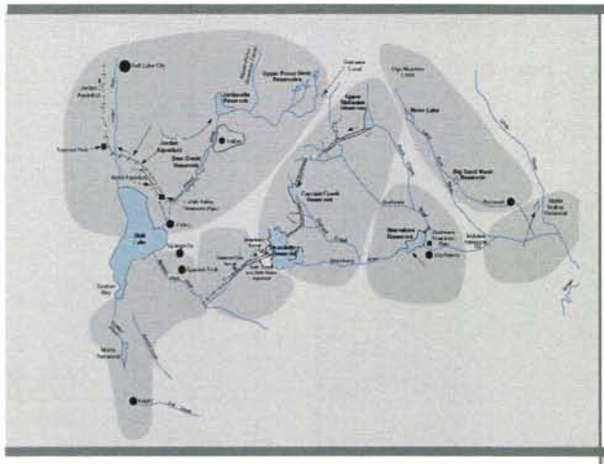
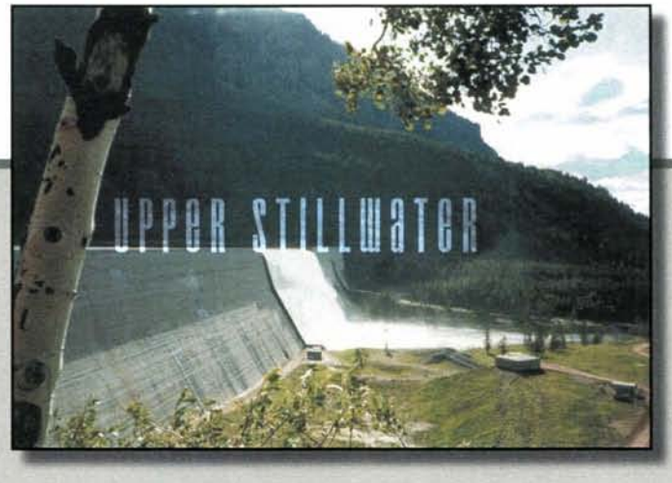
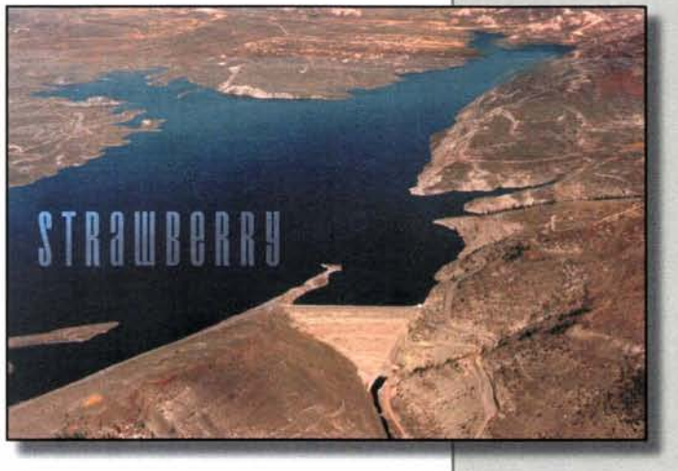
SUPPLEMENT TO THE 1988 DEFINITE PLAN REPORT FOR THE BONNEVILLE UNIT

Central Utah Project Completion Program



October 2004





UTAH RECLAMATION MITIGATION AND CONSERVATION COMMISSION

SUPPLEMENT TO THE BONNEVILLE UNIT DEFINITE PLAN REPORT

DEFINITE PLAN REPORT

CUP COMPLETION ACT

CENTRAL UTAH WATER CONSERVANCY DISTRICT

PREPARED BY:

Central Utah Water Conservancy District
355 West University Parkway
Orem, UT 84058

UNDER THE DIRECTION OF:

Mark Breitenbach, Project Manager
Central Utah Water Conservancy District
Telephone: (801) 226-7105
Facsimile: (801) 226-7150

WITH THE ASSISTANCE OF:

MWH Americas, Inc.
Mayya Group International, LLC

October 2004

TABLE OF CONTENTS

Page No.

CHAPTER 1 – INTRODUCTION 1-1
- Introduction 1-1
- Bonneville Unit Definite Plan Report 1-1
- The Bonneville Unit Planning Process 1-2
  - CUPCA 1-2
  - The CUPCA Program Under the District 1-2
  - Environmental Aspects 1-2
  - Formulation of the ULS System Plan 1-4
- The Bonneville Unit 1-5
  - Bonneville Unit Operations 1-5
  - Changes Authorized by CUPCA 1-6
  - Additional Components Authorized by CUPCA 1-6
  - Features Discontinued or Modified 1-6
  - Bonneville Unit Purposes Served 1-7
  - Water Supply 1-7
  - Irrigation Water 1-7
  - M&I Water 1-7
  - Fishery Flows 1-7
- The ULS System 1-8
  - ULS Pipelines 1-8
  - ULS Powerplants 1-8
  - Water Supply 1-8
  - District Utah Lake Water Rights 1-9
  - Conserved Water (Section 207 Funding) 1-9
  - M&I Water Delivery 1-9
  - SVP Water Irrigation Delivery 1-9
  - 1,590 AF from M&I System 1-10
  - Instream Flow Provisions 1-10
  - ULS System M&I Water Demands 1-10
  - ULS Water Conservation Provisions 1-11
  - ULS System Costs and Level of Detail 1-11
  - Annual Operation, Maintenance and Replacement 1-12
- Evaluation of the Bonneville Unit 1-12
  - Economic Analysis 1-12
  - Financial Analysis 1-13
  - Irrigation Repayment 1-13
  - M&I Repayment 1-13
  - Power Repayment 1-15
- Contracts and Agreements 1-15

CHAPTER 2 –BONNEVILLE UNIT FEATURES 2-1
- Location and Setting 2-1
- Bonneville Unit Components 2-1

Changes Authorized by CUPCA 2-1
Additional CUPCA Components 2-1
Description of Current Systems and Other Components 2-1
Starvation Collection System 2-1
Strawberry Aqueduct and Collection System 2-6
Municipal and Industrial (M&I) System 2-8
Diamond Fork System 2-9
ULS System 2-10
Ute Indian Tribal Development 2-11
Other CUPCA Program Components 2-12
Water Management Improvement 2-12
Fish, Wildlife, and Recreation Mitigation and Enhancement 2-12
Wasatch County Water Efficiency Project and Daniel Replacement Project ... 2-14
Section 203(a) Uinta Basin Replacement Project 2-15
Local Development 2-17
Ute Indian Water Rights Settlement 2-17
Conjunctive Use of Surface Water and Groundwater 2-17
Additional Studies of Utah Lake Salinity and Provo River Water Supply 2-17

CHAPTER 3 – WATER SUPPLY 3-1
Sources of Water for the Bonneville Unit 3-1
Provo River Basin Supply 3-1
Duchesne River Basin Supply 3-1
Overview of Operational Relationships Under the Current Bonneville Unit Plan.... 3-3
State Engineer's Water Distribution Plan 3-3
1991 Operating Agreement with SWUA 3-5
1980 Stream Flow Agreement (the 44,400 acre-foot fishery flow provision) 3-5
Upper Strawberry River Flow Restoration Water (2,900 acre-feet) 3-5
Reduction in Bonneville Unit Transbasin Diversion 3-6
Deer Creek Reservoir/Jordanelle Operating Agreement 3-6
Strawberry to Jordanelle Exchange 3-6
June Sucker Recovery Implementation Program (JSRIP) 3-7
Strawberry Aqueduct and Collection System 3-8
Strawberry Reservoir Operation Under Current Plan 3-8
Operational Model Used 3-8
Results of Current Model Operation 3-8
Other Releases From Strawberry Reservoir 3-9
Summary of Releases From Strawberry Reservoir 3-9
Strawberry Reservoir Operating Levels 3-10
General Conclusion 3-10
Starvation Collection System 3-11
Uinta Basin Replacement Project 3-11
Transbasin Diversion Through Diamond Fork Features 3-12
Utah Lake Drainage Basin Water Delivery System 3-13
Redistribution of Conserved Water 3-13

Routing Summary of Transbasin Diversion Water 3-15
Delivery to Lower Provo River 3-16
Delivery to Provo Reservoir Canal 3-16
Municipal and Industrial System 3-16
Wasatch County Water Efficiency Project 3-19
Other Section 207 Project Water 3-19
Mitigation Commission Acquisition of Water Rights 3-19
Utah Lake and Its Pivotal Role 3-20
End-of-Month Storage Content and Water Levels 3-20
Utah Lake Water Quality 3-25
LKSIM2000 TDS Model 3-25
Database 3-26
Modeling Results 3-26
Colorado River Depletions 3-27

CHAPTER 4 – DIAMOND FORK SYSTEM 4-1
Introduction 4-1
Water Delivery 4-1
Description of Features 4-4
Syar Tunnel and Inlet Portal 4-4
Sixth Water Aqueduct (Pipeline, Shaft and Flow Control Structure) 4-5
Sixth Water Connection to Tanner Ridge Tunnel 4-5
Tanner Ridge Tunnel 4-5
Upper Diamond Fork Pipeline 4-5
Upper Diamond Fork Flow Control Structure 4-5
Diamond Fork Vortex Shafts 4-5
Aeration Chamber and Connection to Upper Diamond Fork Tunnel 4-6
Upper Diamond Fork Tunnel 4-6
Monks Hollow Overflow Structure and Diamond Fork Creek Outlet 4-6
Diamond Fork Pipeline Extension 4-6
Diamond Fork Pipeline 4-7

CHAPTER 5 – THE ULS SYSTEM 5-1
Introduction 5-1
District Water Rights 5-1
Peak Design Flow in Pipelines 5-1
Conserved Water (Section 207 Funding) 5-1
Flows Through Power Generation Plants 5-5
Spanish Fork River Flow Control Structure 5-5
Spanish Fork Canyon Pipeline 5-5
Spanish Fork – Santaquin Pipeline 5-6
Santaquin – Mona Reservoir Pipeline 5-8
Mapleton – Springville Lateral Pipeline 5-8
Spanish Fork – Provo Reservoir Canal Pipeline 5-9
ULS System Hydroelectric Power Plants 5-10

Sixth Water Hydroelectric Power Plant 5-11
Upper Diamond Fork Hydroelectric Power Plant 5-11
Substations and Transmission Lines 5-11
Net Energy Generated 5-12

CHAPTER 6 – PROJECT IRRIGABLE LANDS 6-1
Purpose and Scope 6-1
USBR Land Classification System 6-1
Maps of Classified Acreage 6-2
Bonneville Unit Agricultural Areas 6-5
Spanish Fork Area 6-6
Elberta Area 6-6
Mona-Nephi Area 6-6
Heber-Francis Area 6-6
Duchesne River Area 6-6
Areas Excluded From the Bonneville Unit 6-6
Mosida Area 6-7
Provo Bay Area 6-7
Sevier River Basin 6-7
Levan and Mills Area 6-7
Elimination of Agricultural Drainage From Project Plan 6-7
History of Certification of Lands 6-8
1965 Certification 6-8
1992 Supplemental Certification 6-8
Duchesne River Lands 6-8
Starvation Collection System 6-8
Relationship of UBRP Lands to Upalco Unit 6-9
Heber-Francis Area Lands 6-11
Southern Utah County and Juab County Lands 6-11
Land Classification 6-12
1964 Land Classification 6-12
1989 Supplemental Land Classification Survey 6-12
Acreage Certification 6-12
1965 Certification 6-13
1992 Supplemental Certification 6-13
Irrigable Acreage 6-14
Irrigable Acreage Determinations in 1964 and 1988 6-14
2004 Determination of Irrigable Acreage 6-16
Summary of Arable and Irrigable Acreage Changes 6-16

CHAPTER 7 – FISH AND WILDLIFE 7-1
Introduction 7-1
CUPCA and the Mitigation Commission 7-1
Bonneville Unit Mitigation Program 7-1
Key Documents in Development of the Mitigation Program 7-2

Bonneville Unit Systems 7-2
Environmental Commitments 7-3
Summary of Environmental Commitments 7-3
Bonneville Unit Fish, Wildlife and Recreation Programs 7-4
Commitments Unfulfilled in the 1988 DPR 7-4
Commitments Established by CUPCA and Amendments and From Other Environmental Documents 7-4
Overview of Fish, Wildlife and Related Recreation Programs Associated With the Strawberry and Duchesne River Watersheds 7-12
Overview of Fish, Wildlife and Related Recreation Programs Associated With the Provo River Watershed, Utah Lake and Hobble Creek 7-15
Overview of Fish, Wildlife and Related Recreation Programs Associated With the Diamond Fork and Spanish Fork Watersheds and Southern Utah County 7-17
Overview of Fish, Wildlife and Related Recreation Programs Associated With the Colorado River Storage Project or Statewide Programs 7-20

CHAPTER 8 – WATER CONSERVATION AND WATER EFFICIENCY 8-1
Introduction 8-1
Authorities and Support for Water Conservation and Water Recycling 8-1
Federal Goals and Requirements 8-1
CUPCA Provisions 8-1
Public Law 107-366 Provisions 8-2
State of Utah Provisions 8-2
Central Utah Water Conservancy District 8-2
Local Water Agency Programs 8-4
Water Conservation Through Municipal Water Demand Reduction 8-5
Jordan Valley Water Conservancy District 8-5
Description of Entity 8-5
Population Projections 8-5
Existing Water Usage Rate (gpcd) for JVWCD 8-8
Conservation Plans for JVWCD 8-8
Metropolitan Water District of Salt Lake and Sandy (MWDSLS) 8-20
Population for MWDSLS Service Area 8-20
MWDSLS Water Usage Rate (gpcd) 8-22
MWDSLS Conservation Plans 8-23
Southern Utah Valley Municipal Water Association (SUVMWA) 8-29
Water Conservation Master Plan 8-29
Water Conservation Through Conveyance System Improvements 8-33
Municipal Water Pipeline (CUPCA Section 207) 8-33
Urban Secondary Water Systems (CUPCA Section 207) 8-35
Salt Lake County 8-35
Utah County 8-36
Juab County 8-37
207 Project Anticipated in Future Years 8-37

