 Compromise Agreement as to location, storage capacity, or point of diversion. This alternative would not be eligible for an approved water right unless terms of the 1984 Compromise Agreement and the approved water rights were modified.

2.3.5.1 Reasons Eliminated from Further Consideration

For the following reasons, the Valley Damsite Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal land and fails to meet the minimum requirements of SWCD's non-Federal water rights, making the project unviable and, therefore, ineligible for SRPA funding;

The average annual yield would be about 18% less than the Proposed Action; whereas, the absence of any carryover storage would mean that this shortage would be felt most severely in an extended drought and would, in that sense, provide virtually no water when it is most needed.

Water rights for this alternative are questionable. Lacking modification to the 1984 Compromise Agreement, SWCD would not be able to secure the water rights necessary to establish project water supplies as required by SRPA. Without an approved water right, the alternative would be technically infeasible and ineligible for SRPA funding. Under Utah law, a change of water right cannot be filed on an approved application to appropriate; a change application can be filed only on a certificated water right that only can be acquired after the applied-for application has taken place and the water in question placed to beneficial use. Moving to another site, such as the Valley damsite, would require abandonment of the existing approved application and establishment of a new one, with a much junior priority date and associated complications relating to the downstream rights on Gooseberry Creek and Scofield Reservoir.

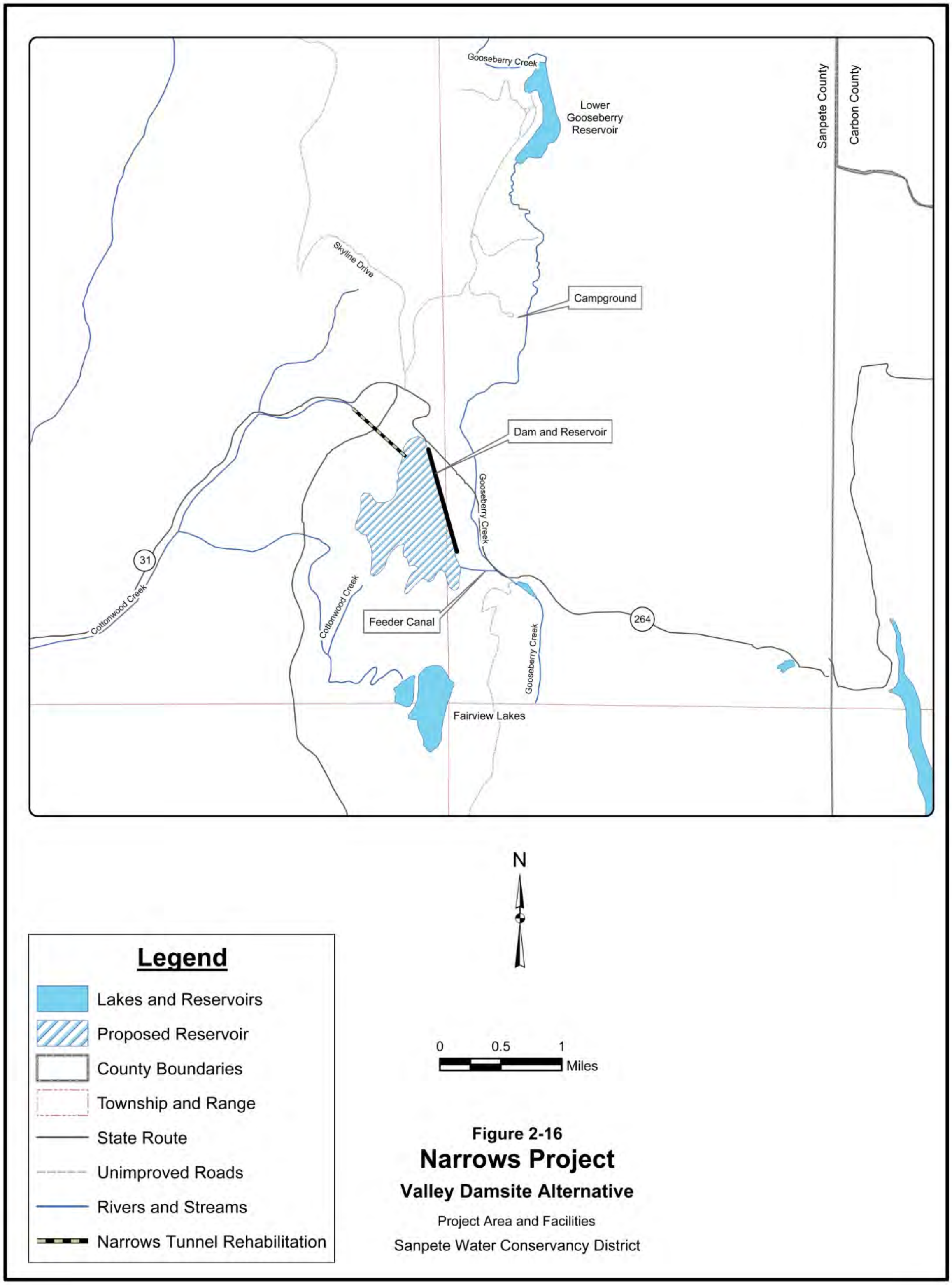


Figure 2-14.—Narrows Project Valley Damsite Alternative.

This alternative does not eliminate most of the impacts to wetlands and Gooseberry Creek that are objectionable aspects of the Proposed Action

2.3.6 Skyline Mine Alternative

Under this alternative, ground water would be developed in the Flat Canyon area, located east of the proposed Narrows Reservoir basin, by drilling deep wells and pumping the ground water from bedrock. This plan originally was developed and proposed by Canyon Fuel Company, the owner of the Skyline Coal Mine.

On August 16, 2001, coal miners in central Utah's Skyline Mine inadvertently tapped into a saturated sandstone formation. As a result, 4,700 gallons per minute of water began flowing into the mine. The coal company, in turn, spent $6 million on pipe and pumping equipment to remove the water from the mine and drain it into Scofield Reservoir. Additional wells were drilled near Electric Lake and were pumped into the Huntington Creek drainage.

Early investigations performed by the mine identified the water as \ being a potentially new unappropriated source from a prehistoric aquifer. The mine developed a theory that, if the water was a new source, development of this source would not interfere with any existing water rights—therefore, this ground water could be developed as a new source of water supply. The idea was that the mine would help pay the capital cost of the project if the surrounding counties (Carbon, Emery, and Sanpete) would pay the cost of pumping the water and then use it for a temporary water supply. The mine would, in turn, benefit by having the ground water levels adjacent to the mine lowered, which would make it economical for Canyon Fuel to mine the remainder of the coal deposit. Some individuals suggested that the water supply developed by this project could be an alternative to the Narrows Project.

However, before the logistics of this alternative could be coordinated among Carbon, Emery, and Sanpete Counties, Utah Power claimed ownership of the water. Utah Power asserted that, since the miners had tapped into the aquifer, Electric Lake, owned by Utah Power, began losing 700 acre-feet of water per month.

In discussions with mine officials, Utah Power, water users, and county officials, the State Engineer gave his opinion that it would be difficult, if not impossible, to prove that the water pumped from the mine is unappropriated.

Recently, Canyon Fuel has abandoned the Flat Canyon portion of the mine where the ground water was encountered and has expanded its operations to the north. It has sealed off that portion of the mine and does not have plans to resume mining operations in the Flat Canyon area.

2.3.6.1 Reasons Eliminated from Further Consideration

For the following reasons, the Skyline Mine Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal land and fails to meet the minimum requirements of SWCD's non-Federal water rights, making the project unviable and, therefore, ineligible for SRPA funding;

Preliminary studies performed by Canyon Fuel showed that water developed by the project would be very expensive, even with Canyon Fuel's assistance with capital costs. The project would be cost prohibitive without Canyon Fuel's participation.

The source of the water and the impact on existing water rights has not been established. The State Engineer maintains the position that all water in the area is fully appropriated; without a water right, this alternative is not feasible.

Since it would have provided only a temporary water supply, it was not considered to be a viable alternative.

2.3.7 Year-round Release with Ground Water Exchange and Pumping Alternative

The purpose and intent of this alternative is to avoid impacts to Cottonwood Creek by making releases from the Narrows Reservoir on a year-round basis. Year-round releases would eliminate SWCD's need for much higher releases during the latter part of the irrigation season. Water would be released through the Narrows Tunnel and would flow down Cottonwood Creek to the San Pitch River and be stored in Gunnison Reservoir. This water would be exchanged with ground water pumped from wells during the irrigation season.

Under the Ground Water Exchange Alternative, a total of about 50.0 cfs would be required to satisfy project demands. Based on typical hydraulic transmissivity of the alluvial material in the northern Sanpete Valley aquifers, it is estimated that properly engineered wells could produce only about 2.0–3.0 cfs each. At this capacity, about 20 wells would be required to deliver the water to the various irrigation companies within the project area. These wells would be located strategically near the existing distribution systems. Under this alternative, the Narrows Reservoir and Tunnel would still be needed by SWCD. The Upper Cottonwood, East Bench, and Oak Creek Pipelines would be eliminated.

Ground water occurs in northern Sanpete Valley in the unconsolidated alluvial fill under water table (unconfined) and artesian (confined) conditions. Depth to water ranges from 10 feet in the center of the valley to about 88 feet near the alluvial slopes at the base of the Wasatch Plateau. The hydraulic transmissivity ranges from less than 1,000 square feet per day (ft^2/day) to about 20,000 ft^2/day. Formations with the lowest transmissivity generally are located in the center of the valley. Typical well depths range from about 50–500 feet. There are about 55 pumped wells and about 185 flowing wells in the entire Sanpete Valley. Most of the ground water currently is being used for irrigation.

As noted, in addition to the Narrows Reservoir and Tunnel, approximately 20 wells would be required by SWCD to produce a total capacity of 50.0 cfs. These would be 20-inch-diameter rotary-drilled wells. Because they would be drilled in unconsolidated alluvial fill, the wells would need to be fully cased and screened with gravel packing. The wells would cost about $6.5 million at a cost of approximately $325,000 per well. O&M costs for pumping would be about $52 per acre-foot or $281,000 per year to deliver 5,400 acre-feet. The total estimated cost of this alternative is about $26,632,000 or about 0.85 times the cost of the Proposed Action. However, with the added cost of pumping, the average annual cost for water is about 1.07 times the cost for the Proposed Action.

As noted above, the productivity of the aquifer as reflected by the range in transmissivity varies considerably from location to location throughout the valley. This suggests some risk associated with the site selection and the associated uncertainty as to whether SWCD's required flow could be developed with the 20 wells for the estimated cost. In addition, the 20 new, high-capacity wells coupled with the relatively large number of existing wells and low transmissivity in parts of the valley suggest that the potential for interference with other wells would be significant.

Change applications would need to be approved by the State Engineer to exchange the imported water from the Narrows Project to the new wells. Historically, the State Engineer has been reluctant to approve change applications or new applications where there is a possibility of significant interference with existing wells. With the high potential for interference, it is unlikely that extensive changes as proposed by this alternative would be approved by the State Engineer.

An additional alternative configuration would be to implement this alternative without constructing the Narrows Dam and Reservoir, diverting approximately 4,671 acre-feet of water. This configuration is simply a variation of the Year-Round Release Alternative and would suffer from the same deficiencies. Therefore, this configuration has been eliminated from further study for the same reasons as the Year-Round Release with the Ground Water Exchange and Pumping Alternative.

2.3.7.1 Reasons Eliminated from Further Consideration

For the following reasons, the Year-Round Release with Ground Water Exchange and Pumping Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal land and fails to meet the minimum requirements of SWCD's non-Federal water rights, making the project unviable and, therefore, ineligible for SRPA funding;

Technical feasibility of the alternative is uncertain. The range of transmissivity of the aquifer formation introduces significant risk and suggests that more than 20 wells might be required for SWCD to produce the 50.0-cfs capacity. The potential for SWCD's ability to obtain an approved change application is equally uncertain because of the potential for significant interference with existing wells.

Water right uncertainties cloud eligibility for SRPA funding. This alternative does not eliminate most of the impacts to wetlands and Gooseberry Creek that are aspects of the Proposed Action.

2.3.8 New Ground Water Development Alternative

Some suggestions received in scoping meetings proposed developing local ground water sources in lieu of constructing the Narrows Dam and Reservoir. Under this alternative, there would be no need for the Narrows Dam and Reservoir or the pipelines included in the Proposed Action. A total well capacity of about 50.0 cfs would be required to supply project needs. As discussed in the previous alternative, about 20 wells with a capacity of 2.0–3.0 cfs would be required. Total cost of the wells would be about $6,500,000; and annual pumping costs would be about $281,000.

This alternative would require approval by the State Engineer. However, the State Engineer considers the ground water aquifer in north Sanpete County to be fully appropriated. Further development of ground water in the area without import would impact existing water rights in downstream locations. In a November 5, 1997, policy memorandum, entitled Water Rights Policy, Sevier River Basin Areas 61, 63, 65, 66, 67, 68, and 69, the State Engineer published the following:

> "As of March 19, 1997, the Sevier River Basin was closed to all new appropriations of ground water. . . All new ground-water development will be based on the acquisition and changing of existing valid water rights

from surface (including direct flow and reservoir storage) and underground sources."

No new water is available for development of the magnitude required here by SWCD. The only water that might be made available to SWCD would be through purchasing existing water rights. Purchasing existing water rights is essentially the same as the proposal to retire irrigated lands, which is discussed subsequently.

2.3.8.1 Reason Eliminated from Further Consideration

For the following reasons, the New Ground Water Development Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal land and fails to meet the minimum requirements of SWCD's non-Federal water rights, making the project unviable and, therefore, ineligible for SRPA funding;

This alternative is technically infeasible. No water supply exists for the proposal.

2.3.9 New Surface Water Development in Sanpete County Alternative

Several suggestions have been made to expand the use of local streams to satisfy SWCD's project needs. These suggestions include storing excess spring flows either in a new reservoir built in Sanpete County or using these flows to recharge the ground water basin for later use. Another version of this alternative would be for SWCD to purchase existing water rights to meet its needs. Under this alternative, there would be no need for SWCD to construct the Narrows Dam and Reservoir or the pipelines included in the Proposed Action.

While it is true that there are excess flows in the local streams during the spring runoff, this water is not available for use in northern Sanpete County. On November 30, 1936, a final decree was entered by Judge LeRoy Cox adjudicating the water and water rights of the Sevier River system. Under the terms of the Cox Decree, all of the waters within the project area, located in the Sevier River drainage, are fully appropriated; and no additional local supplies are available for appropriation or development. Any water, either underground or surface water, in the project area is either fully appropriated by local water right owners or is necessary to satisfy the water rights of downstream appropriators. Thus, no new surface water is available for local development.

Even though the local surface water supplies are fully appropriated, the State Engineer would consider applications to transfer water rights and change points of diversion. To be approved, the change in points of diversion must not adversely impact third party water rights holders. With the complexity of water rights in the Sevier River Basin involving direct and return flows, the possibility of adverse impacts is substantial with almost any conceivable change in points of diversion.

The suggested purchase of water rights and transfer of points of diversion imply that certain irrigated lands would be removed from production with the transfer of the water right. This proposal is essentially the retirement of irrigated lands, which is discussed subsequently.

2.3.9.1 Reason Eliminated from Further Consideration

For the following reasons, the New Surface Water Development in Sanpete County Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal land and fails to meet the minimum requirements of SWCD's non-Federal water rights, making the project unviable and, therefore, ineligible for SRPA funding;

The alternative is technically infeasible. There is no adequate surface water supply for the project.

2.3.10 Central Utah Project Water Alternative

Use of CUP water has been suggested to meet SWCD's project needs. The CUP originally intended to deliver CUP water to southern Sanpete County, south of the city of Gunnison. It is suggested that this water be made available to northern Sanpete County by exchange or through a new pipeline constructed from the outlet of Syar Tunnel to northern Sanpete County. An exchange is not technically possible. No water could be retained in northern Sanpete County to be exchanged for CUP water. As a result, CUP water would need to be delivered directly from Syar Tunnel.

Under this proposal, 50 cfs of CUP water would be delivered from the outfall of Syar Tunnel through a series of pipes and tunnels using the available pressure head from Strawberry Reservoir. This 38.8-mile-long pipeline would start at Syar Tunnel and end at the mouth of Cottonwood Creek Canyon in Sanpete County. It would require three tunnels and pressure pipe with ratings as high as 750 pounds per square inch.

The hydraulics require a minimum of 48-inch-diameter pipe through the reach between the Syar Tunnel and the outfall of the third tunnel, a length of 116,600 feet. From this point on, the pipeline is reduced to a 36-inch-diameter pipe for an additional 88,300 feet. A total of 13,300 feet of tunnel would be required. Costs were developed using 1987 estimates for steel pipe and tunnels for the CUP and indexing them to April 1994. The total cost for the Syar-Cottonwood Pipeline is estimated to be $146,600,000. This includes the cost of the East Bench Pipeline that still would be required to deliver project water.

To be eligible for funding under terms of the SRPA, total project costs must be under $15 million indexed from 1956 to the present or about $50 million in today's dollars. The total cost of the Syar-Cottonwood Pipeline proposal exceeds the maximum limit by over 2.5 times and is more than 8 times that of the Proposed Action. Thus, the proposal would not be eligible for SRPA funding.

The Central Utah Project Completion Act, which authorized completion of the remaining features of the CUP, placed certain restrictions on delivery of project water. It restricted development of the CUP to the Wasatch Front area of central Utah if certain Utah counties withdrew from the CUP. Since passage of the CUPCA, Millard and Sevier Counties formally have withdrawn from the CUP. As a result, delivery of water to Sanpete County has been dropped from the CUP plan in compliance with the CUPCA.

2.3.10.1 Reasons Eliminated from Further Consideration

For the following reasons, the Central Utah Project Water Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal land and fails to meet the minimum requirements of SWCD's non-Federal water rights, making the project unviable and, therefore, ineligible for SRPA funding;

The plan is financially infeasible because the proposal does not qualify for SRPA funding.

Costs exceed the estimated cost of the Proposed Action by more than 8 times.

CUP water cannot be legally delivered to Sanpete County under present law.

2.3.11 Conservation Through Retirement of Irrigation Lands Alternative

Retirement of irrigated lands is one method of reducing water shortages where local supplies are inadequate to meet all demands for irrigation water. In practice, certain irrigated lands are retired; and the water is transferred to other irrigated lands. The shortage on the active lands, thereby, is reduced by some corresponding increment. If storage is available, water originally allocated to the retired lands would be held until needed on the active lands. In the absence of storage, only the existing streamflow allocated to the retired lands would be available for diversion to the active lands. Where snowmelt is the major component of local supplies, flows diminish during the irrigation season. Thus, absent storage, water would be available only for transfer to the remaining active lands when it would normally be applied to the retired land. Since any land that might be considered for retirement is already water short during the mid- to late-summer, little additional water would be available when it is needed most.

It has been suggested that sufficient irrigated lands be retired to reduce the demand by 4,900 acre-feet per year, the amount of irrigation water that would be produced by the Proposed Action. Local water supplies amounting to about 1.78 acre-feet per acre are available in the late irrigation season to lands proposed for retirement. To make 4,900 acre-feet of water available to the active lands, about 2,760 acres of land would need to be retired. This represents about 18% of the 15,420 acres of project-eligible lands. Project-ineligible lands normally do not receive water during most of the water-short portion of the growing season, so there would be no advantage in retiring project-ineligible lands.

To achieve this benefit for the lands remaining in production, the lands (18%) removed from production would be taken out of production in their entirety. An 18% reduction of project-eligible farmland is contrary to one of the stated needs for the project. Agriculture is one of the major components of the economy of north Sanpete County and is seriously impacted by persistent water shortages. Land retirement would not materially improve the overall water supply situation in the project area. It would improve only the water supply for selected farmland, and then only marginally.

It should be noted that the suggested land retirement still would not provide a full water supply to the remaining active lands. To put land retirement in perspective, consider how many acres of land must be retired to provide a full water supply to the remaining active lands. In a typical June when local supplies are still relatively abundant, available local water supplies could supply only the June demands on about 11,900 acres of project-eligible farmland—a reduction of about 3,500 acres from what is now farmed. The typical September demands are considerably lower, but local supplies also have dwindled to the point that they could provide a full water supply only to about 6,000 acres of land—a reduction of about 9,400 acres.

Reduced water shortages on active irrigated lands definitely would provide an incremental improvement in production and yield on those lands. The economic impact of land retirement is detrimental to the local economy and is politically unacceptable to local residents.

Major sources of funding for the proposed project would be from the SRPA and a State loan and grant. However, land retirement is a local land use issue that does not qualify as a water development feature under requirements of the SRPA loan program. Similarly, land retirement does not provide benefits that would be eligible for State funding. Without State and SRPA funding, local funds would be inadequate to retire 2,760 acres of irrigated farmland.

The concept of land retirement also presupposes that there are willing sellers and willing buyers of land, forbearance, or water rights. There seems to be little indication that local farmers are willing to forgo farming on 20% of their irrigated farmland. To the contrary, local farmers appear to be more willing to support the Proposed Action to improve the water supply for their irrigated lands.

The purchase of land or rights for retirement would have to be accomplished either by the project sponsor or by individual farmers. In either case, prospective purchasers most likely would not have the resources to make such extensive land purchases. Land and rights purchases are not eligible for funding under terms of the SRPA, and most banks would not accept idle, nonproductive land as collateral for a bank loan. Further, no buyers have announced any interest in making such purchases. Lacking willing sellers, there may be no equitable or acceptable means for determining which lands would be retired.

2.3.11.1 Reasons Eliminated from Further Consideration

For the following reasons, the Conservation Through Retirement of Irrigation Lands Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal lands, making the project unviable and, therefore, ineligible for SRPA funding;

This plan does not meet SWCD's stated need for supplemental water supplies to support existing farmland; rather, it proposes taking farmland out of production to reduce the need for supplemental water.

Any water made available for late season irrigation under this proposal would be only that fraction of the water formerly used on retired lands during the late irrigation season; most of the water formerly used on these lands would flow past without being used locally.

2.3.12 Purchase of Sanpete County's Water Rights by Carbon County Water Interests Alternative

Scoping comments suggested that Carbon County water interests could purchase Sanpete's rights to Gooseberry Creek water. This would eliminate impacts to Carbon County that would occur as a result of constructing the Narrows Project and diverting Gooseberry Creek water. Since the inception of the Gooseberry Project, this alternative has been available to Carbon County water interests.

2.3.12.1 Reasons Eliminated from Further Consideration

For the following reasons, the Purchase of Sanpete County's Water Rights by Carbon County Water Interests Alternative fails to generate sufficient benefits to justify a SRPA loan and use of Federal lands, making the project unviable and, therefore, ineligible for SRPA funding;

The proposal does not provide any relief from the persistent water shortages that prompted northern Sanpete County water users to pursue developing additional water supplies.

The proposal is infeasible without the presence of both willing sellers and willing buyers.

2.3.13 Carbon County Proposed Recharge Alternative

In September 2006, Carbon County proposed an alternative for review consisting of diverting transbasin water through a rehabilitated Narrows Tunnel and down Cottonwood Creek to a proposed ground water recharge aquifer at the mouth of the canyon. The alternative also would include construction of production wells and a delivery system. Following coordination with the Utah State Engineer to verify feasibility of the alternative from a water rights perspective, Sanpete County agreed to an analysis of the alternative overseen by the Central Utah Water Conservancy District. CH2MHill, under contract to the CUWCD, analyzed this alternative and included it in the June 2008 draft update to the *Sanpete County Master Plan*, which was distributed for public review and comment, including a public meeting on June 26, 2008, hosted by CUWCD in Orem, Utah. Following consideration of comments received on the draft plan, the final *Update to the Sanpete County Master Plan* was published in August 2008.

2.3.13.1 Reasons Eliminated from Further Consideration

For the following reasons, the Carbon County Recharge Alternative fails to generate sufficient benefits to justify a SRPA loan, making the project unviable and, therefore, ineligible for SRPA funding. It is important to note that, in addition to not meeting Reclamation's purpose and need, this alternative does not meet SWCD's water development objectives:

There are several technical reasons why this alternative was not considered.

It is unlikely that an aquifer with a capacity to hold over 4,000 acre-feet of water could be found in northern Sanpete County.

Direct diversion of flows would require extensive construction of diversion dams and canals within the reservoir basin, potentially negating the avoidance of impacts by not building the proposed reservoir.

Water would have to be treated to drinking water standards before injection; or alternately, a large infiltration pond and settling basin, equivalent to a small reservoir, would be required to hold water diverted during spring runoff.

The nature and location of available aquifers and apparent separation of bedrock and shallow aquifers poses technical problems due to the requirement to inject and remove water from the same aquifer.

High drawdown from the proposed high capacity wells could affect adjacent wells and water rights.

2.4 Comparison of Alternatives

Table 2-8 compares the closely examined alternatives against the issues associated with the Proposed Action that are outlined in chapter 1. The scientific and analytical basis for these comparisons can be found in chapter 3.

2.4.1 Preferred Alternative

Based on the comparison of alternatives provided in this section, Reclamation has selected the proposed action alternative (the large reservoir) as the preferred alternative.

Table 2-8.—Comparison of the Narrows Project Alternatives and the Project Issues

Issues	No Action	Proposed Action	Mid-Sized Reservoir	Small Reservoir
Water Resources				
Acre-feet of depletion to the Price River drainage	0	5,491 acre-feet	5,124 acre-feet	4,703 acre-feet
Acre-feet of water available to San Pitch River drainage	0	5,136 acre-feet	4,964 acre-feet	4,710 acre-feet
Water Rights				
Appropriations	No change	No change	No change	No change
Water Quality				
Change in Scofield Reservoir Trophic State Index	0	+3.5	+3.5	+3.5
Change in average phosphorus level in Scofield Reservoir based on external phosphorus loading (milligrams per liter)	0	+0.003 (+10.8%)	+0.003 (+10.8%)	+0.003 (+10.8%)
Air Quality[1]				
Number of days project will exceed National Ambient Air Quality Standards for PM_{10}	0	0	0	0
Slopes and Channel Stability				
Exceed 50-year channel-forming discharge	0	0	0	0
Lateral and vertical degradation	0	0	0	0
Geologic Hazards				
Known geologic hazards within vicinity of dam and reservoir	3	3	3	3
Paleontological Resources				
Paleontological resources inundated or otherwise impacted	0	Undetermined until completion of environmental commitments	Undetermined until completion of environmental commitments	Undetermined until completion of environmental commitments
Soils				
Acres of new soil disturbance	0	668 acres	547 acres	426 acres
Change in sediment loads in Gooseberry Creek	0	-400 tons	-400 tons	-400 tons
Trace Elements				
Increase in levels of select trace elements in ground water	0	0	0	0

[1] Particulate matter of 10 microns in diameter or smaller.

Table 2-8.—Comparison of the Narrows Project Alternatives and the Project Issues (Continued)

Issues	No Action		Proposed Action		Mid-Sized Reservoir		Small Reservoir	
Fisheries								
Instream Change in weighted usable area in fish habitat as measured by instream flow incremental methodology for the following life stages:	Preproject		Postproject (Percent Change)		Postproject (Percent Change)		Pos-project (Percent Change)	
Adult	11,932.32		10,958.04	(-8.17)	10,958.04	(-8.17)	10,958.04	(-8.17)
Juvenile	2,623.93		2,312.67	(-11.86)	2,312.87	(-11.86)	2,312.87	(-11.86)
Spawning	69.14		69.9	(+1.11)	69.91	(+1.11)	69.91	(+1.11)
Fry	427.44		373.25	(-12.68)	373.25	(-12.68)	373.25	(-12.68)
Reservoir Change in surface area in Scofield Reservoir (average)	0		-290		-284		-258	
Wildlife	Species	Without Mitigation (with Mitigation)	Species	Without Mitigation (with Mitigation)	Species	Without Mitigation (with Mitigation)	Species	Without Mitigation (with Mitigation)
Change in habitat units for the following species: mule deer, Brewer's sparrow, beaver, Richardson vole, yellow warbler	Mule deer	0 (0)	Mule deer	-135 (0)	Mule deer	-109 (0)	Mule deer	-78 (0)
	Brewer's sparrow	0 (0)	Brewer's sparrow	-477 (0)	Brewer's sparrow	-386 (0)	Brewer's sparrow	-263 (0)
	Beaver	0 (0)	Beaver	-13 (0)	Beaver	-11 (0)	Beaver	-9 (0)
	Richardson vole	0 (0)	Richardson vole	-63 (0)	Richardson vole	-57 (0)	Richardson vole	-45 (0)
	Yellow warbler	0 (0)	Yellow warbler	-26 (0)	Yellow warbler	-24 (0)	Yellow warbler	-19 (0)
Threatened and Endangered								
Acre-feet depletion from Colorado River system	0		5,491 acre-feet		5,124 acre-feet		4,703 acre-feet	
Vegetative Resources								
Miles of stream lost due to inundation of the reservoir	0		5.3 miles		4.8 miles		4.8 miles	
Number of miles of stream affected by flow:								
Increase in flow	0		4.9 miles		4.9 miles		4.9 miles	
Decrease in flow	0		16.1 miles		16.1 miles		16.1 miles	
Wetland Resources								
Acres of wetlands lost	0 acres (without mitigation) 0 acres (with mitigation)		100 acres (without mitigation) 0 acres (with mitigation)		81 acres (without mitigation) 0 acres (with mitigation)		72 acres (without mitigation) 0 acres (with mitigation)	

Table 2-8.—Comparison of the Narrows Project Alternatives and the Project Issues (continued)

Issues	No Action	Proposed Action	Mid-Sized Reservoir	Small Reservoir
Recreation and Visual				
Change in projected fisherman days in Scofield	0	-6,800	-6,400	-5,800
Increase in developed recreation visitor days at Narrows (including fishing)	0	+46,400	+37,600	+27,800
Increase in dispersed recreation visitor days at Narrows (including fishing)	0	+910	+740	+560
Change in visual quality objective	Partial retention	Partial retention	Partial retention	Partial retention
Cultural Resources				
Cultural resources inundated or otherwise impacted	0	Undetermined until implementation of environmental commitments	Undetermined until implementation of environmental commitments	Undetermined until implementation of environmental commitments
Economic and Social Resources				
Number of jobs (Carbon, Sanpete) created during construction	0	50–100	50–100	50–100
Change in farm income	0	11% increase	10% increase	10% increase
Change in available water supply				
Sanpete County	0	+5,318 acre-feet	+5,157 acre-feet	+4,935 acre-feet
Carbon County	0	-439 acre-feet	-457 acre-feet	-457 acre-feet
Land Resources				
Change in number of AUMs of forage	0	-240 AUMs	-203 AUMs	-166 AUMs
Acres of mineable coal reserves not available for mining	0	0	0	0
Health and Safety				
Percent change in the volume of traffic in the project area	0	19% increase	15% increase	11% increase
Indian Trust Assets				
Number of Indian trust assets affected	None	None	None	None
Environmental Justice				
Number of minority communities disproportionately affected by the Narrows Project	None	None	None	None

CHAPTER 3

Affected Environment and Environmental Consequences

3.0 INTRODUCTION

This chapter discusses the affected environment and environmental consequences that would result from the construction, operation, and maintenance of the project features associated with the Proposed Action and alternatives of the Narrows Project should Reclamation approve the loan application and the use of the Federal land. The affected environment discussions describe existing conditions for resources within the project area. The impact analyses focus on potential direct, indirect, and cumulative impacts on these resources. Potentially significant impacts, together with criteria developed at the beginning of this study for assessing the significance of potential impacts, are identified. Resource specialists reviewed all data and results of the March 1998 DEIS analysis and updated information based on available data and the substantive public comments received, where appropriate, in this FEIS. Mitigation measures that would reduce or avoid certain adverse impacts or would compensate for some unavoidable adverse impacts also are identified. The final section of this chapter describes the irreversible and irretrievable commitment of resources associated with the Proposed Action.

3.1 WATER RESOURCES

3.1.1 Affected Environment

Water resources affected by the Proposed Action include Gooseberry Creek and its three unnamed tributaries located high in the Price River drainage. Gooseberry Creek, a tributary of Fish Creek, flows directly into Scofield Reservoir (see figure 1-1). Scofield Reservoir is included in the affected environment, as is the segment of the Price River immediately below the reservoir down to the first diversion at the town of Heiner, some 25 miles below the dam. Cottonwood Creek, located in the San Pitch River Basin, is located on the opposite side of the divide from Gooseberry Creek. The water from the Narrows Tunnel is diverted into Cottonwood Creek. Cottonwood Creek and the San Pitch River are located in the Sevier River subbasin of the Great Basin.

Typical of Wasatch Mountain streams, flows in these creeks are greatest in the spring, when snowmelt runoff is peaking. Peak flows during May and June are estimated to range from 15 to over 100 cfs in Upper Gooseberry Creek near the proposed damsite. The flow declines considerably in late summer and reaches a minimum in late fall or winter. Late-season flows are estimated to be 1.5–5 cfs in Upper Gooseberry Creek.

The average annual natural runoff volume of Upper Gooseberry Creek, near the proposed damsite, is 9,032 acre-feet. Of this amount, an average of 1,815 acre-feet presently is stored in Fairview Lakes and diverted transmountain to Cottonwood Creek through the Narrows Tunnel. The remaining water continues down Gooseberry Creek to Fish Creek. An average of 35,800 acre-feet per year enters Scofield Reservoir from Fish Creek. The total annual inflow to Scofield Reservoir from all tributaries averages 57,500 acre-feet. The average total contents of Scofield Reservoir are about 42,360 acre-feet. Averages are based on the 1960–2002 hydrologic period of record.

The Price River below Scofield Reservoir, referred to as lower Fish Creek, has a wide range of flows that vary according to downstream water demands and hydrologic conditions. Releases consist of direct flow right bypasses and Scofield Reservoir storage deliveries for Scofield Project users. Spills occur when the reservoir is full and water flows over the spillway or when releases are made in excess of downstream demands. These total releases and spills have averaged 51,815 acre-feet for 1960–2002 but historically have varied from 13,762–154,475 acre-feet. Low flow conditions generally occur from November–March. There are no minimum flow requirements in the Price River, and it is not unusual for the flow below the dam to be completely shut off during winter months. Peak flows below the dam occur in wet years when the reservoir spills. While normal dam releases in June are about 150 cfs, the total releases with these spills have ranged up to more than 1,100 cfs. Because spills are in excess of downstream consumptive use requirements, they usually increase river flows throughout the lower Price River to the confluence with the Green River. From 1960–2002, the reservoir filled and spilled 17 times.

About 25 miles downstream from Scofield Reservoir near the small community of Heiner, the average annual flow of the Price River is about 74,800 acre-feet based on 1960–2002 data. Within 5 miles of Heiner, numerous diversions from the river occur. The largest diversion is the head of the Carbon and Price Wellington Canals, located about 1.5 miles south of Spring Glen. Except during high water conditions when the flow of the river exceeds the capacity of the canals, the river is essentially dry below this diversion. In addition to irrigation water, winter flows also are diverted for stock watering.

Irrigation return flows in this area discharge back to the river, and the flow of the river increases after passing through the Price-Wellington area. Near its confluence with the Green River, measured at the Price River at Woodside, the average annual flow of the river is 94,929 acre-feet, based on 1960–92 records. The stream gauging station on the Price River at Woodside was discontinued in September 1992 and renewed in July 2000.

3.1.2 Methodology and Impact Indicators

Impacts to water resources were determined by using six distinct and detailed operation studies, which simulate streamflows and reservoir operations under historical, future without project, and project conditions.

Averages are based on the 1960–2002 hydrologic period of record. The hydrologic analysis uses USGS stream gauge data, and a majority of the USGS stream gauge data was discontinued in 1989 and 2003. The additional effort to add 1 year of stream gauge data results in an insignificant improvement in the overall analysis.

While these operation studies originally were prepared by Franson Noble Engineering, contractors for SWCD, they have been reviewed carefully and revised by Reclamation. These revisions primarily involved reconciling the State of Utah, USGS, and Reclamation flow data below Scofield Dam using daily flow records. Operation studies then were rerun, and output graphs and tables were revised. These operation studies are briefly described as follows:

- **Scofield Reservoir Historical Operation Study –** This study simulates the historical operation of Scofield Reservoir and is used to calculate ungauged inflow to the reservoir.
- **Scofield Reservoir Demand Study –** This study was performed to segregate the outflow from Scofield Reservoir to separate the releases for downstream demands from the spills and operational releases (releases made in anticipation of a large spill or releases not needed for downstream demands). The study also segregates the bypass of direct flow water rights from releases from storage.
- **Future Without Project Operation Study –** This study shows the flows of Gooseberry and Fish Creeks and the Price River below Scofield Dam and the operation of Scofield Reservoir under the future without Narrows Project conditions. These conditions are the same as the No Action Alternative. Demands identified in the Scofield Reservoir Demand Study are used to operate Scofield Reservoir. Controlled releases from storage are limited to the 30,000-acre-foot water right, which does not include bypasses for direct flow rights.
- **Future with Narrows Project Operation Study –** This study shows the flows of Gooseberry and Fish Creeks and the Price River below Scofield Dam and the operation of Scofield Reservoir under the Proposed Action. Transmountain releases to Cottonwood Creek also are modeled.
- **Mid-Sized Reservoir Alternative Operation Study –** This study is similar to the Future with Narrows Project Operation Study, except that it is based on the Mid-Sized Reservoir Alternative instead of the Proposed Action.
- **Small Reservoir Alternative Operation Study –** This study is similar to the Future with Narrows Project Operation Study, except that it is based on the Small Reservoir Alternative instead of the Proposed Action.

Impact indicators for water resources previously were identified in chapter 1, including the following:

- Acre-feet of depletion to the Price River drainage
- Acre-feet of water available to the San Pitch River drainage

3.1.3 Predicted Effects

3.1.3.1 No Action Alternative

Under the No Action Alternative, streamflows would remain as they are in Gooseberry Creek, Lower Fish Creek, Price River to Heiner, Cottonwood Creek, and about 3 miles of the San Pitch River. There would be no additional depletion of water from these rivers. Water supplies for Sanpete and Carbon Counties would remain at present levels. Water shortages in northern Sanpete County would be reduced with continued implementation of water conservation measures.

Carbon Water Conservancy District would continue to operate Scofield Reservoir, and the storage levels and releases would continue to fluctuate under existing operating parameters (see figure 3-1). Flows below Scofield Reservoir in the Price River to the town of Heiner would see the same occurrence of spills during wet years and dry river conditions when releases are shut off during the nonirrigation season.

Cottonwood Creek would have typical flow conditions. After spring runoff flows subside in late May or early June, natural flows are supplemented with releases from Fairview

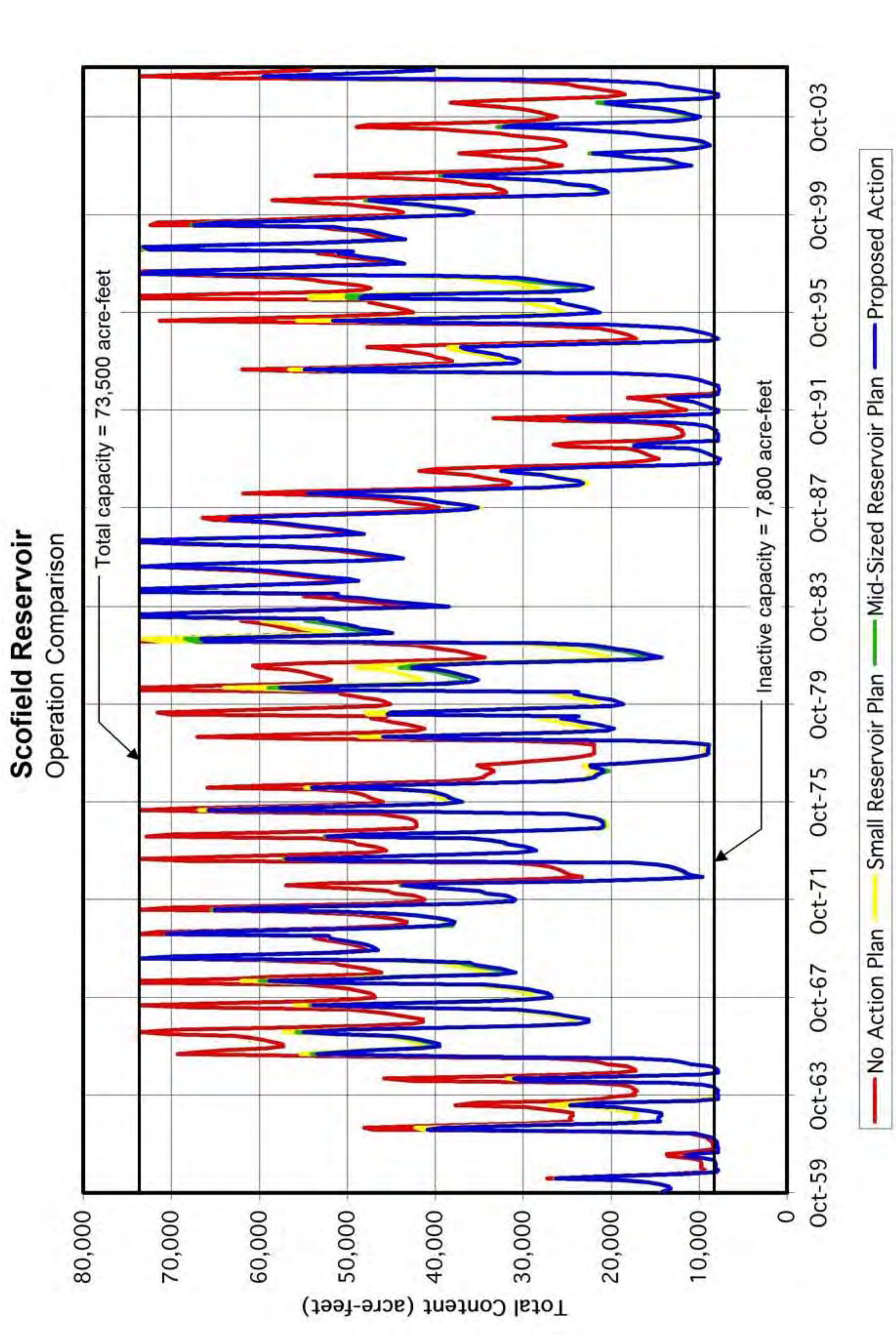


Figure 3-1.—Scofield Reservoir Operation Comparison Proposed Action.

Lakes. These releases are made through an existing transmountain tunnel. Flows from Fairview Lakes are used by the Cottonwood-Gooseberry Irrigation Company as a source of supplemental irrigation water in the Fairview area. These supplemental releases generally occur in July and August. The historic average annual flow volumes at the tunnel outlet and the mouth of Cottonwood Creek have been 2,055 and 8,600 acre-feet, respectively.

There would be no streamflow mitigation measures under the No Action Alternative because there would be no project-induced impacts.

There would be no residual impacts to water resources under the No Action Alternative.

Climate change has the potential to impact the No Action Alternative flows with either wetter or drier conditions. Models that could predict the potential impacts of climate change on the scale of this project have not yet been developed.

3.1.3.2 Proposed Action Alternative

Operation of the Narrows Project would affect streamflows in Gooseberry Creek, Lower Fish Creek, Scofield Reservoir, Price River to Heiner, Cottonwood Creek, and about 3 miles of the San Pitch River. Table 3-1 provides a comparison of average monthly streamflows under the four project alternatives evaluated. Monthly streamflow data were used to develop this table because reliable daily streamflow data were not available.

Impacts to Lower Gooseberry Creek and Fish Creek would occur primarily during the spring snowmelt period as water is stored in Narrows Reservoir for release later in the summer. Impacts to Lower Gooseberry Reservoir would consist of reduced inflow. However, the effect would be negligible because the reservoir is not operated as a storage reservoir. As a result, the outflow would be reduced in the same proportion as the inflow would be reduced. Impacts to Scofield Reservoir would be in the form of reduced inflows, resulting in a lowering of average reservoir storage. Impacts to releases from Scofield Reservoir for Scofield Project use would occur only during multiple successive drought years, such as occurred in the early 1960s, 1990s, and 2000s. Impacts to the Price, Green, and Colorado Rivers would result primarily in reduced spills from Scofield Reservoir.

The impacts of the Narrows Project on water resources are most pronounced near the reservoir. About 1 mile of Upper Gooseberry Creek and 4.3 miles of small streams in the proposed reservoir basin would be inundated by the reservoir. In addition, annual flows in the middle 3 miles of Gooseberry Creek between Narrows Reservoir and inflow into Lower Gooseberry Reservoir would be reduced by about 74%. Under the Proposed Action, a 1.0-cfs minimum flow would be made from Narrows Reservoir to Gooseberry Creek to provide a 1.5-cfs minimum flow at the USDA Forest Service campground ⅛ mile downstream from the proposed damsite. If the 1.5-cfs flow at the campground is not met, up to an additional 0.25 cfs would be released from the reservoir to meet the required flow. Minimum streamflow releases from Narrows Reservoir would eliminate periodic dry stream channels in the Middle Gooseberry Creek segment. An average of 300 acre-feet per year also would be released for channel maintenance (flushing flows).

