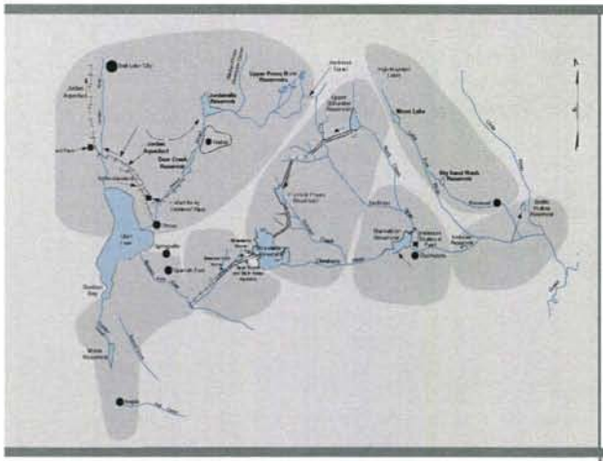
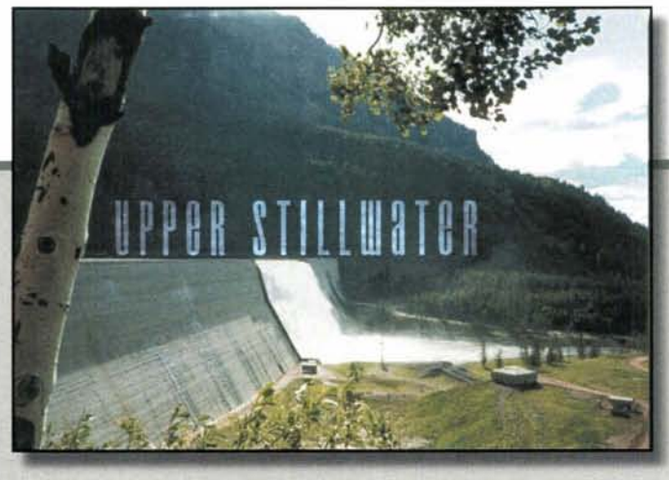
WATER SUPPLY APPENDIX
Volume 1 - Text

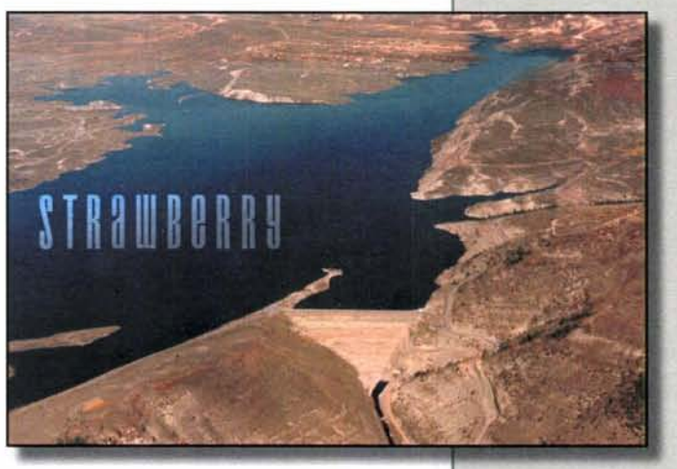
Central Utah Project Completion Program



Supplement to the 1988 Definite Plan Report for the Bonneville Unit

October 2004





UTAH RECLAMATION MITIGATION AND CONSERVATION COMMISSION

SUPPLEMENT TO THE BONNEVILLE UNIT DEFINITE PLAN REPORT

WATER SUPPLY APPENDIX, VOLUME 1 - TEXT

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October 2004

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Central Utah Project Completion Program

Chapter 1

October 2004

UTAH RECLAMATION
MITIGATION
AND CONSERVATION
COMMISSION

PURPOSE AND SCOPE OF THIS APPENDIX

This is the first of six volumes comprising the Water Supply Appendix to the 2004 Supplement to the 1988 Definite Plan Report for the Bonneville Unit (1988 DPR). The appendix documents the water supply and operation studies conducted by the Central Utah Water Conservancy District (District) to prepare the 2004 Supplement to the 1988 DPR. This appendix supersedes the Water Supply Appendix to the 1988 DPR with respect to the Diamond Fork System (which has been reconfigured) and with respect to facilities along the Wasatch Front to distribute water from Strawberry Reservoir (the Irrigation and Drainage System of 1988 has been replaced by the Utah Lake Drainage Basin Water Delivery System). The appendix is supplemental with respect to the other Bonneville Unit systems presented in the 1988 DPR. The studies described in this Water Supply Appendix fulfill the requirements of the Central Utah Project Completion Act (CUPCA), and P.L. 107-366, which amended CUPCA.

This Water Supply Appendix, Volume 1 addresses three themes:

1. ULS System M&I Water Needs (Chapter 2);
2. Bonneville Unit Water Supply (Chapter 3); and
3. Operational Relationships (Chapter 4)

Details and results of the hydrologic analyses associated with these chapters are presented in Water Supply Appendix, Volumes 2, 3, 4, 5, and 6 of the 2004 Supplement to the 1988 Definite Plan Report for the Bonneville Unit, which are titled as follows:

- Water Supply Appendix, Volume 2 - M&I Water Demands
- Water Supply Appendix, Volume 3 - Unita Basin Portion of Bonneville Unit
- Water Supply Appendix, Volume 4 - Diamond Fork Creek and Spanish Fork River
- Water Supply Appendix, Volume 5 - Provo River
- Water Supply Appendix, Volume 6 - Utah Lake and Jordan River

BONNEVILLE UNIT SYSTEMS

The Bonneville Unit consists of facilities to develop and more fully utilize waters tributary to the Duchesne River in the Uinta Basin of Utah, to facilitate a trans-basin diversion from the Colorado River Basin to the Bonneville Basin, and to develop and distribute project water in the Bonneville Basin.

For planning and coordination purposes, the Bonneville Unit is divided into six systems according to location and function. These systems are: 1) the Starvation Collection System, 2) the Strawberry Aqueduct and Collection System, 3) the Ute Indian Tribal Development, 4) the Diamond Fork System, 5) the Municipal and Industrial (M&I) System, and 6) the Utah Lake Drainage Basin Water Delivery System (ULS). The first four interrelated systems were described in the 1988 DPR and, as noted

above, the Diamond Fork System has been reconfigured and the ULS System replaces the I&D System described in the 1988 DPR. The locations of these systems of the Central Utah Project are shown on the next page in Figure 1-1. The Bonneville Unit itself is presented on the following page in Figure 1-2.

In 1992, CUPCA added 7 additional components to the Bonneville Unit, and modified the operation of the Diamond Fork System by prescribing minimum flows in Sixth Water and Diamond Fork creeks. The six Bonneville Unit systems and the additional Bonneville Unit components are described in the following subsections. These components are shown in Table 1-1.

Starvation Collection System

The Starvation Collection System was completed in 1970. The system develops water for irrigation and municipal and industrial uses and provides flood control, recreation, and fish and wildlife benefits in the Duchesne area of the Uinta Basin. Water storage is provided by the 167,310 acre-foot Starvation Reservoir, located on the Strawberry River just above its confluence with the Duchesne River. Starvation Reservoir is filled by winter and spring flows of the Duchesne and Strawberry Rivers. Duchesne River water is diverted by Knight Diversion Dam and conveyed to the reservoir through the Starvation Feeder Conduit.

Starvation Reservoir provides a significant benefit to irrigators along the Duchesne River in the form of water delivery in the late summer and fall when streamflows typically decline below the levels needed for irrigation diversion. Starvation Reservoir provides 24,400 acre-feet of irrigation water and 500 acre-feet of M&I water for use in the Uinta Basin. The reservoir provides wildlife mitigation and public recreation. Because downstream demands are met from storage in Starvation Reservoir, 43,700 acre-feet are made available for diversion to Strawberry Reservoir.

Strawberry Aqueduct and Collection System

The Strawberry Aqueduct and Collection System (SACS), completed in the late 1980's, diverts part of the flow of Rock Creek and eight other tributaries of the Duchesne River and conveys the diverted flows through the 36.8-mile-long Strawberry Aqueduct to Strawberry Reservoir. The Strawberry Reservoir was enlarged from 273,000 acre-feet to 1,106,500 acre-feet of capacity by the construction of Soldier Creek Dam on the Strawberry River. Some of the water in the SACS is released to tributaries of the Duchesne River to provide fishery flows, but most will be used for transbasin diversion to the Bonneville Basin.

Upper Stillwater Reservoir, with a capacity of 33,100 acre-feet, serves as a regulating reservoir at the head of the Strawberry Aqueduct to provide temporary storage during the high runoff period for later diversion to the aqueduct and storage in Strawberry Reservoir. Currant Creek Reservoir, with a total capacity of 15,670 acre-feet, diverts Currant Creek and five tributaries into the SACS. In addition to

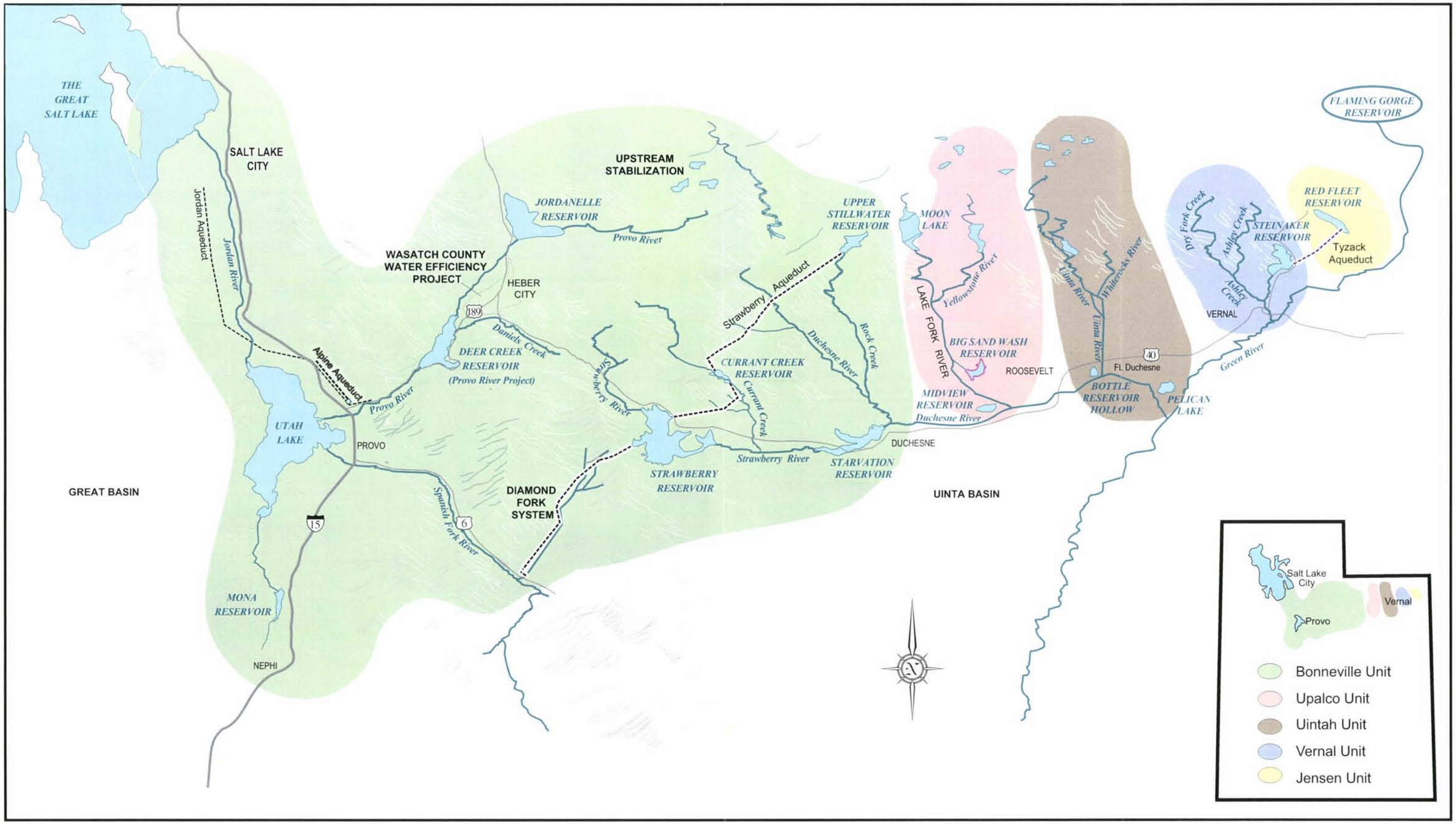


Figure 1-1
Central Utah Project Units

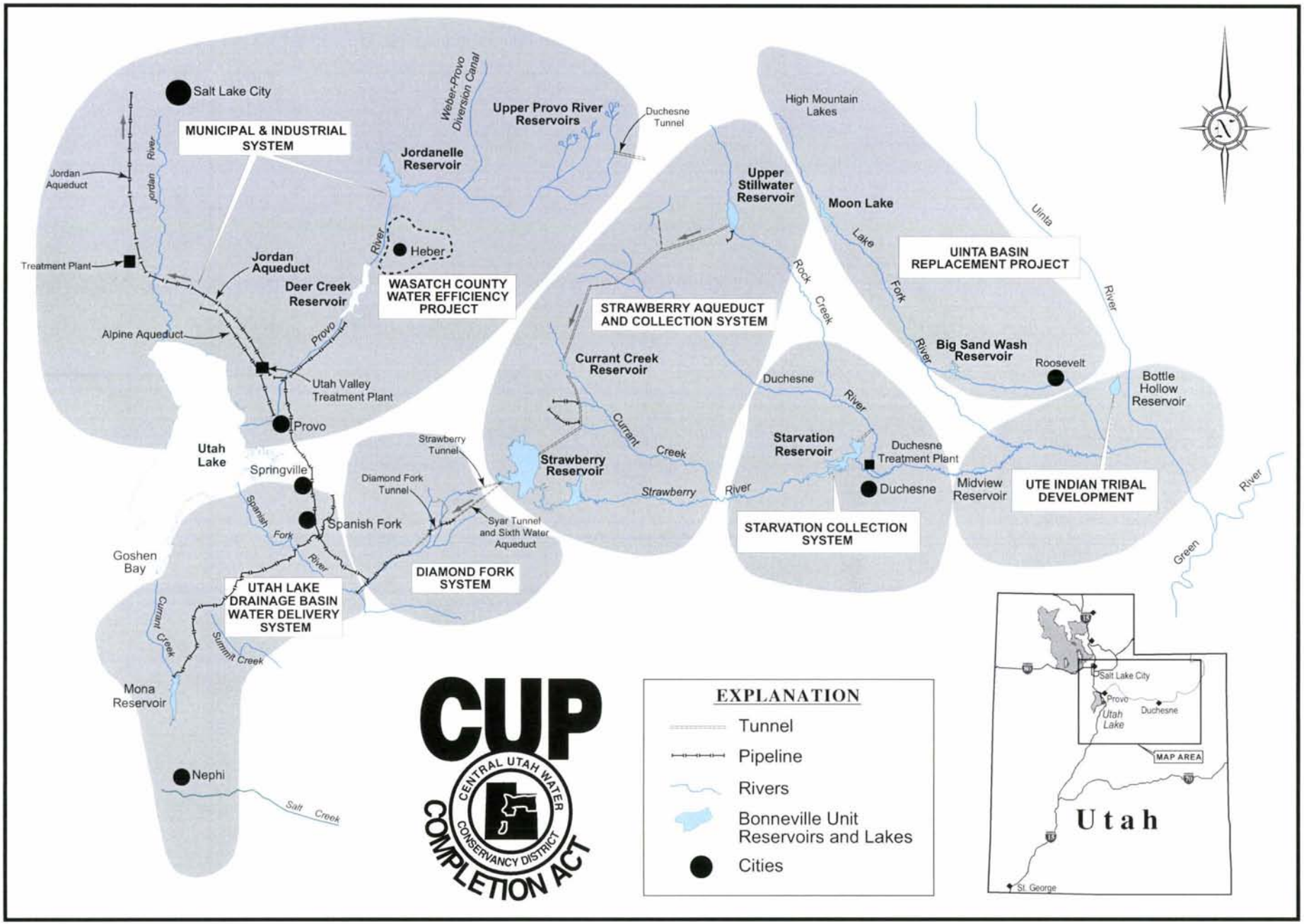


Figure 1-2
Location of Bonneville Unit Systems

providing water for irrigation and M&I purposes, the SACS provides flood control, recreation, and fish and wildlife benefits. The SACS releases 44,400 acre-feet of fishery flows in the Uinta Basin, including 12,600 acre-feet from Soldier Creek Dam.

Ute Indian Tribal Development

The purpose of the Ute Indian Tribal Development Project is to mitigate stream-related fish and wildlife losses on Indian lands associated with the Bonneville Unit. Bottle Hollow Reservoir has been constructed to compensate the Ute Indian Tribe for economic losses associated with stream fishing on the portion of Rock Creek located on the Uinta and Ouray Indian Reservation. With a surface area of 420 acres, this reservoir provides fishing opportunities, wildlife habitat, and a basis for recreation-oriented enterprises to provide additional employment and income for tribal members.

The proposed Lower Duchesne River Wetlands Mitigation Project will mitigate and enhance riparian wetlands habitat on approximately 7,790 acres of land along the Duchesne River corridor and provide wildlife/recreation benefits to the Ute Indian Tribe. The project will involve a variety of restoration measures including rewatering oxbows, connecting oxbows to form contiguous systems, enlarging oxbows, enhancing water quality in oxbows, filling drainage ditches to create marsh complexes, replanting riparian areas with native woody trees and shrubs, and removing non-native invasive species. The acreage extends from the junction of Highways 40 and 89 near Bridgeland, Utah, to the junctions of the Duchesne and Green Rivers just north of Ouray, Utah.

Diamond Fork System

The Diamond Fork System makes the transbasin diversion of water from Strawberry Reservoir in the Colorado River drainage basin to Spanish Fork Canyon, which drains into the Bonneville Basin. The 19.8-mile-long conduit system consists of a series of tunnels, pipelines and water control structures linked together to permit continuous conduit flow through Diamond Fork Valley. The Syar Tunnel and Sixth Water Aqueduct (in combination with the earlier Strawberry Tunnel) provide the diversion from Strawberry Reservoir. From their terminus at Sixth Water Creek, Tanner Ridge Tunnel conveys the water to upper Diamond Fork Creek, where it continues in a downstream direction through a pipeline, another tunnel, and another pipeline to Spanish Fork Canyon.

At Spanish Fork Canyon, water to be delivered under pressure flows into the proposed Spanish Fork Canyon Pipeline (the start of the ULS System) and the water intended for delivery through the Spanish Fork River is released to the river through the ULS System's Spanish Fork River Flow Control Structure. The water conveyed through Strawberry Tunnel and the Diamond Fork System is a combination of Bonneville Unit water averaging 101,900 acre-feet per year and SVP water averaging 61,000 acre-feet per year.

Table 1-1
Bonneville Unit Components

Original Systems						New Components Authorized by CUPCA & Amendments								
STARVATION COLLECTION SYSTEM	STRAWBERRY COLLECTION SYSTEM	M&I SYSTEM	UTE INDIAN TRIBAL DEVELOPMENT	DIAMOND FORK POWER SYSTEM	I&D SYSTEM	SECTION 202 DIAMOND FORK SYSTEM	SECTION 202 ULS SYSTEM[1]	SECTION 202 WASATCH COUNTY WATER EFFICIENCY PROJECT & DANIEL REPLACEMENT PROJECT	SECTION 202 CONJUNCTIVE USE OF SURFACE & GROUNDWATER	SECTION 202 ADDITIONAL STUDIES	SECTION 203 UINTA BASIN REPLACEMENT PROJECT	SECTION 207 WATER MANAGEMENT IMPROVEMENT SECTION 206 LOCAL DEVELOPMENT	TITLE III FISH, WILDLIFE, & RECREATION MITIGATION & CONSERVATION	TITLE V UTE INDIAN WATER RIGHTS
• Knight Diversion Dam • Starvation Feeder Conduit • Starvation Reservoir • Duchesne River Canals	• Soldier Creek Dam and Enlarged Strawberry Reservoir • Upper Stillwater Reservoir • Currant Creek Reservoir • Strawberry Aqueduct	• Jordanelle Reservoir • Jordan Aqueduct • Alpine Aqueduct • Stabilization of High Mountain Lakes (Trial, Lost, & Washington)	• Bottle Hollow Reservoir • Wildlife Habitat Development • Lower Stillwater • Midview Exchange	• Syar Tunnel • Sixth Water Aqueduct • Last Chance Powerplant • Monks Hollow Reservoir • Monks Hollow Powerplant • Diamond Fork Powerplant	• Wasatch Aqueduct (tunnels and pipelines) • Mona-Nephi Canal • Mona, West Mona, and Nephi Pumping Plants • Nephi-Sevier Canal • Mosida Area Canals and Pumping Plants	• Sixth Water Connection to Tanner Ridge Tunnel • Tanner Ridge Tunnel • Upper Diamond Fork Pipeline • Upper Diamond Fork Control Structure • Aeration Chamber and Connection to Upper Diamond Fork Tunnel • Upper Diamond Fork Tunnel • Monks Hollow Overflow Structure • Diamond Fork Creek Outlet • Diamond Fork Pipeline Extension • Diamond Fork Pipeline	• Sixth Water Power Generation • Upper Diamond Fork Power Generation • Spanish Fork River Flow Control Structure • Spanish Fork Canyon Pipeline • Spanish Fork-Provo Reservoir Canal Pipeline • Spanish Fork-Santaquin Pipeline • Santaquin-Mona Reservoir Pipeline • Mapleton-Springville Lateral Pipeline	• Pump Stations • River Diversions • Lateral Piping • Pipeline to Daniel Irrigation Company • Wasatch Canal Rehabilitation • Timpanogos Canal Rehabilitation • Restoration of Stream Flows in Upper Strawberry River and Tributaries	• Sec. 202(a)(2)– Study and Development by Utah Division of Water Resources, in Salt Lake, Utah, Davis, Wasatch, and Weber Counties	• Sec. 202(a)(4)– Study of Utah Lake Salinity Control • Sec. 202(a)(5)– Provo River Studies (i.e. Strawberry-Provo Conveyance Study)	• Big Sand Wash Reservoir Enlargement • Big Sand Wash Diversion Dam • Big Sand Wash Feeder Pipeline • Big Sand Wash Roosevelt Pipeline • High Mountain Lakes Stabilization • Moon Lake Outlet Modification	• Sec. 207(b)– Water Management Improvement Plan • Sec. 207(b)(5)– Water Conservation Credit Program • Sec. 207(c)– Water Conservation Pricing Study • Sec. 207(d)– Study of Coordinated Operations • Sec. 207(f)– Utah Water Conservation Advisory Board • Sec. 206– Local Development in Sanpete, Garfield, and Piute Counties	• Diamond Fork Creek • Provo River and Utah Lake • Duchesne and Strawberry Rivers • Statewide Fish, Wildlife, and Recreation Enhancement • Fish, Wildlife, and Conservation	• Ute Indian Water Rights Settlement

Note:
[1]Alternate system to the I&D System. Authorized in CUPCA, Section 202(a)(1)(B).

Through such an operation, most of the summer flow of SVP water released from Strawberry Reservoir that previously flowed through the Strawberry Tunnel into Sixth Water Creek and lower Diamond Fork Creek, and most of the new Bonneville Unit water are kept out of the streams. This allows the streams to return to flow levels commensurate with their natural characteristics thus improving habitat for fish and wildlife. To further enhance stream characteristics, CUPCA stipulates minimum flows in Sixth Water and Diamond Fork creeks. These minimum flows exceed the summertime natural flows of the creeks, so the minimum flows are achieved by continuing to release a small flow through Strawberry Tunnel for Sixth Water Creek, and by releasing the water to Diamond Fork Creek through the Upper Diamond Fork Flow Control Structure. The minimum flows also serve as maximum flows that are adhered to unless the transbasin diversion rate exceeds the capacity of the conduit system, in which case the minimum flows may be exceeded.

The configuration of the constructed Diamond Fork System differs from the system described in the 1988 DPR in the following respects. In 1988 the facilities proposed for the Diamond Fork System included Monks Hollow Reservoir in Diamond Fork Canyon between the upper end of the Diamond Fork Pipeline and Three Forks--the confluence of Sixth Water and upper Diamond Fork Creeks. The transbasin diversion through Syar Tunnel was to have been released into Sixth Water Creek and flow into the proposed reservoir. From Monks Hollow Dam the water would have been released to lower Diamond Fork Creek and to the Diamond Fork Pipeline. The reservoir would have provided regulation to meet peak irrigation demands and some flood control. The 1988 plan contained two flow-through hydropower generating plants, at Sixth Water Creek and at Spanish Fork Canyon.

Municipal and Industrial System

The Bonneville Unit M&I System provides municipal and industrial water to Salt Lake, Utah, and Wasatch Counties, and supplemental irrigation water to Wasatch and Summit Counties. The system provides flood control, recreation, and fish and wildlife benefits. Jordanelle Dam and Reservoir are the major features of the M&I System. The 300-foot high dam and 314,006 acre-foot water supply storage capacity reservoir, located on the Provo River about 6 miles north of Heber City, were completed in 1993.

Water is developed by storing Provo River flows that historically have flowed into Utah Lake. The Utah Lake water is replaced by Bonneville Unit return flows to the lake, water right acquisitions in Utah Lake, releases of water from Strawberry Reservoir to Utah Lake, and flows that are surplus to Utah Lake rights. The retention of water in Jordanelle Reservoir permits better management of the resource and reduces spills from Utah Lake.

The M&I water for northern Utah County (20,000 acre-feet per year) and Salt Lake County (70,000 acre-feet per year) is released from Jordanelle Reservoir and allowed to flow downstream. The water is then diverted from the Provo River at the Olmsted Diversion Dam. From here the water is conveyed to the Salt Lake County area by the 38-mile long Jordan Aqueduct and to northern Utah County through the 14-mile long Alpine Aqueduct. Water for use in Wasatch County will be made available

through releases from Jordanelle Reservoir and delivery in local distribution systems. Water for use in Summit County is made available through releases from Washington, Trial, and Lost lakes at the headwaters of the Provo River under a storage exchange with Jordanelle Reservoir.

Utah Lake Drainage Basin Water Delivery System

The proposed Utah Lake Drainage Basin Water Delivery System (ULS System) consists primarily of a pipeline system to distribute water from Strawberry Reservoir to areas of use and for fish and wildlife needs along the Wasatch Front. The system receives this water through the Diamond Fork System described above. The ULS System facilities would begin at the end of the Diamond Fork Pipeline at the Spanish Fork River Flow Control Structure where the ULS System's Spanish Fork Canyon Pipeline would receive the water and convey it down through Spanish Fork Canyon. At the mouth of Spanish Fork Canyon the Pipeline turnouts would release water to three pipelines running north and south along the Wasatch Front.

Extending southward, the Spanish Fork – Santaquin Pipeline would deliver 31,590 acre-feet of Bonneville Unit M&I water (minus conserved water) to southern Utah County cities as far south as the Santaquin area. The pipeline would convey up to 10,200 acre-feet of Strawberry Valley Project (SVP) irrigation water for use in southern Utah County, on a space available basis. The proposed Santaquin – Mona Reservoir Pipeline would then extend from the end of the Spanish Fork – Santaquin Pipeline to a natural channel tributary to Mona Reservoir. This pipeline would permit water delivery to maintain a conservation pool for a future June sucker refugium in Mona Reservoir as part of the June sucker Recovery Implementation Program (JSRIP). However, the pipeline would not be constructed until a water supply has been secured for that purpose. The Bonneville Unit M&I water would be distributed in secondary systems for outdoor uses, which do not require treatment to culinary standards.

Extending northward, the proposed Spanish Fork – Provo Reservoir Canal Pipeline would deliver 30,000 acre-feet of Bonneville Unit M&I water to the Provo Reservoir Canal and the Jordan Aqueduct for conveyance to water treatment plants in Salt Lake County. (The Provo Reservoir Canal is known locally as the Murdock Canal). The delivery points are north of the Provo River on the outskirts of the City of Orem. The Provo Reservoir Canal and the Jordan Aqueduct currently convey water from the Provo River to Utah and Salt Lake counties. The proposed Spanish Fork – Provo Reservoir Canal Pipeline would also deliver Bonneville Unit water to Utah Lake by releasing it into the lower Provo River, where the added flow would assist with achieving instream flow targets in the lower Provo River.

Also extending northward from the Spanish Fork Canyon Pipeline would be the proposed Mapleton-Springville Lateral Pipeline ending in Springville. This pipeline would replace much of the existing unlined Mapleton-Springville Lateral, which is a SVP facility, and which currently delivers an annual average of 8,831 acre-feet of SVP Strawberry storage water and 973 acre-feet of SVP Spanish Fork River natural flow water to the Mapleton and Springville areas. Replacing the unlined

Mapleton Lateral by a pipeline would conserve water by preventing conveyance and seepage loss from SVP irrigation and M&I water deliveries to the Mapleton and Springville areas. The pipeline would continue to deliver the SVP Strawberry storage water, but the SVP natural flow water could not be diverted into the new pipeline due to the pipeline pressure. The pipeline would also deliver approximately 12,037 acre-feet of Bonneville Unit water to Hobble Creek, which would contribute to the JSRIP. This water would flow into Utah Lake and be used for exchange to Jordanelle Reservoir.

Hydro-electric powerplants proposed for installation in the Diamond Fork drainage as part of the ULS System consist of the 45 megawatt Sixth Water Powerplant (to be located at the end of the Sixth Water Aqueduct in Sixth Water Canyon) and the 5-megawatt Upper Diamond Fork Powerplant (to be located at the Upper Diamond Fork Flow Control Structure in Diamond Fork Canyon).