Irrigation Water Conservation Projects (CUPCA Section 207) 8-37
Uinta Basin 8-37
Utah County 8-38
Juab County 8-38
Wasatch County 8-38
Sanpete County 8-39
207 Projects Anticipated in Future Years 8-39
Industrial Water Conservation (CUPCA Section 207) 8-39
Salt Lake County 8-39
Water Conservation Education (CUPCA Section 207) 8-39
Salt Lake County 8-39
USBR – Water Conservation Field Services Program 8-40
Water Management Planning (USBR) 8-40
Water Education Training (USBR) 8-41
Demonstration of New Conservation Technologies (USBR) 8-41
Implementation of Effective Efficiency Measures (USBR) 8-41
USBR – Utah's "Bridging-the-Headgate" Alliance 8-41
Water Conservation Through Overall Basin-Wide Water Use Efficiency 8-42
Conjunctive Use of Groundwater and Surface Water 8-42
Northern Utah County 8-42
Salt Lake County 8-42
Water Recycling 8-43
JVWCD and MWDSLS Plans to Recycle Water 8-43
SUVMWA Plans for Water Recycling 8-49
Projected Sewage Effluent Recycling 8-49
Limitations on Use of Return Flows 8-50
Accounting for M&I Return Flows 8-50
Wastewater Treatment Facilities 8-50
Estimation of Unit Rates of M&I Return Flow in Southern Utah County 8-52
Potential Uses of Recycled Wastewater 8-52
Reverse Osmosis Treatment 8-53
Projected Volume of Yield Using Reverse Osmosis Treatment 8-54

CHAPTER 9 – FINANCIAL AND ECONOMIC 9-1
Economic Analysis 9-1
Bonneville Unit Benefits 9-1
Irrigation 9-1
M&I Water Supply 9-1
Power Benefits 9-3
Recreation Benefits 9-5
Highway Improvement 9-5
Total Benefits 9-6
Intangible Benefits 9-6
Bonneville Unit Costs 9-7
Construction Cost 9-7

Interest During Construction 9-10
OM&R Costs 9-10
Bonneville Unit Proportion of CRSP Reservoirs 9-10
Benefit-Cost Ratio 9-10
Basic Analysis 9-10
Principles and Guidelines Analysis 9-10
B/C Ratio 9-10
Financial Analysis 9-11
Allocation of Project Costs 9-11
Cost Allocation Methodology 9-11
Use of Facilities Principles Applied in the Allocation 9-12
Summary of Cost Allocation 9-14
Repayment of Reimbursable Project Costs 9-14
Non-Reimbursable Costs 9-21

CHAPTER 10 – DPR REFERENCES CITED 10-1

List of Tables

1-1 Water Provided by the Bonneville Unit 1-7
1-2 Irrigation Water Provided by the Bonneville Unit 1-7
1-3 M&I Water Provided by the Bonneville Unit 1-8
1-4 Annual Monetary Project Benefits 1-12
1-5 Summary of Local Cost Share and Federal Share 1-14
1-6 Contracts and Agreements Needed by District for the ULS System Preferred Alternative 1-16

2-1 Summary of Bonneville Unit Features 2-3
2-2 Bonneville Unit Components 2-13

3-1 Maximum Modeled Transbasin Diversions 3-9
3-2 Summary of Average Annual Releases from Strawberry Reservoir 3-10
3-3 Water Supply Developed for Duchesne Co. by Starvation Collection System. 3-11
3-4 Water Supply Produced by UBRP 3-12
3-5 Distribution of Transbasin Diversion From Strawberry Reservoir 3-12
3-6 Conserved Bonneville Unit Water Redirected in ULS System 3-13
3-7 Routing of Total Bonneville Unit and SVP Transbasin Diversion with ULS System 3-15
3-8 ULS Deliveries to Supplement the Lower Provo River 3-16
3-9 Bonneville Unit Municipal and Industrial System Water Allocation 3-17
3-10 Utah Lake Monthly Content Under Bonneville Unit Operation 3-23
3-11 Utah Lake Monthly Water Level Under Bonneville Unit Operation 3-24
3-12 Utah Lake Average, Wet, and Dry Year TDS Concentrations 3-26

TABLE OF CONTENTS

4-1 Summary of Diamond Fork System Features 4-2
4-2 Distribution of Transbasin Diversion From Strawberry Reservoir 4-4

5-1 Summary of Generation Plants and Transmission Lines 5-4
5-2 Summary of Pipeline Dimensions 5-4
5-3 Design Flows for Pipelines 5-4
5-4 Projected Flows Through ULS Power Plants 5-6
5-5 Secondary M&I Deliveries Typical Monthly Distribution Pattern 5-7
5-6 Hydraulic Capacity and Pipe Size Spanish Fork – Santaquin Pipeline 5-7
5-7 Hydraulic Capacity and Pipe Size Mapleton – Springville Lateral Pipeline 5-9
5-8 Hydraulic Capacity and Pipe Size Spanish Fork – Provo Reservoir Canal Pipeline 5-10
5-9 Summary of Power Generation Plants and Transmission Lines 5-12
5-10 Net Energy Generated (Kilowatt-hours) 5-12

6-1 Specifications for Detailed Bonneville Unit Land Classification 6-3
6-2 Land Classified as Part of 1964 Bonneville Unit Definite Plan Report 6-4
6-3 Listing of Bonneville Unit Land Classification Maps 6-5
6-4 Agricultural Acreage Duchesne River Area 6-9
6-5 Land Classification Section 203(a) Uinta Basin Replacement Project 6-10
6-6 Agricultural Acreages in Heber – Francis Area 6-11
6-7 1989 Supplemental Land Classification Survey at West Mountain 6-13
6-8 Certified Southern Utah County and Juab County Acreage 6-14
6-9 1964 and 1988 Acreage Tabulations Summary of Arable and Irrigable Acreage 6-15
6-10 ULS System Irrigable Acreage by Class of Land 6-17
6-11 Bonneville Unit Agricultural Land Update Year 2004 6-18

7-1 Environmental Commitments Summarized From Table 2-1 of the Fish and Wildlife Appendix 7-5
7-2 Summary of the 92 Environmental Commitments on the Bonneville Unit Of the Central Utah Project 7-6

8-1 Population in JVWCD Service Area 8-6
8-2 Water Checks 8-13
8-3 Water Saving Results 8-14
8-4 Pilot Toilet Replacement Program 8-14
8-5 Conservation Funding 8-15
8-6 Amount Expended on JVWCD's Water Conservation Years 8-16
8-7 Conservation Calculated Cost Effectiveness 8-16
8-8 CUPCA Section 207 Funding Amounts 8-17
8-9 JVWCD Service Area Population and Water Usage 8-17
8-10 Population in MWDSLS Service Area 8-22
8-11 Unit Water Demand with Conservation Element Included 8-22
8-12 Water Checks 8-24

8-13 Revised Population Projections for Southern Utah County 8-30
8-14 Achievement of SUVMWA Area-Wide Water Conservation of 25 Percent 8-33
8-15 Water Conservation Credit Program – Anticipated Progress to the Year 2016 Water Conservation Goal 8-34
8-16 Central Utah Project Bonneville Unit Estimated Return Flows as Sewage Effluent 8-44
8-17 Relationship of CVWRF Member Agencies to JVWCD and MWDSLS Member Agencies 8-45
8-18 CVWRF Estimated Recycled Water Demand by Member Agency 8-46
8-19 South Valley Communities and JVWCD Member Agencies 8-47
8-20 South Valley Communities Sewage Flows to SVWRF 8-47
8-21 Assumed Daily Sewage Effluent Recycled Flow Requirement for Each SVWRF City 8-48
8-22 South Valley Communities Recycled Water Project Deliveries and Costs 8-48
8-23 Bonneville Unit Projected Wastewater Recycling in JVWCD and MWDSLS Service Area 8-49
8-24 Wastewater Treatment Plants in Southern Utah County 8-51
8-25 Potential Return Flows From Regional Wastewater Treatment Plants for Southern Utah County 8-51
8-26 Approximate Southern Utah County M&I Return Flow in 2050 and Division Between Non-CUP and CUP Waters 8-53
8-27 Projected Yield of Converted Agricultural Water Using Reverse Osmosis Treatment 8-55

9-1 Irrigation Benefits 9-2
9-2 M&I Water Supply Benefits 9-3
9-3 Annual Power Benefits 9-4
9-4 Annual Fish and Wildlife Benefits 9-5
9-5 Recreation Benefits 9-6
9-6 Summary of Project Benefits 9-7
9-7 Project Costs 9-9
9-8 Benefit Cost Analysis 9-11
9-9 Summary of Cost Allocation 9-14
9-10 Summary of Local Cost Share and Federal Obligation 9-16
9-11 Bonneville Unit Repayment Contracts 9-17
9-12 Water Supply Associated with the 1965 Repayment Contract 9-18
9-13 Repayment of Irrigation Costs 9-22
9-14 M&I Repayment 9-23
9-15 Repayment of Power Costs 9-24
9-16 Non-Reimbursable Costs 9-25

List of Figures

3-1 Distribution of Bonneville Unit Water 3-2

3-2 Utah Lake Distribution Plan 3-4
3-3 Exchange Mechanisms Between Strawberry and Jordanelle 3-7
3-4 Simulated Strawberry Reservoir Storage for Bonneville Unit Operations 3-11
3-5 ULS Water Deliveries Under the Bonneville Unit 3-14
3-6 ULS Interconnections to the Provo River 3-18
3-7 Water Acquired With Mitigation Commission Funds for 75-cfs Target in The Lower Provo River 3-21
3-8 Utah Lake and Jordan River Water Balance Under the ULS Proposed Action 3-22
3-9 Utah Lake Monthly Content Under Bonneville Unit Operation 3-23
3-10 Utah Lake TDS Concentrations 3-27

8-1 Jordan Valley Water Conservancy District Service Area 8-7
8-2 JVWCD Demonstration Garden – Total Water Applied to Each Landscape In 2001 and 2002 8-11
8-3 Water Conservation Demonstration Garden 8-12
8-4 MWDSLS Service Area Boundaries 8-21
8-5 Bonneville Unit South Utah Valley Municipalities 8-30

List of Maps

1-1 Central Utah Project Units 1-3

2-1 Bonneville Unit Components 2-2
2-2 Starvation and Strawberry Collection Systems 2-7
2-3 M&I System 2-8
2-4 Diamond Fork System 2-9
2-5 Utah Lake Drainage Basin Water Delivery System 2-11
2-6 Wasatch County Water Efficiency Project 2-15
2-7 Uinta Basin Replacement Project 2-16

4-1 Features of the Diamond Fork System 4-3

5-1 Proposed Pipelines 5-2
5-2 Hydroelectric Power Plants and Transmission Lines 5-3

CENTRAL UTAH PROJECT COMPLETION PROGRAM

Chapter 1

October 2004

INTRODUCTION

This report supplements the Bonneville Unit's 1988 Definite Plan Report (1988 DPR), and was prepared pursuant to the Central Utah Project Completion Act (CUPCA), which was signed into law by the President of the United States on October 30, 1992. CUPCA (Public Law 102-575) authorized the Central Utah Water Conservancy District (District) to plan, design, and construct the remaining Bonneville Unit features.

CUPCA was amended in December 2002 by Public Law 107-366 (PL 107-366). The amendment added the municipal and industrial purpose as a use for water in the Utah Lake drainage basin, and allowed unexpended budget authority to be used for water conservation measures, power development, and fish and wildlife purposes.

This report, when approved by the Secretary of the Interior (Secretary), fulfills the statutory requirements contained in Section 205 of CUPCA. Section 205 of CUPCA indicates that federally appropriated funds may not be obligated or expended by the District for construction of the Irrigation and Drainage System (I&D System) until the District completes a supplement to the 1988 DPR for the I&D System. CUPCA further indicates that the Supplement to the 1988 DPR shall include economic analyses consistent with the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (March 10, 1983). The Secretary may withhold approval of this 2004 Supplement to the 1988 DPR based only on the inadequacy of the document, and specifically not because of the findings of its economic analyses. This report presents the recently formulated plan for the Utah Lake Drainage Basin Water Delivery System (ULS System), which provides for the distribution of the remaining unallocated Bonneville Unit water along the Wasatch Front. The ULS System has emerged through the following process. The CUPCA authorized construction of the Irrigation and Drainage System (I&D) as a water conveyance system from Spanish Fork Canyon to Sevier Bridge Reservoir for the purpose of supplying new and supplemental irrigation water supplies to Utah, Juab, Millard, Sanpete, Sevier, Garfield, and Piute Counties. CUPCA included a provision to construct alternate features to deliver irrigation water to lands in the Utah Lake drainage basin in the event the plan to deliver water to the Sevier River basin was not viable. Millard and Sevier Counties withdrew from participation in the Central Utah Project (CUP) after CUPCA was enacted, which rendered the I&D System no longer viable. The alternative plan under CUPCA was then activated. The initial planning process focused on an irrigation project named the Spanish Fork Canyon-Nephi Irrigation System (SFN System). When insurmountable issues associated with the SFN System project were raised in 1998, the joint-lead agencies (the District, Mitigation Commission, and Department of the Interior) discontinued planning on the SFN System and announced a new planning process for the ULS System, which is documented in this Definite Plan Report.

BONNEVILLE UNIT DEFINITE PLAN REPORT

A Definite Plan Report (DPR) for the Bonneville Unit of the CUP was prepared in 1964 by the U.S. Bureau of Reclamation (Reclamation). That document paved the way for the start of construction of the Bonneville Unit in 1965. As development of the Bonneville Unit proceeded over time, changes occurred in the original plan. In 1988, Reclamation prepared the *1988 Definite Plan Report for the Bonneville Unit* (1988 DPR) to update the Bonneville Unit plan. In October 1992, Congress enacted CUPCA, which: 1) indicated that the 1988 DPR was approved by the Secretary of the Interior, 2) modified the Bonneville Unit Definite Plan and 3) required that this supplemental DPR be prepared as noted above.

This updated DPR presents the changes that have occurred in the Bonneville Unit plan from that described in the 1988 DPR. While this

report encompasses the entire Bonneville Unit, including the components authorized in and constructed pursuant to CUPCA, emphasis is given to the presentation of the new ULS System which is yet to be constructed.

This 2004 Supplement to the 1988 DPR has been completed to fulfill requirements of CUPCA and to serve as a companion document for the ULS System Final EIS of September 2004.

THE BONNEVILLE UNIT PLANNING PROCESS

The CUP was authorized by Public Law 84-485 on April 11, 1956, as a participating project of the Colorado River Storage Project (CRSP) to help meet Utah's long-term water needs. The authorization was based on planning reports by Reclamation and has been amended from time to time by acts of Congress. The CUP (see Map 1-1) was initially composed of the Bonneville, Upalco, Jensen, and Vernal Units. The Uinta Unit was added in 1978.