Flows in Cottonwood Creek would increase during the irrigation season, with the import of project water through the Narrows Tunnel. However, during the irrigation season, these flows would be less than peak flows that occur naturally during the spring snowmelt period. The Upper Cottonwood Creek Pipeline would convey these increased flows outside the stream channel between the tunnel

Table 3-1.—Average Monthly Streamflow Comparison (cfs)

Month	Proposed Action			Mid-Sized Reservoir Alternative			Small Reservoir Alternative			No Action Alternative		
	Average year (1968)	Wet year (1984)	Dry year (1977)	Average year (1968)	Wet year (1984)	Dry year (1977)	Average year (1968)	Wet year (1984)	Dry year (1977)	Average year (1968)	Wet year (1984)	Dry year (1977)
Gooseberry Creek at Proposed Narrows Damsite												
October	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.2	5.3	1.7
November	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.6	3.9	1.5
December	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.6	4.6	0.8
January	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.4	2.6	1.0
February	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	2.6	1.2
March	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.5	2.8	1.2
April	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.9	5.8	5.4
May	5.9	81.0	5.9	5.9	84.1	5.9	1.0	88.2	1.0	49.8	106.0	17.9
June	8.4	100.5	1.0	28.1	101.3	1.0	38.7	102.3	1.0	67.8	105.0	6.9
July	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	7.9	15.3	3.3
August	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	5.4	6.7	1.6
September	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.5	4.8	1.0
Gooseberry Creek Below Lower Gooseberry Reservoir												
October	2.9	5.8	2.4	2.9	5.8	2.4	2.9	5.8	2.4	4.1	10.2	3.0
November	3.1	5.9	2.2	3.1	5.8	2.2	3.1	5.9	2.2	3.8	8.8	2.7
December	3.2	5.4	2.1	3.2	5.4	2.1	3.2	5.4	2.1	3.8	9.0	1.9
January	3.6	6.2	2.1	3.5	6.2	2.1	3.6	6.2	2.1	4.0	7.8	2.1
February	3.7	6.1	2.2	3.7	6.1	2.2	3.7	6.1	2.2	4.1	7.6	2.4
March	3.7	5.2	2.3	3.7	5.2	2.3	3.7	5.2	2.3	4.2	7.0	2.6
April	4.6	6.4	6.5	4.6	6.4	6.5	4.6	6.4	6.5	7.5	11.2	10.9
May	38.2	174.3	0.8	38.2	177.4	0.8	33.3	181.4	0.9	82.1	199.3	12.9
June	32.7	157.4	3.9	52.4	158.2	3.9	63.0	159.2	3.9	92.1	162.0	9.8
July	5.9	9.9	1.5	5.9	9.9	1.5	5.9	9.9	1.5	12.8	24.1	3.8
August	5.6	4.9	1.4	5.6	4.9	1.3	5.6	4.9	1.3	10.0	10.7	2.0
September	3.9	3.6	1.9	3.9	3.6	1.9	3.9	3.6	1.9	6.4	7.4	1.9
Fish Creek Above Scofield Reservoir												
October	9.4	18.9	7.6	9.4	18.9	7.6	9.4	18.9	7.6	10.6	23.3	8.2
November	9.5	17.3	7.9	9.5	17.3	7.9	9.5	17.3	7.9	10.2	20.2	8.4
December	8.4	15.6	7.5	8.4	15.6	7.5	8.4	15.6	7.5	9.1	19.2	7.3
January	9.1	16.3	5.5	9.1	16.3	5.5	9.1	16.3	5.5	9.5	17.9	5.6
February	10.6	19.0	5.3	10.6	19	5.3	10.6	19.0	5.3	11.1	20.6	5.5
March	14.1	17.3	5.4	14.1	17.2	5.4	14.1	17.3	5.4	14.6	19.1	5.7
April	17.8	43.7	24.5	17.8	43.6	24.5	17.8	43.7	24.5	20.7	48.5	29.0
May	211.7	616.3	11.4	211.7	619.4	11.4	206.8	623.4	6.5	255.6	641.3	23.5
June	171.4	361.3	8.5	191.1	362.1	8.5	201.7	363.1	8.5	230.8	365.8	14.4
July	29.6	51.4	4.6	29.6	51.3	4.6	29.6	51.4	4.6	36.5	65.7	6.8
August	17.6	21.6	3.5	17.5	21.6	3.5	17.6	21.6	3.5	22.0	27.4	4.1
September	12.2	17.3	3.5	12.2	17.2	3.5	12.2	17.3	3.5	14.7	21.0	3.5

Table 3-1.—Average Monthly Streamflow Comparison (cfs) (continued)

	Proposed Action			Mid-Sized Reservoir Alternative			Small Reservoir Alternative			No Action Alternative		
Month	Average year (1968)	Wet year (1984)	Dry year (1977)	Average year (1968)	Wet year (1984)	Dry year (1977)	Average year (1968)	Wet year (1984)	Dry year (1977)	Average year (1968)	Wet year (1984)	Dry year (1977)
Price River Below Scofield Dam												
October	49.5	204.0	26.9	49.4	210.4	26.9	49.5	204.0	26.9	49.5	204.0	26.9
November	13.8	15.0	11.4	13.8	15.0	11.4	13.8	15.0	11.4	13.8	15.0	11.4
December	15.0	0.0	9.1	15.0	0.0	9.1	15.0	0.0	9.1	15.0	0.0	9.1
January	5.4	0.0	8.0	5.4	0.0	8.0	5.4	0.0	8.0	5.4	0.0	8.0
February	5.5	0.0	7.1	5.5	0.0	7.1	5.5	0.0	7.1	5.5	0.0	7.1
March	5.1	15.0	5.8	5.1	15.0	5.8	5.1	15.0	5.8	5.1	15.0	5.8
April	4.7	74.4	27.7	4.7	74.3	27.7	4.7	74.4	27.7	4.7	74.4	27.7
May	0.0	646.2	111.6	0.0	648.2	111.6	0.0	653.3	111.6	59.2	733.5	111.6
June	186.0	941.3	52.6	211.3	940.4	52.6	211.7	943.1	52.6	316.1	945.8	52.6
July	212.7	278.8	63.2	212.3	278.3	63.2	212.7	278.8	63.2	212.7	278.8	63.2
August	94.0	126.2	39.1	93.9	126.0	39.1	94.0	126.2	39.1	94.0	126.2	39.1
September	177.5	132.4	22.0	177.2	132.2	17.6	177.5	132.4	22.0	177.5	132.4	22.0
Price River at Confluence of White River												
October	50.9	207.4	27.5	50.9	207.4	27.5	50.9	207.4	27.5	50.9	207.4	27.5
November	14.8	17.8	12.1	14.8	17.8	12.1	14.8	17.8	12.1	14.8	17.8	12.1
December	17.1	2.4	9.2	17.1	2.4	9.2	17.1	2.4	9.2	17.1	2.4	9.2
January	7.1	2.0	8.0	7.1	2.0	8.0	7.1	2.0	8.0	7.1	2.0	8.0
February	7.1	2.8	7.1	7.1	2.8	7.1	7.1	2.8	7.1	7.1	2.8	7.1
March	7.1	18.7	5.9	7.1	18.7	5.9	7.1	18.7	5.9	7.1	18.7	5.9
April	9.3	86.2	30.0	9.3	86.2	30.0	9.3	86.2	30.0	9.3	86.2	30.0
May	33.4	730.6	113.0	33.4	730.6	113.2	33.4	730.6	113.0	92.5	817.7	113.0
June	214.3	970.5	52.7	240.0	970.5	52.8	240.0	970.5	52.7	344.2	975.1	52.7
July	218.9	289.1	63.2	218.9	289.1	63.3	218.9	289.1	63.2	218.9	289.1	63.2
August	97.5	131.3	39.1	97.5	131.3	36.4	97.5	131.3	36.4	97.5	131.3	39.1
September	179.2	135.7	22.0	179.2	135.7	4.5	179.2	135.7	8.9	179.2	135.7	22.0
Price River at Woodside												
October	45.4	399.1	39.4	45.4	399.1	39.4	45.4	399.1	39.4	45.4	399.1	39.4
November	38.8	112.2	31.7	38.8	112.2	31.7	38.8	112.2	31.7	38.8	112.2	31.7
December	46.0	96.5	34.2	46.0	96.5	34.2	46.0	96.5	34.2	46.0	96.5	34.2
January	33.0	69.4	20.0	33.0	69.4	20.0	33.0	69.4	20.0	33.0	69.4	20.0
February	47.5	71.8	20.0	47.5	71.8	20.0	47.5	71.8	20.0	47.5	71.8	20.0
March	71.8	35.0	26.8	71.8	35.0	26.8	71.8	35.0	26.8	71.8	35.0	26.8
April	109.5	396.2	16.8	109.5	396.2	16.8	109.5	396.2	16.8	109.5	396.2	16.8
May	269.6	1,568.0	21.6	269.6	1,568.0	21.8	269.6	1,568.0	21.6	328.7	1,655.2	21.6
June	333.0	1,054.0	3.8	358.7	1,054.0	3.9	358.7	1,054.0	3.8	463.0	1,058.5	3.8
July	105.3	271.3	120.2	105.3	271.3	120.3	105.3	271.3	120.2	105.3	271.3	120.2
August	295.2	276.4	32.3	295.2	276.4	29.6	295.2	276.4	29.6	295.2	276.4	29.6
September	71.2	192.0	21.0	71.2	192.0	3.5	71.2	192.0	7.9	71.2	192.0	8.4

Table 3-1.—Average Monthly Streamflow Comparison (cfs) (continued)

Month	Proposed Action			Mid-Sized Reservoir Alternative			Small Reservoir Alternative			No Action Alternative		
	Average year (1968)	Wet year (1984)	Dry year (1977)	Average year (1968)	Wet year (1984)	Dry year (1977)	Average year (1968)	Wet year (1984)	Dry year (1977)	Average year (1968)	Wet year (1984)	Dry year (1977)
Fairview Tunnel at Outlet												
October	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0
November	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0
December	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.0	0.0	0.0
January	2.0	2.0	2.0	2.0	2.0	1.2	2.0	2.0	2.0	0.0	0.0	0.0
February	2.0	2.0	2.0	2.0	2.0	0.2	2.0	2.0	1.2	0.0	0.0	0.0
March	2.0	2.0	2.0	2.0	2.0	0.2	2.0	2.0	0.2	0.0	0.0	0.0
April	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
May	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
June	4.0	11.8	8.8	0.2	0.2	0.2	0.2	0.2	0.2	3.7	11.6	8.6
July	45.3	45.0	43.4	30.6	32.6	43.0	30.6	32.6	25.5	14.7	12.3	0.3
August	43.5	45.5	33.1	30.1	29.2	18.2	30.1	29.2	0.0	13.3	16.3	0.2
September	17.3	24.9	0.2	15.8	14.6	0.0	15.8	14.6	0.0	1.6	10.3	0.1
Cottonwood Creek at Mouth of Canyon												
October	3.3	5.1	3.1	3.3	5.1	3.1	3.3	5.1	3.1	1.3	3.1	1.1
November	3.6	5.0	3.3	3.6	5.0	3.3	3.6	5.0	3.3	1.6	3.0	1.3
December	3.4	4.8	3.2	3.4	4.8	3.2	3.4	4.8	3.2	1.4	2.8	1.2
January	3.4	4.7	3.0	3.4	4.7	2.2	3.4	4.7	3.0	1.4	2.7	1.0
February	3.6	4.6	3.2	3.6	4.6	2.2	3.6	4.6	2.4	1.6	2.6	1.2
March	4.0	4.7	3.3	4.0	4.7	1.5	4.0	4.7	1.5	2.0	2.7	1.3
April	3.7	8.1	3.2	3.7	8.1	3.2	3.7	8.1	3.2	3.7	8.1	3.2
May	45.0	117.1	4.9	44.8	117.1	4.9	44.8	117.1	4.9	45.0	117.1	4.9
June	46.7	63.5	12.8	42.9	51.9	4.2	42.9	51.8	4.2	46.4	63.2	12.6
July	49.4	53.5	44.6	34.7	20.9	44.2	34.7	41.1	26.8	18.8	20.9	1.6
August	46.0	49.2	34.0	32.6	32.9	19.1	32.6	32.9	0.9	15.9	20.0	1.1
September	19.1	27.9	1.1	17.6	17.6	0.9	17.5	17.6	0.9	3.3	13.3	1.0
San Pitch River Below Cottonwood Creek Confluence[1]												
October	31	33	22	31	33	22	31	33	22	29	31	20
November	+2	+2	+2	+2	+2	+2	+2	+2	+2	n/a	n/a	n/a
December	+2	+2	+2	+2	+2	+2	+2	+2	+2	n/a	n/a	n/a
January	+2	+2	+2	+2	+2	+2	+2	+2	+3	n/a	n/a	n/a
February	+2	+2	+2	+2	+2	+2	+2	+2	+2	n/a	n/a	n/a
March	+2	+2	+2	+2	+2	+2	+2	+2	+0	n/a	n/a	n/a
April	49	63	58	49	63	58	49	63	58	49	63	58
May	73	113	51	73	113	51	73	113	51	73	113	51
June	80	109	32	76	97	23	76	97	23	80	109	32
July	79	98	25	64	65	25	64	86	25	79	98	25
August	74	88	24	61	72	24	61	72	24	74	88	24
September	73	80	23	72	70	23	71	70	23	73	80	23

[1] Based on historical diversion records. Streamflow records are not available at this location. Actual streamflows for wet year may have been higher than indicated by diversion records. No data for winter flows is available. November–March values indicate changes from No Action flows.

outlet and the confluence with Left Hand Fork. About 300 feet below the Left Hand Fork confluence, the project flows would be discharged to the stream. At this point, the increase in average July and August flows from current conditions would be about 200%.

Depletions to the Price River drainage would average 5,597 acre-feet per year. This amount would consist of 5,227 acre-feet of transbasin diversions and 370 acre-feet of increased evaporation in the Price River Basin. When measured in Gooseberry Creek below Narrows Reservoir, the reduction in annual streamflow varies between 1,760 and 10,200 acre-feet, depending on the storage level of Narrows Reservoir and the magnitude of the streamflow into the reservoir. As shown in table 3-1, the greatest impact would occur during the spring snowmelt runoff period. Releases from Narrows Reservoir to Gooseberry Creek would remain at a minimum of 1.0 cfs; and when the reservoir is spilling or when flushing releases are made, the flow would be greater.

As a result of constructing Narrows Reservoir, the operation of Scofield Reservoir would be altered within the normal historic range. Scofield Reservoir would operate at a lower level with implementing the Proposed Action as shown in figure 3-1. Under project conditions, the average total contents of Scofield Reservoir would be reduced from about 42,400 acre-feet to about 31,900 acre-feet. Average reduction in storage releases to irrigators in the Price area would be about 753 acre-feet per year. Total depletions to the Price River drainage would average 5,597 acre-feet per year. Both the volume and frequency of spills from the reservoir would be reduced. With the No Action Alternative, the average reservoir surface area would be reduced from 2,370 acres to about 2,125 acres. This is about a 10% reduction or about 245 acres of the surface area of the No Action Alternative. Since Scofield Reservoir would operate at a lower level, there is an increased potential for the reservoir to be drained to the bottom of its active storage. The frequency of this occurrence increases from 3 times in 43 years for the No Action Alternative to 12 times in 43 years with the Proposed Action. An example of this type of problem occurred during 1992. The lowest water surface elevation at Scofield Reservoir that year was 7,587 feet with a reservoir active capacity of 1,102 acre-feet. A major concern was that the reduced water level would lower water temperature, causing ice to form on the lake. This caused the potential for a blockage at the site of the old dam near the middle of the reservoir, not allowing water to pass from the upstream portion of the reservoir to the dam. Channel improvements and an electrical system to prevent freezing around the outlet structures were put in place. Other measures also were put on standby in case reservoir levels dropped lower. The crises were finally averted by restricting reservoir releases, rationing irrigation water, eliminating the use of water for lawns and yards, and monitoring water tank levels downstream in Carbon County. While such drought periods are not frequent, they do have significant impacts and would occur more often with implementing the proposed project.

During most years, controlled releases from Scofield Reservoir to meet Scofield Project demands would remain unaltered. This was the case in 77% of the years in the model simulation. However, under prolonged drought conditions, irrigation releases from Scofield Reservoir would be reduced due to lack of water in the reservoir. These reductions occurred in 10 of the 43 simulated years. Reductions for 1960–2002 averaged about 753 acre-feet or about 3% of the historical release from storage; whereas during drought periods, the reductions were much larger, as in 1992, when reductions would have been 8,346 acre-feet or 20% of the average annual historical release from storage.

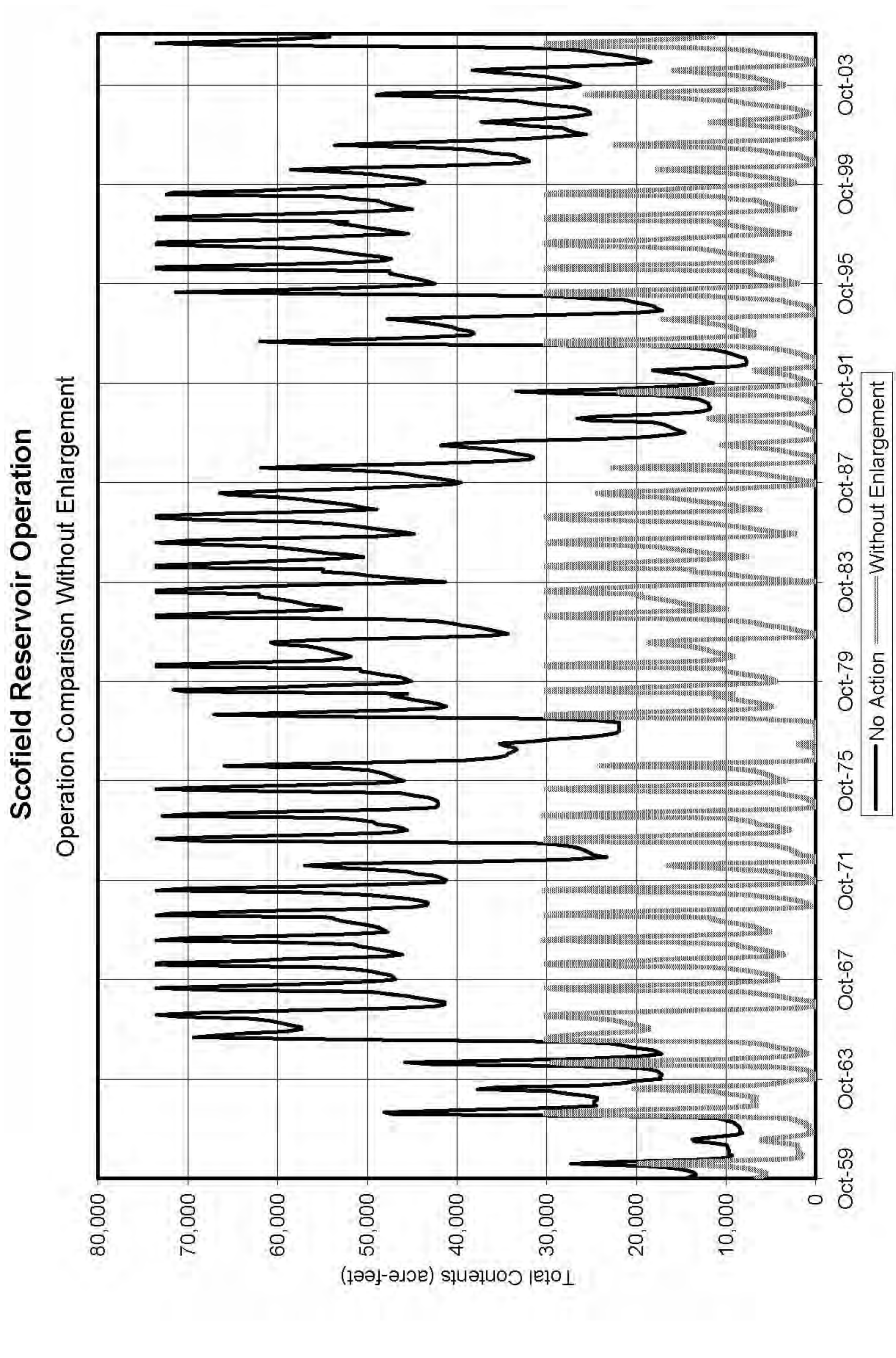
The Proposed Action would impact only storage releases. Direct flow rights that have a senior priority date to the Narrows water rights would be unaffected by the project. During the spring filling period, Scofield Reservoir releases typically are made to prevent the over filling or to ensure downstream senior water rights are fully satisfied. During average and wet hydrological years, senior water rights often are satisfied by tributary flows below Scofield Reservoir, and spring time releases from Scofield Reservoir are governed primarily by filling concerns for both the No Action and Proposed Action Alternatives. Under dry hydrologic conditions, tributary flows generally do not meet the required downstream direct flow rights, and additional releases from Scofield Reservoir are necessary under both the No Action and Proposed Action Alternatives.

It should be noted, however, that the above reductions in storage releases are based on the 73,500-acre-foot Scofield Reservoir, which was enlarged specifically to accommodate the Gooseberry Project (Narrows Project). Without this enlargement and the associated water rights agreements, the usable capacity of Scofield Reservoir would have remained at 30,000 acre-feet. As part of the reservoir enlargement, 7,800 acre-feet of inactive capacity was added to provide a minimum pool for fish habitat. An additional 35,700 acre-feet of active capacity was included to facilitate developing the remainder of the Gooseberry Project Plan without impacting water supplies in Carbon County. In conjunction with the reservoir enlargement, the Carbon County water interests signed an agreement that they would operate the reservoir according to the Gooseberry Project Plan.

If the reservoir capacity had remained at 30,000 acre-feet without the Narrows Project, the storage releases would have been reduced by an average of 2,253 acre-feet as a result of these same drought cycles, which is about 5% of the average annual supply. These reductions would have occurred in 19 of the 43 years simulated, with the largest single-year reduction being over 15,809 acre-feet, about 60% of the average annual storage release. Therefore, the reductions in current Scofield Reservoir storage caused by the Narrows Project would be less, in fact, than the reductions that would have occurred without the enlargement of Scofield Reservoir and the associated water right agreements; Scofield Reservoir water users realize a significant net benefit from the Narrows Project.

Figure 3-2 provides a comparison of the operation of Scofield Reservoir under the No Action Alternative and a simulated operation of the reservoir had it not been enlarged to accommodate the Gooseberry Project Plan. Figure 3-2 also shows that there would be no minimum pool for fishery in Scofield Reservoir had it not been enlarged. Downstream from Wellington, where most of the significant diversions occur on the lower Price River, the effects of the Narrows Project would be much different from those predicted near the Narrows Reservoir. In this stretch of river, Scofield Reservoir controls about 35% of the annual flow. High spring flows characteristic of unregulated hydrographs are contributed by undammed tributaries downstream from Scofield Dam, but spills from Scofield Dam are still the controlling factor in high spring flows.

Flow reductions in the Price River and the Colorado River downstream due to the Narrows Project would occur primarily as a result of decreased spills out of Scofield Reservoir. These effects are illustrated in figure 3-3, which displays average monthly flows of the Price River at Woodside under



Graph based on monthly data.

Figure 3-2.—Scofield Reservoir Operation Comparison Without Enlargement.

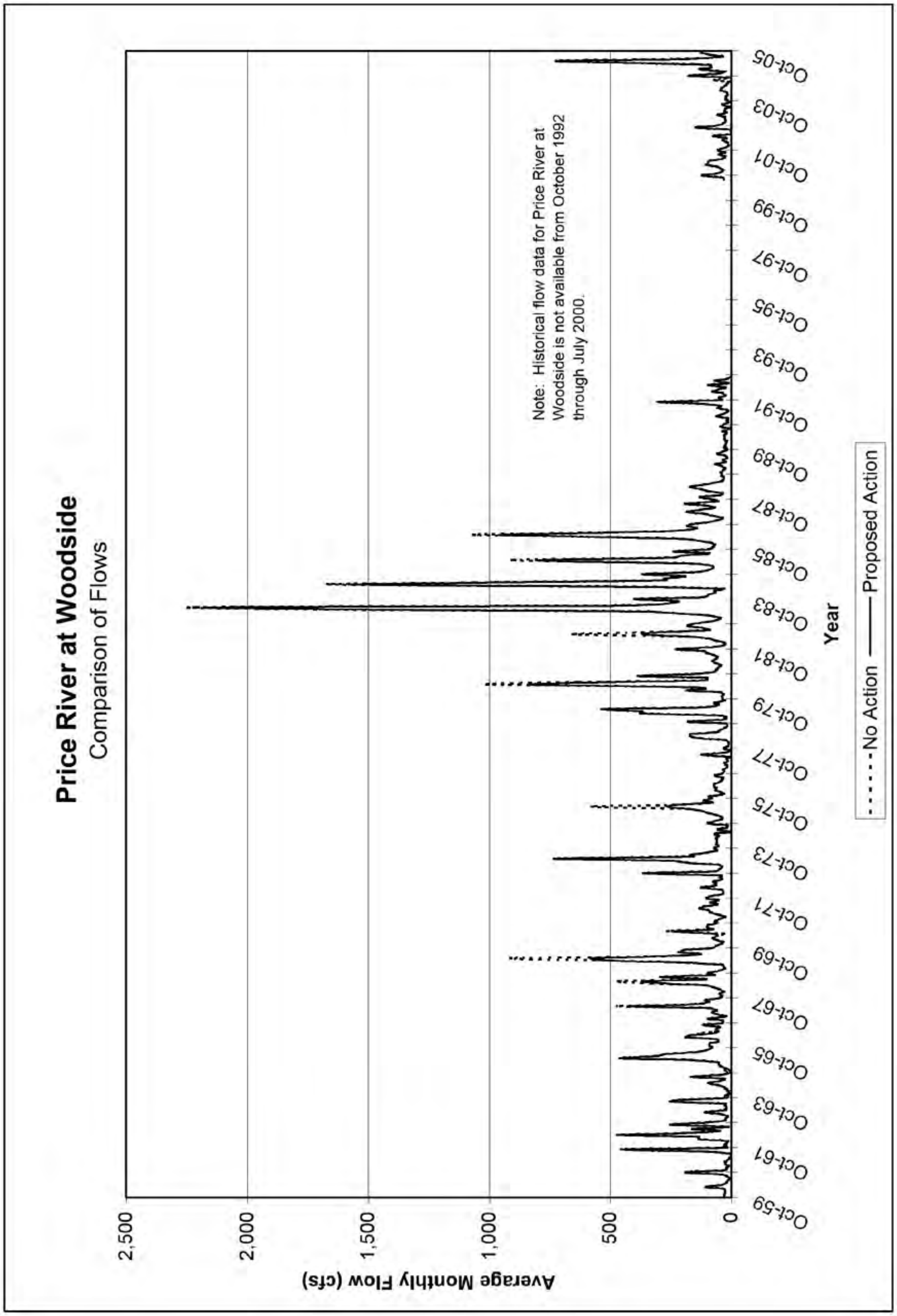


Figure 3-3.—Scofield Reservoir Operation Comparison, Price River at Woodside.

the No Action Alternative and the Proposed Action. This figure is based on data from 1960–92. The stream gauging station at the Price River at Woodside was discontinued in September 1992 and renewed in July 2000. The frequency of spills decreases from 42 to 12% in the years simulated. As seen in figure 3-3, spills in very large runoff years, such as 1983–86, would not be greatly affected; rather, it is the spills in moderate runoff years that would be affected most.

Releases through the Narrows Tunnel would increase under the Proposed Action. In comparison to the natural base flow and the existing channel capacity in Cottonwood Creek, the percent increase in flow due to project releases is reduced as the flow travels downstream. Most of the project water that would be released to Cottonwood Creek during the irrigation season would be diverted by an existing diversion structure near the mouth of Fairview Canyon for use along the east bench area of northern Sanpete Valley. Winter releases would be stored in Wales Reservoir, to the extent of available storage capacity, and would be used on project lands closer to the San Pitch River.

About 1,820 acre-feet of additional return flow to the San Pitch River would result from the Narrows Project, entering the river at various locations between Fairview and Chester and most probably then would be re-diverted from the river by other downstream water users within a short distance after entering the river. The river would continue to be dry-dammed at several locations during irrigation season.

Construction of the Upper Cottonwood Creek Pipeline would convey project releases outside the creek and would prevent degradation of the stream channel. Winter flows of 2.0 cfs in the upper reach of Cottonwood Creek and summer flows of 2.0 cfs in the lower reach of Cottonwood Creek also would be provided.

Under the Proposed Action, water supplies in the San Pitch River Basin would increase by an average of 5,227 acre-feet per year due to releases from Narrows Reservoir. Irrigation water shortages would be reduced to about 10,878 acre-feet per year or about 21.1% of the diversion demand.

In summary, the residual impacts (after mitigation) of the Proposed Action include the inundation of 1.0 mile of Gooseberry Creek and 4.3 miles of unnamed tributaries. Flows in Gooseberry Creek below Narrows Reservoir, Fish Creek, and the Price River would be reduced as shown in table 3-1. The flow in Cottonwood Creek below the confluence with Left Hand Fork would be increased during the nonrunoff portions of the irrigation season. Scofield Reservoir would operate at a lower level in most years, and reductions in storage releases to irrigators in the Price area would occur only after several successive years of drought and would average about 753 acre-feet per year. However, on the average, these reductions would be about 1,500 acre-feet less than the reductions that would have occurred if Scofield Reservoir had not been enlarged to accommodate the Gooseberry Project (Narrows Project).

3.1.3.3 Mid-Sized Reservoir

The impacts to water resources under the Mid-Sized Reservoir Alternative would be similar to those resulting from construction of the Proposed Action. About 1 mile of Upper Gooseberry Creek and 4.0 miles of small streams in the proposed reservoir basin would be inundated. Because Narrows Reservoir would be smaller, it would spill more often, causing higher flows in certain years in Gooseberry and Fish Creeks in May and June. Because of the smaller reservoir, in drought years, there would not be enough water stored to meet the maximum transbasin diversion of 5,400 acre-feet. The long-term, average transbasin diversion to the San Pitch

River drainage would be 5,095 acre-feet. During those years, the flow in Cottonwood Creek would be lower, and project shortages would be greater. These differences in streamflows are shown in table 3-1.

As shown in figure 3-1, Scofield Reservoir Operation Comparison Proposed Action, Scofield Reservoir would operate at a slightly higher level than it would under the Proposed Action. The average contents would consist of about 32,084 acre-feet. Average reductions in storage releases to irrigators in the Price area would be about 753 acre-feet per year. Total depletions to the Price River drainage would average 5,298 acre-feet per year, rather than the 5,597 acre-feet under the Proposed Action.

Streamflow mitigation measures under the Mid-Sized Reservoir Alternative would be the same as those described for the Proposed Action.

Under the Mid-Sized Reservoir Alternative, water supplies in the San Pitch River Basin would increase by an average of 5,095 acre-feet per year due to releases from Narrows Reservoir. Irrigation water shortages would be reduced to about 11,027 acre-feet per year or about 21.2% of the diversion demand.

In summary, the residual impacts of the Mid-Sized Reservoir Alternative would be similar to those of the Proposed Action, except that slightly fewer miles of stream would be inundated, and Scofield Reservoir would operate at a slightly higher level. Annual reductions in storage releases to irrigators in the Price area would occur only after several successive drought years and would average 753 acre-feet per year.

3.1.3.4 Small Reservoir Alternative

The impacts to water resources under the Small Reservoir Alternative would be similar to those resulting from construction of the Proposed Action. About 1 mile of Upper Gooseberry Creek and 3.8 miles of small streams in the proposed reservoir basin would be inundated. Because Narrows Reservoir would be smaller, it would spill more often, causing higher flows in certain years in Gooseberry and Fish Creeks in May and June. Because of the smaller reservoir, in drought years, there would not be enough water stored to meet the maximum transbasin diversion of 5,400 acre-feet. The long-term average transbasin diversion to the San Pitch River drainage would be 4,815 acre-feet. During those years, the flow in Cottonwood Creek would be lower, and project shortages would be greater. These differences in streamflows are shown in table 3-1.

As shown in figure 3-1, Scofield Reservoir Operation Comparison Proposed Action, Scofield Reservoir would operate at a slightly higher level than under the Proposed Action. The average contents would be about 33,049 acre-feet. Average reductions in storage releases to irrigators in the Price area would be about 732 acre-feet per year, rather than 753 acre-feet in the Proposed Action. Total depletions to the Price River drainage would average 4,841 acre-feet per year as compared to 5,597 acre-feet under the Proposed Action and 5,298 acre-feet under the Mid-Sized Alternative.

Streamflow mitigation measures under the Small Reservoir Alternative would be the same as those described for the Proposed Action, with the exception that no year-round flows would be provided in the tributaries to Gooseberry Creek above the proposed Narrows Reservoir site, and no flushing flows would be provided to Gooseberry Creek.

Under the Small Reservoir Alternative, water supplies in the San Pitch River Basin would increase by an average of 4,815 acre-feet per year due to releases from the proposed Narrows Reservoir. Irrigation water shortages would be reduced to about 11,290 acre-feet per year or about 21.8% of the diversion demand.

The residual impacts of the Small Reservoir Alternative would be similar to those of the Proposed Action, except that slightly fewer miles of stream would be inundated, and Scofield Reservoir would operate at a slightly higher level. Annual reductions in storage releases to irrigators in the Price area would occur only after several successive drought years and would average about 21 acre-feet less than under the Proposed Action (i.e., 732 acre-feet rather than 753 acre-feet as in the Proposed Action).

3.2 WATER RIGHTS

3.2.1 Affected Environment

Utah water use is governed by the prior appropriation doctrine. Under this doctrine, Utah's water resources are owned by the State for the welfare of the public; and individuals, corporations, and public entities can acquire conditional rights to beneficial use this resource. Water rights are established either through historic water use prior to the enactment of State water laws or through an application to appropriate water. All water rights are assigned a priority date based upon when the water right was first established, either by use or by application. In times of water shortages, water is allocated to water rights based on their priority dates with senior rights being able to divert ahead of junior water rights—hence, the maxim "first in time, first in right." In river systems, a water right can typically only divert water when all downstream senior water rights have all the water they currently need or are entitled to.

SWCD holds Water Right Numbers (Nos.) 91-130(A14025), 91-131(A14026), and 91-132 (A14477) for the Narrows Project. These water rights were established by Applications to Appropriate Nos. A14025, A14026, and A14477 filed by Reclamation in January and September 1941. Reclamation later transferred these applications, still unapproved, to SWCD in July 1975 for use in the Narrows Project. These applications have been involved in several agreements, the most significant of which is the 1984 Compromise Agreement that was mediated by the Utah State Engineer. The conditions of the 1984 Compromise Agreement, which were incorporated into the January 7, 1985, approval of these applications to appropriate, subordinated certain Price River Water Users Association's water rights to the Narrows Project, limited the annual transbasin diversion and storage allowed by the Narrows Project, and specified how stored water from Scofield Reservoir would be used to satisfy the downstream water rights that are senior to the Narrows Project.

3.2.2 Predicted Effects

3.2.2.1 No Action Alternative

The north Sanpete water users would continue to hold valid water rights in Gooseberry Creek and would be entitled to develop these rights under Utah water law. If the Narrows Project water rights were amended to allow their development without Federal approval, they could be developed outside the scope of this FEIS. Whether or not the Narrows Project is constructed, the distribution of water between the Carbon and Sanpete water users will be based on the priority dates of the individual water rights (except as stipulated in the 1984 Compromise Agreement) that each water user holds.

3.2.2.2 Proposed Action Alternative

Sanpete County's water rights would be allowed to divert water in accordance to their respective priority dates and according to the terms of the 1984 Compromise Agreement. Sanpete County is allowed to develop their approved water rights, even if doing so impairs previously developed junior water rights.

Although the development of the Narrow's Project could impair junior Carbon County water rights holders, it is anticipated that this impairment would be minimal. First, the 5,400-acre-foot annual depletion of the Narrows water rights represents only about 6.6% of the average annual yield of the Price River above the city of Price. Secondly, the Proposed Action should have no or minimal effect because of how Scofield Reservoir is operated (i.e., it is shut off completely for flood control when the White River is running high and then opened as needed to meet the downstream agricultural demands). Scofield Reservoir was enlarged in 1946 by 35,000 acre-feet of additional storage, in part at Federal expense, to offset or provide a buffer to the potential effects of the proposed development of Gooseberry Creek to benefit Sanpete Valley. The two facilities were originally conceived as components of a single project. The Scofield Reservoir enlargement was intended as compensatory storage for the anticipated effects of the transbasin diversion to the Sanpete Valley. Therefore, because of this additional storage in Scofield Reservoir, there should be limited adverse impacts to the direct flow water right holders in the Price River system.

3.2.2.3 Mid-Sized Reservoir Alternative

This alternative is nearly identical to the Proposed Action, except Narrows Reservoir is limited to 10,000 acre-feet. The effects to other water right holders are nearly identical to the Proposed Action except the potential impairment to Carbon County water users would be slightly less than that of the full size reservoir.

3.2.2.4 Small Reservoir Alternative

This alternative is nearly identical to the Proposed Action except Narrows Reservoir is limited to 5,400 acre-feet. The effects to other water right holders are also nearly identical to the Proposed Action except the potential impairment to Carbon County water users would be slightly less than that of the Mid-Sized Reservoir.

3.3 WATER QUALITY

3.3.1 Affected Environment

3.3.1.1 Upper Gooseberry Creek

On the basis of data collected from Upper Gooseberry Creek and Cottonwood Creek, where much of the flow is from Gooseberry Creek through the Narrows Tunnel, the water is considered very good quality. As shown in table 3-2, the dominant chemical constituents are calcium and bicarbonate, with other common ions being minor in concentration. Total dissolved solids (TDS) are low, ranging from 184–258 milligrams per liter (mg/L) in Gooseberry Creek and 160–316 mg/L in Cottonwood Creek. Trace elements are very low in concentration, with most below detection limits.

Although most of the phosphate levels in these samples were considerably less than 0.05 mg/L, previous studies conducted by UDWR indicate that the 0.05-mg/L guideline for streams is often exceeded in Cottonwood Creek. Existing soil and rock erosion may be the major sources of phosphates exceeding this pollution indicator, with livestock grazing, recreation, and wildlife also contributing. At levels of 0.05 mg/L or greater, the Utah Department of Environmental Quality (UDEQ) indicates that investigations should be conducted to develop more information concerning phosphate sources.

Table 3-2.—Water Quality Data Summary of Project Inflows and Lower Gooseberry Reservoir (mg/L) (Conductivity in microhos per centimeter [µmhos/cm])

Constituents	Gooseberry Creek[1]	Gooseberry Creek at Narrows[2]	Cottonwood Creek[3]	Lower Gooseberry Reservoir[4]
Calcium	62	38	55	38
Magnesium	10	12	18	10
Potassium	<1.0	<1.0	<1.0	<1.0
Sodium	1.0	<1.0	9.4	<1.9
Alkalinity (as $CaCO_3$)[5]	193	147.5	201	128
Bicarbonate	236	180	245	148
Carbonate		<10.0		4.9
Chloride	<1.0	<0.5	15	<4.0
Conductivity	337	330	463	263
Nitrate/nitrite	<0.146	<0.01	<0.218	<0.099
Ammonia as N	<0.053		<0.055	<0.068
Phosphate, total	<0.019	0.04	<0.075	<0.022
Phosphate, total, dissolved.	<0.021	0.04	<0.01	<0.020
Sulfate	8.0	<5.0	<16.3	<12.8
Total dissolved solids	215	220	248	152
Total suspended solids	<8.0		92	<20.4
Aluminum			<0.03	<0.03
Arsenic	<0.003		<0.005	<0.003
Barium	<0.046		0.067	<0.047
Boron				<0.039
Cadmium	<0.001		<0.001	<0.001
Chromium	<0.005		<0.005	<0.005
Copper	<0.015		<0.012	<0.015
Iron	0.22		<0.02	0.167
Lead	<0.005		<0.003	<0.004
Manganese	0.034		<0.005	<0.029
Mercury	<0.0002		<0.0002	<0.0002
Selenium	<0.001		<0.001	<0.002
Silver	<0.002		<0.002	<0.002
Zinc	<0.033		<0.03	<0.033

[1] Averages based upon 34 samples collected by the Utah Division of Water Quality on Gooseberry Creek above Lower Gooseberry Reservoir (5932250) between June 1981 and July 2007.

[2] Averages based upon two samples collected by Franson-Noble & Associates, Inc. within the proposed reservoir basin at the crossing of road SR-264, in June and October 1993.

[3] Averages based upon 17 samples collected by the Utah Division of Water Quality on Cottonwood Creek east of Fairview at the USDA Forest Service boundary (4946770) between April 1996 and June 1997.

[4] Averages based upon 61 samples collected by the Utah Division of Water Quality on Lower Gooseberry Reservoir above the dam (5932240) between October 1980 and July 2007.

[5] $CaCO_3$ = calcium carbonate.

3.3.1.2 Lower Gooseberry Reservoir

The Utah Division of Water Quality completed a limnological assessment of Lower Gooseberry Reservoir that indicates it is a fairly stable mesotrophic (moderate levels of organic and mineral nutrients) system with good water quality (UDEQ, Division of Water Quality, 2008). The only parameters to exceed State water quality standards for defined beneficial uses are phosphorus, pH, and DO. The average concentration of total phosphorus in the water column has not exceeded the recommended pollution indicator for phosphorus of 0.025 mg/L; but occasionally, higher values are reported at various depths in the water column. Occasionally, DO levels and pH values have violated State standards near the bottom of the reservoir, mainly during winter ice coverage. The extensive macrophyte coverage of the bottom of the reservoir is the primary factor in the reservoir responsible for this phenomenon. The reservoir is shallow, with a mean depth of 3.7 feet; has good light penetration throughout the water column; and does not stratify. The UDWR has expressed concern about nutrient loading of Lower Gooseberry Reservoir and its effect upon DO levels in the reservoir. The oxygen depletion of the reservoir during the winter is believed to result from low winter inflows combined with decomposition of organic material resulting from the extensive macrophyte growth during the summer, as mentioned above.

3.3.1.3 Scofield Reservoir

Recent water quality assessment indicates that Scofield Reservoir is mesotrophic in its present state. Data collected in 1990 and 1991 depicted the reservoir as hypereutrophic, while data in 1992, after treatment and eradication of trash fish, indicated a moderately eutrophic system. Data collected between 1992 and 2007 indicate an overall mesotrophic system (UDEQ, Division of Water Quality, 2010). Eutrophication is a term applied to the organic degradation of a body of water and is associated with elevated levels of carbon, nitrogen, phosphorus, and other inorganic nutrients. The degree of eutrophication generally is exhibited by the growth and appearance of large colonies of algae in highly eutrophic waters, coupled with a green cast or color to the water. This generally occurs during the warm summer months.

Trophic State Index (TSI) is a general measure of the level of eutrophication in a reservoir. The Carlson TSI is determined using measures of secchi depth, chlorophyll, and phosphorus (Carlson, 1977). TSI values greater than 50 are indicative of a eutrophic system, and TSI values between 40–50 are indicative of a mesotrophic system. The average TSI value for Scofield Reservoir of 53.3 (for 1979–80) was reported by UDEQ in a report entitled *Scofield Reservoir Restoration Through Phosphorus Control*. For 1981–2007, the average TSI value was computed to be 47.1 (see figure 3-4).

Scofield Reservoir typically does not stratify during the summer and only weakly when it does stratify. Stratification in Scofield is largely influenced by its shallow depth (mean depth of 26 feet) and reservoir operations, which withdraw water from near the bottom of the reservoir. For these reasons, Scofield Reservoir is often mixed from top to bottom. During periods of weak stratification, oxygen levels near the bottom of the reservoir become depleted. Low dissolved oxygen increases phosphorus leaching from the bottom sediments (Judd, 1992).

The water quality of Scofield Reservoir is considered fair. Average constituent levels of the reservoir and its tributaries are listed in table 3-3. The average detention time is about 1.4 years. The maximum depth is

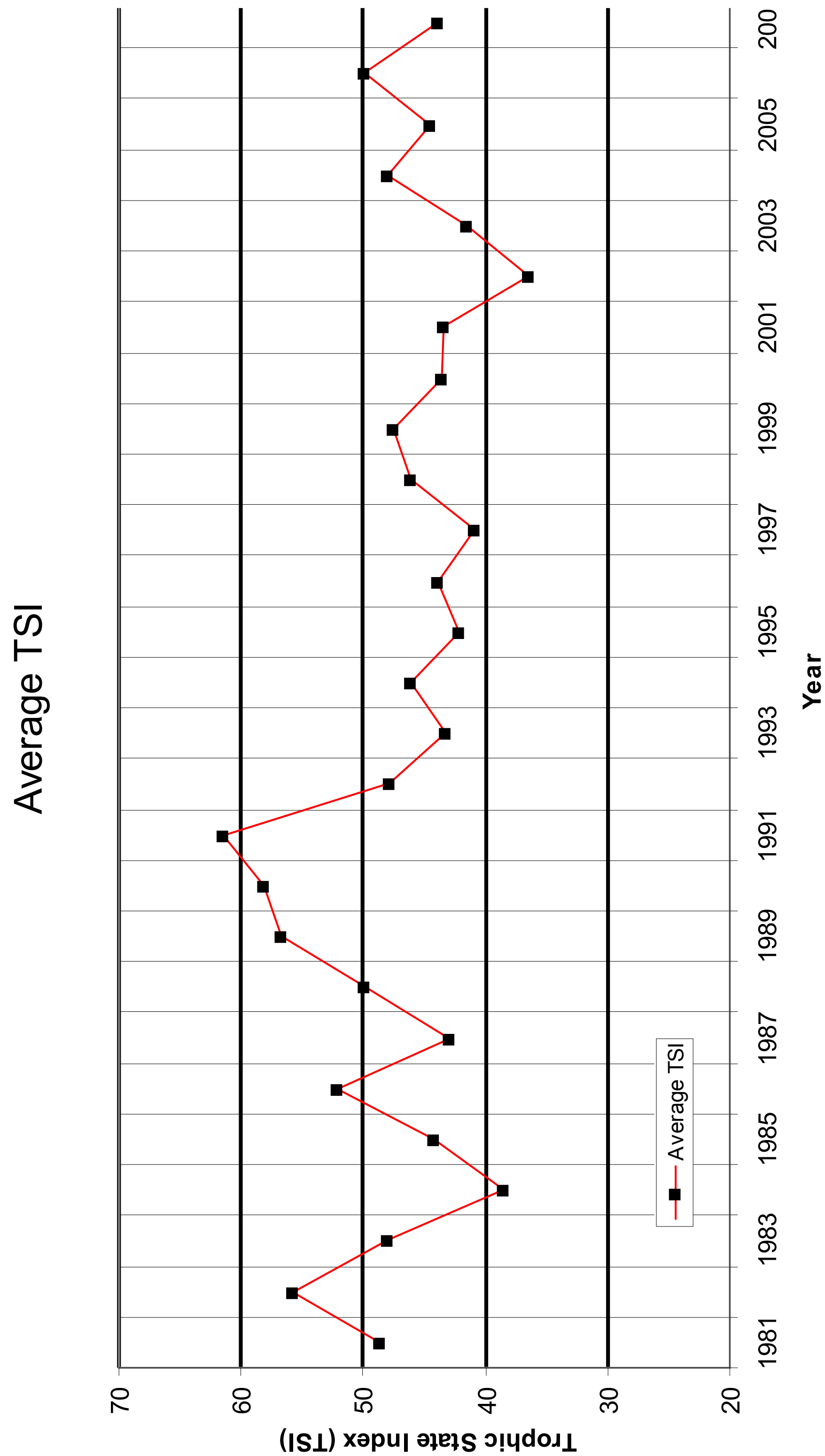


Figure 3-4.—Scofield Reservoir Average TSI.

Table 3-3.—Water Quality Data Summary of Scofield Reservoir and Inflows (mg/L) (Conductivity in µmhos/cm)

Constituents	Scofield Reservoir[1]	Fish Creek[2]	Mud Creek[3]	Pondtown Creek[4]
Calcium	<46	53	66	64
Magnesium	15	13	26	15
Potassium	<1.3	<1.1	3.1	<1.4
Sodium	<5.8	3.1	24	5.8
Alkalinity (as $CaCO_3$)	160	173	210	205
Bicarbonate	192	210	257	249
Carbonate	1.3	1.2	0.5	0.6
Chloride	<5.6	<4.7	30	7.5
Conductivity	365	341	592	425
Nitrate/Nitrite	<0.078	0.203	<0.326	<1.484
Ammonia as N	<0.099	<0.084	<0.078	<0.086
Phosphate, total	<0.049 (top) <0.103 (bottom)	<0.034	<0.084	<0.097
Phosphate, total, dissolved	<0.034 (top) <0.041 (bottom)	<0.041	<0.02	<0.027
Sulfate	<24.1	<17.8	69	22
Total dissolved solids	201	193	359	244
Total suspended solids	<5.6	<21.1	<93.7	<138.9
Aluminum	<0.030	<0.026	<0.028	
Arsenic	<0.002	<0.001	<0.002	<0.001
Barium	<0.053	<0.059	<0.064	<0.075
Boron	<0.053	<0.058	0.102	<0.071
Cadmium	<0.001	<0.001	<0.001	<0.001
Chromium	<0.005	<0.006	<0.007	<0.006
Copper	<0.012	<0.010	<0.011	<0.011
Iron	<0.133	<0.417	<0.563	<1.217
Lead	<0.005	0.005	<0.005	<0.007
Manganese	<0.092	<0.036	0.072	0.184
Mercury	<0.0001	<0.0001	<0.0001	<0.0001
Selenium	<0.001	<0.001	<0.001	<0.001
Silver	<0.002	<0.002	<0.002	<0.002
Zinc	<0.022	<0.032	<0.032	<0.029

[1]Averages based upon 542 samples collected by the Utah Division of Water Quality on Scofield Reservoir (5930980, 5930990, and 5931000) between July 1978 and July 2007.

[2]Averages based upon 124 samples collected by the Utah Division of Water Quality on Fish Creek above Scofield Reservoir (5931650) between July 1978 and November 2007.

[3]Averages based upon 66 samples collected by the Utah Division of Water Quality on Mud Creek in Scofield Town (5931480) between February 1981 and January 2008.

[4]Average based upon 94 samples collected by the Utah Division of Water Quality on Pondtown Creek above Scofield Reservoir (5931680) between September 1978 and August 2006.

66 feet, and the mean depth is 26 feet. The shallow areas with water less than about 15 feet deep normally are covered with extensive macrophyte growth, although these are normally submergent. This adds to the oxygen deficit problem during parts of the year.

The principal pollutants are nutrients, sediments, and trace elements associated with erosion and mining and nonpoint sources such as construction of roads and mine portals, domestic waste disposal, animal grazing, and natural deposits of rock containing phosphates (table 3-3).

Several independent water quality studies of Scofield Reservoir (listed in the "Bibliography") show that phosphorus is the limiting nutrient. This means that all available phosphorus is used up in producing algae or other cell bodies, while there remains a surplus of carbon, nitrogen, and other nutrients. Thus, without the input of additional phosphorus into the system, no additional algal cells can form. About 53% of the phosphorus loading to Scofield Reservoir enters from Fish Creek, according to a 1983 Utah Department of Health study. Indications are that the source of most of the phosphorus consists of naturally occurring, phosphorus-laden soils in the upper watershed.

Fishkills in Scofield Reservoir have been reported during 14 of the 46 years from 1960–2005. These fishkills are minor and generally occur in late summer. They are an indicator of water quality problems with low DO levels being the most probable cause of the fish dying.

In 1984, UDEQ received a Clean Lakes Phase II grant pursuant to the Clean Water Act, Section 314, to rehabilitate Scofield Reservoir through a program to reduce total phosphorus loading to the reservoir. UDEQ had concluded that:

> "the most pragmatic and effective means to control the further eutrophication of Scofield Reservoir, or possibly to effect a moderate reversal of the eutrophication process, appears to be a reduction of the phosphorus load to the lake."

The restoration project consisted of installing stream revetments and checkdams, revegetating denuded streambanks, replacing water diversion systems for irrigation, providing a fish cleaning station, and developing a public awareness and education program to alert people of the pollution problem and solicit their support in reducing phosphorus loads to the reservoir. Streambank rehabilitation activities occurred on segments of Mud Creek and Fish Creek. The overall streambank work was designed to reduce stream sediments and erosion through streambank stabilization and revegetation of denuded soils in highly eroded areas.

A postproject monitoring program indicated that the project was initially effective. Streambank stabilization and revegetation occurred in the project area. Visual observations indicated that sediments were being removed from the streams. Although there is insufficient empirical data to conclusively support the effects of the implementation effort, the data indicated a decline in total phosphorus concentrations. However, many aspects of the project were voluntary on the part of the landowners. Since project completion, many of the project measures have not been maintained. In particular, one aspect included fencing Mud Creek to prevent cattle from entering the stream, damaging the streambanks, and defecating in the stream. This was initially effective, but the landowners currently keep the gates open, thus allowing cattle access to the stream.

Total organic carbon (TOC) data collected by the Utah Division of Water Quality from

1979–91 indicated higher concentrations were present in the reservoir during 1980–81 and 1984–85 when the reservoir was near capacity. Data collected during 1989–91 when the reservoir's capacity was much less have lower TOC concentrations. Similar patterns for TOC data are observed for data collected from the Price River above Willow Creek (STORET ID 7932810).

Utah Division of Water Quality officials believe that the presence of "rough fish," such as carp and suckers, also contribute to the water quality problems in Scofield Reservoir. These fish feed on the reservoir bottom and stir up sediments. This agitation could increase the internal phosphorus loading of the reservoir. In critical water quality years, removal of these fish species might improve the water quality of the reservoir. For example, 1992 was a critical year for Scofield Reservoir operation. Reservoir levels were extremely low, and fishkills were anticipated. However, a fish eradication program was conducted the previous year that killed the undesirable fish. No fishkills were observed in 1992, even though water levels were critically low.