OTHER CUPCA PROGRAM COMPONENTS

In addition to providing direction for the completion of the six systems of the Bonneville Unit (in some cases with additional features), CUPCA authorized the seven additional program components listed below:

- Wasatch County Water Efficiency Project/Daniel Replacement Project (WCWEP/DRP)
- Conjunctive Use of Surface Water and Groundwater
- Additional Studies of Utah Lake Salinity and Provo Water Supply
- Uinta Basin Replacement Project
- Water Management Improvement
- Fish, Wildlife, and Recreation Mitigation and Conservation
- Ute Indian Rights Settlement

Wasatch County Water Efficiency Project

The Wasatch County Water Efficiency Project (WCWEP) improved water use efficiency in the Heber Valley by converting open irrigation laterals to pipelines, which reduced seepage losses and provided pressurized water delivery to irrigators. Pressurized irrigation water makes it possible for farmers to convert from flood to sprinkler irrigation, thereby conserving additional water. Water conserved by the project will be used to supplement flows of the Heber Valley streams. Water conserved by the WCWEP will also provide the Daniel Irrigation Company with replacement water to compensate for the termination of their diversions from the Upper Strawberry River Basin into Daniels Creek. Included with the construction of the WCWEP were facilities to deliver water from Jordanelle Reservoir to the Daniel Irrigation Company. A detailed description of the project is provided in the November 1996 WCWEP and DRP EIS, the January 1997 WCWEP feasibility study, and the March 1997 Record of Decision.

Conjunctive Use of Surface Water and Groundwater

This component consists of the planning and development of systems to allow groundwater recharge, management, and conjunctive use of surface water and groundwater. Section 202(a)(2) of CUPCA authorizes the Utah Division of Water Resources to conduct this program in Salt Lake, Utah, Davis, Wasatch, and Weber counties, and authorizes federal funding for that purpose. This program is intended to provide greater efficiency in the use of water from federally funded facilities as well as local sources, to prevent the further migration of useable groundwater into aquifers of poor quality water, and to reduce groundwater-pumping costs. The program is intended to build upon studies and demonstration projects by local entities in those counties.

Additional Studies

CUPCA authorized studies of several aspects of water management affecting the Bonneville Basin, which were addressed by the District.

Utah Lake Salinity Study. Section 202(A)(4) authorized the District to conduct a feasibility study, with public involvement, to reduce the salinity of Utah Lake water. A preliminary planning report for this study was completed in 1992. The study was coordinated with interested agencies through an ad hoc task force.

Provo River Operation Studies. Section 202(A)(5) authorized two studies involving the water supply of the Provo River. The first involved the analysis of the Provo River system to develop an understanding of the complex hydrology and water rights governing operations and the expected flows and storage under varying water conditions in response to the proposed demands being placed on the river. This study produced the Provo River Simulation Model (PROSIM) which is described in Chapter 4 under River Operation, Provo River.

The second study was a feasibility study of direct delivery of water from Strawberry Reservoir or elsewhere in the Strawberry Aqueduct and Collection System to the Provo River Basin. This study evaluated various alternative means of providing Uinta Basin water to the Provo River while meeting the Bonneville Unit objectives of providing Bonneville Unit water for use along the Wasatch Front. A report was completed in June 1997 by the District.

Uinta Basin Replacement Project

The Uinta Basin Replacement Project (UBRP), currently under construction, will develop additional water supplies for supplemental irrigation and M&I use in the Uinta Basin, and will provide enhancements to stream habitat, fish, wildlife, and recreation values. The water supply facilities of the UBRP consist of the enlargement of the Big Sand Wash Dam and Reservoir and construction of the Big Sand Wash Feeder Diversion structure on the Lake Fork River, the Big Sand Wash Feeder Pipeline to the reservoir, and a Big Sand Wash-Roosevelt Pipeline to convey M&I water to

Roosevelt City and vicinity. The environmental and recreational facilities consist of the stabilization of 13 high mountain lakes in the High Uintas Wilderness, modification of the Lake Fork River outlet works at Moon Lake Dam to regulate instream flows, and improving aquatic habitat in various sections of river.

The implementation plan was developed through the evaluation of numerous options for achieving the project purposes. Section 203 of CUPCA had originally authorized UBRP to include the construction of Pigeon Water Reservoir, McGuire Draw Reservoir, Clay Basin Reservoir and rehabilitation of the Farnsworth Canal. However, preliminary feasibility studies determined that alternative facilities would be more beneficial and less costly than the facilities authorized in CUPCA, leading to the facilities described above. The UBRP water supply analysis is not presented in this appendix, but is described in the Uinta Basin *Replacement Project Feasibility Study*, October 2001 by the District.

Water Management Improvement

Section 207 of CUPCA authorized a comprehensive program to improve water management within the Bonneville Unit service area, including the establishment of water conservation goals to be achieved by year 2010. Specific purposes are to encourage water conservation and wise use, reduce the probability and duration of extraordinary water shortages, reduce water use and system costs, prevent unnecessary depletions that adversely affect environmental values or other public purposes, make effective use of available supplies before importation of water from the Bear River, and provide an objective basis for measuring achievements under this program. To assist in achieving these goals, four specific programs were authorized: 1) development of a Water Management Improvement Plan, 2) preparation of a Water Pricing Study, 3) appointment of a Water Conservation Advisory Board, and 4) preparation of a Study of Coordinated Operations. These programs are collectively referred to as the Water Management Improvement Studies (WMIS).

The District has developed a Water Management Improvement Plan and is using its Water Conservation Credit Program to assist local agencies in funding conservation measures. The Water Conservation Advisory Board has been established and is assisting the District in establishing criteria and priorities for water conservation projects. The two required studies have been prepared.

Fish, Wildlife, and Recreation Mitigation and Enhancement

Title III of CUPCA authorizes a broad program of environmental and recreation mitigation and conservation measures in addition to those described above under various Bonneville Unit systems.

The CUPCA set minimum flows for certain streams to improve and maintain fish and riparian habitats. Notably, CUPCA implements the requirements of the 1980 Stream Flow Agreement and its 1990 Amendment to provide 44,400 acre-feet of fishery flow releases annually to the Duchesne River and its tributaries; Bonneville Unit water has been dedicated to that purpose. Minimum flows have been

set in Sixth Water and Diamond Fork creeks and part of the Spanish Fork River to maintain the trout fishery. The upper Strawberry River's summer flow will be restored through the termination of the transbasin diversion to Daniels Creek, under the provisions of the Daniel Replacement Project described above. In addition to the directives of CUPCA, the proposed ULS System contains provisions for increasing the flows of the lower Provo River and Hobble Creek to assist with the JSRIP.

Ute Indian Water Rights Settlement

Title V of CUPCA contains a variety of provisions for the benefit of the Ute Indian Tribe which, together with earlier agreements, form the Ute Indian Water Rights Settlement. The associated provisions are intended to put the Tribe in the economic position envisioned at the initiation of the Bonneville Unit, by quantifying the Tribe's reserved water rights, allowing increased use of such water, and providing funds for economic development through agriculture and other enterprises.

Central Utah Project Completion Program

Chapter 2

October 2004

UTAH RECLAMATION
MITIGATION
AND CONSERVATION
COMMISSION

SUMMARY OF RESULTS

The computation of future water demands was based on detailed analyses of future population growth by the Governor's Office of Planning and Budget, the Mountainland Association of Governments in Utah County, and the Wasatch Front Regional Council of Governments in Salt Lake County. The projections of future M&I water needs incorporated the State of Utah's water conservation goals, and the availability of local groundwater supplies and surface water supplies. The documentation of the complete analysis of the M&I demands is contained in Volume 2 of the Water Supply Appendix to the 2004 Supplement to the 1988 Definite Plan Report.

The need for additional M&I water supply was evaluated in Juab, Wasatch, Utah and Salt Lake counties. In summary, the analysis determined that at year 2050 the projected M&I shortages in Salt Lake County would be approximately 100,000 acre-feet and the projected shortages in southern Utah County would be about 32,000 acre-feet for the corresponding time frame. These combined shortages in Salt Lake County and southern Utah County are far in excess of the available water supply from the ULS project.

For operational planning purposes a planning horizon of 2030 was used for the ULS System. With DOI's acquisition of 57,073 acre-feet of the District's secondary water rights in Utah Lake, conserved water through CUPCA Section 207 funding, and the 15,800 acre-feet of remaining Bonneville Unit water from Strawberry Reservoir, a total of 60,000 acre-feet of M&I firm yield water would be made available to the Wasatch Front to meet some of the M&I demands. Each service area will integrate the CUP water with other supplies available to them through intricate arrangements as follows.

For the water short areas in Salt Lake County, including Jordan Valley Water Conservancy District (JVWCD) and the Sandy City portion of the Metropolitan Water District of Salt Lake and Sandy (MWDSLS), the 2030 M&I water demand would be 236,305 acre-feet per year. The existing local supplies in Salt Lake Valley plus known future supplies (not including ULS water) would provide 177,816 acre-feet per year, resulting in an annual shortage of 58,489 acre-feet of water. To meet this shortage, the ULS would provide 30,000 acre-feet for culinary use and the remaining shortage at 2030 would be met through water recycling of return flows from wastewater treatment plants and reverse osmosis treatment of Utah Lake waters.

Sandy City of MWDSLS and member cities of JVWCD would reduce well pumping after the ULS water becomes available. Well pumping would gradually resume to pre-ULS rates after Salt Lake County population increases exceed the ULS water supplies. Prior to the initiation of planning activities on the ULS System the JVWCD had plans of developing approximately 50,000 acre-feet of Bear River water shortly after the year 2020. With M&I water supply deliveries from the ULS System and with increased focus on recycling Bonneville Unit water, the present plans for developing a water supply from the Bear River would be postponed until after the year 2040, a delay of about 20 years.

The 2030 M&I water demand in southern Utah County would be 45,858 acre-feet per year. The existing local supplies would meet 43,184 acre-feet of this demand, leaving an M&I shortage of 2,674 acre-feet at year 2030. However, cities in southern Utah County have indicated a willingness to begin taking delivery of the full 30,000 acre-feet of Bonneville Unit water starting in 2016. The water would be delivered and used as secondary system M&I water (used for outdoor watering) in southern Utah County communities. By taking delivery of ULS M&I water in 2016, the cities could voluntarily reduce their groundwater pumping that would otherwise be used for outdoor watering and could reserve this groundwater supply for indoor use as the demand for culinary grade water increases in the time-frame from 2016 to 2050.

WATER CONSERVATION GOALS

The Utah Governor's Office has established water conservation goals consisting of a 12.5 percent reduction in per capita water use by 2020 and a 25 percent reduction in per capita water use by 2050, using year 2000 water use as a comparison basis. The ULS target conservation goal builds on the State water conservation goals, the CUPCA Water Conservation Credit Program, and the success of other municipalities. The joint-lead agencies for the ULS project - the Central Utah Water Conservancy District (District); Utah Reclamation, Mitigation and Conservation Commission (URMCC); and the U.S. Department of the Interior (DOI) have established an average daily M&I water usage ranging from 180 to 220 gallons per capita per day (gpcd) to be eligible for Bonneville Unit water. One of the criteria for receiving Bonneville Unit water under the ULS project is that entities requesting water must develop and implement an acceptable water conservation plan. The water contracts incorporating water conservation measures would be with South Utah Valley Municipal Water Association (SUVMWA), Jordan Valley Water Conservancy District (JVWCD), and Metropolitan Water District of Salt Lake and Sandy (MWDSLS).

SUMMARY OF WATER REQUESTS

The Water Supply Appendix, Volume 2, presents a revised assessment of municipal and industrial (M&I) water needs of the Utah Lake Drainage Basin Water Delivery System (ULS) of the Bonneville Unit of the Central Utah Project (CUP). It was prepared initially to serve as a Supplemental Report to the *ULS Draft Plan Formulation Report* of February 2002 by the ULS Joint Lead Agencies. This analyses of M&I Water Needs presented in Water Supply Appendix, Volume 2, incorporates analyses of M&I water needs completed by the two Salt Lake County entities consisting of the Jordan Valley Water Conservancy District and the Metropolitan Water District of Salt Lake and Sandy. An in-depth analysis of the water needs of Juab, Wasatch, and Utah County was made by the District. The northern Utah County M&I needs are documented in the M&I Water Needs analysis and draw upon work completed in another report, the *North Utah County Water Needs Study* completed by the District in October 2001. The in-depth analyses of southern Utah County water needs have been addressed in several reports with the results of the analyses on M&I needs being presented in Water Supply Appendix, Volume 2.

SCOPING MEETINGS

Various scoping meetings were conducted by the joint-lead agencies to inform local water agency representatives and the general public of the proposed scope of the ULS planning effort, provide opportunities for local input to the planning process, and to determine M&I water needs of communities in the ULS service area. The first two public meetings were conducted as informal open houses - one in September 2000 to provide background information on the Bonneville Unit completion program and receive initial requests for Bonneville Unit water, and the other in October 2001 to provide information on the scope of the ULS, present preliminary results of the water needs analysis, and receive public comments.

Formal scoping meetings were held in February 2002 in Utah County and Salt Lake County to provide more specific information on ULS water delivery concepts and to solicit specific responses on those concepts from agency representatives and the public. The results of the various public meetings are documented in the following publications, which are on file at the District's office.

1. *Initial Scoping Comments, Utah Lake Drainage Basin Water Delivery System*, October 31, 2000.
2. *Public Information Meeting, Utah Lake Drainage Basin Water Delivery System*, October 17, 2001.
3. *Scoping Summary Report, Utah Lake Drainage Basin Water Delivery System*, May 2002.

At the scoping meetings it was stated that the M&I water demands analysis was preliminary and subject to revision based upon final population projections using census data for the year 2000.

SUMMARY OF M&I WATER REQUESTS

The joint-lead agencies, as stated above, held a public open house in September 2000 and received requests from petitioners in October 2000 for Bonneville Unit water that would be delivered through the ULS water delivery features. The requests totaled approximately 200,000 acre-feet, far surpassing the potential available water supply under the ULS.

East Juab County requests were primarily for agricultural water; Southern Utah County requested agricultural and municipal and industrial; and Wasatch County, Northern Utah County and Salt Lake County requested only M&I water.

The ULS service area is a combination of agricultural land, small communities and municipal areas. It includes the communities of Mona, Nephi and Rocky Ridge in east Juab County; agricultural lands in south Utah and east Juab counties; 10 cities in Southern Utah County served by the South Utah Valley Municipal Water Association; nine communities in Northern Utah County; and Charleston, Heber, Midway and the Jordanelle Special Service District in Wasatch County. Lindon, Orem and Provo did not express interest in receiving water, and municipalities

in the Salt Lake Valley get most of their water from Jordan Valley Water Conservancy District and Metropolitan Water District of Salt Lake and Sandy.

For ease of planning, the study was organized into five planning areas; east Juab County, Southern Utah County, Northern Utah County, Salt Lake County, and Wasatch County.

Table 2-1 summarizes the water requests for the five planning areas. Table 2-2 presents the water requests by entity in each of the areas.

TABLE 2-1
Summary of Water Service Requests in the Utah Lake Drainage Basin Water Delivery System
(Units: acre-feet)

Area	Agriculture	Municipal and Industrial	Total
East Juab County	42,000	2,600	44,600
Southern Utah County	31,500	65,000	96,500
Northern Utah County[1]	0	9,200	9,200
Salt Lake County	0	40,200	40,200
Wasatch County	5,000[2]	4,000	9,000
Total	**78,500**	**121,000**	**199,500**

Notes:
[1]Communities of Eagle Mountain and Saratoga Springs are included in north Utah County.
[2]Wasatch County amended their request with a letter dated April 26, 2001 to limit the amount of water requested to 4,000 acre-feet of municipal and industrial water.
Source: *Initial Scoping Comments, October 31, 2000, Utah Lake Drainage Basin Water Delivery System* (District 2000)

TABLE 2-2
Utah Lake Drainage Basin Water Delivery System
Summary of Water Service Requests of October 2000
(Units: acre-feet)

	Water Service Requests		
Agency	**Agriculture**	**Municipal and Industrial**	**Total**
South Utah County			
Strawberry Water Users Association (SWUA) and other Spanish Fork agricultural areas.			
Strawberry Highline Canal	8,100	0	8,100
Mapleton- Springville Irrigation District	400	0	400
Salem Canal Company	200	0	200
Lake Shore Irrigation Company (SWUA Request)	1,100	0	1,100
East Bench Canal Company	1,900	0	1,900
West Field Irrigation Company	1,400	0	1,400
Spanish Fork South Irrigation Company	2,400	0	2,400
Spanish Fork Southeast Irrigation Company	200	0	200
Other Non-SWUA Area	6,000	0	6,000
Subtotal SWUA Request	21,700	0	21,700
Lake Shore Additional Request	400	0	400
Total for Spanish Fork Area	22,100	0	22,100
South Utah Valley Municipal Water Association (SUVMWA)			
Springville City	0	500	500
Mapleton	0	0	0
Spanish Fork City	0	0	0
Santaquin	0	1,880	1,880
Salem	0	0	0
Woodland Hills	0	1,150	1,150
Elk Ridge	0	2,630	2,630
Payson City	0	5,840	5,840
Genola	0	0	0
Goshen	0	0	0
Unincorporated area	0	53,000	53,000
Total for SUVMWA	0	65,000	65,000
Other Irrigation Companies			
Summit Creek Irrigation Co.	6,000	0	6,000
Currant Creek Irrigation Co.	3,400	0	3,400
Total Summit/Currant Creek	9,400	0	9,400
Total For Southern Utah County	**31,500**	**65,000**	**96,500**

TABLE 2-2 (CONTINUED)
Utah Lake Drainage Basin Water Delivery System
Summary of Water Service Requests of October 2000
(Units: acre-feet)

	Water Service Requests		
Agency	**Agriculture**	**Municipal and Industrial**	**Total**
Juab County			
East Juab County Water Conservancy District			
Mona and North Canyon Irrigation Companies	13,900	0	13,900
West Mona Area Private Lands	5,700	0	5,700
Mona Town	0	1,500	1,500
Nephi Irrigation Company	22,400	0	22,400
Nephi City Corporation	0	500	500
Unincorporated Areas	0	600	600
Town of Rocky Ridge	0	Included in unincorporated	Included in unincorporated
Total for Juab County	**42,000**	**2,600**	**44,600**
North Utah County			
Lehi City	0	6,000	6,000
City of Highland	0	2,325	2,325
Alpine City	0	875	875
Town of Saratoga Springs	0	unknown	Unknown
Town of Eagle Mountain	o	unknown	unknown
Total for North Utah County	**0**	**9,200**	**9,200**
Salt Lake County			
Jordan Valley Water Conservancy District	0	35,000	35,000
Metropolitan Water District of Salt Lake and Sandy	0	5,200	5,200
Total for Salt Lake County	**0**	**40,200**	**40,200**
Wasatch County			
Wasatch County Water Service Area No. 1	5,000	4,000	9,000
Total for Wasatch County	**5,000[a]**	**4,000**	**9,000**
Total Requests for Water – All Counties	**78,500**	**121,000**	**199,500**

Note:
[a]Wasatch County withdrew its request of 5,000 acre-feet of irrigation water by a letter dated April 26, 2001.

Figure 2-1 shows that East Juab County requests were primarily for agricultural water. Petitioners in south Utah County and Wasatch County requested agricultural and municipal and

industrial water. Wasatch County amended their request with a letter dated April 26, 2001 to limit the requested water to municipal and industrial uses, specifically limiting the request to the area surrounding Jordanelle Reservoir. Northern Utah County and Salt Lake County petitioners requested only municipal and industrial water.

Figure 2-1
Summary of Water Service Requests

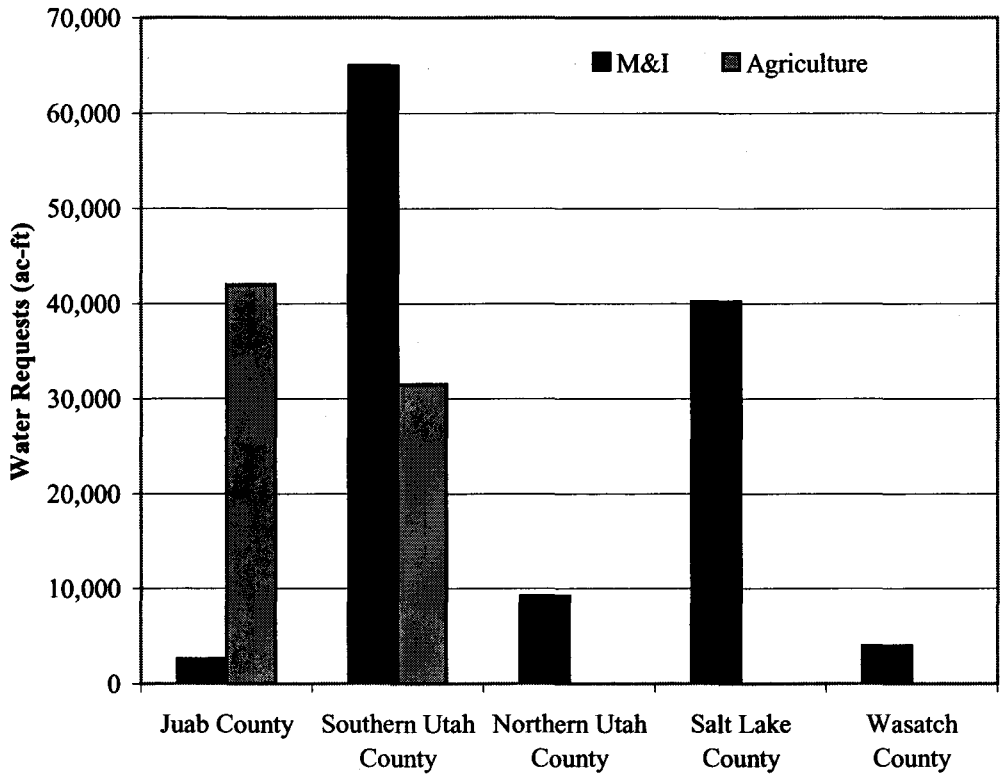
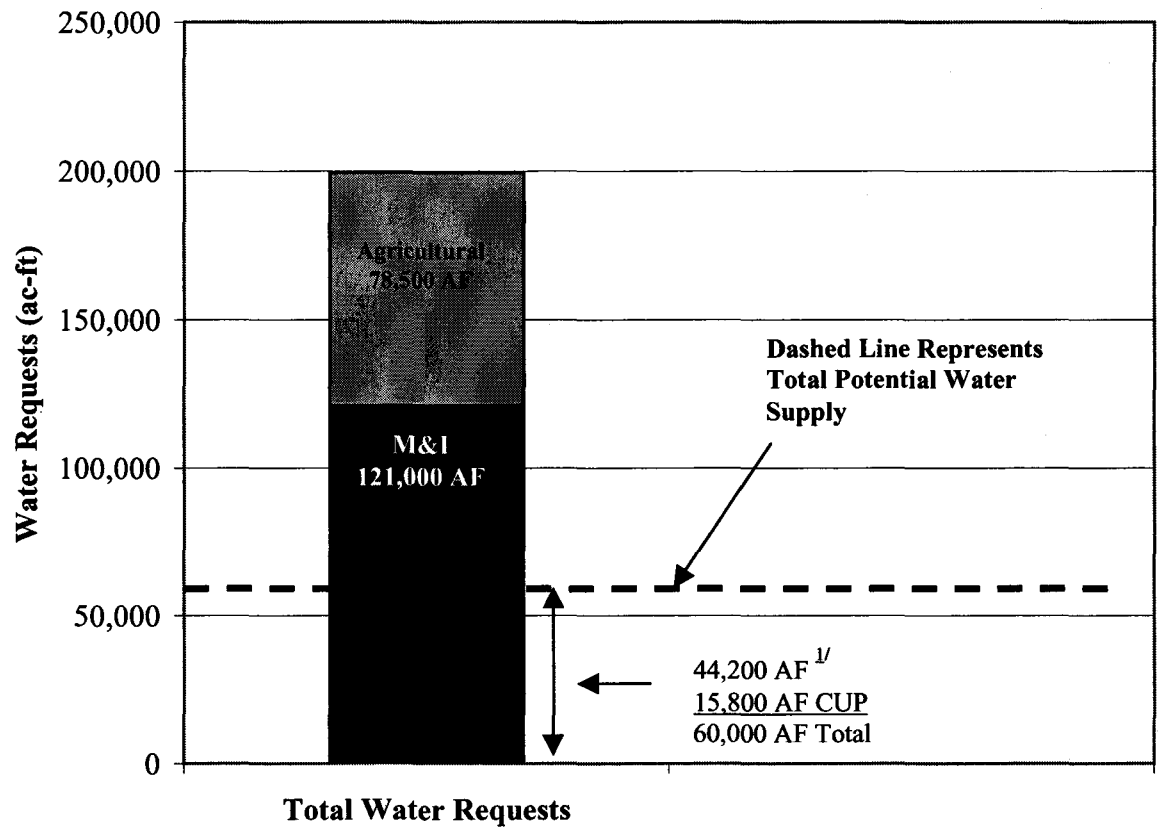


Figure 2-2 shows the total requests for 78,500 acre-feet of agricultural water and 121,000 acre-feet of municipal and industrial water. It also shows the 15,800 acre-feet of uncommitted Bonneville Unit water plus the yield from the District's Utah Lake secondary water right and from conserved water under CUPCA Section 207 program.

Figure 2-2
Total Water Service Requests vs. Available CUP Water



[1] The 44,200 acre-feet would be comprised of the yield from the District's secondary Utah Lake water rights and from conserved water under the CUPCA Section 207 program.

DRAFT PLAN FORMULATION REPORT - FEBRUARY 2002

In February 2002, the *Draft Plan Formulation Report* was completed, which is on file in the District's Office. That report described the six-step planning process used to formulate water delivery concepts for the ULS. The steps consisted of 1) identifying water-related land resource problems and opportunities; 2) conducting inventories, forecasts and analyses of conditions related to those problems and opportunities; 3) formulating and assessing water delivery

concepts to meet needs; 4) formulating those concepts into potentially viable alternatives; 5) evaluating and comparing the effects of those alternatives; and 6) laying the groundwork for the eventual selection of viable alternatives for subsequent National Environmental Policy Act compliance.

Key considerations during this six-step process were population projections, water conservation, and the capability of local water supplies to meet future M&I needs.

Preliminary Evaluation of M&I Water Requests in Draft Plan Formulation Report

The M&I water requests were evaluated as to their individual justification and overall effect on plan formulation. The results of the initial evaluation, described in the *Draft Plan Formulation Report*, used average annual amounts of water and did not address shortages that could arise from peak seasonal demands, seasonal timing of water availability and geographic distribution of sources and facilities to obtain and distribute water. For example, while groundwater may be regionally available, some communities may not be able to fully develop groundwater within their incorporated boundaries.

The *Draft Plan Formulation Report* anticipated that new population projections would become available in the late spring of 2002, and that they would be used to make more detailed analysis of M&I water needs in Utah County and Salt Lake County.

A schematic planning process was used to assess M&I water needs as described below.

Step 1. Make Maximum Use of Data from Previous Reports
Step 2. Gather Historical M&I Water Use in Gallons per Capita per Day for Each Municipality
Step 3. Utilize Population Projections from the Governor's Office of Planning and Budget
Step 4. Apply Future Water Conservation to Historical Water Usage to Project Future Demand
Step 5. Determine Volume of Local Water Supplies to Meet M&I Needs
Step 6. Determine Need for Bonneville Unit Water

Step 1 - Previous Reports. The following reports provided the bulk of the information in determining historical water use and sources of municipal and industrial water supplies.

- Brown and Caldwell, September 1999. *2070 Water Demand and Supply Analysis for South Utah County and East Juab County, Utah*, South Utah Valley Municipal Water Association.

- Carpenter, Carl H. June 1966. *Water Supply Planning Report for South Utah Valley Municipal Water Association.*

- Hansen, Allen Luce, July 2000. *Municipal and Industrial Water Supply and Uses in the Utah and Juab County Areas*, Final Report, Utah Division of Water Resources.

- James M. Montgomery, Consulting Engineers, Inc., February 1993. *Wasatch County Water Efficiency Study – Preliminary Planning Report*, Central Utah Water Conservancy District (CUWCD).

- J.U.B. Engineers, Inc March 1996. *Water Rights Analysis Future Demands and Inventory.* South Utah Valley Municipal Water Association.

- Parsons Engineering Science. October 9, 2001. *North Utah County Needs Study*, CUWCD.

- Spanish Fork River Commissioner. John Mendenhall. 1961 Water Delivery Records.

Step 2 - Historical M&I Use. Present water use was determined by reviewing existing reports and data prepared by various petitioners and the Utah Division of Water Resources. Usage is expressed in gallons per capita per day (gpcd), a common term for expressing municipal water usage that describes the total volume of water used per person per day. Gpcd is calculated by dividing annual water usage in gallons by the total population, then dividing by 365 to convert to average daily usage.

Peak historical use was not evaluated. Future peaking needs were considered after applying population growth and water conservation to estimate average future water needs. To provide for meeting future peak demands, the pipeline conveyance facilities and water supply deliveries are designed to meet peak monthly requirements based on a typical M&I monthly demand pattern. It is assumed that each community would have storage tanks to meet their daily peaking needs. Storage tanks could be filled during periods of time when demands on the system will allow this to be accomplished.

<u>Information on present water use was obtained from the following sources:</u>

- *Eastern Juab County and Southern Utah County* - Historical M&I usage for Juab and Utah Counties was obtained from the *Municipal and Industrial Water Supply and Uses in the Utah and Juab County Areas Final Report*, prepared for the Utah Division of Water Resources (July 2000). Information in the report was based on the 1998 water use in gallons per capita per day. In addition, the report provided information on potable (indoor and outdoor use) and non-potable secondary use. A few communities such as Mapleton and Santaquin were updated with more recent water use information supplied by city staff for the year 2000.

- *Northern Utah County* - The primary source of information on historical M&I usage for North Utah County was obtained from the *Municipal and Industrial Water Supply and Uses in the Utah and Juab County Areas Final Report*, prepared for the Utah Division of

Water Resources (July 2000). A second source of information was, Parsons Engineering Science. October 9, 2001. *North Utah County Needs Study*, CUWCD.

- *Wasatch County* - Historical water use for Wasatch County was obtained from the *Wasatch County Water Efficiency Study Preliminary Planning Report,* prepared for the CUWCD (1993).