Construction progress on the Bonneville Unit has proceeded slowly because of the complexity of the project, the need for environmental analyses resulting from the National Environmental Policy Act of 1969, and inadequate federal funding. The slow progress prompted state and local officials to request Congress to empower the District to complete the planning and construction of the remaining portions of the CUP, including the Bonneville Unit.

CUPCA

Congress responded to local concerns about slow construction progress by enacting the CUPCA which, as stated earlier, was enacted on October 30, 1992. With CUPCA, Congress provided direction for completing the CUP with certain modifications of the 1988 plan of development. CUPCA envisioned a partnership among the District, Utah Reclamation Mitigation and Conservation Commission, and Department of the Interior. To respond to public desires and expedite development, CUPCA authorized the District to construct the remaining features, authorized an increased cost ceiling for various features of the CUP, and authorized federal appropriations under a cost-sharing arrangement between the District and the Department.

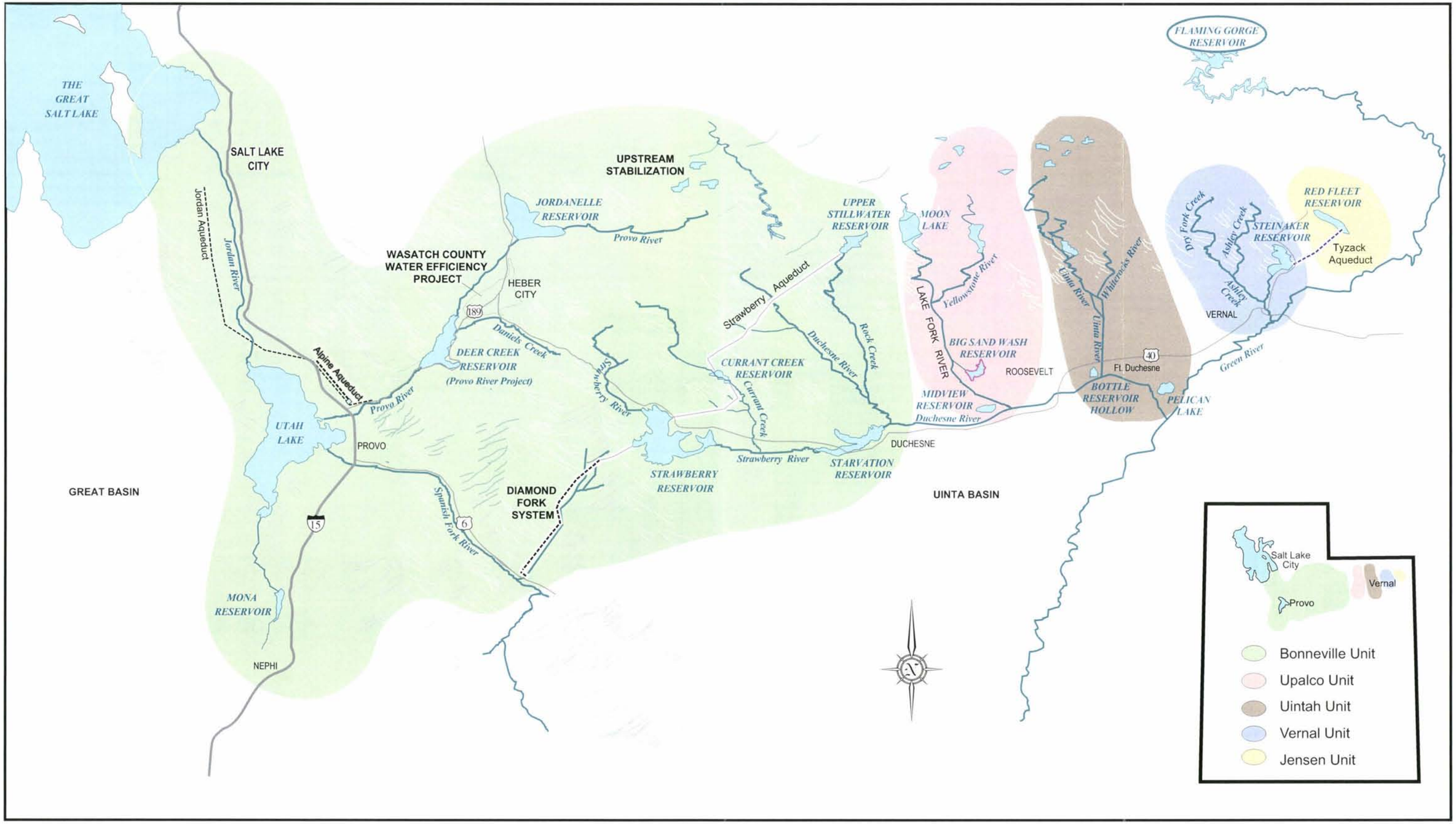
The CUPCA Program Under the District

The District has an 18-member Board of Directors representing local water users in the 10-county district, including all or portions of Salt Lake, Utah, Juab, Wasatch, Summit, Duchesne, Uintah, Sanpete, Piute, and Garfield Counties. As directed by CUPCA, the District has developed planning and construction programs for the completion of the CUP, and the necessary internal organization to accomplish them. The District has prepared the necessary environmental documents for the features that have been completed under CUPCA.

Environmental Aspects

The Bonneville Unit contains a substantial environmental component for both mitigation and enhancement of fish and wildlife habitat in various areas. The Bonneville Unit utilizes various streams to convey water towards areas of use, notably the Provo, Spanish Fork, Strawberry, and Duchesne Rivers, and Diamond Fork Creek. CUPCA includes provisions for maintaining stream flows at prescribed minimum rates for the benefit of aquatic and riparian habitat. In addition, the project storage reservoirs provide opportunities for public recreation and fishing. Wetlands and terrestrial habitat impacted by development will be mitigated through acquisition and improvement of other lands.

Title III of CUPCA created the Utah Reclamation Mitigation and Conservation Commission (Mitigation Commission) with responsibility for coordinating and planning of mitigation measures, and administering both the



Map 1-1
Central Utah Project Units

funding previously authorized for environmental mitigation in the 1988 DPR and funding authorized for the mitigation and conservation measures added to the Bonneville Unit by CUPCA. In 1997, the Mitigation Commission issued a Mitigation and Conservation Plan containing additional measures for enhancement of wildlife habitat and recreation opportunities, which will complement the measures already constructed or proposed in the 1988 Bonneville Unit plan. The Mitigation Commission's plan was updated in 2002.

The fish and wildlife aspects of the Bonneville Unit are summarized in Chapter 7 of this 2004 DPR Supplement with additional details in the Fish and Wildlife Appendix that accompanies this report.

Formulation of the ULS System Plan

The District, Mitigation Commission, and Department of the Interior (referred to as the joint lead agencies) issued a notification of planning for the ULS System with a Notice of Intent published in the Federal Register on October 14, 1998 (FR Doc. 98-27484). The notice stated that

> "The joint-lead agencies will initiate a new planning process with public involvement on the facilities authorized in section 202(a)(1) of the Central Utah Project Completion Act (Utah Lake Drainage Basin Water Delivery System). Any other additional uses of Bonneville Unit water on the Wasatch Front (Salt Lake City to Nephi, Utah), and all-remaining environmental issues and commitments associated with the Bonneville Unit will be addressed during this new process. When planning for the Utah Lake Drainage Basin Water Delivery System is initiated, a Notice of Intent regarding NEPA compliance will be published."

The 1998 Notice of Intent also announced the discontinuation of planning on the SFN System.

On August 23, 2000, the joint-lead agencies published a Federal Register Notice of Intent to prepare an EIS and hold an informal scoping meeting on the ULS System of the Bonneville Unit. (FR Doc. 00-21458). The notice indicated that the ULS would connect to the Diamond Fork System and make water available to the Wasatch Front Area for irrigation, municipal and industrial, fish and wildlife, and other authorized uses. It stated that "Any other additional uses of Bonneville Unit water within the Wasatch Front Area and all remaining environmental issues and commitments associated with the Bonneville Unit will be addressed during this planning and EIS process."

The resulting ULS System plan is summarized in this chapter with additional details on the ULS System features in Chapter 5 of this 2004 Supplement. Additional information on the ULS System and the Bonneville Unit is contained in supporting appendices to this supplemental Definite Plan Report. These appendices are arranged in nine separate binders as follows:

- Binder 2: Designs and Estimates Appendix Volume 1
- Binder 3: Designs and Estimates Appendix Volume 2
- Binder 4: Financial and Economic Appendix
- Binder 5: Power Appendix
- Binder 6: Water Supply Appendix Volume 1 – Text
- Binder 7: Water Supply Appendix Volume 2 – M&I Demands
- Binder 8: Water Supply Appendix Volume 3 – Uinta Basin and Water Supply Appendix Volume 4 – Spanish Fork River
- Binder 9: Water Supply Appendix Volume 5 – Provo River and Water Supply Appendix Volume 6 – Utah Lake and Jordan River
- Binder 10: Fish and Wildlife Appendix

THE BONNEVILLE UNIT

The Bonneville Unit is located in portions of Salt Lake, Utah, Wasatch, Summit, and Duchesne Counties. The Bonneville Unit develops the water resources in mountainous areas in northeast Utah for use in the Bonneville Basin (west of the Wasatch Mountains) and in the Uinta Basin (east of the Wasatch Mountains). The features of the Bonneville Unit were originally grouped into six major systems, shown previously on Map 1-1. Some systems have been constructed, some partially constructed, and one planned for future construction (ULS System).

The Bonneville Unit has developed water supplies by collecting and storing flows of the Duchesne River and its tributaries, by water rights purchased on the Provo River, and in Utah Lake, and by return flows. Bonneville Unit facilities will make a transbasin diversion of water from the Uinta Basin to the Bonneville Basin and will deliver water for municipal and industrial (M&I) use, irrigation use, power generation, flood control, water conservation, fish and wildlife purposes, and instream flow maintenance in the Bonneville Basin of the Great Basin of Utah.

The Bonneville Unit's Strawberry Aqueduct and Collection System (SACS) contributes to the release of fishery flows to Uinta Basin streams in accord with the 1980 Streamflow Agreement and its Amendments which were prepared by a multi-agency team.

Bonneville Unit Operations

The Bonneville Unit is the largest and most comprehensive of the authorized units of the CUP. Water is collected in the SACS starting at Upper Stillwater Reservoir, conveyed through tunnels and pipelines, with additional collection from selected streams along its route, to Currant Creek Reservoir. From Currant Creek Reservoir the water continues through another series of tunnels and pipelines and is eventually discharged into the enlarged Strawberry Reservoir. The Starvation Collection System stores flows from the Duchesne and Strawberry rivers in Starvation Reservoir, releases water to supplement irrigation in the Duchesne area, and replaces water diverted for use in the Bonneville Basin by the SACS.

The transbasin diversion of Bonneville Unit water is released from Strawberry Reservoir into the Diamond Fork System, consisting of a series of tunnels and pipelines that convey the water to Utah Lake for the Jordanelle Exchange, the proposed ULS System, and the Spanish Fork River.

With the summer 2004 startup of the Diamond Fork System, an average of 86,100 acre-feet per year of Bonneville Unit water is now being released through the Strawberry Tunnel, Syar Tunnel and Sixth Water Aqueduct and conveyed through the Diamond Fork System or through Sixth Water Creek and Diamond Fork Creek to the Spanish Fork River for delivery to Utah Lake. A portion of that amount plus return flows and Utah Lake water rights would make up an average of 84,510 acre-feet to be made available in Utah Lake in exchange for Provo River water that is stored in Jordanelle Reservoir (Jordanelle Exchange). This 84,510 acre-feet includes: 40,310 acre-feet of deliveries from Strawberry Reservoir, 9,660 acre-feet of project return flows, and 34,540 acre-feet of Utah Lake water rights. The remaining 1,590 acre-feet is M&I water already contracted for use by cities in southern Utah County.

Jordanelle Reservoir is the primary feature of the Bonneville Unit's M&I System. Water stored in the reservoir is released down the Provo River and conveyed through existing pipelines and tunnels to northern Utah County and Salt Lake County to meet M&I water needs.

Completion of the Bonneville Unit of the CUP would be achieved with construction and operation of ULS System described below. After the ULS System is operational, the entire Bonneville Unit transbasin diversion amount of 101,900 acre-feet annually will become available for use along the Wasatch Front.

Annual operation, maintenance, and replacement (OM&R) costs of the Bonneville Unit are estimated to be $10.74 million which consists of $4.77 million of Section 5 and $5.97 million of Section 8 costs.

Changes Authorized by CUPCA

CUPCA modified some of the six Bonneville Unit systems by adding or eliminating features. The most notable changes occurred to the I&D System in the 1988 plan for the Bonneville Unit.

The I&D System was reauthorized with changes, including the elimination of facilities to convey water from Utah Lake to the Mosida area, the draining of Benjamin Slough, and diking off Goshen Bay and Provo Bay in Utah Lake. CUPCA required the Main Conveyance Aqueduct to be constructed as a pipeline, instead of including reaches of open canals as previously proposed. Changes in the irrigation service area of the system were addressed in CUPCA.

The I&D System was replaced by the Spanish Fork Canyon-Nephi Irrigation System (SFN System) in 1995 when Sevier and Millard counties in the lower Sevier River Basin chose to withdraw from the District and were removed from the Bonneville Unit irrigation water service area. However, planning on the SFN System was discontinued in 1998 and the new planning process was initiated in 2000 on the ULS, as previously discussed. Thus, the I&D System has now been replaced by the ULS System, which is presented in this report.

CUPCA directed certain operational changes in the Diamond Fork System, and a subsequent reassessment of system alternatives led to a major reconfiguration of the system. CUPCA specified minimum flows in Sixth Water and Diamond Fork creeks, and authorized the Mitigation Commission to conduct a program of restoration and fishery enhancement. Under these imperatives the 1988 Bonneville Unit plan to construct a regulating reservoir on Diamond Fork Creek and to use sections of creek for conveyance of Strawberry Reservoir water was changed to essentially a continuous conduit from Strawberry Reservoir to Spanish Fork Canyon. This new plan, recently constructed, is described later in this report.

Additional Components Authorized by CUPCA

Besides providing direction for the completion of the six Bonneville Unit systems, CUPCA authorized other Bonneville Unit components that improve water management and wildlife habitats. These components are –

- Water Management Improvement Program
- Fish, Wildlife, and Recreation Mitigation and Enhancement
- Wasatch County Water Efficiency Project and Daniel Replacement Project
- Uinta Basin Replacement Project (UBRP)
- Local Development
- Ute Indian Water Rights Settlement
- Conjunctive Use of Surface Water and Groundwater
- Additional Studies of Utah Lake Salinity and Provo River Water Supply

Features Discontinued or Modified

As a result of legislation and the plan formulation process on the Bonneville Unit, several features that were part of the 1988 Definite Plan Report were deauthorized, discontinued, or modified. These include –

- Bjorkman Hollow dam
- Deep Creek pumping plant
- North Fork pumping plant
- Mosida pumping plant, canals, and laterals
- Draining Benjamin Slough
- Diking Goshen and Provo Bays
- Ute Indian Unit
- Leland Bench development
- Monks Hollow Dam and Reservoir;
- Last Chance Powerplant; and
- Pipeline to Sevier River drainage.