During the 1992 drought year, residents of Price asked the State of Utah to investigate an apparent increase in gastrointestinal disease. Residents believed the increase in disease was caused by either residual bacterial coliforms in the treated water or the superchlorination that was necessary to render the water safe. The State thoroughly reviewed all the required monitoring (chlorine residual and coliform counts) by the water treatment entities. There were no documented problems with the treated water, nor was the water superchlorinated, because it was not needed. Likewise, neither the State nor local Health Departments documented any increased gastrointestinal illnesses during that time period.

In 2000, the Utah Department of Water Quality submitted, and EPA approved, a phosphorus total maximum daily load (TMDL) for Scofield Reservoir (UDEQ, Division of Water Quality, 2000). The TMDL identifies total phosphorus and DO as pollutants of concern that have attributed to the impairment Scofield Reservoir's Class 3A beneficial use for cold water species of game fish. The TMDL focuses on total phosphorus as the pollutant of concern because low DO is linked to high phosphorus levels. The loading assessment quantified the current total phosphorus load to the reservoir at 6,723 kilograms per year (kg/yr). The TMDL identified three endpoints to improve reservoir water quality:

1. Shift in phytoplankton dominance from blue-green algae
2. DO level of no less than 4.0 mg/L in 50% of water column
3. TSI values between 40 and 50

These endpoints are to be met by reducing the total phosphorus load to the reservoir by 1,881 kg/yr.

3.3.1.4 Price River

Water in the Price River suffers major water quality deterioration as the stream crosses the irrigated sectors of the river basin. The deterioration results from both geologic and human factors. From about November–April, little water is released from Scofield Reservoir, and the upper portion of the basin contributes little water to the river. During this period, irrigation return flow is not significantly diluted by better quality water. Although major releases are made from Scofield Reservoir from May–October, a large part of the flow is diverted during this period into major irrigation canals in the upstream part of the basin. Significant amounts of irrigation return flow of poor quality enter the river downstream from points where most of the flow is diverted from the river.

Accordingly, during most of the year, the flow in Price River in the central basin is composed of relatively small amounts of good quality water from the upper basin and variable amounts of irrigation return flow and natural flow from tributaries that drain the marine shales. This increases the TDS level from about 300 mg/L to about 2,000 mg/L as measured above and below the areas of principal use. Although some deterioration in the chemical quality of the Price River probably would occur in the absence of stream regulation and irrigated agriculture in the central basin, deterioration is intensified with the presence of both.

The Price River from its confluence with the Green River upstream to its confluence with Soldier Creek is listed as impaired for TDS. A TMDL has been completed and approved for these segments (UDEQ, Division of Water Quality, 2004). The TMDL established target daily TDS concentrations of 1,200 mg/L for all flow regimes.

3.3.1.5 Colorado River Salinity

At its headwaters in the mountains of north-central Colorado, the Colorado River has a salinity concentration of 50 mg/L. As a tributary to the Colorado River, the Price River contributes to the salinity load of the river system. The concentration progressively increases downstream as a result of water diversions and salt contributions from a variety of sources. Near Yuma, Arizona, the Imperial Dam, built in the 1930s, diverts Colorado River water into three different canals and holds the river water until it can be directed into a desilting plant. Annual salinity concentrations at Imperial Dam are expected to decrease from the 2007 measured average level of 702 mg/L, assuming continuing successful implementation of the salinity control program (Colorado River Basin Salinity Control Forum, 2008).

Congress established the Colorado River Water Quality Improvement Program (CRWQIP), which includes numerous salinity control projects to mitigate the salinity impacts of water development as the Upper Basin States develop their existing Compact apportionments and water supplies.

3.3.1.6 Cottonwood Creek and San Pitch River

As indicated above, Cottonwood Creek has good water quality and generally meets all of its present beneficial use classifications. The San Pitch River is also generally good quality water above Fairview. However, the San Pitch River degrades downstream since most of the water is diverted; and near Moroni, the river is composed mostly of return flows from irrigation and municipal waste water. However, the TDS levels are generally below 500 mg/L in this reach, and the water is very suitable for irrigation. Most of the water is diverted from the stream about 2.5 miles west of Mt. Pleasant. Table 3-4 summarizes the water quality in this reach of the San Pitch River. Levels of trace elements (metals) in both streams are normally below detection levels.

Table 3-5 summarizes the water quality in the lower section of the San Pitch River and in Sixmile Creek near the mouth. Water in Sixmile Creek is very good quality with TDS levels averaging about 350 mg/L. Waters in the lower San Pitch River consist of mostly return flows and are further degraded below the proposed project area. The average TDS in the San Pitch River above Gunnison Reservoir is about 1,050 mg/L and 1,635 mg/L below Gunnison Reservoir, respectively. The recommended TDS criterion for irrigation water is

Table 3-4.—Water Quality Data Summary of San Pitch River in the Project Area (mg/L) (Conductivity in µmhos/cm)

Constituents	San Pitch at Highway U.S. 89 North of Fairview[1]	San Pitch 2.5 Miles West of Mt. Pleasant[2]	San Pitch Above Moroni Wastewater Treatment Plant Outfall[3]
Calcium	63	70	64
Magnesium	40	50	56
Potassium	<1.6	2.9	3.3
Sodium	13	22	33
Alkalinity (as $CaCO^3$)	307	337	345
Bicarbonate	370	413	420
Carbonate	1.8	4.5	0.1
Chloride	<12.0	22	29
Conductivity	627	749	817
Nitrate/nitrite	<0.461	<0.575	<1.159
Ammonia as N	<0.056	<0.065	<0.074
Phosphate, total	<0.019	<0.046	<0.095
Phosphate, total, dissolved	<0.017	<0.024	<0.034
Sulfate	<25.5	<59.8	<78.1
Total dissolved solids	361	446	502
Total suspended solids	<15.2	<52.6	<81.9
Aluminum	<0.03	<0.032	<0.042
Arsenic	<0.004	<0.004	<0.032
Barium	0.147	0.18	<0.576
Boron	0.05	0.133	0.102
Cadmium	<0.0009	<0.001	<0.001
Chromium	<0.005	<0.005	<0.006
Copper	<0.011	<0.015	<0.017
Iron	<0.022	<0.179	<0.405
Lead	<0.003	<0.004	<0.005
Manganese	<0.008	<0.036	<0.047
Mercury	<0.0002	<0.0002	<0.0002
Nickel	<0.001	<0.002	<0.001
Selenium	<0.002	<0.003	<0.002
Silver	<0.030	<0.025	<0.019
Zinc	63	70	64

[1]Averages based upon 56 samples collected by the Utah Division of Water Quality on San Pitch River at U.S. 89 crossing north of Fairview (4946790) between April 1986 and June 2007. The trace element (metal) samples were filtered or dissolved metals.

[2]Averages based upon 194 samples collected by the Utah Division of Water Quality on San Pitch River 2.5 miles west of Mt. Pleasant at U16 crossing (4946750) between July 1976 and June 2007. Most trace element (metal) samples were filtered or dissolved.

[3]Averages based upon 166 samples collected by the Utah Division of Water Quality on San Pitch River above Moroni Wastewater Treatment Plant (4946960) between November 1975 and May 2006. Trace element (metal) samples were filtered or dissolved.

Table 3-5.—Water Quality Data Summary of Lower San Pitch River and Sixmile Creek (mg/L) (Conductivity in μmhos/cm)

Constituents	Six Mile Creek near Mouth near San Pitch[1]	San Pitch Above Gunnison Reservoir[2]	San Pitch 2 Miles East of Gunnison[3]
Calcium	48	77	88
Magnesium	35	123	80
Potassium	<1.5	4.7	5.0
Sodium	32	155	385
Alkalinity (as $CaCO_3$)	250	445	351
Chloride	301	537	424
Conductivity	2.6	6.2	2.0
Nitrate/nitrite	<26.9	161	527
Ammonia as N	655	1,713	2,635
Phosphate, total	1.433	<0.451	<2.026
Phosphate, total, dissolved	<0.074	<0.098	<0.070
Sulfate	<0.065	<0.095	<0.076
Total dissolved solids	<0.020	<0.042	<0.022
Total suspended solids	<47.9	371	264
Aluminum	351	1,147	1,635
Arsenic	<395.5	<83.9	<130.1
Barium	<0.055	<0.036	<0.045
Boron	<0.003	<0.009	<0.005
Cadmium	0.117	0.127	<0.093
Chromium	<0.083	0.186	0.361
Copper	<0.0009	<0.001	<0.001
Iron	<0.006	<0.008	<0.006
Lead	<0.011	<0.012	<0.016
Manganese	<0.073	<0.121	<0.257
Mercury	<0.003	<0.004	<0.005
Selenium	<0.008	<0.013	<0.022
Silver	<0.0002	<0.0002	<0.0002
Zinc	<0.001	<0.002	<0.002

[1]Averages based upon 71 samples collected by the Utah Division of Water Quality on Six Mile Creek above confluence with San Pitch River northwest of Sterling (4946360) between September 1976 and June 2007. The trace element (metal) samples were filtered or dissolved metals.

[2]Averages based upon 143 samples collected by the Utah Division of Water Quality on San Pitch River west of Manti above Gunnison Reservoir at CR crossing (4946450) between September 1976 and June 2007. The trace element (metal) samples were filtered or dissolved.

[3]Averages based upon 228 samples collected by the Utah Division of Water Quality on San Pitch River 2 miles east of Gunnison at U137 crossing (4946150) between October 1976 and June 2007. The trace element (metal) samples were filtered or dissolved.

1,200 mg/L. The San Pitch River from its confluence with the Sevier River upstream to the U132 crossing was listed as impaired for TDS. A TMDL has been completed and approved for these segments (UDEQ, Division of Water Quality, 2003). The TMDL determined that cause of impairment was natural sources and that current TDS criteria could not be obtained. The TMDL further recommended site-specific criteria and that the impaired status be removed. Levels of trace elements (metals) in both streams normally are below detection levels.

3.3.2 Methodology and Impact Indicators

Impacts on water quality were analyzed using a comparison of phosphorus mass balance analysis. Scofield Reservoir was the primary focus of the water quality impact analysis since this was the predominant water quality issue identified in scoping.

3.3.2.1 Phosphorus Mass Balance Analysis

A recent study of impacts of Narrows Reservoir operations on Scofield Reservoir phosphorus loading is described in the report by Franson Noble Engineering entitled, *Eutrophication Study, Flow and Phosphorus Impacts of Proposed Narrows Project on Scofield Reservoir* (October 2006, revised) (appendix F). This recent study (based on the 1978–2005 period) accounts for flow and phosphorus routing through Lower Gooseberry and Scofield Reservoirs under existing conditions and includes the proposed Narrows Reservoir under project conditions. Phosphorus export and uptake in the reservoirs are included.

Reservoir eutrophication models have been developed for both existing and project conditions. This mass-balance mathematical modeling of Scofield Reservoir, based on external phosphorus loading, indicates that the average probability of eutrophication is about 68% under existing conditions. The average in-lake total phosphorus was 0.0279 mg/L during the 28 years modeled (1978–2005). The average annual inflow of phosphorus to Scofield Reservoir during that period was 4,434 kilograms (kg). Project impacts were determined by comparing the total modeled in-lake phosphorus under the various alternatives. In interpreting the results of this study, it should be noted that the study is based on external phosphorus loading only. In addition to external phosphorus loading, other factors, including internal phosphorus loading, affect the water quality of Scofield Reservoir.

3.3.3 Predicted Water Quality Effects

Water quality impacts of main concern that might occur as a result of construction and operation of the proposed Narrows Project are as follows:

- Degradation of existing water quality in the current nondegradation segments of project area streams during construction
- Potentially decreased DO levels and increased fishkills in Lower Gooseberry Reservoir due to decreased inflow
- Increased phosphorus concentrations in Scofield Reservoir that would increase potential for eutrophication and blue-green algal dominance and would result in an overall decrease in water quality
- Increased potential for fishkills in Scofield Reservoir as a result of possible decreases in water quality due to reduced inflows
- Increase in average salinity levels in the Colorado River at Imperial Dam of

0.54 mg/L due to an average annual depletion of 5,597 acre-feet

3.3.3.1 No Action Alternative

Under the No Action Alternative, there would be no temporary water quality impacts to Gooseberry and Fish Creeks because there would be no heavy construction in the area. Low DO levels would continue to occur in Lower Gooseberry Reservoir. The total in-lake phosphorus level in Scofield Reservoir would not change. The average probability of eutrophication would remain about 68%. The TSI would average about 47.1, and the reservoir would continue to be mesotrophic. Fishkills would continue to occur in about 14 of 46 years.

Salinity levels in the Colorado River would continue as at present under this alternative.

There would be no water quality mitigation under the No Action Alternative since there are no net impacts to water quality.

There would be no residual or cumulative impacts to water quality under the No Action Alternative.

3.3.3.2 Proposed Action Alternative

Under the Proposed Action, there could be some water quality impacts during construction; however, measures would be implemented to minimize those impacts. The contractor would be required to comply with applicable Federal and State laws, orders, and regulations concerning the control and abatement of water pollution. The contractor's construction activities would be performed by methods that would prevent solid matter, contaminants, debris, and other objectionable pollutants and wastes from entering and accidentally spilling into streams, lakes, and underground water sources. Sanitary wastes would be disposed of by approved methods.

The construction contract would require the contractor to develop and implement a Water Quality Management Plan (Erosion Control Plan) and a Storm Water Pollution Prevention Plan. The contractor also would be required to implement the best management practices (BMPs) specified in the *Nonpoint Source Water Pollution Control Plan for Hydrologic Modifications in Utah*, which is an addendum to the *Utah Nonpoint Source Management Plan*. Specifically, applicable sections such as Hydromod Planning Process, Measures to Control Construction Activities, and Impoundments would be followed and implemented. Implementation of these measures would be expected to limit construction-related impacts on water quality to temporary sediment and turbidity impacts. Under a worst case scenario, if sediment control facilities temporarily failed and any stream sections were significantly impaired, remediation/restoration work would be implemented to the satisfaction of the appropriate government agencies.

Any construction work occurring in streams or associated wetlands would be conducted in compliance with USACE's 404 Permit and/or the Utah State Engineer's stream alteration permit, which would include the State 401 certification process.

3.3.3.2.1 Lower Gooseberry Reservoir

The average annual inflow (based on 1978–2005 data) to Lower Gooseberry Reservoir would be reduced by 40%. The average annual phosphorus load levels below the proposed Narrows Reservoir would be reduced by about 113 kg/yr, resulting from phosphorus export and uptake in the Narrows Reservoir. This would result in a 45% reduction in the average nutrient load in the total inflowing water. The average in-lake phosphorus concentration would be reduced from 0.0131 to 0.0119 mg/L, and the probability of eutrophication would be reduced from 24.3 to 19.7%. Because the

DO levels are greatest near the stream inlet, a decrease in inflow is expected to decrease the overall DO level of the reservoir in winter during iced-over conditions, thus increasing the potential for fishkills unless mitigation is implemented. Mitigation for this would include minimum streamflow releases as discussed in section 3.10, "Fisheries."

3.3.3.2.2 Scofield Reservoir

As a result of the Proposed Action, the inflow to Scofield Reservoir would be reduced by an annual average of 5,726 acre-feet (about 9.2%). This means that Scofield Reservoir generally would operate at a lower elevation and smaller surface area.

Shallower conditions in Scofield Reservoir would decrease periods of weak stratification, and reservoir turnover would occur earlier in the fall. Water temperatures at the surface of the reservoir, which is a function of solar input and wind mixing, would not be expected to change. Water temperature throughout the water column would increase slightly as the volume of water in the hypolimnion, or bottom temperature zone in the water column, would be reduced. Oxygen depletion at depth in the reservoir would occur less frequently due to shallower depths and increased mixing. Shallower conditions may lead to reduced water clarity as a result of wind-induced mixing.

The results of the eutrophication study (Franson-Noble Engineering) (appendix F) with the Narrows Dam and Reservoir show that, under the Proposed Action, there would be a reduction of average annual phosphorus mass loading into Scofield Reservoir (105 kg/yr) and an increase by 10.8% in phosphorus in-lake concentration from 0.0279 to 0.0309 mg/L. The reduction in phosphorus loading results from basin export and uptake in Narrows and Lower Gooseberry Reservoirs. The increase in phosphorus in-lake concentrations results from decreased dilution caused by water depletion from the Proposed Action. Figure 3-5 shows a comparison of the future without project and project phosphorus level in Scofield Reservoir based on external loading.

Increased phosphorus concentrations would be expected to lead to increased algal blooms, particularly blue-green algae, and increased eutrophication. The overall probability of eutrophication for the period studied shows an increase from 68.3 to 73.5% (about a 5.2% increase). The probability of eutrophication was increased every year except 1984.

Increased algal blooms also may lead to increased organic matter in the reservoir and in releases. Significant increases in organic matter would impact drinking water treatment processes.

The increase of in-lake phosphorus concentration and increased probability of eutrophication indicates that the overall water quality in Scofield Reservoir would be degraded by the Proposed Action without mitigation. Mitigation measures to offset these potential impacts are described in section 3.3.3.2.6.

3.3.3.2.3 Proposed Narrows Reservoir

The overall water quality in the proposed Narrows Reservoir is projected to be good. The probability of eutrophication would be about 12% (compared to 73.5% for Scofield Reservoir and 19.7% for Lower Gooseberry Reservoir). The proposed Narrows Reservoir is not expected to strongly stratify due to its shape, water budget, and location. The active pool (the storage above the inactive pool) would only be 45 feet deep, with an average drawdown of 9 feet during the recreation season and 12 feet annually. The proposed plan is to have three outlets spaced 20 feet apart, at elevations 8,640; 8,660; and 8,680 feet, respectively. The normal water surface elevation is 8,690 feet. If a mild

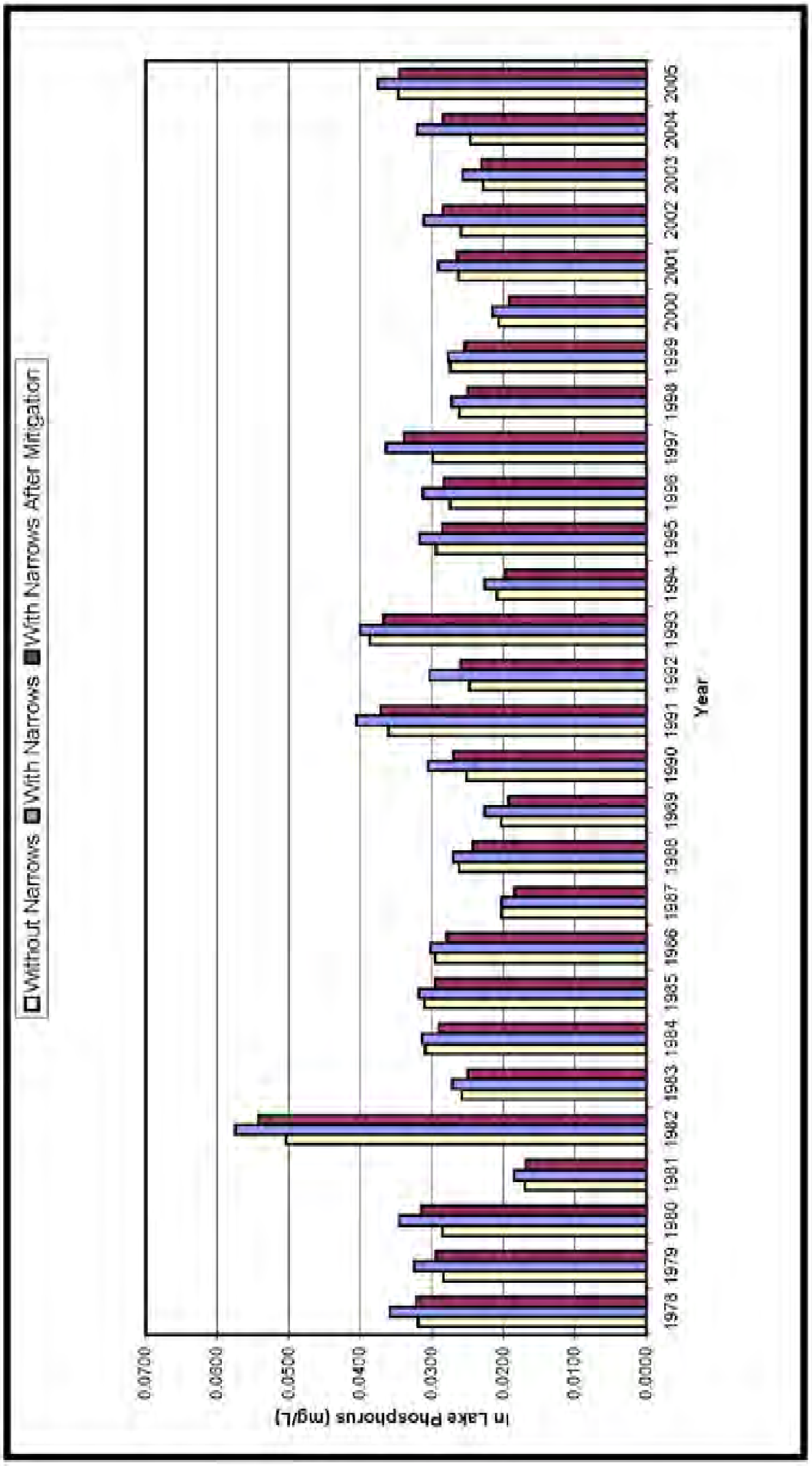


Figure 3-5.—Scofield Reservoir – Average Annual In-Lake Phosphorus Comparison.

thermocline develops, it normally would start at about 16 to 20 feet and, over the summer season, migrate down to a depth of 32 to 45 feet, depending upon the release pattern, level of water withdrawn, and type of year. Once the reservoir was constructed, filled, and operated for several years, an operating plan would be developed jointly with the State and Federal agencies to enhance habitat for fish and wildlife downstream. As a result of the small releases and stream channel conditions downstream, the water would reach ambient conditions within the first ¼ to 2 miles downstream, relative to temperature and dissolved oxygen, even if conditions were less than optimum in waters released. Releases from the Narrows Reservoir would be expected to meet or exceed water quality standards of the State of Utah as found in UAC R317-2 for downstream designated beneficial uses.

Water quality at the proposed Narrows Reservoir would be protected by establishing protection zones adjacent to the reservoir. Within these protection zones, land use practices would be restricted to eliminate activities that would impact reservoir water quality.

3.3.3.2.4 Price and Colorado Rivers

The Narrows Project would have virtually no effect on the lower Price River water quality during the November–April high TDS period because the effects of depletions caused by the proposed Narrows Project would consist primarily of reduced spills from Scofield Reservoir during the snowmelt runoff period.

Reduced spills from Scofield Reservoir would slightly increase exceedances of the TMDL established for TDS on the lower Price River (UDEQ, Division of Water Quality, 2004).

Implementing the Proposed Action would have a slight detrimental impact on Colorado River salinity. While operation of the proposed Narrows Dam and Reservoir would remove about 1,520 tons of salt per year from the Colorado River system, depletions from the project would increase salinity concentrations. The project would cause a depletion of about 5,597 acre-feet of water, which would result in an increase in salinity concentration by about 0.54 mg/L at Imperial Dam.

3.3.3.2.5 Cottonwood Creek and San Pitch River

The overall water quality of Upper Gooseberry Creek is better than that of Cottonwood Creek (see table 3-2), so the additional water imported to Cottonwood Creek would improve its quality slightly. The exception may include temporary periods of slightly higher turbidity from the increased summer flows. Flows in Cottonwood Creek (below Left Hand Fork) would increase in July and August due to the increased irrigation releases, but these flows would be significantly less than peak flows that naturally occur during the spring snowmelt period. As discussed in Section 3.5, “Slope and Channel Stability,” the Narrows Tunnel operating gate would be automated to regulate releases through the tunnel so that, even during thunderstorms, the channel forming discharge would not increase above historical conditions. Consequently, even though the Proposed Action would increase the summer base flow, it would have no effect on Cottonwood Creek channel stability because the increase would be well below the 50-year channel forming discharge.

Except during spring runoff and winter conditions, flows in the San Pitch River below the project area consist mostly of return flows from irrigation and municipal waste water. The project would increase the volume of return flows from both of these sources; however, since no new lands receive project water, the quality of return flows would be similar to existing flows or possibly would be of slightly better quality because lands would receive a more complete water supply. Consequently, the concentration of dissolved salts should be more diluted in the increased volume of return flows. The potential decrease in irrigation return flows, resulting from increasing agricultural efficiencies, would be offset by the increase of return flow from the additional project irrigation water. Even if the overall volume of return flow were reduced significantly due to increased efficiencies, the quality of the return flows probably would not change significantly, nor would the existing quality of the San Pitch River change significantly since it mostly is composed already of return flows.

As shown in table 3-5, the salinity of lower San Pitch River is about 1,150–1,635 mg/L TDS compared to about 350 mg/L in Sixmile Creek. If the Manti Meadows Alternative wetland mitigation area is selected, and if water is delivered from Sixmile Creek and replaced with project return flows delivered to Gunnison Reservoir in exchange, there could be some impact to affected irrigated lands.

Diversions to the wetland area would have to be timed to not significantly affect the exchanged irrigation water supply, or replacement waters would need to be blended with higher quality Sixmile water to avoid impact to crops using the water. Under worst case conditions, an agreement with the Manti Irrigation Company might be needed, and minimal compensation might be required.

3.3.3.2.6 Proposed Mitigation Measures

Under the Proposed Action, water quality measures would be implemented to offset any measurable impacts to water quality in Lower Gooseberry and Scofield Reservoirs. These measures include stabilizing the Gooseberry Creek channel and making improvements to 9.5 miles of stream segments tributary to Scofield Reservoir to reduce external phosphorus loading. These proposed mitigation measures are identified and discussed in section 2.2.2.

The channel of Gooseberry Creek between Lower Gooseberry Reservoir and Narrows Dam would be narrowed to stabilize the banks and provide better fish habitat with the reduced flows. It is expected that, in time, the channel would narrow by itself due to the decreased flow. However, to expedite the process, certain manmade improvements would be made. These improvements also would decrease the inflow of phosphorus-laden sediments to Lower Gooseberry Reservoir and would reduce historical water quality problems. Prior to construction of these improvements, a detailed design would be developed by SWCD in coordination with the USDA Forest Service, Service, USACE, UDWR, and the Utah Division of Water Rights. Where the stream passes through private land, a right-of-way corridor adjacent to the stream would be acquired to protect the streambanks and water quality. The right-of-way corridor would be acquired in the name of the United States. Fencing also would be provided where needed to protect the stream from livestock. In addition, a high percentage of the nutrients flowing into Lower Gooseberry Reservoir would be caught in Narrows Reservoir.

These stream stabilization measures also would tend to improve the water quality in Scofield Reservoir by reducing phosphorous loading and, thereby, reducing the potential for eutrophication including blue-green algal blooms. This improvement would be realized in conjunction with the improvement of stream segments on tributary streams above Scofield Reservoir. About 9.5 miles of stream segments would be improved, consisting of bank stabilization, primarily through riparian planting. The stream segments also would be fenced to protect them from grazing impacts. This measure would reduce the amount of sediment and animal waste and, hence, the amount of phosphorous flowing into the reservoir. Historically, fishkills have occurred in Scofield Reservoir due to poor water quality. Phosphorous has been identified as the limiting nutrient in the eutrophication of the reservoir (UDEQ, Division of Water Quality, 2000). Phosphorous loading occurs through several methods, including inflow of sediments, which are naturally high in phosphorous and animal waste. The Utah Division of Water Quality concluded that:

> "…the most pragmatic and effective means to control the further eutrophication of Scofield Reservoir, or possibly to effect a moderate reversal of the eutrophication process, appears to be a reduction of the phosphorous load to the lake." (Judd, 1992)

As mentioned earlier, the phosphorus loading and eutrophication models indicate that there would be an increase in the phosphorus concentration in Scofield Reservoir as a result of the Proposed Action. The future without the project model shows a concentration of 0.0279 mg/L of phosphorus in Scofield Reservoir. The Proposed Action phosphorus concentration is estimated to be 0.0309 mg/L for the study period of 1978–2005, an increase of 10.8%.

To offset this impact on Scofield Reservoir, phosphorus loading to the reservoir will be reduced through mitigation measures to achieve preproject in-lake phosphorus concentrations. The model used in the eutrophication study estimates phosphorus loading would need to be reduced by 530 kg/yr. However, the model underestimates both the phosphorus loading to the reservoir and the in-lake phosphorus concentrations. The phosphorus load reduction required to achieve preproject conditions in the lake is calculated from a ratio of the model phosphorus load (4,434 kg/yr) and the TMDL estimated phosphorus load (6,723 kg/yr). The necessary phosphorus load reduction is estimated to be 805 kg/yr.

An interagency team of water quality specialists proposed mitigation measures on 9.5 miles of stream segments to achieve the required phosphorus load reduction of 805 kg/yr. Mud Creek would account for 6.5 miles of the mitigation stream segments, with 2.0 miles on Pondtown Creek and 1.0 mile on Fish Creek. Water quality monitoring on each tributary would be implemented to identify specific locations of stream restoration efforts and type and to quantify phosphorus reductions from proposed mitigation measures. All mitigation measures would be implemented prior to storage and diversion of water in the Proposed Alternative. Monitoring also would continue following implementation of mitigation measures to verify continued effectiveness in reducing phosphorus loading. If the estimated phosphorus reduction of proposed mitigation measures does not equal or exceed the required reduction of 805 kg/yr, then additional mitigation measures would be identified and implemented until the required reduction is reached. The development and implementation of the water quality monitoring program and identification of mitigation measure locations would be coordinated with and approved by the Utah Division of Water Quality.

Water quality monitoring of Scofield Reservoir also would be implemented to ensure the effectiveness of the proposed mitigation measures and to verify that other water quality impacts do not occur. The proposed monitoring method would be to compare future water quality samples once the project is in operation, with the samples taken before that time. Calculated TSI values, phytoplankton samples, and an average of the phosphorus concentration in these water samples over time would indicate the effectiveness of the mitigation measures.

Salinity of the Colorado River has been increased by developing water resources in two major ways:

1. The addition of salts from water use
2. The consumption (depletion) of water

The combined effects of water use and consumption have had a significant impact on salinity in the Colorado River Basin. The net effect of this project on Colorado River salinity is anticipated to be an increased salinity concentration of about 0.54 mg/L at Imperial Dam.

The Colorado River Basin States have agreed to limit this impact and adopted numeric criteria, requiring that salinity concentrations not increase (from the 1972 levels) due to future water development. The goal of the Colorado River Basin Salinity Control is to offset (eliminate) the salinity effects of additional water development (U.S. Department of the Interior, 2005).

Although it is not possible to accurately quantify the net effect of the project plan on water quality in Lower Gooseberry and Scofield Reservoirs, it is believed that the mitigation measures described above, along with the nutrient capture and export due to the project, would offset any adverse impacts caused by the water reduction and other consequences of the project, leaving essentially no residual project impact.

3.3.3.3 Mid-Sized Reservoir Alternative

Water quality impacts under the Mid-Sized Reservoir Alternative would be similar to those of the Proposed Action. The Price River depletion would be 5,298 acre-feet instead of 5,597 acre-feet under the Proposed Action, which would indicate a slightly reduced impact to water quality in the Lower Gooseberry and Scofield Reservoirs. This would be a reduction of 39% of the annual inflow to Lower Gooseberry Reservoir and 8.8% to Scofield Reservoir. The depletion to the Colorado River would be reduced slightly to 5,298 acre-feet, removing about 1,470 tons of salt per year from the Colorado River system but increasing salinity concentration at Imperial Dam by about 0.51 mg/L.

Water quality mitigation measures under the Mid-Sized Reservoir Alternative would be the same as those under the Proposed Action.

After mitigation, there would be effectively no residual project impact on water quality in Lower Gooseberry and Scofield Reservoirs.

3.3.3.4 Small Reservoir Alternative

Water quality impacts under the Small Reservoir Alternative would be similar to those of the Proposed Action. The Price River depletion would be 4,841 acre-feet instead of 5,597 acre-feet under the Proposed Action, which would indicate a slightly reduced impact to water quality in the Lower Gooseberry and Scofield Reservoirs—a reduction of 36% of the annual inflow to Lower Gooseberry Reservoir and 8.3% to Scofield Reservoir. This depletion would remove about 1,380 tons of salt per year from the Colorado River system but would increase salinity concentration at Imperial Dam by about 0.46 mg/L.

Water quality mitigation measures under the Small Reservoir Alternative would be the same as those under the Proposed Action.

After mitigation, there would be no residual project impact on water quality in Lower Gooseberry and Scofield Reservoirs.

3.4 AIR QUALITY RESOURCES

3.4.1 Affected Environment

Utah air quality is monitored by UDEQ, Division of Air Quality, but there are no monitoring sites near the proposed Narrows Project located in Sanpete County. The closest monitoring station is located in Utah County, which has poor air quality in terms of carbon monoxide, nitrogen dioxide, and particulate matter (www.epa.gov/air/data).

3.4.2 Methodology and Impact Indicators

Under the 1970 Clean Air Act, the EPA established National Ambient Air Quality Standards (NAAQS) for particulate matter and five other criteria pollutants considered harmful to public health and the environment. The NAAQS specify maximum concentrations below which the air quality is considered acceptable, meaning an area below these thresholds are "in attainment" for EPA standards.

Sanpete County is generally in attainment for all but particulate matter. The standards for particulate matter, expressed as micrograms per cubic meter (µg/m^3), are as follows: 150 µg/m^3 (24-hour), 50 µg/m^3 (annual arithmetic average). The impact indicator for this issue is the number of days the project would exceed NAAQS for particulate matter (PM_{10} levels).

3.4.3 Predicted Effects

3.4.3.1 No Action Alternative

Under the No Action Alternative, Sanpete County ranks among the cleanest 20% of all counties in the United States for total annual average emissions, but for particulate matter (PM_{10}), it ranks among the dirtiest 40% of all counties in the United States (based on the EPA's National Emissions Trends database at www.scorecard.org). The existing sources of particulate matter would continue to be present, but particulates are not expected to significantly increase under the No Action Alternative (table 3-6).

3.4.3.2 Proposed Action Alternative

Typical PM_{10} emissions associated with construction activities described in the Proposed Action were estimated, using emission factors from the EPA's *Compilation of Air Pollutant Emission Factors* (EPA, 1985). Approximately 232 pounds per day (lb/day) of construction dust PM_{10} emissions would be produced from activities described in the Proposed Action.

Table 3-6.—Number of Days PM_{10} Dust Emissions Exceed NAAQS in Sanpete County During Construction of Narrows Project

Alternative	Ambient Standard for PM_{10} (µg/m^3)	Daily Emissions (pounds per µg/m^3)	Number of Days PM_{10} Emissions Exceed Standards
No Action	150	150	0
Proposed Action	150	150	0
Mid-Sized Reservoir	150	150	0
Small Reservoir	150	150	0

Most of these emissions would be from vehicle and equipment travel over unpaved roads or direct disturbance of the soil by excavating, grading, and compacting. Application of standard dust suppression techniques (for example, soil stabilization or watering of stockpiled materials) would reduce daily PM_{10} emissions from 232 lb/day to less than the national standard of 150 lb/day. Short-term increases of particulate matter would occur during construction of the Proposed Action. Fugitive dust emissions and emissions from internal combustion engines would be generated by excavation and earth-moving vehicle traffic on unpaved surfaces. The contractor would be required to meet all applicable regulations concerning exhaust and dust control.

Following construction, long-term impacts on air quality would include some increased vehicle emissions and campfires due to additional recreational facilities that would result from the project. This, along with the increased use associated with project O&M, would contribute to some increased level of air pollutants. This impact would not be expected to exceed NAAQS in the Narrows Project area.

Wherever and whenever necessary, the contractor would be required to comply with all Federal regulations and take proper and efficient measures to reduce dust and exhaust pollution that might originate from construction to prevent it from becoming a nuisance to people or causing damage to crops, cultivated fields, or dwellings. The contractor would be required to control particle pollution resulting from the manufacture of concrete aggregate or excessive exhaust pollution resulting from improperly tuned engines or improperly equipped vehicles and equipment.

3.4.3.3 Mid-Sized Reservoir Alternative

Air quality effects associated with this alternative would be the same as those described above for the Proposed Action; however, once the construction phase of the project is completed, the long-term effects on criteria pollutants, especially particulate matter, would be proportionately reduced due to the reduced number of mobile emission sources (vehicles) that would be attracted to the reservoir.

3.4.3.4 Small Reservoir Alternative

Air quality effects associated with this alternative would be the same as those described above for the Proposed Action; however, given the smaller size of the reservoir, it would attract fewer visitors and the future mobile sources of air pollution would be proportionately reduced.

3.5 SLOPE AND CHANNEL STABILITY

3.5.1 Affected Environment

Fairview Canyon, which contains Cottonwood Creek, is a steep, narrow canyon located east of Fairview, Utah. Highway SR-31 is located in the canyon. The canyon is approximately 7 miles long. The stream elevation at the mouth of the canyon is about 6,300 feet and about 8,800 feet near the summit. Typical slopes of the canyon wall are 2:1 to 2.5:1 (ratio of horizontal to vertical distance). Numerous landslides are located throughout the canyon on both sides. In several places, continual road maintenance is required to repair damage caused by landslides.

A total of 104 landslides were identified from aerial photographs and during a 1991 field review along the slopes of a 6-mile reach of Cottonwood Creek. The review team was comprised of individuals from various government agencies and private consulting firms. The review was to determine the impact of projected flow increases from Narrows Tunnel on adjacent slopes of Cottonwood Creek. The state of activity of the slides was noted, with 85 slides classified as "active" and 19 classified as "dormant." The certainty of landslide identification included 89 slides as "definite," 13 as "probable," and 2 as "questionable." The distances of the landslides from the tunnel portal ranged from 0.3 mile to 6.1 miles. Dominant types of slope movement of the 104 landslides are shown in table 3-7.

Table 3-7.—Fairview Canyon Slope Movement[1]

Type of Movement	Number of Landslides
Slump earthflow	8
Debris slide	64
Debris flow	8
Earthflow	1
Slump	22
Debris cone	1

[1] Based on the type of material involved in the movement (soil, rock, or debris) and the dominant type of movement (whether the material is sliding, flowing, falling) or a combination thereof.

Based on observations during the review, it was determined that landslide activity is not related to stream channel stability or the flow in Cottonwood Creek but is caused by saturation from water sources on the hillsides.

Over the majority of the reach between the confluence with Left Fork and the mouth of the canyon near Site 7 (figure 3-6), Cottonwood Creek is a small, steep, step-pool stream that is confined in a narrow canyon.

The natural drainage area upstream of Left Hand Fork is relatively small, and the size of the channel between Left Fork and the Narrows Tunnel outlet is primarily a product of the flows that have been imported to the reach since construction of the tunnel in the 1930s. Between the mouth of the canyon and the confluence with the San Pitch River, Cottonwood Creek flows across an alluvial fan through the town of Fairview (refer to figure 3-6 for location of stream reaches and features).

Upstream, in approximately 0.3 mile of the 0.9-mile-long reach, the tunnel outlet and Left Fork cross a relatively wide, mountain meadow area at a gradient of about 5% and have a slightly sinuous planform. The bed material in this area is primarily angular cobbles and gravel, and the banks are well defined and root-reinforced. A surface sediment sample collected at approximately the midpoint of the reach had a median size of 69 millimeters (mm) in size. A series of log-drop check structures have been installed in this portion of the stream. Large, angular cobbles have been placed around many of the structures to provide additional stability. Some of this material likely has been transported away from the structures and is represented in the bed material sample. Some of the structures have been flanked due to lateral movement of the channel. At the downstream end of the meadow reach, the valley bottom narrows considerably, and the stream gradient steepens.

In the approximately 5.3-mile reach between Left Fork and the mouth of the canyon, the planform and gradient of the reach are controlled by the bedrock geology of the canyon and by material that has been delivered to the valley bottom by the numerous landslides that occur along the reach. Steep, colluvial slopes that are underlain by bedrock outcrop consisting of interbedded layers of moderately cemented sandstones and shales extend to the edge of the channel in many locations.

Based on the USGS 72-minute quadrangle maps, the channel gradient averages about

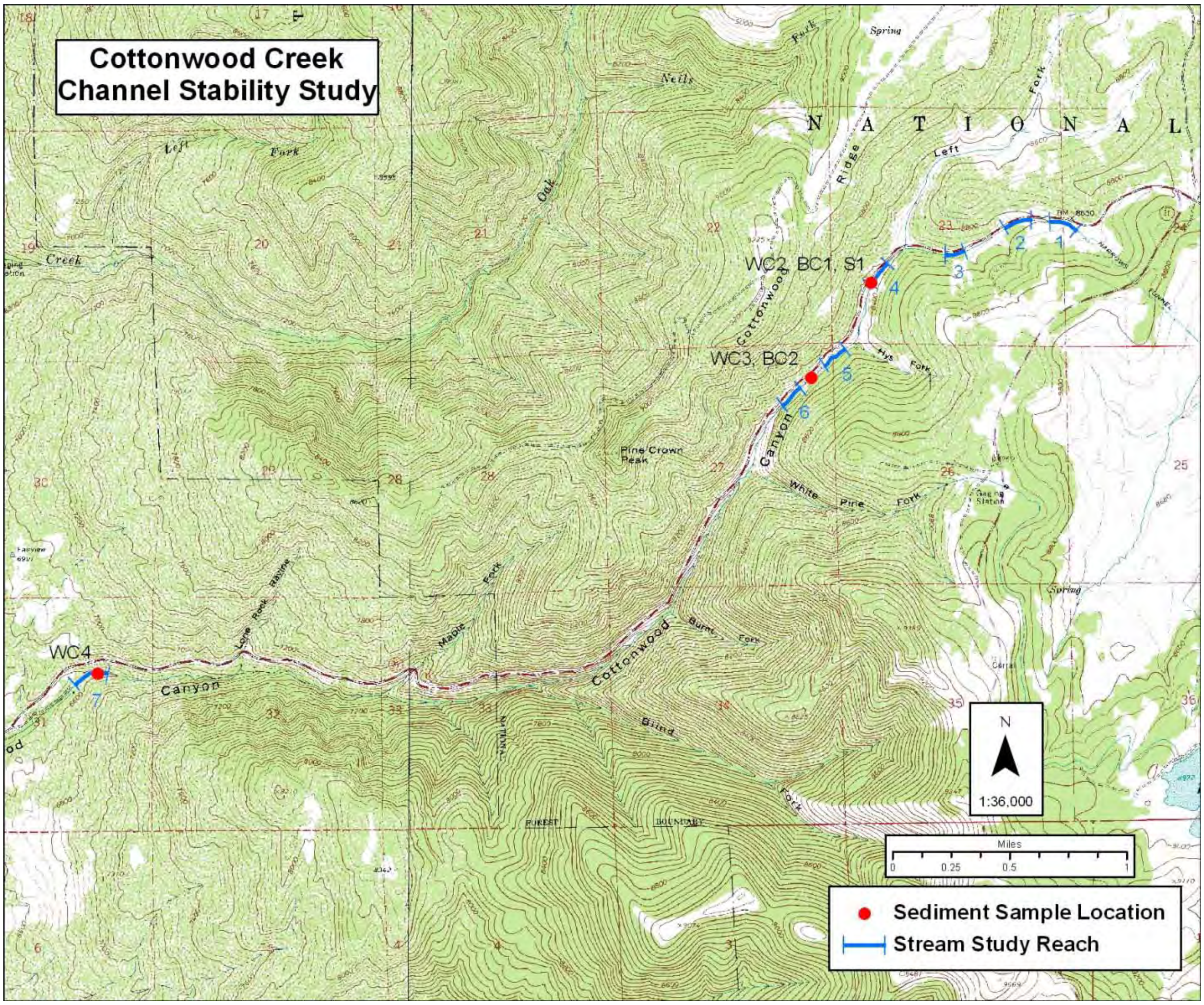


Figure 3-6.—Cottonwood Creek Channel Stability Study Reaches.

4.2% between the mouths of Left Fork and Hys Fork, steepens to about 9.1% between Hys Fork and Maple Fork, and then flattens to about 6.6% between Maple Fork and the mouth of the canyon. In several locations below Left Fork, beaver activity significantly affects the planform and profile, creating depositional areas behind the dams, deflecting the stream alignment at the dams, and, in some locations, creating split-flow reaches. The bed material along this portion of the reach consists of particles ranging in size from sand to boulders exceeding 2 feet in diameter.

The finer-grained gravel and cobble-sized material are found in the flatter-gradient portions of the reach where depositional zones are created by beaver activity and in-channel bars along the margins of the channel, while the boulder steps tend to occur in steeper, more confined reaches. A subsurface sediment sample, taken from the bank-attached gravel bar at the same location as surface sample WC2 (approximately 0.2 mile downstream from Left Fork), contained particles ranging in size from fine sand to coarse gravel and had a median size of 14 mm, while the surface sample had a median size of about 50 mm. This relatively fine-grained material is representative of the material that deposits in depositional zones, while the coarser surface layer is indicative of the typical mobile surface pavement that occurs in gravel bed streams to regulate transport of the relatively low supply of finer-grained material. Steeper, step-pool reaches that provide a positive vertical control for the channel profile also occur between the flatter areas. The median size of the boulders in the step-pool reach just upstream of WC2 was about 380 mm and ranged up to 900 mm in diameter.

In portions of the reach where the valley bottom is wider than the stream (e.g., between Left Fork and Hys Fork), the overbank sediment contains a mixture of gravel, cobbles, and fines (sands, silts, and some clays) that support thick stands of willows and other riparian species. In the confined, steeper portions of the reach between approximately the mouth of Hys Fork and the mouth of the canyon, the channel is primarily boulder step, with a narrow riparian corridor along the channel. Upland species (e.g., evergreen trees) grow very near the channel edge in many locations. A surface bed material sample that was taken about 0.25 mile downstream from Hys Fork had a median size of 103 mm and contained particles up to 250 mm in diameter. The boulder steps in this area had a median size of about 300 mm and ranged up to 750 mm in diameter. There is little evidence of a flood plain along this portion of the reach. Where a flat overbank surface that can be inundated by relatively frequent flows occurs, this feature is very localized and discontinuous and is typically the result of a local deposition zone caused by a downstream obstruction or by an expansion zone caused by bedrock outcrop or debris along the valley margins. The lack of a well-developed flood plain indicates that the stream is laterally very stable, due to the confinement in the bottom of the canyon. There is some minor, localized bank erosion; however, in most cases, the toe of the banks is armored with coarse-grained material, much of which likely is composed of colluvium from the adjacent valley walls or by bedrock outcrop. In some locations, angular cobbles and boulders in the right (north) bank are likely side-case material associated with construction of SR-31.

In the downstream portions of the reach near Site 7, the stream has incised within terraces created by debris flow deposits and colluvium near the head of the alluvial fan. Bank heights in this reach range from 6–10 feet, and the overbank material is composed of a heterogeneous mixture of sands to boulders. The stream profile is controlled by bedrock outcrop and large, woody debris jams in portions of this reach and has a step-pool character in other areas. A surface sediment sample (WC4) taken in the depositional area upstream of the large, woody debris jam had a median size of 113 mm and contained particles up to 450 mm in diameter. Bed material in the reach downstream from the mouth of the canyon is very coarse-grained and appears to be very stable. As is typical on coarse grained alluvial fans, this portion of the reach likely loses a significant amount of flow to infiltration. (Upstream diversions also reduce the surface flow in this portion of the reach.)

The processes associated with the step-pool morphology, such as that in most of the reaches in Cottonwood Creek downstream from the tunnel outlet, had been studied by numerous researchers (Ashida et al., 1976, 1982; Griffiths, 1980; Whittaker and Jaeggi, 1982; Whittaker and Davies, 1982; Whittaker, 1987a, 1987b; Chin, 1989; Grant et al., 1990; Montgomery and Buffington, 1997). This morphology “is generally associated with steep gradients, small width-to-depth ratios, and pronounced confinement by valley walls” (Montgomery and Buffington, 1997). Step-pool channels are sediment supply limited, which means that their capacity to transport sediment is much greater than the supply (Grant et al., 1990; Mussetter, 1989). Step spacing typically varies from one to four channel widths (Bowman, 1977; Whittaker, 1987b; Chin, 1989; Grant et al., 1990) and corresponds to maximum flow resistance, providing stability for a bed that would otherwise be mobile (Whittaker and Jaeggi, 1982; Abrahams et al., 1995). In these types of channels, the grain sizes that are found in the bed are mobile only during extreme floods; and the step-pool morphology is re-established during the falling limb of the flood hydrograph (Sawada et al., 1983; Whittaker, 1987b; Warburton, 1992).

Discharges of the 50-year flood or larger typically are required to form or modify the steps (Grant et al., 1990). Tracer studies have demonstrated that transport of the finer-grained material stored in the pools between the steps is mobilized during frequent flow events, but the transport of this material is strongly supply limited (Schmidt and Ergenzinger, 1992). Because of the above described characteristics, step-pool streams are resilient to changes in discharge and sediment supply (Montgomery and Buffington, 1997).

As is clearly shown in the above cited literature, the channel forming or dominant discharge in creeks such as Cottonwood Creek is not related to frequently occurring flows associated with the mean annual (or 1.5- to 2-year) flood peak. The concept of the dominant discharge is derived from work on self-formed, alluvial channels in which the boundary material is mobilized over a broad range of discharges, including those that occur for a few to several days per year. These channels typically are able to adjust their cross-sectional shape, planform, and gradient to achieve a state of dynamic equilibrium with the water and sediment supply. The self-formed alluvial streams on which the dominant discharge concept is based typically have well-developed flood plains in which there is a distinct top of bank with a relatively flat overbank area (i.e., bankfull).