- *Salt Lake County* – Information on present water use for Salt Lake City and Sandy was supplied by the Metropolitan Water District of Salt Lake and Sandy. Information on present water use for the remainder of Salt Lake County was supplied by the Jordan Valley Water Conservancy District (JVWCD) staff. Most of the future growth in Salt Lake County will occur within the boundaries of the JVWCD.

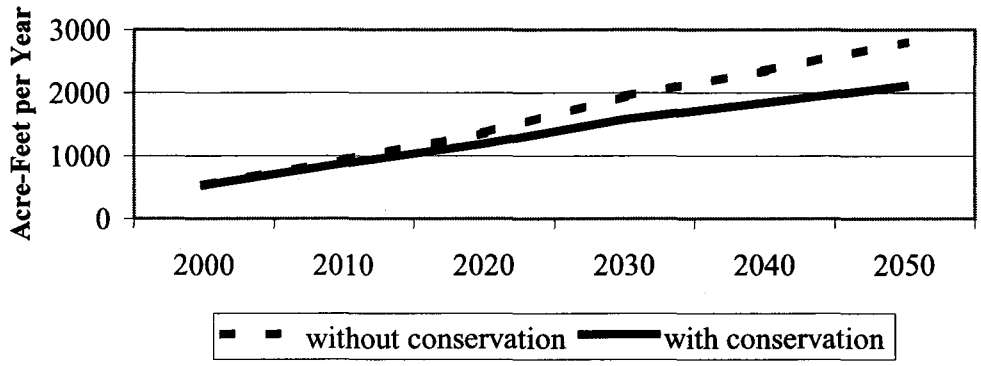
Step 3 - Population Projections. The population projections for each community in the five planning areas were based on the Governor's Office of Planning and Budget (GOPB) report for 2000, which shows projections through 2050. Supporting information on population projections is presented in Appendix B of the Draft Plan Formulation Report. After census data on year 2000 populations were made available, the 2000 projected population values were replaced by the actual 2000 Census results. The previously estimated population projections for 2010 to 2050 were not changed and therefore did not reflect results of the 2000 Census. In early 2002, the GOPB revised the population projections through year 2050 using the 2000 Census data. The revised population projections were then used to further refine M&I water needs before deciding on final ULS water supply allocations.

Step 4 - Water Conservation. According to the 2000 Census report by Governor's Office of Planning and Budget, the population in the ULS service area could more than double from 1,290,376 to 2,912,716 by 2050. This would increase municipal and industrial (M&I) water diversions from current levels of about 500,000 acre feet to more than 1,000,000 acre feet per year (assuming no change in current per capita water use), which means effective water conservation measures and programs are critical to satisfying Utah's future water needs.

The goal of the State is to conserve water wherever possible to reduce per capita demand from public community systems by 12½ percent by 2020 and 25 percent by 2050. This equates to about 240,000 acre-feet per year in the ULS planning area. The State's goals are directly linked to projected population growth, which will drive water demand in the future.

Figure 2-3 shows a hypothetical application of water conservation to water demands.

Figure 2-3
Hypothetical Example of Future Demands
With and Without Conservation



Step 5 - Maximum Utilization of Local Streams and Groundwater. Communities in the ULS service area generally have water rights to obtain their M&I supply from wells, springs, streams, and as holders of irrigation company stock. The following assumptions were used to estimate the capability of local supplies to meet needs.

- Communities will be able to meet water conservation goals to reduce consumption 12½ percent by 2020 and 25 percent by 2050.
- An acre of convertible irrigated land would be gained for every six new residents on the newly developed lands.
- Urbanization of agricultural lands. The dry-year yield of the converted irrigated lands (typically the 1961 streamflow) would be available for conversion to M&I. [1]
- Communities would be able to fully develop their current groundwater rights.
- Conjunctive use opportunities would eventually be realized in some communities to firm up or increase the yield of local groundwater wells, and to even-out annual and seasonal variations in supply and demand for water.
- Distributing, transferring or exchanging the available M&I water supplies from one community to another could decrease the projected M&I shortages subject to physical

[1] The six people per acre is not a population density. It is used as a conservative estimate to calculate the blocks of irrigated land that would go out of production as new developments initially take place. As a comparison the Utah Division of Water Resources uses a population density of 8 to 9 people per acre in projecting water demands for new growth in the various communities.

and legal constraints. This may particularly work for the South Utah Valley Municipal Water Association (SUVMWA), which is a legal entity comprised of the 10 communities to promote development and financing of municipal water resources.

- Utah Lake water is not an economical water supply because of the costly technology required to de-mineralize the water for culinary use. It was assumed that direct use of Utah Lake water for municipal use would be a "last resort" water supply if ULS or other less costly water supplies were not available.

Step 6 - Calculation of Municipal and Industrial Needs. The assessment of M&I water requests takes into consideration the change in land use from agriculture to urban use, the conservation goals of the State of Utah and maximum utilization of local streams and groundwater supplies.

Water Conservation in the Draft Plan Formulation Report

In the *Draft Plan Formulation Report* the assumption was made that measures would be taken to be sure that each entity requesting ULS water would meet the target conservation goals established by the State, which provide for reductions in per-capita water use of 12 ½ percent by year 2020 and 25 percent by the year 2050. Upon further analysis it was concluded that the most practical means to meet these conservation goals would be to have agreements with the entities that contract for ULS water stipulating that they would be responsible for achieving the goals. For southern Utah County this would be the South Utah Valley Municipal Water Association (SUVMWA). In northern Utah County, because the communities are not represented by an umbrella organization, it would be the individual cities that contract for the ULS water. In Salt Lake County the responsible agencies would be the Jordan Valley Water Conservancy District (JVWCD) and the Metropolitan Water District of Salt Lake and Sandy (MWDSLS).

Accounting of Local Water Supplies in the Draft Plan Formulation Report

In estimating future demands for M&I water from the ULS Project, an accounting of potential water supplies from local sources to meet these projected needs was made. As noted above, the preliminary results presented in the *Draft Plan Formulation Report* were based on average annual amounts of water and did not address shortages that could arise from peak seasonal demands, seasonal timing of water availability, and geographic distribution of sources and delivery systems. And, among other things, the accounting did not include the following water supply aspects:

- Recognition of approximately 4,900 acre-feet of Strawberry Valley Project (SVP) water presently used as irrigation water within incorporated city boundaries in southern Utah County. This amount is projected to increase to approximately 10,200 acre-feet by the year 2050.

- Limitations on future conversion of SVP irrigation water. Any water above the 10,200 acre-feet per year from future urbanization of agricultural lands in southern Utah County would supply supplemental water to the remaining SVP agricultural lands which presently experience a shortage of irrigation water;

- Firm reliable amount of Utah Lake Basin surface water that could be used for M&I purposes when the seasonal variability in flow was considered for streams such as the Spanish Fork River, Peteetneet Creek, and Summit Creek;

- Limitations on the amount of groundwater that could be pumped;

- Limitations on the amount of the Districts' Utah Lake rights that would be acquired by the U.S. Department of Interior;

- The potential volume of Central Utah Project (CUP) return flows that may reach the Jordan River in Salt Lake County. The use of these return flow rights is subject to approval by the State Engineer. The revised assessment of M&I water needs incorporated herein addresses the projected return flows.

Population Projections in the Draft Plan Formulation Report

The population projections in the *Draft Plan Formulation Report* of February 2002 were based on projections released in 2000 by the Governor's Office of Planning and Budget (GOPB). The projections were published to year 2030 for each community in the five planning areas. The GOPB made countywide population growth projections for the decades between 2030 and 2050, but did not publish them. Although not published, the data was made available to the countywide Associations of Governments (AOG) for their local planning purposes. The AOG's representing counties in ULS planning area are as follows:

- Utah and Wasatch Counties - Mountainland Association of Governments (MAG);

- Juab County - Six County Association of Governments; and

- Salt Lake County - Wasatch Front Regional Council

An AOG may, upon request by local communities, extend community population projections beyond 2030 to a longer planning horizon, such as the year 2050. To do this the local AOG disaggregates the GOPB county population among its communities subject to these general constraints; (1) the total county population projected by the GOPB may not be exceeded, and (2) the populations for communities must be reasonable compared to historical growth trends. Thus, for the *Draft Plan Formulation Report* the community population projections for the ULS service area were extended to 2050.

The *Draft Plan Formulation Report* anticipated that the community projections to 2050 would be updated in the late spring of 2002 based on the data from the 2000 census, and that a more detailed analysis of M&I water needs would then be made. Accordingly, the various chapters of the Water Supply Appendix, Volume 2 M&I Water Needs, present updated community population projections prepared for use in estimating the water needs. An aspect of population growth that was not addressed in earlier projections is the build-out population of communities, considering geographical and other constraints. The estimation of M&I water needs takes into consideration that some communities would achieve build-out prior to the 2050 planning horizon, while other communities, particularly in southern Utah County, would achieve build-out after 2050.

REVISED POPULATION PROJECTIONS

In 2001, the GOPB furnished community population counts based on the 2000 census data.

Utah County

Using such information, MAG conducted a more in-depth review of Utah County population and prepared community projections to 2050. In conducting this review MAG worked closely with mayors, Utah County commissioners, other county officials, and the staff of the GOPB to include a comprehensive growth perspective. The resulting projections recognized that build-out would occur in some communities prior to 2050, while for others build-out would occur after 2050.

Salt Lake County

Data from updated population projections, were used by the Jordan Valley Water Conservancy District and the Metropolitan Water District of Salt Lake and Sandy to revise their need for M&I water. These results are documented in Water Supply Appendix, Volume 2, Chapter 7 - Salt Lake County (Jordan Valley Water Conservancy District) and Chapter 8 – Salt Lake County (Metropolitan Water District of Salt Lake and Sandy).

Juab and Wastach County

While updated county projections had been made, revisions had not been released as of the date of the revised M&I Water Needs Assessment in January 2003. However, due to the small population base of these counties and the availability of local water supplies to meet needs, the updated population projections did not result in any demand for ULS water.

Community Growth in Utah County

The updated projections by MAG are presented below in Table 2-3. Additional details of these projections are presented in Appendix A of Water Supply Appendix, Volume 2. For several

communities in Utah County, MAG estimated "build-out populations" that could be supported by available space and other resources. These communities are noted on Table 2-3, with their 2050 population projections and the projected build-out populations.

TABLE 2-3
Year 2050 and Build-out Population Projections for Utah County Communities

City	2050 Population	Build-out Population
SOUTHERN UTAH COUNTY		
Elk Ridge	6,000	Same as year 2050
Genola	18,191	Projections beyond 2050 not made
Goshen	3,251	Projections beyond 2050 not made
Mapleton	34,024	Projections beyond 2050 not made
Payson	80,763	Projections beyond 2050 not made
Salem	31,409	Projections beyond 2050 not made
Santaquin	62,621	Projections beyond 2050 not made
Spanish Fork	66,028	Projections beyond 2050 not made
Springville	59,658	Same as year 2050
Woodland Hills	4,793	Same as year 2050
NORTHERN UTAH COUNTY [1]		
Alpine	18,900	Same as year 2050
American Fork	56,433	82,509
Cedar Fort	1,127	Same as year 2050
Cedar Hills	12,300	Same as year 2050
Eagle Mountain	53,644	190,000
Highland	28,163	Same as year 2050
Lehi	89,098	146,941
Pleasant Grove	40,700	Same as year 2050
Saratoga Springs	53,762	121,803

1 Information on build-out populations are from both MAG and the "North Utah County Water Needs Study", dated October 9, 2001

Growth in Unincorporated Areas of Utah County

The projections by MAG included four newly listed unincorporated areas with significant growth potential. Three of the areas are in southern Utah County and one in northern Utah County. Growth in these unincorporated areas will accelerate overall county growth. Their year 2050 populations are listed in Table 2-4.

TABLE 2-4
Year 2050 Population Projections
for Unincorporated Areas of Utah County

UNINCORPORATED AREA	2050 Population
Southern Utah County	
Goshen Valley	48,114
West Shore Area	13,061
West Mountain Area	14,525
Northern Utah County	
Cedar Valley	33,666

REFINEMENTS IN METHODOLOGY

Following the completion of the Draft Plan Formulation Report of February 2002, planning efforts continued to refine the methods and underlying assumptions for computing M&I water demand. The more significant refinements are:

- Refinements in local responsibility to achieve water conservation goals;
- More in-depth analysis of the availability of local water supplies, particularly from urbanization of agricultural lands in southern Utah County;
- Utilization of Utah Lake water rights through reverse osmosis treatment in Salt Lake County; and
- Analysis of the potential use of return flows through water recycling.

Table 2-5 summarizes the methodology and assumptions previously presented in the Draft Plan Formulation Report, together with the refinements used in the M&I Water Needs Appendix. The following paragraphs discuss these various refinements.

TABLE 2-5 Refinements in Methodology and/or Assumptions	
Assumptions Used in the Draft Plan Formulation Report	**Refinements To Assumptions**
1. Communities will be able to meet water conservation goals to reduce consumption 12 ½ percent by 2020 and 25 percent by 2050.	1. This assumption was refined to apply the conservation goals to the entities that contracted for ULS water. For southern Utah County this would be the Southern Utah Valley Municipal Water Association. In northern Utah County it would be the individual cities and in Salt Lake County it would be the Jordan Valley Water Conservancy District and the Metropolitan Water District of Salt Lake and Sandy.
2. An acre of irrigated land would be converted for every six new residents on the newly developed lands.	2. The following modifications were made: In Utah County, the State of Utah uses 9 people per acre for rate of urbanization of agricultural lands. An estimate was made of the percent of growth that would occur on agricultural lands and the percent of growth on non-agricultural lands. For example, if 50% of the growth is on non-agricultural lands then the net result is 1 acre of agriculture for each increase of 4.5 people.

TABLE 2-5
Refinements in Methodology and/or Assumptions

Assumptions Used in the Draft Plan Formulation Report	Refinements To Assumptions
3. Agricultural conversion could meet a significant portion of M&I demand, particularly in southern Utah County. The dry-year supply for the converted irrigated land (e.g., 1961) would be available for conversion to M&I.	3. The following modifications were made: a) Recognition of 10,200 acre-feet of SVP water irrigation water used within city boundaries with the remainder of the SVP water that amounts to 50,800 acre-feet (minus conveyance and seepage losses) to be used to meet needs of the agricultural lands. b) As lands are urbanized SVP water presently used on irrigated lands would be transferred to other SVP lands for use as a water supply to supplement late season irrigation needs on the remaining SVP agricultural lands. c) As irrigated lands are urbanized, up to 50 percent of Spanish Fork River water located within the declaration boundaries of the cities could become available for M&I use within the SUVMWA area. Competing demand for water rights would limit the supply available to SUVMWA. d) Up to 50 percent of Summit Creek water could be converted to M&I in Santaquin on irrigated lands urbanized. e) No further Salem Pond shares (22 shares) are obtained by Salem. The location of the remaining shares makes acquisition by the city unlikely. f) The entire yield of Peteetneet Creek, Spring Lake, Maple Creek and Hobble Creek becomes available to the cities as lands on which the shares are located are urbanized. g) Spanish Fork Southeast Irrigation Company lands have been designated as open space by Spanish Fork City and will continue to be irrigated in the city's plan for growth.
4. Communities would be able to fully develop their current groundwater rights.	4. No change

TABLE 2-5 Refinements in Methodology and/or Assumptions	
Assumptions Used in the Draft Plan Formulation Report	**Refinements To Assumptions**
5. Conjunctive use opportunities would eventually be realized in some communities to firm up or increase the yield of groundwater supplies.	5. No change
6. Distributing, transferring or exchanging the available M&I water supplies from one community to another could decrease the projected M&I shortages. This may particularly work for the South Utah Valley Municipal Water Association (SUVMWA), which is a legal entity comprised of the 10 communities in southern Utah County to promote development and financing of municipal water resources.	6. Based upon further review it was determined that this distribution would not be practical because of the lack of infrastructure to convey water from one community to another and the need to retain water by each community to meet its build-out population.
7. Utah Lake water compared to other water sources is not a feasible water supply because of the cost of demineralizing the water for culinary, outdoor or ornamental plant use.	7. The following modifications were made: In recognition of comments received from the public, scoping meetings of February 27th and 28th, 2002, the feasibility of using Utah Lake water through reverse osmosis treatment should be evaluated.

Refinements in Local Responsibility to Achieve Water Conservation in Southern Utah County

The initial ULS water demand sheets, based on meeting the State water conservation goals, were provided to the communities for review. Several communities in southern Utah County expressed concern over what they perceived as unrealistic water conservation projections. Representatives stated that the majority of existing homes located in some of the southern Utah County communities are situated on lots that are substantially larger than those found in more urban areas. Some communities such as Spanish Fork City have established large areas as green belts. The cities' representatives contend the higher per capita water usage rates in southern Utah County are more likely due to this factor than to over-consumption. SUVMWA, while acknowledging the validity of this argument, determined that an *average* 25% conservation goal could indeed be reached across its service area. This was reflected in the computations of water demands for southern Utah County presented in Water Supply Appendix, Volume 2, M&I Water Needs.

Local Water Supplies

Communities in the ULS service area generally have water rights to obtain their M&I supply from wells, springs, streams, and as holders of irrigation company stock. However, the dry-year yield from various water rights may be significantly less than the amount of the water right. Consequently water supply data from 1961 (a dry year), which is about 50% of the annual average streamflow, was used in order to approximate the reliable volume of water supplies.

As indicated above in Table 2-6, assumptions were adopted which more realistically represent the volume of water that would be available from the Spanish Fork River and local irrigation companies. The following assumptions were made regarding the urbanization of agricultural lands.

1. Recognition of 10,200 acre-feet of SVP water to be used as existing irrigation water within city boundaries.

2. The portion of the SVP water that would become available through conversion of agricultural lands would become part of the irrigation water supply for the remaining SVP lands.

3. The irrigation water available from urbanization of lands with rights to Spanish Fork River water and other surface streams would become part of the water supply for the city in which the lands were urbanized. This water would supply needs of some of the communities in meeting the M&I demands for their build-out populations.

Utah Lake Water Rights

The water rights and operation of Utah Lake are key elements of the Bonneville Unit water supply. The lake's water was originally used solely for irrigation in Utah and Salt Lake counties. As agriculture in Salt Lake County declined, a significant portion of the irrigation rights have been purchased by other entities for industrial purposes and as a future potential municipal water supply after treatment such as reverse osmosis. Water rights, such as those held by the District and the Jordan Valley Water Conservancy District, will be used in a manner to meet the M&I needs of their service areas. A discussion has been included in Chapter 2 of the M&I Water Needs Appendix to illustrate the means whereby the waters of Utah Lake may be used for M&I purposes.

Return Flows and Water Recycling

Public Law 107-366, signed into law by President Bush on December 19,2002 amends the Central Utah Project Completion Act (CUPCA) to include funds for implementing conservation measures in a manner consistent with the intent of the amended CUPCA. The conservation measures include the use of reverse osmosis membrane technology, which is a key to direct use of water from Utah Lake and the Jordan River, and water recycling of return flows from wastewater treatment plants. Consequently, the M&I Water Needs Appendix contains an assessment of the potential for recycling water from wastewater treatment plants and reverse osmosis treatment of water from Utah Lake and the Jordan River for M&I use.

RESULTS OF M&I WATER NEEDS STUDY

The results of the M&I water needs assessment from the Draft Plan Formulation Report of February 2002, the revised M&I water needs report of January 2003 using revised population projects, and updates by the JVWCD and the MWDSLS are summarized in the following paragraphs.

Eastern Juab County

This analysis shows that the M&I water demand for the projected population of eastern Juab Valley can be met through existing M&I water supplies and future conversion of irrigation water for M&I use. The conversion of irrigation water would involve the cost of purchasing water rights, either in conjunction with the purchase of irrigated land for development or separately from urbanization of the irrigated land.

Southern Utah County

The total M&I water deficit in 2050 under existing supplies is projected to be 32,000 acre-feet. The communities facing the greatest future shortages under existing supplies are located in the southern part of Utah County, namely south of Utah Lake where little or no natural stream flow is available for M&I diversion, and where groundwater supplies tend to be relatively low. The

most pressing examples are 1) the Goshen Valley Area with low amounts of ground water rights and spring water, little or no CUP or SVP water, and where the only stream flow consists of Current Creek and Warm Springs; and 2) Santaquin with moderate amounts of groundwater and stream flow (already heavily used), little CUP water, and no SVP water.

Based on the considerations discussed in this analysis, it is concluded that a ULS supply of 30,000 acre-feet of M&I water for southern Utah County would be an essential new supply for the area. The shortages for the various areas in southern Utah County are presented in Table 2-6.

TABLE 2-6
Southern Utah County
Municipalities and Areas with M&I Shortages
(Units: acre-feet)

Area	Yr-2000	Yr-2010	Yr-2020	Yr-2030	Yr-2040	Yr-2050
Elk Ridge			406	401	498	557
Genola						1,307
Payson						4,350
Salem					1722	3,365
Santaquin					3,187	6,271
Woodland Hills			174	352	536	536
Goshen Valley	102	237	335	456	4,978	10,609
West Mountain		554	960	1,465	1,670	1,877
West Shore					1,341	2,919
Total	102	955	1,875	2,674	13,932	31,791
					Rounded to	**32,000**

Northern Utah County

In this analysis of water needs, only two incorporated communities, (Saratoga Springs and Draper) and one un-incorporated community (Cedar Valley) in Northern Utah County may have a need for assistance in meeting future water demands. However, these demands are not projected to occur until the time frame of 2040 to 2050. This is much later than the needs in Salt Lake County where significant water shortages will begin to occur starting around year 2015. There are ways to meet needs in these northern Utah County areas in absence of any direct deliveries from the ULS project. Due to the small water demand and alternate opportunities, the ULS project alternatives have not focused on water deliveries to these northern Utah County communities.

The incorporated communities with potential shortages are Saratoga Springs (1,554 acre-feet) and Draper City (2,980 acre-feet). Draper City's needs would be met from water supplies and

deliveries from the Jordan Valley Water Conservancy District. The potential needs of Saratoga Springs could be met though local cooperative efforts with the District's remaining Utah Lake rights, a conjunctive use program in northern Utah County, and water recycling. Water for the conjunctive use program would become available as significant blocks of irrigated lands are converted to urban use.

The un-incorporated area of Cedar Valley could experience a shortage of about 3,000 acre-feet if the projected growth at year 2050 were to occur. However, in the case of Cedar Valley there are no elected representatives that have petitioned for water. Because of this, there is not a foreseeable need to deliver water through either direct deliveries or through exchanges. The most likely scenario for any growth to occur in Cedar Valley would be for developers to purchase agricultural groundwater rights within Cedar Valley or irrigation rights outside the valley that, with approval from the State Engineer, could be transferred for M&I use. With growth from this water supply a small-scale water recycling project would meet the remaining demands.

Salt Lake County

The estimated volume of water that may be available to Salt Lake County from the ULS project is approximately 30,000 acre-feet. The current split of Bonneville Unit water between the Metropolitan Water District of Salt Lake/Sandy (MWDSLS) and the Jordan Valley Water Conservancy District (JVWCD) is 2/7 to MWDSLS and 5/7 to JVWCD. It is anticipated that the ULS water would be split in this same ratio.

Projected M&I Shortages of JVWCD Under Existing Supplies. Table 2-7 presents the resulting M&I water demand in comparison with the existing supply. The estimates indicate that between 2000 and 2010 the JVWCD water supply will change from a surplus condition to a deficit condition as water demands increase and as temporary surplus water supply availability expires. The expiration of the temporary surplus water supply will be offset and superseded by increased well production and additional CUP water from the Bonneville Unit M&I System. However, in spite of these compensating supplies, the projected demand in excess of existing water supplies could reach 90,000 acre-feet by the year 2050.

TABLE 2-7
Projected M&I Shortages Under Existing Water Supply Available to the JVWCD
(Units: acre-feet)

Case	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*
Total M&I Demand	129,868	154,033	168,605	180,345	205,335	235,811
Existing Supply [a)]	133,436	148,530	148,530	148,530	148,530	148,530
Surplus	**3,568**					
Deficit		**5,503**	**20,075**	**31,815**	**56,805**	**87,281**

a) In year 2010 the supply will be reduced by the loss of 13,636 acre-feet of temporary surplus water that was available in Year 2000 from MWDSLS. This reduction will be partially offset by increases in groundwater development and pumping by JVWCD, and by availability of additional CUP Bonneville Unit M&I System water under a JVWCD petition totaling 50,000 acre-feet.

Opportunities to fill this deficit include, in addition to the ULS water supply, the treatment of contaminated groundwater in the southwestern portion of Salt Lake County, membrane treatment of saline groundwater along the Jordan River, water recycling from wastewater treatment plants, and reverse osmosis treatment of Utah Lake water.

Projected M&I Shortages of MWDSLS under Existing Supplies. The areas of the two cities within the MWDSLS service area are projected to fare differently under their existing M&I water supplies. The Salt Lake City service area, by virtue of its local and contracted water supplies, is projected to have a small excess of supply over demand to year 2050 when a slight deficit will exist. This is illustrated in Table 2-8 by a declining surplus to 2050. The Sandy City water service area, by contrast, has begun to experience a water supply deficit, which is projected to increase in future decades under existing supplies. This is illustrated in Table 2-8.

TABLE 2-8
Projected M&I Shortages Under Existing Supplies
Within the MWDSLS Service Areas
(Units: acre-feet)

Water Entity	2000	2010	2020	2030	2040	2050
Salt Lake City						
Total M&I Demand	96,000	96,000	96,448	97,304	97,887	107,154
Existing Supplies (Dry Year)	104,051	104,051	104,051	104,051	104,051	104,051
Surplus/Deficit	***8,051***	***8,051***	***7,603***	***6,747***	***6,164***	***-3,103***
Sandy City						
Total M&I Demand	34,979	33,928	32,503	32,885	38,556	41,600
Existing Supplies (Dry Year)	31,415	31,415	31,415	31,415	31,415	31,415
Surplus/Deficit	***-3,564***	***-2,513***	***-1,088***	***-1,470***	***-7,141***	***-10,185***

Table 2-8 poses the logical question of whether the Sandy City deficit could be offset by the Salt Lake City surplus over the next few decades, perhaps under the auspices of MWDSLS. The answer is that such a pooling of existing water supply is not practicable for several reasons, namely 1) each of the cities has water service responsibilities that extend beyond the jurisdictional area of MWDSLS, 2) the various water sources of each city are essentially held in trust for their local water using communities, 3) the estimated surplus or deficit of each city is a relatively small portion of its total water needs, and thus subject to unanticipated changes in population growth and permanence of water source capacity, and 4) the recent long-term dry cycles that have occurred in Utah require each member city to provide a reserve pool of their own supply to help meet their water needs during the multi-year drought cycles. The current Sandy City deficit is made up by lease of water from other agencies and Sandy City's utilization of groundwater supplies that will be limited in the future.

Wasatch County

The analysis, as contained in Water Supply Appendix, Volume 2, shows that the M&I water supply for the GOPB projected population in Wasatch County can be met through full utilization of existing groundwater wells and springs coupled with future conversion of irrigated land to municipal use.

Central Utah Project Completion Program

Chapter 3

October 2004

UTAH RECLAMATION
MITIGATION
AND CONSERVATION
COMMISSION

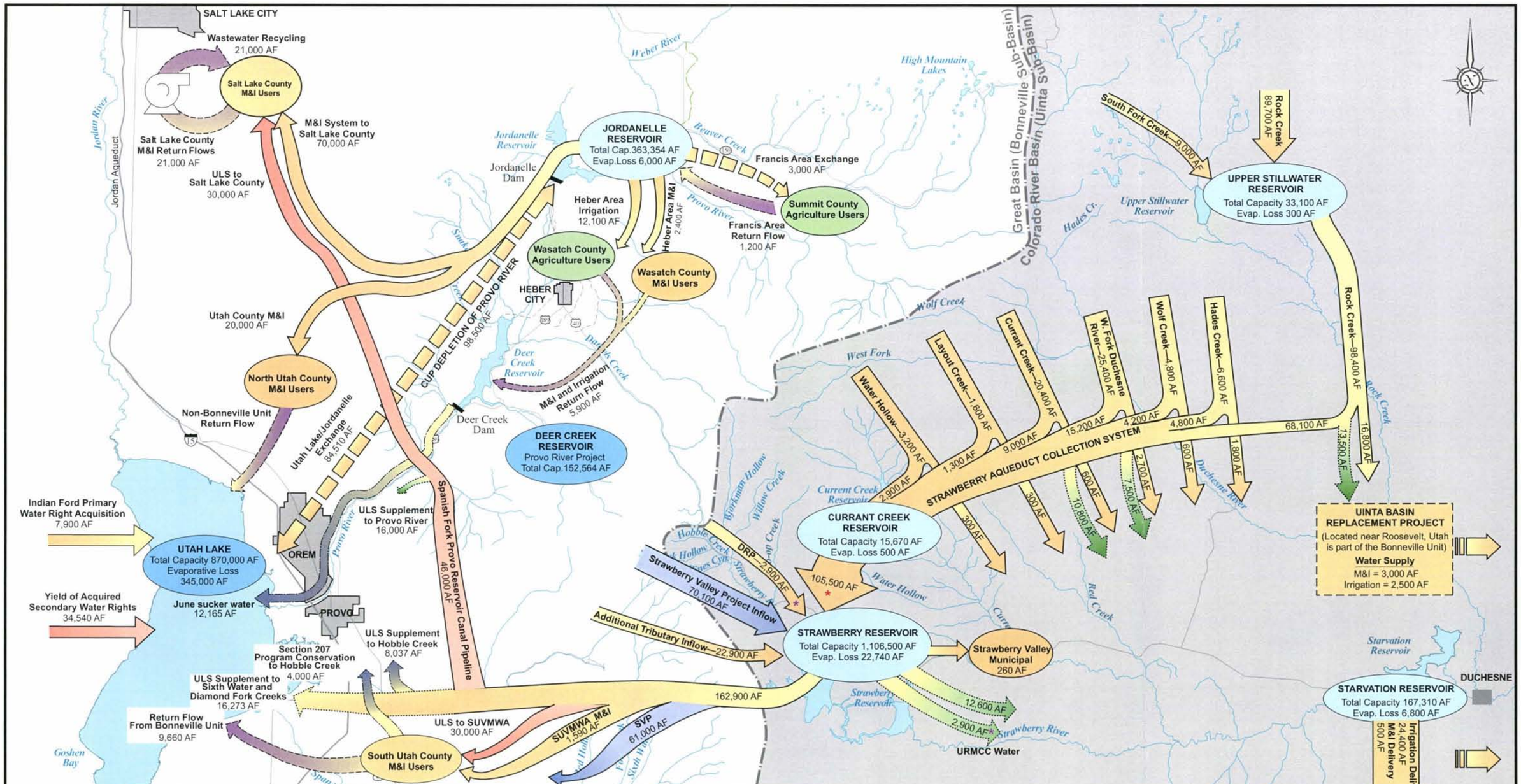
Chapter 3

SUMMARY OF TOTAL WATER SUPPLY

The total water supply developed and delivered by the Bonneville Unit is 244,150 acre-feet, for irrigation, M&I use, and fishery flows. The amounts of water for various purposes are each listed in Table 3-1 and are shown schematically on Figure 3-1. River conveyance losses are determined by the State Engineer's local representatives. Reservoir evaporation is included in the modeling of water supply reservoirs by using monthly evaporation data and converting to volume by multiplying by reservoir surface area. Average annual reservoir evaporation losses are shown on Figure 3-1. Changes in average annual reservoir evaporation losses are not considered to significantly impact the project water supply. It has been assumed that sedimentation in the reservoirs will only impact the dead pool capacities and not impact future storage volumes.