Bonneville Unit Purposes Served

The Bonneville Unit is a multipurpose unit. When completed, it will serve a variety of water-related purposes - irrigation, M&I use, fisheries enhancement, hydropower generation, flood control, wildlife enhancement, wetlands preservation, recreational opportunities, water conservation, and water quality improvements in Utah Lake, the Provo River, and Diamond Fork Creek, and fishery flows in the Uinta Basin. Some of these purposes are discussed in more detail in the following paragraphs.

Water Supply

The Bonneville Unit will annually provide a total water supply of 244,150 acre-feet. This water will be divided between irrigation use, M&I use, and fishery flows. Table 1-1 shows the proportions of water provided to different uses by the Bonneville Unit, including the UBRP.

TABLE 1-1
Water Provided by the Bonneville Unit
(acre-feet)

Purpose	Acre-feet
Permanent Supply	
Irrigation Water	42,000
M&I Water	157,750
Fishery Flows	44,400
Subtotal Permanent Supply	**244,150**
Temporary Supply	
Irrigation Water	20,000
TOTAL Permanent & Temporary Supply	**264,150**

Irrigation Water

The Bonneville Unit delivers an annual average of 42,000 acre-feet of irrigation water to agricultural areas in several counties. In addition it will provide a temporary water supply to south Utah County of 20,000 acre-feet. The locations and respective amounts delivered are shown in Table 1-2. All lands to be served have been certified as arable by the Secretary, including acreages related to UBRP for which certification was completed on March 24, 1998.

TABLE 1-2
Irrigation Water Provided by the Bonneville Unit
(Average Annual Amount)

Area	Acre-feet
Permanent Supply	
Wasatch County	12,100
Summit County	3,000
Duchesne County (Starvation)	24,400
UBRP – Duchesne and Uintah Counties (UBRP)	2,500
Subtotal Permanent Supply	**42,000**
Temporary Supply	
Irrigation Water	20,000
TOTAL Permanent & Temporary Supply	**62,000**

M&I Water

The Bonneville Unit will deliver an average of 157,750 acre-feet of M&I water annually to urbanized areas in several counties. The locations and respective amounts delivered are shown in Table 1-3. The amount shown for Duchesne County includes 3,000 acre-feet produced by UBRP.

Fishery Flows

The Bonneville Unit provides fishery flows in the amount of 44,400 acre-feet annually in the Uinta Basin, to be divided among the Strawberry River, the West Fork of the Duchesne River, and Currant and Rock Creeks. These fishery flows are provided in compliance with the 1980 Stream Flow Agreement and its Amendments.

TABLE 1-3 M&I Water Provided by the Bonneville Unit (average annual amount)	
Location	**Acre-feet**
Permanent Supply	
Duchesne County	3,500
Wasatch County	2,400
Northern Utah County	20,000
Salt Lake County	100,000
Southern Utah County	31,590
Strawberry Valley	260
Subtotal Permanent Supply	**157,750**
Temporary Supply	
None	0
TOTAL Permanent & Temporary Supply	**157,750**

THE ULS SYSTEM

The purpose of the ULS System is to distribute a portion of the water developed by the other parts of the Bonneville Unit to areas along the Wasatch Front. The ULS System provides the physical means of linking the operation of the other systems to make the overall management of the Bonneville Unit more efficient in meeting projected water needs. The system conveys water received from the Diamond Fork System to points of use in southern Utah County (including Hobble Creek) and to the Provo River and Provo Reservoir Canal in northern Utah County for delivery to Salt Lake County for M&I use.

ULS Pipelines

The ULS System includes the following pipelines, whose purposes are described in Chapter 5 of this report and in the Designs and Estimates Appendix:

- Spanish Fork Canyon Pipeline
- Spanish Fork-Santaquin Pipeline
- Santaquin-Mona Reservoir Pipeline
- Spanish Fork-Provo Reservoir Canal Pipeline
- Mapleton – Springville Lateral Pipeline

The Spanish Fork River Flow Control Structure, located at the terminal end of the Diamond Fork Pipeline, is a feature of the Utah Lake Drainage Basin Water Delivery System and has already been constructed. A description of this feature is included in Chapter 5.

ULS Powerplants

Two powerplants would be located in Diamond Fork Canyon at existing flow control structures of the Diamond Fork System. They are -

- Sixth Water Powerplant to be installed at the Sixth Water Flow Control Structure; and
- Upper Diamond Powerplant to be installed at the Upper Diamond Fork Flow Control Structure

The Sixth Water Powerplant would be of 45 megawatt (MW) capacity and the Upper Diamond Fork Powerplant would be of 5 MW capacity. Approximately 134,000,000 kilo-watt hours of electricity would be generated annually at Sixth Water Powerplant and about 31,000,000 kilo-watt hours of annual generation would be produced at the Upper Diamond Fork Powerplant.

The water supply for the hydro-powerplants would consist of transbasin releases from Strawberry Reservoir through the Diamond Fork System as scheduled to meet the ULS System and Strawberry Valley Project (SVP) water requirements. No releases would be made solely for hydropower generation.

Water Supply

The ULS System has a transbasin diversion of 101,900 acre-feet which consists of a delivery of – 30,000 acre-feet of M&I water to southern

Utah County; 1,590 acre-feet previously contracted to southern Utah County; 30,000 acre-feet of M&I water to Salt Lake County; and 40,310 acre-feet of M&I water to Utah Lake for exchange to Jordanelle Reservoir. Of the 40,310 acre-feet, about 16,273 acre-feet would be released down the Spanish Fork River, an average of 16,000 acre-feet would be conveyed through the Spanish Fork-Provo Reservoir Canal Pipeline for release to the lower Provo River and 8,037 acre-feet would be conveyed through the Mapleton-Springville Lateral Pipeline for release to Hobble Creek.

The allocations of 30,000 acre-feet of new CUP water each to southern Utah County and Salt Lake County were based on input received from public ULS System scoping meetings and subsequent evaluations of future needs.

District Utah Lake Water Rights

The District owns primary and secondary water rights in Utah Lake. Under the ULS System Proposed Action, the DOI would acquire all of the District's secondary rights amounting to approximately 57,000 acre-feet. These rights would yield at least 34,540 acre-feet annually and would be used to convert or exchange Utah Lake water to Jordanelle Reservoir under approved water rights used in conjunction with provisions of the State Engineer's Utah Lake Distribution Plan.

Conserved Water (Section 207 Funding)

Section 207 of CUPCA authorized a program of federal cost sharing for improvements to local water systems to conserve water. In some cases the enclosure of canals into pipelines would provide opportunities to include capacity for CUP water delivery. These include the Provo Reservoir Canal Enclosure, Mapleton-Springville Lateral Pipeline and numerous other smaller Section 207 projects. The cost for the Mapleton-Springville Lateral Pipeline is presented as part of the ULS System cost estimate. The Provo Reservoir Canal Enclosure is not a part of the ULS System but under a cost sharing arrangement the Department of the Interior could contribute 207 funding.

M&I Water Delivery

Salt Lake County. The ULS System will provide 30,000 acre-feet of ULS M&I water for use in Salt Lake County under contracts with the Jordan Valley Water Conservancy District (JVWCD), and the Metropolitan Water District of Salt Lake and Sandy (MWDSLS). The water would be conveyed to treatment plants in Salt Lake County through a combination of the existing Jordan Aqueduct and Provo Reservoir Canal (to be enclosed in pipe). The proposed ULS System's Spanish Fork–Provo Reservoir Canal Pipeline would deliver the water to the two aqueducts into Salt Lake County.

Southern Utah County. The ULS System will provide 30,000 acre-feet of ULS M&I water to southern Utah County under contract with the South Utah Valley Municipal Water Association (SUVMWA). The water would be delivered through the Spanish Fork–Santaquin Pipeline and the Mapleton–Springville Lateral Pipeline. 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 become part of the 12,037 acre-feet delivered to Hobble Creek to provide instream flows for June sucker spawning and rearing. This water would then be exchanged from Utah Lake to Jordanelle Reservoir.

SVP Irrigation Water Delivery

Up to 10,200 acre-feet of existing and future SVP irrigation water held by SUVMWA would be conveyed to southern Utah County through the new ULS System pipelines on a space-available basis. This water is part of the overall 61,000 acre-feet of SVP water available from Strawberry Reservoir. The balance of the SVP water supply would be 1) released through the Strawberry Tunnel and Syar Tunnel to Sixth Water and Diamond Fork creeks to provide minimum flows and continue in the Spanish Fork River, 2) released to the Spanish Fork

River, or 3) conveyed through the proposed Spanish Fork Canyon Pipeline to the Mapleton-Springville Lateral Pipeline.

1,590 AF from M&I System

Of the 1,590 acre-feet of Bonneville Unit water 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 as conserved water under section 207 and is part of the 12,037 acre-feet released to Hobble Creek.

Instream Flow Provisions

Diamond Fork. Approximately 16,273 acre-feet of Bonneville Unit water from Strawberry Reservoir would be released annually for in-stream flows in Sixth Water Creek and Diamond Fork Creek, mainly during the winter months. The water would continue down the Spanish Fork River to Utah Lake. This water is included in 40,310 acre-feet that would be delivered to Utah Lake for exchange to Jordanelle Reservoir.

Lower Provo River. Up to 16,000 acre-feet of Bonneville Unit water from Strawberry Reservoir would be delivered to the lower Provo River to assist in meeting the in-stream flow objectives of Section 303 (c) (4) of CUPCA, and would be subsequently exchanged from Utah Lake to Jordanelle Reservoir. This water would be delivered through the ULS System's 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.

CUPCA provides a goal to increase instream flows in the Provo River, stating in Section 303(c)(4) 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. The Act limits the purchases to willing sellers below Heber Valley. Toward this goal, CUPCA authorized $15 million in funds for acquiring up to 25,000 acre-feet of water rights in the Utah Lake Drainage Basin. Using such funding the District and Mitigation Commission have acquired irrigation company water shares representing about 3,300 acre-feet, which would allow such water to flow undiverted to Utah Lake.

ULS System M&I Water Demands

The computation of future water demands is 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, described below, and the availability of local groundwater supplies, surface water supplies, and conversion of water supplies from agricultural use. The documentation of the complete analysis of the M&I demands is contained in Volume 2 of the Water Supply Appendix to this Definite Plan Report.

Future M&I demands were 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 57,000 acre-feet of the District's secondary water rights in Utah Lake 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 and the Sandy City portion of the Metropolitan Water District of Salt Lake and Sandy, 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 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.

ULS Water Conservation Provisions

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 the baseline. The ULS target conservation goal builds on the State's water conservation goals, the CUPCA Water Conservation Credit Program, and the success of other municipalities. The joint-lead agencies for the ULS project will require agencies receiving M&I water through the ULS System to meet these goals, which will be incorporated into the water delivery contracts with the SUVMWA, JVWCD, and MWDSLS. Another contractual requirement for receiving Bonneville Unit M&I water is that requesting entities must develop and implement an acceptable water conservation plan.

ULS System Costs and Level of Detail

The implementation cost of the ULS System is estimated to be $470 million Based on October 2004 prices. The estimating effort completed for the Proposed Action is classified as a concept screening level estimate, or Class 5 estimate as defined by the Association for the Advancement of Cost Engineering International (AACEI). This class of estimate is typically prepared based on engineering design from 0% to 10% complete, and often with only the proposed type of system, location, and capacity known. The expected accuracy range is +/- 25% for this type of estimate. However, for the ULS Proposed Action the District and the U.S. Department of Interior assembled a blue-ribbon team to review the cost estimate. From this review, revisions

were made to the cost estimate that would provide an estimate with an accuracy significantly better than the +/- 25%.

Annual Operation, Maintenance and Replacement

Annual operation, maintenance, and replacement (OM&R) costs of the ULS System are estimated to be $2.35 million of which about $2.17 million is annual OM&R for the hydropower generating facilities and $0.18 million of annual OM&R for the pipelines.

The District would provide personnel and be responsible for daily O&M at the power plants and pipeline facilities. Western Area Power Administration would on an annual basis reimburse the District for the OM&R of the power plants.

Annual operation, maintenance and replacement costs (OM&R) for the Sixth Water and Upper Diamond Fork Powerplants was estimated based on a comparison to the Crystal Powerplant and the Lower Molina Powerplant. Crystal Powerplant is a part of the Bureau of Reclamation's Colorado River Storage Project and Lower Molina Powerplant is a part of the Bureau of Reclamation's Collbran Project. Specific information on the OM&R for these powerplants is presented in Chapter 4 and Chapter 5 respectively of the Power Appendix. The combined OM&R at Sixth Water and Upper Diamond Fork is estimated to be approximately 13.1 mils per kilowatt hour of energy generated.

EVALUATION OF THE BONNEVILLE UNIT

The economic and financial analyses of the Bonneville Unit include the benefit cost analysis, the project cost allocation, and the determination of repayment obligations.

Economic Analysis

The purpose of the economic analysis is to determine the economic justification for the Bonneville Unit, based on a comparison of monetary benefits and monetary costs. Not all benefits can be readily quantified. Those benefits that were effectively quantified are displayed in Table 1-4: Annual Monetary Project Benefits. The total annual monetary benefit of the Bonneville Unit is $148.2 million.

TABLE 1-4
Annual Monetary Project Benefits

Project Purpose Served	Benefit
Irrigation	$6,490,450
M&I Water	$105,018,156
Power	$7,481,656
Fish and Wildlife	$16,259,306
Recreation	$11,499,497
Flood Control	$1,417,282
Total	**$148,166,347**

The costs used in the economic analysis are: construction costs; interest during construction; operation, maintenance, and replacement (OM&R) costs; and the Bonneville Unit's prorated share of the cost of Colorado River reservoirs constructed under the Colorado River Storage Project Act of 1956 (CRSPA). The latter cost is used only for benefit cost comparison and does not affect repayment. Under the project planning interest rate (3.125 percent), the total cost of the Bonneville Unit (for benefit cost analysis) converts to an annual equivalent of $116.5 million. The costs used for the economic analysis are shown in Chapter 9 of this report.