Portions of the relatively short reach of Cottonwood Creek between the mouths of Left Fork and Hys Fork have areas that, at a superficial level, appear to fit the definition of a flood plain. (For example, there is a relatively flat overbank area in the narrow valley bottom that is two to three times wider than the channel, and there is a well-defined bankline. The channel capacity in this area appears to be of the 2- to 5-year flood peak.) Closer examination, however, shows that these areas are primarily the result of beaver activity in this locally flatter reach of the stream. As previously discussed, the overbank material is a heterogeneous mixture of materials ranging in size from cobbles to silt and clay. The finer-grained areas are depositional zones that developed behind beaver dams, and much of the nonlinear planform is caused by flow deflection around the remnants of breached dams.

In the step-pool reaches of Cottonwood Creek, the processes that control the size, gradient, and planform are very different from those that control these features in the self-formed streams that have well-developed flood plains. The channel is confined between the valley walls, occupying essentially the entire valley bottom. The lateral and vertical accretion processes that create flood plains do not occur because the channel is laterally confined, and the concept of the bankfull discharge is essentially meaningless. The bed shear stresses in the step-pool reaches of the stream, indicated by a hydraulic analysis of the peak of the 2-year flood, are substantially less than are required to mobilize the boulder steps that locally control the profile of the channel.

3.5.2 Methodology and Impact Indicators

Because the review team determined that existing landslides in the canyon are not related to stream channel stability or the flow in Cottonwood Creek, it was determined that the project would have no effect on the landslides. Therefore, no additional analysis of the landslides was performed.

As mentioned previously, the majority of Cottonwood Creek is a step-pool stream. This determination is based on a detailed field review. The project effects on channel stability are based on physical characteristics of the stream, the processes associated with step-pool morphology, and the impacts of the project on the flow characteristics. The impact indicator is flows exceeding the 50-year channel forming flow because of project operation.

3.5.3 Predicted Effects

3.5.3.1 No Action Alternative

Under the No Action Alternative, there would be no change in channel forming discharge in Cottonwood Creek over its present value; therefore, there would be no impact to Cottonwood Creek channel stability.

3.5.3.2 Proposed Action Alternative

Under the Proposed Action, increased flows in Cottonwood Creek will occur due to releases from Narrows Reservoir through the Narrows Tunnel and Upper Cottonwood Creek Pipeline. These increased flows will occur below Left Hand Fork where the Upper Cottonwood Creek Pipeline will discharge into the creek. Figure 3-7 is a hydrograph based on daily flow data that compares present, or No Action Alternative, flows in Cottonwood Creek with flows that will occur under the Proposed Action. The figure is based on 1968 data, which is an average year. As shown in the figure, the peak discharge of about 112 cfs occurs during the snowmelt runoff period. Presently, summer base flows are about 18 cfs. Under the Proposed Action, the summer base flows would increase to about 50 cfs. The maximum flow possible through the tunnel was increased in 2011 by 45 cfs, from a capacity of 15 cfs to a capacity of 60 cfs.

The 50-year rainfall peaks expected in the canyon range from 330 cfs below Left Fork to 570 cfs near the mouth of the canyon. The possible maximum increase in tunnel flows is less than 15% of the rainfall peaks. The snowmelt peak is not a consideration because the tunnel will not operate during the snowmelt runoff. Based on the physical characteristics of Cottonwood Creek and the impacts of the proposed project on the flow characteristics, the project is unlikely to have a significant impact on the stability of the creek. To ensure that the tunnel releases will not cause an impact, the measures described below will be implemented.

As described previously in chapter 2, remote control of the Narrows Tunnel operating gate would be provided to automatically regulate the releases through the tunnel. These controls would be coupled to an automated stream gauging station on Cottonwood Creek near the mouth of the canyon. The streamflow in Cottonwood Creek would be constantly monitored by these controls. As the streamflow increases during high runoff events such as thunderstorms, the tunnel operation would be discontinued when the flow exceeds 100 cfs. The project releases would not resume until after the flows drop below 100 cfs. Under this operating regime, the project flows through the tunnel would not increase streamflows above what is considered safe for channel stability.

Increased flows under project conditions would be well below the 50-year channel-forming discharge.

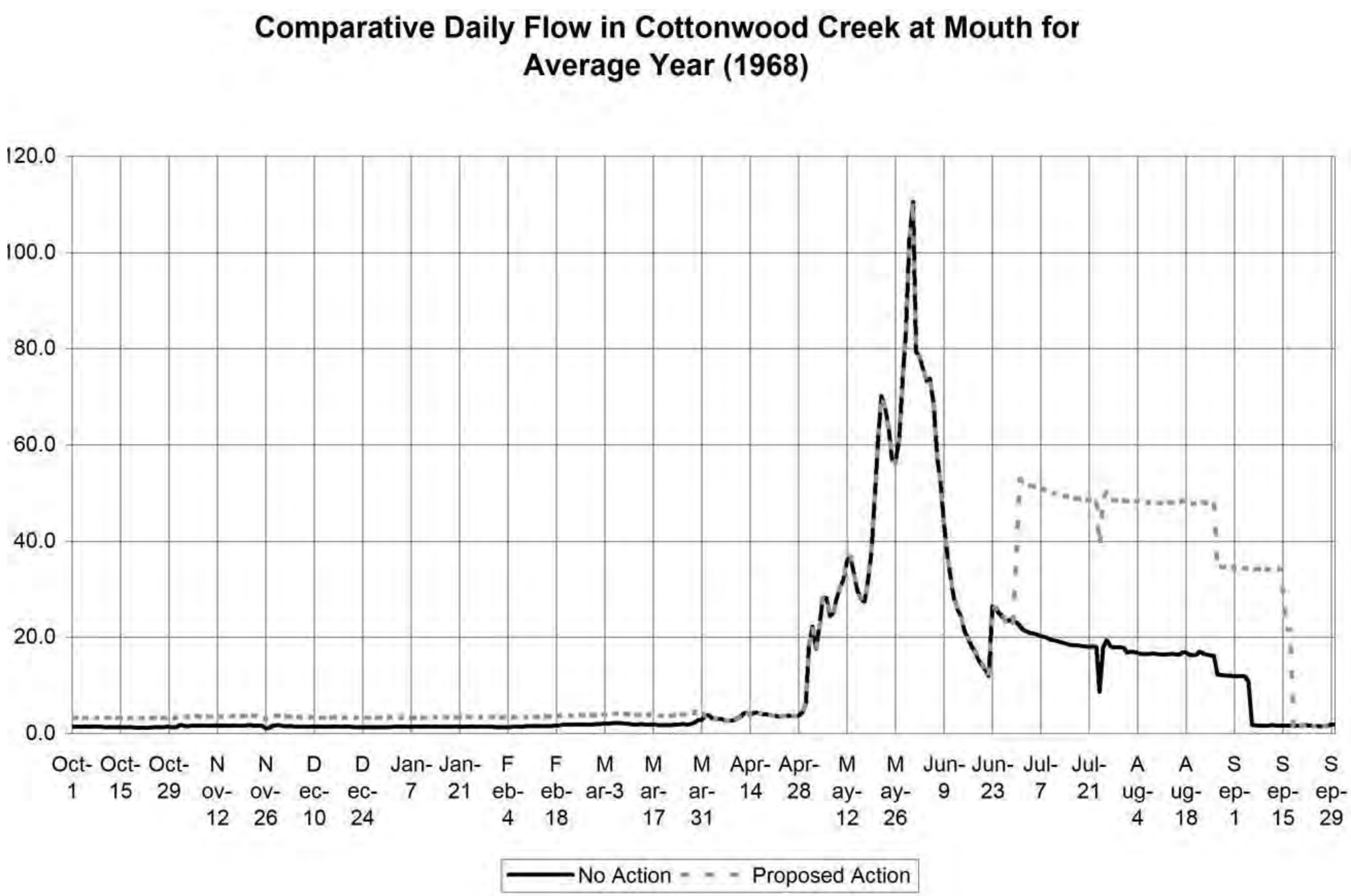


Figure 3-7.—Comparative Daily Flow in Cottonwood Creek at Mouth for Average Year (1968).

Erosion along the banks of Cottonwood Creek would be carefully monitored, especially during the first year of operation, to verify that the project has no effect on Cottonwood Creek channel stability.

Appropriate action would be taken if additional erosion above background levels is observed during project operation. Remedial actions could include placing additional armoring materials in the channel or along the bank or revising project operation to avoid more widespread stability problems.

3.5.3.3 Mid-Sized Reservoir Alternative

Channel flows in Cottonwood Creek with the Mid-Sized Reservoir Alternative would be similar to the Proposed Action; therefore, there would be no impact to Cottonwood Creek channel stability. Monitoring of Cottonwood Creek channel stability would take place to ensure that there are no measurable impacts as described in the Proposed Action.

3.5.3.4 Small Reservoir Alternative

Channel flows in Cottonwood Creek with the Small Reservoir Alternative would be similar to the Proposed Action; therefore, there would be no impact to Cottonwood Creek channel stability. Monitoring of Cottonwood Creek channel stability would take place to ensure that there are no measurable impacts, as described in the Proposed Action.

3.6 GEOLOGIC RESOURCES

3.6.1 Affected Environment

The reservoir basin lies within a high elevation, shallow valley in the Wasatch Plateau subprovince of the Colorado Plateau. This subprovince represents the transition between the Colorado Plateau to the east and the Basin and Range Province to the west. Several ridges isolate the valley basin, which lies about 8,680 feet above sea level.

The proposed Narrows Dam and Reservoir area is underlain by the Cretaceous age North Horn Formation. This formation consists primarily of interbedded sandy, clayey siltstone, silty claystone, silty sandstone, and limestone with occasional thin seams of coal. Bedrock crops out on the steeper slopes of the left abutment and in the drainage located immediately upstream of the left abutment. There is less exposure of bedrock on the right abutment. Unconsolidated sediments overlying bedrock consist primarily of a mixture of residual soil (weathered rock) and colluvium that generally consists of silty sand with some fine to coarse gravel. A geologic study performed by SWCD indicates that there is low potential for reservoir-induced landslide activity in the reservoir basin.

The North Horn Formation is overlain by the Flagstaff Limestone Formation that consists primarily of microcrystalline limestone with thinly bedded shale and silty claystone. Abundant fossils are common within the limestone, and the boundary between the formations is transitional. The Flagstaff Limestone Formation generally is present in the higher elevations and beyond the actual limits of the proposed dam and reservoir.

The Flagstaff Limestone Formation is present at the downstream portal area of the existing Narrows Tunnel.

Bedrock generally is covered by a mantle of residual soils and/or colluvium. These unconsolidated sediments are about 5–10 feet thick with some areas in excess of 27 feet. The unconsolidated sediments are composed of a mixture of clay, silt, and sand with minor amounts of organic deposits. Within the active stream channel of Gooseberry Creek and its tributaries, there are limited deposits of recent alluvial sand and gravel.

The structure of the Wasatch Plateau is dominated by a series of north-trending faults across the broad, west-dipping monocline of the plateau. The Sevier fault zone lies closest to the damsite at a distance of about 20 miles. The local structure is dominated by north-trending faulting around the site area. The dam and reservoir sites are located entirely on a down-dropped block between two fault traces, which is known as the Gooseberry Graben. Variation in orientation of beds indicates that the dam area is located on a westward-plunging synclinal fold with the axis running about 1,000 feet south of the proposed dam axis.

Three faults have been mapped in the vicinity of the Narrows Project. These faults, shown in figure 3-8, are all north-trending normal faults; and the West Gooseberry Fault, the Fairview Lakes Fault, and the East Gooseberry Fault are from west to east.

Observed earthquakes in the region of the Narrows damsite date back to 1853, giving a historical database of about 158 years. A network of seismograph stations throughout the region currently provides the accurate location of any seismic event. Geologic evaluation of the Wasatch Plateau area indicates that existing faults are not active. Maximum seismic events for the area are, therefore, projected to be controlled by random background earthquakes—that is, events not attributable to specific faults or geologic structures.

The largest earthquake recorded in the Wasatch Plateau Province is a magnitude 4.9 event. The maximum random earthquake event postulated for the Wasatch Plateau is a 5.5 event, occurring beneath the site at a depth of 3 miles. Such an event would produce a maximum acceleration of approximately 0.35 g (acceleration of gravity). Seismic activity related to mining activities would not be expected to produce events that exceed magnitude 4.5 and, therefore, would not produce the maximum earthquake. Earthquake epicenters are shown on figure 3-9.

3.6.2 Methodology and Impact Indicators

Geologic hazards are not of notable concern in the project area; however, earthquake epicenters have been mapped adjacent to the project area. The highest recorded magnitude earthquake recorded for the Wasatch Plateau Province is 4.9.

The impact indicator for this issue is number of known geologic hazards within the vicinity of the dam and reservoir.

3.6.3 Predicted Effects

3.6.3.1 No Action Alternative

Geologic conditions and seismic hazards would remain the same as at present under this alternative.

3.6.3.2 Proposed Action Alternative

From a geoseismic standpoint, the recommended Narrows damsite is suitable for construction. No significant geologic hazards were found in the embankment or reservoir area, and no seismic activity would be expected to occur from, or be induced by, this reservoir. Faults that occur in the site vicinity are believed to be inactive; however, design of project facilities would be based on a "maximum credible earthquake" (MCE). Preliminary studies indicate that the appropriate MCE would be of magnitude 5.5. Further review of the appropriate MCE would be performed prior to final design of the dam. Additional geologic field evaluation and assessment of the dam and reservoir site would be completed that addresses the proximal active faults associated with the site and further characterizes the earth materials underlying the damsite, reservoir, and

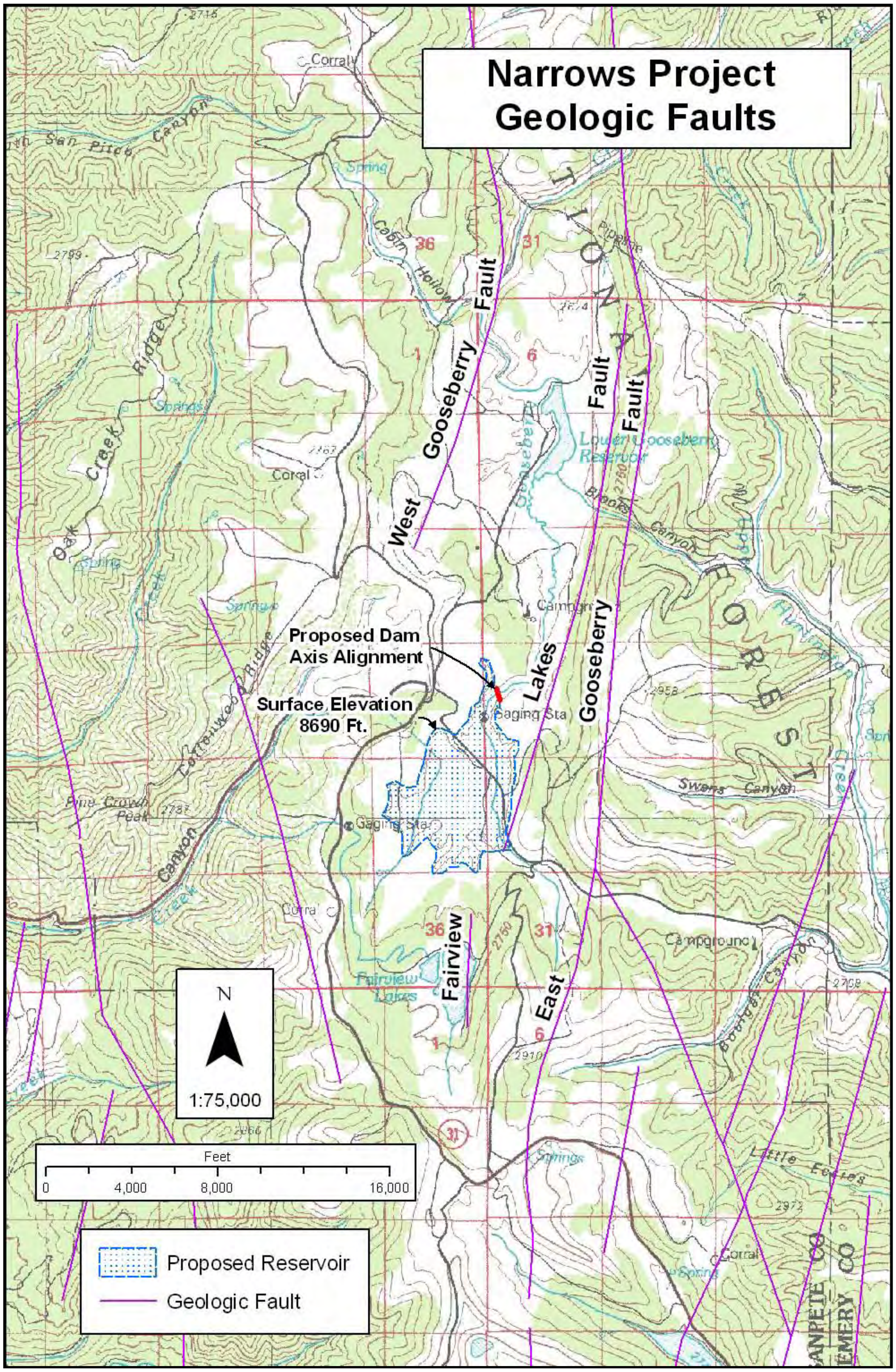


Figure 3-8.—Narrows Project Geologic Faults Location Map.

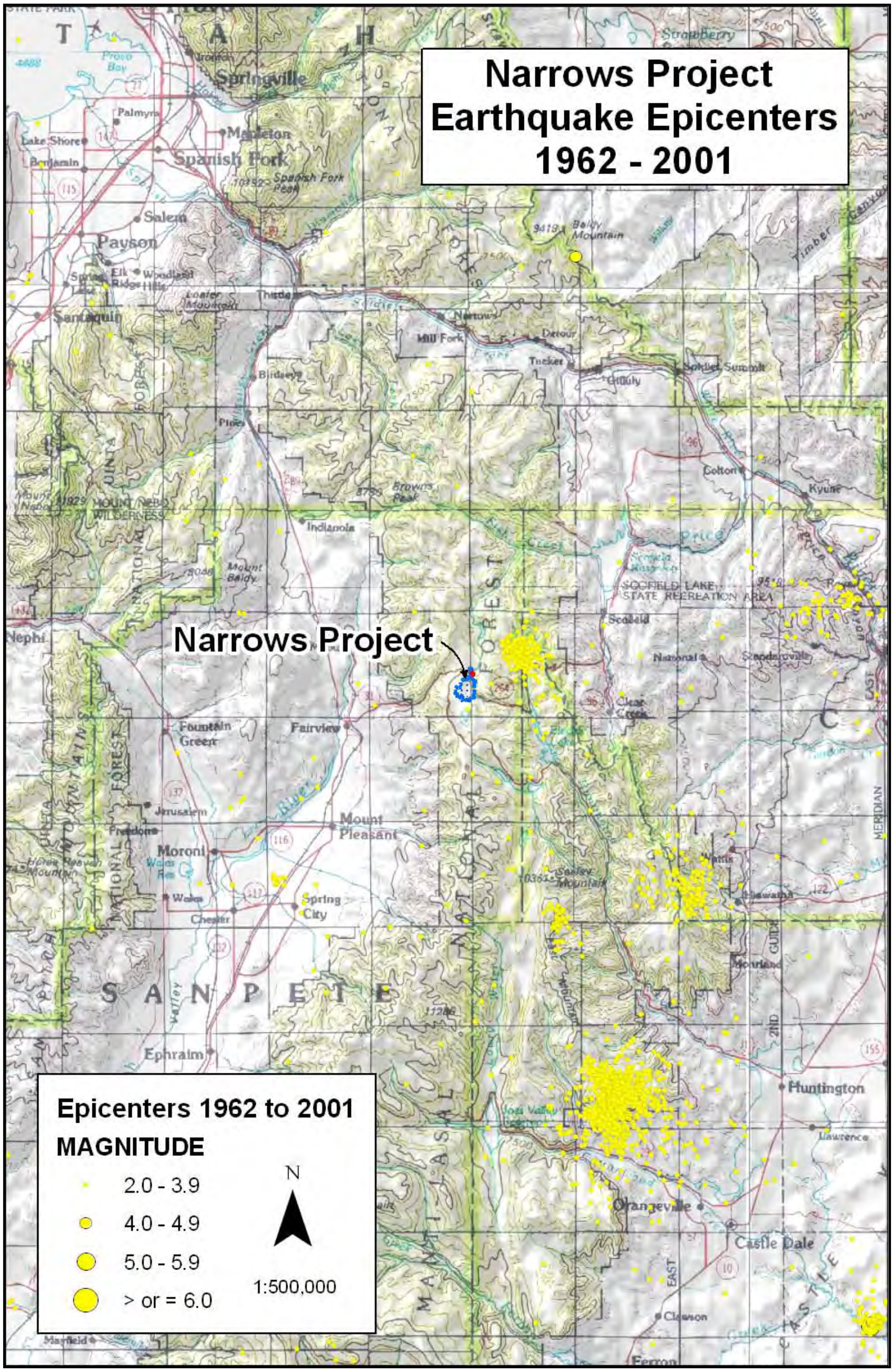


Figure 3-9.—Narrows Project Earthquake Epicenters Location Map.

reservoir rim to evaluate their engineering properties to ensure adequate design of features associated with the dam and reservoir. Designs would incorporate maximum accelerations associated with natural and or manmade seismic events that are determined or probable that could potentially occur in the area. Mitigation for other potential geologic hazards also would be integrated into design.

During construction, detailed observations of the subsurface conditions would be monitored by qualified personnel.

There would be no residual geology or seismicity impacts under the Proposed Action. There would be no geology or seismicity mitigation measures under the Proposed Action.

3.6.3.3 Mid-Sized Reservoir Alternative

As described for the Proposed Action, no significant geologic hazards were found in the embankment or reservoir area; and no seismic activity would be expected to occur from, or be induced by, this alternative. Design of project facilities would be based on a MCE.

Detailed observations of the subsurface conditions would be monitored by qualified personnel during construction.

There would be no residual geology or seismicity impacts measures under the Mid-Sized Reservoir Alternative. There would be no geology or seismicity mitigation measures under the Mid-Sized Reservoir Alternative.

3.6.3.4 Small Reservoir Alternative

As described for the Proposed Action, no significant geologic hazards were found in the embankment or reservoir area; and no seismic activity would be expected to occur from, or be induced by, this alternative. Design of project facilities would be based on a MCE.

Detailed observations of the subsurface conditions would be monitored by qualified personnel during construction.

There would be no residual geology or seismicity impacts measures under the Small Reservoir Alternative. There would be no geology or seismicity mitigation measures under the Small Reservoir Alternative.

3.7 Paleontological Resources

Paleontological resources are defined as any fossilized remains, traces, or imprints of organisms, preserved in or on the earth's crust, that are of paleontological interest and that provide information about the history of life on earth. Section 6302 of the Paleontological Resources Preservation Act (PRPA) of 2009 (Sections 6301–6312 of the Omnibus Land Management Act of 2009 [Public Law 111-11 123 Stat. 991-1456]) requires the Secretary of the Interior to manage and protect paleontological resources on Federal land using scientific principles and expertise.

3.7.1 Affected Environment

The affected environment for paleontological resources is represented by the same APE that corresponds to cultural resources as described in section 3.16.1 (Cultural Resources, Affected Environment).

3.7.2 Methodology

Reclamation will be responsible for ensuring the completion of paleontological resource compliance, as stated in the environmental commitments (see appendix G), as a means to fulfill the requirements of the PRPA. The commitment requires a paleontological literature search through the Utah Geological Survey (UGS). This process involves a search of the statewide paleontological resource locality database as well as an examination of geologic maps of the APE and its immediate vicinity. Through the literature search process, the UGS will determine the potential for discovering paleontological resources as a result of the Proposed Action. Based on the determined potential, the UGS will either make a determination of no effect or require that a paleontological survey be conducted.

3.7.3 Predicted Effects

Predicted effects to paleontological resources as a result of the Proposed Action will be definitively determined following the paleontological literature search and survey of the APE and its immediate vicinity.

3.7.3.1 No Action Alternative

Under the No Action Alternative, there likely would be no effects to paleontological resources. There would be no need for ground-disturbing activities associated with the Proposed Action. The existing conditions would remain intact and would not be affected.

3.7.3.2 Proposed Action Alternative

Under the Proposed Action, there would be ground disturbing activities associated with the Proposed Action. These activities have the potential to effect subsurface fossil material.

3.7.3.3 Mid-Sized Reservoir Alternative

Paleontological resource effects under this alternative would be the same as those described above in the Proposed Action.

3.7.3.4 Small Reservoir Alternative

Paleontological resource effects under this alternative would be the same as those described above in the Proposed Action.

3.8 SOIL RESOURCES

3.8.1 Affected Environment

Soils in the project service area and along the Oak Creek and East Bench Pipelines alignments have developed under semiarid conditions. They are highly calcareous, are high in inherent plant nutrients, have weak to moderate developed soil profiles, and have a wide range of soil textures. They are derived principally from both old and recent alluvial materials eroded from geologic materials of the Wasatch Plateau. The lands are found on benches and terraces formed by the coalesced alluvial fans of the stream's tributary to the San Pitch River. A broad area of valley fill material of deeper soils is found west of Mount Pleasant and in small cove areas at the base of the large alluvial fans. Valley fill also is found in the flat valley or river bottom areas west and southwest of Moroni.

Soils within the vicinity of the proposed Narrows Reservoir are formed mostly in colluvial, alluvial, and residuum materials weathered from sedimentary rocks, limestone, sandstone, and shale. Soils on the high ridges along the west side of the area are formed in materials derived primarily from limestone, while soils in the central and eastern sections of the project area are formed in materials dominated by sandstone, (silty) shale, and some limestone.

Soils are dark colored, rich in bases, freely drained, and cold. Mean annual soil temperature is less than 47 °F, and the mean summer soil temperature is less than 59 °F. Average annual precipitation ranges from 20–25 inches, and the growing season is approximately 90–100 days. All but two of the soil series described are in the Cryoboroll Great Group, Boroll Suborder, and Mollisol Order of soil classification. The two exceptions, Fairview and Gooseberry series, are classified as being in the Cryaquoll Great Group, Aquoll Suborder, and Mollisol Order.

The erosion hazard for the soils within the vicinity of the proposed reservoir ranges from severe to low, with over 80% of the area being classified as having a moderate or low erosion potential. Precipitation runoff rates range from rapid to slow, with most of the area having a moderate to slow runoff rate. Average sediment yields in the vicinity of the proposed reservoir are estimated to be 73 tons per square mile per year. With a drainage area of about 5.5 square miles, there is an estimated sediment load of 400 tons per year at the proposed damsite. This drainage area excludes the area that drains into Fairview Lakes.

3.8.2 Methodology and Impact Indicators

Project effects on soils resources were determined by determining the number of acres of soils that would be disturbed by construction activities or project operation and by the amount of sediment entering Gooseberry Creek. These two items serve as impact indicators.

3.8.3 Predicted Effects

3.8.3.1 No Action Alternative

Under this alternative, soil erosion would continue at historical rates, with about 73 tons per square mile per year of sediment entering Gooseberry Creek. This would continue to generate a sediment load of about 400 tons per year at the proposed damsite. Soil disturbance due to construction would not occur, and soils within the study area would not be inundated.

3.8.3.2 Proposed Action Alternative

Under the Proposed Action, about 604 acres of land would be inundated by Narrows Reservoir. An additional 32.4 acres would be disturbed by construction of SR-264 relocation and recreation area. Development of a rockfill material source area outside of the reservoir basin would disturb another 2.0 acres. Earthfill material source areas would be developed within the reservoir basin, and contractor staging areas and tunnel spoil areas also would be located below the low water level of the reservoir basin.

The alignment of the proposed highway relocation crosses relatively gentle terrain, and cut and fill slopes would be minimal. All cut and fill slopes would be revegetated to minimize erosion. Roadways in the recreation area would be paved to minimize dust and soil erosion. Following construction, the rockfill material source area would be recontoured, topsoil would be replaced, and the area would be revegetated. Virtually all runoff from disturbed areas would flow into Narrows Reservoir that would act as a trap for all upstream sediment. The current sediment load in Gooseberry Creek downstream from the proposed Narrows Reservoir would be reduced by about 400 tons per year with construction of the Proposed Action. This sediment would accumulate in the reservoir.

The Upper Cottonwood Creek Pipeline would be constructed in a previously disturbed area along the shoulder of SR-31. Construction of the Oak Creek and East Bench Pipelines would disturb about 30 acres. As part of the construction process, the ground would be recontoured and revegetated with native plants to minimize erosion and to restore the natural appearance.

Mitigation for disturbances to soils under the Proposed Action would be accomplished by revegetating all cut and fill slopes to minimize erosion. Roadways in the recreation area would be paved to minimize dust and soil erosion. Following construction, the rockfill material source area would be recontoured, topsoil would be replaced, and the area would be revegetated.

Residual impacts to soils under the Proposed Action would include inundating 604 acres by Narrows Reservoir and the 32.4 acres that would be covered by relocating SR-264.

3.8.3.3 Mid-Sized Reservoir Alternative

Under the Mid-Sized Reservoir Alternative, about 489 acres of land would be inundated by Narrows Reservoir. The reservoir would reduce the sediment load to Gooseberry Creek by about 400 tons per year. Other impacts such as those caused by SR-264 relocation, pipeline construction, and development of material source areas would be the same as under the Proposed Action.

Mitigation for disturbances to soils under the Mid-Sized Reservoir Alternative would be similar to that proposed under the Proposed Action.

Residual impacts to soils under the Mid-Sized Reservoir Alternative would include inundating 489 acres by Narrows Reservoir and the 32.4 acres that would be covered by relocating SR-264.

3.8.3.4 Small Reservoir Alternative

Under the Small Reservoir Alternative, about 362 acres of land would be inundated by Narrows Reservoir. The reservoir would reduce the sediment load to Gooseberry Creek by about 400 tons per year. Other impacts such as those caused by SR-264 relocation, pipeline construction, and development of material source areas would be the same as under the Proposed Action.

Mitigation for disturbances to soils under the Small Reservoir Alternative would be similar to that proposed under the Proposed Action.

Residual impacts to soils under the Small Reservoir Alternative would include inundating 362 acres by Narrows Reservoir and the 32.4 acres that would be covered by relocating SR-264.

3.9 TRACE ELEMENTS

3.9.1 Affected Environment

A trace element survey was conducted in accordance with current Reclamation practices to identify where concentrations of potentially toxic elements such as selenium, arsenic, and mercury likely would be to occur in irrigation return flows under project conditions. Accumulations of these substances can be harmful to humans and wildlife. A total of 11 soil samples, collected in 1990, were analyzed by the USGS. The results are shown in table 3-8 for arsenic, mercury, and selenium from three representative sites in the project area.

Study results indicate that all three elements analyzed are present in low to moderate concentrations; therefore, further testing for these elements was not considered necessary.

Data also were gathered from the National Geochemical Database that contained extensive information on soils in the vicinity of the survey area. Most of the data was from the National Uranium Resource Evaluation Surveys conducted from 1976–80. The primary objective of these surveys was to prospect for uranium; however, many other trace elements also were analyzed in the survey. Located in the vicinity of the survey area were 59 soil sampling sites from this. Almost all sites were in Quaternary alluvium.

Table 3-8.—Narrows Project Trace Elements Data Summary Total Concentrations in Soil

Site and Sample Number	Arsenic (ppm)[1]	Mercury (ppm)	Selenium (ppm)
Upper Alluvial Fans Shallow Phase			
1	6.4	0.02	0.2
2	7.6	N0.02	0.2
Alluvial Fans Moderate to Deep Phase			
3	6.2	0.02	0.2
4	6.3	0.02	0.2
5	5.3	N0.02	0.2
6	4.9	N0.02	0.1
Valley Fill Deep Phase			
7	4.0	N0.02	0.2
8	3.7	0.02	0.2
9	4.5	N0.02	0.2
10	5.0	N0.02	<0.1
11	5.6	N0.02	<0.1
Geometric Mean Concentration of 733 Western Soils[2]	5.5	0.046	0.23
Common Range in Western Soils[3]	1.2–22.0	0.0085–0.25	0.039–1.4

[1] ppm = parts per million.

[2] Shacklette and Boerngen, USGS Paper 1270, 1984.

[3] Values chosen to represent an expected 95% range (Tidball and Ebens, 1976).

The data indicate that most trace elements are present in concentrations within the common range for western soils. Cobalt was the only element consistently present in concentrations outside the common range; however, the levels observed were trace amounts. Cobalt in nature at the levels observed in the National Uranium Resource Evaluation Survey for the area is considered a nutrient and nonhazardous. Limited water analysis data indicate cobalt was not detected in the San Pitch River.

Table 3-9 summarizes the number of soil samples with noteworthy concentrations of trace elements. Although these elements were found at elevated concentrations at scattered sites, it appears that none of the elements are present in concentrations of concern in the existing project return flows.

Table 3-9.—Sanpete Valley Soil Samples with Uncommonly High Trace Element Concentrations

Element	Number of Samples	Number at Uncommonly High Concentration
Silver	59	[1]20
Molybdenum	59	[2]23
Uranium	59	[2]6
Selenium	59	[2]5

[1] Used 1,000 parts per billion as threshold value.

[2] Exceeds the expected 95% range (Tidball and Ebens, 1976).

The data presented in table 3-10 indicate that trace elements are present in low concentrations in ground water in or near the proposed Narrows Project. A review of the STORET data for the San Pitch River indicated low concentrations of the same trace elements present in the surface water in the Narrows Unit.

The data presented in table 3-11, from the EPA STORET database, indicate that water quality of the San Pitch River in the project area is generally acceptable. The San Pitch River shows some improvement in water quality through the project area, possibly due to high quality inflows from the Manti-La Sal drainage.

Data gathered from the National Geochemical Database have been used as a baseline for concentrations of select trace elements in the soils and ground water within the project area. The impact indicator for this issue is measured by the increase in levels of select trace elements in ground water due to the construction and operation of the Narrows Project.

3.9.2 Methodology and Impact Indicators

Data gathered from the National Geochemical Database have been used as a baseline for concentrations of select trace elements in the soils and ground water within the project area. The impact indicator for this issue is measured by the increase in levels of select trace elements in ground water due to the construction and operation of the Narrows Project.

3.9.3 Predicted Effects

3.9.3.1 No Action Alternative

An increase of potentially toxic trace elements is not expected under the No Action Alternative.

3.9.3.2 Proposed Action Alternative

Lands in the project area have been irrigated for more than 50 years, and the results of the data gathered showed no significant quantities of trace or toxic elements in the ground water and in the San Pitch River; therefore, no increase of potentially toxic trace elements is anticipated under project conditions. There would be no residual impacts associated with potentially toxic trace elements under the Proposed Action.

3.9.3.3 Mid-Sized Reservoir Alternative

No increase of potentially toxic trace elements is anticipated under implementation of the Mid-Sized Reservoir Alternative. There would be no residual impacts associated with potentially toxic trace elements under the Mid-Sized Reservoir Alternative.

3.9.3.4 Small Reservoir Alternative

No increase of potentially toxic trace elements is anticipated under implementation of the Small Reservoir Alternative. There would be no residual impacts associated with potentially toxic trace elements under the Small Reservoir Alternative.

3.10 FISHERIES

3.10.1 Affected Environment

Most of the Narrows Project alternatives have the potential to affect aquatic resources in Gooseberry Creek, Fish Creek, three unnamed headwater tributaries to Gooseberry Creek, Cottonwood Creek, Lower Gooseberry Reservoir, Fairview Lakes, and Scofield Reservoir (see the location map). Cottonwood Creek is in the San Pitch River Basin, whereas all of the others are in the Price River drainage. Cottonwood Creek flows into the San Pitch River downstream

Table 3-10.—Comparison of Ground Water in the Narrows Project with Selected Standards

	EPA Standards (micrograms per liter [µg/L])			Ground Water Concentrations (µg/L)		
Element	**Drinking Water**[1]	**Aquatic Life**[2]	**Irrigation Water**[3]	**Number of Samples**	**Range**	**Mean**
Aluminum		87	5,000			
Arsenic	50	190	100	2	1-2	1.5
Barium	1,000			2	80-100	90
Beryllium		5.3	100			
Boron			750	23	20-450	112
Cadmium	10	1.1	10	2	<1	<1
Chromium	50	210	100	2	<5	<5
Hex. Cr.		11				
Cobalt			50			
Copper	1,000	12	200	2	<20-29	24.5
Cyanide	200	5.2				
DBCP	1					
Fluoride	1,400-2,400			28	<100-2,700	382
Iron			5,000	12	3-190	27.6
Lead	50	3.2	5,000	2	<5	<5
Lithium			75	2	<10-20	15
Manganese	50		200	2	<5-41	23
Mercury	2	0.012		2	<.0.5	<0.5
Molybdenum			10			
Nickel		96	200			
Nitrate	45,000			37	0-43,000	12,100
Selenium	10	5	20	9	<1-5	2
Silver	50	0.12		2	<2	<2
Strontium				2	460-1,800	1,130
Uranium[5]	20	[4]300		12	1.1-23.6	5.3
Vanadium			100			
Zinc	5,000	47	2,000	2	<20	<20

[1] Primary or secondary standards.
[2] Freshwater criteria.
[3] Adapted from *Water Quality Criteria for Agriculture*, 1972.
[4] Canadian criteria.
[5] Data from National Geochemical Database.

Table 3-11.—Water Quality Data for the San Pitch River[1]

STORET Station Location	EC at 25 °C	SAR	Soluble Cations, (meq/L)				Soluble Anions (meq/L)				Toxic Elements, (µg/L)			
			Ca	Mg	Na	K	CO_3	HCO_3	SO_4	Cl	Arsenic	Boron	Mercury	Selenium
Above Narrows Project														
San Pitch River 1 mile west of Milburn	1,300.8	.025	11.41	4.36	0.70	0.10	0.03	5.36	10.93	0.24	1.70	121	0.06	0.38
Cottonwood Creek 1.5 miles east of Fairview	459.0	.019	2.63	1.80	0.29	0.04	0.00	4.38	0.58	0.09	0.93	89	0.05	0.40
Fountain Green Hatchery - east outflow	426.0	1.00	1.70	1.48	1.26	0.03	0.00	4.36	0.10	0.14	1.00	50	0.10	1.00
Fountain Green Hatchery - west outflow	431.9	0.28	2.30	1.48	0.39	0.03	0.00	4.30	0.16	0.11	1.00	50	0.10	1.00
Within Narrows Project														
San Pitch River above Moroni Wastewater Treatment Plant outfall	791.8	0.64	3.06	4.50	1.25	0.09	0.01	6.76	1.41	0.81	2.47	75	0.14	0.97
San Pitch River 2.5 miles west of Mt. Pleasant	771.4	0.56	3.33	4.23	1.09	0.08	0.00	6.72	1.47	0.54	3.09	155	0.14	1.32
Just below Narrows Project														
San Pitch River 1 mile west of Chester	1,111.0	1.07	3.55	5.08	2.22	0.21	0.08	7.02	2.09	1.34	3.42	220	0.00	0.45
Below Narrows Project														
San Pitch River northwest of Manti	1,272.0	2.28	4.28	8.31	5.71	0.13	0.00	8.12	6.15	2.20	5.00	260	0.07	1.00
San Pitch River below Gunnison Reservoir	1,630.8	2.46	2.61	10.26	6.23	0.14	0.28	9.26	6.17	3.86	6.00	No data	0.10	1.00
San Pitch River at U-137 crossing	2,591.3	6.78	4.26	6.85	15.99	0.14	0.07	6.87	5.73	11.59	5.54	349	0.15	1.07

[1] **°C = degrees Celsius; SAR = specific absorption rate; meq/L = milliquivalent per liter.**

from Fairview, Utah; but the San Pitch River, within the project area, does not support a sport fishery because of low summer flows.

Flows in Gooseberry Creek, its unnamed tributaries, and Cottonwood Creek presently are affected by the operation of Fairview Lakes that store water during spring runoff. Water from the lakes is delivered during the irrigation season via one of the unnamed tributary streams and a canal to the Narrows Tunnel that discharges into Cottonwood Creek. The released water then is diverted for irrigation in Sanpete County.

Lower Gooseberry Creek and Fish Creek, downstream from the confluence with Gooseberry Creek, also are affected by the operation and limited regulation offered by Fairview Lakes. If the project is approved, an operating agreement would have to be negotiated between SWCD and CGIC to regulate seasonal releases from Fairview Lakes in connection with downstream discharges from Narrows Reservoir.

Cutthroat trout (*Oncorhynchus clarkii*) exist within the streams potentially affected by the proposed project. Identification of these populations to the subspecies level is problematic. It is clear that various non-native subspecies of cutthroat trout as well as rainbow trout (*Oncorhynchus mykiss*), which interbreed with cutthroat trout, have been transplanted and stocked in these drainages in the past. Also, fish eradication activities have been carried out in the past. No genetic analysis has been attempted to determine the level of hybridization found in the current fish assemblages. Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*are) are endemic to Gooseberry Creek. Bonneville cutthroat trout (*Oncorhynchus clarki utah*) are endemic to Cottonwood Creek.

Cutthroat trout within the Gooseberry Drainage are predominantly Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*). The Bear Lake strain of Bonneville cutthroat trout (*Oncorhynchus clarki utah*) also have been transplanted into Schofield Reservoir. These fish spawn in Fish Creek and Gooseberry Creek and likely have hybridized with other subspecies present. Both Yellowstone and Bear Lake cutthroat trout are not native to these drainages.

Upper Cottonwood Creek does not support a self-sustaining trout population. Lower Cottonwood Creek may contain endemic Bonneville cutthroat trout; however, genetic analysis to determine the degree of hybridization within this population has not been done.

The existing Lower Gooseberry Reservoir acts as a fish barrier that helps to limit the occurrence of transbasin cross breeding between the populations.

Diseases may be spread between the basins within the project area. Currently, these drainages are not known to be infected with whirling disease.

The transbasin diversion has been functioning for decades, and any diseases or fish species present could have crossed the divide between the drainages in either direction numerous times in the past. The proposed project likely would not increase the occurrence of these events and may act as a barrier to these events.

Aquatic resources vary considerably between the different reservoirs and stream segments that could be affected by the Narrows Project. Fish habitat study reaches are shown in figure 3-10. A summary of aquatic resources present in the different stream segments and reservoirs is provided in the following sections of this document.

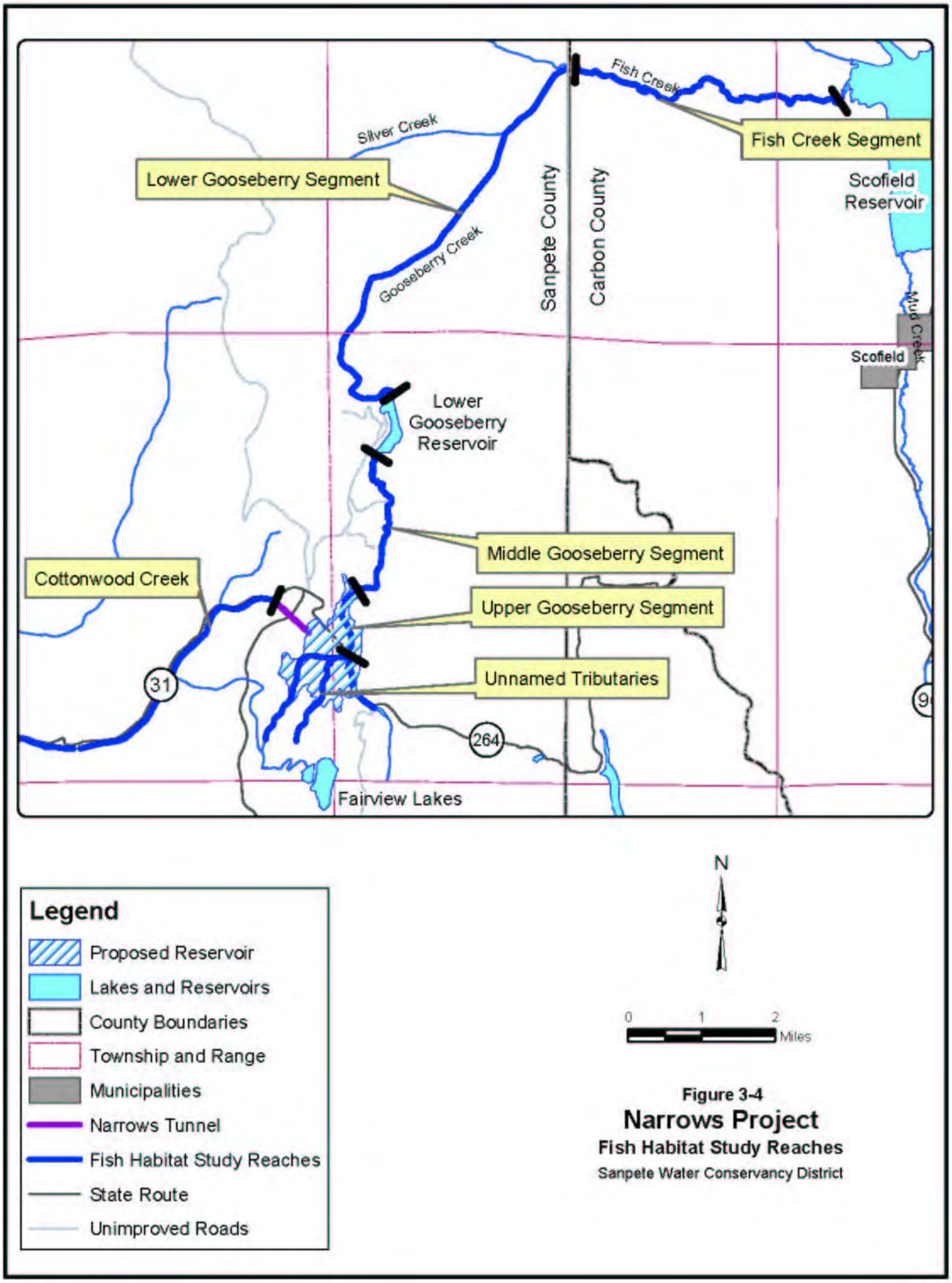


Figure 3-10.— Narrows Project Fish Habitat Study Reaches.

3.10.1.1 Gooseberry Creek (UDWR Class 3B – Unique)

Class 3 streams support the bulk of the stream fishing in Utah. Gooseberry Creek provides important spawning, nursery, and unique habitat for cutthroat trout (*Oncorhynchus clarkii*). The entire length of Gooseberry Creek has the potential to be affected either by reservoir inundation or by flow alterations. Gooseberry Creek is a tributary to Scofield Reservoir. Other fish populations found in creeks tributary to Scofield Reservoir include rainbow trout (*Oncorhynchus mykiss*), tiger trout (*Salmo trutta X Salvelinus fontinalis*), redside shiner (*Richardsonius balteatus*), Utah chub (*Gila atraria*), and mountain sucker (*Catostomus platyrhynchus*). For ease of discussion, the stream has been divided conceptually into three segments—Upper Gooseberry Creek, Middle Gooseberry Creek, and Lower Gooseberry Creek.

The Upper Gooseberry Creek segment extends from the confluence of the three unnamed tributaries near SR-264 downstream 1 mile to Narrows Gorge and averages approximately 11 feet in width. Average monthly flows for average, wet, and dry years are shown in table 3-1. This stream segment supports a natural reproducing cutthroat trout population. The population is comprised of adult, juvenile, and young-of-year (YOY) fish. The standing crop of cutthroat trout in this stream segment averages about 38 pounds per acre. This stream segment contains numerous riffle areas that provide cutthroat trout spawning habitat. The value of this stream segment in providing yearling habitat is shown in population estimates of over 450 fish per mile (most were YOY) since 1971. The amount of weighted usable area (WUA)[1] for the various cutthroat trout life stages in this stream segment is shown in table 3-12.

Table 3-12.—WUA for Cutthroat Life Stages in Upper Gooseberry Creek with Existing Flows

Month	Life Stage	Average Weighted Usable Area (1,000 units)
January	Adult	8.4
	Juvenile	1.9
February	Adult	8.4
	Juvenile	1.9
March	Adult	8.7
	Juvenile	1.9
April	Adult	11.3
	Juvenile	3.3
May	Adult	11.7
	Juvenile	2.7
	Spawning	0.0
June	Adult	10.7
	Juvenile	2.5
	Spawning	0.0
July	Adult	13.2
	Juvenile	3.5
	Spawning	1.5
August	Adult	12.2
	Juvenile	3.7
	Spawning	1.3
	Fry	4.7
September	Adult	11.1
	Juvenile	3.0
	Fry	4.8
October	Adult	10.2
	Juvenile	2.0
November	Adult	8.9
	Juvenile	2.0
December	Adult	8.7
	Juvenile	1.9

As shown, this stream segment provides only extremely limited overwinter habitat for adult cutthroat trout. Major factors contributing to the poor habitat include low winter flows and limited pool habitat.

The Middle Gooseberry Creek segment is 3.0 miles in length and extends from the Narrows Gorge downstream to Lower Gooseberry Reservoir. The Middle Gooseberry Creek segment has more flow than the upper segment because of inflow from numerous springs and seeps within and

[1] The impact indicator used to determine effects on stream fisheries.

immediately downstream from Narrows Gorge. In addition, this stream segment receives flow from several tributary streams, including Brooks and Charlie Creeks. Average monthly flows that presently occur at the upper end of this stream segment are shown in table 3-1. This stream segment also supports a self-reproducing population of cutthroat trout.

Aquatic habitat studies have been conducted on this stream segment, and the total amount of WUA for the segment is provided in table 3-13. As shown, the amount of adult and juvenile cutthroat trout habitat available in this stream segment during September–March is extremely limited.