TABLE 3-1
Total Bonneville Unit Water Supply

Purpose	Acre-Feet
Irrigation Water	
Wasatch & Summit Counties	15,100
Duchesne County	
Starvation Reservoir	24,400
UBRP Agriculture	2,500
Subtotal Irrigation	*42,000*
M&I Water	
Duchesne County	3,500
Wasatch County	2,400
Northern Utah County	20,000
Southern Utah County	31,590
Salt Lake County	100,000
Strawberry Valley	260
Subtotal M&I	*157,750*
Uinta Basin Fishery Flows	44,400
Total	**244,150**



Depletions to the Provo River

Description of Depletion	Average Annual Acre-Feet
M&I Salt Lake County	70,000
M&I North Utah County	20,000
Francis Area Agriculture	3,000
Wasatch County Agriculture	9,200
Daniels Replacement Project	2,900
M&I Wasatch County	2,400
Jordanelle Evaporation & Storage	6,000
Francis Area Return	-1,200
Wasatch County Agric. Return	-4,400
Wasatch County M&I Return	-1,500
Indian Ford/ Utah Lake Rights	-7,900
Total	**98,500**

Depletions to Utah Lake

Description of Depletion	Average Annual Acre-Feet
Provo River Depletion	98,500
Strawberry to Supplement Sixth Water and Diamond Fork	-16,273
Strawberry to Supplement Hobble Creek	-8,037
Strawberry to Supplement Provo River	-16,000
North Utah County M&I Return	
So Utah Return	-9,660
Yield of Utah Lake Rights	-34,540
Total	**13,990**

Depletions to the Colorado River

Description of Depletion	Average Annual Acre-Feet
Strawberry Collection System Operation	
Bonneville Unit water released to the Basin	-101,900
Strawberry Valley M&I use	-260
Strawberry Reservoir evaporation (BU portion)	-17,700
Upper Stillwater Reservoir evaporation	-300
Currant Creek Reservoir evaporation	-500
Starvation Collection System Operation	
Duchesne River area Irrigation	-12,200
Duchesne River area M&I use	-250
Starvation Reservoir evaporation	-6,800
Uinta Basin Replacement Project	
Roosevelt area M&I use	-1,500
Upalco area irrigation use	-1,250
Offsetting gain from Daniel Replacement Project	+2,900
Total	**139,760**

Strawberry Reservoir

Project	Inflow	Outflow to Great Basin
Strawberry Valley Project	70,100 AF	61,000 AF
Central Utah Project	128,400 AF	101,900 AF
Daniel Replacement Project	2,900 AF	0 AF
Total	**201,400 AF**	**162,900 AF**

Project	Outflow to Uinta Basin
Strawberry Valley M&I	260 AF
Instream Flow	12,600 AF
Daniel Replacement Project	2,900 AF
Total	**15,760 AF**

Notes:

BONNEVILLE UNIT

CUP Transbasin diversion 101,900 AF

AF = acre-feet

Water deliveries and spills

Fishery flows

Return flows

June sucker flow

* Includes 4,000 AF Strawberry Valley Project Water

* Wasatch County Water Efficiency Project and Daniel Replacement Project

Sum of fishery flow in Uinta Basin = 44,400 AF

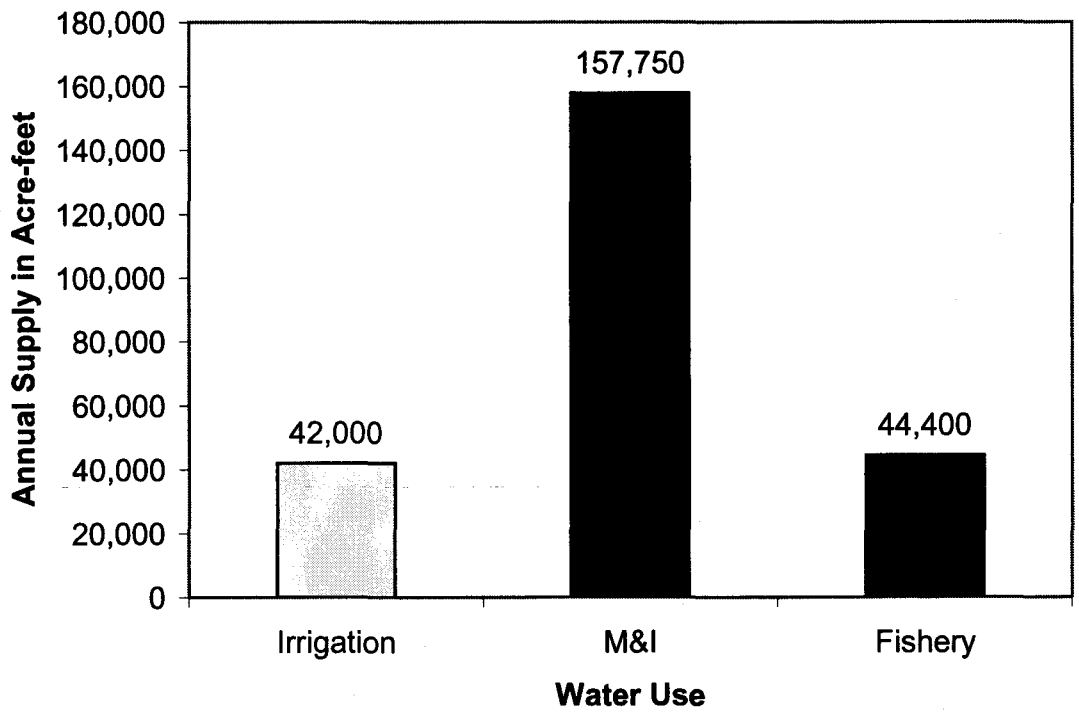
Figure 3-1
Distribution of Bonneville Unit Water

The water supply in this 2004 Supplement to the 1988 DPR includes 5,500 acre-feet of water supply produced by UBRP, 3,000 acre-feet of M&I water for Duchesne County and 2,500 acre-feet of irrigation water for Duchesne County. The UBRP, described in Chapter 1, was authorized by Section 203 of CUPCA and was administratively included in the Bonneville Unit.

OVERALL WATER SUPPLY

As shown in Table 3-1, the overall water supply is distributed among irrigation (42,000 AF), M&I (157,750 AF) and Instream Flow (44,400 AF). This is represented below in Figure 3-2.

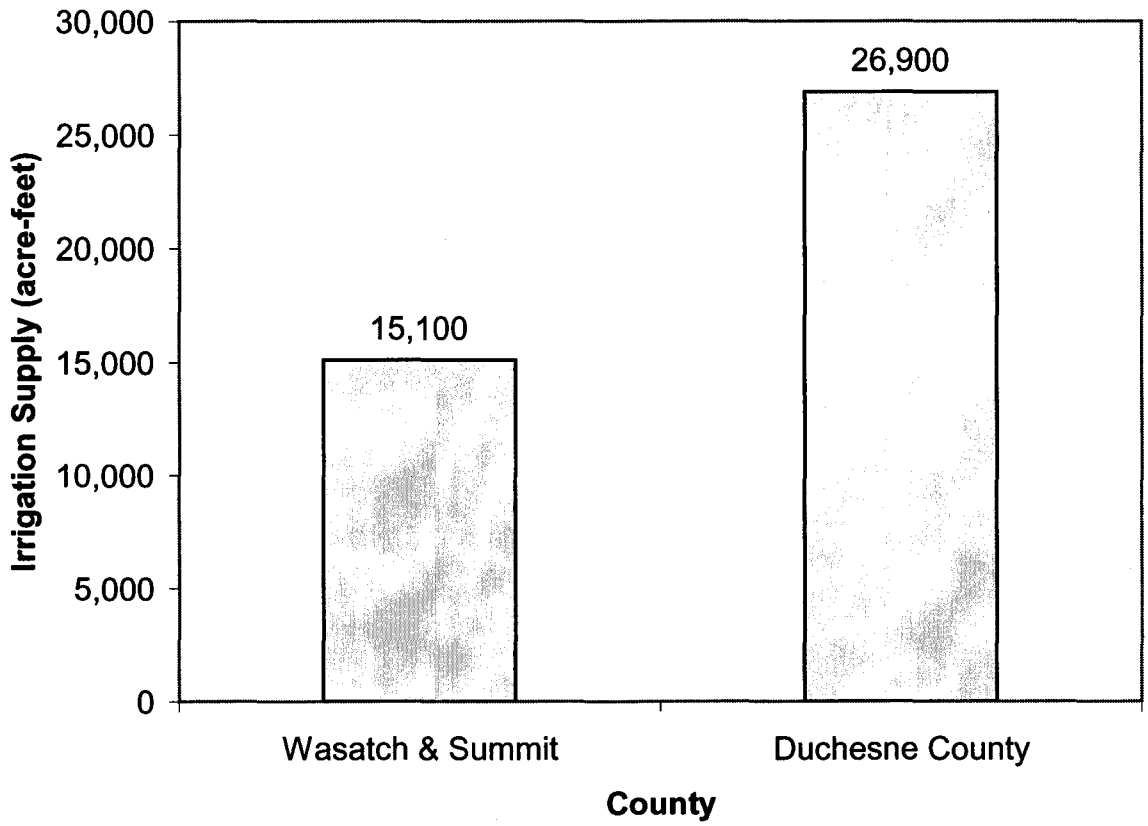
Figure 3-2
Comparison of Bonneville Unit Water Uses



IRRIGATION WATER SUPPLY

The irrigation water developed by the Bonneville Unit will be supplied to irrigable lands in Wasatch, Duchesne, and Summit Counties that have been certified as arable by the Secretary of the Interior and to which a water supply can be provided. Table 3-1 shows the amounts of and delivery locations for irrigation water to be delivered by the Bonneville Unit. In addition the irrigation supply is represented below in Figure 3-3.

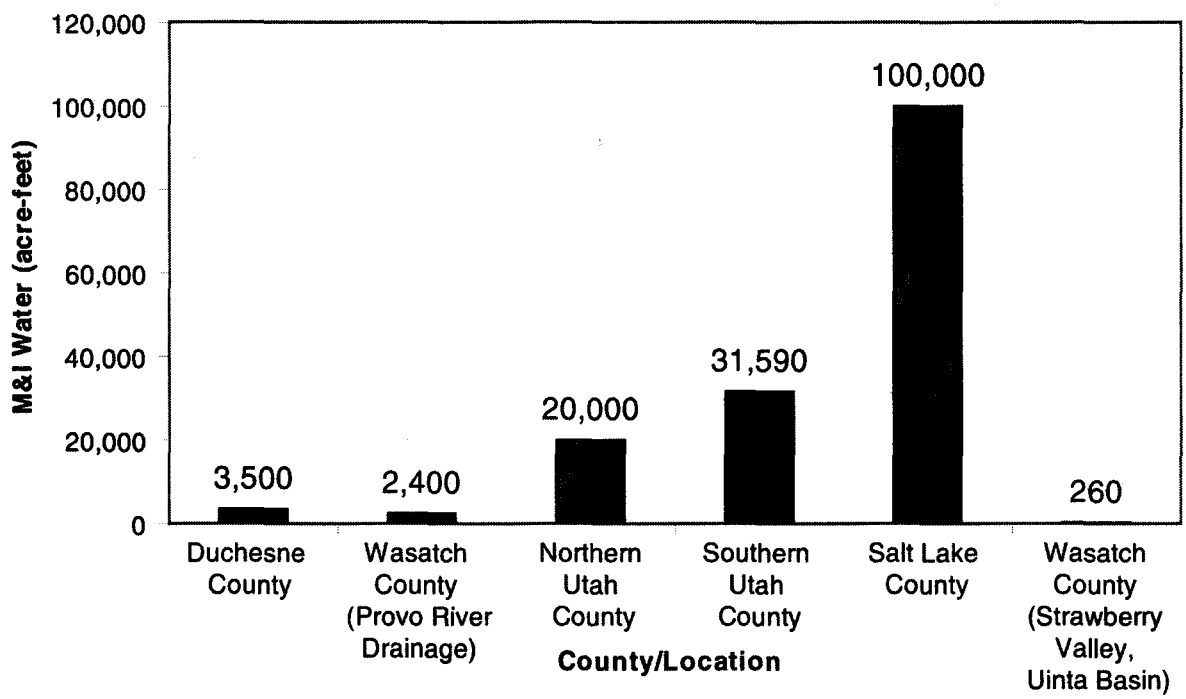
Figure 3-3 Bonneville Unit Irrigation Water



M&I WATER SUPPLY

M&I water supply would be made available to populated areas of Duchesne, Wasatch, and Salt Lake Counties, northern and southern Utah County, and Strawberry Valley in the amounts listed on Table 3-1 and below in Figure 3-4. The Duchesne County M&I water supply consist of 500 acre-feet developed in Starvation Reservoir and 3,000 acre-feet developed in the enlarged Big Sand Wash Reservoir, part of UBRP. Wasatch County is supplied with 2,400 acre-feet by the Bonneville Unit M&I System. Salt Lake County is being served by the Bonneville Unit M&I System and will receive additional M&I water from the proposed ULS System. Northern Utah County is being served by the Bonneville Unit's M&I System. Southern Utah County will be served through the proposed ULS System. Strawberry Valley will be served partly from Strawberry Reservoir and partly through releases from the Reservoir.

Figure 3-4 Bonneville Unit M&I Water



NON-CONSUMPTIVE USE FOR HYDROPOWER PRODUCTION

Water released from Bonneville Unit reservoirs provides potential for hydropower generation. P.L. 107-366 authorized federal cost sharing for construction of power plants with non-federal entities. Power generation must not interfere with the water supply operation of the Bonneville Unit; flows for power generation would be restricted to releases for water supply. Specific restrictions to this effect are contained in CUPCA Section 208, as follows:

> 208(b) COLORADO RIVER BASIN WATERS--Use of [Bonneville Unit] water diverted out of the Colorado River Basin for power purposes shall only be incidental to the delivery of water for other authorized project purposes. Diversion of such waters out of the Colorado River Basin exclusively for power purposes is prohibited.

Bonneville Unit water is being used for or is proposed for hydropower generation at three locations. One would be under Lease of Power Privilege at Jordanelle Dam. The other two would be located in the Diamond Fork drainage and constructed as part of the ULS System. The ULS power plants would operate on transbasin diversion water conveyed in the Diamond Fork System conduits and the tail water from the plants would continue to flow through the Diamond Fork System conduit next in line below the generating station.

INSTREAM FLOWS

Fishery Flow Releases to Duchesne River System

The Bonneville Unit will release 44,400 acre-feet annually to streams affected by the operation of the Strawberry Collection System to maintain stream fish populations. These are termed "fishery flow" releases to distinguish them from the other streamflow provisions of the Bonneville Unit.

The Strawberry Aqueduct and Collection System, described in Water Supply Appendix, Volume 3, diverts water from various streams in the Uinta Basin and conveys the water to Strawberry Reservoir. In February 27, 1980, "Instream Flow Agreement" between the District and various State and federal resource agencies, it was agreed to develop and release sufficient flow in the four main collection system streams to meet 50 percent of the historical adult trout habitat. The remaining 50 percent would be accomplished through an aquatic mitigation plan that was finalized in December 1988. The streams are the Strawberry River, the West Fork Duchesne River, and Currant and Rock creeks. The distribution of the 44,400 acre-feet of fishery flow releases is discussed in Chapter 4 of this Water Supply Appendix Volume as well as in Water Supply Appendix Volume 3 and in the Fish and Wildlife Appendix that accompanies the 2004 Supplement to the 1988 Definite Plan Report.

The Fish and Wildlife Service issued a Biological Opinion for the Duchesne River Basin in 1998 that historic project operations and development and use of new project water contributes to endangerment of listed fishes and is likely to jeopardize continued existence of the endangered

Colorado River fishes. The Fish and Wildlife Service determined that completion of all elements of the reasonable and prudent alternative would offset impacts of historic and future projects and would avoid the likelihood of jeopardy and destruction or adverse modification of critical habitats. The FWS has prepared an amendment to incorporate new information into the 1998 Final Biological Opinion, to provide a revised reasonable and prudent alternative, and a notice re-initiating consultation.

Restoration of Strawberry River Flows Upstream of Strawberry Reservoir

The Daniel Irrigation Company had historically diverted water from the upper Strawberry River and certain tributaries into Daniels Creek, which conveyed the water to the Heber Valley. This transbasin diversion, which had averaged 2,900 acre-feet per year, depleted the flow of the Strawberry River upstream of Strawberry Reservoir to the detriment of the fishery in that area.

In accordance with Section 303(b)(1) of CUPCA the transbasin diversion was terminated in order to restore the summer flow in the upper Strawberry River. Through the Wasatch County Water Efficiency Project and the Daniel Replacement Project the Daniel Irrigation Company is provided a replacement water supply from Jordanelle Reservoir.

Diamond Fork Creek Summer Flow Reduction

The transbasin diversion of water from Strawberry Reservoir by the Strawberry Valley Project has historically been conveyed in Sixth Water Creek and Diamond Fork Creek from Three Forks to its confluence with the Spanish Fork River. This conveyance has created unnaturally high summer flows in Sixth Water Creek and Diamond Fork Creek.

The Diamond Fork System will convey most of the SVP water (that has historically flowed in Sixth Water Creek) and most of the Bonneville Unit water from the Sixth Water Aqueduct to its connection with the Spanish Fork Canyon Pipeline near the confluence of Diamond Fork Creek with the Spanish Fork River. The flow reduction in both creeks, coupled with the minimum flow provisions discussed below, will facilitate the Mitigation Commission's ability to restore the creek channels.

Minimum Flow Requirements in Various Streams

The Bonneville Unit contains various provisions for improving aquatic and riparian habitat by providing water for streamflow augmentation and by regulating streamflows through its operation. The purposes are to improve the aquatic habitat in the streams, to enhance sport fishing opportunities, to improve riparian habitat, and to assist with the JSRIP. The streamflow provisions are divided into the categories listed below in terms of their objectives and type of operation. The flow rates and water quantities involved in these streamflow provisions are listed on Table 3-2.

TABLE 3-2
Instream Flow Provisions in the Bonneville Unit

Stream	Location	Flow Requirement
Provo River	From the Washington-South Kamas diversion to Jordanelle Reservoir	Minimum of 10 cubic feet per second (cfs)
Provo River	From Jordanelle Dam to Deer Creek Reservoir	Minimum of 125 cfs
Provo River	From its confluence with Deer Creek to the Olmsted Diversion Dam	Minimum of 100 cfs
Provo River	From Olmsted Diversion Dam to Utah Lake	Minimum of 25 cfs from November through March
Provo River	From Orem to Utah Lake	16,000 AF per year[a]
Strawberry River	Above Strawberry Reservoir	2,900 acre-feet/year[b]
Strawberry River	Starvation Dam to confluence with Duchesne River	Minimum of 15 cfs[c]
Sixth Water Creek	Between the outlet of Strawberry Tunnel and the outlet of the Sixth Water Aqueduct	No less than 32 cfs during May through October and no less than 25 cfs during November through April
Diamond Fork Creek	Below Monks Hollow	No less than 80 cfs during May through September and no less than 60 cfs during October through April
Hobble Creek	From Springville to Utah Lake	12,037 AF per year[a]
Uinta Basin Fishery Flow Releases	Strawberry River and West Fork of the Duchesne River; Currant and Rock creeks	44,400 acre-feet per year. The distribution among the four streams is set annually by the Interagency Biological Assessment Team
Rock Creek	Below Upper Stillwater Dam	No less than 29 cfs during May through October and no less than 23 cfs during November through April

[a] Utah Lake water delivery routed through the stream as part of the JSRIP and to provide other fish and wildlife benefits by assisting to meet the target flows described in section 303(c)(4) of CUPCA; variable by month and year. In some years there would be no water delivered to the Provo River.
[b] This amount is the average of 40 years of varying annual amounts stemming from natural runoff.
[c] The minimum flows on the Strawberry River below Soldier Creek Dam and on Rock Creek are included in the 44,400 acre-foot Bonneville Unit contribution to Uinta Basin streams.

- Fishery flow releases of 44,400 acre feet from the Strawberry Aqueduct and Strawberry Reservoir to the Duchesne River and its tributaries
- Restoration of summer flow of the Strawberry River above Strawberry Reservoir
- Diamond Fork Creek summer flow reduction
- Minimum flow requirements in various streams
- Releases to Provo River and Hobble Creek for JSRIP.

There are minimum flow requirements to maintain aquatic habitat in Diamond Fork and Sixth Water creeks and in the Provo and Strawberry rivers. Most of these requirements stem from Section 303 (c) of CUPCA. However, some were included as environmental commitments in the Bonneville Unit prior to enactment of CUPCA.

During the normal operation of the Bonneville Unit, most of these minimum flow requirements can be met while making water deliveries through the affected streams. For example, the 50-year average annual delivery to Utah Lake from Strawberry Reservoir through the Spanish Fork River is estimated to be approximately 16,273 acre-feet per year. This delivery, plus certain SVP irrigation water deliveries and local flow originating in Diamond Fork Creek, will provide sufficient water to meet the instream flow requirement in Sixth Water and Diamond Fork creeks in most years. However, in the event that low water supply or other conditions reduce the Bonneville Unit water conveyed in the streams, the minimum flows will still need to be maintained.

RETURN FLOWS

Part of the Bonneville Unit M&I water to Salt Lake, Utah and Wasatch counties and the irrigation water delivered to Duchesne, Wasatch, and Summit counties would return to the Bonneville Unit hydrologic systems. Such return flows are either credited as Bonneville Unit waters or considered natural flows in the system. The distinction is specified by the State Engineer in the administration of various project water rights as discussed below. Return flows that are credited as Bonneville Unit return flows are considered by the DOI to be Bonneville Unit waters, and would be available as part of the supply for subsequent Bonneville Unit water deliveries or Bonneville Unit water exchanges. A ruling by the State Engineer is needed to confirm the status of the return flows.

Bonneville Basin Return Flows

Return flows from water delivered by the Bonneville Unit M&I and ULS Systems would occur and be tributary to the Provo River, Utah Lake, and the Jordan River. Table 3-3 lists the return flow quantities and the origins of the return flows.

TABLE 3-3
Summary of Bonneville Unit Return Flows
Tributary to Utah Lake and Jordan River
Units: acre-feet

Area and Type of Water Use	Average Annual Return Flow To		Total
	Provo River And Utah Lake	Jordan River	
Summit County Irrigation	1,200	n.a.	1,200
Wasatch County M&I and Irrigation	5,900	n.a.	5,900
Southern Utah County M&I	9,660	n.a.	9,660
Northern Utah County M&I	7,000[1]	n.a.	7,000
Salt Lake County M&I	n.a.	21,000	21,000
Column Totals	**23,760**	**21,000**	**44,760**
Creditable Return Flow Totals	**16,760**	**21,000**	**37,760**

The Summit County return flows of 1,200 acre-feet stem from the delivery of 3,000 acre-feet of irrigation water from the Bonneville Unit M&I System by exchange for use in the Francis area. The return flows return to Jordanelle Reservoir where they contribute to the water supply of the Bonneville Unit M&I System.

The Wasatch County return flows of 5,900 acre-feet stem from the delivery of 14,500 acre-feet of irrigation and M&I water from the Bonneville Unit M&I system for use in the Heber Valley. These return flows are recaptured in Deer Creek Reservoir from which they are subsequently released to meet Bonneville Unit M&I System demands downstream of the reservoir.

Southern Utah County return flows of 9,960 acre-feet stem from the delivery of 27,590 acre-feet of M&I water from the ULS System. These return flows would flow to Utah Lake and become part of the Bonneville Unit water supply to be used for conversion or exchange to Jordanelle Reservoir under the State Engineer's Utah Lake Distribution Plan and then for delivery to the District's petitioners in Wasatch, Utah, and Salt Lake counties.

Northern Utah County return flows are estimated to be 7,000 acre-feet. These stem from the use of 20,000 acre-feet of M&I System water delivered to northern Utah County. However, this return flow is not creditable as Bonneville Unit water. In previous Bonneville Unit documents, it was stated that this return flow to Utah Lake would be 13,000 acre-feet and would be accounted for as part of the Bonneville Unit water supply provided to Utah Lake for exchange to Jordanelle Reservoir. However, in November 2002, the Utah State Engineer issued a ruling that precluded such

[1] This return flow does not qualify as Bonneville Unit water creditable for exchange to Jordanelle Reservoir because the water producing the return flow originated in the Provo River.

credit. The ruling stated that return flows from water that is not imported to the Utah Lake Basin would accrue to the lake as part of the water rights of those individuals and entities that have Utah Lake water rights. This is the case even if the supplied water is the result of an exchange of imported water delivered to Utah Lake. Consequently, return flows from this source are not available to the project.

The Salt Lake County return flows from M&I water delivered by the M&I and ULS Systems are estimated to be 21,000 acre-feet annually. These return flows stem from the use of the 70,000 acre-feet delivered by the M&I System and the 30,000 acre-feet delivered by the ULS System. These flows would consist primarily of municipal wastewater tributary to the Jordan River, which are available for recycling and reuse as circumstances warrant.

WATER RIGHTS

Bonneville Unit water rights are covered by a variety of applications filed with the Utah State Engineer's office. The principal water right application for the Bonneville Unit is Application No. 36639 (43-3822), appropriating 500,000 acre-feet of water from the Strawberry and Duchesne Rivers and their tributaries for use in the Uinta and Bonneville basins. This application has been approved by the Utah State Engineer and assigned a priority date of November 19, 1964.

Four other significant water right applications pertinent to the Bonneville Unit have been filed with the Utah State Engineer:

- Application No. 37093 (55-1875), with a priority date of July 13, 1965, seeks to appropriate up to 195,000 acre-feet of return flows from project water used for irrigation, municipal, and industrial purposes under the Bonneville Unit. This application was approved on September 29, 1999.

- Application No. 40523 (55-4494), approved June 7, 1985, and assigned a priority date of March 18, 1971, provides storage of up to 300,000 acre-feet of surplus flows on the Provo River in Jordanelle and Deer Creek reservoirs.

- Application No. 40528 (53-399) was filed on March 18, 1971, and seeks to appropriate 21,000 acre-feet of surplus flows and Bonneville Unit return flows in Currant Creek for storage in Mona Reservoir. This application is pending approval.

- Exchange Application No. 398 (55-8506) seeks to exchange up to 300,000 acre-feet of Bonneville Unit water in Utah Lake for flows of the Provo River which are surplus to water rights above Utah Lake, but covered by existing rights in Utah Lake. Bonneville Unit water in Utah Lake is to be supplied under Application Nos. 36639, and 37093. This application has a priority date of March 18, 1971, and was approved by an August 19, 1985, memorandum decision.

In addition to the water right filings with the Utah State Engineer's office, the District has acquired two water rights from previous permittees that provide for diversion from Utah Lake and the Jordan River:

- Water Right Nos. 55-9327, 55-9695, and 51-7755 provides for the diversion of 25,000 acre-feet of water. This is a decreed right granted by the Booth Decree of June 5, 1909, and is a primary storage right. Of the 25,000 acre-feet, the U.S. Department of Interior owns 7,900 acre-feet (55-9695), the community of Elk Ridge in south Utah County was assigned 237 acre-feet (51-7755) by the Central Utah Water Conservancy District, and the Central Utah Water Conservancy District owns the remaining 16,863 acre-feet (55-9327). This right was segregated from Water Right No. 57-7624 on November 10, 1997. Prior to the segregation, Water Right No. 57-7624 provided for diversion of 39,600 acre-feet of water, including 3,600 acre-feet of carrier water which must remain in the Jordan River. The Central Utah Water Conservancy District owned 25,000 acre-feet of that amount, and Salt Lake City owned 14,600 acre-feet of that amount, including the carrier water. Water Right No. 57-7624 had originally been acquired by the Central Utah Water Conservancy District on August 16, 1988.

- Certificate Nos. 2072 and 2073 provides for diversion of 57,073 acre-feet and has a priority date of August 6, 1909. These water right certificates were issued on March 27, 1969, and are secondary water rights. The diversion right was acquired from Kennecott Copper Corporation on December 31, 1987.

Under the ULS System, the DOI would acquire all of the District's secondary rights. These rights would amount to approximately 57,073 acre-feet and would yield at least 34,540 acre-feet. The acquired water rights would be used to convert or exchange water to Jordanelle Reservoir under approved water rights used in conjunction with the State Engineer's Utah Lake Distribution Plan.