The final step of the economic analysis is the comparison of benefits with costs. The benefit cost ratio is a comparison of the annual project benefits and annual costs made by dividing the benefits by the costs. When the project planning interest rate is applied, the benefit cost ratio for the Bonneville Unit is 1.27. As required under Section 205 (e) of CUPCA, Chapter 9 includes a

benefit cost evaluation based on the Water Resource Council's *Principles and Guidelines*.

Financial Analysis

The financial analysis allocates costs among project purposes and determines the repayment obligations as required by CRSPA and CUPCA. Consistent application of the Use of Facilities method of cost allocation, prescribed by the Comptroller General as required under Section 211 of CUPCA, resulted in the allocation of project cost shown in Table 1-5: Summary of Local Cost Share and Federal Obligation.

There is no repayment obligation associated with costs allocated to the following project purposes: fish and wildlife; flood control; highway improvement; and irrigation (interest during construction). Reimbursable project purposes require repayment of costs to the federal treasury. Reimbursable purposes are: irrigation (construction); M&I; and power. Section 204 of CUPCA requires the District to pay a local cost share of all costs authorized under CUPCA and allocated to reimbursable purposes. Table 1-5 displays the local cost share requirements for irrigation, M&I and power.

The following summarizes the determination of the repayment obligations for irrigation, M&I, and power.

Irrigation Repayment

Costs allocated to irrigation are subject to a 50-year repayment period at no interest. Of the irrigation repayment obligation, irrigators are only obligated to repay the amount that is equal to their ability to pay, which under the Bonneville Unit is $9.9 million. Under CRSPA, the amount in excess of the irrigators' ability to pay is repaid from CRSP power sales. Under this allocation, the CRSP power users' obligation is $282.6 million.

M&I Repayment

Under the Water Supply Act, costs allocated to M&I are generally subject to a repayment period of 50 years at the project repayment rate of 3.222 percent. For repayment purposes, Bonneville Unit M&I costs are divided into three parts: costs under the existing repayment contracts; ULS costs; and UBRP costs.

Costs under existing repayment contracts are tied to 94,750 acre-feet of the M&I water supply. The Section 211 deferral ($96.7 million) applies to these costs; hence, the District is not responsible for repayment of the entire amount allocated but is obligated to repay $560.6 million. Also, the District's prepayment of Jordan Aqueduct costs applies to these costs. After deduction of the Jordan Aqueduct prepayment, the final obligation is $495.7 million, which results in an annual payment of $205.39 per acre-foot under a 50-year amortization.

The ULS M&I costs are associated with the ULS water supply (60,000 acre-feet of the M&I water supply). The Section 211 deferral does not apply to these costs. Based on a final allocation to this block of water of $416.3 million, the annual payment is $272.33 under a 50-year amortization.

The UBRP M&I costs are linked to the UBRP M&I water supply of 3,000 acre-feet. This water will be provided under an existing water service contract (Supplement No. 2 to Contract No. 14-06-400-4286, dated November 15, 2001). The water service contract obligation may be converted to a repayment obligation. If the District elects to convert, that conversion would likely take place on terms and rates similar to the ULS obligation (with potential crediting of funds remitted under the water service agreement).

Table 1-5:
Summary of Local Cost Share and Federal Share

	Construction	IDC	Total Investment (Construction + IDC)	Local Cost Share	Net Investment (Total Investment - Local Cost Share)	Statutory and/or Other Adjustments	Reimbursable Net Investment	Non-Reimbursable Net Investment
Section 5 Costs								
Flood Control	$39,736,976	$11,326,321	$51,063,298	$0	$51,063,298	$0	$0	$51,063,298
Fish and Wildlife	$700,231,251	$120,933,683	$821,164,934	$0	$821,164,934	$0	$0	$821,164,934
Highway Improvement	$66,115,000	$20,420,113	$86,535,113	$0	$86,535,113	$0	$0	$86,535,113
Irrigation IDC	$0	$35,477,238	$35,477,238	$0	$35,477,238	$0	$0	$35,477,238
Irrigation Construction	$356,924,313	$0	$356,924,313	$48,214,831	$308,709,482	$9,696,772	$299,012,710	$0
M&I	$1,131,463,952	$145,738,999	$1,277,202,951	$172,060,375	$1,105,142,576	$10,740,000	$1,094,402,576	$0
Power	$138,728,494	$22,247,488	$160,975,981	$15,524,980	$145,451,002	$12,596,000	$132,855,002	$0
Sub-Total - Section 5:	**$2,433,199,986**	**$356,143,842**	**$2,789,343,828**	**$235,800,185**	**$2,553,543,643**	**$33,032,772**	**$1,526,270,288**	**$994,240,583**
Section 8 Costs								
Fish and Wildlife	$451,142,767	$0	$451,142,767	$0	$451,142,767	$0	$0	$451,142,767
Recreation	$66,200,400	$0	$66,200,400	$0	$66,200,400	$0	$0	$66,200,400
Sub-Total - Section 8:	**$517,343,167**	**$0**	**$517,343,167**	**$0**	**$517,343,167**	**$0**	**$0**	**$517,343,167**
Total - Sections 5 and 8:	$2,950,543,153	$356,143,842	$3,306,685,995	$235,800,185	$3,070,886,810	$33,032,772	$1,526,270,288	$1,511,583,750

Power Repayment

In this financial analysis, the modified Use of Facilities approach to power costs limits the allocation to power to the total expected revenue and credits for power from all sources. The result is $138.7 million allocated to power, as shown in the Financial and Economic Appendix which is a supporting document for the 2004 DPR Supplement. When amortized over 50 years at 3.222 percent, the annual repayment obligation for power is about $5.4 million annually. Of this amount, $115,000 will come from Jordanelle Lease of Power Privilege revenues and $5.3 million will come from sales of power (at approximately 45 mills per kilowatt-hour). These payments will be deposited in the Upper Colorado River Basin Fund as a credit to the Bonneville Unit.

CONTRACTS AND AGREEMENTS

Numerous contracts and agreements with federal, state, and local agencies are needed to construct and operate facilities and to reimburse federal and local funding. The repayment of federal funding for Bonneville Unit facilities completed or presently approved for construction is covered under existing contracts. Facilities yet to be built will be covered under agreements currently being negotiated or scheduled for future negotiation.

Table 1-6 summarizes the ULS System contracts and agreements.

TABLE 1-6
Contracts and Agreements Needed by District for the ULS System Proposed Action

Contract or Agreement	Purpose
Repayment Contract between DOI and District for M&I water (Contract No. 04-WC-40-120)	To repay the reimbursable construction costs of project features to the federal government. associated with 60,000 acre-feet of M&I water
M&I water petition between District and JVWCD and approved by DOI (Contract No. 04-WC-40-140)	To govern the sale of ULS M&I water to Jordan Valley Water Conservancy District associated with 21,400 acre-feet of M&I water
M&I water petition between District and MWD and approved by DOI (Contract No. WC-40-150)	To govern the sale of ULS M&I water to Metropolitan Water District of Salt Lake and Sandy associated with 8,600 acre-feet of M&I water
M&I water petition between District and SUVMWA and approved by DOI (Contract No. 04-WC-40-160)	To govern the sale of ULS M&I water to South Utah Valley Municipal Water Association for 30,000 acre-feet of M&I water
Project Water Contract between DOI and the District for Utah Lake water (Contract No. 04-WC-40-170)	To provide for the acquisition of District Utah Lake water rights by DOI
Master construction agreement among UDOT, DOI, and District for Spanish Fork Canyon Pipeline	To provide for construction of ULS features along highways and roads controlled by Utah Department of Transportation
Funding agreement under the Drainage and Minor Construction Act (D&MC) program guidelines between DOI and the District for Spanish Fork Canyon Pipeline (Contract No. 04-WC-40-180).	To provide federal funding and local cost sharing under which the District would construct the Spanish Fork Canyon Pipeline
Funding agreement under D&MC guidelines between DOI and the District for Spanish Fork–Santaquin Pipeline (Contract No. 04-WC-40-190)	To provide federal funding and local cost sharing under which the District would construct the Spanish Fork–Santaquin Pipeline
Funding agreement under D&MC guidelines among DOI, Mitigation Commission and the District for the Spanish Fork–Provo Reservoir Canal Pipeline (Contract No. 04-WC-40-200)	To provide federal funding and local cost sharing under which the District would construct the Spanish Fork–Provo Reservoir Canal Pipeline and conveyance of various water supplies for delivery to users and lower Provo River
Funding agreement under D&MC guidelines among DOI, Mitigation Commission, and District for the Santaquin-Mona Pipeline	To provide federal funding and local cost-sharing under which the District would construct the Santaquin-Mona Pipeline and conveyance of JSRIP water supplies to Mona Reservoir
Cooperative Agreement between Mitigation Commission and the District for Spanish Fork–Provo Reservoir Canal Pipeline (Agreement No. 04-FC-UT-1170).	To provide transfer of Section 8 funds from the Mitigation Commission to the District to construct the Spanish Fork–Provo Reservoir Canal Pipeline
Implementation agreement among DOI, District, Mitigation Commission , Spanish Fork Canyon and Spanish Fork – Provo Reservoir Canal pipelines. (WS-04-140)	To provide for the funding arrangements for the construction of the Spanish Fork – Provo Reservoir Canal pipelines.
Implementation Agreement among DOI, District, Reclamation, and Springville and Mapleton Irrigation Districts, SUVMWA and Springville/Mapleton Cities for the Springville-Mapleton Pipeline. (Contract No. WS-04-150)	To provide for replacement of the Springville–Mapleton lateral with the Springville Mapleton Pipeline, necessary rights of way to construct the pipeline, various water deliveries, and conserved water provided for in-stream flows
Funding agreement under D&MC guidelines between DOI and the District for Springville–Mapleton Pipeline	To provide federal funding and local cost sharing under which the District would construct the

TABLE 1-6
Contracts and Agreements Needed by District for the ULS System Proposed Action

Contract or Agreement	Purpose
(Contract 04-WC-40-250).	Springville-Mapleton Pipeline
Section 207 agreement between DOI and District for Springville-Mapleton Pipeline (Contract No. WS-04-160).	To provide a federal grant and local cost sharing under which the District would construct the Springville-Mapleton Pipeline
Section 207 agreement between DOI and District (WS-04-170)	To provide a federal grant and local cost sharing under which the District would construct Section 207 Water Conservation Measures and provide 8,000 acre-feet of conserved water for in-stream flows
Funding agreement under D&MC guidelines between DOI and the District for Diamond Fork Power Facilities	To provide federal funding and local cost sharing under which the District would construct the Diamond Fork Power Facilities
Power contracts among Western Area Power Administration, DOI, Reclamation, and District	To provide for the sale of project power and Operation and Maintenance of project power facilities.
Public Land Order for withdrawal of National Forest System lands by BLM	To withdraw National Forest System lands for construction, operation and maintenance of ULS project features, by application to the Bureau of Land Management
Memorandum of Agreement with the State Historic Preservation Officer	To provide for documentation and conservation of any cultural resources encountered during construction
Warranty deeds	To acquire permanent rights-of-way for ULS features
Easement agreements	To provide temporary easements for construction activities
Construction crossing agreements with Union Pacific Railroad	To provide for construction crossings under Union Pacific Railroad tracks
Warren Act Contract among DOI, District, and SUVMWA (04-WC-40-230)	To provide authorization whereby SUVMWA could convey up to 10,200 acre-feet of SVP water through CUP facilities
Water Service contract between DOI and District for temporary irrigation water.	To provide supplemental irrigation water in southern Utah County until 2030.

CENTRAL UTAH PROJECT COMPLETION PROGRAM

Chapter 2

October 2004

LOCATION AND SETTING

The Bonneville Unit is located in central and northeastern Utah and provides water in the following counties: Salt Lake, Utah, Wasatch, Summit, and Duchesne.

Bonneville Unit water is developed by collecting and storing excess flows of several streams (principally tributaries of the Duchesne River), purchasing water rights and using part of the existing water supply in Utah Lake, and using project return flows and high flows entering Utah Lake.

The Bonneville Unit includes features that facilitate a transbasin diversion of water from the Uinta Basin to the Bonneville Basin and development of local water resources in both basins. The Bonneville Unit water supply will be used for municipal and industrial (M&I) purposes and irrigation in both basins, to provide sufficient instream flow to maintain fisheries in various streams within the Bonneville Unit area, and to provide flood control, recreation, project power, and fish and wildlife habitat improvements.

BONNEVILLE UNIT COMPONENTS

For convenience in planning, the Bonneville Unit was originally divided into six systems according to location and function. These six systems are (1) the Starvation Collection System, located in the Uinta Basin; (2) the Strawberry Aqueduct and Collection System, located in the Uinta Basin; (3) the Municipal and Industrial System (M&I System), located in the Provo River basin; (4) the Ute Indian Tribal Development, located in the Duchesne River basin; (5) the Diamond Fork Power System, located in Diamond Fork Canyon; and (6) the ULS System.

Changes Authorized By CUPCA

CUPCA modified the authorization for the Central Utah Project with various new provisions including the following:

- Increased the authorized cost ceiling;
- Required minimum streamflows for Diamond Fork Creek and Sixth Water Creek, which increase flow during the non-irrigation season;
- Excluded certain features;
- Authorized the ULS System as an M&I alternative to the I&D System if delivery of water to the Sevier River Basin was not included in the development plan;
- Authorized federal funds for project power generation; and
- Authorized water conservation as a project purpose including water recycling and reverse osmosis treatment.

Additional CUPCA Components

In addition to providing direction for the completion of the six original Bonneville Unit systems, CUPCA has authorized other Bonneville Unit components that improve water management and wildlife habitats in the Bonneville Unit. These components are discussed later in this Chapter.

Map 2-1 on next page shows the components of the Bonneville Unit. Table 2-1 contains a summary of the various elements of the Bonneville Unit components.

DESCRIPTION OF CURRENT SYSTEMS AND OTHER COMPONENTS

Starvation Collection System

The Starvation Collection System was completed in 1970. The system provides water for irrigation and M&I use, 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.