The Lower Gooseberry Creek segment is the longest of the three segments and extends downstream 7.1 miles from Lower Gooseberry Reservoir to the confluence with Fish Creek. Vehicle access to this segment is limited to two or three locations. As shown in table 3-2, flow in this segment is approximately double the flow of the upper and middle segment. The total WUA for cutthroat and rainbow trout for the segment is provided in tables 3-13 and 3-14, respectively. As shown, spawning habitat for cutthroat trout currently is limited in this stream segment. Although the amount of spawning habitat appears to be low, it is not a limiting factor since YOY cutthroat trout have been plentiful whenever UDWR sampled the fish population. The amount of adult and juvenile cutthroat trout habitat is less during September–March than the amount of habitat available during April–August. Past fish population studies conducted by UDWR indicate that the cutthroat trout standing crop normally ranges from 40–50 pounds per acre and that the stream segment supports a fair cutthroat population. Since 1971, cutthroat trout numbers have ranged from about 400–750 fish per mile. Sampling prior to 1991 did not indicate the presence of rainbow trout; however, sampling of the stream prior to eradicating undesirable fish species in Scofield Reservoir resulted in the collection of adult and juvenile rainbow trout.

3.10.1.2 Fish Creek (UDWR Class 2 - Unique)

Class 2 waters are of great importance to the State fishery. These are productive streams with high aesthetic value and, according to UDWR policy, should be preserved. This segment of Fish Creek extends 6 miles from the confluence of Gooseberry Creek downstream to Scofield Reservoir. In addition to being a self-reproducing cutthroat trout population, this stream segment also is used as a spawning and rearing area by rainbow trout that migrate upstream of Scofield Reservoir (a limited number of adult rainbow trout remain in the stream). Therefore, this stream segment provides habitat for adult, juvenile, spawning, and fry life stages of both cutthroat trout and rainbow trout.

As shown in table 3-1, flow in this segment of Fish Creek is considerably greater than the flow of Gooseberry Creek. The amount of rainbow and cutthroat trout WUA in the segment is provided in tables 3-15 and 3-16, respectively. As shown in table 3-16, the existing flow regime provides only limited spawning habitat for cutthroat trout during 2 of the 4 months that spawning habitat is used. Population data indicate fair numbers of all cutthroat trout life stages in this segment of Fish Creek.

As shown in table 3-15, this segment of Fish Creek also supplies a desirable habitat for rainbow trout. The amount of habitat for juvenile fish remains fairly uniform, with the lowest amount of habitat available during the low flow months (October–March). Fish population surveys have shown a wide range in standing crop estimates (3.5–105.7 pounds per acre); and overall, the estimates have averaged almost

Table 3-13.—Monthly Preproject and Postproject Cutthroat Trout Habitat In Middle and Lower Gooseberry Creek During Average Water Year[1]

Month	Life Stage	Middle Gooseberry Creek			Lower Gooseberry Creek		
		Preproject	Postproject	Change (%)	Preproject	Postproject	Change (%)
January	Adult	62.9	57.6	8.4	355.4	344.7	-3.0
	Juvenile	18.0	16.7	7.2	61.6	60.9	-1.1
February	Adult	62.9	57.6	-8.4	359.0	348.5	-2.9
	Juvenile	18.0	16.7	-7.2	63.0	61.1	-3.0
March	Adult	64.7	57.6	-11.0	359.0	344.7	-4.0
	Juvenile	18.3	16.7	-8.7	62.6	60.9	-2.7
April	Adult	106.2	57.6	-45.8	404.9	393.1	-2.9
	Juvenile	30.1	16.7	-44.5	73.2	68.7	-6.1
May	Adult	205.8	57.6	-72.0	562.1	548.3	-2.5
	Juvenile	91.0	16.7	-81.6	75.0	56.0	-25.3
	Spawning	1.5	0.1	-93.3	0.0	0.0	-
June	Adult	202.6	57.6	-71.6	553.2	548.1	-0.9
	Juvenile	88.7	16.7	-81.2	79.6	56.1	-29.5
	Spawning	0.4	0.1	-75.0	0.0	0.0	-
July	Adult	144.4	57.6	-60.1	430.6	405.3	-5.9
	Juvenile	42.7	16.7	-60.9	71.3	73.4	+2.9
	Spawning	0.9	0.1	-88.9	0.0	0.0	-
August	Adult	127.4	57.6	-54.8	413.9	398.7	-3.7
	Juvenile	36.6	16.7	-54.4	73.0	70.4	-3.6
	Spawning	2.8	0.1	-96.4	0.0	0.0	-
	Fry	57.3	28.1	-51.0	65.3	73.1	+11.9
September	Adult	100.2	57.6	-42.5	397.3	355.4	-10.5
	Juvenile	28.4	16.7	-41.2	69.8	61.6	-11.7
	Fry	44.5	28.1	-36.9	73.6	67.1	-8.8
October	Adult	75.4	57.6	-23.6	362.2	327.4	-9.6
	Juvenile	20.9	16.7	-20.1	63.2	58.0	-8.2
November	Adult	66.4	57.6	-13.3	341.5	323.9	-5.2
	Juvenile	18.8	16.7	-11.2	60.0	57.5	-4.2
December	Adult	64.7	57.6	-11.0	348.5	330.9	-5.1
	Juvenile	18.3	16.7	-8.7	61.1	58.5	-4.3

[1] The amount of WUA is expressed in 1,000 units. Average water year is defined as 1968 flows.

Table 3-14.—Monthly Preproject and Postproject Rainbow Trout Habitat in Lower Gooseberry Creek During Average Water Year[1]

Month	Life Stage	Preproject	Postproject	Change (%)
January	Adult	44.1	43.2	-2.0
	Juvenile	21.0	21.0	0.0
February	Adult	44.5	43.5	-2.2
	Juvenile	21.1	21.0	-0.5
March	Adult	44.5	43.2	-2.9
	Juvenile	21.1	21.0	-0.5
April	Adult	65.6	50.0	-23.8
	Juvenile	29.4	22.3	-24.1
May	Adult	142.1	133.0	-6.4
	Juvenile	49.7	51.9	+4.4
	Spawning	0.0	0.0	-
June	Adult	141.9	132.9	-6.3
	Juvenile	47.8	51.9	+8.6
	Spawning	0.3	0.0	-100.0
July	Adult	87.0	66.3	-23.8
	Juvenile	35.1	29.7	-15.4
	Spawning	0.0	0.0	-
August	Adult	79.4	56.3	-29.1
	Juvenile	35.3	25.2	-28.6
	Spawning	0.1	0.0	-100.0
	Fry	62.6	51.8	-17.3
September	Adult	54.4	44.2	-18.8
	Juvenile	24.3	21.0	-13.6
	Fry	49.7	48.8	-1.8
October	Adult	44.8	41.7	-6.9
	Juvenile	21.1	20.9	-0.9
November	Adult	42.9	41.4	-3.5
	Juvenile	21.0	20.9	-0.5
December	Adult	43.5	42.0	-3.4
	Juvenile	21.0	20.9	-0.5

[1] The amount of WUA is expressed in 1,000 units.

Table 3-15.—Monthly Preproject and Postproject Rainbow Trout Habitat in Fish Creek During Average Water Year[1]

Month	Life Stage	Preproject	Postproject	Change (%)
January	Juvenile	170.7	171.0	+0.2
February	Juvenile	173.1	171.5	-0.9
March	Juvenile	187.2	185.0	-1.1
April	Juvenile	203.1	198.4	-2.3
May	Juvenile	239.5	239.6	<0.1
	Spawning	45.9	44.9	-2.2
June	Juvenile	240.2	238.8	-0.6
	Spawning	48.4	36.9	-23.8
July	Juvenile	224.0	219.5	-2.0
	Spawning	23.6	18.2	-22.9
August	Juvenile	202.6	197.9	-2.3
	Spawning	11.0	8.2	-25.5
	Fry	226.4	223.1	-1.5
September	Juvenile	183.7	179.0	-2.6
	Fry	219.0	214.9	-1.9
October	Juvenile	172.7	170.5	-1.3
November	Juvenile	171.1	170.8	-0.2
December	Juvenile	171.0	171.6	+0.4

[1] The amount of WUA is expressed in 1,000 units. Average water year is defined as 1968 flows.

Table 3-16.—Monthly Preproject and Postproject Yellowstone Cutthroat Trout Habitat in Fish Creek During Average Water Year[1]

Month	Life Stage	Preproject	Postproject	Change (%)
January	Adult	362.7	363.0	+0.1
	Juvenile	85.3	85.5	+0.2
February	Adult	370.4	365.7	-1.3
	Juvenile	85.8	85.3	-0.6
March	Adult	414.2	406.6	-1.8
	Juvenile	88.3	88.3	0.0
April	Adult	476.9	456.1	-4.4
	Juvenile	87.5	87.8	+0.3
May	Adult	666.4	694.6	+4.2
	Juvenile	226.7	235.4	+3.8
	Spawning	0.8	6.0	+650.0
June	Adult	680.8	714.1	+5.0
	Juvenile	231.2	229.4	-0.7
	Spawning	1.7	21.8	+1,182.4
July	Adult	603.4	575.2	-4.7
	Juvenile	91.3	88.3	-3.3
	Spawning	39.8	27.3	-31.4
August	Adult	489.6	454.1	-7.3
	Juvenile	87.4	87.8	+0.5
	Spawning	17.8	14.2	-20.2
	Fry	88.6	84.2	-5.0
September	Adult	415.2	387.8	-6.6
	Juvenile	88.2	87.6	-0.7
	Fry	82.2	81.3	-1.1
October	Adult	369.2	362.5	-1.8
	Juvenile	86.0	85.2	-0.9
November	Adult	364.5	362.8	-0.5
	Juvenile	82.1	85.3	+3.9
December	Adult	363.1	363.9	+0.2
	Juvenile	85.5	85.9	+0.5

[1] The amount of WUA is expressed in 1,000 units. Average water year is defined as 1968 flows.

50 pounds of trout per acre. This level of fish biomass indicates that this segment of Fish Creek supports a good trout population. Fish population surveys conducted over 35 years have reported as few as 40 to as many as 4,000 fish per mile. Movement of spawners into the stream from Scofield Reservoir contributes to large increases in numbers and biomass in this stream segment.

3.10.1.3 Gooseberry Creek Tributaries

Three headwater tributaries join to form Gooseberry Creek. Together, these three tributaries contain 7.5 stream miles. The three streams average approximately 4 feet in width. During late summer and early fall flow, major portions of the streams have little or no flow. The flowing reaches are used extensively by cutthroat trout for spawning and rearing of YOY fish. The standing crop of cutthroat trout in these tributary streams averages approximately 86 pounds per acre. Most of the trout are YOY or yearling fish, and fish numbers have averaged over 300 fish per mile. Even though the streams are small, the standing crop indicates their high value for cutthroat trout spawning and rearing habitat.

3.10.1.4 Cottonwood Creek (UDWR Class 3)

At the present time, Upper Cottonwood Creek does not support a self-sustaining trout population because of low and intermittent flows during much of the year (table 3-2). During the spring runoff and irrigation season, the upper segment contains adequate water for fish, and UDWR maintains a rainbow trout fishery during that period by stocking catchable-size fish. Brown trout (*Salmo trutta*), cutthroat trout, and mottled sculpin (*Cottus bairdii*) also exist in this creek.

As shown in table 3-1, flows in the lower portion of Cottonwood Creek are considerably greater than in the upper segment. Sampling conducted by UDWR in 1988 indicated that the lower segment of Cottonwood Creek supports excellent brown and cutthroat trout populations (approximately 210 pounds per acre). The amount of WUA for rainbow, cutthroat, and brown trout in Cottonwood Creek is provided in tables 3-17 through 3-19, respectively. As indicated in the tables, the amount of spawning habitat for all three species is limited.

3.10.1.5 Lower Gooseberry Reservoir

Lower Gooseberry Reservoir is an old reservoir that was created by placing a rock dam across Gooseberry Creek and is a popular fishing area. In 1990, the USDA Forest Service upgraded the dam to meet appropriate dam safety criteria.

This approximately 57-acre surface area reservoir is managed as a catchable rainbow trout fishery and also supports a resident cutthroat trout population. A creel survey conducted in 1993 determined that, of the trout harvested from the lake, 3% were cutthroat trout and 97% were rainbow trout. During that year, it was estimated that the lake received over 25,000 hours of fishing pressure from which 9,300 trout were harvested. Two gill nets set in the lake in 1991 collected 104 cutthroat trout ranging from approximately 6.5–15.5 inches long.

A large portion (30–40%) of the reservoir has a water depth of less than 3 feet. Areas with shallow water encourage the growth of phytoplankton and aquatic macrophytes, which can contribute to low DO levels. Lower Gooseberry Reservoir has a history of fishkills attributed to low DO concentration. Generally, the reported fishkills have been confined to the lower portion of the reservoir near the dam where water exchange is the least.

Table 3-17.—Monthly Preproject and Postproject Rainbow Trout Habitat in Cottonwood Creek During Average Water Year[1]

Month	Life Stage	Pre Q	Preproject	Post Q	Postproject	Change (%)
January	Adult	0.98	1,832	2.98	2,910	+58.9
	Juvenile	0.98	1,456	2.98	1,928	+32.4
February	Adult	1.12	1,926	3.12	2,960	+53.7
	Juvenile	1.12	1,509	3.12	1,943	+28.7
March	Adult	1.4	2,106	3.4	3,056	+45.1
	Juvenile	1.4	1,609	3.4	1,971	+22.5
April	Adult	2.59	2,728	2.59	2,728	+0.0
	Juvenile	2.59	1,864	2.59	1,864	+0.0
May	Adult	31.56	4,254	31.56	4,254	+0.0
	Juvenile	31.56	2,093	31.56	2,093	+0.0
	Spawning	31.56	204	31.56	204	+0.0
June	Adult	33.59	4,202	33.89	4,195	-0.2
	Juvenile	33.59	2,079	33.89	2,077	-0.1
	Spawning	33.59	206	33.89	206	+0.1
July	Adult	17.57	4,481	48.17	4,158	-7.2
	Juvenile	17.57	2,167	48.17	1,953	-9.9
	Spawning	17.57	180	48.17	210	+16.6
August	Adult	15.12	4,448	45.25	4,141	-6.9
	Juvenile	15.12	2,172	45.25	1,977	-9.0
	Spawning	15.12	171	45.25	209	+21.9
	Fry	15.12	2,822	45.25	2,034	-27.9
September	Adult	2.79	2,821	18.56	4,473	+58.5
	Juvenile	2.79	1,897	18.56	2,164	+14.1
	Fry	2.79	2,915	18.56	2,761	-5.3
October	Adult	0.91	1,774	2.91	2,877	+62.2
	Juvenile	0.91	1,418	2.91	1,916	+35.1
November	Adult	1.12	1,926	3.12	2,960	+53.7
	Juvenile	1.12	1,509	3.12	1,943	+28.7
December	Adult	0.98	1,832	2.98	2,910	+58.9
	Juvenile	0.98	1,456	2.98	1,928	+32.4

[1] WUA (square feet per 1,000 feet). Average water year is defined as 1968 flows.

Table 3-18.—Monthly Preproject and Postproject Cutthroat Trout Habitat in Cottonwood Creek During Average Water Year[1]

Month	Life Stage	Pre Q	Preproject	Post Q	Postproject	Change (%)
January	Adult	0.98	3,053	2.98	4,544	+48.9
	Juvenile	0.98	1,392	2.98	1,504	+8.0
February	Adult	1.12	3,183	3.12	4,627	+45.3
	Juvenile	1.12	1,431	3.12	1,494	+4.4
March	Adult	1.4	3,430	3.4	4,788	+39.6
	Juvenile	1.4	1,496	3.4	1,475	-1.4
April	Adult	2.59	4,289	2.59	4,289	+0.0
	Juvenile	2.59	1,521	2.59	1,521	+0.0
May	Adult	31.56	7,642	31.56	7,642	+0.0
	Juvenile	31.56	1,236	31.56	1,236	+0.0
	Spawning	31.56	218	31.56	218	+0.0
June	Adult	33.59	7,579	33.89	7,570	-0.1
	Juvenile	33.59	1,212	33.89	1,209	-0.3
	Spawning	33.59	198	33.89	195	-1.5
July	Adult	17.57	7,712	48.17	7,219	-6.4
	Juvenile	17.57	1,369	48.17	1,078	-21.2
	Spawning	17.57	364	48.17	133	-63.6
August	Adult	15.12	7,584	45.25	7,276	-4.1
	Juvenile	15.12	1,356	45.25	1,103	-18.7
	Spawning	15.12	393	45.25	144	-63.5
	Fry	15.12	1,827	45.25	1,345	-26.4
September	Adult	2.79	4,420	18.56	7,736	+75.0
	Juvenile	2.79	1,512	18.56	1,368	-9.5
	Fry	2.79	1,817	18.56	1,793	-1.3
October	Adult	0.91	2,965	2.91	4,498	+51.7
	Juvenile	0.91	1,351	2.91	1,507	+11.6
November	Adult	1.12	3,183	3.12	4,627	+45.3
	Juvenile	1.12	1,431	3.12	1,494	+4.4
December	Adult	0.98	3,053	2.98	4,544	+48.9
	Juvenile	0.98	1,392	2.98	1,504	+8.0

[1] WUA (square feet per 1,000 feet). Average water year is defined as 1968 flows.

Table 3-19.—Monthly Preproject and Postproject Brown Trout Habitat in Cottonwood Creek During Average Water Year[1]

Month	Life Stage	Pre Q	Preproject	Post Q	Postproject	Change (%)
January	Adult	0.98	835	2.98	1,448	+73.4
	Juvenile	0.98	1,071	3.0	1,669	+55.8
	Spawning	0.98	22	3.0	97	+349.3
	Fry	0.98	263	3.0	559	+112.5
February	Adult	1.12	899	3.1	1,472	+63.8
	Juvenile	1.12	1,128	3.1	1,700	+50.6
	Fry	1.12	291	3.1	572	+96.6
March	Adult	1.4	1,021	3.4	1,518	+48.6
	Juvenile	1.4	1,238	3.4	1,761	+42.2
	Fry	1.4	345	3.4	597	+73.0
April	Adult	2.59	1,361	2.6	1,361	+0.0
	Juvenile	2.59	1,577	2.6	1,577	+0.0
	Fry	2.59	514	2.6	514	+0.0
May	Adult	31.56	2,324	31.6	2,324	+0.0
	Juvenile	31.56	2,690	31.6	2,690	+0.0
	Spawning	33.59	2,327	33.9	2,328	+0.0
June	Adult	33.59	2,327	33.9	2,328	+0.0
	Juvenile	33.59	2,700	33.9	2,702	+0.1
July	Adult	17.57	2,232	48.2	2,280	+2.1
	Juvenile	17.57	2,576	48.2	2,736	+6.2
August	Adult	15.12	2,179	45.3	2,292	+5.2
	Juvenile	15.12	2,539	45.3	2,736	+7.7
September	Adult	2.79	1,406	18.6	2,248	+59.9
	Juvenile	2.79	1,624	18.6	2,589	+59.4
October	Adult	0.91	795	2.9	1,432	+80.2
	Juvenile	0.91	1,035	2.9	1,652	+59.7
	Spawning	0.91	19	2.9	93	+404.4
November	Adult	31.56	899	3.1	1,472	+63.8
	Juvenile	1.12	1,128	3.1	1,700	+50.6
	Spawning	1.12	12	3.1	89	+635.9
December	Adult	1.12	835	3.0	1,448	+73.4
	Juvenile	0.98	1,071	3.0	1,669	+55.8
	Spawning	0.98	22	3.0	97	+349.3

[1] WUA (square feet per 1,000 feet). Average water year is defined as 1968 flows.

When the USDA Forest Service upgraded the dam, a new outlet structure was constructed so that water could be released from near the bottom of the reservoir. Release of water from near the bottom has improved the DO levels in the lower portions of the reservoir.

3.10.1.6 Fairview Lakes

Fairview Lakes are owned and operated by the Cottonwood-Gooseberry Irrigation Company. The lakes are managed as a catchable rainbow trout put-grow-and-take fishery by UDWR with over 9,000 catchable rainbow trout stocked annually. In 2005, the average rainbow stocked was 11 inches in length and grew 3 inches in 4 months. The stocking usually occurs in early June, and approximately 8,700 of the stocked trout are harvested. Approximately 13,000 hours of fishing pressure occurs annually on Fairview Lakes. Due to the low level of the lakes during the winter period, winter survival of the stocked rainbow trout normally does not occur. Even though Fairview Lakes are located adjacent to the project, they would not be directly affected. However, they could be affected by changes in fisherman usage, changes in UDWR fishery management programs, and possible mitigation measures.

3.10.1.7 Scofield Reservoir

Scofield Reservoir supports a good sport fishery consisting of cutthroat trout (natural reproduction and stocking), rainbow trout (natural reproduction and stocking), and, recently, tiger trout (stocking). Other fish species present in the reservoir include: redside shiner, Utah chub, mountain sucker, brown trout and common carp (*Cyprinus carpio*). Historically, UDWR has stocked up to 600,000 rainbow trout into Scofield Reservoir every year. Stocking quotas typically have included 450,000 rainbow trout fingerlings and 100,000 rainbow trout subcatchables. In the past, Yellowstone and Bear Lake cutthroat trout also were stocked. Hybridization of cutthroat trout with rainbow trout is common. In 2005, tiger trout were stocked for the first time; and beginning in 2008, rainbow trout fingerlings were no longer stocked. The fingerling rainbow trout were replaced with an increase in the number of subcatchable rainbow trout stocked. Based on a 1986 creel survey, an estimated 250,000 trout (both cutthroat and rainbow) were harvested from the lake, with about 347,000 hours of fishing pressure. At 4.27 hours per angler-day, this equates to 81,241 angler days or 30 angler days per surface acre. Subsequent creel surveys in 2005 and 2007 show a considerable reduction of 67% in fishing hours, which is typical of reduction in creel survey results statewide in the last 20 years. Scofield Reservoir consistently has excellent catch rates. This fishery resource represents a significant economic resource to the local area and is considered to be the third best flat water fishery in the State.

In the past, the reservoir has experienced periodic fishkills, usually late summer or fall. In 1991, a fish management program eradicated undesirable fish species.

Scofield Reservoir and the Price River between the Highway 6 Bridge and Scofield Dam are Blue Ribbon Fisheries. Under the proposed project, Scofield Reservoir would be operated within normal ranges. Peak flows may be reduced in some years. Riparian and aquatic habitats and animals dependant on these habitats, including fish, would not be significantly affected by these changes.

3.10.2 Methodology and Impact Indicators

A team, comprised of representatives from SWCD, Reclamation, UDWR, and the USDA Forest Service, was assembled to analyze the impact to stream fisheries and develop mitigation recommendations. Potential effects that were included in the evaluation are: stream habitat loss associated with reservoir inundation, effects of project-induced flow changes on aquatic habitat (both beneficial and adverse), and project effects on reservoir angler-days.

Available stream habitat under baseline and project alternative conditions was evaluated by instream flow incremental methodology modeling (U.S. Fish and Wildlife Service 1994). In performing this analysis, extensive field data is collected, including hydrologic data such as velocity and depth of flow over a wide range of discharge conditions, substrate conditions, and vegetation along the banks. Habitat Suitability Indices (HSI) curves then are applied for each fish species that occurs in the area. This data is used to estimate the amount of available habitat measured as WUA. WUA is the impact indicator used to determine effects on stream fisheries.

For the analysis shown in this document, data for the instream flow incremental methodology (IFIM) modeling in Cottonwood Creek was collected during low flow conditions only (Addley 1997). Additional data will be collected during the snowmelt runoff to verify the accuracy of the hydrologic model under high flow conditions. The impact indicator for stream fisheries is the percent change in weightable usable area as measured by IFIM for the various life stages.

Impacts on reservoir fisheries are based on the average reservoir surface area. The impact indicator on reservoir fisheries is the change in surface area in Scofield Reservoir.

3.10.3 Predicted Effects

3.10.3.1 No Action Alternative

Under the No Action Alternative, project-induced changes to existing conditions would not occur. The three tributaries to Gooseberry Creek in the proposed Narrows Reservoir basin would continue to provide spawning habitat for cutthroat trout to the same extent as at present. The 1.0 mile of Upper Gooseberry Creek would continue to provide habitat for all life stages of cutthroat trout, and habitat for cutthroat and rainbow trout in Gooseberry Creek and Fish Creek would remain as listed in tables 3-12 through 3-14. Habitat for cutthroat, rainbow, and brown trout in Cottonwood Creek would remain as listed in tables 3-17 through 3-19.

Fishing conditions at Lower Gooseberry Reservoir and Fairview Lakes would remain the same as at present. Lower Gooseberry Reservoir would continue to experience occasional fishkills during winter months. Fairview Lakes probably would continue to be managed as at present with annual stocking and no overwintering of fish due to low reservoir levels. Scofield Reservoir would continue to have an average of 2,375 acres of surface area.

3.10.3.2 Proposed Action Alternative

The State Engineer stipulates that a minimum of 1.0 cfs is to be released downstream from the proposed Narrows Dam; and, if the flow is not 1.5 cfs at the Gooseberry Campground ⅛ mile downstream from the proposed damsite, SWCD is required to release 1.25 cfs from the dam. It also is stipulated that the dam be constructed by SWCD with a multiple-level outlet to regulate water temperature for the trout located downstream from the dam.

The proposed project would cause flow reductions in Gooseberry and Fish Creeks as shown in table 3-1. Flows in Middle Gooseberry Creek immediately downstream from the proposed dam would be expected to be reduced, on average, by 74%; whereas, flows downstream from Lower Gooseberry Reservoir would be expected to be reduced by 43%. In Fish Creek, flows would be expected to be reduced approximately 15%.

The 5,400-acre-foot diversion of project water into Cottonwood Creek would cause about a 200% increase in the base summer flow in Upper Cottonwood Creek (table 3-1). As shown, the base summer flows in Lower Cottonwood Creek would be increased by about 160%. However, the increased flows would occur only during the July-to-October period and not during the peak runoff or the low flow months (November–April). Additionally, these base summer flows would be less than the peak flows that currently shape the stream channel. Therefore, the stream channel itself would remain stable.

Providing a 2.0-cfs winter release through the Narrows Tunnel is expected to greatly increase the WUA for all fish species in Cottonwood Creek. This increased flow particularly would benefit the upper reaches of the creek and would be expected to facilitate the overwintering of fish.

The length of time required initially to fill Narrows Reservoir would, of course, depend on hydrologic conditions in the basin. During wet years, the reservoir could fill during a single spring runoff. For more normal conditions, if no diversions were made to Cottonwood Creek until the reservoir filled, it probably would fill in 2 years—almost certainly within 3 years. Under dry conditions, if diversions to Cottonwood Creek did occur during the filling period, it could take 5–15 years to fill Narrows Reservoir. Due to these hydrologic uncertainties, there is no firm filling schedule for the reservoir.

3.10.3.2.1 Reservoir Inundation Effects

At maximum storage, the proposed Narrows Reservoir would inundate about 1 mile of Upper Gooseberry Creek and approximately 4.3 miles of the three headwater tributaries with permanent flows that join to form Gooseberry Creek.

Based on the stream habitat that would be inundated by the proposed reservoir, it is expected that 1.3 and 2.1 acres of stream-based aquatic habitat would be lost in Gooseberry Creek and the tributaries, respectively. Using the standing crop estimates, approximately 230 pounds of stream-based cutthroat trout would be lost, of which 22% would occur in Gooseberry Creek and 78% would occur in the tributary streams, although the trout biomass probably would be converted into a flat water equivalent.

3.10.3.2.2 Flow Alteration Effects

3.10.3.2.2.1 Upper Gooseberry Creek Segment.—The upper reach of Gooseberry Creek above the proposed reservoir currently suffers from the lack of flows, particularly during the late summer and early fall. Under the proposed action, flows would be augmented during these periods to improve fish habitat.

3.10.3.2.2.2 Middle Gooseberry Creek Segment.—As shown in table 3-1, preproject average monthly flows in this stream segment range from 1.3–61.8 cfs and average 11.2 cfs. The expected 1-cfs postproject flow represents a 74% reduction in annual flow in this stream segment. As described above, this segment of Gooseberry Creek supports all life stages of cutthroat trout. Adult and juvenile cutthroat trout use the aquatic habitat throughout the year, while cutthroat trout spawning habitat (including incubation) is used during May, June, July, and August, and fry are present in August and September. Table 3-13 shows the cutthroat trout habitat available on a monthly basis for the four life stages under preproject and postproject flow regime. Adult and juvenile cutthroat trout habitat is limited during the existing low flow period, which in an average year extends from October–March. Even though more habitat may occur during the high flow months, the overall trout population would be expected to be controlled by available habitat during this 6-month period. As shown in table 3-4, adult and juvenile cutthroat trout habitat is expected to be reduced by as much as 72.0 and 81.6%, respectively, in the high flow months. Conversely, during the low flow period (October–March), adult and juvenile cutthroat trout habitat in an individual month would be reduced up to 23.6 and 20.1%, respectively. On average during this period, adult habitat would be reduced 12.9%, whereas juvenile habitat would be reduced 10.8%.

Since spawning and fry life stages are in the stream segment during the spring and summer, the effect of flow reductions attributable to the project would be much greater during these seasons, with spawning habitat being reduced by almost 94% and fry habitat being reduced by almost 45%. If fry from cutthroat trout spawning upstream of the proposed dam presently are being carried into this stream reach, construction of the dam would prevent these fry from entering this reach of stream.

The project would eliminate large flows in this stream segment; therefore, it is expected that the width of the stream would be reduced. However, without the normal flushing flows, the stream could be expected to have more fine materials in the substrate, which could almost eliminate the small amount of cutthroat trout spawning habitat that is projected to remain in the stream segment. Unless the configuration of the channel of the stream is altered, the stream segment would have limited value, and 50–75% of trout biomass may be lost. If the channel configuration is altered, then the loss of trout biomass may not be as great.

3.10.3.2.2.3 Lower Gooseberry Creek Segment.—Operation of the proposed project would cause monthly flow reductions in this 7.1-mile stream segment that would range from 8–62% and average 43% (table 3-1). The largest flow reductions would occur during April–August. However, due to tributary inflow between the proposed dam and this stream segment, the reductions would not be as severe as they may be in the segment immediately upstream of Lower Gooseberry Dam.

As previously discussed, this stream segment supports a self-reproducing population of cutthroat trout. The amount of habitat available for the four life stages on a monthly basis with preproject and postproject flow regimes is shown in table 3-13. Similar to the upstream segment, existing habitat for adult and juvenile cutthroat trout is most restricted during the low flow period, which extends from October–March. As discussed for the previous stream segment, habitat during this period would be expected to be a major factor that would control trout biomass in the stream. As shown in table 3-13, adult and juvenile habitat would be reduced up to 10.5 and 29.5%, respectively. However, during the low flow months, adult and juvenile habitat reductions never exceed 10% in a specific month and, for the 6-month period, average 5.0 and 3.9%, respectively. With these small reductions in adult and juvenile habitat, any change in the trout population would be expected to be negligible and difficult to detect.

Cutthroat trout spawning habitat is extremely limited with both preproject and postproject flow regimes. It appears that availability of spawning habitat is not a limiting factor, as YOY fish are normally abundant in this stream segment. Fry habitat would be expected to be only slightly affected (0.9% increase) by the proposed project.

It is expected that the proposed project would cause less than a 5% reduction in the cutthroat trout habitat in this stream segment. This is well within the range of fluctuations in the trout population that presently occurs. Little or no opportunity exists to mitigate the adverse impact within this stream segment.

As discussed above, rainbow trout (adults and juveniles) also were documented in this stream reach. The presence of these two life stages strongly suggests that rainbow trout also are using the stream for spawning and rearing habitat. The amount of rainbow trout habitat (WUA) for the four life stages in the entire stream reach was shown in table 3-14. Similar to cutthroat trout, adult and juvenile rainbow trout habitat is most restricted during the low flow period (October–March), and this would be expected to be a major factor that controls trout biomass in this stream segment. For this 6-month period, operation of the proposed project is expected to reduce rainbow trout adult and juvenile habitat by an average of 6.5 and 5.4%, respectively.

Rainbow trout spawning habitat is limited in this stream reach. Implementing the proposed project is expected to result in a slight increase (less then [<] 7%) of spawning habitat. Rainbow trout fry habitat is abundant in this stream reach, and implementing the proposed project also is expected to cause a slight increase (< 8%) in fry habitat (table 3-16). Neither increase is considered to be significant.

3.10.3.2.2.4 Fish Creek Segment.—The proposed project would result in a 3–24% reduction in the average monthly flow in Fish Creek. The largest reductions would occur during April–August when preproject flows are the highest. Flows during the low flow months would be reduced 10% or less, and flows during the other months would remain several times higher than those in the low flow months. Reduction in high flows would reduce the sediment transport capacity of the stream, which could increase the amount of sediment deposited within the stream channel, reducing its spawning value.

The amount of cutthroat trout habitat available for the four life stages on a monthly basis with preproject and postproject flow regimes is shown in table 3-16. Similar to the upstream segment, adult and juvenile cutthroat trout habitat is the lowest during October–March, and reduced habitat during this period would be expected to be a major factor that controls the cutthroat trout population in this stream segment. As shown in table 3-16, adult and juvenile cutthroat trout habitat in a specific month may be reduced up to 7.3 and 3.3%, respectively; while in other months, available habitat may be increased. On average for the 6-month low flow period, adult cutthroat trout habitat is expected to be reduced by less than 1%, whereas juvenile habitat would be increased by about 0.5%. Both of these changes are considered to be insignificant.

The month-to-month changes in spawning and fry cutthroat trout habitat, as shown in table 3-16, may be reduced or increased. Overall spawning habitat is expected to be increased by slightly more than 15%, while fry habitat would be reduced by about 3%.

The increase in spawning habitat is considered to be a significant beneficial impact, while the decrease in fry habitat is not significant.

The amount of juvenile, spawning, and fry habitat for rainbow trout in this segment of Fish Creek, based on preproject and postproject flow regimes, was presented earlier in table 3-15. Similar to the cutthroat trout, existing juvenile rainbow trout habitat is most limiting during October–March; and available habitat during this period would be a major factor that controls the abundance of juvenile rainbow trout in this stream segment. During this 6-month period, adult rainbow trout habitat would decrease between 0.5 and 2.7% in specific months, while juvenile rainbow trout habitat is expected to increase by up to 0.4% and decrease to 1.3% in specific months. Overall, adult and juvenile habitat reductions are expected to average about 1.3 and 0.5%, respectively. This is considered to be an insignificant impact.

Also, as shown earlier in table 3-15, impacts to rainbow trout spawning and fry habitats would be expected to decrease about 16 and 2%, respectively. If rainbow trout habitat in this stream segment was limiting, then the reduction in spawning habitat would amount to a significant impact. If so, this effect also would be carried into Scofield Reservoir, since it could affect the number of rainbow trout entering the reservoir's fishery from natural reproduction.

3.10.3.2.2.5 Cottonwood Creek Segment.— Flows in Cottonwood Creek would be increased during July–October (table 3-1). Increased winter flows also would be provided. This increase in summer flow would cause a slight decrease in WUA for rainbow and cutthroat trout in June, July, and August. There would be an increase in WUA for adult and juvenile rainbow and cutthroat trout in September. The higher summer flows would increase the spawning WUA for rainbow trout by 9% and decrease the spawning WUA for cutthroat trout by 41%. Overall, WUA for adult rainbow and cutthroat trout would increase by about 20%. Fry habitat would decrease by 16% for rainbow trout and by 14% for cutthroat trout. All life stages of brown trout would be benefited by the increased flows. WUA for adult brown trout would increase by 26%, WUA for juvenile brown trout would increase by 24%, spawning habitat for brown trout would increase by 410%, and habitat for fry brown trout would increase by 59%.

3.10.3.2.3 Reservoir Fishery Effects

Existing reservoir fisheries with the potential to be affected by the proposed project include Lower Gooseberry Reservoir, Fairview Lakes, and Scofield Reservoir. Each is discussed below.

3.10.3.2.3.1 Lower Gooseberry Reservoir.—Under the Proposed Action, flows from Gooseberry Creek into Lower Gooseberry Reservoir would be substantially reduced. As shown in table 3-1, most of the flow reduction would occur during April–August. Flow reduction during this period would reduce the exchange rate within the reservoir and may affect water quality or aquatic habitat during this period. As noted under the No Action Alternative, Lower Gooseberry Reservoir occasionally experiences fishkills due to low DO levels during the winter months. If the problem becomes more severe, it would be an adverse effect attributable to the project. If cutthroat trout spawning upstream of the proposed reservoir contributes to the abundance of cutthroat trout in Lower Gooseberry Reservoir, which appears likely, the proposed project could adversely affect the cutthroat trout population in that reservoir.

3.10.3.2.3.2 Fairview Lakes.—Project operation would not change the amount of water (acre-feet) that would be released from Fairview Lakes. The release would be spread over the entire year, rather than the present 18- to 20-week discharge period. This would allow higher water levels later in the year, which would increase the opportunity for overwintering of fish. This change in operation would have a beneficial effect on the overall quality of the fishery and potentially could decrease the amount of stocking of catchable size fish required.

3.10.3.2.3.3 Scofield Reservoir.—A primary concern regarding Scofield Reservoir as it relates to the Narrows Project has been that the decreased inflow to the reservoir resulting from the Narrows Project would further degrade the reservoir's water quality and increase the potential for fishkills. Additionally, implementing the Proposed Action would cause Scofield Reservoir to operate at a lower level and, thus, decrease the average surface area of the flat water fishery by about 245 acres (10% total reduction in surface acres for Scofield Reservoir).

3.10.3.2.3.4 Narrows Reservoir.—It is expected that, under the Proposed Action, UDWR would manage Narrows Reservoir as a cutthroat trout fishery. Although natural reproduction is expected in the tributary streams upstream of the reservoir, UDWR may need to augment natural reproduction with fingerling introductions to ensure that maximum reservoir production occurs. As an example, UDWR presently is managing Cleveland Reservoir, located about 6 miles southeast of the proposed Narrows Reservoir site, for rainbow trout and maintaining the population by stocking fingerling rainbow trout. Narrows Reservoir would provide an average of 436 surface acres of flat water fishery under the Proposed Action, more than under either the Mid-Sized or Small Reservoir Alternatives.

3.10.3.2.4 Fishery Mitigation

The UDWR does not recognize the creation of a reservoir fishery as adequate compensation for the loss of stream aquatic resources. Creating an additional reservoir fishery would compensate for adverse effects that may occur on Lower Gooseberry Reservoir and Scofield Reservoir. This would represent a cumulative beneficial project impact to reservoir fishery.

In summary, the Proposed Action would result in loss of cutthroat trout stream habitat attributable to reservoir inundation and flow alteration. The project also would result in more reservoir habitat for cutthroat trout. The reservoir cutthroat trout habitat that would be created by the project would compensate for any adverse impacts that may occur on Gooseberry or Scofield Reservoirs. Therefore, mitigation for reservoir habitat has not been proposed.

A total of 11 fishery improvement and mitigation measures have been proposed by SWCD to compensate for the adverse aquatic impacts that have been identified with the proposed project. To the extent possible, an attempt was made to mitigate "in place" and "in kind." These measures have been developed in coordination with various Federal and State agencies and were described in detail in chapter 2, section 2.2.2.2.1 of this document. Table 3-20 is a summary of the aquatic impacts and proposed improvement and mitigation commitments for the Proposed Action.

The intent of the aquatic mitigation measures described above is to provide full mitigation for all adverse impacts resulting in no residual cumulative or overall impacts.

Table 3-20.—Fishery Impacts and Mitigation Measures: Proposed Action

Impacts	Mitigation Commitment
Stream Fisheries	
Gooseberry Creek tributaries – Loss of 4.3 miles (spawning Yellowstone cutthroat).	Restore year-round flows in 2.3 miles of tributaries and stabilize 3.0 miles of Middle Gooseberry Creek.
Upper Gooseberry Creek – Loss of 1.0 mile (all life stages Yellowstone cutthroat). Middle Gooseberry Creek – 74% reduction in average annual flow for 3.0 miles (all life stages Yellowstone cutthroat). Lower Gooseberry Creek – 43% flow reduction for 7.1 miles (decrease of 5% adult and 4% juvenile low flow habitat for Yellowstone cutthroat). Fish Creek – Average 17% flow reduction of 6.0 miles (decrease of less than 1% adult and juvenile low flow habitat for Yellowstone cutthroat; overall increase of 15% spawning and 3% fry habitat for Yellowstone cutthroat; decrease of 1.3% adult and 0.5% juvenile low flow habitat for rainbow; overall decrease of 16% spawning and 2% fry habitat for rainbow).	Acquire, fence, and improve fishery habitat on the following stream segments: Mud Creek 4.0 miles Winterquarters Creek 2.5 miles Upper Fish Creek 1.0 mile Pondtown Creek 2.0 miles Price River below Scofield Reservoir 2.0 miles Provide 1.0-cfs minimum year-round release into Gooseberry Creek to provide 1.5-cfs flow at Gooseberry Campground. Provide temperature control for releases to Gooseberry Creek.
Upper Cottonwood Creek – No summer flow increase, 2-cfs winter flow provided.	Construct Upper Cottonwood Creek Pipeline and provide 2-cfs winter release.
Lower Cottonwood Creek – Average 162% annual flow increase. Average 200% summer flow increase. Overall increase in habitat of 10 to 20% for rainbow trout adult, juvenile, and spawning. Increase in Yellowstone cutthroat trout adult habitat of about 20%. Little change for Yellowstone cutthroat juvenile habitat. Average of 41% decrease in Yellowstone cutthroat spawning habitat and decrease of 14% for Yellowstone cutthroat fry habitat. Increase in habitat for all life stages of brown trout.	Provide 2-cfs minimum flow during irrigation season in Lower Cottonwood Creek.
Price River below Scofield Dam – reduced peak flow may alter fluvial geomorphic processes	
The number of miles of stream affected by increase in flow is 4.9 miles. The number of miles of stream affected by decrease in flow is 16.1 miles.	The project would provide an average 300 acre-feet per year of additional water for release to Gooseberry Creek for flushing flows.
Reservoir Fisheries	
Scofield Reservoir – Increased potential for poor water quality resulting in fishkills; loss of some natural reproduction in rainbow trout. Reduced surface area of 274 acres, resulting in reduced standing crop of fish.	Reduce external phosphorus loading by improving riparian areas along Mud Creek, Winterquarters Creek, Upper Fish Creek, and Pondtown Creek. These measures also will improve habitat for all life stages of Yellowstone cutthroat and rainbow trout including spawning. Lost angler days would be replaced by new fishery in Narrows Reservoir.
Lower Gooseberry Reservoir – Increased potential for poor water quality resulting in fishkills.	
Fairview Lakes – Lower fishing pressure; less severe drawdown during fishing season and winter.	Beneficial impact. No mitigation required.
Narrows Reservoir – New reservoir fishery (average).	Would provide approximately 454 acres of flat water fishery.

3.10.3.3 Mid-Sized Reservoir Alternative

Impacts to aquatic resources under the Mid-Sized Reservoir Alternative would be similar to those generated by the Proposed Action. The exceptions would be that 4.0 miles of tributaries to Gooseberry Creek would be inundated by the reservoir instead of the 4.3 miles that would be inundated by the Proposed Action and that the Mid-Sized Reservoir Alternative would reduce the surface area of Scofield Reservoir by 231 acres (10%), while providing 331 new surface acres at Narrows Reservoir.

A summary of the 11 fishery improvement and mitigation measures proposed for the Mid-Sized Reservoir Alternative (all of which were described in greater detail in chapter 2) is presented in table 3-21.

The residual impacts to aquatic resources caused by the Mid-Sized Reservoir Alternative would be nearly equivalent to those under the Proposed Action.

3.10.3.4 Small Reservoir Alternative

Impacts to aquatic resources under the Small Reservoir Alternative would be similar to those generated by the Proposed Action. The exception would be that 3.8 miles of tributaries to Gooseberry Creek would be inundated by the reservoir instead of the 4.3 miles inundated by the Proposed Action. In addition, the Small Reservoir Alternative would reduce the surface area of Scofield Reservoir by 205 acres (9%) while providing 215 new acres at Narrows Reservoir.

A summary of the nine fishery improvement and mitigation measures proposed for the Small Reservoir Alternative (all of which were described in greater detail in chapter 2) is presented in table 3-22.

The residual impacts to aquatic resources caused by the Small Reservoir Alternative would be nearly equivalent to those of the Proposed Action.

3.11 WILDLIFE

3.11.1 Affected Environment

The study, *Vegetation and Wildlife Impacts from the Narrows Project*, states that wildlife species found in the general project area are common in the Great Basin Desert valleys and Rocky Mountain Range. There are about 364 species of terrestrial vertebrates that may inhabit the project area. Approximately 88 bird species and 33 mammal species may use the habitats that would be disturbed by the proposed project (Mt. Nebo Scientific, 1992).

3.11.2 Methodology and Impact Indicators

The method used to evaluate the project is known as the Habitat Evaluation Procedure—a “species habitat” approach to impact assessment and habitat quality. The program uses selected species as indicators to evaluate habitat for a host of other species, assuming that these indicator (evaluation) species are functioning units of part of an ecosystem.

Impacts to a particular indicator species assume that there also would be impacts to the group of the species it represents.

HSI were ascertained for each evaluation (indicator) species. These indices range from 0.0 to 1.0 with each increment of change identical to the next. An HSI value is linearly related to the carrying capacity of the species. An HSI of “1.0” would represent the optimum habitat for the particular evaluation species, whereas “0.0” would represent habitat that is unsuitable.

Table 3-21.—Fishery Impacts and Mitigation Measures: Mid-Sized Reservoir Alternative

Impacts	Mitigation Commitment
Stream Fisheries	
Gooseberry Creek tributaries – Loss of 4.0 miles (spawning Yellowstone cutthroat).	Restore year-round flows in 2.3 miles of tributaries and stabilize 3.0 miles of Middle Gooseberry Creek.
Upper Gooseberry Creek – Loss of 1.0 mile (all life stages Yellowstone cutthroat). Middle Gooseberry Creek – 74% reduction in average annual flow for 3.0 miles (all life stages Yellowstone cutthroat). Lower Gooseberry Creek – 43% flow reduction for 7.1 miles (decrease of 5% adult and 4% juvenile low flow habitat for Yellowstone cutthroat). Fish Creek – Average 17% flow reduction of 6.0 miles (decrease of less than 1% adult and juvenile low flow habitat for Yellowstone cutthroat; overall increase of 15% spawning and 3% fry habitat for Yellowstone cutthroat; decrease of 1.3% adult and 0.5% juvenile low flow habitat for rainbow; overall decrease of 16% spawning and 2% fry habitat for rainbow).	Acquire, fence, and improve fishery habitat on the following stream segments: Mud Creek 4.0 miles Winterquarters Creek 2.5 miles Upper Fish Creek 1.0 mile Pondtown Creek 2.0 miles Price River below Scofield Reservoir 2.0 miles Provide 1.0-cfs minimum year-round release into Gooseberry Creek to provide 1.5-cfs flow at Gooseberry Campground. Provide temperature control for releases to Gooseberry Creek.
Upper Cottonwood Creek – No summer flow increase, 2-cfs winter flow provided.	Construct Upper Cottonwood Creek Pipeline and provide 2-cfs winter release.
Lower Cottonwood Creek – Average 162% annual flow increase. Average 200% summer flow increase. Overall increase in habitat of 10 to 20% for rainbow trout adult, juvenile, and spawning. Increase in Yellowstone cutthroat trout adult habitat of about 20%. Little change for Yellowstone cutthroat juvenile habitat. Average of 41% decrease in Yellowstone cutthroat spawning habitat and decrease of 14% for Yellowstone cutthroat fry habitat. Increase in habitat for all life stages of brown trout.	Provide 2-cfs minimum flow during irrigation season in Lower Cottonwood Creek.
Price River below Scofield Dam – reduced peak flow may alter fluvial geomorphic processes	
The number of miles of stream affected by increase in flow is 4.9 miles. The number of miles of stream affected by decrease in flow is 16.1 miles.	The project would provide an average 300 acre-feet per year of additional water for release to Gooseberry Creek for flushing flows.
Reservoir Fisheries	
Scofield Reservoir – Increased potential for poor water quality resulting in fishkills; loss of some natural reproduction in rainbows. Reduced surface area of 260 acres resulting in reduced standing crop of fish.	Reduce external phosphorus loading by improving riparian areas along Mud Creek, Winterquarters Creek, Upper Fish Creek, and Pondtown Creek. These measures also will improve habitat for all life stages of Yellowstone cutthroat and rainbow trout including spawning. Lost angler days would be replaced by new fishery in Narrows Reservoir.
Lower Gooseberry Reservoir – Increased potential for poor water quality resulting in fishkills.	
Fairview Lakes – Lower fishing pressure, less severe drawdown during fishing season and winter.	Beneficial impact. No mitigation required.
Narrows Reservoir – New reservoir fishery (average).	Would provide approximately 277 acres of flat water fishery

Table 3-22.—Fishery Impacts and Mitigation Measures: Small Reservoir Alternative

Impacts	Mitigation Commitment
Stream Fisheries	
Gooseberry Creek tributaries – Loss of 3.8 miles (spawning Yellowstone cutthroat).	Stabilize 3.0 miles of Middle Gooseberry Creek.
Upper Gooseberry Creek – Loss of 1.0 mile (all life stages Yellowstone cutthroat). Middle Gooseberry Creek – 67% reduction in average annual flow for 3.0 miles (all life stages Yellowstone cutthroat). Lower Gooseberry Creek - 39% flow reduction for 7.1 miles (decrease of 5% adult and 4% juvenile low flow habitat for Yellowstone cutthroat). Fish Creek – Average 17% flow reduction of 6.0 miles (decrease of less than 1% adult and juvenile low flow habitat for Yellowstone cutthroat; overall increase of 15% spawning and 3% fry habitat for Yellowstone cutthroat; decrease of 1.3% adult and 0.5% juvenile low flow habitat for rainbow; overall decrease of 16% spawning and 2% fry habitat for rainbow).	Acquire, fence, and improve fishery habitat on the following stream segments: Mud Creek 4.0 miles Winterquarters Creek 2.5 miles Upper Fish Creek 1.0 mile Pondtown Creek 2.0 miles Price River below Scofield Reservoir 2.0 miles
Upper Cottonwood Creek – No summer flow increase, 2-cfs winter flow provided.	Construct Upper Cottonwood Creek Pipeline and provide 2-cfs winter release.
Lower Cottonwood Creek – Average 162% annual flow increase. Average 200% summer flow increase. Overall increase in habitat of 10 to 20% for rainbow trout adult, juvenile, and spawning. Increase in Yellowstone cutthroat trout adult habitat of about 20%. Little change for juvenile habitat. Average of 41% decrease in Yellowstone cutthroat spawning habitat and decrease of 14% for Yellowstone cutthroat fry habitat. Increase in habitat for all life stages of brown trout.	Provide 2-cfs minimum flow during irrigation season in Lower Cottonwood Creek.
Price River below Scofield Dam – Reduced peak flow may alter fluvial geomorphic processes	
The number of miles of stream affected by increase in flow is 4.9 miles. The number of miles of stream affected by decrease in flow is 16.1 miles.	
Reservoir Fisheries	
Scofield Reservoir – Increased potential for poor water quality resulting in fishkills; loss of some natural reproduction in rainbows. Reduced surface area of 234 acres resulting in reduced standing crop of fish.	Reduce external phosphorus loading by improving riparian areas along Mud Creek, Winterquarters Creek, Upper Fish Creek, and Pondtown Creek. These measures also will improve habitat for all life stages of Yellowstone cutthroat and rainbow trout including spawning. Lost angler days would be replaced by new fishery in Narrows Reservoir.
Lower Gooseberry Reservoir – Increased potential for poor water quality resulting in fishkills.	Stabilize 3.0 miles of Middle Gooseberry Creek to reduce external phosphorus loading.
Fairview Lakes – Lower fishing pressure; less severe drawdown during fishing season.	Beneficial impact. No mitigation required.
Narrows Reservoir – New reservoir fishery (average).	Would provide approximately 238 acres of flat water fishery.