The District has acquired the rights to the transbasin diversion from the upper Strawberry River and certain tributaries of the Strawberry River as required in Section 303(b)(1) of CUPCA, and has assigned these water rights to the United States. The water from these rights, historically diverted by the Daniel Irrigation Company, will increase Strawberry River summer flow upstream of Strawberry Reservoir and provide additional flows in the Duchesne River and its tributaries.

COLORADO RIVER DEPLETIONS BY THE BONNEVILLE UNIT

The Duchesne River is tributary to the Green River, which is part of the Colorado River system. The operation of the Bonneville Unit will reduce the Duchesne River's discharge into the Green River by an average of 139,760 acre-feet per year. This depletion of the Colorado River system results from the transbasin diversion of water to the Bonneville Basin, consumptive use of irrigation and

M&I water from Strawberry and Starvation Reservoirs, and reservoir evaporation. Irrigation consumptive use calculations were based on the irrigation of alfalfa, so that estimates were conservative. Table 3-4 lists the components of the depletion.

TABLE 3-4
Bonneville Unit Depletion of the Colorado River

Description of Depletion	Average Annual Water Use (acre-feet)	Average Annual Depletion (acre-feet)
Strawberry Collection System Operation		
Bonneville Unit water released to the Bonneville Basin	101,900	-101,900
Strawberry Valley M&I use	260	-260
Strawberry Reservoir evaporation [1]	17,700	-17,700
Upper Stillwater Reservoir evaporation	500	-500
Currant Creek Reservoir evaporation	300	-300
Starvation Collection System Operation		
Duchesne River area Irrigation [2]	24,400	-12,200
Duchesne River area M&I use [2]	500	-250
Starvation Reservoir evaporation	6,800	-6,800
Uinta Basin Replacement Project		
Roosevelt area M&I use [2]	3,000	-1,500
Upalco area irrigation use [2]	2,500	-1,250
Offsetting gain from Daniel Replacement Project (DRP)	-2,900	+2,900
Total Bonneville Unit Depletion		**139,760**

[1] The amount of Strawberry Reservoir evaporation attributable to the Bonneville Unit. The balance of the Strawberry Reservoir total evaporation is attributable to the Strawberry Valley Project.
[2] It is assumed that 50% of irrigation and M&I diversions would be depleted.

Central Utah Project Completion Program

Chapter 4

October 2004

UTAH RECLAMATION
MITIGATION
AND CONSERVATION
COMMISSION

Chapter 4

INTRODUCTION

The distribution of Bonneville Unit water through the completed Bonneville Unit systems has been detailed to account for the average annual volumes in and between the systems. Figure 3-1 in Chapter 3 showing these interrelationships serves as a tool for tracking flows.

The operation of various systems was worked out through the use of various models covering interfaces between systems. The Strawberry Aqueduct and Collection System (SACS), which accumulates water from streams in the upper Uinta Basin and conveys it into Strawberry Reservoir, was investigated as discussed below. The Diamond Fork System operation was modeled together with the deliveries to the ULS System and together with the Strawberry Reservoir. The water delivery provided by the Bonneville Unit M&I System using Provo River conveyance was modeled as described below. Finally, the operation of Utah Lake was modeled under the effects of the Bonneville Unit. The modeling assisted with the sizing of the ULS facilities and demonstrated that the operational interrelationships among Bonneville Unit systems form an effective water supply operation for the Wasatch Front.

The distribution of the water supply provided by the ULS System was determined through a public process. Public scoping meetings were conducted jointly by the District; Department of the Interior; and the Mitigation Commission; and by water agencies in Salt Lake, Utah, Wasatch, and Juab Counties to explain the potentials for water availability and distribution system layout. Water agencies in Salt Lake, Utah, and Juab Counties were invited to submit requests for water from the ULS System. The amount of M&I water in the resulting requests totaled approximately 121,000 acre-feet which exceed the available water supply. This demand for M&I water eliminated the availability of ULS water for irrigation purposes. The requests were evaluated as to their individual justification and overall effect on plan formulation, including availability of undeveloped local sources and geographic distribution of sources and facilities to obtain and distribute water. The results of the evaluation, described in Water Supply Appendix, Volume 2, led to the allocation of 30,000 acre-feet each to Salt Lake and southern Utah counties.

Key aspects of Bonneville Unit operations include:

- Strawberry Reservoir operations;
- Utah Lake operations; and
- Provo, Jordan, and Spanish Fork river operations

Overview of Strawberry Reservoir Operations

Strawberry Reservoir, a component of the SACS, forms a nexus between the water collection facilities in the Uinta Basin and the conveyance and delivery facilities of the Bonneville Unit service areas along the Wasatch Front. The Strawberry Reservoir Spreadsheet Model was used to confirm the reservoir's ability to meet the anticipated operational demands on it. Inflows to the Reservoir, which vary monthly and yearly according to runoff conditions in the Uinta Basin, were

projected with a Bureau of Reclamation model of the SACS. Withdrawals from the Reservoir would vary monthly and yearly according to runoff conditions, weather, and water needs along the Wasatch Front. They were modeled with the Strawberry Reservoir Spreadsheet Model which based transbasin diversions on Wasatch Front hydrologic data that was synchronized with inflows based on Uinta Basin hydrologic data of the same years and months. Operational commitments regarding SVP holdover storage and fish flow releases were honored. Testing the proposed ULS System operation against 50 years of historical Uinta Basin runoff conditions shows that Strawberry Reservoir provides the storage capacity sufficient for a total transbasin diversion of 162,900 acre-feet annually (61,000 acre-feet of SVP and 101,900 acre-feet of Bonneville Unit water annually).

The 162,900 acre-foot transbasin diversion is less than the 199,200 acre-foot transbasin diversion in the 1988 DPR. However, the basic operating pattern of the reservoir has remained constant, inasmuch as reductions in inflow to Strawberry Reservoir and releases from Strawberry Reservoir compensate for one another.

Overview of Utah Lake Operations

Utah Lake is located on the Wasatch Front in Utah County. It is a natural lake that has been modified to serve as a water reservoir by the addition of a low dam, control gates, and a pumping plant at its outlet to the Jordan River. The lake currently receives inflow from the Provo and Spanish Fork rivers, and from numerous smaller streams, drains, and groundwater discharge. Under Bonneville Unit operation, Jordanelle Reservoir reduces the inflow to the lake by storing Provo River water for the Bonneville Unit M&I System. Compensation for the reduction in inflow is made in the form of Strawberry Reservoir water released or returning to the lake and the acquisition of water rights in the lake. The District holds Utah Lake water rights (16,863 acre-feet of primary rights and 57,073 acre-feet of secondary rights). The Department of the Interior will acquire the District's secondary water rights for inclusion in the Bonneville Unit water supply. Utah Lake's outflow consists of irrigation diversions made by releasing water into the Jordan River, spills during high runoff, the Indian Ford Exchange, and evaporation. From Utah Lake's outlet, the Jordan River flows north and ultimately discharges into the Great Salt Lake.

Thus Utah Lake also forms a nexus; between Bonneville Unit water from Strawberry Reservoir, water withheld by Jordanelle Reservoir, the non-project tributary inflow, the yield of the water rights to be acquired for the ULS System, releases to the Jordan River, and diversions by numerous parties with Utah Lake rights. A model study was run to confirm the lake's stability under the full operation of the Bonneville Unit. The effect on the storage in the lake was modeled with the Provo River Simulation Model (PROSIM2000) and with the Utah Lake Spreadsheet Model, which included the hierarchy of water rights in Utah Lake and the provisions of the Utah State Engineer's Utah Lake Distribution Plan. Testing the proposed ULS System operation against 50 years of historical runoff and demand conditions indicated that the operation of Utah Lake contemplated in the 1988 DPR continues to be valid, as discussed in Water Supply Appendix, Volume 6.

Overview of River Operations

Provo River. CUPCA directed a comprehensive analysis of the Provo River operation to support water supply and environmental studies. The directive included the development of the PROSIM Model to permit analysis of the river system in more detail than was possible in the 1988 DPR. The model was developed and used in the 1990s for various environmental studies involving river operation, and has been used for analyses supporting the ULS EIS and this supplemental DPR.

While the basic operation of Jordanelle Reservoir and the Provo River system did not change from that in the 1988 DPR, numerous flow adjustments are occurring, generally for ecological purposes. CUPCA stipulated certain minimum flows in various reaches of the river. Water diversions at various locations on the river decreased as the result of water conservation activities and the water "returned" to the system. The returned water is re-regulated in Jordanelle Reservoir, which permits further seasonal augmentation of instream flows. In addition, the ULS System proposes to convey Strawberry Reservoir water to the lower Provo River for instream flow augmentation and to contribute to the June Sucker Recovery Implementation Program (JSRIP). The model analysis determined the operational balance of the Provo River under full Bonneville Unit operating conditions, which included protection of existing water rights as a model constraint.

Jordan River. The Jordan River begins at the Utah Lake outlet works and flows to the Great Salt Lake. The Jordan River has long served as a conveyance for delivery of Utah Lake water to irrigators in Salt Lake County who divert the water at the Jordan River Narrows or downstream. The Jordan Narrows is approximately 5-3/4 miles north of the lake's outlet, straight-line distance. The storage in Utah Lake and the flow of the Jordan River from Utah Lake to the Jordan Narrows were modeled using PROSIM2000 and the Utah Lake Spreadsheet Model.

Other Rivers and Streams. The flows of Sixth Water Creek, Diamond Fork Creek, Spanish Fork River, Provo River, and Hobble Creek were analyzed under Bonneville Unit operating conditions. These streams will all convey Bonneville Unit water to Utah Lake and some of them will convey Bonneville Unit M&I water for diversion to Salt Lake County and SVP irrigation water for use in southern Utah County. The streams were modeled with various models described in the next major section, and the model analyses adhered to minimum flow requirements set under the Bonneville Unit and deliveries under historical rights and previous projects such as the SVP and Provo River Project. The analyses are described below and in the Water Supply Appendix volume appropriate to the element being modeled.

Overview of Utah Lake Water Quality

The salinity of Utah Lake water exceeds the standards for culinary water and causes problems with certain varieties of agricultural or landscaping plants. Demineralization of Utah Lake water is a potential future source of water for southern Salt Lake County and possibly areas in Utah County located northwest of Utah Lake. An increase or decrease in salinity could have a slight

economic effect on the cost of demineralization. The effect of Bonneville Unit operation on the salinity of the lake was modeled using the same operational hydrology as was used for the ULS System operation. The results indicated that the operation of the Bonneville Unit would not change the lake's salinity from its historical variation, as discussed in Water Supply Appendix, Volume 6.

COMPUTER MODELS USED TO ANALYZE WATER SUPPLY AND QUALITY

Various computer models were used to analyze the distribution and quality of water involved in the operation of the Bonneville Unit. Their names, purposes, and where they are described in this Water Supply Appendix are listed below.

Strawberry Reservoir Spreadsheet Operations Model

A mass balance spreadsheet accounting model designed to aggregate and supply from storage the water needs to be met by transbasin diversion from Strawberry Reservoir on a monthly basis. This model was used to simulate the inflows and withdrawals from, and the storage in Strawberry Reservoir and to analyze the operation of Strawberry Reservoir. Additional information is provided in Water Supply Appendix Volume 3.

Spanish Fork River Spreadsheet Model

A mass balance spreadsheet accounting model designed to track water released from Strawberry Reservoir through Syar Tunnel, Strawberry Tunnel, Diamond Fork System conduits, Spanish Fork Canyon Pipeline, Sixth Water Creek, lower Diamond Fork Creek, Spanish Fork River, and ULS System pipelines on a monthly basis. This model was used to distribute the withdrawals from Strawberry Reservoir between the Diamond Fork System conduits and creeks and between the ULS System pipelines and the Spanish Fork River. Additional information is provided in Water Supply Appendix Volume 4.

Hobble Creek Model

A spreadsheet accounting model to evaluate the volume and frequency of Bonneville Unit water delivered to Hobble Creek to meet target flows for the June sucker Recovery Implementation Program. Additional information is provided in Water Supply Appendix Volume 4.

Provo River Simulation Model (PROSIM2000)

A prioritized water balance allocation calculator designed to analyze the effect of the Bonneville Unit operation on the Provo River and Utah Lake system. PROSIM is a computerized representation of the hydrology, facilities, water rights and institutional arrangements that includes transbasin diversions from the Weber River, Strawberry Reservoir, and Duchesne River

to the Provo River and Utah Lake Drainage Basin. Additional information is provided in Water Supply Appendix Volume 5.

Provo River Spreadsheet Model

A mass balance spreadsheet accounting model designed to track water in Jordanelle and Deer Creek Reservoirs and in the Provo River system below Jordanelle Reservoir. Inputs to this model are PROSIM2000 baseline model results, inflows to the River from ULS pipelines, and changes to diversions associated with ULS inter-related actions. Additional information is provided in Water Supply Appendix Volume 5.

Utah Lake Spreadsheet Model

A mass balance spreadsheet accounting model that tracks Utah Lake inflows, outflows, and storage in and outflows from the Lake for any set of operational schemes. It was used to analyze the storage and water level of Utah Lake, and the flows in the Jordan River from Utah Lake to the Jordan Narrows, under Bonneville Unit operating conditions. Additional information is provided in Water Supply Appendix Volume 6.

Utah Lake Simulation Model (LKSIM2000)

A mass balance model that calculates the water and salt balance of Utah Lake. It was used to analyze the salinity (total dissolved solids) of Utah Lake under Bonneville Unit operating conditions. Additional information is provided in Water Supply Appendix Volume 6.

STRAWBERRY RESERVOIR OPERATIONAL RELATIONSHIPS

Since the 1988 DPR, the quantity of transbasin water available from Strawberry Reservoir has been reduced from 199,200 acre-feet to 162,900 acre-feet. However, the basic operating pattern of Strawberry Reservoir has remained essentially unchanged. Since the 1991 Operating Agreement with SWUA and the 1992 enactment of CUPCA, various changes have occurred in the uses and distribution of the CUP water from Strawberry Reservoir. The following sections describe the current operating conditions and a summary of operational relationships including:

- 1980 Streamflow Agreement with the 44,400 acre-feet fishery flow provision;
- Upper Strawberry River Flow Restoration Water (2,900 acre-feet);
- 1991 Operating Agreement with SWUA;
- Bonneville Unit Transbasin Diversion;
- Transbasin Diversion Resulting from 1991 and 1992 Changes; and
- Total Releases from Strawberry Reservoir

The 44,400 Acre-Foot Fishery Flow Provision

Section 303(a) of CUPCA requires the District to provide, from project water if necessary, the amounts of water sufficient to sustain the minimum stream flows established pursuant to the 1980 Stream Flow Agreement. The effect of the CUPCA requirement cited above was to reduce the usable inflow to Strawberry Reservoir by 37,900 acre-feet (44,400 acre-feet minus the 6,500 acre-foot commitment in the 1988 DPR). The distribution pattern for the fishery flow releases remained as originally devised by the Interagency Biological Assessment Team (IBAT). The IBAT will evaluate the release pattern each year and determine the most favorable distribution for the year in the light of natural runoff conditions and other factors. The District will then operate the SACS to provide the recommended distribution, to the extent possible, while meeting water supply objectives. The distribution of releases among streams proposed in the 1980 Stream Flow Agreement and its amendments is listed on Table 4-1. Figure 4-1 shows the general location of the streams affected by the 1980 Streamflow Agreement.

TABLE 4-1
Proposed Fishery Flow Releases

Release	Volume (acre-feet)
Release from Upper Stillwater Dam to Rock Creek	13,500
Release from Strawberry Aqueduct to	
West Fork Duchesne River	7,500
Currant Creek	10,800
Release from Soldier Creek Dam to Strawberry River	12,600
Total Release	**44,400**

The disposition of the fishery flows, after they have served their purpose in the receiving streams, is uncertain at this time. Since the costs associated with this block of project water have been allocated to fish and wildlife, existing agreements may require that these fishery flows remain in the Duchesne River until its confluence with the Green River. The FWS issued a Biological Opinion for the Duchesne River Basin in 1998 that historic project operations and development and use of new project water contributes to endangerment of listed fishes and is likely to jeopardize continued existence of the endangered Colorado River fishes. The Fish and Wildlife Service determined that completion of all elements of the reasonable and prudent alternative would offset impacts of historic and future projects and would avoid the likelihood of jeopardy and destruction or adverse modification of critical habitats. The Fish and Wildlife Service has prepared an amendment to incorporate new information into the 1998 Final Biological Opinion, to provide a revised reasonable and prudent alternative, and a notice re-initiating consultation.

Upper Strawberry River Flow Restoration Water (2,900 acre-feet)

The Daniel Irrigation Company, located in the Heber Valley of Wasatch County, has historically diverted water from the Strawberry River and its tributaries upstream of Strawberry Reservoir to Daniels Creek, which flows into the Heber Valley. This transbasin diversion has averaged 2,900 acre-feet per year but the amount fluctuated from year to year depending on natural runoff conditions affecting the streams involved. In accordance with Section 303(b)(1) of CUPCA the transbasin diversion was terminated in order to restore the summer flow in the upper Strawberry River. Through the Wasatch County Water Efficiency Project and the Daniel Replacement Project the Daniel Irrigation Company is provided a replacement water supply from Jordanelle Reservoir, as described in Chapter 1 of this Water Supply Appendix.

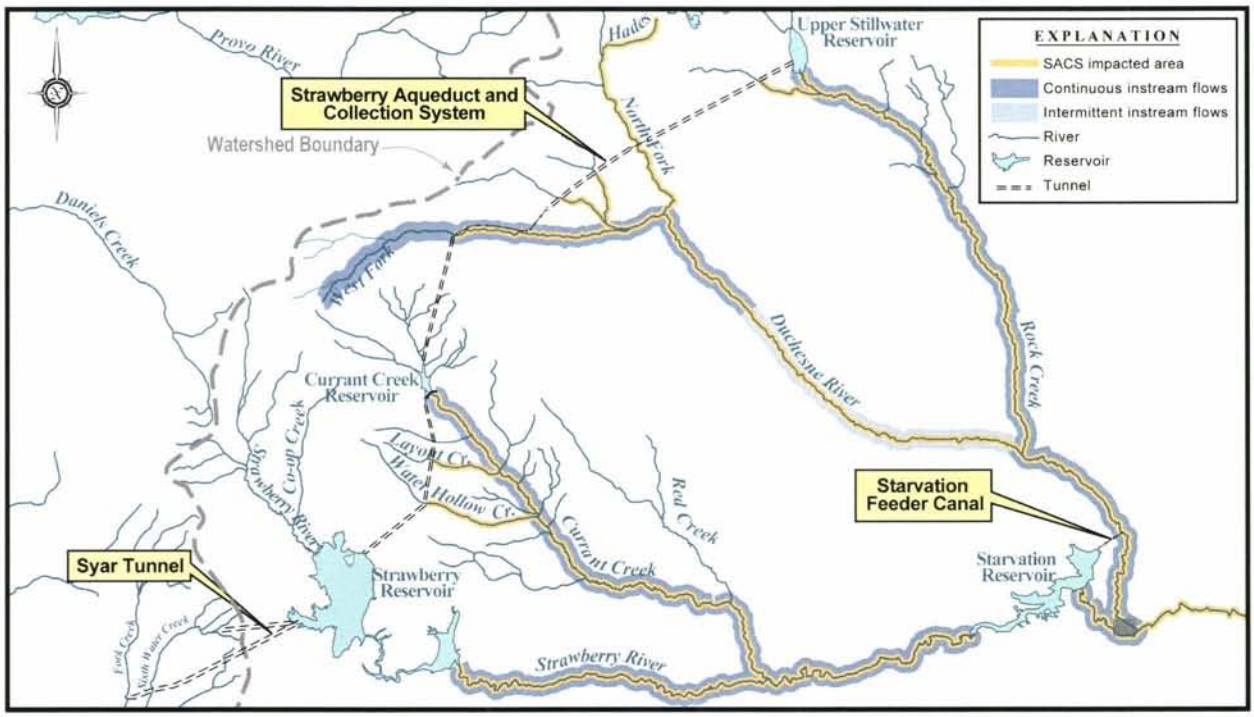


Figure 4-1
Location of Streams Affected by
Strawberry Aqueduct and Collection System

This restoration of summer streamflow would, in effect, provide an additional source of water for the Uinta Basin that was not addressed in the 1988 DPR. CUPCA has provided that once the water has entered Strawberry Reservoir it would be released to the lower Strawberry River below Soldier Creek Dam and/or to other Uinta Basin streams affected by the SACS. The manner in which this would be done will be determined by the Mitigation Commission in consultation with the Fish and Wildlife Service and the Utah Division of Wildlife Resources.

1991 Operating Agreement with SWUA

In 1991, the United States, the District, and the Strawberry Water Users Association (SWUA) entered into an operating agreement covering storage in, and delivery from, Strawberry Reservoir of SVP water. Although some of the provisions of this agreement are currently a matter of litigation, the 1991 Agreement does address the operation of the enlarged Strawberry Reservoir, Syar Tunnel, and the Diamond Fork System.

The enlarged Strawberry Reservoir provides long-term storage of both Bonneville Unit and SVP water in a common pool of active storage. The 1991 Operating Agreement guaranteed the SWUA 61,000 acre-feet each year from storage in Strawberry Reservoir. In addition the 1991 Operating Agreement provides the SWUA with a permanent right to 50,000 acre-feet of holdover storage capacity, with an initial (one-time) allocation of 50,000 acre-feet of stored water. In years when SVP requires more than 61,000 acre-feet, the excess would come from SVP storage water, which in years when less than 61,000 acre-feet were used, had been stored in the 50,000 acre-foot storage space. Up to 600 cfs of SVP water would be conveyed through the natural stream channels and the Diamond Fork System to the confluence with the Spanish Fork River as described in the July 1999, Diamond Fork Final Supplement to the Final Environmental Impact Statement.

Bonneville Unit Transbasin Diversion

The water supply for the Wasatch Front, including water for exchange to Jordanelle Reservoir, is based on the transbasin diversion from Strawberry Reservoir, together with the yield of Utah Lake water rights to be acquired, plus useable return flows. The distribution of water diverted to the Bonneville Basin with the ULS System is summarized below. All amounts are in acre-feet per year.

	Acre-Feet
SVP Water	61,000
Bonneville Unit M&I Water direct delivery	61,590
Other Bonneville Unit Deliveries to Utah Lake	40,310
Total Transbasin Diversion	162,900

Transbasin Diversion Resulting from 1991 and 1992 Changes

The agreement with SWUA in 1991 and the Fishery Flow releases required by CUPCA in 1992 resulted in changes in proposed transbasin diversions as the proposed Bonneville Unit water delivery was reduced to achieve a balance with the available supply. Table 4-2 compares the transbasin releases adjustment with the proposed releases in the 1988 DPR. Additional details of the evolution of the Strawberry Reservoir operating plan are presented in Volume 3 of the Water Supply Appendix.

TABLE 4-2 Transbasin Diversion Under Various Operating Plans			
Operating Plan	**Transbasin Diversions to Diamond Fork System (acre-feet)**		
	Bonneville Unit	**SVP**	**TOTAL**
1988 DPR	142,500	56,700	199,200
Operating Agreement with SWUA (1991) and CUPCA (1992)	101,900	61,000	162,900
2004 Supplement to 1988 DPR	101,900	61,000	162,900

Total Releases from Strawberry Reservoir

The total average annual release from Strawberry Reservoir consists of the transbasin release of 162,900 acre-feet to the Bonneville Basin plus various releases in the Uinta Basin. Other releases to be made from Strawberry Reservoir are 260 acre-feet of M&I water for use in Strawberry Valley and Duchesne County, 12,600 acre-feet of fishery flows to the lower Strawberry River (part of the 44,400 fishery flow release), and 2,900 acre-feet of restored flow in the upper Strawberry River. Table 4-3 lists the proposed releases from the Reservoir. Evaporation losses from the Reservoir are not shown.

TABLE 4-3 Average Annual Releases from Strawberry Reservoir	
Category	**Average Annual Release (acre-feet)**
SVP Transbasin Diversion	61,000
CUP Water for delivery to Utah Lake	40,310
CUP M&I water for ULS System Delivery	61,590
Subtotal, Transbasin Diversion	*162,900*
M&I Water for Strawberry Valley[1]	260
Fishery Flow Release to Strawberry River[2]	12,600
Upper Strawberry River Flow Restoration[3]	2,900
Total Average Annual Release	**178,660**

Notes:

[1] Includes 25 acre-feet for Duchesne County

[2] This release is part of the 44,400 acre-feet of fish flow release under the 1980 Instream Flow Agreement and its amendments.

[3] The point(s) of release from Strawberry Reservoir may include exchange with Strawberry Aqueduct diversions.

DIAMOND FORK OPERATIONAL RELATIONSHIPS

Operational relationships in the Diamond Fork Creek Drainage include –

- Streamflow requirements under CUPCA;
- Coordination of Streamflows and Tunnel/Pipeline Flows;
- Strawberry Valley Project operations; and
- ULS System Power Plants

Streamflow Requirements under CUPCA

Figure 4-2 on the next page provides a schematic of the Diamond Fork drainage minimum stream flows as defined by CUPCA.

Sixth Water Creek. In Sixth Water Creek, minimum flows have been set for the reach between the outlet of Strawberry Tunnel and the outlet of the Sixth Water Aqueduct, a creek distance of approximately six miles. The stipulated minimum flows are 32 cfs during May through October, and 25 cfs during November through April. The minimum flows will be achieved by releasing the requisite amount of water through the Strawberry Tunnel.

Diamond Fork Creek. Section 303(c) of CUPCA specifies minimum flows of 80 cfs during May through September, and 60 cfs during October through April, in lower Diamond Fork Creek from Monks Hollow to the Spanish Fork River, to be provided by the operation of the Bonneville Unit. Thus, releases to the creek would be made at the upper end of the Diamond Fork Pipeline to achieve these minimum flows when the natural flow plus the Strawberry Tunnel discharge is less than the minimum flow.

The Monks Hollow Flow Control Structure and Diamond Fork Creek Outlet may be required to release up to 100 cfs of the water conveyed through the Upper Diamond Fork Pipeline because the Diamond Fork Tunnel has a 660 cfs capacity whereas the capacity of the Upper Diamond Fork Pipeline is only 560 cfs. At the Spanish Fork River Flow Control Structure, any flow in the Diamond Fork Pipeline intended for SVP irrigation use (except as conveyed to the SUVMWA cites and the Springville/Mapleton Irrigation Districts through the piped Mapleton-Springville Lateral), and any flow for CUP delivery to Utah Lake through the Spanish Fork River would be released to the Spanish Fork River. The remaining flow in the Diamond Fork Pipeline would flow into the proposed ULS System Spanish Fork Canyon Pipeline.

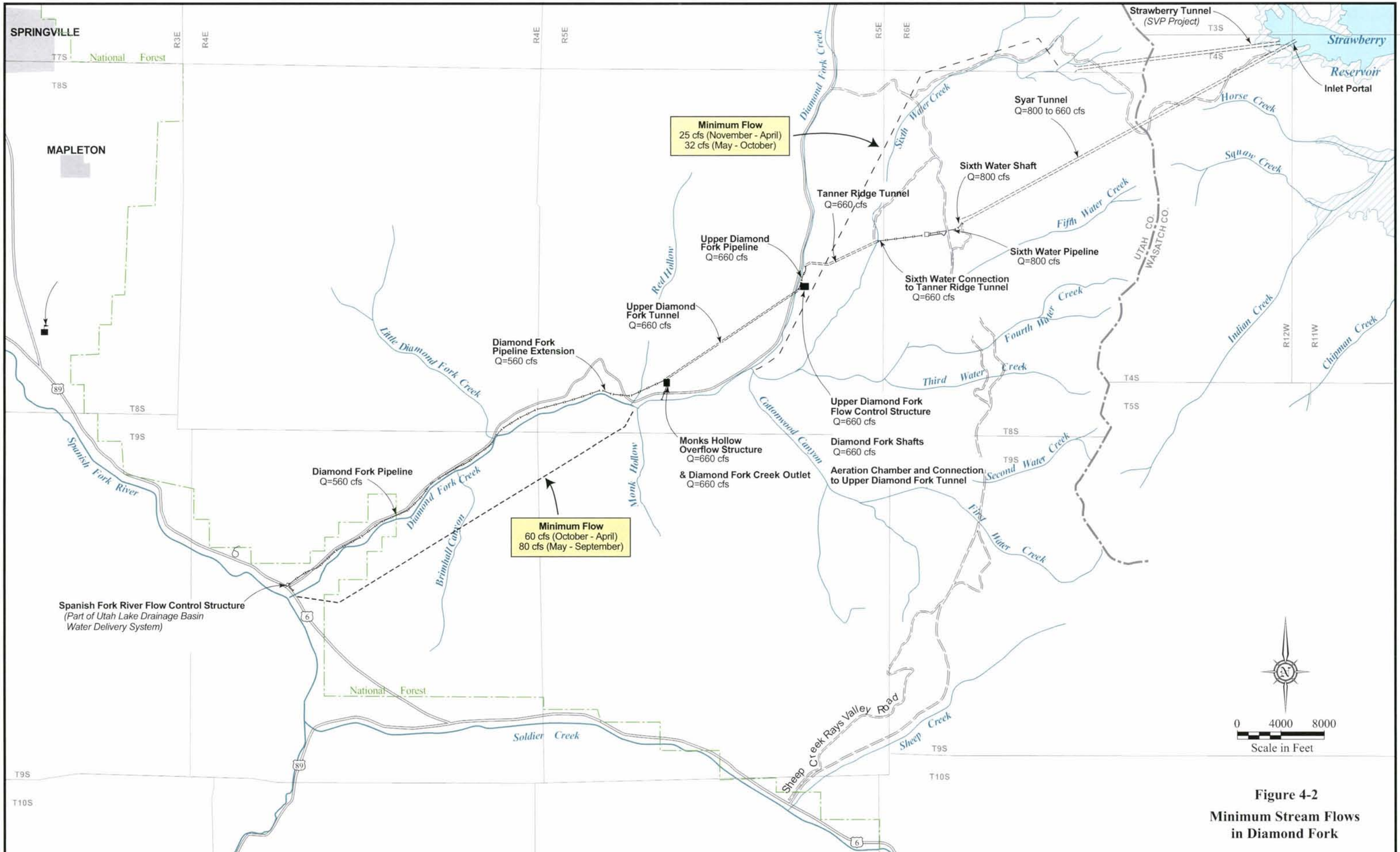


Figure 4-2
Minimum Stream Flows in Diamond Fork

Coordination of Streamflows and Tunnel/Pipeline Flows

In the Diamond Fork System the transbasin diversion essentially breaks down into four parts--SVP water for the Spanish Fork River, SVP water for the ULS System pipelines, CUP water for the Spanish Fork River, and CUP water for the ULS System pipelines. The general operating concept is to release sufficient flow to Diamond Fork Creek at Monks Hollow to meet minimum flow requirements and to convey the rest in the closed conduit system as far as the confluence of Diamond Fork Creek with the Spanish Fork River. There the final flow adjustment would be made between the Spanish Fork River and the ULS System pipelines.