Map 2-1
Bonneville Unit Components

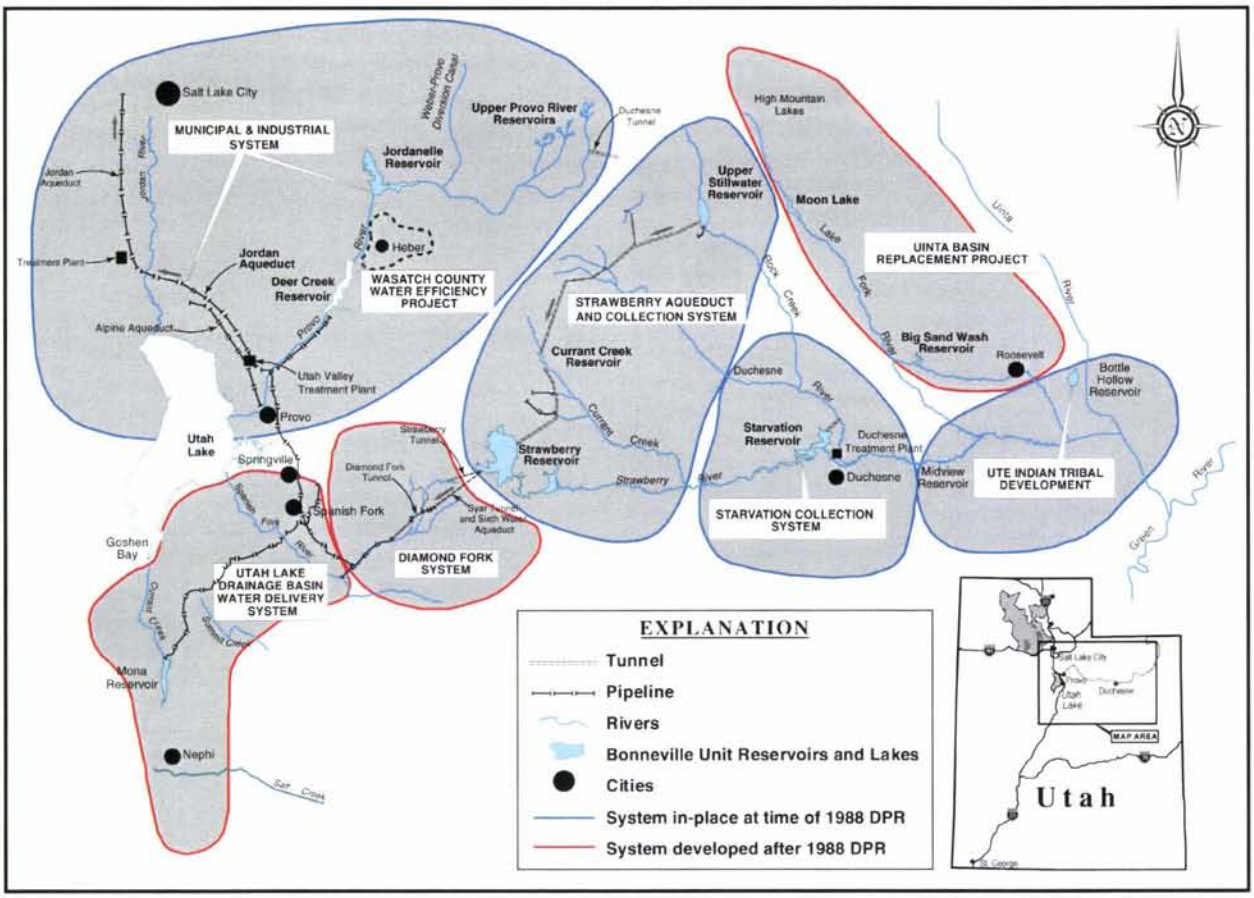


TABLE 2-1
Summary of Bonneville Unit Features

System/Feature	Purpose-Description
Starvation Collection System	
Knight Diversion Dam	Diverts water from the Duchesne River to the Starvation Feeder Conduit. *Diversion capacity: 300 cubic-feet per second (cfs)*
Starvation Feeder Conduit	Conveys water by pipeline and tunnel from Knight Diversion to Starvation Reservoir. *Length: 1.7miles; capacity: 300 cfs*
Taylor Canal Area Drains	Drainage system for Myton Bench in the Duchesne area. Part of the system was constructed, but the remainder is not needed because sprinkler irrigation has alleviated drainage problems.
Duchesne River Area Canal Rehabilitation Program	Prevents significant water shortages by reducing or eliminating canal seepage losses. The program includes either replacing canals with pipeline or lining canals with clay or concrete. *Length: 40.9 miles; conserved water: 14,000 acre-feet per year.*
Starvation Reservoir	Develops irrigation and M&I water by capturing winter and springtime surplus flows of the Strawberry and Duchesne Rivers; located on the Strawberry River. *Total capacity: 167,310 acre-feet; active capacity: 152,330 acre-feet*
Strawberry Aqueduct and Collection System	
Upper Stillwater Reservoir	Provides short-term storage on Rock Creek to supply water for Strawberry Aqueduct and fisheries enhancement through reservoir fishers and instream flow below the dam. *Total capacity: 32,009 acre-feet; active capacity: 29,884 acre-feet*
Currant Creek Reservoir	Diverts unregulated flows of Currant Creek and five of its smaller tributary streams to the Strawberry Aqueduct. The reservoir serves as a regulat-ing reservoir for the Strawberry Aqueduct flows that flow through the reservoir. The reservoir has very little active storage capacity as the water level only fluctuates 4 feet. *Total capacity: 15,671 acre-feet; active capacity: 1,118 acre-feet; and 14,553 acre-feet (inactive capacity); diversion capacity to Strawberry Aqueduct: 620 cfs*
Strawberry Reservoir and Soldier Creek Dam	Provides long-term storage for the Bonneville Unit. The reservoir is located on the Strawberry River and receives water from Strawberry Aqueduct, Strawberry River, and other tributaries. *Total capacity: 1,106,500 acre-feet; active capacity: 951,360 acre-feet.*
Strawberry Aqueduct	Receives water from the West Fork of the Duchesne River and Rock, South Fork Rock, Hades, Wolf, Currant, Layout, and Water Hollow Creeks. Conveys an average of 105,500 acre-feet per year to Strawberry Reservoir. *Length: 36.8 miles; capacity: 285 to 620 cfs*
Municipal and Industrial System	
Jordanelle Reservoir	Provides M&I water for Salt Lake, Utah, and Wasatch Counties; located on the Provo River above Heber City. Contributes to instream flow needs on the Provo River and for the June sucker Recovery Imple-mentation Program. *Total capacity: 363,354 acre-feet; active capacity: 314,006 acre-feet, (49,348 acre-feet of exclusive flood control capacity)*
Alpine Aqueduct	Conveys water from the Provo River to northern Utah Co. metropolitan areas. *Length: 14 miles; capacity: 450 to 87.5 cfs Consists of reaches Alpine 1, Alpine 2, and Alpine 3.*

TABLE 2-1
Summary of Bonneville Unit Features

System/Feature	Purpose-Description
Jordan Aqueduct	Conveys water from the Provo River to Salt Lake County. *Length: 38 miles; diameter: 78" to 48" Capacity = 270 cfs*
Upper Provo River Reservoir Modification	Restores 15 small reservoirs in the Provo River headwaters (three for water supply storage and 12 for wildlife and recreation values).
Olmsted Diversion and Flowline	Consists of the rehabilitation of diversion dam, intake screen, pipeline and tunnel. *1. Diversion Dam and intake structure* - Capacity = 450 cfs; *2. Pipeline* – 4.5 miles in length, diameter 10.5 feet to 8.5 feet with a capacity of 450 cfs; *3. Tunnel* – 0.94 miles, diameter of 10.5 feet, flow capacity of 450 cfs.
Ute Indian Tribal Development	
Bottle Hollow Reservoir	Constructed on Indian lands near Fort Duchesne to help compensate the Ute Tribe for economic, fishing, and recreation losses on Rock Creek. The reservoir is used for fishing, wildlife, and recreational purposes and receives water from the Uintah River through the Indian Bench Canal. Capacity: 11,100 acre-feet; surface area: 420 acres
Midview Reservoir Exchange	As part of mitigation for the losses of tribal resources caused by the Bonneville Unit, the operation and maintenance of the recreational, fishery, and wildlife resources of Midview Reservoir were transferred to the Ute Indian Tribe in 1968, with storage rights in the reservoir sufficient to maintain a 1,500 acre-ft minimum conservation pool for fisheries.
Duchesne River Wetlands Mitigation Project	The project would create, restore and otherwise enhance riparian wetlands habitat on approx. 7,790 acres of land along the Duchesne River corridor. The project would involve a variety of restoration measures including re-watering 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, removing non-native invasive species and changing management areas adjacent to wetlands to benefit wildlife.
Ute Indian Water Right Settlement	Under Title V of CUPCA, the Dept. of Interior has an on-going work effort to reach a settlement with the Tribe on their water right claims.
Diamond Fork System	
Syar Tunnel and Inlet Portal	Conveys water from Strawberry Reservoir to Sixth Water Aqueduct. The inlet portal extends 2,435 feet into Strawberry Reservoir. Tunnel dimensions are - Length: 30,100 feet; capacity: 800 to 660 cfs, depending upon Strawberry Reservoir water levels.
Sixth Water Aqueduct (pipeline, shaft and flow control structure)	The aqueduct connects Syar Tunnel to a pipeline leading to the Sixth Water Flow Control Structure. The pipeline is 4,224 feet in length with a diameter of 96 inches and a capacity of 800 cfs. The Sixth Water Shaft is 575 feet in length; a diameter of 102 inches and a capacity of 800 cfs
Sixth Water Connection to Tanner Ridge Tunnel	This connection conveys water by gravity flow from the existing Sixth Water Flow Control structure at the end of Sixth Water Aqueduct to the Tanner Ridge Tunnel. *Length & Diameter: 100 feet box culvert 12 foot wide and a 50 foot shaft of 240 inch diameter: Capacity of connection: 660 cfs*

TABLE 2-1
Summary of Bonneville Unit Features

System/Feature	Purpose-Description
Tanner Ridge Tunnel	The tunnel conveys water through Tanner Ridge, which lies between Sixth Water Canyon and Diamond Fork Canyon. *Length: 5,234 feet; Diameter: 126 inches; Capacity: 660 cfs*
Upper Diamond Fork Pipeline	This pipeline connects the Tanner Ridge Tunnel with the Upper Diamond Fork Flow Control Structure. *Length: 5,485 feet; Diameter: 96 inches; Capacity: 660 cfs*
Upper Diamond Fork Flow Control Structure	This structure consists of 2 sleeve valves and associated piping. *Length: 100 feet; Diameter: Two – 54 inch; Capacity 660 cfs,*
Diamond Fork Vortex Shafts	The Diamond Fork Shafts consist of three vertical shafts – each 187.5 feet deep and 78 inches in diameter. One shaft is for venting and two for conveying a combined flow of 660 cfs.
Aeration Chamber and Connection to Upper Diamond Fork Tunnel	The chamber extends from the bottom of the Diamond Fork Shafts to the Upper Diamond Fork Tunnel. Length: 148 feet; The initial cross section is 16' x 16' transitioning to 10.5' x 10.5'. It connects to the Upper Diamond Fork Tunnel via a 126-inch diameter tunnel segment with a capacity of 660 cfs.
Upper Diamond Fork Tunnel	This tunnel conveys water from the Upper Diamond Fork Flow Control Structure to the Monks Hollow Overflow Structure, *Length: 13,114 feet; Diameter: 126 inches; Capacity; 660 cfs*
Monks Hollow Overflow Structure	This structure is located at the Upper Diamond Fork Tunnel outlet portal and connects to the Diamond Fork Creek Outlet. *Length: 40 feet; Diameter: 96 inches; Capacity: 660 cfs*
Diamond Fork Creek Outlet	Diamond Fork Creek Outlet consists of a concrete pipeline from the Monks Hollow Overflow Structure to an energy dissipation structure discharging to a 350-foot long open channel tributary to Diamond Fork Creek. *Length: 1,500 feet; Diameter: 84 inches; Capacity: 660 cfs.*
Diamond Fork Pipeline Extension	This pipeline extension connects the Upper Diamond Fork Tunnel to the upstream end of the Diamond Fork Pipeline. *Length: 6,364 feet: Diameter: 96 inches; Capacity: 560 cfs*
Diamond Fork Pipeline	Conveys Bonneville Unit water from the end of the Diamond Fork Pipeline Extension to the Spanish Fork River Flow Control Structure where it will connect to the Spanish Fork Canyon Pipeline of the ULS. Water conveyed in the pipeline reduces the flow in Diamond Fork Creek, providing an opportunity for restoration of aquatic and riparian habitat along Diamond Fork Creek. *Length: 35,643 feet; diameter: 96 inches; capacity: 560 cfs*
Utah Lake Drainage Basin Water Delivery System	
Sixth Water Power Facility	Will produce commercial power for sale by Western Area Power Administration. The plant will have an installed capacity of 45 megawatts with a 138 KV underground transmission line of 12.9 miles.
Upper Diamond Fork Power Facility	Will produce commercial power for sale by Western Area Power Administration. The plant will have an installed capacity of 5 megawatts with an existing 25 KV transmission line of 1.6 miles in length.
Spanish Fork River Flow Control Structure	Main elements include: (1) an extension of the Diamond Fork Pipeline of approximately 1200 feet of 96-inch diameter steel pipe; (2) a

TABLE 2-1
Summary of Bonneville Unit Features

System/Feature	Purpose-Description
	reinforced concrete flow control structure, consisting of the valve operator vault, control building, and sleeve valve vault; (3) associated piping and appurtenances, including two 42-inch sleeve valves, two 48-inch spherical valves, two flow meters, and two stainless steel vault liners; and (4) discharge weir structure to convey 560 cfs maximum flow into Diamond Fork Creek. This structure spans approximately 65 feet.
Spanish Fork Canyon Pipeline	Will convey Bonneville Unit water from the outlet of the Diamond Fork Pipeline (located at the mouth of Diamond Fork Canyon) to the mouth of Spanish Fork Canyon. The pipeline length is 7.0 miles with a capacity of 365 cfs.
Spanish Fork – Santaquin Pipeline	Will convey Bonneville Unit water from the terminus of the Spanish Fork Canyon pipeline at the mouth of Spanish Fork Canyon to the city of Santaquin in southern Utah County. The pipeline will be 17.5 miles in length and have a capacity of 120 to 50 cfs.
Santaquin – Mona Reservoir Pipeline	Will convey water from the terminus of the Spanish Fork – Santquin Pipeline to Mona Reservoir located in Juab County. The pipeline is 7.5 miles in length and diameter of 24 inches with a capacity of 20 cfs.
Mapleton – Springville Lateral Pipeline	Will convey Bonneville Unit water from the terminus of the Spanish Fork Canyon Pipeline (located at the mouth of Spanish Fork Canyon) to Hobble Creek Canyon. The pipeline is 5.7 miles in length and has a capacity of 125 cfs.
Spanish Fork – Provo Reservoir Canal Pipeline	Will convey Bonneville Unit water from a turnout at the terminus of the Spanish Fork Canyon pipeline to the a point near the head of the Provo Reservoir Canal at the mouth of Provo Canyon. The pipeline will be 19.7 miles in length and will have a capacity of 120 to 90 cfs.
Utah County Section 207 Projects	Features that could potentially be constructed under Section 207 funding include the Provo Reservoir Canal Enclosure, Mapleton-Springville Lateral Piping and/or other Section 207 projects. The cost for the Mapleton-Springville Lateral Pipeline is presented as part of the ULS System cost estimate. The Provo Reservoir Canal Enclosure is not a part of the ULS System but under a cost sharing arrangement the Federal government could contribute up to 65 percent of the construction of the project with this cost being reflected in the financial and economic analyses along with the other remaining Section 207 projects.