Evaluation species chosen to assess the impacts to habitat of the proposed project included: mule deer, beaver, Richardson vole, yellow warbler, and Brewer's sparrow. The Brewer's sparrow was used because of the vegetative community it represented, not for the species. It was determined that the Brewer's sparrow would reflect summer range needs for deer, elk, and other species as well as the sparrow. These wildlife species and the communities that they use are described below.

- **Mule Deer –** Deer are of great public interest in the area and are plentiful in the reservoir area. The project area provides excellent summer range, and areas surrounding the reservoir basin and aspen forest are critical in summer because of fawning.
- **Beaver –** The beaver is able to use a wide variety of wetlands habitat and is found at two different locations within the proposed reservoir basin.
- **Richardson Vole –** The vole uses much of the wetland habitat in the area. These voles live primarily in moist areas with high densities of grasses and sedges.
- **Yellow Warbler –** The yellow warbler also uses the wetland habitats in the area but does not use the same grassy habitat as the vole. The warbler occurs in the deciduous shrub/scrub wetlands and also is found in high abundance at the reservoir site.
- **Brewer's Sparrow –** This sparrow nests and forages in the sagebrush, which allows the evaluation to take the shrub habitat into consideration.

The impact indicator for vegetation and wildlife is the change in habitat units for the indicator species listed above. Habitat units are based on the quantity and quality of the various vegetation types used as habitat for the species.

3.11.3 Predicted Effects

3.11.3.1 No Action Alternative

The baseline conditions within the reservoir basin are summarized under the No Action Alternative in table 3-23. Wildlife habitat conditions are expected to remain the same as baseline conditions if the project were not constructed and if there were no other future developments. Because there are no impacts, no mitigation would be provided.

3.11.3.2 Proposed Action Alternative

Table 3-23 summarizes the impacts to wildlife habitat that would result from construction of the Proposed Action. In an assumed worst-case situation where the most habitat would be lost at one time, it would take the reservoir 2 years to fill to capacity. The *1994 Fish and Wildlife Coordination Act Report* evaluates the impacts of the proposed Narrows Project on fish and wildlife resources and recommends appropriate mitigation (see appendix D).

In addition to the 604 acres of habitat inundated by the reservoir, there would be an additional 32 acres lost due to SR-264 relocation, of associated forest development roads, and of the recreation area construction.

These areas are primarily mule deer and Brewer's sparrow habitat.

Temporary impacts would result from construction of the Upper Cottonwood Creek, Oak Creek, and East Bench Pipelines and from developing the rockfill material source area. These areas would be recontoured, covered with topsoil, and revegetated with native plant species after construction. Implementing the fishery and wildlife

Table 3-23.—Comparison of Wildlife Habitat Losses Within Narrows Reservoir Basin (Without Mitigation)

Species	Cover Type(s)[1]	No Action Alternative			Proposed Action			Mid-Sized Reservoir Alternative			Small Reservoir Alternative		
		Acres	HSI[2]	HU[3]	Acres	HSI[2]	HU[3]	Acres	HSI[2]	HU[3]	Acres	HSI[2]	HU[3]
Mule deer	PEM, PSS, USHE	0	0.23	0	587	0.23	135	475	0.23	109	341	0.23	78
Beaver	PEM, PSS	0	0.13	0	100	.013	13	81	0.13	11	72	0.13	9
Richardson vole	PEM	0	1.00	0	63	1.00	63	51	1.00	51	45	1.00	45
Yellow warbler	PSS	0	0.70	0	37	0.70	26	30	0.70	24	27	0.70	19
Brewer's sparrow	USHE	0	0.98	0	487	0.98	477	394	0.98	386	269	0.98	264

1 PEM = Palustrine emergent wetland cover (herbaceous wetlands); PSS = palustrine scrub/shrub cover (shrubby wetlands); and USHE = shrub cover (Vasey sagebrush; silver sagebrush).

2 A HSI of "1.0" represents the optimum habitat; whereas "0.0" represents unsuitable habitat.

3 Habitat Unit = Habitat availability.

mitigation measures would increase the amount of wildlife habitat affected by the Proposed Action to a total of about 1,931 acres of land. Species benefitting by the mitigation measures would include mule deer, beaver, Richardson vole, yellow warbler, and Brewer's sparrow.

Analyses were performed comparing the habitat units available with and without the proposed project. As mentioned previously, if the Narrows Dam were constructed, a mitigation plan would be implemented to compensate for wetlands and upland communities impacted by reservoir inundation.

Alternative wetland mitigation measures for the Proposed Action were described in chapter 2. The proposed wetland mitigation areas are in kind, and a detailed mitigation plan would be developed in conjunction with the Clean Water Act Section 404 permitting process. In determining the exact acreage to be provided, careful monitoring of the mitigation sites would be conducted to ensure that the value of the mitigation sites is at least equal to the value of the wetlands lost. This determination would be accomplished by performing HEP analyses of the sites and comparing habitat values. Because plants require time to become fully established, it is anticipated to take 6 years from the time construction is initiated to achieve the desired wildlife habitat for the wetland mitigation.

To accommodate the loss of habitat for mule deer and Brewer's sparrow if the Narrows Reservoir were constructed, additional mitigation measures would be implemented. Impacts to upland game (mule deer and Brewer's sparrow habitat and the host of species that they represent) would be mitigated in the following ways:

- ♦ Acquisition of conservation easements around Narrows Reservoir. The conservation easements would be in the name of the United States. These easements would include restrictions on land use that would benefit impacted species. This measure would serve to protect wildlife values adjacent to the reservoir and minimize impacts that would occur if the land were developed.

- ♦ Acquisition of private or State School Trust land adjacent to the Price River below Scofield Reservoir. Wildlife values would be enhanced by fencing the land to protect it from livestock grazing. The primary objective of this measure would be to protect mule deer habitat. The lower Fish Creek acquisition would protect both summer and winter range, depending on which side of the canyon is acquired. South facing slopes provide winter range in early winter and mild winters. The area would provide riparian and fishery habitat. The wetland mitigation area near Scofield Reservoir also would provide habitat for mule deer.

A wildlife mitigation program has been designed to provide at least full mitigation for each impacted species.

A monitoring program would be implemented on a yearly basis using qualitative and quantitative sampling methods to monitor the progress of the mitigation plans. At the end of the predicted time, when it is assumed that full mitigation should be achieved, the areas would be sampled using the same techniques that were used to gather the baseline information. Statistical comparisons would be made. If full mitigation standards are not achieved, steps would be taken to ensure that the goals are eventually met.

A survey of migrating, ground nesting birds would be conducted prior to any ground disturbing activities. This survey would be conducted by a biologist to avoid, to the extent possible, any negative impacts to these birds.

Also, construction activities within 0.5 mile of any active raptor nest would not be allowed from March 15–August 31. This restriction would ensure that any nesting raptors would not be significantly affected by the project. Any effects to raptors would be short term or very limited in extent and would have no significant negative effects since these birds would be able to use very similar roost sites or other habitat elements in the vicinity of the project.

Because the wetland and upland wildlife mitigation measures are intended to provide full mitigation for project impacts, there would be no residual impacts.

3.11.3.3 Mid-Sized Reservoir Alternative

Table 3-23 summarizes the impacts to wildlife habitat that would result under the Mid-Sized Reservoir Alternative. Permanent impacts caused by SR-264 relocation and construction of the recreation area would be the same as with the Proposed Action. Temporary impacts due to construction of pipelines and development of material source areas also would be the same.

Implementing the wildlife mitigation measures would increase the amount of wildlife habitat on about 1,680 acres of land. Benefited species would include mule deer, beaver, Richardson vole, yellow warbler, and Brewer's sparrow.

Under the Mid-Sized Reservoir Alternative, wetland and upland wildlife habitat mitigation measures would be similar to those described under the Proposed Action, except that the amount of acreage would be smaller, as described in chapter 2. The proposed wetland mitigation areas are in kind, and a detailed mitigation plan would be developed and designed in conjunction with the Section 404 permitting process.

Because the wetland and upland wildlife mitigation measures are intended to provide full mitigation for project impacts, there would be no residual impacts.

3.11.3.4 Small Reservoir Alternative

Table 3-23 summarizes the impacts to wildlife habitat that would result under the Small Reservoir Alternative. Permanent impacts caused by SR-264 relocation and construction of the recreation area would be the same as with the Proposed Action. Temporary impacts due to construction of pipelines and development of material source areas also would be the same.

Implementing the wildlife mitigation measures would increase the amount of wildlife habitat on about 1,510 acres of land. Benefited species would include mule deer, beaver, Richardson vole, yellow warbler, and Brewer's sparrow.

Under the Small Reservoir Alternative, wetland and upland wildlife habitat mitigation measures would be similar to those described under the Proposed Action, except that the amount of acreage would be smaller, as described in chapter 2. The proposed wetland mitigation areas are in kind, and a detailed mitigation plan would be developed and designed in conjunction with the Section 404 permitting process.

Because the wetland and upland wildlife mitigation measures are intended to provide full mitigation for project impacts, there would be no residual impacts.

3.12 Threatened and Endangered Species

3.12.1 Affected Environment

No plant species currently receiving protection under the Endangered Species Act are known to exist in the project area/action area.

A biological assessment of potential effects on endangered, threatened, and candidate wildlife and fish species was conducted in October 1991 and was amended three times, in July 1994, March 1997, and February 1999 for the Narrows Project in compliance with Section 7(c) of the Endangered Species Act of 1973 (appendix C). Federally listed or otherwise protected species addressed in the assessment included: bald eagle (*Haliaeetus luecocephalus*), greater sage grouse (*Centrocercus urophasianus*), Colorado pikeminnow (*Ptychocheilus lucius*), bonytail (*Gila elegans*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*).

The bald eagle, now delisted by the Service, was listed as an endangered species in 1967. Historically, the bald eagle was a resident of Utah but currently occurs primarily as a winter visitant. Of the 10 known historic nest sites (4 sites currently occupied), none are in the vicinity of the proposed Narrows Project.

Golden eagles, which are protected under the Bald and Golden Eagle Protection Act, may use the area around the proposed dam and reservoir.

The Colorado pikeminnow evolved as the main predator in the Colorado River system. Larval pikeminnow measuring less than 40 mm subsist on diets of plankton and macroinvertebrates; pikeminnow between 40–80 mm begin to become piscivorus (fish eating); and those measuring more than 80 mm are entirely piscivorus. Fish less than 80 mm are considered larval or YOY fish. The Colorado pikeminnow is the largest cyprinid fish (minnow family) native to North America and, during the predevelopment period, may have grown as large as 6 feet in length and weighed nearly 100 pounds. The Colorado pikeminnow currently occupies about 1,000 river miles in the Colorado River system and is presently found only in the Upper Colorado River Basin above Glen Canyon Dam. Since 1995, as many as 20 adult pikeminnow, 1 in breeding condition, have been caught in the Price River and individually marked. It is currently unknown whether Colorado pikeminnow use the Price River year round. Colorado pikeminnow have been located in the Price River from April–October. Their known range in the Price River extends from the confluence with the Green River upstream almost 90 miles to the Farnham Diversion near Wellington. Further study is needed to determine the pikeminnow's seasonal use of the Price River and to identify the extent to which pikeminnow use the Price River.

Little is known about the biological requirements of the bonytail, as the species greatly declined in numbers in the Upper Colorado River Basin shortly after 1960. Bonytail are considered extremely rare or functionally extirpated from the Upper Colorado River Basin. Occasional captures of *Gila* individuals show bonytail characteristics; however, no wild populations are known to exist.

The humpback chub generally does not make migrational movements in the Upper Colorado River and tends to reside throughout the year within a limited reach of the river. The species is found in narrow, deep canyon areas and is relatively restricted in distribution, seldom leaving its canyon habitat. None have been found in the Price River.

Historically, the razorback sucker was abundant throughout the Colorado River Basin. At present, the only concentrations occur in the Green River in the Upper Colorado Basin and Lake Mojave in the Lower Colorado Basin. Catch-effort estimates suggest that adult razorback suckers are rarer than other native suckers and the endangered Colorado pikeminnow. An immediate goal for razorback sucker recovery is to prevent the species' extinction in the wild. A draft recovery plan has been developed for the razorback sucker.

The Service wrote to Reclamation, identifying the southwestern willow flycatcher (SWWF) as an additional endangered species present at a site known as Fish Creek in the proximity of the Narrows Project, and advised Reclamation that an amendment to the biological assessment would be necessary. An amended biological assessment was submitted to the Service on February 5, 1999. A final *Recovery Plan for the Southwestern Willow Flycatcher* was prepared by Region 2 of the Service and signed August 30, 2002.

Based on recent information, the Service "believes that the willow flycatcher found at the Fish Creek site is not the endangered subspecies, the southwestern willow flycatcher." No discussion was offered specifically in reference to the endangered subspecies, *E.t. extimus* from the Service. To date, the following information was used to identify the subspecies:

- ♦ The willow flycatcher subspecies inhabiting the riparian corridor in the proposed Narrows Project proximity is located at the extreme northern boundary of *E.t. extimus* but within the range of *E.t. adastus*, an unlisted species. Experts suggest that the central part of the State of Utah is probably an area of intergradation between *E.t. extimus* and *E.t. adastus* (Behle, 1985).
- ♦ Research data confirms that this willow flycatcher population is probably not the endangered *E.t. extimus* subspecies but is more likely to be *E.t. adastus* (Paxton et al., 2008).
- ♦ Vocalization analysis has determined the population to be *E.t. adastus* (personal communication, Dr. Jim Sedgwick, 1999). However, these results have yet to be published or peer reviewed.

Greater sage grouse were listed as a candidate species under the ESA in 2010. The Narrows Dam and Reservoir are proposed to be constructed within potential brood rearing and foraging habitat.

3.12.1.1 Conservation and Other Special Species

A distinct population segment (DPS) of the Columbia spotted frog, *Rana luteiventris*, occurs in the San Pitch drainage and is part of what is known as the Wasatch Front population. A conservation agreement for this DPS was signed by Reclamation, the

Service, as well as others. Subsequently, on April 2, 1998, the Service removed the Wasatch Front population from the candidate species list.

The San Pitch drainage site, located near Fairview, was surveyed for spotted frog in 1991–92 and again in 1997. In 1991–92, the estimated number of breeding individuals in the population was 108; while in 1997, the estimate was 48 individuals.

Specifically within the project boundaries, two spotted frogs were found near Oak Creek at the northern terminus of the proposed water delivery pipeline. A *Conservation and Management Plan for Three Fish Species in Utah* was published September 2006. This document was developed to prevent the Federal listing of three Utah State sensitive species. These are roundtail chub (*Gila robusta*), bluehead sucker (*Catostomus discobolus*), and flannelmouth sucker (*Catostomus latipinnis*).

These species historically occupied the Price River. Roundtail chub have been extirpated from the river. Bluehead sucker and flannelmouth sucker exist in the river below the Farnham Diversion Dam, which acts as a barrier to upstream fish migration. This diversion is located approximately 3 miles southeast of Wellington, Utah, in Carbon County

Migratory birds seasonally inhabit the project area. These species are listed in table 3-24. The table indicates that three of the birds are listed under the Utah Comprehensive Wildlife Conservation Strategy as at-risk and declining species in need of conservation.

3.12.2 Methodology and Impact Indicators

Water depletions in the Upper Colorado River Basin have been recognized as a major source of impact to endangered fish species. Continued water withdrawal has restricted the ability of the Colorado River system to produce flow conditions required by various life stages of the fishes.

Table 3-24.—Birds in the Project Area.

Greater sage grouse[1]	Eared grebe
Bald eagle	Ferruginous hawk[1]
Golden eagle	Peregrine falcon
Yellow rail	Snowy plover
Long-billed curlew	Marbled godwit
Yellow-billed cuckoo	Flammulated owl
White-headed woodpecker	Calliope hummingbird
Black-chinned sparrow	Williamson's sapsucker
Black swift	Willow flycatcher
Loggerhead shrike	Pinyon jay
Sage thrasher	Virginia's warbler
Green-tailed towhee	Brewer's sparrow
Lewis's woodpecker[1]	Sage sparrow
Tricolored blackbird	Black rosy-finch

[1] Species of concern.

The importance of the Green River and its tributaries to endangered fish was established by the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin (RIP) and recognized by many biologists as noted in the recovery plans for each of the species. The Service identified water, physical habitat, and biological environment as the primary constituent elements of critical habitat. This includes a quantity of water of sufficient quality that is delivered to a specific location in accordance with a hydrologic regime that is required for the particular life stage for each species.

The RIP (Chart et al., 2011) studied the proposed Narrows Project and the Price River and recommended relevant to the Proposed Action:

1. Base flows in the lower Price River of at least 30 cfs and that opportunities be investigated to increase the frequency of time when base flows exceed 30 cfs in the lower Price River.

2. Securing a pool of water (e.g., 600 acre-feet or 5 cfs for 60 days) that could be delivered in July and August to the Woodside, Utah, gauge to avoid periods of dewatering.

Based on these RIP recommendations, the volume of water in the Price River at its confluence with the Green River and at Woodside are indicators for endangered fish.

Important habitat requirements for the SWWF include space for individual and population growth; food, water, air, light, minerals, or other nutritional or physiological needs; cover or shelter; sites for breeding, reproduction, and rearing of offspring; and habitats that are protected from disturbance or are representative of the historic geographical or ecological distribution of the species.

The impact indicator for this issue is acre-feet of water depleted from the Colorado River system. This indicator is critical for the Colorado endangered fish species and is a key habitat requirement for the SWWF.

3.12.3 Predicted Effects

3.12.3.1 No Action Alternative

Under No Action, listed species would continue to be present in the project area, including the Colorado pikeminnow, bonytail, humpback chub, razorback sucker, and possibly the SWWF Under No Action, the willows that serve as habitat or potential habitat along Gooseberry and Fish Creeks might decline over time, and the habitat of SWWFC become reduced.

3.12.3.2 Proposed Action Alternative

Project impacts to threatened or endangered species were evaluated by Reclamation in a biological assessment and submitted to the Service. Subsequently, the Service issued a final biological opinion on August 24, 2000, (appendix C), finding that the proposed project would have no effect upon the bald eagle, which was subsequently delisted in 2007. The Service believes that the willow flycatcher found at the Fish Creek site is not the endangered subspecies; therefore, no discussion was offered specifically in reference to the SWWF.

The Service concluded that the project and associated depletion of water from the Colorado River system is likely to jeopardize the continued existence of the four endangered Colorado River fishes and to destroy or adversely modify designated critical habitat in the Green and Colorado Rivers from the confluence of the Price and Green Rivers downstream to Lake Powell.

The RIP for Upper Colorado River Basin Endangered Fish Species serves as the reasonable and prudent alternative (RPA) to avoid the likelihood of jeopardizing the continued existence of these listed species or the destruction or adverse modification of their critical habitat.

Reclamation suggested the following actions be developed into the RIP's Recovery Action Plan to offset the proposed Narrows Project impacts to the Price River and these endangered fish species:

1. Payment of a one-time financial contribution by SWCD to the RIP. The current depletion charge is $18.29 per acre-foot (2009 figure); and when multiplied by the project's 5,597-acre-foot average, annual depletion of flows to the Colorado River system amounts to a financial contribution of $102,369

to the RIP. The Service will notify SWCD of the current depletion charge by September 1 each year. On July 13, 1995, SWCD made a partial payment of $7,063, 10% of the total depletion charge as identified in the January 9, 1995, Biological Opinion.

2. The RIP would agree to provide funding for continuing the Price River endangered fish studies.
3. The RIP would secure water rights on the Price River that could be used to maintain instream flows during critical times of the year for Colorado pikeminnow.

These items have been incorporated into the RPA and have been identified in the fiscal year 2001 RPA.

The Service also included in the RPA the recommissioning of the discharge gauge located at Woodside in the lower Price River. The Recovery Program funded USGS to bring the Woodside, Utah, gauge back online in August 2000, and it has been functioning ever since.

Reliance on the RIP to serve as the reasonable and prudent alternative for project impacts is dependent upon the RIP making sufficient progress. In the event sufficient progress is not made by the RIP, re-initiation of consultation would be required. Payment of the depletion charge would be made by SWCD prior to beginning construction.

Initially, the Service issued a biological opinion in March 1992. Consultation was re-initiated in 1994 as a result of the Service's designation of critical habitat for the four endangered Colorado River fishes and again in 1995 after new information arose about the presence of Colorado pikeminnow in the Price River. The Service issued a biological opinion in January 1995, an amended biological opinion in October 1995, a biological opinion on December 13, 1999, and the final biological opinion on August 24, 2000 (appendix C), that addresses project impacts to designated critical habitat and the Price River. As an element of the RPA to the Narrows proposal, the Recovery Program was directed under the 2000 biological opinion to fund a study to determine seasonal endangered fish use in the Price River and develop recommendations for year-round instream flow requirements in the Price River for Colorado pikeminnow. The Recovery Program has completed field investigations to address this element of the reasonable and prudent alternative and is planning to release a summary of flow requirements for internal committee review and approval. The Recovery Program prepared a draft document titled "The Upper Colorado River Endangered Fish Recovery Program's Position on the Role of the Price River in Recovery of Endangered Fish and the Need for Flow Management." This position paper recommended that:

1. The Recovery Program should work with Utah Water Users and the State of Utah to investigate opportunities to support flows in the lower Price River and minimize periods of streamflow less than 30 cfs.
2. In support of the Three Species Conservation Agreement, the Recovery Program recommends that any future water development projects (e.g., Price-Narrows) incorporate some mechanism to secure an emergency native fish pool of water that could be delivered (most probable in July and August) to the Woodside, Utah, gauge to avoid periods of dewatering in the lower Price River. For example, a 600-acre-foot pool could support an instream flow of 5 cfs for 60 days, provided it could be delivered to the Woodside, Utah, gauge.

Because the project would result in a depletion of water to the Price River and reduced spills from Scofield Reservoir, there is, at this time, some uncertainty about what effect the project would have on the timing, duration, and magnitude of flows in the portion of the Price River used by Colorado pikeminnow. Further study of the extent to which pikeminnow use the Price River and other tributaries is needed before conclusions can be made regarding the importance of Price River flows in recovery. If flow recommendations are approved and implemented, further study may be necessary to assess response of endangered fish over a range of hydrologic conditions.

Reduced flows to Fish Creek, as a result of the Narrows Project, may affect SWWF through reduction in availability of tall, thick stands of willows and reduction of standing water and saturated soils, both typical components of their breeding habitat.

During the critical growing season, willow seedling establishment can be reduced or eliminated from a riparian system if flows are reduced to such an extent that gravel bars and other probable seed nursery sites are no longer wetted. Seedling establishment is the primary means of willow regeneration and, at the proposed project elevation and latitude, occurs in early July through late August. The average annual depletion to Fish Creek is 18%. Depletions are highest in May (18%), June (24%), July (13%), August (16%), and September (17%). Stage changes of the above levels, because they occur during the growing season, are large enough to potentially cause severe impediment of willow seedling establishment.

The Narrows Project plan includes proposed modifications to portions of the Gooseberry Creek channel. These modifications include narrowing the channel to maintain the depth of flow. In designing the stream channel modifications, the intent would be to create a stream channel that is more naturally suited to the new flow regime and that will have the same depth of flow as under baseline conditions. Therefore, the depth of ground water adjacent to the stream would not decrease, nor would there be any adverse effects on riparian and wetland vegetation adjacent to the streams.

As stated earlier, there is no Service-designated or proposed critical habitat for the SWWF in Utah; therefore, there is no adverse modification of existing or proposed critical habitat.

Prior to construction of the proposed project, greater sage grouse habitat would be surveyed for any use by these birds. If active nests are found in the area, construction would be delayed until these birds have left their nests, probably in early June.

A survey for golden eagle nest use would be conducted prior to construction. If active nests are found, construction activities within 0.5 miles of the nest would not be allowed from January 1–August 31.

With respect to the DPS of the Columbia spotted frog that occurs in the action area, Reclamation and SWCD would cooperate in implementing the measures prescribed in the *Spotted Frog Conservation Agreement and Strategy* should the loan and use of Federal land be approved.

3.12.3.3 Mid-Sized Reservoir Alternative

There would be a 5,298-acre-foot-per-year depletion to the Colorado River, which could affect the Colorado pikeminnow, bonytail, humpback chub, and razorback sucker.

Incidental take of Colorado pikeminnow, humpback chub, bonytail, or razorback sucker is not anticipated under this alternative, nor would it be authorized.

It was assumed that the same criteria applied to the Proposed Action to offset project depletion impacts could be applied proportionately to the Mid-Sized Reservoir Alternative. This would result in a one-time contribution of $96,900 (5,298 acre-feet multiplied by the 2009 depletion charge of $18.29) to the Recovery Program. Other conservation measures described for the Proposed Action also would be implemented under this alternative.

Under the provisions of the Endangered Species Act, there would be no irreversible impacts to endangered species as a result of implementing the Mid-Sized Reservoir Alternative. In the event sufficient progress is not achieved under the RIP, re-initiation of consultation would be required to discuss additional conservation measures.

The impacts to the SWWF under the Mid-Sized Reservoir Alternative would be the same as those under the Proposed Action.

Prior to construction of the proposed project, greater sage grouse habitat would be surveyed for any use by these birds. If active nests are found in the area, construction would be delayed until these birds have left their nests, probably in early June.

A survey for golden eagle nest use would be conducted prior to construction. If active nests are found, construction activities within 0.5 miles of the nest would not be allowed from January 1–August 31.

3.12.3.4 Small Reservoir Alternative

There would be a 4,841-acre-foot-per-year depletion to the Colorado River that could affect the Colorado pikeminnow, bonytail, humpback chub, and razorback sucker.

Incidental take of Colorado pikeminnow, humpback chub, bonytail, or razorback sucker is not anticipated under this alternative, nor would it be authorized.

It was assumed that the same criteria applied to the Proposed Action to offset project depletion impacts could appropriately be applied to the Small Reservoir Alternative. This would result in a one-time contribution of $88,542 (4,841 acre-feet multiplied by 2009 depletion charge of $18.29) to the Recovery Program. Other conservation measures described for the Proposed Action also would be implemented under this alternative.

Under provisions of the Endangered Species Act, there would be no irreversible impacts to endangered species as a result of implementing the Small Reservoir Alternative. In the event sufficient progress was not achieved under the RIP, re-initiation of consultation would be required to discuss additional conservation measures.

The impacts to the SWWF under the Small Reservoir Alternative would be the same as with the Proposed Action but proportionately reduced.

Prior to construction of the proposed project, greater sage grouse habitat would be surveyed for any use by these birds. If active nests are found in the area, construction would be delayed until these birds have left their nests, probably in early June.

A survey for golden eagle nest use would be conducted prior to construction. If active nests are found, construction activities within 0.5 miles of the nest would not be allowed from January 1–August 31.

3.12.4 Conservation and Other Special Status Species Impacts

The spotted frog is not a federally listed species. However, potential project impacts to the species have been considered. A survey of historic spring and wetland habitat along the San Pitch River was conducted, and spotted frogs were found to be present within the project area. Increased flows in the San Pitch River associated with any of the construction alternatives of the project could benefit the springs and wetlands that comprise spotted frog habitat along the San Pitch River by increasing water quantity. On the other hand, if spotted frog habitat receives return flows from irrigation, habitat quality could be diminished by virtue of the conservation measures. If a construction alternative is implemented, the net effect of the project, together with the conservation measures, would probably be a slight net reduction dispersed over a large area.

Three fish species, including roundtail chub, bluehead sucker, and flannelmouth sucker, are Utah State-listed sensitive species. Although roundtail chub historically inhabited the Price River, they have been extirpated from the system. The bluehead sucker and the flannelmouth sucker exist in the Price River below the Farnham Diversion Dam, which is approximately 3 miles southeast of Wellington, Utah. This structure effectively eliminates upstream fish migration. Reaches of the Price River below this structure are a significant distance from the Proposed Narrows Dam. Effects to flows associated with this project would be attenuated to the point of insignificance as measured at the Farnham Diversion Dam. Therefore, the proposed project would have no effect on these fish species.

Migratory bird species and their habitat would be temporarily disturbed during construction activities. The long-term effects of altering flows in the various drainages described in this FEIS would be of significance. However, the FEIS proposes several mitigative measures to provide improved and additional wetland habitats that these species rely on.

3.13 Vegetative Resources

3.13.1 Affected Environment

Major plant communities occurring in the project area have been mapped (see figure 3-11) and include vasey sagebrush, silver sagebrush, and wetlands. Wetlands are discussed separately below.

There are also areas within the basin that have been disturbed previously by diverting water to Cottonwood Canyon through the existing Narrows Tunnel. In addition, there are those disturbed areas associated with SR-264 that cross the north end of the basin.

A summary of vegetated areas affected by the project is listed in table 3-25.

Table 3-25.—Narrows Project Summary of Affected Vegetated Areas

Area	Acres
Reservoir basin	604
Wetland mitigation	220
Upland mitigation	790
Fisheries mitigation	90
Pipelines	63
SR-264 relocation	34
Recreational areas	12
Materials source	2
Total	1,815

3.13.1.1 Vasey Sagebrush Community

This community is the driest of the three major plant communities in the basin. It exists on the more well-drained soils of the upland slopes. The vasey sagebrush community comprises 55% (331 acres) of the reservoir basin. Dominant woody plant species of the community include vasey sagebrush (*Artemisia tridentata* var. *vaseyana*), low rabbitbrush (*Chrysothamnus viscidiflorus*), and snowberry (*Symphoricarpos oreophilis*).

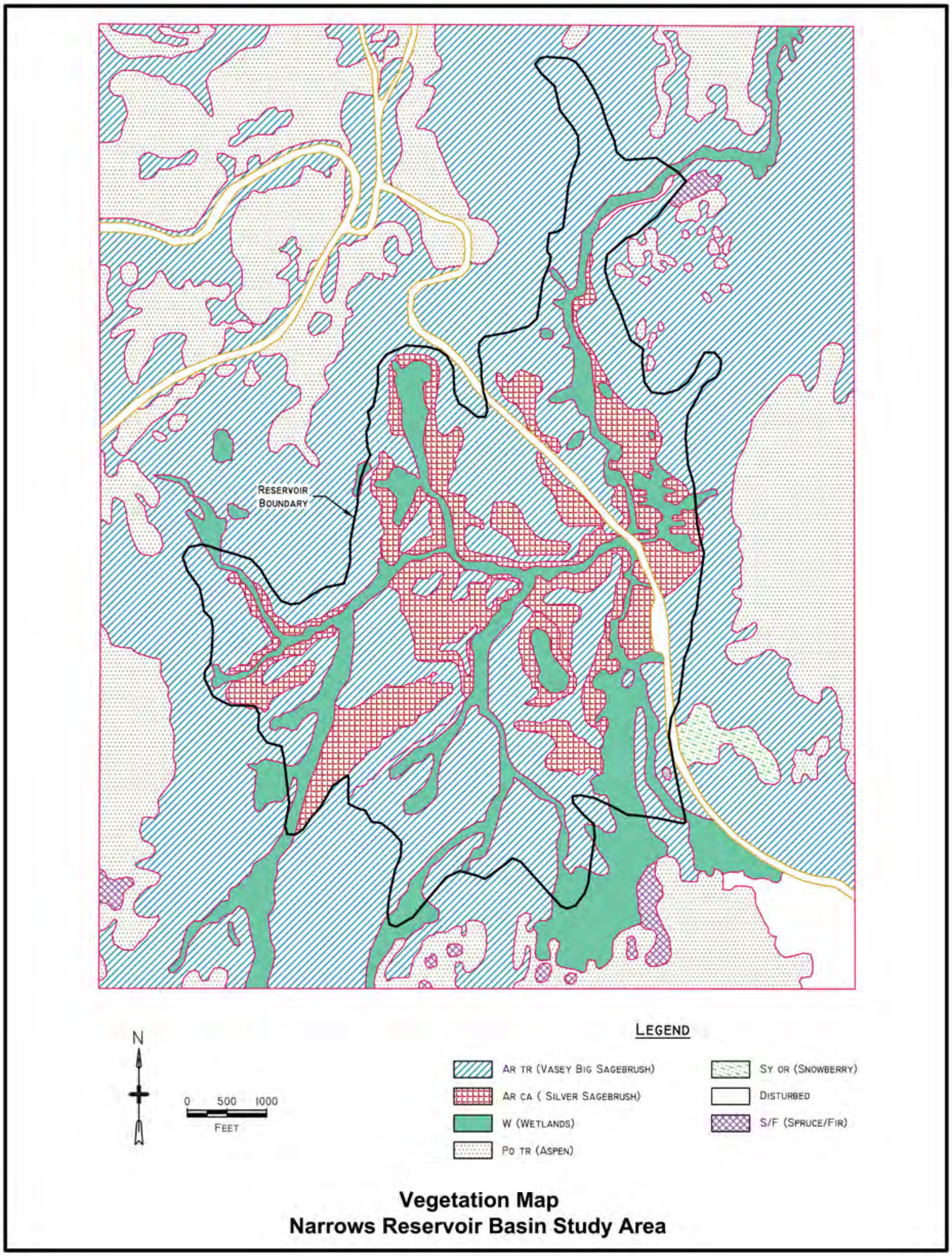


Figure 3-11.—Narrows Reservoir Basin Study Area Vegetation Map.

Dominant forbs are Pacific aster (*Aster chilensis*), yarrow (*Achillea millefolium*), and orange sneezeweed (*Helenium hoopsii*). The dominant grasses are represented by slender wheatgrass (*Elymus trachycaulus*), Letterman needlegrass (*Stipa lettermanii*), and mountain brome (*Bromus carinatus*).

Range analysis studies were conducted by the USDA Forest Service on federally owned land near the project area. Total annual production ranged from 682–949 dry pounds per acre.

3.13.1.2 Silver Sagebrush Community

The silver sagebrush community lies immediately below (downslope) the vasey sagebrush community and comprises 26% (156 acres) of the basin. The soils of this community occur on both level and sloped terrain but generally are on the less well-drained and flatter areas. Consequently, they support more mesic shrub species—for example, silver sagebrush (*Artemisia cana*) and shrubby cinquefoil (*Potentilla fruticosa*). Forb species include penstemon (*Penstemon* spp.), varileaf phacelia (*Phacelia heteophylla*), and silver cinquefoil (*Potentilla anserina*). Grasses dominant in the area are orchardgrass (*Dactylis glomerata*), and Kentucky bluegrass (*Poa pratensis*).

3.13.1.3 Previously Disturbed Areas

The total previously disturbed area within the reservoir basin was calculated to be about 17 acres or 2%. Table 3-26 is a summary of vegetation communities found in the reservoir basin.

3.13.1.4 Noxious Weeds

Both the Utah Noxious Weed Act (Utah Code 4-17 et seq.) and the *Manti-LaSal Forest Plan* identify invasive species and noxious weeds. Of these species of concern, there are extensive stands of Dalmation toadflax (*Linaria dalmatica*) and some scattered musk thistle (*Carduus nutans*) that occur in the reservoir basin area, primarily on private land. These noxious weeds occur primarily in the sagebrush communities and, to a lesser extent, in the wetland areas.

Table 3-26.—Vegetation Communities in the Reservoir Basin[1] of the Proposed Action

Affected Type	Acres
Vasey sagebrush	331
Silver sagebrush	156
Wetland communities	100
Previously disturbed	17
Total	604

[1] An almost negligible amount (<1%; 0.18 acre) of aspen forest also could be affected within the reservoir basin.

3.13.1.5 Plant Communities Adjacent to the Reservoir Basin

Major plant communities that exist within the immediate area, but are not within inundation areas, include vasey sagebrush, snowberry, aspen, and spruce/fir (see figure 3-11).

3.13.1.6 Other Plant Communities

Other plant communities were studied as part of the existing environment, which could be affected by the proposed project. Foothill areas along the west side of the Wasatch Plateau would be dissected with the conveyance pipelines. Plant communities found in those areas include valley sagebrush, scrub oak, grassland, and mountain brush.

3.13.2 Methodology and Impact Indicators

The Narrows Reservoir basin was identified as the area that would be most significantly impacted by the proposed project. For this reason, vegetation of the basin was studied in more detail than the other areas associated with the project. Other areas also would be directly affected by the proposed project as a result of reservoir inundation, construction disturbance, and mitigation.

Potential impacts on vegetative resources are considered significant if project implementation results in any loss of wetland acreage (extent) or function. Based on this criterion, all impacts on wetlands and riparian communities would be significant because of the loss of acreage and function prior to implementing mitigation measures.

Potential impacts on aquatic resources in streams are considered significant if project construction, implementation, or long-term operation would cause a loss of stream length due to inundation by the reservoir or stream reaches affected by the increase or decrease in flow.

Impact indicators for this issue include the number of miles of stream lost due to inundation of the reservoir or the number of miles of stream affected by flow.

3.13.3 Predicted Effects

3.13.3.1 No Action Alternative

Vegetative conditions are expected to remain the same as baseline conditions if the project were not constructed and if there were no other future developments.

Noxious weeds have the potential to spread. Control must be performed by the landowner or Sanpete County.

3.13.3.2 Proposed Action Alternative

A hydrologic study conducted on the potential impacts to the riparian vegetation of Gooseberry Creek by decreased flows suggested only a minor impact to the riparian vegetation. Flow measurement conducted by the State Engineer's office indicated that the stream was a "gaining stream." This means that the depth of the ground water table adjacent to the stream corresponds directly with the water surface of the stream—that is, an increase or decrease in stream water level results in the corresponding increase or decrease in the elevation of the ground water table. Moreover, the project plan includes channel modification work in the middle segment of Gooseberry Creek to keep the flow levels up. Because the depth of flow in the stream would not be reduced significantly under the project, the depth of the ground water table adjacent to the stream should not be expected to be lowered.

A lack of overbank flooding due to stream regulation can result in an absence of recruitment of younger age classes of natural riparian vegetation such as cottonwood trees and willows. Overbank flooding, particularly on larger streams and rivers, both scours the banks, providing a new seedbed, and transports and deposits seed thereon. The reduction of overbank flows appears to be the result of stream regulation—that is, placing a smaller stream into a larger channel formed by larger peak flows of the unregulated stream or river.

At the proposed project, this effect would be offset by the channel modifications on Middle Gooseberry Creek, whereby the channel actually would be sized down to match the postdam stream. Base flows would be provided from the Narrows Project, but overbank flooding also still should occur as the result of natural local events such as thunderstorms, as well as from periodic flushing flow releases from the proposed Narrows Reservoir. Given the relative size of Gooseberry Creek (i.e., as compared to larger streams), the likelihood of actual scouring would be no greater than under predam conditions, but seed spreading and propagation most probably would remain similar under postdam conditions as under predam conditions. Therefore, the riparian vegetation should not be adversely affected by the project. (See also the discussion of "Wetland Resources" under section 3.14.3.2.)

Because the Narrows Project water would be added only to the flow (if any) of Cottonwood Creek when that creek is flowing well below its channel capacity, there would be no period of extended overbank flooding resulting from the Proposed Action. Flooding would result, both predam and postdam, only when the natural flow in the Cottonwood Creek basin is high. Project releases would not be added on top of such peak flows, nor would they be added to lower flows to produce additional floods. As a result of existing diversions, Cottonwood Creek is now dry much of the summer and fall. Project releases simply would provide a longer period of wetted channel, which should benefit riparian vegetation (see additional discussion in section 3.14).

The areas that are disturbed during construction have a high probability of being infested by noxious weed species. People using the area may spread the weeds by carrying the seeds on their person or on their vehicles. Seeds will get into the water and be spread downstream in both Gooseberry Creek and Cottonwood Creek. Control of noxious weeds as part of the Narrows Project would be the responsibility of SWCD.

Areas along the foothills of the west side of the Wasatch Plateau would be dissected with the diversion pipelines. Plant communities such as big sagebrush (*Artemisia tridentata var. tridentata*), gamble oak (*Quercus gambelii*), grasslands, and mountain brush communities, along with their associated wildlife species, would be disturbed by the conveyance pipelines. These disturbances, however, would be only temporary because the pipelines would be buried. Revegetation that reflects the existing plant community would be accomplished with a mixture of grasses, forbs, and shrubs. A total of 30 acres along a 17-mile-long alignment would be disturbed by the pipeline construction.

The reservoir basin was identified to receive the most significant impact by the proposed project. For this reason, the reservoir basin was studied in greater detail than the other areas associated with the project. The affected wetlands in this area occur in a dendritic pattern in the riparian zones along small drainages. As shown in table 3-26, plant communities that would be highly impacted by reservoir inundation include vasey sagebrush, silver sagebrush, and wetlands. All vegetation in the 604 acres listed in the table would be inundated by the reservoir. (See table 3-26 for acreage breakdown by vegetative type.)

3.13.3.3 Mid-Sized Reservoir Alternative

Impacts to vegetation resulting from implementing the Mid-Sized Reservoir Alternative would be similar to those resulting from construction of the Proposed Action. The primary difference would be the smaller amount of acreage (489 acres) that would be inundated by the proposed Narrows Reservoir. This area includes 81 acres of wetlands. The affected wetlands in the reservoir basin occur in a dendritic pattern in the riparian zones along small drainages. Other impacts to vegetation would be similar to those experienced under the Proposed Action.

3.13.3.4 Small Reservoir Alternative

Impacts to vegetation resulting from implementing the Small Reservoir Alternative would be similar to those resulting from construction of the Proposed Action. The primary difference would be the smaller amount of acreage (362 acres) that would be inundated by the proposed Narrows Reservoir. This area includes 72 acres of wetlands. The affected wetlands in the reservoir basin occur in a dendritic pattern in the riparian zones along small drainages. Other impacts to vegetation would be similar to those experienced under the Proposed Action.

3.14 WETLAND RESOURCES

3.14.1 Affected Environment

The wetland community lies near the bottom of the basin and comprises 17% of the basin. The wetlands affected by the project are not unique to the area, consisting of wetland plant communities common to high elevation mountain areas. Cattle and sheep were introduced into the area in the 1800s and, subsequently, overgrazed the vegetation to the extent that rangeland restoration was necessary. In 1908, the USDA Forest Service established a controlled grazing plan for rangelands on the Manti-La Sal National Forest. Cattle and sheep grazing are still allowed in this area under USDA Forest Service control.

Within the proposed reservoir basin, water collects and forms meadows, wetlands, and, ultimately, small creeks that converge to Gooseberry Creek. Wetland communities are composed of wet meadows, riparian sedge, and willow thickets. The wet meadows are formed in topographic depressions located adjacent to some of the streamside vegetation and on higher ridges where seeps occur. They consist of plant species such as rushes (*Juncus* spp.), sedges (*Carex* spp.), and various hydric grasses, including tufted hairgrass (*Deschampsia caespitosa*). Similar in species and composition are the riparian sedge communities, which occur in a dendritic pattern along small drainages. They also consist of various rushes, sedges, and grass species, which form narrow bands (usually 3–6 feet wide) of streamside vegetation common to the area. Less common in the reservoir basin are willow thickets, occurring primarily in the upper reaches of the proposed inundation level, usually along stream channels in the basin and along Gooseberry Creek and in Cottonwood Creek. Willow species include Drummond's willow (*Salix drummondiana*), Booth willow (S. *boothii*), and Wolf willow (*S. wolfii*).

Former wetlands being considered as a mitigation alternative are located adjacent to Mud Creek near Scofield. In addition to Mud Creek, numerous springs emerge from the nearby side hill. The creek and springs should provide an ample water supply for wetland vegetation. This area, however, currently is overgrazed and often is covered by weedy plant species, but it has the potential of supporting stable, wetland plant communities. In addition, the streambanks have been severely damaged by cattle that are kept on the land.

Both USACE and EPA have jurisdiction over wetlands for the Narrows Project. USACE is responsible for issuing permits for activities in waters of the United States. The combined jurisdictional wetlands of the basin study area constitute 89 acres of the reservoir basin. Of the 89 wetland acres that exist in the reservoir basin, the riparian sedge and meadows comprise about 63%; whereas, the willow thickets comprise nearly 37%. Previous wetland losses within the reservoir basin include less than 0.5 acre associated with construction of SR-264.

For a map showing the wetland communities within the basin study area, refer to figure 3-11.

3.14.2 Methodology and Impact Indicators

A wetland delineation for the reservoir site was completed in 1991–92 following the procedures outlined in the USACE manual.

In 2003 at the request of the Utah Regulatory Office of the USACE, a wetland delineation verification was performed for a portion of the area within the proposed Narrows Reservoir. The 2003 delineation was verified by the USACE on January 13, 2004. The 2003–04 delineation and re-verification covered approximately 349 acres of the proposed reservoir, representing45% of the proposed reservoir area.

In 2003, it was found that the 1992 wetlands map was generally accurate; but because of methods used to create the 1992 map and possibly because of change in vegetation over time, the wetland delineation verification in 2003 was 24.53 acres out of the 349 acres examined. From this, the 2003 study extrapolated that the entire reservoir area contained 71 acres of wetlands.

Re-verification of the wetland delineation was performed in 2009. In 2009, the overall estimated wetlands were 89 acres. Because the original 1992 wetland delineation of 100 acres was generally accurate, data from that delineation were used in this FEIS for mitigation.

Because the primary function of wetlands is wildlife habitat, HEP was used to evaluate the wetland values. This is a "species habitat" approach to impact assessment of habitat quality. The program uses selected species for indicators to evaluate habitat for a host of other species, with the assumption that these indicator (evaluation) species are functioning units of part of an ecosystem. Impact to a particular indicator species assumes that there also would be impacts to the group of other species it represents.

The HSI were ascertained for each evaluation (indicator) species. These indices range from 0.0–1.0, with each increment of change identical to the next. An HSI value is linearly related to the carrying capacity of the species. An HSI of "1.0" would represent the optimum habitat for the particular evaluation species, whereas "0.0" would represent habitat that is unsuitable.

The HEP analysis is an indicator of the function and value of wetlands lost. Another important impact indicator is the total number of acres of wetlands lost as a result of the Narrows Project. Based on these criteria, all impacts on wetlands would be important because of the loss of acreage and function prior to implementing mitigation measures.

3.14.3 Predicted Effects

3.14.3.1 No Action Alternative

Wetland conditions are expected to remain the same as baseline conditions if the project were not constructed and if there were no future developments. Based on the 2009 re-verification of the wetlands in the project area, there are 89 acres of jurisdictional wetlands.

3.14.3.2 Proposed Action Alternative

The proposed Narrows Reservoir would inundate 89 acres of wetlands.

Hydrologic and hydraulic studies were conducted to determine the potential impacts to the riparian and wetland vegetation of Gooseberry Creek resulting from decreased flows. Flow measurements conducted by the Utah Division of Water Rights indicate that the stream is a "gaining stream." This means that the streamflow increases as it moves downstream because the stream is being fed by the adjacent ground water aquifer. Because the stream is serving as a drain for the ground water system, an increase or decrease in stream water level would result in a corresponding increase or decrease in the elevation of the ground water table adjacent to the stream.