Strawberry Valley Project

Water from Strawberry Reservoir developed by the SVP in the early 1900s has for decades been released through the Strawberry Tunnel into Sixth Water Creek at a point approximately 9.5 miles upstream of its confluence with Diamond Fork Creek. The irrigation water thus flowed through Sixth Water Creek and lower Diamond Fork Creek to the Spanish Fork River, which conveyed the water to developed areas of southern Utah County. The water has been diverted to irrigated areas by various diversion dams below Spanish Fork Canyon.

Operational relationships with the SVP include the following:

Use of Strawberry Tunnel. Section 303 (f) of CUPCA stipulates that upon completion of the Diamond Fork System, the Strawberry Tunnel shall be used only to release water for instream flow purposes, except at times when the Syar Tunnel or the Sixth Water Aqueduct is unusable or emergency circumstances require the use of the Strawberry Tunnel for the CUP and SVP water deliveries. Thus, under normal operating conditions, Sixth Water Creek will convey the natural flow originating in the creek, water that seeps into Strawberry Tunnel, and any transbasin release from Strawberry Reservoir that is needed for instream flow purposes in Sixth Water Creek. Also, under normal operating conditions, only minimal releases would be made to Sixth Water Creek from the Sixth Water Aqueduct. However, unusual or emergency operating circumstances could result in higher rates of flow in Sixth Water Creek, as described in the following items.

Transbasin diversion release through Strawberry Tunnel to Sixth Water Creek will consist of:

(1) Sixth Water Creek Instream Flow Releases. Releases will be made from Strawberry Reservoir in the amounts necessary to attain at least the minimum flow rates in Sixth Water Creek that are specified in Section 303(c) of CUPCA. CUPCA specifies minimum flows of 32 cfs during May thorough October, and 25 cfs during November through April, in Sixth Water Creek between the outlet of Strawberry Tunnel and the outlet of the Sixth Water Aqueduct, a creek distance of approximately six miles. Following the completion of additional studies and associated NEPA compliance by the joint-lead agencies, the stipulated minimum flows would be subject to adjustment by the Utah Reclamation Mitigation and Conservation Commission in consultation with other entities to provide greater enhancement of aquatic and riparian habitat

along the creek. The minimum flow releases from Strawberry Reservoir would be part of the SVP and/or CUP deliveries to the Spanish Fork River.

(2) Infrequent water releases. Additional releases up to a total of approximately 230 cfs could be made infrequently, when unusually high SVP summer irrigation demand and CUP deliveries together exceed the capacity of Syar Tunnel and the minimum flow releases through Strawberry Tunnel. The Syar Tunnel capacity varies from 660 cfs to 800 cfs, depending on the water level in Strawberry Reservoir.

(3) Emergency use. Transbasin release up to the maximum capacity of Strawberry Tunnel may be made if Syar Tunnel or Sixth Water Aqueduct is rendered unusable, or emergency circumstances require the use of Strawberry Tunnel for delivery of contracted SVP and Bonneville Unit water, all as stipulated in Section 303(f) of CUPCA. In this case, up to 230 cfs of SVP and/or CUP water could be released through the Strawberry Tunnel on an emergency basis.

The natural flow of Sixth Water Creek and the seepage into Strawberry Tunnel are not part of the Bonneville Unit water supply. These flows have historically been used for irrigation in southern Utah County and this practice will continue.

Relation to ULS System Power Plants

The control structures at the end of the Sixth Water Aqueduct and at the end of the Upper Diamond Fork Pipeline have been designed to accommodate the installation of power plants. The plants would be adjacent to and in parallel with the control structures, which would be valved to direct the flow through the control structure or through the power plants.

SPANISH FORK AND HOBBLE CREEK OPERATIONAL RELATIONSHIPS

Operational relationships include –

- General SVP Operation;
- Coordination of Streamflows and Pipeline Flows;
- Conveyance of SVP and Mapleton-Springville Irrigation Company Water;
- Santaquin – Mona Reservoir Pipeline;
- ULS System Operations

General SVP Operation

SVP water deliveries through the Diamond Fork System would continue to operate according to existing operating agreements and procedures, and applicable NEPA compliance documents. Under Bonneville Unit operation, SVP water used for irrigation would continue to be delivered through the Spanish Fork River and diverted at the existing Spanish Fork River diversion

facilities, except for SVP irrigation water conveyed to the cities through the Spanish Fork - Santaquin Pipeline on a space available basis, and the SVP irrigation water delivered to the Springville/Mapleton area through the Mapleton-Springville Lateral Pipeline.

Coordination of Streamflows and Pipeline Flows

The SVP and Bonneville Unit water released from the Diamond Fork System would be routed through proposed ULS System facilities, the Spanish Fork River, and Hobble Creek. The SVP and Bonneville Unit water will be commingled in Sixth Water and Diamond Fork creeks, and the ULS System pipelines to provide efficient and economical service to users of SVP and CUP water. The Bonneville Unit water and the SVP water for specific deliveries would be routed to the proposed Spanish Fork Canyon Pipeline and the River, as follows.

The SVP irrigation water would be divided between the Spanish Fork River and the Spanish Fork Canyon Pipeline. Most of the SVP water would be routed down the Spanish Fork River to be diverted and delivered as is currently the practice. However, the SVP water to be delivered in the Mapleton-Springville area would be conveyed in the Spanish Fork Canyon Pipeline to the Mapleton-Springville Lateral Pipeline for delivery to the water agencies currently served.

Some SVP irrigation water would be distributed through the Spanish Fork-Santaquin Pipeline on a space available basis to the cities in south Utah County.

The Bonneville Unit water would be divided between the Spanish Fork River and the proposed Spanish Fork Canyon Pipeline. Much of the Bonneville Unit water would be delivered for M&I use, and would be conveyed under pressure in the proposed Spanish Fork Canyon Pipeline and the three branching ULS System pipelines extending northward and southward from the end of that pipeline. A portion of the Bonneville Unit water would be delivered to Utah Lake, and approximately 16,273 acre-feet of the Utah Lake delivery would be made through the Spanish Fork River. (The remainder of the Utah Lake delivery would be made via Hobble Creek and the Provo River.)

The Bonneville Unit water delivered for M&I use would consist of three components, each conveyed in and released from the end of the Spanish Fork Canyon Pipeline. The M&I waters for southern Utah County south of the river, for southern Utah County north of the river, and for Salt Lake County would be released to the three proposed ULS System distribution pipelines--respectively the Spanish Fork-Santaquin Pipeline, the Mapleton-Springville Lateral Pipeline, and the Spanish Fork Canyon - Provo Reservoir Canal Pipeline. The Mapleton-Springville Lateral Pipeline would also convey a portion of the Bonneville Unit Utah Lake water for release to Hobble Creek.

Adding complexity to the distribution pattern of the Bonneville Unit water in the proposed ULS System is the redirection of some of the Bonneville Unit water for fish and wildlife conservation purposes under the ULS System plan. This is Bonneville Unit water that will be conserved by

water users in southern Utah County and be made available to the Department of the Interior for discretionary use to improve instream flow conditions in Hobble Creek and other purposes. The quantities of such waters are presented in Water Supply Appendix, Volume 4.

Conveyance of SVP Irrigation Water to the Cities and the Mapleton-Springville Irrigation Companies

A portion of the SVP irrigation water would be used in secondary systems of cities in southern Utah County. This water would be delivered in ULS System pipelines on a space-available basis. The current plan provides an average of 10,200 acre-feet of SVP irrigation water to be delivered through the ULS pipelines in this manner. Otherwise, SVP irrigation water would be delivered in the irrigation systems operated by the SWUA and local irrigation companies.

SVP water for irrigation delivery in the Mapleton - Springville area would also be conveyed through the ULS pipelines.

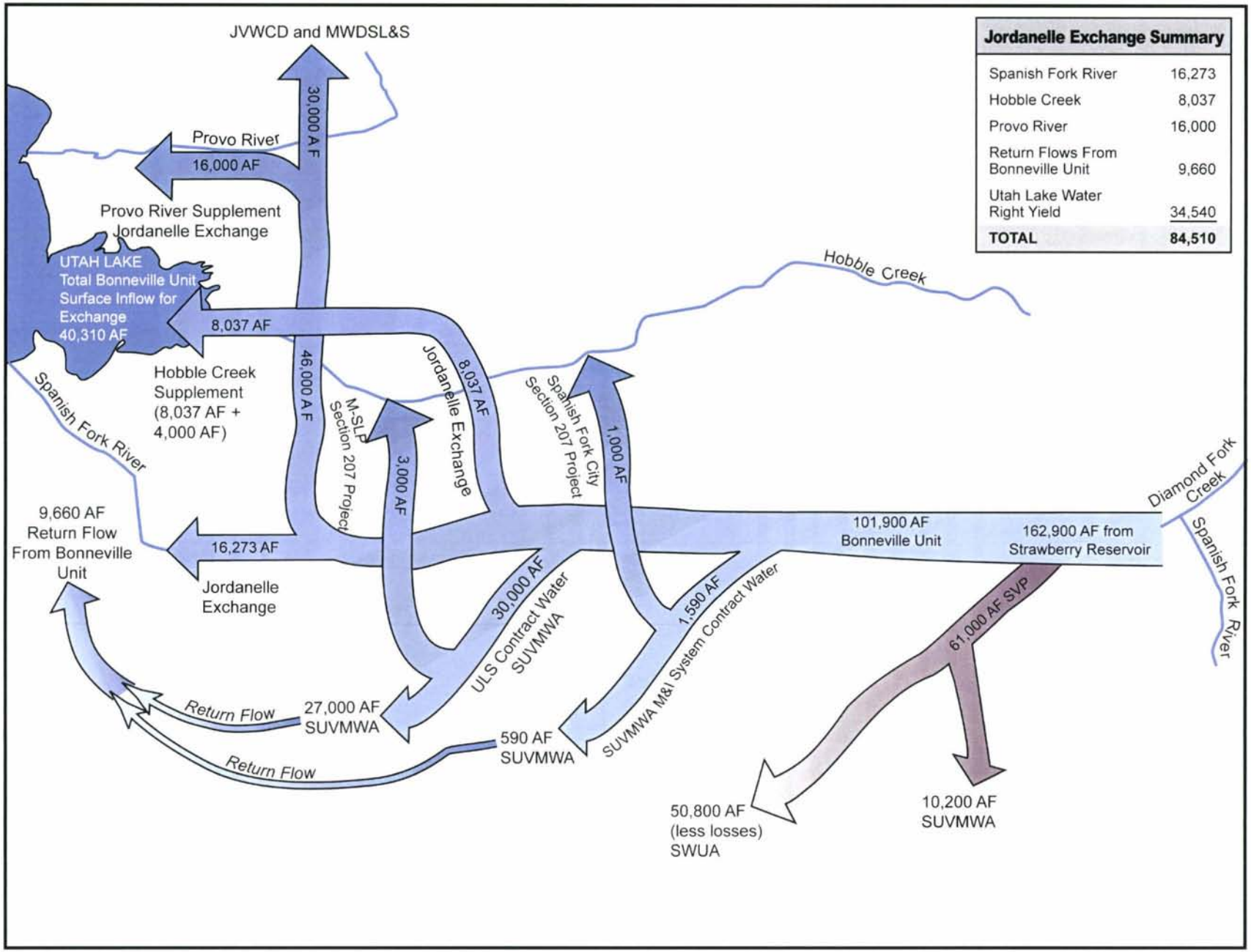
Santaquin – Mona Reservoir Pipeline

The Santaquin – Mona Reservoir Pipeline would convey non-project water as part of the June sucker Recovery Implementation Program (JSRIP), pending availability of a water supply for that purpose.

ULS System Operations

Water Sources. ULS water sources would consist of transbasin diversion water released from Strawberry Reservoir, District water rights in Utah Lake to be acquired by DOI, return flows of Bonneville Unit M&I water, and conserved water developed from features of the ULS project and Section 207 projects. The following sections describe the ULS water sources.

Transbasin Diversion. ULS water deliveries would consist of a transbasin diversion from Strawberry Reservoir in the Strawberry River drainage basin for conveyance through the Syar Tunnel and Sixth Water Aqueduct into the Diamond Fork System to the Utah Lake drainage basin (Figure 4-3). An average of 101,900 acre-feet of Bonneville Unit water would be conveyed from Strawberry Reservoir, with an average of about 93,127 acre-feet flowing through the Syar Tunnel, and approximately 8,773 acre-feet flowing through the Strawberry Tunnel to provide in-stream flows in Upper Sixth Water and Diamond Fork creeks. The annual transbasin diversion would include 61,000 acre-feet of SVP water and an average 101,900 acre-feet of Bonneville Unit water for a total diversion of 162,900 acre-feet. The SVP water is delivered to water users in southern Utah County and used for irrigation purposes.



Jordanelle Exchange Summary	
Spanish Fork River	16,273
Hobble Creek	8,037
Provo River	16,000
Return Flows From Bonneville Unit	9,660
Utah Lake Water Right Yield	34,540
TOTAL	**84,510**

Figure 4-3
Utah Lake System Water Deliveries
Under the Bonneville Unit

The following water quantities would comprise the Bonneville Unit transbasin diversion:
30,000 acre-feet of Bonneville Unit M&I water to Salt Lake County
30,000 acre-feet of Bonneville Unit M&I water to southern Utah County
1,590 acre-feet of M&I water already contracted to southern Utah County cities
40,310 acre-feet of Bonneville Unit M&I water to Utah Lake for exchange to Jordanelle
101,900 acre-feet total Bonneville Unit transbasin diversion

Approximately 84,510 acre-feet of water would be required in Utah Lake to complete the exchange to Jordanelle Reservoir. This includes: 40,310 acre-feet that would be released from Strawberry Reservoir as described above; 9,660 acre-feet of Bonneville Unit water return flows to Utah Lake; and DOI acquiring the District's secondary water rights in Utah Lake to yield an average annual volume of at least 34,540 acre-feet. The exchanged water would be stored in Jordanelle Reservoir for M&I and agricultural delivery to Salt Lake County, Wasatch County, and northern Utah County under existing contracts.

ULS Water Delivery Operations. CUP Bonneville Unit water deliveries would be made through normal operations. The following describes annual normal operations under the ULS Proposed Action.

(1) 30,000 acre-feet of ULS M&I water would be conveyed to Salt Lake County through a combination of Jordan Aqueduct and enclosed Provo Reservoir Canal conveyance facilities to water treatment plants for treatment and culinary supply. This water would be delivered to Salt Lake County through the Spanish Fork–Provo Reservoir Canal Pipeline to the Provo Reservoir Canal and Jordan Aqueduct and then conveyed into Salt Lake County.

(2) Approximately 16,273 acre-feet of Bonneville Unit water from Strawberry Reservoir would be released for in-stream flows in Sixth Water Creek and Diamond Fork Creek and flow down the Spanish Fork River to Utah Lake mainly during the winter months, as previously described in the 1999 Diamond Fork System Final Supplement to the Final Environmental Impact Statement (Reclamation 1999). This water is included in 40,310 acre-feet that would be exchanged from Utah Lake to Jordanelle Reservoir.

(3) As the ULS facilities are completed, but not later than 2030, 30,000 acre-feet of ULS M&I water would be available for use in southern Utah County under a contract with SUVMWA. Of this amount, an estimated 3,000 acre-feet would be conserved under Section 207 projects, assigned to DOI, conveyed through the Mapleton–Springville Lateral Pipeline, and is included in the 12,037 acre-feet of Bonneville Unit delivered to Hobble Creek for June sucker spawning and rearing flows and other in-stream flows as provided by deliveries from Strawberry Reservoir to Utah Lake. Most of the 12,037 acre-feet of water would then be exchanged from Utah Lake to Jordanelle Reservoir. The remaining amount of the 30,000, minus the 3,000 would be delivered through the Spanish Fork-Santaquin Pipeline and Mapleton-Springville Lateral Pipeline.

(4) Up to 10,200 acre-feet of SVP water shares contractually assigned or made available to SUVMWA would be conveyed to member cities in southern Utah County through the new ULS pipelines on a space-available basis. This water is part of the overall 61,000 acre-feet of SVP water stored in Strawberry Reservoir. The balance of the SVP water supply would be released through the Strawberry Tunnel and Syar Tunnel to the Diamond Fork System and released to the Spanish Fork River or through the Spanish Fork Canyon Pipeline to the Mapleton-Springville Lateral Pipeline. Historically, an average of 8,831 acre-feet of SVP storage water and 973 acre-feet of SVP Spanish Fork River natural flow water was diverted into the Mapleton-Springville Lateral. Under the ULS Proposed Action, only the 8,831 acre-feet of SVP water would be conveyed and delivered through the new pipeline because there would be no way to convey the river water due to the pipeline pressure.

(5) Of the 1,590 acre-feet already under contract to SUVMWA, 590 acre-feet would be used by SUVMWA member cities as secondary M&I water. This water would be delivered through the Spanish Fork Canyon Pipeline, the Mapleton–Springville Lateral Pipeline, and Spanish Fork–Santaquin Pipeline to the SUVMWA member cities. The remaining 1,000 acre-feet has been assigned to DOI and is part of the 12,037 acre-feet released to Hobble Creek.

(6) Up to 16,000 acre-feet of Bonneville Unit water would be delivered to the lower Provo River to assist in meeting the in-stream flow targets and would be subsequently exchanged from Utah Lake to Jordanelle Reservoir. This water would be conveyed through the Spanish Fork–Provo Reservoir Canal Pipeline and discharged to the Provo River at the pipeline crossing when needed to make the Utah Lake–Jordanelle Reservoir exchange and when flows in the Provo River are less than 75 cfs (Figure 4-4). A minimum 75 cfs flow normally occurs in the river between the Olmsted and Murdock diversions during the summer months when releases are made from Deer Creek Reservoir for conveyance through the Provo Reservoir Canal.

CUPCA Section 303(c)(4) states that "Upon the acquisition of the water rights in the Provo Drainage identified in section 302, in the Provo River from the Olmsted Diversion to Utah Lake, a minimum of seventy-five cubic feet per second" shall be provided from the yield and operating plans for the Bonneville Unit of the CUP. The Act states the purchases would be limited to willing sellers below Heber Valley. Toward this goal, CUPCA has authorized funds for acquiring up to 25,000 acre-feet of water rights in the Utah Lake Drainage Basin. The District has acquired with Mitigation Commission funds irrigation company water shares representing about 3,300 acre-feet, which would allow such water to flow undiverted to Utah Lake, thereby increasing the summertime flow in the lower Provo River.

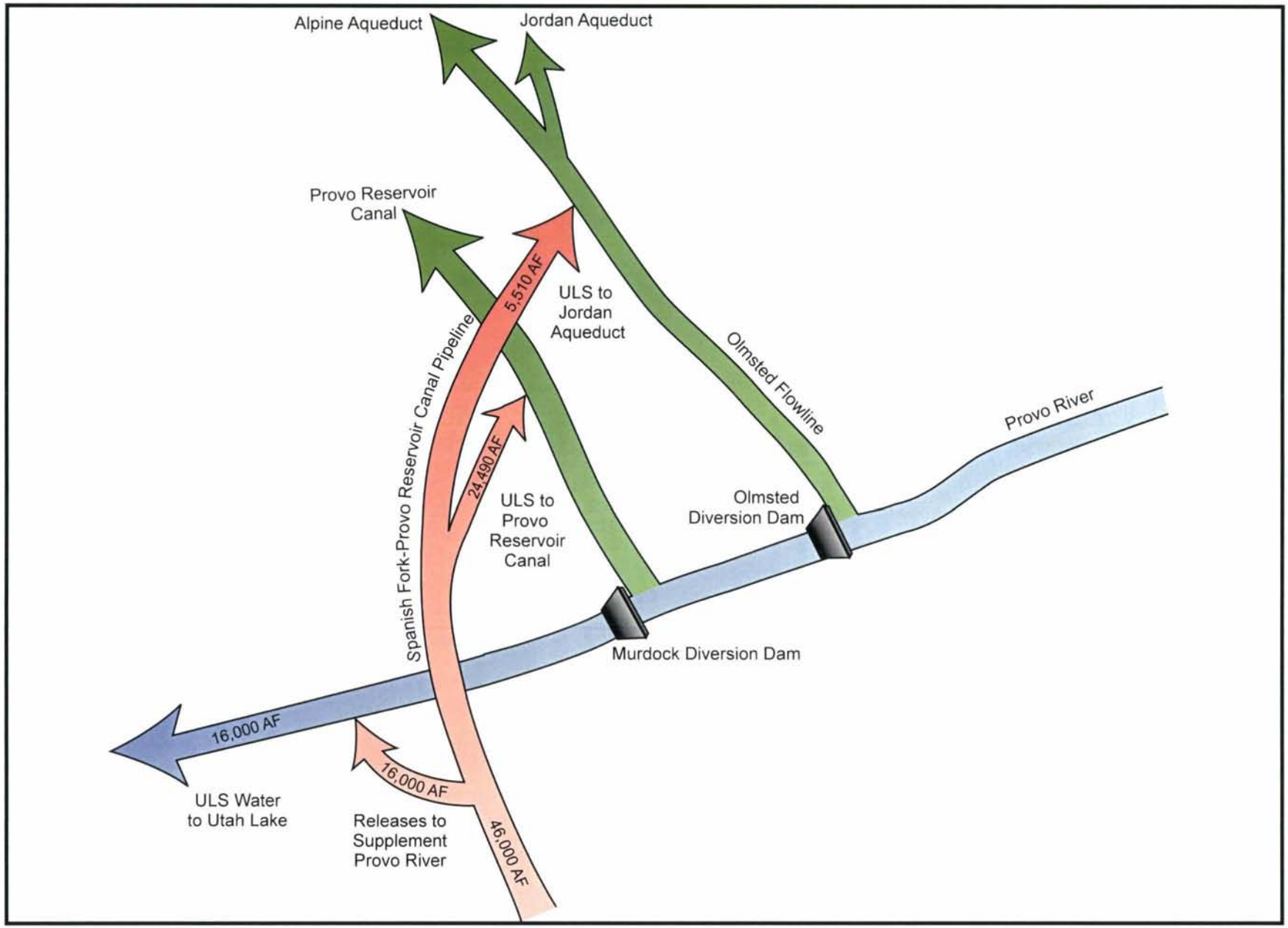


Figure 4-4
Utah Lake System Interconnections to the Provo River

(7) As allowed under the Deer Creek Reservoir/Jordanelle Reservoir Operating Agreement, an average annual 12,165 acre-feet of water would be provided as flows for June sucker spawning and rearing in the lower Provo River to meet JSRIP goals annually. This water would be comprised of the conserved water quantities shown later in this chapter in Table 4-7.

(8) Approximately 12,037 acre-feet of water would be available through the Mapleton-Springville Lateral Pipeline to Hobble Creek for June sucker spawning and rearing flows (April through July) and to provide other fish and wildlife benefits throughout the year. A portion of this water would be part of 40,310 acre-feet of Utah Lake inflow from Strawberry Reservoir and would be subsequently exchanged from Utah Lake to Jordanelle Reservoir. Of the 12,037 acre-feet, 4,000 acre-feet would be provided in every year because this is the amount of water conserved each year. The remaining 8,037 acre-feet only would be provided when water is being delivered from Strawberry Reservoir to Utah Lake for exchange up to Jordanelle Reservoir. Hobble Creek supplemental water would not be delivered during high runoff years when Utah Lake is above compromise level. The high runoff years correspond with years when natural runoff would be sufficient to attract June sucker spawning.

(9) Hydroelectric power would be generated from the M&I water conveyance and contracted to the Western Area Power Administration. The hydroelectric power would be generated from water conveyed through Diamond Fork System features. Power generation would be incidental to project purposes and water would not be released only for power generation purposes. Sixth Water would generate about 134,000,000 kilowatt hours annually and Upper Diamond Fork would generate about 31,000,000 kilowatt hours annually. The water supply through the two power plants is shown in Table 4-4.

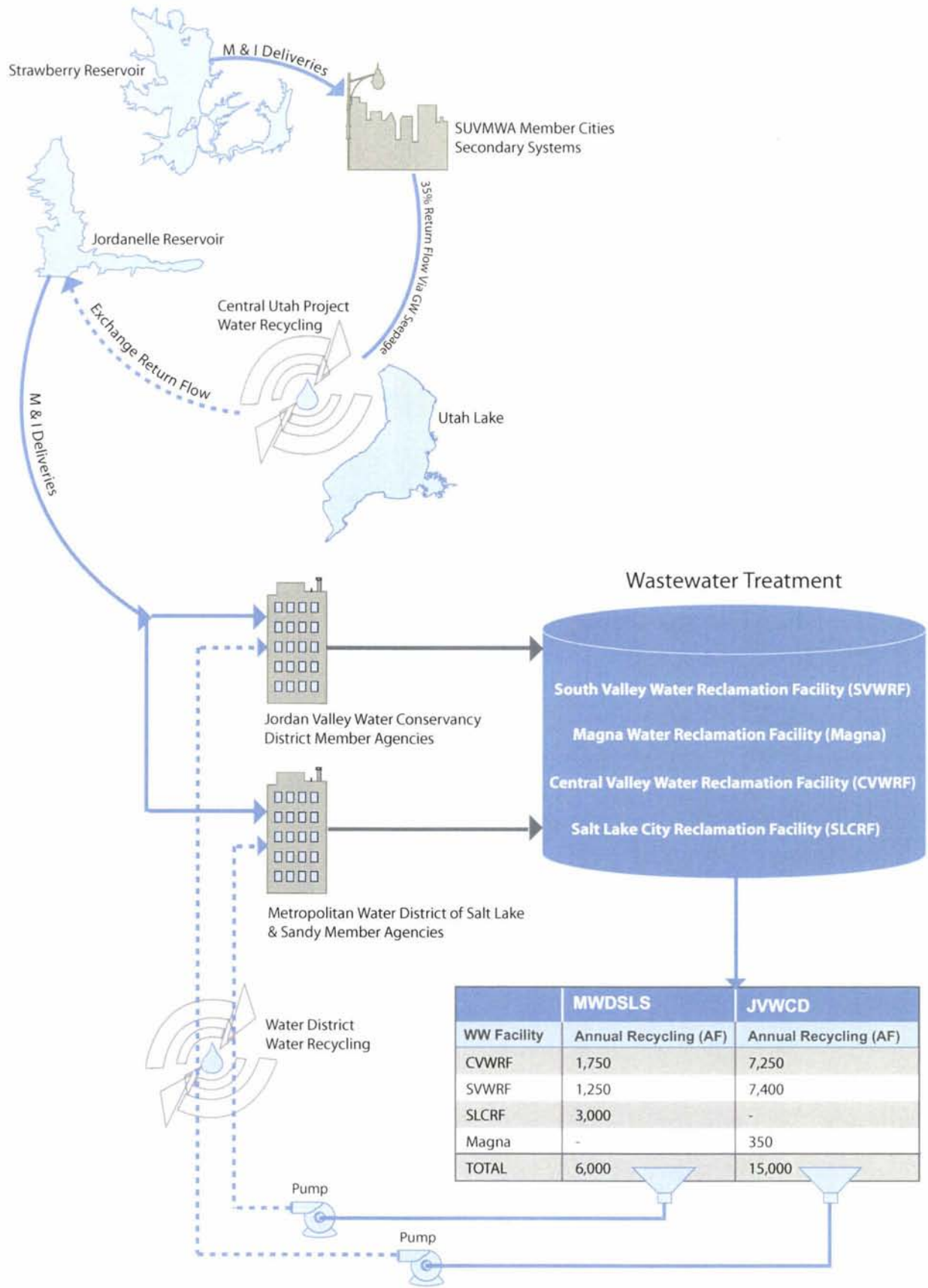
District Water Rights. The District owns primary and secondary water rights in Utah Lake. Under the Proposed Action, the DOI would acquire all of the District's secondary rights. These rights would amount to approximately 57,073 acre-feet. The acquired water rights would be used to convert or exchange water to Jordanelle Reservoir under the State Engineer's Utah Lake Distribution Plan. The secondary water rights would amount to an average of at least 34,540 acre-feet of yield.

Return Flows and Recycled Water. The amount of return flows credited as Bonneville Unit water by the State Engineer from M&I and agricultural use of Bonneville Unit transbasin water is considered by the DOI to be Bonneville Unit water and thus available for recycling as a federal water supply. An official estimate of the amount of Bonneville Unit return flow that can be credited to the Bonneville Unit would need to be determined by the State Engineer. In the case of Salt Lake County, an estimate of 21,000 acre-feet has been made. According to contracts with Salt Lake County water users, up to 18,000 acre-feet would be recycled.

Figure 4-5 is a general schematic of the return flow potential for the Bonneville Unit.