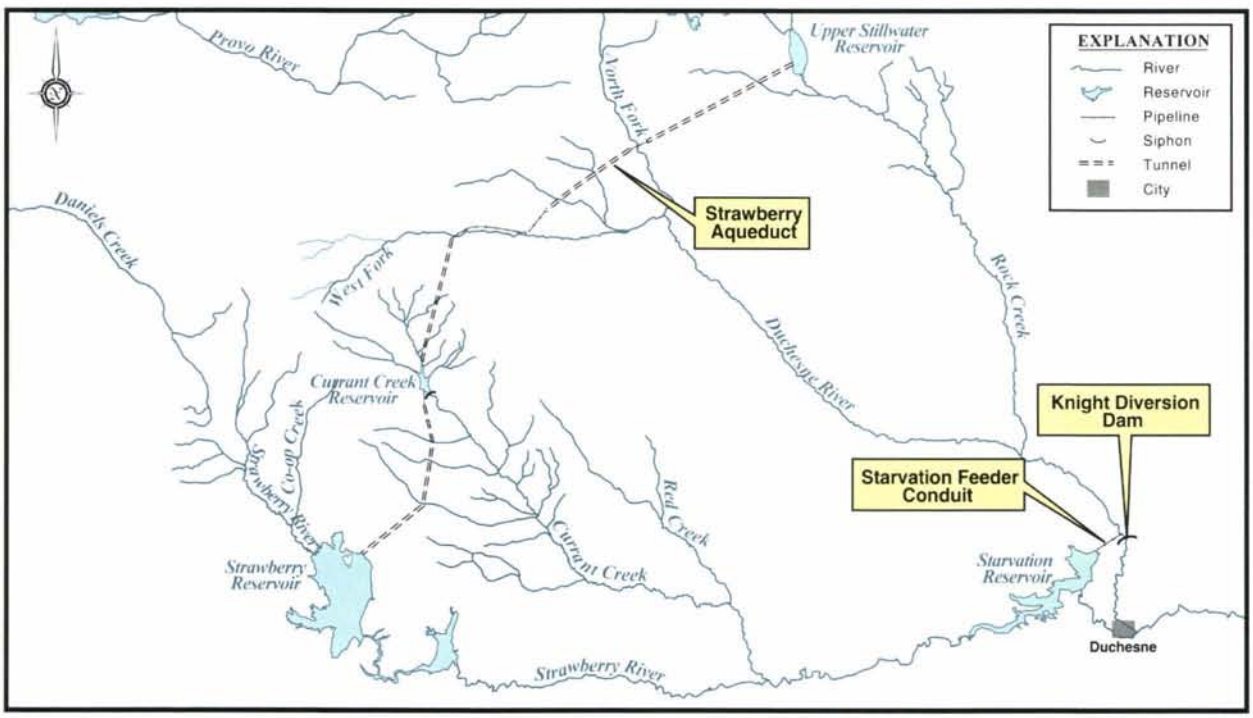
Starvation Reservoir provides a benefit to irrigators along the Duchesne River in the form of water delivery in the late summer and fall when streamflows typically decline below the levels needed for irrigation diversion. Water stored in Starvation Reservoir provides 24,400 acre-feet of irrigation water and 500 acre-feet of M&I water for use in the Uinta Basin. Starvation Reservoir (see Map 2-2) provides an average of approximately 43,000 acre-feet of water annually to irrigators to replace water diverted in the Strawberry Aqueduct and Collection System to Strawberry Reservoir. The reservoir provides fishery benefits and public recreation.

Strawberry Aqueduct and Collection System

The Strawberry Aqueduct and Collection System (SACS) (see Map 2-2), completed in the late 1980s, diverts part of the flows 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. Upper Stillwater

Reservoir, with a capacity of 32,009 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 15,671 acre-feet, diverts Currant Creek and five tributaries into the Strawberry Aqueduct. The SACS provides 44,400 acre-feet of in-stream flows for fishery mitigation purposes annually. The capacity of Strawberry Reservoir was enlarged from 273,000 acre-feet to 1,106,500 acre-feet by the construction of Soldier Creek Dam on the Strawberry River. Some of the water stored in the reservoir is released to the Strawberry River to provide fishery flows, but most of the stored water is for transbasin diversion to the Bonneville Basin. In addition to water supply, the SACS provides flood control, recreation, and fish and wildlife benefits.

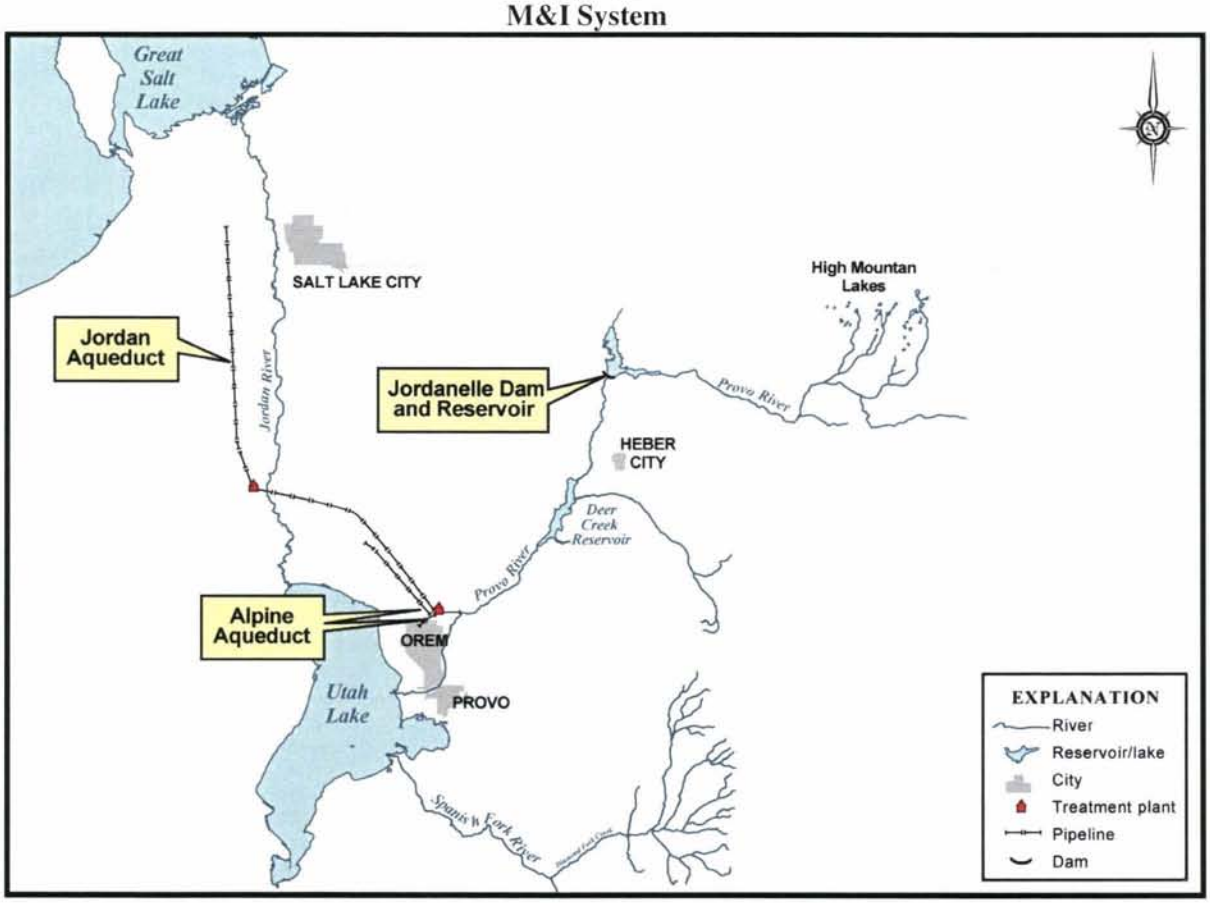
Map 2-2
Starvation and Strawberry Collection Systems



Municipal and Industrial (M&I) System

The Bonneville Unit M&I System (see Map 2-3) provides M&I 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 is the major feature of the M&I System. The 300-foot-high dam located on the Provo River about 6 miles north of Heber City was completed in April 1994. The reservoir has a total capacity of 363,354 acre-feet. Provo River flow that historically flowed into Utah Lake is stored in Jordanelle Reservoir and in Deer Creek Reservoir. Utah Lake water originating from the Provo River would be replaced by Bonneville Unit return flows to the lake, water rights previously acquired by the District in Utah Lake, direct releases of water from Strawberry Reservoir to Utah Lake, and flows that are surplus to Utah Lake rights. 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 or diverted under direct flow water rights and then re-diverted from the Provo River into the Olmsted Flowline. From this diversion, 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 is released from Jordanelle Reservoir for delivery through local irrigation canals, current secondary M&I systems, and a future M&I treated water system. Water for use in Summit County is provided from Washington, Trial, and Lost lakes in the headwaters of the Provo River or directly from the Provo River, both facilitated through an exchange with storage in Jordanelle Reservoir.

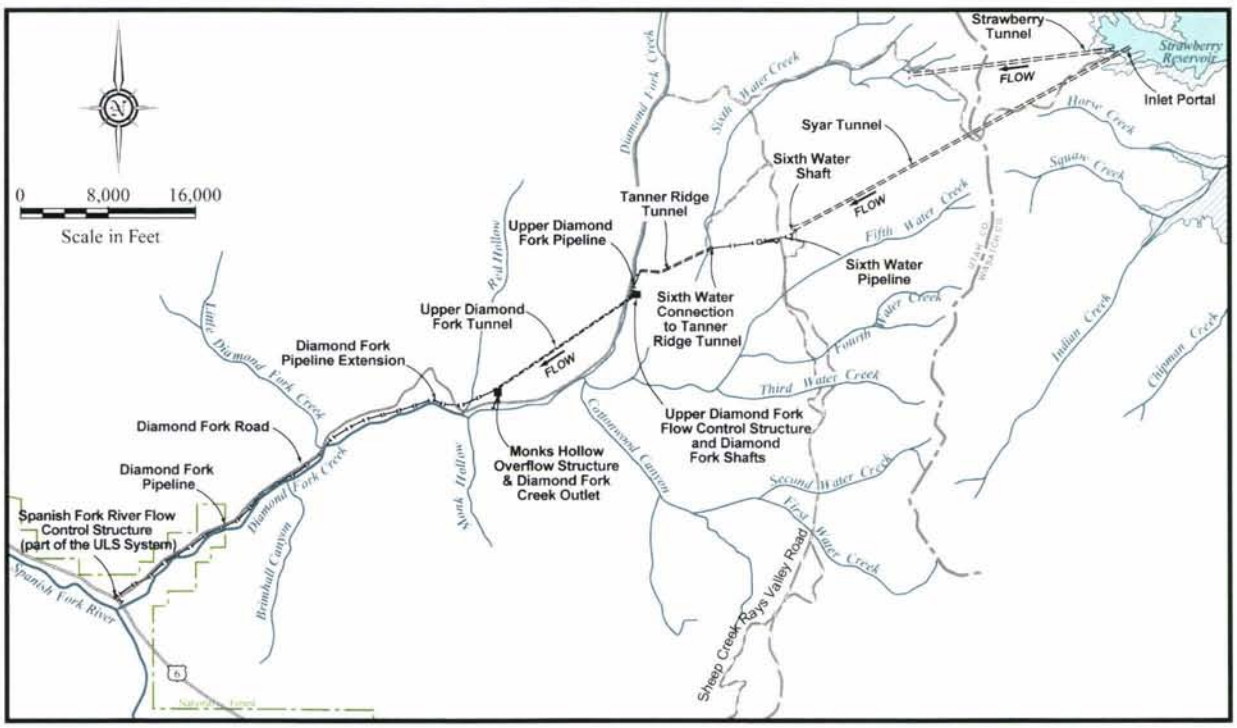
Map 2-3
M&I System



Diamond Fork System

The Diamond Fork System (see Map 2-4) will allow for the transbasin diversion of Bonneville Unit water from Strawberry Reservoir in the Colorado River drainage basin to Spanish Fork Canyon in the Bonneville Basin. The Diamond Fork System will protect the Diamond Fork Creek and Sixth Water Creek riparian areas from damaging high flows. The Diamond Fork System has been constructed in three primary phases. The U.S. Bureau of Reclamation (Reclamation) constructed the first phase; the District constructed the second and third phases under the CUPCA. The first phase included the Syar Tunnel Inlet, Syar Tunnel, Sixth Water Aqueduct, and Sixth Water Flow Control Structure, which together form a continuous 7.3-mile conduit from Strawberry Reservoir to Sixth Water Creek and currently discharges water into Sixth Water Creek. The second phase included the Diamond Fork Pipeline from Monks Hollow downstream to the mouth of Diamond Fork Creek. The third phase, now completed, consists of a tunnel connection to the Sixth Water Shaft and Flow Control Structure, Tanner Ridge Tunnel, Upper Diamond Fork Pipeline, Upper Diamond Fork Flow Control Structure, connection to Upper Diamond Fork Tunnel, Upper Diamond Fork Tunnel, and connection to the Diamond Fork Pipeline. Flow control structures are located at Sixth Water Creek, Upper Diamond Fork Creek, and at Monks Hollow. The 19.8-mile-long conduit will convey Bonneville Unit water and Strawberry Valley Project (SVP) water to the mouth of Diamond Fork Canyon. The Diamond Fork System will remove a portion of the SVP irrigation flows that were historically conveyed down Sixth Water Creek and Diamond Fork Creek. In-stream flows specified in CUPCA will be released into Sixth Water Creek and lower Diamond Fork Creek as part of an effort to enhance fisheries in these streams.