Water surface profile studies were conducted to determine the depth of flow in Gooseberry Creek between the Narrows damsite and Lower Gooseberry Reservoir. The studies indicated that, with the reduced flows proposed by the Proposed Action and with the existing stream cross section, the depth of flow would decrease by 6–11 inches under worst-case conditions. However, the project plan includes proposed modifications to this portion of the Gooseberry Creek channel. These modifications include narrowing the channel to maintain the depth of flow. In designing the stream channel modifications, the intent would be to create a stream channel that is more naturally suited to the new flow regime and that will have the same depth of flow as under baseline conditions. Therefore, the depth of ground water adjacent to the stream would not decrease, nor would there be any adverse effects on riparian and wetland vegetation adjacent to the stream. If anything, it is entirely possible that the wetland communities would be enlarged as a result of the project impacts; the current outer bounds of those communities probably would be unchanged as a result of the shallow ground water flowing toward the stream, but the wetlands probably would be increased precisely to the degree that the stream channel itself (or at least, the open water surface of the stream) narrows.

The process of narrowing the stream, as described in the FEIS, is planned so that the configuration of the narrowed streambanks would conform to that of the original streambank with respect to slope, materials, material size, and frequency as well as the water depth. The only change would be in the width of the channel and available open water surface. The result is that the same opportunity for overbank flows and wetted perimeter would exist as in the natural configuration. The gaining nature of the stream in this reach means that ground water is flowing toward and into the stream channel and that the stream does not provide the primary supply for the riparian community. The “wetted perimeter,” therefore, should continue to be supplied from this source; and the stream will continue to gain as it flows. Bank saturation will not be affected here, as it would on many streams, because the direction of the ground water flows into the stream rather than away from it. While overbank flows may be reduced in frequency, such flows, for this same reason, also are not critical to the bank saturation that supports the riparian community.

About 160 square feet (0.004 acre) of wetlands adjacent to Cottonwood Creek would be impacted by constructing the discharge structure at the end of the Upper Cottonwood Creek Pipeline. The other proposed pipelines would not affect wetlands.

3.14.3.3 Mid-Sized Reservoir Alternative

Impacts to wetlands resulting from implementing the Mid-Sized Reservoir Alternative would be similar to those resulting from construction of the Proposed Action. The primary difference would be the smaller amount of acreage (81 acres of wetlands) that would be inundated by Narrows Reservoir.

3.14.3.4 Small Reservoir Alternative

Impacts to wetlands resulting from implementing the Small Reservoir Alternative would be similar to those resulting from constructing the Proposed Action. The primary difference would be the smaller amount of acreage (72 acres of wetlands) that would be inundated by Narrows Reservoir.

3.14.4 Mitigation

Wetland mitigation measures are included in the project alternatives to compensate for impacts to wetlands. The wetland mitigation measures would provide similar wildlife habitat values for those potentially lost due to the proposed inundation of the reservoir should the project be built.

3.14.4.1 Proposed Mitigation – Mud Creek Area

The proposed mitigation would restore and create wetlands adjacent to Mud Creek near Scofield. This measure would entail purchasing about 220 acres of private land adjacent to Mud Creek, south of Scofield Reservoir. Portions of this land contain wetlands that have been severely damaged by past livestock grazing practices. The remaining portions are upland. It is anticipated that, by removing livestock, the wetland vegetation would return on its own with little or no other outside measures. Stream channel improvements on the Mud Creek channel would create additional wetlands adjacent to the stream. Some earthwork would be needed to create small berms and swales, which would create cells of new wetlands. These wetlands would be fed by the discharge from existing springs in the area (additional details can be found in section 2.2.2.2.4). Flows from Mud Creek also could be used to supply water for these wetlands. All or a portion of the required wetland mitigation could be performed at this site. The wetland area would be maintained by SWCD under a MOA with UDWR.

3.14.4.2 Alternative Mitigation – Area West of Lower Gooseberry Reservoir

Water would be diverted from an existing diversion structure on Cabin Hollow and would be transported through an existing open ditch to the 120-acre mitigation site. The water would be diverted from the ditch at several locations and allowed to flow across the uplands and to the surrounding wetlands. The existing wetlands on this site appear to have been created and maintained by the existing irrigation system. Some earthwork would be needed to create small berms and swales, creating cells of wetlands. The area around the perimeter would be excavated somewhat deeper and to a 20-foot minimum width, wider in some areas so that the edge of the swale is not abrupt but serpentine. This deeper area would allow for willows and other shrubs to be planted to create a vegetation barrier to the interior wetlands. The area would still be available for grazing, and wildlife would use the area; however, sheep would be deterred from entering the wetland by the perimeter swale, unless forced to cross the deeper water. The above perimeter swale would eliminate the need to fence the area and would allow access for wildlife. At least a portion of the required wetland mitigation could be accomplished at this site.

3.14.4.3 Alternative Mitigation – Area Between Fairview Lakes and Narrows Reservoir

This alternative would include enlarging existing wetland areas and creating new wetlands adjacent to Narrows Reservoir. About 100 acres of new wetlands would be created adjacent to Narrows Reservoir. This would be accomplished by releasing water from Fairview Lakes to inundate lands adjacent to existing wetlands. A new outlet from Fairview Lakes would be provided. The outlet would be designed to automatically begin releasing water once Fairview Lakes reaches a certain level. The releases would stop as the water level receded in the fall. The water would be conveyed to and distributed within the wetland area by a system of open ditches. Some recontouring would be performed to ensure that the soils become saturated. All or a portion of the required wetland mitigation could be accomplished at this site. This wetland area would be maintained by SWCD under a MOA with UDWR.

3.14.4.4 Alternative Mitigation – Manti Meadows

Under this alternative, return flows from the Narrows Project in the San Pitch River drainage would be available for UDWR to use at the Manti Meadows Waterfowl Management Area located southwest of Manti. Sixmile Creek water, which belongs to the Gunnison Irrigation Company and now flows into Gunnison Reservoir, would be diverted and delivered to the Manti Meadows area through existing facilities belonging to the Manti Irrigation and Reservoir Company. Narrows Project return flows arising in the San Pitch River would be delivered to Gunnison Reservoir in exchange for the water delivered to Manti Meadows. The water could be used to create at least 100 acres of new wetlands and to improve wetland habitat values of existing wetlands in the area. Some excavation and ground recontouring of existing uplands would be required to control drainage and encourage wetland development.

SWCD would have primary responsibility for implementing the wetland measures described above. SWCD would be responsible for funding and acquiring all lands and rights-of-way. SWCD would provide and transplant any native plantings needed. The wetland area would be maintained by SWCD under a MOA with UDWR.

3.14.5 Monitoring

Careful monitoring of the mitigation sites would be conducted to ensure that the value of the mitigation sites is at least equal to the value of the wetlands lost. This determination would be accomplished by performing HEP analysis of the sites prior to construction. Baseline information would be collected and compared to existing habitat values for 4 years after construction was completed to determine whether objectives were met. Monitoring would continue for a longer period of time if the wetland mitigation was not completed satisfactorily, or as otherwise deemed appropriate by USACE. If the mitigation goal is not met, additional mitigation would be provided at other alternative mitigation sites.

3.14.6 Maintenance

SWCD would be responsible to ensure that all fences are in good repair and are maintained properly. SWCD also would be responsible to install and maintain any diversion and/or irrigation facilities. The initial work would be performed concurrently with construction of other project facilities such as the dam, tunnel rehabilitation, and pipelines. All lands and rights-of-way would be acquired, and initial construction of wetland measures would be completed prior to initial filling of the reservoir. SWCD would be responsible to fund the monitoring of the wetland mitigation. SWCD would be responsible to enter into a MOA with UDWR, USACE, and other appropriate agencies for wetland measures. The MOA clearly would define the roles and responsibilities of SWCD, UDWR, USACE, and other parties for implementing and maintaining the wetland measures.

3.14.7 Secondary Benefits

3.14.7.1 Upper Cottonwood Creek from the Left Hand Fork to the Mouth of the Canyon and Irrigation Diversion Works

During winter months, a 2.0-cfs release flow would be made from Narrows Reservoir to Cottonwood Creek to increase the available fish habitat and provide hydrology for wetlands along the creek. Although primarily intended as a measure to facilitate winter survival of fish, this measure also would have some beneficial effects on the riparian and wetland areas adjacent to the creek.

3.14.7.2 Lower Cottonwood Creek from the Irrigation Diversion to the San Pitch River

A 2.0-cfs minimum diversion would be provided in lower Cottonwood Creek from the canyon mouth. This measure would provide year-round flows in the stream, which would enhance the riparian corridor. This segment of stream historically has been dewatered during the irrigation season. Although primarily intended as a measure to facilitate winter survival of fish, this measure also would have some beneficial effects on the riparian and wetland areas adjacent to the creek. Cottonwood Creek has essentially no riparian zone, due to existing irrigation diversions, from the mouth of the creek to the San Pitch River confluence. Providing flows in summer months would stimulate the growth of riparian and wetland vegetation.

3.14.7.3 Streamflows from Fairview Lakes to the Proposed Reservoir

Presently, during the spring runoff period, water is stored in Fairview Lakes and released for irrigation use in the Fairview area. This release is a transbasin diversion of water to the San Pitch River drainage. With the historic operational pattern, the small tributaries to Gooseberry Creek located downstream from Fairview Lakes are dry several months each year. This mitigation measure involves providing year-round releases, averaging about 2.6 cfs from Fairview Lakes, into two of these tributaries to Gooseberry Creek. This amounts to an average 1.3-cfs flow per channel. The total annual amount of water that is released from Fairview Lakes would not be changed. The flow, however, would be dispersed during the entire year, rather than the present 18- to 20-week discharge period.

Water released from Fairview Lakes during the year would be captured and stored in Narrows Reservoir. Upon call by CGIC, their water would be released through the Narrows Tunnel to the San Pitch River drainage. This would provide aquatic benefits to the Narrows Project and aesthetic and recreational benefits to Fairview Lakes. These benefits would result from maintaining the lakes at a higher water level during the prime summer recreational season. This measure also would result in creating approximately 2.3 stream miles of spawning and rearing habitat for cutthroat trout and creating and enhancing wetlands and riparian areas along the stream.

SWCD would be responsible for entering into operating agreements necessary to implement these year-round releases. SWCD would ensure that the releases are made according to environmental commitments.

3.14.7.4 Middle Gooseberry Creek

As part of the fishery mitigation, the channel of Gooseberry Creek would be narrowed between Lower Gooseberry Reservoir and Narrows Dam to provide better habitat with reduced flows. It is expected that the channel eventually would narrow by itself due to the decreased flow. However, to expedite the process, certain manmade improvements would be made, reducing the vertical cut and eroded banks and providing wetland and riparian areas.

3.15 RECREATION AND VISUALS

3.15.1 Recreation

3.15.1.1 Affected Environment

According to the Utah Division of Parks and Recreation's *2009 State Comprehensive Recreation Plan*, the most popular outdoor individual recreational activity in Utah is walking for pleasure or exercise, followed by picnicking. The third most popular activity in most districts was swimming, though camping was the third in the six-county and southeastern planning districts. As with other major reservoirs along the Wasatch Front, Lower Gooseberry Reservoir, Beaver Dam Reservoir, and Fairview Lakes are heavily fished and overcrowded. Boating also ranks as a popular outdoor recreation activity in Utah.

High priority needs for new facilities are mostly new parks, new facilities at existing parks, new ballfields, new motorized trails, and facilities.

Beaver Dam is a heavily used day-use area for anglers near the proposed project, and there are several developed USDA Forest Service campground facilities in close proximity to the project area. The Lower Gooseberry Reservoir (16 units), Gooseberry (10 units), Flat Canyon (13 units), and Lake Campground (51 units) are all fee areas, with a 92-day season of use from June 15–September 15. Water, sanitation facilities, tables, and fire grills are provided. Also in the area is Boulger Reservoir, a nondeveloped, dispersed camping area equipped with vault toilet facilities. These campgrounds (with the exception of Boulger) are typically full on weekends and one-third full on weekdays throughout their season of use.

The proposed reservoir area is known as a very popular location for snowmobile enthusiasts. The USDA Forest Service and UDOT maintain unloading, parking, and sanitation facilities along SR-31, immediately west of the proposed reservoir area, from which snowmobiles embark for travel along groomed trails following Skyline Drive and SR-31, as well as in the proposed reservoir area itself.

Whitewater boating is limited mostly to a relatively short season when flows are peaking, coinciding with the high flows from the White River, when the gates at Scofield Reservoir are closed. In wet years, spills from Scofield may contribute to the peak. When Scofield releases again are started up to supply irrigation demands downstream, the level of boating falls off significantly. The segment of the river between Scofield Reservoir and the picnic area above Price Canyon Dam (approximately 15 river miles) contains Class I–III rapids. The segment of the river between the picnic area above Price Canyon to Castle Gate (approximately 8.5 river miles) contains Class III–V rapids. This segment of the river is more challenging and requires skill and careful maneuvering to avoid the hazards of the narrow canyon. The segment of the river between Woodside to the confluence with Green River receives the greatest use due to the flow regime and the wilderness setting of the river segment. This segment of the river also contains Class III–V rapids.

3.15.1.2 U.S. Bureau of Labor and the U.S. Census Methodology and Impact Indicators

Recreation use rates at Narrows Reservoir would be expected to be approximately the same use rates as at Scofield, Huntington North, Millsite, Piute, and Otter Creek Reservoirs, based on the current recreation use, number of campsites, and other such facilities per surface acre at each of these reservoirs. The proposed number of campground units and picnic sites for the Proposed Action, the Mid-Sized Reservoir Alternative, and the Small Reservoir Alternative are intended only as reasonable estimates. The actual number, including restroom type and quantity, boat ramp capacity, group site accommodations, and other facilities, would be determined in detail during the recreation facility design process for the proposed project.

Scofield and Huntington North Reservoirs, both constructed by Reclamation, are in the same vicinity as the proposed Narrows Reservoir. Both reservoirs are heavily used for recreation. Table 3-27 shows the recreation use at Scofield, Huntington North, Millsite, Piute, and Otter Creek Reservoirs as well as the annual visitation and revenues.

Table 3-27.—Narrows Project Nearby Reservoirs Present Recreation Use and Revenues

Reservoir	Recreation Days	Revenues
Scofield	79,076	$68,912
Huntington North	56,451	$41,627
Millsite	32, 556	$32,499
Piute	22,230	$ 7,410
Ottercreek	64,752	$77,666

Recreation use of the reservoirs includes fishing, boating, camping, picnicking, snowmobiling, and hunting. Although total recreation days (any or all of a 24-hour period) are available for these areas, there is no breakdown of data for the number of visitor days spent on each specific activity.

Lower Gooseberry Reservoir, Beaver Dam Reservoir, and Fairview Lakes are heavily fished. In the immediate project area, Gooseberry Creek is used to a lesser degree by fishermen.

Dispersed recreation occurs outside of areas where existing recreation facilities are built. It occurs mostly along or adjacent to roads and includes activities such as driving for pleasure, camping, hiking or mechanized trail use, hunting, fishing, and wilderness travel. Based on the Recreation Opportunity Spectrum (ROS) system for classifying recreation opportunities, as described in the 1986 *Manti-La Sal National Forest Land and Resource Management Plan (LRMP)*, the dispersed recreation opportunity within the proposed reservoir area would be classified as "Roaded Natural." There are nearly 413,672 acres of land with this classification within the Manti-La Sal National Forest. As indicated in table 3-28, the 1980 recreation use of these lands was about 524,036 visitor days or an average of 1.3 visitor days per acre per year. By the year 2030, the demand for this type of recreation use is expected to increase to about 1,587,912 visitor days per year or 3.8 visitor days per acre per year.

Other areas within the Gooseberry Creek and Fish Creek drainage, but outside the reservoir basin, provide dispersed recreation opportunities classified as "Roaded Natural," "Semiprimitive Motorized," "Semiprimitive Nonmotorized," and "Primitive." The 1980 use and estimated 2030 project demands for these types of recreation opportunities are summarized in table 3-28.

3.15.1.3 Predicted Effects

3.15.1.3.1 No Action Alternative

The existing recreational facilities in and around the project area are overcrowded. Under this alternative, the overcrowding would continue.

3.15.1.3.2 Proposed Action Alternative

Under this alternative, recreation facilities, including a 24-unit campground, boat ramp, boat ramp parking area for 26 vehicles with trailers, 14 picnic sites, and a corresponding

Table 3-28.—Manti-La Sal National Forest Dispersed Recreation 1980 Use and Estimated 2030 Demand

ROS Class	1980 Base		2030 Demand	
	RVDs[1]	Gross Acres	RVDs	Gross Acres
Primitive	2,806	48,082	20,800	48,082
Semiprimitive nonmotorized	18,162	117,891	58,256	117,891
Semiprimitive motorized	158,194	831,807	473,287	831,807
Roaded natural appearing	524,036	413,672	1,587,912	413,672
Total	703,198	1,411,452	2,140,255	1,411,452

[1] RVD = recreation visitor day.

number of restroom facilities, would be provided at the proposed Narrows Reservoir. The recreation facilities would draw heavy use from not only Sanpete, Carbon, and Emery Counties but also from the Provo/Orem and metropolitan Salt Lake City areas. The proposed Narrows Project would help meet the demand for additional boating facilities in the area. In addition, it is expected that the reservoir would develop into an excellent flat-water fishery. A conservation pool would be provided to ensure successful overwintering of fish.

The proposed Narrows Reservoir would increase the State and regional inventory for fishing, boating, and water play. At the top of the active capacity water level for the Proposed Action, the proposed project's facilities are expected to attract a total of 46,930.8 additional recreation days per year of total developed recreation use. These use rates are based on use rates of Scofield, Huntington North, Millsite, Piute, and Otter Creek Reservoirs. Construction of the proposed Narrows Project and its associated recreation facilities would cause the loss of 237 acres of "Roaded Natural" dispersed recreation on Reclamation withdrawn lands and 466 acres on private lands. It is estimated that these 703 acres would provide approximately 910 visitor days at 1980 levels of use and would provide about 2,670 visitor days of use in 2030. This reduction in dispersed use would be offset by the new facilities that would act as an attraction to local communities and individuals from the Wasatch Front who already contribute above 60% of the use on the Manti-La Sal National Forest. It is anticipated that the 46,930.8 recreation days of newly developed recreation use would be paralleled by an equal amount of dispersed recreation in the reservoir vicinity within the first 5 years of operation. This growth in recreation use would be a direct effect of the project and would require more intensive management in the area surrounding it (approximately, the area 8–10 miles in each direction).

At times when this newly developed recreation site and others in the area are at capacity (most of the summer season and particularly holiday weekends), users would move into nearby nondeveloped or dispersed areas. Some reservoir users actually would prefer dispersed sites regardless of developed site availability, and others would use dispersed sites to avoid associated fees.

The amount of dispersed use within 8–10 miles of the proposed reservoir is already at a level considered to be crowded during holidays and big game hunting seasons. The additional attraction of the new flat-water fishery in this area is expected to increase dispersed use to a point that the USDA Forest Service would need to place restrictions on areas available for this type of use. Such restrictions may include special measures for sensitive areas such as wetlands.

In addition to increased resource protection and rehabilitation costs, conflicts among such activities as ice fishing and snowmobile use, hiking, and ATV users could be expected.

Along with increased, dispersed use in the area, nearby developed recreation facilities would be impacted. Gooseberry Campground and the Lower Gooseberry Reservoir units are immediately adjacent to the proposed reservoir, as is the Scenic Byway and snowmobile parking area. Skyline Drive, Flat Canyon Campground, and the limited facilities at Beaver Dam and Boulger Reservoirs are also within reasonably close proximity.

Implementing the Proposed Action would cause Scofield Reservoir to operate at a slightly lower level, thus reducing the surface area. Based on current recreation use at varying water levels, it is anticipated that there would be no impact to the recreation visits annually. Reclamation data is referenced in table 3-27. Based on use rates obtained in 2005 and 2007 creel surveys by UDWR, there would be a loss of 3,239 angler days of fisherman use. The aquatic mitigation measures of restoring year-round flows in two small tributaries to Gooseberry Creek and maintaining Fairview Lakes at a higher elevation during the prime summer recreational season also would provide angler benefits to the area.

Under the Proposed Action, more frequent fishkills and accelerated eutrophication also could degrade the park. However, water quality mitigation has been provided. Whereas the total inventory of water-based recreation may be increased, some of it would be offset by a downgraded State park at Scofield. The higher elevation of the proposed Narrows Reservoir would have a shorter season of use at an elevation of more than 8,600 feet than would the Scofield Reservoir at about 7,600 feet. Greater snow cover probably would occur at elevation 8,600 feet, causing less access because of deep snow and later snowmelt.

Depending on the type of hydrologic year, water levels in Narrows Reservoir would fluctuate between 25–75% of the full pool area during the recreation period—25% on average and up to 75% in an extended drought cycle. Recreation action may be affected, particularly for those using the boat dock at maximum drawdown.

3.15.1.3.3 Mid-Sized Reservoir Alternative

Under this alternative, recreation facilities would include a 20-unit campground, a boat ramp, 11 picnic sites, and a corresponding number of restroom facilities. At the top of the active capacity for the Mid-Sized Reservoir Alternative, the facilities are expected to attract 37,995.3 additional recreation days per year of developed recreation use (see tables 3-29 and 3-30).

Table 3-29.—Proposed Recreation Use at the Narrows Project

Alternative	Surface Area Acres	Visitor Days per Acre	Visitor Days
Proposed Action	604	X 77.7 =	46,930.8
Mid-Sized Reservoir	489	X 77.7 =	37,995.3
Small Reservoir	362	X 77.7 =	28,127.4

Source: Reclamation comparable reservoir analysis, Liljegren, Sterzer, Brown; August 2011.

Table 3-30.—Proposed Recreation Use at the Narrows Project Including Impacts to Scofield

Alternative	Visitor Days for Narrows	Visitor Days for Scofield	Overall Visitor Days for Alternatives
Proposed Action	46,930.8	3,239	43,691.8
Mid-Sized Reservoir	37,995.3	3,073	34,922.3
Small Reservoir	28,127.4	2,766	25,361.4

Source: Reclamation comparable reservoir analysis, Liljegren, Sterzer, Brown; August 2011.

3.15.2 Visual Resource

3.15.2.1 Affected Environment

The project features would be located within the Manti-La Sal National Forest on the Wasatch Plateau. The dam and diversion works would be located in the Gooseberry Valley, a tributary to the Price River, at about elevation 9,000 feet.

The characteristic landscape is consistent with typical high elevation mountain areas. The topography on top of this plateau is rolling and contains shallow basins covered with sage/grass communities bordered by spruce/fir, interspersed with aspen.

The Narrows damsite is within 2 miles of the intersection of two State highways, SR-31 and SR-264. Both highways have been designated as National and State Scenic Byways. SR-31 connects Fairview in the Sanpete Valley with Huntington in Emery County. SR-264 connects Scofield with SR-31 at Skyline Drive. These are major commuter routes for miners from the Sanpete Valley working in the coal mines on the east side of the Wasatch Plateau. In addition to commuting and recreation traffic, SR-31 serves as a route for hauling livestock from the Sanpete Valley to summer ranges.

It should be emphasized that scenery is an important natural resource and recreational element in this part of the forest. It is primarily through the visual sense that most visitors perceive the forest and its interrelated components. There is additional visual sensitivity here due to the adjacent Scenic Byway, which serves as a forest gateway/ viewing corridor for many recreationists.

3.15.2.2 Methodology and Impact Indicators

General direction for visual resource management located on page III-17 of the *Manti-La Sal National Forest Land and Resource Management Plan* states, "Forest resource uses or activities should meet the adopted Visual Quality Objective as displayed on the Planned Visual Quality Objective Map."

The Manti-La Sal LRMP has assigned a VQO to each area of the forest, reflecting the desired management emphasis of the specific area. Some of those objectives assigned by the LRMP allow a noticeable degree of change from the existing condition, as determined during the visual assessment conducted in 1986, to facilitate subsequent use in reaching comprehensive forest management goals.

The term, visual quality objective, refers to the degree of acceptable visual alteration of the landscape and is defined as follows: a desired level of scenic excellence based on physical and sociological characteristics of an area. Typically, more stringent VQOs are incorporated to protect the most highly visible and most frequently seen areas that have the greatest amount of variety in vegetation and other features that occur naturally. These long-term VQOs or goals are based on a large-scale visual inventory and management process called the Visual Management System (VMS), which has been used by the national forests for the past two decades. Although inherently subjective, the VMS framework facilitates the attainment of aesthetic goals while balancing other important resource needs.

Much of the reservoir itself, and particularly the anticipated area of mud flat to become exposed when the reservoir is drawn down, is located on private land, which, consequently, has no assigned VQO. A portion of the project near the proposed dam and rerouted section of SR-264 is located in an area designated with a VQO of "Partial Retention."

The objective of the classification of Partial Retention is to ensure that management activities do not visually dominate the characteristic landscape. Management activities should repeat form, line, color, or texture commonly observed in the area. Management activities may introduce form, line, color, or texture, which are found infrequently or not at all in the surrounding scenery, but any changes should remain visually subordinate to the characteristic landscape. Reduction in form, line, color, or texture to meet partial retention should be accomplished as soon after project completion or, at a minimum, within the first year. Any activity must be blended into the landscape so as to attract little uncharacteristic attention.

3.15.2.3 Predicted Effects

3.15.2.3.1 No Action Alternative

The scenic character of the area would remain undisturbed. Neither positive nor negative visual impacts on the landscape would occur under this alternative.

3.15.2.3.2 Proposed Action Alternative

Temporary and permanent landscape disturbances would be apparent from the placement of project features such as the rerouting of SR-264 and construction of the Narrows Dam structure. These more permanent features would be acceptable in this area of partial retention, especially in the long term. The dam would be within the setting of other dams in the area, and the rerouted portion of the Scenic Byway would serve as a viewing corridor and not a dominant element. Maintaining views within the parameters of partial retention would be contingent upon successful restoration/ revegetation of the old highway alignment and any scarred areas associated with the dam. Care would need to be taken in developing any associated recreation facilities to ensure that their design is subordinate to the surrounding landscape.

The Narrows Reservoir would be the most noticeable feature. The reservoir would have a surface area of 604 acres when full; however, during the recreation season, the surface area would average 454 acres. A body of water generally is considered to be aesthetically pleasing; however, as the reservoir is drawn down, exposed mud flats around the more shallow parts of the reservoir may be visually detractive but should remain naturally appearing as they follow the natural line of the reservoir's shore. Although viewed from the Scenic Byway and the reservoir itself, these mud flats primarily would be located on private lands that have no VQO designation. However, it is anticipated that these areas would appear more natural over time; and the additional variety provided by the new water body would well offset any negative effect. In the short term, it is anticipated that the visual impact of exposed mud flat or shoreline would be negligible due to steeper topography and the duration and angle of view.

The aquatic mitigation measures of restoring year-round flows in two small tributaries to Gooseberry Creek and maintaining Fairview Lakes at a higher elevation during the prime summer recreational season also would provide aesthetic benefits to the area.

During project construction, increased human activity, heavy machinery, and surface excavation would temporarily detract from the scenery. Such detractions would be visible in localized areas where construction would occur. Minor disruption of traffic on SR-264 would be expected since the existing road would not be inundated until dam construction was completed and the relocated road is serviceable. Temporary disruption on SR-31 is expected.

3.15.2.3.3 Mid-Sized Reservoir Alternative

Under the Mid-Sized Reservoir Alternative, temporary and permanent landscape disturbances would be the same as those described for the Proposed Action but at a somewhat reduced scale. The proposed Narrows Reservoir would have a surface area of 489 acres when full. During the recreation season, the surface area would average 277 acres. Detractions associated with project construction would be the same as those described for the Proposed Action.

The net effect to visual quality in comparison with the Proposed Action would be largely unnoticeable to the casual forest visitor. A dam still would be built, and a portion of highway would be rerouted. Possibly, there would be less than a proportionate impact relative to exposed mud flats because the Mid-Sized Reservoir Alternative would fill steeper topography near the dam.

3.15.2.3.4 Small Reservoir Alternative

Under the Small Reservoir Alternative, temporary and permanent landscape disturbances would be the same as those described for the Proposed Action but at a somewhat reduced scale. The proposed Narrows Reservoir would have a surface area of 362 acres when full. During the recreation season, the surface area would average 238 acres. Detractions associated with project construction would be the same as those described for the Proposed Action.

The net effect to visual quality in comparison with the Proposed Action would be largely unnoticeable to the casual forest visitor. A dam still would be built, and a portion of highway would be rerouted. Possibly, there would be less than a proportionate impact relative to exposed mud flats because the smaller reservoir would fill steeper topography near the dam.

3.16 CULTURAL RESOURCES

Cultural resources are defined as places, natural features, structures, buildings, landscapes, districts, and objects that are significant in history, architecture, archeology, engineering, community, or culture. Cultural resources are protected by a number of statutes, regulations, and policies that must be taken into consideration during the NEPA process. Of particular importance is Section 106 of the National Historic Preservation Act, which mandates that Federal agencies take into account the potential effects of a proposed Federal undertaking (the Proposed Action) on historic properties and afford the Advisory Council on Historic Preservation the opportunity to comment. In compliance with the NHPA, historic properties are defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the *National Register of Historic Places*.

3.16.1 Affected Environment

The affected environment for cultural resources corresponds to the APE as defined in the regulations implementing Section 106 of the NHPA (36 CFR Part 800).

> "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist."
> (36 CFR 800.16(d))

The APE for the Proposed Action includes the areas impacted by construction activities associated with the construction of the dam and the land areas eventually inundated by the reservoir pool area. Also included would be any disturbed areas associated with the construction of a proposed pipeline to Cottonwood Creek as well as additional pipelines to deliver water to existing water distribution systems. Finally, impacts from the proposed rehabilitation of an existing tunnel to Cottonwood Creek, the development of recreation facilities, staging areas, access roads, borrow areas, and any other ancillary facilities linked to the Proposed Action would be included in the APE.

3.16.2 Methodology

Should Reclamation approve the loan application and use of Federal lands, then a Federal undertaking would be initiated in compliance with Section 106 of the NHPA, and Reclamation would work with the SWCD, the State Historic Preservation Officer, the Forest Service, Indian tribes and other interested parties to fulfill Section 106 of the NHPA.

To review potential effects to historic properties, the APE was reviewed for prior inventories and documentation of sites or historic properties. Some 1,514 acres were inventoried (Singer, 1979). The 1979 inventory identified three sites: two prehistoric archaeological and one historic site. The prehistoric sites were open lithic scatters with few formal tools.

One historic site, a stone structure foundation, was also located during the 1979 inventory. The three cultural resource sites were not evaluated for their NRHP eligibility. As a result, the sites would have to be revisited and evaluated for their current NRHP eligibility should the undertaking proceed.

The 1979 inventory did not include the Upper Cottonwood Creek, Oak Creek, and East Bench Pipeline alignments, new road alignments, borrow areas, staging areas, recreation facilities, marinas, wetland mitigation areas, haul roads, and other potential ancillary facilities associated with the Proposed Action. These additional portions of the APE would have to be intensively inventoried should the undertaking proceed.

3.16.3 Predicted Effects

Predicted effects are based on the 1979 inventory results.

3.16.3.1 No Action Alternative

Under the No Action Alternative, there likely would be no effects to the three cultural resources that are known to be present, except for the ongoing effects from grazing and natural processes like erosion.

3.16.3.2 Proposed Action Alternative

Under the Proposed Action, should the project be built, then the responsible Federal agency would have to work with the SWCD and other consulting parties to comply with the procedures outlined at 36 CFR 800. The regulatory requirements would be as follows:

- Determine whether the project constitutes a Federal undertaking.
- Identify the State Historic Preservation Officer and other consulting parties, including Indian tribes.
- Define the APE.
- Identify any historic properties within the APE.
- Apply the criteria of adverse effect to any historic properties.
- Assusming adverse effects, resolve adverse effects to historic properties as a result of the Federal undertaking per 36 CFR 800.6.

Based on the three sites (1,514 acres) inventoried, there is a low density of sites in the APE; and historic properties eligible to the *National Register of Historic Places* are expected to be few in number. Furthermore, consultation with Indian tribes that might attach religious or cultural significance to these sites or that might have sacred sites (as defined in Executive Order 13007) in this area indicates that such sites are not present.

Reclamation and the other consulting parties could either enter into a programmatic agreement to stipulate how these or alternative procedures would be carried out for the undertaking, or the parties could elect to follow the regulatory process at 36 CFR 800 and enter into a memorandum of agreement to resolve effects.

3.16.3.3 Mid-Sized Reservoir Alternative

Cultural resource impacts under this alternative would be the same as those described above in the Proposed Action, except the APE would be reduced in size. Presumably, the number of historic properties and potential adverse effects would decrease proportionately. Given the density of resources in the previously inventoried area, we would not expect to find more historic properties.

3.16.3.4 Small Reservoir Alternative

Cultural resource impacts under this alternative would be the same as those described above in the Proposed Action. The APE would be reduced even further in size, and the number of historic properties would decrease as well.

3.17 ECONOMIC AND SOCIAL RESOURCES

3.17.1 Affected Environment

Sanpete and Carbon Counties are considered the affected environment for this analysis.

In 2009,[2] population in Carbon County was 19,989 and Sanpete County was 25,946 (i.e., the total county region contained 45,935 persons.) From 1990–2009, Carbon County has the smallest population change, (-0.8%), while Sanpete had an increase of 58.9%. Ethnically, both counties are unusual by United States standards with 91.1% of Carbon County identifying themselves as white and 92.4% of Sanpete County; the median family income in Carbon County was $40,900 in the year 2000, while Sanpete was $37,796.[3] In 2000, Carbon County has 13.4% of its population below the poverty threshold, while Sanpete has a larger share of individuals living below the poverty threshold at 15.9%. In 2000, the United States percentage was 12.4.

For both counties combined, 49.6% of the land is owned by the Federal Government. This high percentage of Federal land is important to socioeconomic analysis because these lands play a role in local employment by providing for commodity extraction, as well as opportunities for travel and tourism. In 2009, mining accounted for 13.8% of the jobs in Carbon County and 0.2% in Sanpete County; agriculture accounted for 2.3% of the jobs in Carbon County and 9.1% in Sanpete. The travel and tourism industry accounted for 13.4% of the jobs in Carbon County and 11.4% in Sanpete. In 1998, travel and tourism accounted for 15.99% of the total employment, and in 2009, 12.63%.

From 1970–2009, farm employment in both counties shrank from 1,641 to 1,332 jobs, an 18.8% decrease.[4] During this same period, nonfarm employment grew by 144.7%. By

[2] U.S. Department of Commerce, 2011. Bureau of Economic Analysis, Regional Economic Information System.

[3] U.S. Department of Commerce, 2011. Census Bureau, American Community Survey Office.

[4] U.S. Department of Commerce, 2011. Bureau of Economic Analysis, Regional Economic Information System, tables CA25 and CA25N.

farms, we include all forms of agricultural production, including livestock operations. In 2007, Carbon County had 294 farms with 215,557 acres devoted to agriculture; while Sanpete had 879 farms with 311,551 acres in agriculture. Some 22.8% of the land area in Carbon County was used for farms and 30.7% in Carbon County.[5] Table 3-31 shows that both counties have the greatest amount of land devoted to raising beef cattle.

Under existing conditions in Sanpete County, two crops of alfalfa are harvested each year; and in some years (less than 25% of the time) when weather conditions are favorable, a small third crop is harvested. One crop of meadow hay normally is harvested, and the aftermath is used as late summer and fall pasture. Small grains are used as rotation crops for hay and pasture. Small grains also sometimes are used as a “nurse” or companion crop for alfalfa. The most common small grain crop is barley. Corn silage, which makes up less than 1% of the irrigated area, is raised primarily by dairymen and livestock feeding operations. Present and projected project crop distribution and yields in Sanpete County are summarized in table 3-32.

3.17.2 Methodology

There are two main methods of analysis for the economics of the Narrows Project. The first method is the modeling of regional economic effects; the second is the application of six indicators by Reclamation’s loan engineer who will make the decision to approve or deny the loan application from SWCD.

3.17.2.1 IMPLAN Modeling

The modeling package used in this study to assess the regional economic effects of construction of each alternative is IMpact Analysis for PLANning (IMPLAN). IMPLAN is an economic input-output modeling system that estimates the effects of economic changes in an economic region.

IMPLAN data files are compiled for the study area from a variety of sources, including the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor, and the U.S. Census Bureau. This analysis used 2004 IMPLAN data for Utah’s Sanpete County, where most of the construction activity would occur for the regional impact analysis.

The expenditures associated with construction were placed into categories that represent different sectors of production in the economy. The expenditures that are made inside the study region were considered in the regional impact analysis. Expenditures made outside the study area were considered “leakages” and would have no impact on the local economy. Some construction items (specialized equipment and skilled labor) more likely are to be purchased outside the region and brought to the construction site because of their high cost and lack of availability in the region.

Because of the scale of the construction project, it was assumed that local suppliers and contractors would be able to supply only a portion of the necessary construction, equipment, supplies, and expertise. The regional impact analysis assumed that approximately 50% of the labor wages would be spent locally, and approximately 45% of the construction equipment and supplies would be purchased locally.

[5] U.S. Department of Agriculture, 2009, National Agricultural Statistics Service, Census of Agriculture, table 8.

Table 3-31.—Types of Farms by County and Production, 2007

Number of Farms by Type, 2007	Carbon	Sanpete
All farms	294	879
Oilseed and grain farming	7	15
Vegetable and melon farming	2	13
Fruit and nut tree farming	5	6
Greenhouse, nursery, etc.	8	7
Other crop farming	89	272
Beef cattle ranch and farm	96	261
Cattle feedlots	9	21
Dairy cattle and milk production	0	20
Hog and pig farming	1	11
Poultry and egg production	8	68
Sheet and goat farming	14	67
Animal aquaculture and other animal production	55	118
Percent of Total	**%**	**%**
Oilseed and grain farming	2.4	1.7
Vegetable and melon farming	0.7	1.5
Fruit and nut tree farming	1.7	0.7
Greenhouse, nursery, etc.	2.7	0.8
Other crop farming	30	30.9
Beef cattle ranch and farm	33	29.7
Cattle feedlots	3.1	2.4
Dairy cattle and milk production	0	2.3
Hog and pig farming	0.3	1.3
Poultry and egg production	2.7	7.7
Sheet and goat farming	4.8	7.6
Animal aquaculture and other animal production	19	13.4

Source: U.S. Department of Agriculture, 2009. National Agricultural Statistics Service, Census of Agriculture, Washington DC, table 45.

Table 3-32.—Summary Crop Distribution and Yield for Sanpete County

Crop/Unit	Distribution of Total Crop Production (%)[1]	1990 Yields[2]	Project Yields With Full Water Supply[3]
Pasture (per animal unit month)	39	5.0 AUM per acre	8.0
Alfalfa hay (per ton)	31	3.5 tons per acre	5.2
Small grains (per bushel)	12	80.0 bushels per acre	85.0
Meadow hay (per ton)	8	2.0 tons per acre	2.5
Other crops	2	NA[4]	NA
Fallow and idle	8	NA	NA

[1] Distribution would be essentially the same for present and project conditions; source is *1999 Utah State Water Plan*, Sevier River Basin, table 10-2.

[2] Estimates were generated by SWCD for this study.

[3] Estimates for irrigators purchasing enough project water to obtain a full water supply.

[4] NA = Not applicable.

This analysis also assumed that the majority of the construction expenditures will be funded from sources outside the study area. Money from outside the region that is spent on goods and services within the region would contribute to regional economic impacts, while money that originates from within the study region is much less likely to generate regional economic impacts. Spending from sources within the region represents a redistribution of income and output, resulting in a negligible increase in economic activity.

For the purpose of this study, the construction costs allocated to labor and construction materials spent in the region were used to measure the overall regional impacts. These overall impacts would be spread over the construction period and would vary year by year proportionate to actual expenditures.

3.17.2.2 Indicators for the Loan Application

Reclamation has not had an active small loan program since the 1990s. However, as mentioned previously, the Narrows Project was "grandfathered in" with the understanding that the factors that would be used to analyze the loan are those in effect in 1991. At that time, the Credit Reform Act of 1990 had been passed by Congress; this, coupled with the Office of Management and Budget's Circular A-11, modified how loans were to be made under the SRPA. In accordance with the Credit Reform Act and OMB requirements, Reclamation was directed to compute loan risks tied to computing loan subsidy and to adjust cash inflows from scheduled principal and interest payments for estimating defaults or deferrals. The six indicators that were established in 1991 to determine the overall loan risk and category assignment were:

- ♦ Debt/revenue ratio
- ♦ Debt/repayment ratio
- ♦ Interest/debt ratio
- ♦ Expenditures/cash and securities
- ♦ Quality of investments
- ♦ Bond rating (Moody's)

For the Narrows Project (and other SRPA loan applications), the results of these six financial indicators will be compared against national averages (standards) to determine the loan's overall classification assignment. In gleaning out this financing and accounting information, the SWCD's audit reports and balance sheets may need to be supplemented and revised to fully evaluate and measure the indicators. The audit report formation and content now required in all loan application reports generally will not cover the entities' bonding status or authority, and this additional information will need to be provided. It is believed that at least four of the six proposed indicators would need to be presented and weighted in determining an overall risk profile and assignment for each loan.

3.17.3 Predicted Effects

3.17.3.1 No Action Alternative

Under the No Action Alternative, there would be no economic effects of the Narrows Project. The economic profile of the forest was described under the Affected Environment section. The Forest Plan, as amended in 2003, updated and projected the economics for Sanpete County. Comparable projections are not available for Carbon County.

3.17.3.2 Regional Impact Analysis of Proposal

The number of jobs created in Sanpete and Carbon Counties during construction of the Narrows Project would not be significant based on a regional impact analysis conducted for this study's action alternatives. At the regional level, the project would cause positive economic output to the study area. Potentially, the most significant short-term impact would occur from construction activities.

It was estimated that the regional impacts on employment, regional output, and income would be less than 1% of the study area's base employment, output, and income (see table 3-33).

Table 3-33.—Regional Impacts

	Regional Base Data	Regional Impacts	% Change
Employment (Full-time jobs)	9,443	50	<1
Output (millions of dollars)	$802	$5.8	<1
Income (millions of dollars)	$234	$0.9	<1

The regional impacts from the construction costs for all the alternatives would be similar in that the impacts would be less than 1% of the regional employment, output, and income.

These regional construction impacts would be lost after construction was completed. A small amount of regional impacts related to O&M activities would be expected but would not significantly impact the overall regional economy in the study area. The additional water amount provided by each of the alternatives would support the existing community lifestyles and social structure in the study area.

3.18 LAND RESOURCES

3.18.1 Affected Environment

The proposed non-Federal Narrows Project is located within the exterior boundaries of the Manti-La Sal National Forest. The proposed Federal action is that Reclamation will: 1) approve or deny the SRPA loan application and 2) determine whether to allow the SWCD to use 304.5 acres of Reclamation withdrawn land. SWCD has acquired 366 acres of private lands for project uses from owners by perpetual easement or in fee. SWCD would need to purchase 1,340 additional acres of private and State School Trust lands for project needs (table 2-4). It is important to note that there may be no SRPA loan, but construction may proceed on Reclamation land with other sources of funding.

While there are some private in-holdings, the majority of the lands located within the Manti-La Sal National Forest boundary is federally owned and is administered by the USDA Forest Service pursuant to specific authorities granted by Congress to the Secretary of Agriculture and pursuant to the public land laws.

Lands within forest reserves may, however, be withdrawn and used for irrigation works constructed under authority of Section 3 of the Reclamation Act of 1902 (32 Statute 388). Therefore, by Secretarial Order dated April 1, 1941, Reclamation withdrew certain forest lands from public entry under the first form of withdrawal (as provided in Section 3 of the 1902 Act). These lands were withdrawn for the Federal Gooseberry Project, which, as originally planned, was never constructed. However, a portion of the original project was constructed as the Scofield Project. The Narrows Project is presently proposed as a private project by SWCD. Their proposal is to use 304.5 acres of the 6,728 acres of the lands originally withdrawn by Reclamation for the Gooseberry Project.

The 1941 Reclamation withdrawal of lands within the Manti-La Sal National Forest created the potential for two Federal agencies—Reclamation and the USDA Forest Service—to have overlapping jurisdiction on the same lands. However, the authority of the Secretary of the Interior under the 1902 Act to withdraw and administer lands for Reclamation purposes is limited to the specific water projects provided for in that Act—that is, Reclamation projects.

At present, both Reclamation and the USDA Forest Service have administrative authority over the withdrawn lands—but each for activities related only to its own mission. Thus, Reclamation has jurisdiction over the withdrawn lands for uses associated with water resources, while the USDA Forest Service has jurisdiction over the withdrawn lands for uses related to their mission. If the non-Federal Narrows Project were constructed, the Reclamation withdrawal would be revoked for all but the 304.5 acres that would be licensed to SWCD under the authority of Section 10 of the 1939 Act for the proposed non-Federal Narrows water project.

Land ownership and use characteristics of Sanpete and Carbon Counties are summarized in tables 3-34 and 3-35, respectively. An inventory of prime and unique farmland (Public Law 95-87) did not reveal any prime or unique farmland in the project area, but as described under the Economic and Social Resources section, in 2007, Carbon County had 215,557 acres devoted to agriculture, while Sanpete had 311,551 acres.

Lands approximately 3 miles east of the project area are under a Federal coal lease and currently are being mined. Additional mineable coal reserves are believed to exist beneath lands east of the East Gooseberry Fault approximately 1 mile east of the project area. A nearby landowner with both land and mineral rights to the east of the proposed reservoir, between the proposed dam and the currently operating Skyline mine, expressed to Reclamation in April 2009 his intent to mine his coal, but exact plans and timing are unknown at this time. Lands immediately adjacent to the project area (within the Gooseberry Graben) are not believed to have mineable coal reserves due to an offset of several hundred feet within the Gooseberry Graben area.

Table 3-34.—Land Ownership – Sanpete and Carbon Counties, 2011 (acres)

	Carbon	Sanpete
Total Acres	949,893.75	1,024,678.25
Private Lands	370,605.24	436,369.54
Federal Lands	451,296.62	527,429.09
Forest Service	30,269.52	391,554.45
Bureau of Land Management (BLM)	421,027.10	135,118.43
Department of Defense (DOD)	0.00	756.21
State Lands	127,991.89	60,879.62
State Trust Lands	105,073.04	31,770.16
Other State	22,794.19	29,109.46
Tribal Lands	124.66	0.00
Percent of Total		
Private Lands	39.015	42.586
Federal Lands	47.511	51.472
Forest Service	3.187	38.212
BLM	44.324	13.186
DOD	0.000	0.074
State Lands	13.461	5.941
State Trust Lands	11.062	3.101
Other State	2.399	2.840
Tribal Lands	0.013	0.000

Source: Utah GIS Portal, 2011. http://gis.utah.gov/utah-gis-portal/utah-land

Table 3-35.—Land Use Characteristics, Sanpete and Carbon Counties

	County[1]	
Item	Sanpete	Carbon
Total acres	1,022,609	947,632
Urban	1,664	9,200
Percent of total	.16	.98
Agricultural (acres)	311,551	215557
Percent of total acres	30	23
Cropland (acres)	98,230	22,781
Percent of agriculture acres	32	11
Rangeland (acres)	199,272	179,210
Percent of agriculture acres	64	83

[1] U.S. Department of Agriculture National Agricultural Statistics Service, 2007.

Agricultural land use within the project area is based on the livestock economy of the area—principally, cattle and sheep operations and a number of Grade A dairies. Other land uses include the turkey industry, large garden spots, potatoes, raspberries, and conifer or deciduous trees.

The majority of the land area that would be inundated by the reservoir is privately owned; the dam, however, would be on Federal land. Some of the private land near the proposed dam and reservoir within the national forest boundary has been subdivided for summer homes and recreation development. Such development must comply with the zoning and building codes of the Sanpete County Commission and the sanitation requirements of the Utah Department of Environmental Quality. The area adjacent to the proposed Narrows Reservoir is county-owned and is zoned as Forest Watershed 1–10 (one dwelling per 10 acres). The primary areas now under development include the area approximately 2 miles east of Lower Gooseberry Reservoir and the area on the north side of privately owned Fairview Lakes.

The Fairview Lakes development contains approximately 150–200 memberships in the privately owned Fairview Lakes Association. The memberships include the right to use a specific lot in the area north and east of Fairview Lakes and south of the project area to park a trailer or construct a cabin. This area has been rezoned, and the one dwelling per 10 acres development ratio does not apply to this area. As a result, it has been developed with lots every 1+ acre each. About 50 cabins have been constructed within the past 5 years. The cabins are used during the winter as well as the summer, since the general area is a popular cross-country skiing and snowmobiling area. Many of the other lots have one to three trailers parked on them for the summer season (June–September). The private landowners allow their members to use some of the area southwest of Fairview Lakes for recreation use.

Portions of three grazing allotments occur within the project area. They include Swen's Canyon allotment, the Gooseberry-Cottonwood allotment, and the Beaver Dams-Boulger allotment.

Additional allotments that may be impacted by the mitigation measures include the Fairview, Cabin Hollow, and Pondtown allotments.

Swen's Canyon allotment is located in two watershed drainages. That portion, which is located in the same drainage as the proposed Narrows Dam and Reservoir, consists of 583 acres, of which all is suitable for grazing land in fair range condition. Grazing capacity of that portion is about 115 AUMs.

The Beaver Dams-Boulger allotment is a combination of two allotments. Grazing use includes 1,200 head of sheep with a season of July 6–October 5. It is grazed with a rest rotation grazing system where part of the allotment is rested each year.

The Cottonwood-Gooseberry allotment is grazed by 900 head of sheep with a season of July 6–September 30 using a rest rotation grazing system. Suitable grazing land was determined during a range analysis conducted during 1976.

A summary of information concerning the three grazing allotments and four grazing permits is presented in table 3-36. Range conditions and grazing were discussed earlier in the vegetation section of this chapter.

3.18.2 Methodology and Impact Indicators

Information on numbers of livestock and grazing seasons was obtained from USDA Forest Service grazing permits.