Table 4-4
Estimated Flows Available for Generation
Sixth Water and Upper Diamond Fork Power Plants
(cfs)

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ave
1950	89.4	40.9	42.1	53.6	32.6	31.5	42.5	116.4	436.0	427.8	510.2	389.4	184.4
1951	50.4	38.6	38.1	37.2	34.0	36.1	42.5	105.7	441.2	512.5	417.0	307.7	171.8
1952	50.6	40.7	41.0	33.5	33.0	30.1	42.5	101.8	248.7	422.7	365.7	340.4	145.9
1953	148.1	24.8	29.6	25.0	30.2	29.3	94.0	137.0	451.7	484.1	397.7	291.6	178.6
1954	44.9	39.9	43.5	31.9	41.5	36.0	113.6	273.0	458.4	439.6	454.0	204.6	181.8
1955	53.3	45.3	46.8	40.5	42.9	46.1	160.1	258.6	481.9	536.9	393.7	253.9	196.7
1956	56.2	50.4	46.8	40.5	45.9	38.0	64.6	303.5	559.1	487.8	451.2	265.9	200.8
1957	54.5	47.0	46.8	40.5	39.2	42.9	111.9	176.8	260.5	551.0	477.3	326.8	181.3
1958	50.8	42.0	45.1	40.5	38.8	42.9	48.7	176.8	496.3	519.3	499.4	253.7	187.8
1959	54.8	45.3	45.1	40.5	42.4	43.5	161.6	439.9	558.0	402.6	347.2	209.2	199.2
1960	56.2	48.7	50.0	42.1	40.4	36.6	143.2	400.3	560.7	471.2	420.5	203.0	206.1
1961	55.1	47.0	50.0	42.1	46.0	59.0	177.5	459.7	540.0	382.1	274.8	200.5	194.5
1962	57.4	48.7	48.4	43.7	42.4	46.1	45.3	203.7	474.3	487.3	537.2	272.6	192.3
1963	50.9	47.0	48.4	40.5	31.6	42.9	166.8	313.1	333.5	553.8	489.3	244.3	196.8
1964	81.3	69.5	119.5	116.7	75.8	66.7	153.9	177.7	272.3	649.4	512.5	370.7	222.2
1965	128.3	65.4	71.5	72.6	79.8	81.5	53.4	176.8	274.9	433.4	407.8	297.6	178.6
1966	135.5	100.0	46.1	52.4	74.3	39.6	106.0	315.6	570.5	455.0	462.8	279.5	219.8
1967	101.2	59.1	92.9	60.5	49.8	46.9	148.1	200.7	220.4	557.7	532.8	391.8	205.1
1968	125.9	78.9	74.2	71.7	60.5	77.7	97.5	177.8	322.3	528.0	387.7	355.9	196.5
1969	115.6	92.3	113.4	36.9	56.3	22.6	42.5	104.8	321.2	453.5	522.2	345.6	185.6
1970	113.8	41.8	57.9	67.7	67.9	77.0	151.7	163.2	325.7	488.4	555.2	295.5	200.5
1971	87.9	37.4	82.5	66.7	56.6	47.6	58.7	218.0	390.8	558.3	549.4	251.7	200.5
1972	112.3	38.6	73.2	79.4	77.7	35.3	91.5	379.8	440.3	496.5	464.7	251.7	211.7
1973	123.2	98.1	84.5	75.5	70.7	71.1	42.5	101.8	307.0	497.6	504.5	263.0	186.6
1974	123.0	92.5	72.2	77.8	81.8	65.8	60.7	136.8	474.9	477.2	521.6	274.8	204.9
1975	116.6	110.4	80.3	66.5	68.4	66.0	133.7	176.8	158.7	526.4	571.3	366.5	203.5
1976	119.3	40.8	37.4	55.0	56.1	64.6	108.1	331.2	566.7	559.6	525.7	300.2	230.4
1977	107.3	65.1	83.8	77.4	43.4	46.4	162.2	377.3	565.4	497.6	499.2	287.4	234.4
1978	189.0	179.6	179.0	147.2	134.1	76.9	83.7	176.8	456.9	607.5	562.9	277.6	255.9
1979	178.9	176.4	167.3	144.2	137.6	134.7	80.2	182.6	517.3	576.7	509.9	267.1	256.1
1980	221.6	189.5	182.1	136.0	123.2	126.6	42.5	108.5	315.2	495.7	566.6	245.2	229.4
1981	165.6	78.4	65.1	93.6	90.4	102.6	158.2	350.5	489.6	534.6	510.2	237.0	239.7
1982	136.1	73.6	91.8	100.1	90.9	36.1	42.5	101.8	249.1	448.1	542.9	258.9	181.0
1983	60.1	41.0	40.6	38.7	39.5	22.7	42.5	180.5	330.5	353.4	395.8	182.7	144.0
1984	52.1	34.4	32.1	29.3	31.2	20.8	42.5	156.1	323.4	428.5	449.2	347.3	162.2
1985	50.4	38.8	42.8	41.1	42.7	19.8	42.5	101.8	372.9	374.0	519.1	224.7	155.9
1986	58.9	37.3	41.4	38.7	24.7	19.8	42.5	101.8	306.7	428.4	465.9	219.0	148.8
1987	54.1	70.4	38.2	35.7	36.0	36.7	128.1	316.4	513.4	429.8	459.3	331.8	204.1
1988	97.2	44.8	45.7	41.3	42.0	42.0	163.2	380.1	547.7	559.6	497.1	301.7	230.2
1989	37.8	90.4	91.7	60.6	46.2	44.7	138.9	450.4	551.3	500.5	417.0	234.0	222.0
1990	141.3	88.3	93.3	77.6	79.5	80.2	160.6	369.5	413.0	545.7	531.3	363.4	245.3
1991	107.6	80.3	104.0	103.7	55.0	56.7	181.4	298.7	285.0	560.0	574.4	285.4	224.4
1992	134.6	82.1	104.3	88.2	63.1	68.5	157.8	432.9	540.4	442.6	444.3	297.1	238.0
1993	153.6	139.3	121.3	114.4	100.2	65.3	86.7	176.8	318.4	486.8	557.3	357.2	223.1
1994	86.9	74.4	82.1	79.1	65.2	47.4	156.8	352.6	563.0	552.9	421.7	356.3	236.5
1995	91.0	90.7	90.1	84.9	76.7	61.2	88.1	176.8	204.1	367.3	523.7	283.0	178.1
1996	119.5	41.9	42.6	37.0	43.3	25.5	45.1	101.8	321.7	428.9	534.9	274.8	168.1
1997	129.1	112.3	67.8	59.8	64.3	19.8	42.5	101.8	256.3	505.9	473.1	281.5	176.2
1998	183.9	119.9	74.2	124.1	135.0	49.8	55.1	101.8	194.2	547.2	622.5	422.8	219.2
1999	98.4	42.5	43.8	64.9	36.2	34.3	114.3	101.8	320.2	530.0	526.2	308.9	185.1
Ave.	**100.2**	**70.5**	**71.0**	**65.4**	**60.3**	**51.2**	**98.4**	**226.5**	**398.0**	**491.2**	**483.1**	**289.1**	**200.4**
Max.	**221.6**	**189.5**	**182.1**	**147.2**	**137.6**	**134.7**	**181.4**	**459.7**	**570.5**	**649.4**	**622.5**	**422.8**	**256.1**
Min.	**37.8**	**24.8**	**29.6**	**25.0**	**24.7**	**19.8**	**42.5**	**101.8**	**158.7**	**353.4**	**274.8**	**182.7**	**144.0**



	MWDSLS	JVWCD
WW Facility	Annual Recycling (AF)	Annual Recycling (AF)
CVWRF	1,750	7,250
SVWRF	1,250	7,400
SLCRF	3,000	-
Magna	-	350
TOTAL	6,000	15,000

Figure 4-5

Generalized Schematic of Return Flow and Recycled Water Potential for the Bonneville Unit

The hydrology presented in previous Bonneville Unit NEPA and planning documents has consistently assumed that historical inflows to Utah Lake, including return flows, would continue in the future. The hydrology models that were used throughout the planning process for ULS are based on the historical data, levels, and operations of Utah Lake. Instead of identifying the thousands of components of water that historically occurred in Utah Lake, the models use key data elements, including evaporation, inflow, outflow, and the historic variability of Utah Lake to predict future project operations.

(1) **ULS Return Flows to Utah Lake (Southern Utah County Secondary Systems).** Return flows from the groundwater basin to Utah Lake from M&I secondary water delivered to southern Utah County would be approximately 9,660 acre-feet. These return flows would become part of the Bonneville Unit water supply to be used for exchange to Jordanelle Reservoir under the State Engineer's Utah Lake Distribution Plan for delivery to the District's petitioners in Wasatch, Utah, and Salt Lake counties.

(2) **Bonneville Unit Return Flows.** In northern Utah County, the delivery and use of 20,000 acre-feet of Bonneville Unit M&I water for municipal and secondary system use would produce a return flow of 7,000 acre-feet to Utah Lake. In previous Bonneville Unit documents, it was stated that this return flow to Utah Lake would be credited and exchanged to Jordanelle Reservoir. However, the State Engineer issued a decision in November 2002 that return flows from in-basin water would accrue to the Utah Lake as part of the water rights of those individuals and entities that have Utah Lake water rights. Consequently, return flows from the 20,000 acre-foot delivery in north Utah County are not available to the project.

The Salt Lake County return flows available for reuse from the Bonneville Unit M&I System are calculated as 15 percent of the 70,000 acre-feet delivered under the Bonneville Unit M&I System and 35 percent of the 30,000 acre-feet that would be delivered through the ULS features of the Bonneville Unit. Thus, the total of the estimated return flows that may be approved by the Utah State Engineer for re-use is about 21,000 acre-feet. The 21,000 acre-feet of return flows includes 15,000 acre-feet from the Jordan Valley service area and 6,000 acre-feet from the Metropolitan Water District of Salt Lake and Sandy service area.

Approximately 18,000 acre-feet of the 21,000 acre-feet would return to the South Valley and Central Valley wastewater treatment facilities. Recycling of this water would help meet the municipal and industrial needs in the Jordan Valley Water Conservancy District service area. Recycling would involve the DOI, District, District's petitioners, and the owners of the wastewater treatment plants. The remaining 3,000 acre-feet of the 21,000 acre-feet would return to the Salt Lake City Wastewater Treatment Plant. The 18,000 acre-feet to be recycled would not be part of the ULS supply per-se but would be included in the overall Bonneville Unit water supply.

Conserved Water

Provo Reservoir Canal Enclosure. In early 2002 the Provo River Water Users Association requested the authority to enclose the Provo Reservoir Canal. In response to this request, Reclamation prepared an Environmental Assessment. The final EA and Finding of No Significant Impact on the canal enclosure was signed by Reclamation on April 30, 2003. Under this plan the Provo River Water Users Association would enclose the Provo Reservoir Canal. The water conserved by enclosing the Provo Reservoir Canal would total 8,000 acre-feet in seepage-loss savings. It is anticipated that the Provo Reservoir Canal enclosure project would receive Section 207 funding. If the enclosure project does proceed with Section 207 funding, the ULS FEIS provides the necessary NEPA compliance and would require 8,000 acre-feet of water to be returned to DOI.

Mapleton–Springville Lateral Piping. The existing Mapleton–Springville Lateral would be replaced with a Bonneville Unit, ULS pipeline throughout most of its length, resulting in conserved water. A portion of the cost of piping the lateral would be funded under the CUPCA Section 207 program. In addition to the canal piping, other Section 207 water conservation projects would be implemented in the Springville-Mapleton area. These projects would result in 3,000 acre-feet of ULS M&I water returned to DOI for use as Hobble Creek in-stream flows. This would be added to 1,000 acre-feet already conserved under the Spanish Fork City Section 207 water conservation project, and about 8,037 acre-feet of transbasin ULS water released from Strawberry Reservoir to Utah Lake. Thus, approximately 12,037 acre-feet of water would be conveyed to Hobble Creek for June sucker spawning and rearing flows to meet JSRIP goals in the months of April, May and June and to supplement natural creek flows at other times of the year. Piping of the Mapleton Lateral would not change the conveyance of 8,831 acre-feet of SVP storage water, other than to make it more efficient by eliminating seepage losses.

The following water quantities and sources comprise the water that would be conveyed through the Mapleton–Springville Lateral Pipeline to Hobble Creek for June sucker spawning and rearing flows, and for delivery to Utah Lake for exchange to Jordanelle Reservoir:

3,000 acre-feet from Section 207 projects in the Springville-Mapleton area that is returned to DOI
1,000 acre-feet Spanish Fork City Section 207 water already returned to DOI
8,037 acre-feet transbasin ULS water released to Utah Lake for exchange to Jordanelle Reservoir
12,037 acre-feet total water released to Hobble Creek

Other Section 207 Project Water. Other Section 207 project water would provide a total of 12,165 acre-feet of conserved water in the Provo River. This includes about 2,875 acre-feet of existing contracted Bonneville Unit M&I System water conserved from Section 207 projects in northern Utah County, about 1,000 acre-feet of water conserved from Section 207 piping of the Upper East Union and East River Bottom canals, and about 290 acre-feet of water conserved from Section 207 piping of the Timpanogos Canal.

The following water quantities and sources comprise the water that would be released to the lower Provo River annually for June sucker spawning and rearing flows under the Proposed Action:

2,875 acre-feet Northern Utah County 207 project savings already assigned to DOI
1,000 acre-feet Upper East Union and East River Bottom canals piping to be assigned to DOI
290 acre-feet Timpanogos Canal piping already assigned to DOI
8,000 acre-feet Provo Reservoir Canal savings or other future 207 project savings to be assigned to DOI
12,165 acre-feet total water released to the lower Provo River

Redistribution of Conserved Water under CUPCA Section 207 Program

Some of the water that is deliverable under the full operation of the ULS System will be conserved by local entities through water conservation measures. Under ULS System operation, certain blocks of conserved water would be assigned to the Department of the Interior (DOI) in return for Section 207 financial assistance to the water agencies to construct conservation measures. DOI has designated these blocks of water for use to improve instream flow conditions in Hobble Creek. Table 4-5 lists the blocks of conserved water to be distributed by the ULS System. The water conservation program is described in Water Supply Appendix Volume 2.

TABLE 4-5
Conserved Bonneville Unit Water Redirected in ULS System

Source of Conserved Water	Acre-Feet Conserved	Proposed Use
Part of the 1,590 acre-feet of Bonneville Unit M&I System water available in southern Utah County under existing contract with SUVMWA.	1,000 AF	Release to Hobble Creek from Mapleton-Springville Lateral Pipeline
Part of the 30,000 acre-feet of Bonneville Unit (ULS) water allocated for M&I use in southern Utah County.	3,000 AF	Release to Hobble Creek from Mapleton-Springville Lateral Pipeline
Total	**4,000 AF**	

The change in delivery for conserved waters cited on Table 4-5 affects the flows in ULS System pipelines. For example, whereas 31,590 acre-feet was allocated for M&I use in the southern Utah County area served by the Spanish Fork-Santaquin Pipeline, only 27,590 acre feet of Bonneville Unit water would actually be delivered through that pipeline and 4,000 acre-feet

would be routed through the Mapleton-Springville Lateral Pipeline to Hobble Creek. Such routing accommodations for conserved water are included in the conveyed quantities listed above, and in the modeled flows summarized on Table 4-6.

Routing Summary of Transbasin Diversion Water

Table 4-6 presents the modeled distribution of deliveries from the transbasin diversion among the various proposed ULS System pipelines and the Spanish Fork River. The quantities presented are the modeled, 50-year annual average amounts conveyed, under full operation of the Bonneville Unit. The quantities tabulated include the conveyance of SVP irrigation water in ULS System pipelines on a space-available basis. Note that both the Bonneville Unit and SVP water deliveries are less than the average annual transbasin diversions by the estimated amounts of conveyance losses in Sixth Water and Diamond Fork creeks and the Spanish Fork River. These conveyance loss estimates are based on loss rates imposed by the Spanish Fork River Commissioner as documented in Attachment 1 to the ULS Final EIS Surface Water Hydrology Technical Report (September 2004).

TABLE 4-6
Routing of Total Bonneville Unit and SVP Transbasin Diversion with ULS System
(Unit: acre-feet)

Conveyance	Spanish Fork-Santaquin Pipeline	Mapleton-Springville Lateral Pipeline	Spanish Fork - Provo Reservoir Canal Pipeline	Spanish Fork River	Total
Bonneville Unit Water					
Salt Lake County M&I	-	-	30,000	-	30,000
Southern Utah County M&I	27,590	-	-	-	27,590
Utah Lake Delivery	-	12,037	16,000	15,935	43,972
Subtotal – Bonneville Unit	*27,590*	*12,037*	46,000	*15,935*	*101,562*
SVP Irrigation Water					
South Utah County Cities	7,320	2,880	-	-	10,200
Irrigation Water	-	5,951	-	43,343	49,294
Subtotal - SVP	*7,320*	*8,831*	-	*43,343*	*59,494*
Total	**34,910**	**20,868**	**46,000**	**59,278**	**161,056**

Notes:
1. All waters in the first three columns are also conveyed in the Spanish Fork Canyon Pipeline.
2. The Bonneville Unit water delivery to Utah Lake through the Mapleton-Springville Lateral Pipeline includes conserved water released to Hobble Creek for instream flow maintenance.
3. Certain Bonneville Unit water and SVP water deliveries through the Spanish Fork River System have been diminished by conveyance losses in Sixth Water and Diamond Fork creeks, and the Spanish Fork River. Therefore, the total delivered is less than the 162,900 acre-foot average annual transbasin diversion plus Tunnel seepage.

Mitigation Commission Water Acquisition in the Lower Provo River

The Mitigation Commission has acquired irrigation water company shares representing 3,300 acre-feet of water towards the amount necessary to meet the 75-cfs target flow in the lower

Provo River. This water comes from the following sources and is available only during the summer irrigation season:

• Timpanogos Canal Section 207 Project	714 acre-feet
• Timpanogos Canal Water Rights	223 acre-feet
• Upper East Union Canal Water Rights	93 acre-feet
• East River Bottom Canal Water Rights	474 acre-feet
• Fort Field/Little Dry Creek Water Stock	295 acre-feet
• Provo Bench/Tanner Deed Water Stock	353 acre-feet
• West Union/West Smith Water Stock	925 acre-feet
• North Union/Tanner Deed Water Stock	223 acre-feet
Total	3,300 acre-feet

Unlike the Section 207 project water, none of the water acquired by the Mitigation Commission is storage water and thus it cannot be regulated by reservoir operations. Instead, the water would be allowed to flow past the diversion location associated with the original water right or share, and the water would continue to flow to Utah Lake. Figure 4-6 displays how the individual elements would combine to increase the flow of the lower Provo River. This water would increase the flow in the river only during the April 1 to October 31 summer irrigation season because these are irrigation water rights. The water flowing to Utah Lake is shown on Figure 4-6 An appropriate filing with the State Engineer will be made to implement this action.

PROVO RIVER OPERATIONAL RELATIONSHIPS

Deer Creek Reservoir/Jordanelle Reservoir Operating Agreement

Reservoir operations of Deer Creek Reservoir and Jordanelle Reservoir are coordinated under the Deer Creek Reservoir / Jordanelle Reservoir Operating Agreement executed in 1994 (Reservoir Operating Agreement). This agreement acknowledges the water rights and water right priorities of both projects, and specifies when each project can store water. The parties to the Reservoir Operating Agreement are the United States, the State of Utah, the Provo River Water Users Association (operators of the Provo River Project (PRP), which includes Deer Creek Reservoir), and the Central Utah Water Conservancy District.

The agreement provides accounting procedures to allow PRP and Bonneville Unit water to be stored on a space available basis in Deer Creek Reservoir for later exchange to Jordanelle Reservoir. For example, there is a 125 cfs minimum instream flow between Jordanelle and Deer Creek Reservoirs. At certain times of the year, the rate of release from Jordanelle Reservoir to meet the instream flow exceeds the required downstream Bonneville Unit deliveries. Pursuant to the Reservoir Operating Agreement, Bonneville Unit water not needed for immediate delivery is stored on a space available basis in Deer Creek Reservoir until needed by the Bonneville Unit petitioners. If any PRP water remains in Jordanelle Reservoir after final accounting is made at the end of the storage season, it will be released to Deer Creek Reservoir at the request of PRWUA and under the direction of the Utah State Engineer.

Table of Net Change on Utah Lake

Water Purchase	Volume	Baseline Return Flow	Net Impact
Timpanogos Canal Section 207 Water	714	714	0
Timpanogos Canal Water Rights Purchase	223	112	111
Provo Bench/Tanner Deed Water Stock	353	177	176
North Union/Tanner Deed Water Stock	223	112	111
Upper East Union Water Rights Purchase	93	47	46
East River Bottom Water Rights Purchase	474	237	237
West Union/West Smith Water Stock	925	463	462
Fort Field/Little Dry Creek Water Rights Purchase	295	148	147
Total	**3,300**	**2,010**	**1,290**

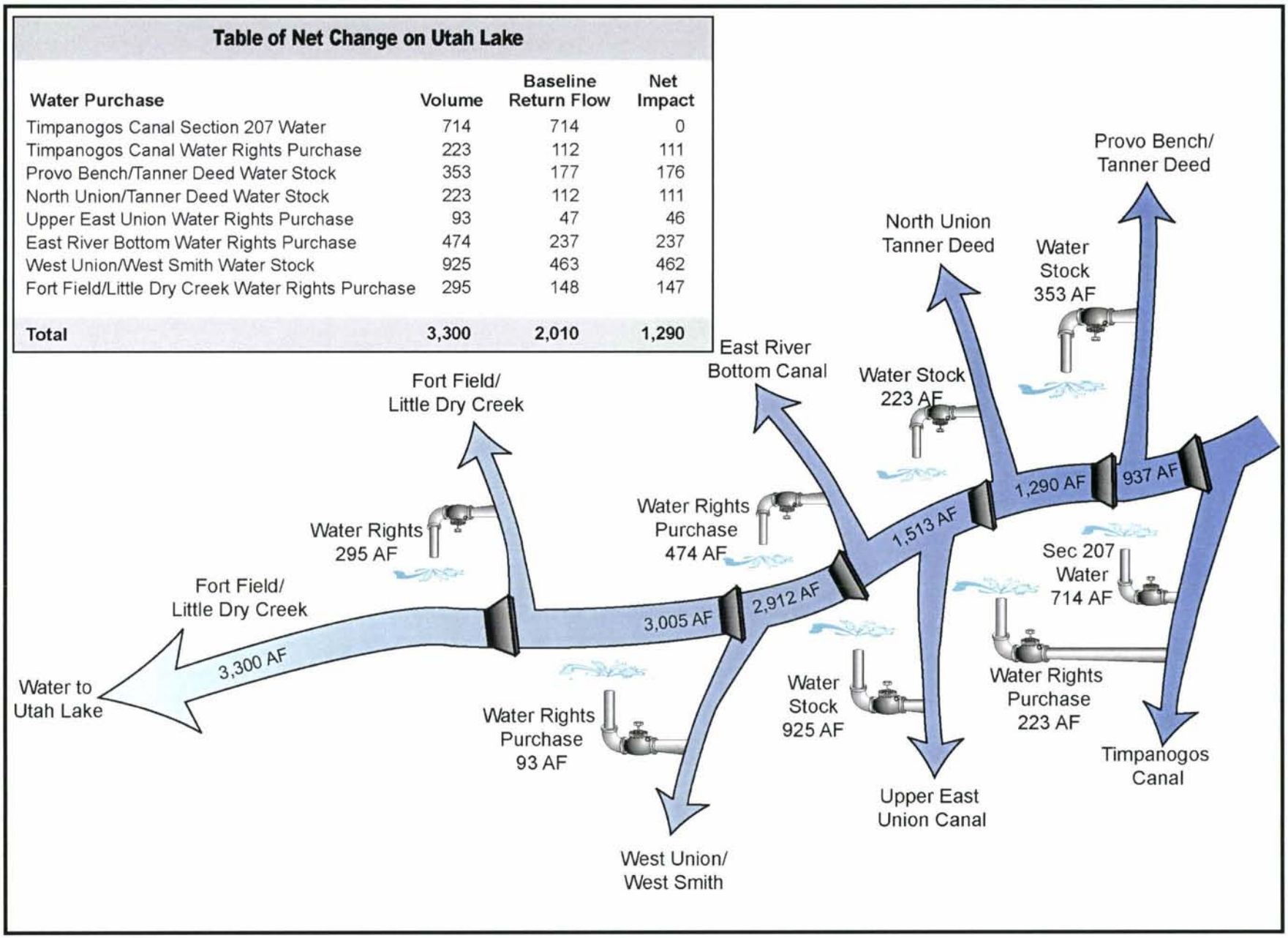


Figure 4-6
Water Acquired With Mitigation Commission Funds
For 75-cfs Target Flow in the Lower Provo River

As allowed under the Reservoir Operating Agreement, an average annual 12,165 acre-feet of water would be provided as flows for June sucker spawning and rearing in the lower Provo River to meet JSRIP goals annually. This water would be made up of the conserved water shown in Table 4-7.

TABLE 4-7
Sources of Water for June Sucker Spawning and Rearing in the Lower Provo River

Source of Water Savings	Quantity	Comments
CUP M&I Water N. Utah County (District)[1]	2,875 AF	Northern Utah Co. 207 project savings
Timpanogos Canal Piping (District)[1]	290 AF	Water saved by piping canal
Upper East Union/East River Bottom Canals Piping (District)	1,000 AF	Water saved by piping canals and connecting them to the Timpanogos pipe
Section 207 water conservation measures	8,000 AF	Conserved water returned to DOI
Total	**12,165 AF**	Available for June sucker spawning in lower Provo River

[1]Does not include all conserved water. A portion of the conserved water is included in the 3,300 acre-feet of water acquired by the District with Mitigation Commission funds toward meeting the 75 cfs target flow.

Water Quality Management Plan

The Jordanelle Reservoir Water Quality Technical Advisory Committee (JTAC) was formed in 1982 due to concerns over eutrophication in Deer Creek Reservoir. JTAC subsequently developed a reservoir management plan for Deer Creek Reservoir and for the then proposed Jordanelle Dam and Reservoir. The resulting Upper Provo River Water Quality Management Plan was implemented in 1984.

The primary goal of the Water Quality Management Plan is to protect and enhance water quality in Deer Creek Reservoir. Cooperating federal, state, and local agencies are accomplishing this goal through a comprehensive watershed protection program which includes water quality monitoring, implementation of pollution control facilities, development of code revisions, and more restrictive discharge permits. The result has been improved water quality in Deer Creek Reservoir with less severe algal blooms and reduced taste and odor problems.

Strawberry to Jordanelle Exchange

Because the Bonneville Unit's rights to Provo River water are junior in priority to most other Provo River and Utah Lake water users, the M&I System's water supply depends on the exchange of water from Utah Lake to Jordanelle Reservoir. An average annual volume of approximately 84,510 acre-feet is required in Utah Lake to complete the exchange to Jordanelle Reservoir. This includes: 40,310 acre-feet that would be released from Strawberry Reservoir as described in the Water Supply Appendix Volume 4; 9,660 acre-feet of Bonneville Unit water return flows to Utah Lake; and DOI acquiring the District's secondary water rights in Utah Lake to yield an average annual supply of at least 34,540 acre-feet. The exchanged water would be stored in Jordanelle Reservoir for M&I delivery to Wasatch County, Salt Lake County and

northern Utah County under existing contracts. See Figure 4-7 for a schematic showing the relationship of the exchange between Strawberry Reservoir and Jordanelle Reservoir.

Other Exchanges Affecting Provo River Operation

Under Bonneville Unit operation, the M&I System water supply is provided by exchanges operating under the provisions of the Utah Lake Distribution Plan (see Figure 4-8), and under Application A40524. The five basic components of the water supply are:

- System storage in Jordanelle or Deer Creek;
- System storage conversion under the Distribution Plan;
- Direct exchange (or conversion) using the District's Utah Lake water rights;
- Direct exchange of system storage with imported Strawberry Reservoir water delivered or returning to Utah Lake; and
- Direct diversion (without storage) of Provo River water under Application A40524

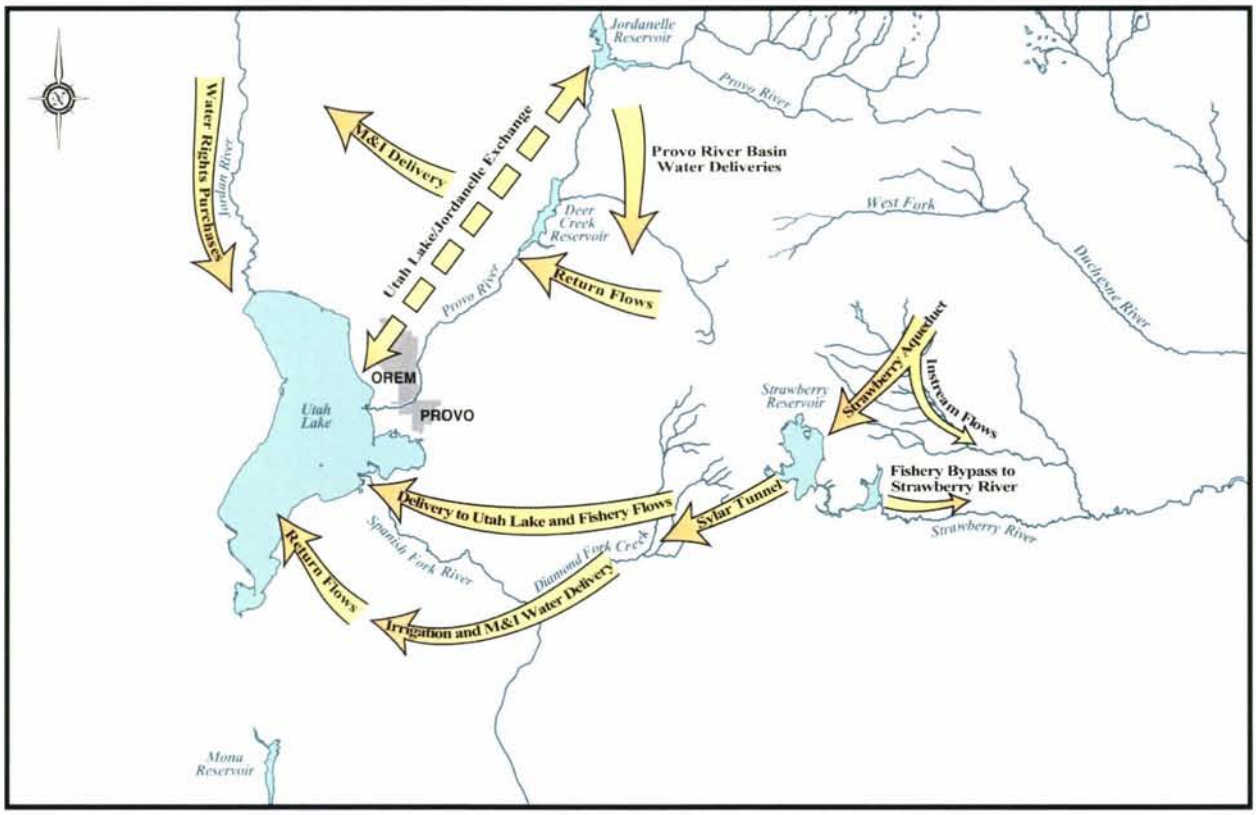


Figure 4-7
Exchange Mechanisms Between Strawberry and Jordanelle

The mechanisms for using these categories of rights by the Bonneville Unit are discussed in the following subsections. The discussion centers on system storage and priority storage. System

storage is defined under the Utah Lake Distribution Plan as all of the total active storage in Utah Lake, excluding 125,000 acre-feet of primary storage, plus water stored in upstream reservoirs under later priority date water rights that is subject to call by Utah Lake rights. Upstream system storage is held by the user owning the water rights under which it was stored, i.e., either Bonneville Unit or PRP. Priority storage is legal storage under a water right. Such stored water is not subject to call by other right(s) and can be diverted and used in accordance with the owner's right.