Grazing capacity is derived from range analysis data and other studies to determine grazing capacity.

Impact indicators are the change in AUM available for livestock use. The changes are caused by direct and indirect effects such as increased recreational use and mitigation.

Additional areas will be impacted as additional homes are built.

3.18.3 Predicted Effects

If an action alternative were selected and a non-Federal Narrows Project were constructed (see action alternatives below), the Reclamation withdrawal would be revoked for all but the 304.5 acres, which would be licensed to SWCD under the authority of Section 10 of the 1939 Act for the proposed non-Federal water project. Direct effects of this license on withdrawn lands within the area of the dam and reservoir are described in chapter 3 of the FEIS. Reclamation may license the 304.5 acres to SWCD regardless of SWCD's source of financing for the non-Federal water project. Consequently, these effects remain the same whether the construction of the dam is financed under a SRPA loan or some other mix of public and private financing.

3.18.3.1 No Action Alternative

Construction of summer homes on private land outside of platted subdivisions is expected to continue at the current rate until development reaches the zoning restrictions of one dwelling per 10 acres. Development of the Fairview Lakes complex would continue as presently planned. Sheep and cattle grazing would continue as described for the existing environment. Mining of Federal and private coal reserves would continue at current levels consistent with market demands and as coal leases are available.

Table 3-36.—Grazing Allotments Within the Narrows Project Vicinity[1]

Allotment	Swen's Canyon	Gooseberry-Cottonwood	Beaver Dams-Boulger
Permits	1	1	1
Acreage			
Federal[2]	2,277	4,229	3,014
Private	1,473	384	940
Total	3,750	4,613	3,954
Suitable grazing	3,000	3,096	2,631
Number of Sheep Allowed			
Federal	559	1,200	900
Private	400	0	0
Period of use	July 1–September 30 (3.0 months)	July 6–September 30 (2.90 months)	July 6–October 5 (3.06 months)
Animal Unit Months[3]			
Federal	335	696	551
Private	240	0	0
Condition of Suitable Grazing Land			
GOOD			
Number of acres	326	542	360
Percent	11	18	14
FAIR			
Number of acres	2,057	2,088	1,551
Percent	69	67	59
POOR			
Number of acres	617	466	720
Percent	20	15	27

[1] Source: USDA Forest Service, 1992; Personal communication, USDA Forest Service Supervisory Range Conservationist. Reverified by personal communication in 2003.

[2] Includes Reclamation withdrawn and USDA Forest Service lands.

[3] 1 AUM = 5 sheep.

3.18.3.2 Proposed Action Alternative

Major changes in land use in the area surrounding the dam and reservoir are not anticipated under the Proposed Action. Construction of summer homes outside of platted subdivisions might be accelerated but would be limited by zoning restrictions of one dwelling per 10 acres. Development of the Fairview Lakes complex would continue as previously planned although build-out may occur earlier. Narrows Reservoir, SR-264 and forest development roads relocation, the recreation area, and the conservation easements adjacent to the reservoir would reduce the available grazing area by 856 acres. This area is about 10% of the suitable grazing acreage in the area. The Proposed Action may result in the direct loss of 114 AUM grazing use (856 project acres per 1.5 acres per sheep month = 571 sheep months per 5 sheep months per AUM = 114 AUM); however, indirect loss of grazing (estimated to be about 1,014 acres) may occur on adjacent areas around the reservoir, between the highway and the reservoir, and around camping and residence areas. The total grazing impact is estimated to be 249 AUM (1,870 acres per 1.5 acres per sheep month = 1,247 sheep months per 5 sheep per AUM = 249 AUM). This impact of grazing includes both private and Federal lands. Restrictions on the number of sheep and cattle allowed and/or realignment of grazing allotments may be required due to implementing the Proposed Action.

As the recreation use increased and summer home development proceeded, there could be additional areas in the upper Gooseberry drainage that would not be available for livestock grazing due to anticipated or existing livestock-people conflicts. For every 7 to 10 acres of additional land that cannot be grazed due to conflicts with traffic and/or people, there may be a loss of 1 AUM (5 sheep months) grazing use. Grazing permits and allotment boundaries may need to be adjusted. Land use in the *Manti-La Sal National Forest Land and Resource Management Plan* would change to reflect project implementation.

No reduction of acres of mineable coal reserves is anticipated under the Proposed Action.

3.18.3.3 Mid-Sized Reservoir Alternative

As with the Proposed Action, major changes in land use in the area surrounding the dam and reservoir are not anticipated under this alternative. Narrows Reservoir, SR-264 relocation, the recreation area, and the conservation easements adjacent to the reservoir would reduce the available grazing area by 736 acres. This area is about 7% of the suitable grazing acreage in the area. The Mid-Sized Reservoir Alternative may result in the direct loss of 98 AUM (736 project acres per 1.5 acres per sheep month = 491 sheep months per 5 sheep months per AUM = 98 AUM); however, indirect loss of grazing (estimated to be about 811 additional acres) may occur on adjacent areas around the reservoir, between the highway and the reservoir, and around camping and residence areas. The total grazing impact is estimated to be 206 AUM (1,547 acres per 1.5 acres per sheep month = 1,031 sheep months per 5 sheep month per AUM = 206 AUM). This impact to grazing includes both private and Federal lands. For every 7–10 acres of additional land that cannot be grazed due to conflicts with traffic and/or people, there may be a loss of 1 AUM (5 sheep months) grazing use. Grazing permits and allotment boundaries may need to be adjusted. Land use in the *Manti-La Sal National Forest Land and Resource Management Plan* would change to reflect project implementation.

No reduction of acres of mineable coal reserves are anticipated under the Mid-Sized Reservoir Alternative.

As the recreation use increased and summer home development proceeded, there could be additional areas in the upper Gooseberry drainage that would not be available for livestock grazing due to livestock-people conflicts. Livestock grazing is generally not compatible in, or immediately adjacent to, dwellings and high recreation use areas.

3.18.3.4 Small Reservoir Alternative

As with the Proposed Action, major changes in land use in the area surrounding the dam and reservoir are not anticipated under this alternative. Narrows Reservoir, SR-264 relocation, the recreation area, and the conservation easements adjacent to the reservoir would reduce the available grazing area by 610 acres. This area is about 7% of the suitable grazing acreage in the area. The Small Reservoir Alternative may result in the direct loss of 81 AUM (610 project acres per 1.5 acres per sheep month = 407 sheep months per 5 sheep months per AUM = 81 AUM); however, indirect loss of grazing (estimated to be about 705 additional acres) may occur on adjacent areas around the reservoir, between the highway and the reservoir, and around camping and residence areas. The total grazing impact is estimated to be 175 AUM (1,315 acres per 1.5 acres per sheep month = 877 sheep months per 5 sheep month per AUM = 175 AUM). This impact to grazing includes both private and Federal lands. For every 7–10 acres of additional land that cannot be grazed due to conflicts with traffic and/or people, there may be a loss of 1 AUM (5 sheep months) grazing use. Grazing permits and allotment boundaries may need to be adjusted. Land use in the *Manti-La Sal National Forest Land and Resource Management Plan* would change to reflect project implementation.

No reduction of acres of mineable coal reserves would be anticipated under the Small Reservoir Alternative.

As the recreation use increased and summer home development proceeded, there could be additional areas in the upper Gooseberry drainage that would not be available for livestock grazing due to livestock-people conflicts. Livestock grazing is generally not compatible in or immediately adjacent to dwellings and high recreation use areas.

3.19 PUBLIC HEALTH AND SAFETY

3.19.1 Affected Environment

Two public health and safety issues were raised related to development of the Narrows Project. The first issue deals with increases in recreational traffic, while the second is the public's concern with drinking water quality from Scofield Reservoir. The latter issue is covered in detail in the Water Quality section, but the following is a summary of effects by alternatives.

As to the traffic issue, the area adjacent to the proposed Narrows Reservoir is served by two State highways, SR-31 and SR-264. These two-lane roads are narrow and winding. Both highways are maintained for year-round use by the Utah Department of Transportation. Average daily traffic (ADT) numbers for these roads are listed in table 3-37.

ADT values shown in the table are based on UDOT traffic counts taken in 2000.

3.19.2 Methodology and Impact Indicators

Narrows Project impacts on public safety were quantified by comparing projected ADT values under each of the action alternative conditions with the ADT under the No Action Alternative. Increased ADT was estimated based on projected recreation visitor days created by each of the alternatives and using an average of two persons

Table 3-37.—Projected Average Daily Traffic in Vicinity of Narrows Reservoir During Recreation Season (Vehicles Per Day)

	No Action[1]	Proposed Action[2]	Mid-Sized Reservoir Alternative[2]	Small Reservoir Alternative[2]
SR-31 in Fairview Canyon	1,540	1,792	1,744	1,691
SR-264 adjacent to Narrows Reservoir site	820	1,072	1,024	971

[1] Based on 2000 UDOT traffic surveys.
[2] Based on two persons per vehicle and 92-day recreation season.

per vehicle. All of the increase in traffic was assumed to occur within a 92-day recreation season from June 15–September 15.

The impact indicator for public safety is the percent increase in ADT.

3.19.3 Predicted Effects

3.19.3.1 No Action Alternative

There would be no increase in ADT under the No Action Alternative. ADT values for SR-31 and SR-264 would be expected to remain as shown in table 3-37.

As for drinking water effects under the No Action Alternative, the drinking water standards would continue to be met. Because drought years or low flow years are not correlated with changes in drinking water conditions, even if there were climate change or an unusual run of drought years, there should be no changes in public health.

3.19.3.2 Proposed Action Alternative

As shown in table 3-37, ADT on SR-31 would increase by 252 or 16% under the Proposed Action. ADT on SR-264 would increase by 31%. However, even with these increases, both roads still would be well within their design capacity. To increase safety, additional turning lanes with adequate sight distance would be provided at recreation area entrances and exits.

With respect to public health and drinking water quality, as mentioned in the Water Quality section, in 1992 and subsequently, the State of Utah investigated alleged correlations between drought, gastrointestinal illnesses, and chlorination at the city of Price water treatment plant. No correlations were found. Therefore, due to the lack of correlation, the reduction in water availability in Scofield Reservoir should not lead to any public health effects in Price or homes served by the local water treatment plant. Public health should be unaffected by the proposal.

3.19.3.3 Mid-Sized Reservoir Alternative

ADT on SR-31 would increase by 204 or 13% under the Mid-Sized Reservoir Alternative. ADT on SR-264 would increase by 25%. As with the Proposed Action, additional turning lanes with adequate sight distance would be provided at recreation area entrances and exits to enhance public safety.

As with the Proposed Action, there should be no effects on drinking water due to the lack of correlation with water levels in Scofield Reservoir or downstream.

3.19.3.4 Small Reservoir Alternative

ADT on SR-31 would increase by 151 or 10% under the Small Reservoir Alternative. ADT on SR-264 would increase by 18%. As with the Proposed Action, additional turning lanes with adequate sight distance would be provided at recreation area entrances and exits to enhance public safety.

As with the Proposed Action, there should be no effects on drinking water due to the lack of correlation with water levels in Scofield Reservoir or downstream.

3.20 INDIAN TRUST ASSETS

The United States has a trust responsibility to protect and maintain rights reserved by, or granted to, American Indian tribes or individuals by various treaties, statutes, and Executive orders. These rights are sometimes further interpreted through court decisions and regulations. This trust responsibility requires that agencies, such as Reclamation, take actions reasonably necessary to protect these trust assets.

Reclamation policy is to reasonably protect ITAs from adverse impacts of its programs and activities. ITAs are property interests held in trust by the United States for the benefit of Indian tribes or individuals.

No Indian trust assets have been identified in or near the affected area; therefore, implementation of the Proposed Action would have no foreseeable negative impacts on ITAs.

3.21 ENVIRONMENTAL JUSTICE

On February 11, 1994, the President issued Executive Order 12898 on Environmental Justice in Minority Populations and Low Income Populations. As a result of that Executive order, each Federal agency is required to analyze the environmental effects, including human health, economic, and social effects, of Federal actions, including effects on minority communities and low-income communities.

In the project area, there are no minority or low-income populations; and, therefore, there are no environmental justice effects.

3.22 RELATED LAWS, RULES, REGULATIONS, AND EXECUTIVE ORDERS

The Council of Environmental Quality regulations (40 CFR 1500.2 and 1502.25) encourage related environmental laws, rules, regulations, and Executive orders to be integrated concurrently to the fullest extent possible in an EIS.

The following environmental laws, rules, regulations, and Executive orders have been considered during preparation of this FEIS. It has been determined that the Narrows Project would have no adverse effect upon them.

- Executive Order 11988 (Flood Plain Management)
- Wild and Scenic Rivers Act, Public Law 90-542. In 2007, the USDA Forest Service and Bureau of Land Management evaluated thousands of river miles for potential inclusion in the National Wild and Scenic Rivers System. In determining suitability, a key question was, does the river segment have Outstanding Remarkable Values (ORV).

The USDA Forest Service conducted an environmental impact statement to evaluate the suitability of 86 eligible river segments (840 miles) including 21 miles of Fish Creek and Gooseberry Creek. The Record of Decision, signed November 2008, determined that Fish Creek and Gooseberry Creek were not suitable to be designated by Congress as components of the National Wild and Scenic Rivers System. All the nonsuitable river segments are no longer afforded agency interim protection under the Wild and Scenic

Rivers Act and continue to be managed under the direction of the respective agencies.

3.23 CUMULATIVE IMPACTS

3.23.1 Cumulative Resource Issues

Cumulative impacts are the effects on the environment that result from the impact of implementing the Proposed Action in combination with other actions. The CEQ regulations for implementing NEPA define cumulative impacts as: "…the impact on the environment, which results from the incremental impact of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR 1500-1508)

3.23.2 Cumulative Impact Area and Reasonably Foreseeable Actions

After a careful review of the resources or components of the environment analyzed in chapter 3 of the FEIS, Sanpete and Carbon Counties are considered the affected environment for this cumulative impact analysis. The cumulative impacts area is Sanpete and Carbon Counties or within the watershed potentially affected by the Narrows Project.

Following U.S. Department of the Interior regulations at 43 CFR 46.30, reasonably foreseeable future actions include all Federal and non-Federal activities not yet undertaken, but sufficiently likely to occur, within the cumulative impact area. These activities include activities for which there are existing decisions, funding, or proposals identified by bureaus or local governments. Plans and environmental decisions of BLM's Richfield Field Office, the Price Field Office, and the Manti-LaSal National Forest were reviewed to identify any existing decisions, funded projects, or proposals that should be analyzed for their cumulative impacts. For the BLM, all documents posted to their online environmental notification bulletin board were checked to see if actions approved in findings of no significant impact or records of decision would add cumulative impacts to the resources in chapter 3. No decisions were found that would affect any of the resources affected by the Narrows Project.

For the USDA Forest Service, the Manti-LaSal Forest Plan and related social and economic assessment were the main reasonably foreseeable actions that are considered here. The Narrows Project was planned in conformance with the Forest Plan. Multiple environmental assessments of the USDA Forest Service were checked, but no specific action was identified that meets the definition of a reasonably foreseeable future action for the Narrows Project.

Nor were reasonably foreseeable actions identified by Sanpete or Carbon Counties. Thus, there are no single or specific actions to be analyzed for cumulative effects. Instead, the direct and indirect impacts of the Narrows Project that might contribute to a cumulative impact on identified resources in chapter 3 are summarized below. The action alternatives are grouped for this analysis.

Resource issues have been affected by past Reclamation developments and would be affected by the proposed project; thus, they have the potential to contribute to cumulative (additive) impacts within Sanpete and Carbon Counties. These issues involve stream depletions that can impact fisheries, endangered native fishes, and change salt loading within the Colorado River. These issues are treated below under the headings of water resources, use, and quality; water rights; paleontological resources; fisheries;

wildlife; threatened and endangered species; wetlands; recreation and visual; and cultural resources.

3.23.2.1 Water Resources

As described in chapter 3, a long-term diversion of water by the Narrows Project to the Cottonwood Creek and San Pitch River watersheds would permanently reduce flows downstream from the project. The lowered reservoir storage would increase the potential of reaching dead storage in Scofield Reservoir by 20%. Decreased reservoir storage in Scofield Reservoir also would result in reduced spills from the reservoir, which would, in turn, impact the Price, Green, and, ultimately, the Colorado Rivers.

Approximately 5 miles of small streams or creeks, including 1 mile of Upper Gooseberry Creek, would be inundated by Narrows Reservoir. Middle Gooseberry Creek, between the proposed Narrows Reservoir and Lower Gooseberry Reservoir, would see a 74% reduction in annual flows; but the minimum flow requirements from the Narrows Project would eliminate historic periods of dry stream channels. Mitigation measures could include 300 acre-feet of water to be managed for water quality and aquatic biological resources.

Another water resources effect would be that a transbasin diversion through the Narrows Tunnel to Cottonwood Creek would result in lower peak flows during the spring runoff period, offset by higher flows during the irrigation season.

3.23.2.2 Water Quality

Carbon County has identified water quality in the Price River and watershed as a major concern, largely because the county's ground water is unusable due to high salinity. The county has formed a Carbon Water Committee that has and will continue to investigate uses to which the Price River are applied. County planning will continue to attempt to provide a land use and water quality scheme that is viable and in conformance with USDA Forest Service and BLM plans.

If one of the action alternatives is selected, timing of flows, temperature, turbidity, and ecological composition of the rivers and streams would be affected; and water quality downstream from the project would be more sensitive to future activities that degrade or improve water quality. These include phosphorus load increases and reduction efforts in the Scofield Reservoir drainage and salinity control efforts in the Price River watershed.

Proposed mitigation measures to reduce phosphorus loading in Scofield Reservoir as part of the Narrows Project may impact the ability to meet the target phosphorus load reduction through stream restoration identified in the Scofield Reservoir TMDL. Mitigation measures implemented as part of the Narrows Project may be the most cost effective, most easily implemented, and maintained. This may result in less effective load reduction measures available for implementation as part of the Scofield Reservoir TMDL. A great deal of uncertainty exists surrounding this potential impact though, as specific mitigation measures through stream restoration have not been identified for either the Scofield Reservoir TMDL or the Narrows Project. It is possible that measures are available to satisfy the reduction target of both efforts or that the mitigation from both efforts will not overlap. SWCD is required to mitigate impacts to water quality in Scofield Reservoir and to ensure that it does not deteriorate due to the Narrows Project. Mitigation measures are designed to maintain Scofield Reservoir at its existing condition.

Under a water quality protection program, water quality at the proposed Narrows Reservoir would be protected by meeting State and Federal requirements and establishing protection zones adjacent to the reservoir. Within these protection zones, land use practices would be restricted to eliminate activities that would impact reservoir water quality.

3.23.2.3 Water Rights

If the Narrows Project is built, Water Right Nos. 91-130, 91-131, and 91-132 would be developed and would increase the water depletions in the Gooseberry Creek basin up to 5,400 acre-feet per year. The Narrows water right represents about 6.6% of the average annual yield of the Price River above the city of Price. Although these are valid water rights, their development would incrementally decrease the water available in the Gooseberry, Price, Green, and Colorado River systems. The 1948 Colorado River Compact gives Utah 23% of the Colorado River (and all tributaries) water allocated to the Upper Basin States, which is estimated at approximately 1.3 million acre-feet (maf) of depletion annually. Utah is currently depleting 1.0 maf per year of Colorado River water, and this project would bring Utah closer to using its entire allocation. Once Utah reaches full allocation, there would be a greater likelihood that some water rights would need to be curtailed to ensure that Utah does not exceed its allotment.

3.23.2.4 Paleontological Resources

Under the No Action Alternative, the existing conditions in the APE would remain intact, and paleontological resources likely would not be impacted. No past, present, or reasonably foreseeable actions are expected to result in cumulative effects to fossil resources. Thus, there would be no cumulative effects to paleontological resources from the No Action Alternative.

Under the action alternatives, should paleontological resources located directly within or adjacent to the Narrows Reservoir pool area be present, the lowered reservoir pool could result in damage to or theft of fossil resources due to increased public visitation. This increased visitation, in the form of recreation and residential development, for example, has the potential to cause cumulative impacts to paleontological resources. Therefore, cumulative effects to cultural resources are likely under the action alternatives.

3.23.2.5 Fisheries

Past and future water diversions and depletions have affected and will continue to affect the sport fishery and native species. The analysis in chapter 3 shows that the Narrows Project will have minor impacts on flows below Scofield Reservoir. Mitigation measures are designed to help reduce impacts.

3.23.2.6 Wildlife

If one of the action alternatives is selected, and the reservoir is built, then there will be a future loss of vegetation and wildlife habitat; and the quality of the habitat could be degraded from development around the reservoir. This could increase forage competition among grazing animals. Habitats may be unavailable to wildlife because of human disturbance factors (e.g., traffic or noise during sensitive time periods such as winter, birthing, nesting, and early rearing of young). Impacts on wildlife could result if increased development and surface disturbance altered existing migration corridors where access to important habitat areas would be greatly reduced. Mitigative efforts have reduced these effects or they have improved habitat conditions for these species in various areas.

The additive effects of the Proposed Action, in conjunction with the past action have resulted in irreversible and irretrievable impacts to wildlife. Mitigation measures have been designed to mitigate these impacts to the extent possible.

Conservation species, such as the Columbia spotted frog, roundtail chub, bluehead sucker, flannelmouth sucker, as well as other sensitive species identified in the FEIS, have experienced cumulative effects from loss of habitat from development and construction projects over the years. These species rely on natural water systems for their habitat. The proposed project identifies reasonable actions to reduce or eliminate impacts to these species.

3.23.2.7 Threatened, Endangered, Conservation, and Other Special Species

Under past and ongoing actions, the Colorado pikeminnow, bonytail, razorback sucker, and humpback chub are endangered in the Colorado River Basin, including the Green, Yampa, Gunnison, and San Juan Rivers. These species evolved in the Colorado River and its larger tributaries under conditions of warm water, large seasonal flow fluctuations, heavy sediment loads, extreme turbulence, and a wide range of dissolved solids concentrations. These conditions have been altered by human activities, and all four species have experienced population declines. The Upper Colorado River Endangered Fish Recovery Program was established as the major offset for the impacts of historic and future water development projects in the basin.

To minimize the possible adverse effects of the Narrows Project on the Colorado pikeminnow, bonytail, humpback chub, and razorback sucker, SWCD would participate in the Recovery Program as described in the FEIS, which includes a one-time depletion fee payment.

3.23.2.8 Wetlands and Riparian

The proposed Narrows Reservoir would permanently inundate approximately 89 acres of wetlands. Proposed modifications to portions of the Gooseberry Creek include narrowing the channel to maintain the depth of flow. Flows in the middle portion of Gooseberry Creek between the proposed dam and Lower Gooseberry Reservoir would decrease the average current flow by about 73.1%. The reduced magnitude and duration of flood flows would have the potential to impact the riparian area along Gooseberry and Fish Creeks. The riparian vegetation communities of sedges, rushes, and hydric grasses found as bands and small pockets along the banks of the stream may be reduced in quantity and quality by the proposed action. Willow thickets along Gooseberry and Fish Creeks could be reduced in quantity and quality. This reduction of the quantity and quality of riparian and wetland systems is likely to continue. Implementation of recommended flows by the Utah Division of Wildlife Resources and the gaining stream status of Gooseberry Creek could result in positive changes for riparian and wetland vegetation.

3.23.2.9 Recreation and Visual

3.23.1.9.1 Recreation

As discussed in chapter 3, travel and tourism employment has decreased from 1998 to 2009 in Sanpete and Carbon Counties by 5.8%. Over the same time period, nontravel and tourism employment has grown from 8,299 to 10,298 jobs, a 24.1% increase. This trend is likely to continue into the future, although there could be some increase in visitor use due to the Narrows Project.

ATVs are popular within the project area for agricultural and recreational use. The Arisen Trail System, a joint effort of Federal, State, and local agencies and communities, is an extensive trail system south of the project area that links Federal- and State-managed public lands with communities. There are areas of intensive ATV use throughout the project area, particularly around some of the communities, where soils, vegetation, and scenic values are being affected. Should the project be implemented, dispersed recreational activity would not change. There would be some changes in recreational use; however, these are disclosed in section 3.15.

3.24 OTHER NEPA CONSIDERATIONS

3.24.1 Irreversible and Irretrievable Commitments of Resources

Renewable and nonrenewable resources would be irreversibly or irretrievably committed by construction and operation of the Narrows Project. Although it would be theoretically possible to reverse commitments of some of these resources, the Council on Environmental Quality has stated that ". . . construction and facility uses are basically irreversible since a large commitment of resources makes removal or nonuse thereafter unlikely." This section briefly describes these commitments for all alternatives, with the exception of the No Action Alternative. Under that plan, there would be no commitment of resources other than moneys already spent.

3.24.1.1 Water Resources

The Narrows Project would commit up to 5,400 acre-feet of water from Upper Gooseberry Creek and its tributaries, which are located in the Price River drainage, to project purposes. Initially, about 4,900 acre-feet would be used for irrigation, and 500 acre-feet would be designated for municipal use in the northern Sanpete County area. As the need arises, the balance between M&I and irrigation water will change. As the demand for M&I use increases, M&I use will increase, and irrigation use will decrease. The conversion of water from irrigation to M&I use will occur in stages.

Under present Utah water law and the 1984 Compromise Agreement, commitments of water resources essentially would remain permanent, provided that they are beneficially used. Although the area's water resources would not be irretrievably or irreversibly committed, use of the project water would be long term in nature.

3.24.1.2 Fish, Wildlife, and Grazing Habitat

The inundation by the reservoir of about 1 mile of UDWR Class 3B-Unique stream fishery in Upper Gooseberry Creek and 4.3 miles of cutthroat trout spawning and rearing habitat in the Gooseberry Creek tributaries would be essentially irreversible.

The commitment of land in the reservoir pool for water storage and around the reservoir to recreation uses would be essentially irreversible, since to do otherwise could jeopardize the water quality of the reservoir as well as the proposed wildlife mitigation plan. Streamflow patterns resulting from project operation would be subject to change should water needs in service areas change, but current trends indicate that the proposed operational criteria would be long term and would constitute a basically irreversible commitment. The loss of grazing AUMs also would be considered an irreversible commitment of resources.

3.24.1.3 Land

Narrows Reservoir and other project features (damsite, recreation facilities, and road relocations) would permanently alter use on about 786 acres of the 1,931 acres needed for the project. The land currently functions primarily as recreation, rangeland, and wildlife habitat. The remaining 1,145 acres for the project will, over time, be restored to original functions as rangeland and wildlife habitat. Geologic studies of the reservoir and damsite have not identified any critical mineral resources within the reservoir basin or damsite.

3.24.1.4 Construction Materials

About 375,000 cubic yards of permeable and impermeable earth material, gravel, cobble, and riprap would be irretrievably committed to use in the dam embankments and associated features. Much smaller amounts of concrete aggregate would be used in the dam and project features. Imported cement and manufactured materials would be irretrievably committed to the project features. Fuels, explosives, and electrical power would be consumed during project construction.

3.24.1.5 Aesthetics

Narrows Project would irreversibly alter the scenery of the feature sites by the building of structures, excavation of landscape, and inundation of the reservoir. The construction scars would be revegetated where practical; but the visual impact, which would be unattractive to some people, would be permanent.

3.24.2 Short-Term Uses and Long-Term Productivity

The CEQ regulations for implementing NEPA at 40 CFR 1502.16 require analysis of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity.

3.24.3 Action Alternatives

Short-term losses from the action alternatives, as described in sections 3.23 and 3.24.1, would include construction impacts such as increased noise, traffic delays, or detours. Air quality would be worse during construction. These temporary environmental impacts would be balanced through mitigation and avoidance as much as is reasonably possible.

Short-term benefits would include increased jobs from construction and revenue generated during construction.

Long-term losses from the action alternatives would include the permanent loss of approximately 1,145 acres of rangeland and wildlife habitat, displacement of wildlife and fish, loss of grazing habitat, reduction of water flows below the dam, visual impacts, possible loss of paleontological resources, and recreational impacts such as access inconveniences.

Long-term benefits would include that the reservoir would make it possible to store water from spring runoff for use during the drier summer months. This would allow local farmers the opportunity to have a longer, more productive growing season. The reservoir also would provide a habitat for sport fish and provide water for the nearby wildlife. Below the dam, a minimum flows requirement would provide year-round flows in Gooseberry Creek and Cottonwood Creek. These stream segments historically have been dewatered at times of the year. Although primarily intended as a measure to facilitate winter survival of fish, this requirement also would have some beneficial effects on the riparian and wetland areas adjacent to the creeks. Providing flows in summer months also would stimulate the growth of riparian and wetland vegetation.

3.24.4 No Action Alternative

This alternative would offer none of the benefits or have any of the losses listed above. It would not meet SWCD's proposal or need for additional water for irrigated agriculture.

CHAPTER 4
Consultation and Coordination

4.0 INTRODUCTION

This chapter details the consultation and coordination between Reclamation and other State, Federal, and local agencies; Native American tribes; and the public in preparation of this FEIS, the SDEIS, and the DEIS published in 1998, which this FEIS updates and supplements. Throughout the EIS process dating back to 1990, input has been actively solicited from a broad range of public constituencies as part of the ongoing public involvement process. Comments and involvement in the planning for, and preparing of, the Narrows Project generally were sought through two broad efforts: communication and consultation with a variety of Federal, State, and local agencies; Native American tribes; and interest groups and the formal SDEIS scoping process and comment process, both of which invited input from the general public.

4.1 SUMMARY OF INTERAGENCY COORDINATION 1996–2003

In 1996, Reclamation invited a number of State and Federal agencies to become cooperating agencies in preparation of the DEIS. The two agencies that agreed to become cooperating agencies for the EIS process, including this FEIS, are the U.S. Department of Agriculture Forest Service and the U.S. Army Corps of Engineers. In addition to these two agencies, the following agencies had representation on the interdisciplinary team led by Reclamation that prepared the DEIS published in 1998:

- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency
- Utah Division of Wildlife Resources
- Utah Division of Water Quality
- U.S. Department of the Interior, Office of the Solicitor
- Sanpete Water Conservancy District

Reclamation hosted periodic cooperating agency meetings and interdisciplinary team meetings throughout preparation of the DEIS and the SDEIS to ensure that all of the agencies were informed of, and involved in, the issues and analyses related to this FEIS.

4.2 CONSULTATION

Consultation was conducted as needed with agencies or experts that provided information for preparation of the DEIS published in 1998, the SDEIS, and this FEIS.

4.2.1 Fish and Wildlife Coordination Act

Reclamation consulted with the Service on fish and wildlife resources and habitats that would be affected by the Narrows Project. A Fish and Wildlife Coordination Act Report was prepared by the Service. As a result of continued consultation regarding project impacts to fish and wildlife, Reclamation requested an updated Fish and Wildlife Coordination Act Report from the Service (appendix D). In 2006, the Service verified that this report was still current and did not require updating.

4.2.2 Endangered Species Act of 1973

Reclamation consulted with the Service regarding potential project impacts to threatened and endangered species. A list of species that could occur in the project area was received from the Service. Reclamation submitted a biological assessment to the Service. The Service then issued a biological opinion. Consultation was re-initiated by Reclamation as a result of critical habitat designation. The Service then issued an amended biological opinion for the Narrows Project. Consultation was again re-initiated by Reclamation after the discovery of Colorado pikeminnow in the lower Price River. Subsequently, Reclamation submitted an amended biological assessment to the Service analyzing this new information. Reclamation received a biological opinion from the Service August 24, 2000.

4.2.3 National Historic Preservation Act of 1966

In a letter dated September 10, 1997, Reclamation consulted with the SHPO regarding cultural resources potentially affected by the Proposed Action (appendix E). In the letter, Reclamation requested a review of the cultural resource-related environmental commitments in the 1998 DEIS to determine their adequacy in complying with Reclamation's Section 106 responsibilities. SHPO concurred with the adequacy of Reclamation's environmental commitments in a letter dated September 16, 1997 (appendix E).

On January 25, 2007, Reclamation consulted again with the SHPO by phone regarding the same cultural resource-related environmental commitments in appendix G. The SHPO again concurred with the cultural resource commitments and agreed that they were adequate in complying with Reclamation's responsibilities under Section 106 of the NHPA.

Due to both the age of the previous SHPO consultations and the fact that the entire APE was not included in the previous consultations for the Proposed Action (as discussed in section 3.16.1), Reclamation will be required to conduct consultations with the SHPO in findings and determinations made throughout the Section 106 process. This requirement is stated in the environmental commitments in appendix G.

In addition to the SHPO, 36 CFR 800 requires consultation with other consulting parties, such as representatives of local governments, for example, in findings and determinations made throughout the Section 106 process. The Advisory Council on Historic Preservation also must be consulted if historic properties are adversely affected by the Proposed Action. The environmental commitments (see appendix G) require Reclamation to conduct consultation with all consulting parties as mandated under 36 CFR 800.

4.2.4 Tribal Consultations

In 1997, Reclamation initiated consultation with the Ute Indian Tribe of the Uintah and Ouray Reservation in accordance with 36 CFR Part 800, Section 106 of the NHPA, and all other cultural resource-related laws, regulations, and directives pertinent to the Proposed Action. Members of the tribe toured the proposed location of the Narrows Dam and Reservoir and were briefed on the scope of the Proposed Action. Reclamation consulted again with the Ute Indian Tribe of the Uintah and Ouray Reservation, in a letter dated September 28, 2001, regarding potential traditional cultural properties

(TCPs) or sacred sites within the APE. Reclamation also consulted with the Paiute Indian Tribe of Utah, in a letter dated September 28, 2001, concerning the same inquiry. Neither tribe expressed concerns regarding either TCPs or sacred sites within the APE.

Due to the age of the previous tribal consultations, Reclamation will be required to conduct consultations with tribes prior to initiation of final design and construction associated with the Proposed Action. This requirement is stated in the environmental commitments in appendix G. In accordance with 36 CFR 800.2(ii), consultation will be required with any tribe that may attach religious and cultural significance to historic properties potentially affected by the Proposed Action. The consultation process shall provide each tribe a "reasonable opportunity" to identify concerns about historic properties, advise Reclamation on the identification and evaluation of historic properties, including those of traditional religious and cultural importance, express views on the Proposed Action's effects on such properties, and participate in the resolution of any adverse effects.

4.2.5 Indian Trust Assets

In a letter dated January 7, 1997, Reclamation consulted with the Bureau of Indian Affairs (BIA), Uintah and Ouray Agency, regarding possible impacts upon ITAs resulting from the Proposed Action. In a response letter, dated January 18, 1997, BIA concluded that the Proposed Action would not impact any ITAs under the jurisdiction of the Uintah and Ouray Agency of BIA.

4.3 PUBLIC INVOLVEMENT AND SCOPING

The scoping process for this FEIS was conducted by Reclamation beginning in November 2003 to provide the general public, organizations, State and local governments, and affected Federal agencies an opportunity to identify issues and concerns they believe should be studied early in preparation of the SDEIS. "Scoping" is the public involvement process required by the Council on Environmental Quality regulations to help Federal agencies determine issues and alternatives analyzed in the SDEIS. Results of the scoping meetings and comments received during the scoping process were used to establish the scope of the SDEIS and to focus the environmental analysis on the important issues and concerns.

The original scoping process for the Narrows Project began with scoping meetings held at Fairview and Price, Utah, on October 3 and 4, 1990, respectively. Notice of the scoping meetings was given through a *Federal Register* Notice dated September 7, 1990, and through a news release dated September 24, 1990. In addition, 32 letters were sent to State and Federal agencies and environmental groups giving notice of the meetings. Three newspapers—the Salt Lake Tribune, the Mt. Pleasant Pyramid, and the Sun Advocate—published articles regarding the project and the upcoming scoping meetings. Concerned citizens were encouraged to attend the scoping meetings or express their concerns in writing.

After the 1995 Record of Decision was rescinded, a new DEIS was prepared, beginning in 1996, and was published in 1998. Comments were received on that DEIS (and public hearings were held to receive comments); those comments were analyzed and responded to, and the 1998 DEIS was revised based on input from those comments. Since a decision was made in 2003 to prepare this SDEIS in lieu of publishing a FEIS based on the 1998 DEIS, it should be noted that the SDEIS does capture revisions made earlier based on public comments and input.

After the decision was made to prepare the SDEIS, public meetings to inform the public and to share information were held in Price and Manti, Utah, in September 2003. On November 25, 2003, a *Federal Register* Notice was published to serve as an official notice that Reclamation intended to prepare a supplemental draft environmental impact statement for the Narrows Project. Public hearings were held again in Price and Manti, Utah, in April 2010 during a 63-day comment period ending June 2010. Reclamation received 696 comment documents, and formal responses to substantive comments were published in appendix H of this FEIS. Comments received in response to the *Federal Register* Notice also were taken into consideration, along with all prior public comments in preparing this FEIS.

Section 1.4 provides further information on the scoping process for this FEIS.

4.4 Document Availability

Those who were on the mailing list for the 1998 DEIS, or who asked to be added to the mailing list in response to the SDEIS in 2010, were provided notification of document availability along with other environmental groups; Federal, State, and local government agencies; and other interested parties. Over 400 notifications of the FEIS have been mailed to interested agencies, organizations, and individuals. The FEIS is available online at www.usbr.gov/uc/envdocs/index.html.

CHAPTER 5
List of Preparers

This Narrows Project, Utah, Final Environmental Impact Statement was prepared by the Bureau of Reclamation, Upper Colorado Region, Provo Area Office. The names of persons who prepared various sections, provided extensive background information, or participated to a significant degree in preparing the present document are listed below. Immediately following is a listing of members of the former interdisciplinary team who produced the 1998 *Draft Environmental Impact Statement, Narrows Project*.

Preparers of Final Environmental Impact Statement

U.S. Department of the Interior
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Name and Title	Education and Professional Experience	EIS Responsibility
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Preparers of Final Environmental Impact Statement (continued)

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CHAPTER 6

Bibliography, Glossary of Terms, and List of Acronyms and Abbreviations

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http://www.water.utah.gov/waterplan.

6.1 GLOSSARY OF TERMS

A

Acre-foot	A measure of water volume—1 foot of water covering an acre in area.
Active storage	That portion of a reservoir capacity from which releases are made.
Activity occasion	Any activity by an individual at a recreation area for any length of time.
Alluvium	A deposit of sand and gravel formed by flowing water.
Angler day	Any visit by an individual to a fishing area during any part or all of a 24-hour day.
Animal unit month (AUM)	The amount of feed necessary to support one cow and her unweaned calf or five sheep for 1 month.
Autotrophic	Organisms that are capable of producing organic substances from inorganic materials by means of energy received from outside the organism.

B

Bedrock	The solid rock that underlies soil, sand, clay, or other loose surface material.
Benthos	Organisms living in or on the bottom of a lake or stream.
Biomass	The amount of living matter in the form of one or more kinds of organisms present in a particular habitat.
Browse	Twigs, leaves, and young shoots of trees and shrubs on which animals feed—in particular, those shrubs that are used by big game animals for food.

C

Carrying capacity	The number of animals that can be maintained in a given habitat through the pinch period—usually winter.
Celsius (Centigrade)	ºC = (ºF-32)5/9.
Coldwater fishery	Generally, water or a water system that has an environment suitable for salmonoid fishes such as trout.

Cubic foot	A measure of a moving volume of water per second (measured in cubic feet per second).
Cultural resource	Physical or other expressions of human activity or occupation. Such resources include culturally significant landscapes, prehistoric and historic archaeological sites as well as isolated artifacts or features, traditional cultural properties (TCPs), Native American and other sacred places, artifacts, and documents of cultural and historic significance.

D

Dead storage	That portion of a reservoir capacity that constitutes the minimum pool. Because this portion of a reservoir is below the outlet works, it cannot be released. It is used for the benefit of recreation, fishery habitat, and silt deposition.
Degradation	The geologic process wherein streambeds and flood plains are lowered in elevation by removing material. The opposite of aggradation.

E

Ecosystem	A complex system composed of a community of fauna and flora, taking into account the chemical and physical environment with which the system is interrelated.
Endangered species	A species that is in danger of extinction throughout all or a significant portion of its range.

F

Fahrenheit	$^{\circ}F = (9/5\ ^{\circ}C) + 32$.
Fault	A break in the rocks in which there has been unequal movement of the two sides relative to each other.
Fish stream improvement	Improving a stream channel to make a new fish habitat or to enhance an existing habitat.
Fisherman day	An aggregate of 12 hours of fishing use by one or more individuals.
Forb	An herb other than grass.
Fry	Fish between the egg and fingerling stage.

G

Game fish	Those species of fish classified and managed by the State for sport fishing or angling.
Gauging station	A location on a water channel where streamflows are recorded.

H

Habitat evaluation procedure (HEP)	"HEP" is a "species habitat" approach to impact assessment and habitat quality.
Head	The difference in elevation between two bodies of water.
Hectare	An area of land or water equal to 2.471 acres.
Hunting day	A visit by an individual to an area for the purpose of hunting during any portion or all of a 24-hour day.

I

Inactive storage	That portion of a reservoir's capacity that is neither dead storage nor active storage. It normally is not released because of the benefits to fish, recreation, and other uses; but it can be since it is above the outlet works in the reservoir's profile.
Indian trust assets	Legal interests in property held in trust by the United States for Indian tribes or individuals.
Invader plants	Species, often annuals, which are not part of the climax vegetation that invade land when there is little or no competition from other plant species.
Irrigation water management	The art of timing and regulating irrigation water applications in a way that will satisfy the water requirement of the crop with minimum waste of water, soil, or plant nutrients.

L

Lateral	A small ditch used to deliver water from a canal to irrigation lands.
Limnology	The scientific study of physical and chemical conditions in fresh waters.

M

Macroinvertebrates	Animals lacking a backbone and internal skeleton (i.e., insects, worms, and crayfish).
Mesophyte	A plant growing under medium condition of moisture.
Metabolism	The sum total of the chemical transformations occurring in the body of a living organism.
Minimum pool	The amount of inactive and dead storage in a reservoir.
Mitigation	Actions to avoid, minimize, reduce, eliminate, or rectify the impact of a management practice.

N

National Register of Historic Places (NRHP)	The federally maintained register of significant districts, sites, buildings, structures, and objects associated with American history, architecture, archeology, engineering, and culture.
Nongame fish	Those species of fish not classified as sport fish by the State.

P

Palustrine	Living or thriving in a marshy environment.
Paleontological resource	Any fossilized remains, traces, or imprints of organisms, preserved in or on the Earth's crust, that are of paleontological interest and that provide information about the history of life on Earth.
Periphyton	Organisms that live attached to underwater surfaces.
Persons-at-one-time	A recreation capacity measurement term indicating the number of people who can use a facility or area at one time.
Phreatophyte	A deep-rooted plant that grows in riparian zones and obtains water from the water table or the soil just above it.
Phytoplankton	Passively floating plant life, primarily algae.
Pipelines	A means of conveying water from a water source to a farm or group of farms. They also are used to convey water between fields or to sprinkler laterals.

R

Reach	A finite length of a stream, river, or canal.
Recreation day	Twelve visitor hours, which may be aggregated continuously, intermittently, or simultaneously by one or more persons.
Recruitment	The increase in population caused by natural reproduction or immigration.
Redd	The spawning ground or nest of various fishes.
Riffle	A shallow water area across a streambed causing broken water.
Riparian (vegetation)	Living on the banks of a river or stream.
Riprap	Stones placed on the face of a dam or on streambanks or other land surfaces to protect them from erosion.

S

Salinity	A term referring to the quantity of dissolved mineral salts in solution.
Salmonid	Of or related to the Salmonidae, the family of fishes including trout.
Salt loading	Term used to express the amount of salt added to streams from any natural or manmade source.
Scoping	The public involvement process required by the Council on Environmental Quality regulations to help Federal agencies determine issues and alternatives analyzed in the final supplemental environmental impact statement.
Sediment	Any usually finely divided organic and/or mineral matter deposited by water in nonturbulent areas.
Seismicity	The phenomenon of Earth movement that usually results in an earthquake.
Sere	A series of ecological (vegetative) communities.
Sheep month	Use of forage by one mature ewe with lamb at side for 1 month. A sheep month equals 1/5 animal unit month.

Sprinkler irrigation	Application of water to the land surface by aboveground sprinkler nozzles attached to either stationary, moving, or movable laterals.
Supplemental service land	Irrigated land that receives project water in addition to a previous allotment from another source.
Surface irrigation	Application of water to the land surface through the use of corrugations, furrows, graded borders, or level borders.

T

Taxon (plural taxa)	A group of genetically similar organisms.
Thermal stratification	A temperature gradient within a body of water caused by warmer water occupying the upper level of the water and colder, denser water occupying the lower level.
Threatened species	A species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
Trophic	Related to nutrition, particularly the types of food an organism requires.
Trophic level	Place of an organism in the food chain.
Trophy fish	In terms of trout, a fish that exceeds 14 inches.

V

Visitor day	An aggregate of 12 hours of recreation use by one or more individuals.

W

Water right	A legal permit issued by the State government that allows the holder to divert a specific amount of water for beneficial use.
Weighted usable area	An expression of the quantity of fish habitat in feet squared per 1,000 feet of river channel.
Wetland	An area characterized by periodic inundation or saturation, hydric soils, and vegetation adapted for life in saturated soil conditions.
Wildlife wetland habitat management	Retaining, creating, or managing wetland habitat for wildlife.

Winter range (big game)	An area of land that has suitable vegetation and topographic conditions to support big game animals during the winter months when snow depth restricts use in other areas.

6.2 LIST OF ACRONYMS AND ABBREVIATIONS

A

ADT	average daily traffic
APE	area of potential effects
ATV	all terrain vehicle
AUM	animal unit months

B

BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	best management practice

C

$CaCO^3$	calcium carbonate
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGIC	Cottonwood-Gooseberry Irrigation Company
CMP	corrugated metal pipe
CRSP	Colorado River Storage Project
CRWQIP	Colorado River Water Quality Improvement Program
CUP	Central Utah Project
CUPCA	Central Utah Project Completion Act
CUWCD	Central Utah Water Conservancy District
CWCD	Carbon Water Conservancy District

D

DEIS	draft environmental impact statement
DO	dissolved oxygen
DOD	Department of Defense
DPS	Distinct population segment

E

ECC	Environmental Chemical Corporation
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act

F

FDR	Forest Development Road
FEIS	final environmental impact statement
Forest Plan	1986 Forest Land and Resource Management Plan for the Manti-La Sal National Forest
ft^2/day	square feet per day
FY	fiscal year

G

GPCD	gallons per capita per day

H

HEP	habitat evaluation procedures
HSI	Habitat Suitability Index
HU	habitat unit

I

IDC	interest during construction
IFIM	instream flow incremental methodology
IMPLAN	IMpact Analysis for PLANning
Interior	U.S. Department of the Interior
ITA	Indian trust asset

K

kg	kilogram
kg/yr	kilogram per year

L

lb/day	pound per day
LEDPA	Least Environmentally Damaging Practicable Alternative
LRMP	Land and Resource Management Plan

M

maf	million acre-feet
M&I	municipal and industrial
Master Plan	Sanpete County Water Resources Master Plan
MCE	maximum credible earthquake
meq/L	milliquivalent per liter
mg/L	milligram per liter
mm	millimeter
MOA	memorandum of agreement
MOU	memorandum of understanding
msl	mean sea level

N

NAAQS	National Ambient Air Quality Standards
Narrows Project	Narrows Project, Utah
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966
NOI	notice of intent
No.	number
NRHP	*National Register of Historic Places*

O

O&M	operation and maintenance
ORV	Outstanding Remarkable Values

P

PEM	palustrine emergent wetland cover (herbaceous wetlands)
PM_{10}	Particulate matter of 10 microns in diameter or smaller
ppm	parts per million
PRPA	Paleontological Resources Preservation Act of 2009
PRWUA	Price River Water Users Association
PSS	palustrine scrub/shrub cover (shrubby wetlands)
PVC	polyvinyl chloride

R

RAP	Recovery Action Plan
Reclamation	Bureau of Reclamation
Recovery Program	Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River Basin
Research Report 145	*Consumptive Use of Irrigated Crops in Utah*, October 1994
RIP	Recovery Implementation Program
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
ROW	rights-of-way
RPA	reasonable and prudent alternatives
RVD	recreation visitor day

S

SAR	Specific absorption rate
SCORP	1992 Utah State Comprehensive Recreation Plan
SDEIS	supplemental draft environmental impact statement
Service	U.S. Fish and Wildlife Service
SHPO	State Historic Preservation Officer
SR	State Route
SRPA	Small Reclamation Projects Act of 1956

Stat.	Statute
SWCD	Sanpete Water Conservancy District
SWWF	southwestern willow flycatcher

T

TCP	traditional cultural property
TDS	total dissolved solids
TMDL	total maximum daily load
TOC	total organic carbon
Tripartite Agreement	The October 11, 1943, reconstruction and repayment contract on Scofield Reservoir between the Federal Government and local sponsors
TSI	Trophic State Index

U

UDEQ	Utah Department of Environmental Quality
UDOT	Utah Department of Transportation
UDWR	Utah Division of Wildlife Resources
UGS	Utah Geological Survey
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USDA Forest Service	U.S. Department of Agriculture Forest Service
USGS	U.S. Geological Survey
USHE	shrub cover

V

VMS	Visual Management System
VQO	Visual Quality Objective

W

WUA	weighted usable area

Y

YOY	young-of-the-year

Miscellaneous

1995 FEIS	January 1995 final environmental impact statement
1998 DEIS	*Draft Environmental Impact Statement, Narrows Project* (DES-98-10), published in March 1998
°C	degree Celsius
°F	degree Fahrenheit
<	less than
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
µmhos/cm	microhos per centimeter
%	percent
§	section

CHAPTER 7

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