System Storage in Jordanelle or Deer Creek. The Distribution Plan permits the storage of Provo River water in Jordanelle or Deer Creek reservoirs after the needs of prior direct diversion rights are met. Particularly in the winter when most of the direct diversion rights on the Provo River are not being diverted, surplus flows can be stored as system storage. Surplus flows up to 429 cfs can also be stored as Bonneville Unit System Storage, under the hydropower rights (applications number A2636 and A2637) associated with the Olmsted Power Plant. However, because the Olmsted Hydropower Plant's rights are non-consumptive, they only allow the water to be stored as system storage, and not to be directly used or stored as priority storage.

System storage is not directly usable by the Bonneville Unit. If required by the higher priority owners of Utah Lake and Jordan River water rights, the Bonneville Unit could be forced to release system storage to Utah Lake to keep those water users whole. Before system storage can be diverted to the M&I System water users, it must be changed to priority storage, either by conversion (under the terms of the Distribution Plan), or by exchange (under other water rights).

System Storage Conversion Under the Distribution Plan. The Bonneville Unit can convert system storage water stored in Jordanelle and Deer Creek reservoirs when the total storage in Utah Lake crosses the system storage conversion line. The conversion line is established by the Distribution Plan at a level to be sure that Utah Lake contains enough water to guarantee that all of its higher priority rights can be met. Under this exchange mechanism, the Bonneville Unit system storage in Jordanelle and Deer Creek reservoirs becomes Bonneville Unit priority storage and the volume of water converted reduces the remaining volume of system storage. This conversion may continue to occur until the system storage volume decreases to reach the conversion line again.

Direct Exchange (or Conversion) Using Utah Lake Rights. By holding its acquired Utah Lake rights in Utah Lake (rather than releasing them to downstream users), the Bonneville Unit has two additional options for changing the Bonneville Unit system storage to priority storage. The Bonneville Unit can ask the State Engineer to lower the system storage conversion line by the appropriate volume associated with its acquired rights, making it possible to convert (see above) at a lower Lake level. Or the District and DOI can directly exchange their Utah Lake water rights for Bonneville Unit system storage in Jordanelle and Deer Creek Reservoirs even when the conversion line is not crossed, if the State Engineer determines that this can be done without impairing prior rights.

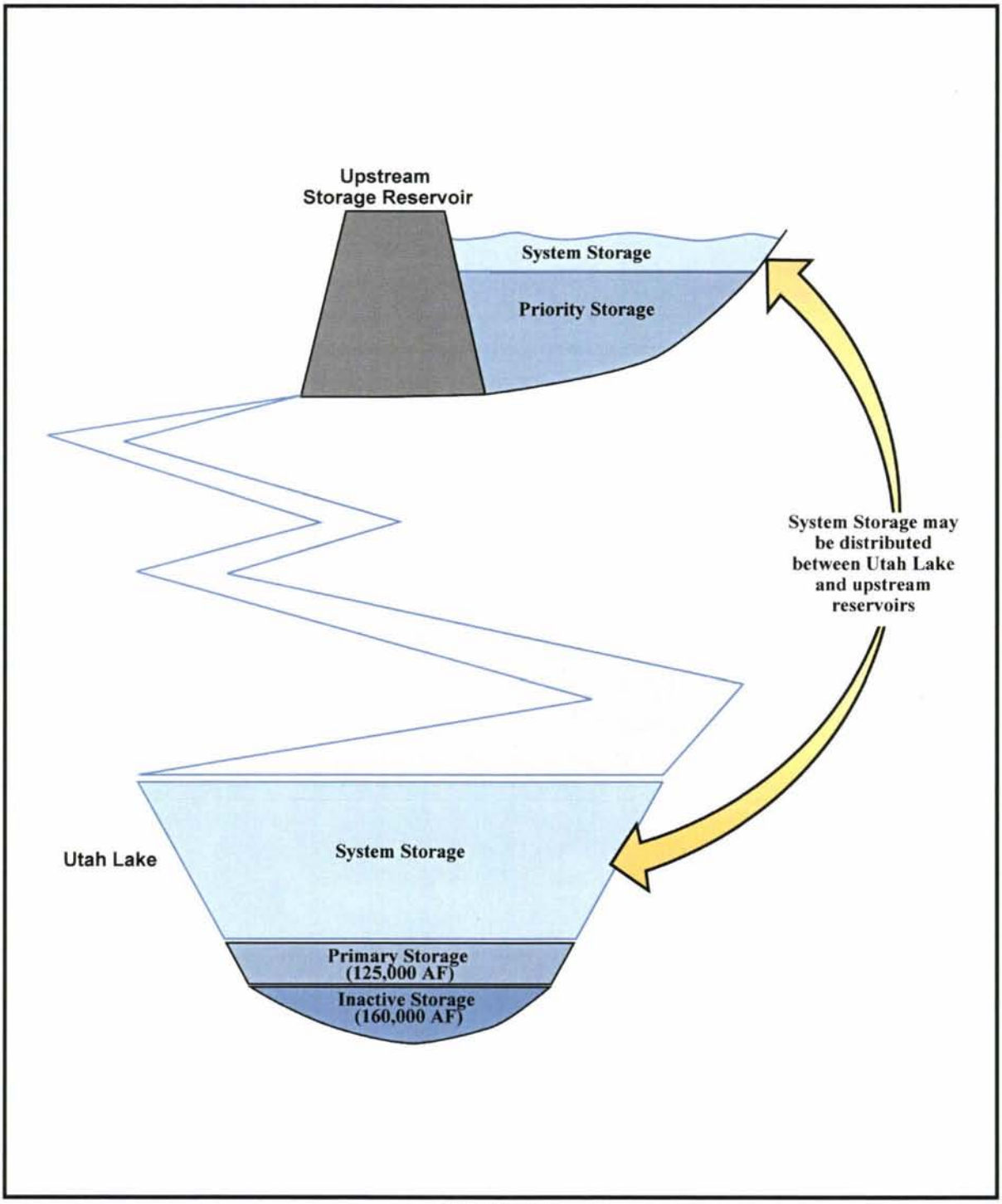


Figure 4-8
Utah Lake Distribution Plan Schematic

Exchange With Strawberry Reservoir Water Delivered or Returning to Utah Lake. Under Bonneville Unit operation, a special storage account has been created in Utah Lake for storing transbasin diversion water imported by the project. This account will hold water released directly from Strawberry Reservoir to Utah Lake, as well as project return flows from Strawberry Reservoir water that enter the Lake. Because the Bonneville Unit water delivered through the ULS System is new water to the Utah Lake drainage, the District has the right to capture and re-divert this return flow. Any water stored in this Utah Lake account will be held on a space-available basis. When Utah Lake is full and begins to spill, water held in the account will be the first water to spill. Water stored in this account will be subject to evaporation losses. Utah Lake seepage losses are assumed to be minor. The evaporation losses will be equal to the incremental amount of evaporation caused by the increased storage in Utah Lake.

Water held in the Utah Lake account will be used to make exchanges with Bonneville Unit system storage held in Jordanelle or Deer Creek reservoirs. It will be used to maximize the amount of priority storage. In some years all of the system storage in Jordanelle and Deer Creek reservoirs can be converted to priority storage under one of the previously described mechanisms. This generally occurs when there is a large quantity of system storage available. In those years, the water in the Utah Lake account will remain in the account for exchange in subsequent years. In other years, system storage is held in Jordanelle Reservoir, but the total system storage throughout the system is below the amount required for conversion to priority storage. In those years, water held in the District's Utah Lake account will be exchanged with the system storage in Jordanelle Reservoir.

Direct Diversion of Provo River Water Under Application A40524. Application A40524 permits the diversion of up to 400 cfs of surplus Provo River natural flow to meet Bonneville Unit M&I water demands at the Olmsted Diversion Dam or at the Murdock Diversion Dam. The water is not storable, but must be diverted to use. Because surplus flows, above the rights of other Provo River water right holders, only tend to exist in the winter and spring, this right is somewhat limited. Modeling studies estimate that an average of 7,600 acre-feet per year may be diverted under Application A40524. By diverting under this Application, less demand is placed upon Jordanelle Reservoir storage.

June Sucker Recovery Implementation Program (JSRIP)

The June sucker (*Chasmistes liorus*), occurs naturally only in Utah Lake and spawns naturally only in the lower Provo River. Provo River diversions have resulted in hydrological and habitat changes in the lower river. In essence, the flows of the lower Provo River discharging into Utah Lake have declined to the point that they fail to attract sufficient numbers of the June sucker to migrate upriver for spawning and fail to provide sufficient flow for incubation and out-migration of juvenile suckers to Utah Lake. Increasing the discharge from the Provo River to Utah Lake during the spawning cycle can mitigate the decline in attraction. The species has been listed as endangered under the ESA and the last 4.9 miles of the Provo River have been designated as

critical habitat. The study team has developed the JSRIP to develop ways and means to counteract the decline.

The Bonneville Unit completion plan includes measures to increase the flows in the lower Provo River during the spawning season. Under the Water Management Improvement Program, Section 207 of CUPCA, conserved water has been accumulated in Jordanelle Reservoir for release when needed to provide flows in the lower river. The target hydrographic flow pattern to attract the June sucker to enter the Provo River and migrate upstream for spawning is to mimic the natural flow of the river during the June sucker spawning season. The release pattern was developed in cooperation with the JSRIP and is included in the Provo River operational analysis.

Provo Reservoir Canal Enclosure

See earlier discussion under the section that discusses conserved water.

MITIGATION COMMISSION PROGRAM RELATING TO OPERATION OF PROVO RIVER

The Provo River watershed is a high priority resource area for the Utah Reclamation Mitigation and Conservation Commission (Mitigation Commission). Priority goals are to complete unfulfilled mitigation requirements of the Bonneville Unit and ongoing Title III projects. In order to facilitate planning for this program, the Provo River is subdivided into three distinct segments.

- Lower Provo River (Utah Lake to Deer Creek Dam)
- Middle Provo River (Deer Creek Dam to Jordanelle Dam)
- Upper Provo River (Jordanelle Dam to headwaters)

Lower Provo River - Deer Creek Dam to Utah Lake

The Commission's program for the lower Provo River contains a number of components including: study of instream flows; acquisition of water rights; June sucker recovery; stream restoration and changes to diversion dams, and water quality improvements. These components are discussed in the following sections of this Chapter.

Existing Minimum Instream Flows. There are two existing minimum instream flow requirements on the Lower Provo River. The first of these is a 100 cfs minimum flow from below the confluence of Deer Creek and the Provo River (just below Deer Creek Dam) to the Olmsted Diversion Dam. This requirement is met using natural flows of the Provo River, deliveries of Bonneville Unit and PRP water to Olmsted and the Provo Reservoir Canal, and (if necessary) by diverting PRP water at Olmsted and pumping it back into the Salt Lake Aqueduct using the Transfer Pump. The location of Provo River minimum flow requirements are shown graphically on Figure 4-9.

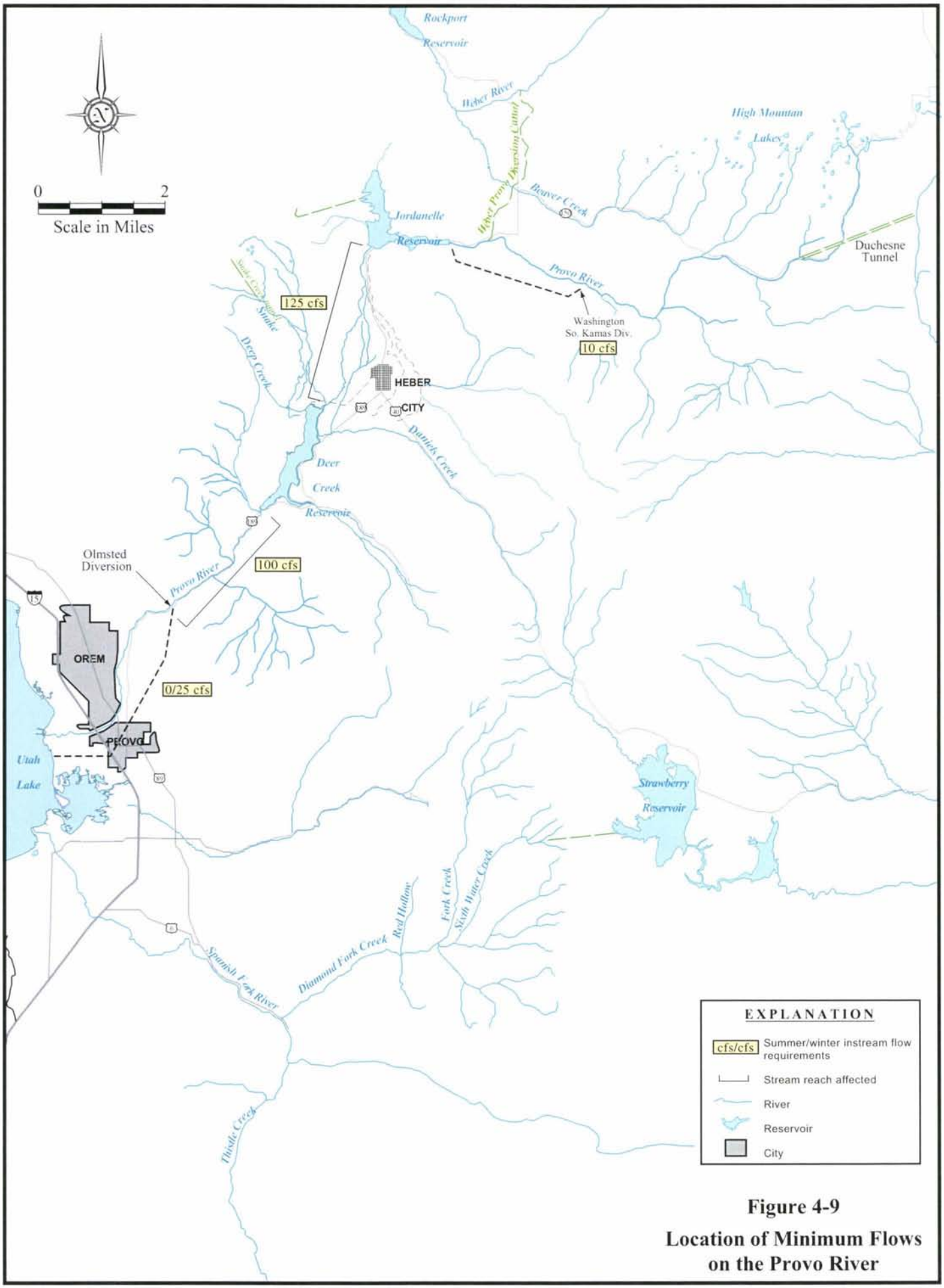


Figure 4-9

Location of Minimum Flows on the Provo River

The other minimum instream flow requirement on the Lower Provo River is a 25-cfs, winter-time only minimum flow between Olmsted Diversion Dam and Utah Lake. This minimum flow is met by natural flows, gains, and return flows of the Provo River, and by releases of Bonneville Unit water from Deer Creek and Jordanelle reservoirs.

High Flows Study. In 2002 the Mitigation Commission initiated the first phase of a comprehensive study to determine relationships among flow levels, aquatic habitat and other ecological functions on the Provo River System.

Acquisition of Water Rights. CUPCA Section 303(c)(4) states that "Upon the acquisition of the water rights in the Provo Drainage identified in Section 302, in the Provo River from the Olmsted Diversion to Utah Lake, a minimum of seventy-five cubic feet per second" shall be provided to the yield and operating plans for the Bonneville Unit of the Central Utah Project. The Act states the purchases would be limited to willing sellers below Heber Valley. Toward this goal, CUPCA has authorized $ 15 million in funds for acquiring up to 25,000 acre-feet of water rights in the Utah Lake Drainage Basin. The District has acquired with Mitigation Commission funds irrigation company water shares representing about 3,300 acre-feet, which would allow such water to flow undiverted to Utah Lake, thereby increasing the summertime flow in the lower Provo River.

The Mitigation Commission is participating in the ULS System to convey 16,000 acre-feet of Strawberry Reservoir water to the lower Provo River. This water will be released to assist in meeting the 75 cfs target flow and to meet deliveries to Utah Lake for the Jordanelle exchange.

June Sucker Recovery. The Mitigation Commission is participating with other Federal, State and Local entities in implementing reasonable and prudent alternatives for the restoration of the June sucker. Refer to discussion presented earlier on the JSRIP.

Stream Restoration and Changes to Diversions. This component includes planning for and implementing actions to improve the biotic, hydraulic and geomorphic conditions of the riverine and riparian system. This could include measures to combine, relocate or redesign and reconstruct diversion dams. Some potential water conservation projects might involve combining diversions, resulting in elimination of one or more structures. Ecological studies will identify possible modifications in selected reaches of the river channel to provide the diversity of habitat conditions necessary to support all life stages of aquatic biota including June sucker in the lower river.

Water Quality Improvements. The Mitigation Commission is working cooperatively with the Provo River Water Users Association, other water-user organizations and interested parties, in pursuit of agreements and measures to achieve better water quality in lower reaches of the Provo River. Measures may include changes to operation of Deer Creek Dam to increase dissolved oxygen content in releases during the summer months.

Middle Provo River - Deer Creek Reservoir to Jordanelle Dam

The Commission's program for the middle Provo River focuses on completion of unfulfilled mitigation requirements of the Bonneville Unit. Additionally, the Commission will continue cooperative efforts with the District, the U.S. Bureau of Reclamation and others to assure that instream flows and water quality requirements of the 1987 Final Supplement to the Final Environmental Impact Statement for the Bonneville Unit's Municipal and Industrial System are achieved. Those requirements are captured in the following projects.

Existing Minimum Instream Flows. There is an existing minimum instream flow requirement of 125 cfs on the Middle Provo River, between Jordanelle and Deer Creek. This requirement is met using natural flows, gains, and return flows of the Provo River, deliveries of Bonneville Unit and PRP water to downstream diversions, and transfers of Bonneville Unit and PRP water to Deer Creek Reservoir.

Daniel Replacement Project. The Daniel Replacement Project has been completed. This project terminates the diversion of an annual average of 2,900 acre-feet of water from the upper Strawberry tributaries into Daniels Creek for irrigation in Wasatch County. The irrigation water is replaced by a delivery of 2,900 acre-feet from Jordanelle Reservoir. The 2,900 acre-feet of water left in the upper Strawberry tributaries flows into Strawberry Reservoir for downstream delivery.

Fish and Riparian Habitat Restoration Project. In 1999, the Mitigation Commission began the Provo River Restoration Project (PRRP) between Jordanelle Dam and Deer Creek Reservoir to restore the middle Provo River's pattern and ecological function to a more natural condition. The project is expected to be completed in 2006. PRRP consists of restoring the straightened river channel to a meandering channel mimicking historic conditions, reconnecting the river to existing remnants of historic secondary channels, and constructing small side channels to recreate aquatic features.

Middle Provo River Diversion Dams. The 1987 Final Supplement to the Municipal and Industrial System committed the U.S. Bureau of Reclamation to be sure that instream flows released from Jordanelle Dam could be bypassed all the way to Deer Creek Reservoir. Some diversion dams in this reach are incapable of accurately measuring or delivering bypasses for instream flows. No funding, or responsible party, was identified for this item. The Commission's plan includes funding for this program element to implement the mitigation measures of the 1988 Definite Plan Report for the Bonneville Unit. Modifications to these diversion dams will be implemented in concert with the selected action of the Provo River Restoration Project.

Upper Provo River - Jordanelle Reservoir to Headwaters

The following elements form the basis of the program for the upper Provo River relating to water operation.

Existing Minimum Instream Flows. There is an existing minimum instream flow requirement of 10 cfs on the Upper Provo River, below the Washington/South Kamas Diversion. This requirement is met using natural flows, gains, and return flows of the Provo River, transbasin diversions of PRP water from the Duchesne Tunnel, and releases of Bonneville Unit water from the Head of River Reservoirs. The location of this Upper Provo River minimum flow requirement is shown graphically on Figure 4-9.

Upper Provo River Reservoir Stabilization Project. This project is complete. The primary goal of the project is to stabilize 12 lakes, formerly used as irrigation storage facilities since the early 1900's, for fishery and recreation purposes. In addition to stabilizing the lakes at levels beneficial to fish and recreation, the project will mitigate impacts from heavy recreational use of the area by hardening dispersed camping areas and relocating trails away from fragile environmental resources. Water rights from the 12 lakes have been transferred downstream to Jordanelle Reservoir or to the three lakes in the upper Provo River drainage that are still used for irrigation water storage.

WATER EXCHANGES IN UTAH LAKE

As stated earlier, Bonneville Unit operation includes a complex set of water exchanges to develop the full water supply. The majority of these exchanges are made through Utah Lake. PROSIM2000, which was developed to simulate operation of Provo River and Utah Lake under Bonneville Unit conditions, models these exchanges. In modeling these exchanges, PROSIM assumes a coordinated operation of Jordanelle and Deer Creek Reservoir that is occuring under the 1994 Agreement. Under this agreement, Bonneville Unit water may be stored in either reservoir. The water would be stored as high in the system as possible to maximize the operational flexibility.

The four basic mechanisms listed below are used for exchange of Utah Lake water to Jordanelle Reservoir under Bonneville Unit operation. A brief description of each of these mechanisms is included in the previous section entitled "Other Exchanges Affecting Provo River Operations", as well as in Water Supply Appendix Volume 6.

1. System storage conversion under the Distribution Plan
2. System storage conversion after lowering the Conversion Line
3. Direct exchange of Utah Lake water rights
4. Direct exchange of releases from Strawberry Reservoir to Utah Lake

Any water stored in the District's Utah Lake account will be held on a space-available basis. When Utah Lake is full and begins to spill, water held in the District's account will be the first water to spill. Water stored in this account will be subject to evaporation losses, but not seepage losses. The evaporation losses will be equal to the incremental amount of evaporation caused by the increased storage in Utah Lake.

Water held in the District's Utah Lake account will be used to make exchanges with system storage held in Jordanelle and Deer Creek reservoirs. It will be used to maximize the amount of priority storage. In some years all of the system storage in Jordanelle and Deer Creek reservoirs can be converted to priority storage under one of the previously described mechanisms. This generally occurs when there is a relatively large quantity of system storage available. In those years, the water in the District's Utah Lake account will remain in the account for exchange in subsequent years. In other years, system storage is held in Jordanelle Reservoir, but the total system storage throughout the system is below the amount required for conversion to priority storage. In those years, water held in the District's Utah Lake account will be exchanged with the system storage in Jordanelle Reservoir. Under this exchange the system storage in Jordanelle and Deer Creek Reservoir becomes priority storage and water in the District's Utah Lake account becomes system storage.

In extreme drought years there is not enough water in the Utah Lake drainage to provide adequate priority storage in Jordanelle Reservoir under the exchange mechanisms described above. In those years, large quantities of water (60,000 to 70,000 acre-feet) will be released from Strawberry Reservoir to Utah Lake. This water will then be exchanged with Bonneville Unit system storage held in Jordanelle and Deer Creek reservoirs.

YIELD OF DISTRICT'S UTAH LAKE RIGHTS

Releases from Utah Lake

The historical releases to the Jordan River to meet downstream irrigation diversions rights are declining as irrigated agriculture gives way to urban development. However, a compensating trend is anticipated as the JVWCD and others acquire irrigation rights to provide water for M&I use. Under appropriate adjustments in points of diversion, the JVWCD would pump the water from the alluvial valley fill along the river and allow the streamflow to infiltrate the bed and banks of the River and recharge the alluvial aquifer. While not a routing strategy for Bonneville Unit water, this practice would facilitate water conservation measures promoted by the CUP. Operation of the Bonneville Unit will cause an average annual depletion of 98,500 acre-feet to the Provo River, as described in Volume 5 of this Appendix. The depletion is made up by credits consisting of releases from Strawberry Reservoir, Bonneville Unit return flows, acquisition of CUWCD's Utah Lake water rights, and changes in Utah Lake evaporation, spills, and storage.

CUWCD Water Rights Proposed for Acquisition

As noted in Chapter 2, the CUWCD has acquired water rights in Utah Lake, consisting of 25,000 acre-feet of primary rights from Salt Lake City and 57,073 acre-feet of secondary rights. Primary rights are water rights defined by the Morse Decree to have storage rights in Utah Lake; secondary rights are storage rights in Utah Lake established by applications to appropriate water and confirmed by the Booth Decree. The Department of the Interior has acquired 7,900 acre-feet of these primary rights to offset the effect of the loss of the Indian Ford Exchange on the M&I System water supply. As part of the ULS System, the DOI would acquire the District's secondary water rights in Utah Lake. These rights would amount to 57,073 acre-feet and would yield at least 34,540 acre-feet.

Water Supply from District's Water Rights

Proposed Operation. Simulated operation studies for the Bonneville Unit have shown that in successive dry years the amount of Utah Lake system storage would be depleted and the total amounts would fall below the target levels required for conversion to priority storage. Under these circumstances the Distribution Plan would not provide adequate priority storage in Jordanelle Reservoir to meet Bonneville Unit demands. The studies indicated that in successive dry years there is a need for the water available under the District's secondary Utah Lake water rights to lower the conversion line or for direct exchange to Jordanelle Reservoir.

In order to provide an adequate water supply in Jordanelle Reservoir for the M&I System when Utah Lake's total system storage level fails to allow conversion of all of the CUP system storage in Jordanelle and Deer Creek reservoirs, the CUWCD's Utah Lake water rights would be used to lower the conversion line or would be directly exchanged with system storage in Jordanelle Reservoir. The choice of which use of the rights would depend upon the specifics of the situation and authorizations from the State Engineer. Under the exchange, the system storage in Jordanelle and Deer Creek reservoirs would become priority storage and the District's rights in the Lake (acquired by DOI) would become available to the other Utah Lake water users. Under the alternative use, the District and DOI would inform the State Engineer that they intended to hold their rights in the Lake, he would lower the conversion line accordingly, and the CUP and PRP would both have an improved opportunity to convert their system storage in Jordanelle and Deer Creek reservoirs. In either case, the acquired Utah Lake water rights would be used to replace the converted system storage.

Operation studies were performed to verify that the use of the CUWCD/DOI rights in Utah Lake (either to lower the conversion line or to directly exchange to Jordanelle) would not change flows in the Jordan River below the Narrows or adversely impact Utah Lake/Jordan River water users.

As required by Utah water law, these operations would only be made to the extent that they did not interfere with prior water rights. In most years, the secondary Utah Lake water rights

acquired from the CUWCD would remain in Utah Lake to increase the total amount of system storage available. Under the Distribution Plan, when Utah Lake system storage is above predetermined levels, system storage held in upstream reservoirs would be converted to priority storage. Once converted to priority storage, the water is no longer subject to call by downstream Utah Lake water users. By increasing the amount of available system storage, or by reducing the secondary water rights calls on Utah Lake, more water stored in Jordanelle and Deer Creek reservoirs could be converted to priority storage and more water in Strawberry Reservoir is able to be directly delivered to meet ULS water demands.

Annual Yield of District's Utah Lake Water Rights. The historical average yield of the CUWCD's 57,073 acre-feet of secondary water rights was about 45,978 acre-feet, which is greater than the 34,540 acre-feet needed for the ULS water supply. The approach used was to catalogue the historical quantities of water diverted by all of the owners of Utah Lake secondary rights during the period 1950 through 1999. Historical diversions for the period after CUWCD acquired the rights were estimated, since the rights were held in the Lake during this period. It was found that historically, the total yield of the 112,739 acre-feet of Utah Lake secondary rights was 112,739 acre-feet in 29 out of the 50 years. The minimum yield was zero in 1992, and less than 50 percent in seven other years. The average yield over the 50 year period (allowing for periods after the Distirct acquired its Utah Lake rights) was estimated to be 90,822 acre-feet or 80.6 percent. Given that the CUWCD's rights amount to 50.6 percent of the total, it is reasonable to assume that they would have had a historical yield equal to 50.6 percent of the total. This calculation indicates that the yield of the 57,073 acre-feet of CUWCD secondary rights would be 45,978 acre-feet.

The historical deliveries and the historical yield estimates described above were not based upon operation of Utah Lake under the Utah Lake Distribution Plan. They were based upon historical water demands and historical operation of Utah Lake, operations that will be different in the future. It is not known whether or how the Distribution Plan and future demands and operations may affect the average yield of the secondary rights in Utah Lake. What is known is that operation studies conducted under the provisions of the Distribution Plan show that Utah Lake can be operated without significantly changing Utah Lake levels, Jordan River water rights deliveries, or flows below the Narrows. These studies indicate that the historical yield of the CUWCD water rights is probably a good indication of the likely future yield.