Map 2-4
Diamond Fork System



ULS System

The ULS System (see Map 2-5 on next page) would include the following features:

1) Sixth Water Powerplant and Transmission Line,
2) Upper Diamond Fork Powerplant and Underground Transmission Cable,
3) Spanish Fork River Flow Control Structure (already constructed),
4) Spanish Fork Canyon Pipeline,
5) Spanish Fork–Santaquin Pipeline,
6) Santaquin–Mona Reservoir Pipeline,
7) Mapleton–Springville Lateral Pipeline, and
8) Spanish Fork–Provo Reservoir Canal Pipeline.

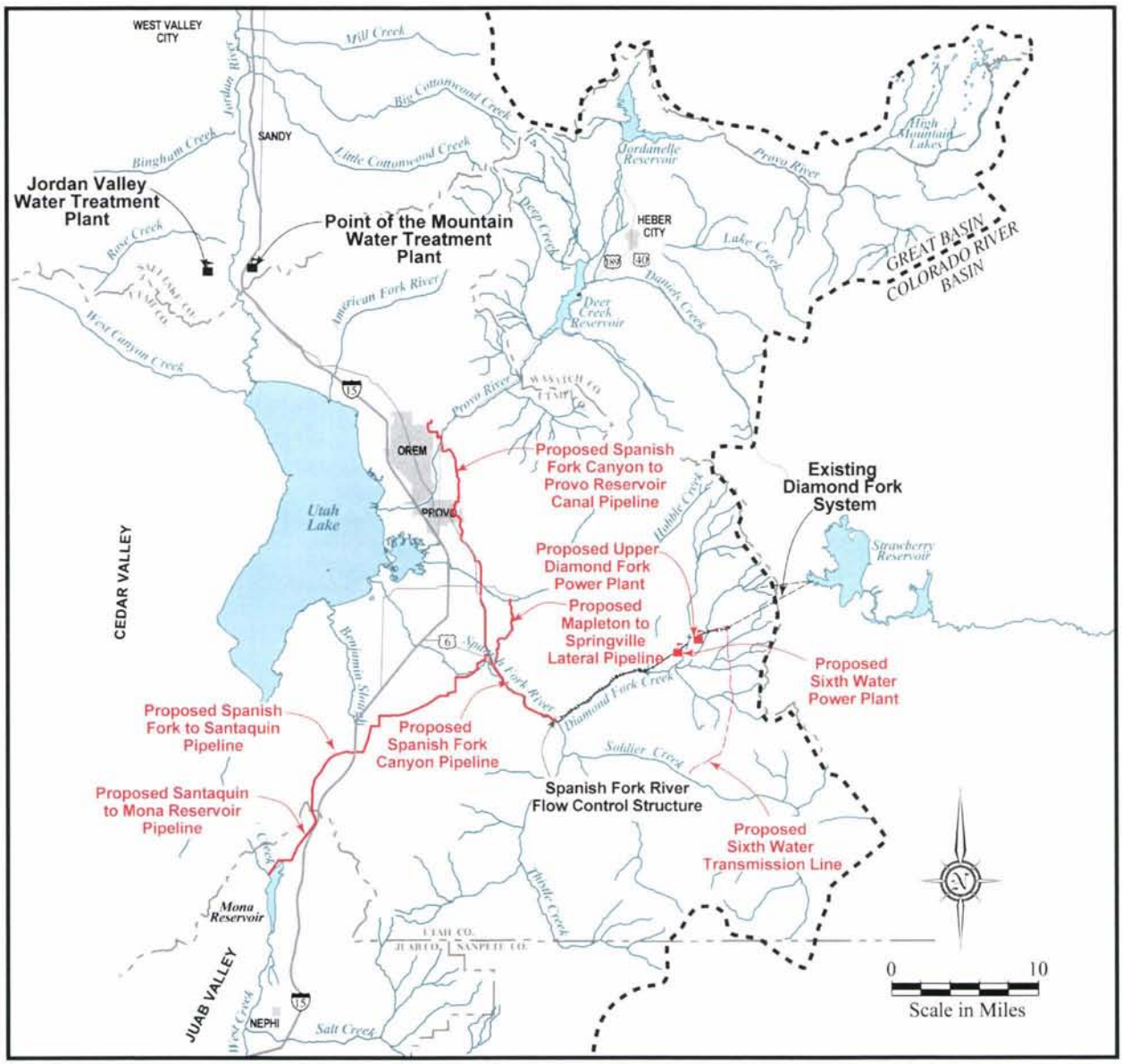
These features would deliver ULS M&I secondary water to southern Utah County cities, deliver water to Hobble Creek to provide June sucker spawning flows, and supplemental flow during other times of the year, deliver water for supplemental flow in the lower Provo River, deliver M&I raw water to the Provo Reservoir Canal and the Jordan Aqueduct for conveyance to water treatment plants in Salt Lake County, and generate electric power incident to water deliveries at two hydropower plants. The proposed Sixth Water Powerplant would be of 45 megawatt capacity and the proposed Upper Diamond Fork Powerplant would be of 5 megawatt capacity. The Spanish Fork Canyon Pipeline and Spanish Fork–Santaquin Pipeline would convey up to 10,200 acre-feet of SVP irrigation water shares held by SUVMWA to member cities in southern Utah County through the new ULS pipelines, on a space-available basis.

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. An average of 101,900 acre-feet of Bonneville Unit water would be conveyed from Strawberry Reservoir each year, 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 farmers in southern Utah County and used for irrigation purposes.

Of the average 101,900 acre-feet: 30,000 acre-feet of M&I water would be delivered into Salt Lake County; 30,000 acre-feet of M&I water would be delivered to SUVMWA member cities in southern Utah County, who would assign about 3,000 acre-feet to DOI for in-stream flows; 1,590 acre-feet has already been contracted for by the SUVMWA, of which 1,000 acre-feet has been assigned for in-stream flows; and 40,310 acre-feet, minus conveyance losses, would be delivered to Utah Lake for exchange to Jordanelle Reservoir under the M&I system. Of the 40,310 acre-feet, about 16,273 acre-feet would be released down the Spanish Fork River during the winter months, an average of 16,000 acre-feet would be conveyed through new pipelines to the lower Provo River to assist in meeting in-stream flows, and about 8,037 acre-feet would be conveyed to Hobble Creek to assist in the recovery of the June sucker.

Approximately 84,510 acre-feet 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 supply of at least 34,540 acre-feet. The exchanged water would be stored in Jordanelle Reservoir for M&I delivery to Salt Lake County and northern Utah County under existing contracts.

Map 2-5
Utah Lake Drainage Basin Water Delivery System



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 and other specific fish and wildlife losses associated with the Bonneville Unit. Bottle Hollow Reservoir was constructed to compensate the Ute Indian Tribe for economic losses associated with stream fishing on the portion of Rock Creek located on the Uintah 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 Lower Duchesne River Wetlands Mitigation Project, currently being planned by the Mitigation Commission, DOI and the Ute Indian Tribe, will create, restore and otherwise enhance riparian wetland habitats along the Duchesne River, Utah, as partial mitigation for

the Bonneville Unit, Central Utah Project. This project has been planned in conjunction with the Ute Indian Tribe of the Uintah and Ouray Agency and is intended to fulfill long-standing commitments to mitigate for impacts on wetland-wildlife habitats arising from construction and operation of the SACS, and to provide additional wetland/wildlife mitigation to the Ute Indian Tribe. Originally proposed in 1965, this project has undergone recent planning revisions and a Draft EIS was issued in November 2003.

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 following eight additional projects or program components listed below.

- Water Management Improvement Program
- Fish, Wildlife, and Recreation Mitigation and Enhancement
- Wasatch County Water Efficiency Project and Daniel Replacement Project
- Uinta Basin Replacement Project
- Local Development
- Ute Indian Water Rights Settlement
- Conjunctive Use of Surface Water and Groundwater
- Additional Studies of Utah Lake Salinity and Provo River Water Supply

Table 2-2 summarizes the additional components along with the six original systems.

Water Management Improvement

Section 207 of CUPCA authorized a comprehensive program to improve water management within the CUP 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 achieve these purposes, the District has developed a Water Management Improvement Plan and is using its Water Conservation Credit Program to assist local agencies in funding measures. The Utah Water Conservation Advisory Board was established to assist the District in identifying criteria and priorities for water conservation projects. This Board was disbanded in 1995 and its function is now provided by the State Board of Water Resources. The District's water conservation goal was originally established at 39,294 acre-feet of savings per year. However, strong local support has indicated that a greater potential exists, and the District has increased its goal to 62,100 acre-feet of water savings per year after 2016. The District has funded approximately 30 CUPCA Section 207 projects with water savings in excess of the target water conservation goal. Water has been developed for operating the Provo River for a favorable spring spawning regime for the endangered June sucker in the lower Provo River.

Fish, Wildlife, and Recreation Mitigation and Enhancement

Under Title III of CUPCA, the Mitigation Commission was established to develop plans and administer the mitigation and conservation program authorized by Congress. It is a joint lead agency for the preparation of this DPR with the District and DOI. CUPCA established the Utah Reclamation Mitigation and Conservation Account, which has been funded by the federal government, the State of Utah, the District, and other project beneficiaries. The Mitigation Commission is charged with administration of this account and implementation of the mitigation measures enumerated in CUPCA, and for future fish and wildlife mitigation measures associated with the ULS. A detailed description of this program can be found in the Fish and Wildlife Appendix to this DPR.

Table 2-2
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

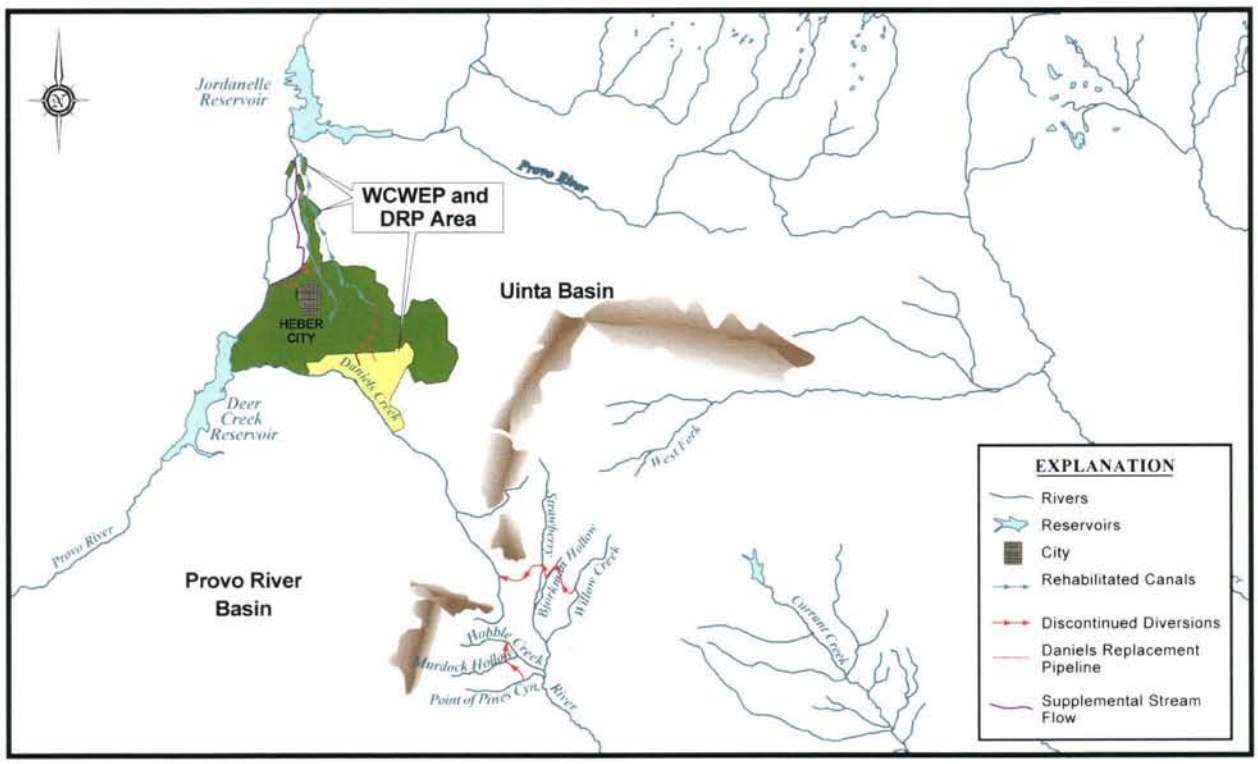
Note:
[1]Alternate system to the I&D System. Authorized in CUPCA, Section 202(a)(1)(B).

Wasatch County Water Efficiency Project and Daniel Replacement Project

The Wasatch County Water Efficiency Project and Daniel Replacement Project (see Map 2-6 on next page) improves water use efficiency in Heber Valley by delivering pressurized irrigation water and making it possible for farmers to convert from flood to sprinkler irrigation. Water conserved by the project is used to supplement flows of Heber Valley streams. The project provides the Daniel Irrigation Company with replacement water after its diversion from the upper Strawberry River basin was terminated as provided in Section 303 of CUPCA. Water conserved by the project from CUP agricultural supply is used to provide the replacement water. This project is described in the *Final Environmental Impact Statement–Wasatch County Water Efficiency Project and Daniel Replacement Project* (CUWCD 1996a), and the *Wasatch County Water Efficiency Project Feasibility Study* (CUWCD 1997a). The Mitigation Commission signed its Record of Decision on March 12, 1997, and the Department of the Interior signed its Record of Decision on March 21, 1997, both selecting the Proposed Action for implementation. Construction has been completed and the projects are operational. During the 2002 irrigation season, the Wasatch County Water Efficiency Project reported water conservation savings of 24,492 acre-feet.

The termination of the Daniel Creek Irrigation Company's transbasin diversion in 2001 and restoration of summer flow in the Strawberry River and its tributaries upstream of Strawberry Reservoir fulfilled a long-standing commitment as partial mitigation for the adverse effects of construction and operation of the SACS on riverine resources. The Wasatch County Water Efficiency Project and Daniel Replacement Project FEIS provided for restoring the natural flows in the upstream tributaries and increasing the water supply of Strawberry Reservoir by an average of 2,900 acre-feet. The Mitigation Commission is considering delivery of the 2,900 acre-feet from Strawberry Reservoir into: the Strawberry River below Soldier Creek Dam for in-stream flows; and/or delivery by exchange into tributaries below the Strawberry Collection System. In accordance with section 303 of CUPCA, a separate evaluation and NEPA compliance will be conducted by the Mitigation Commission regarding the use of the 2,900 acre-feet.

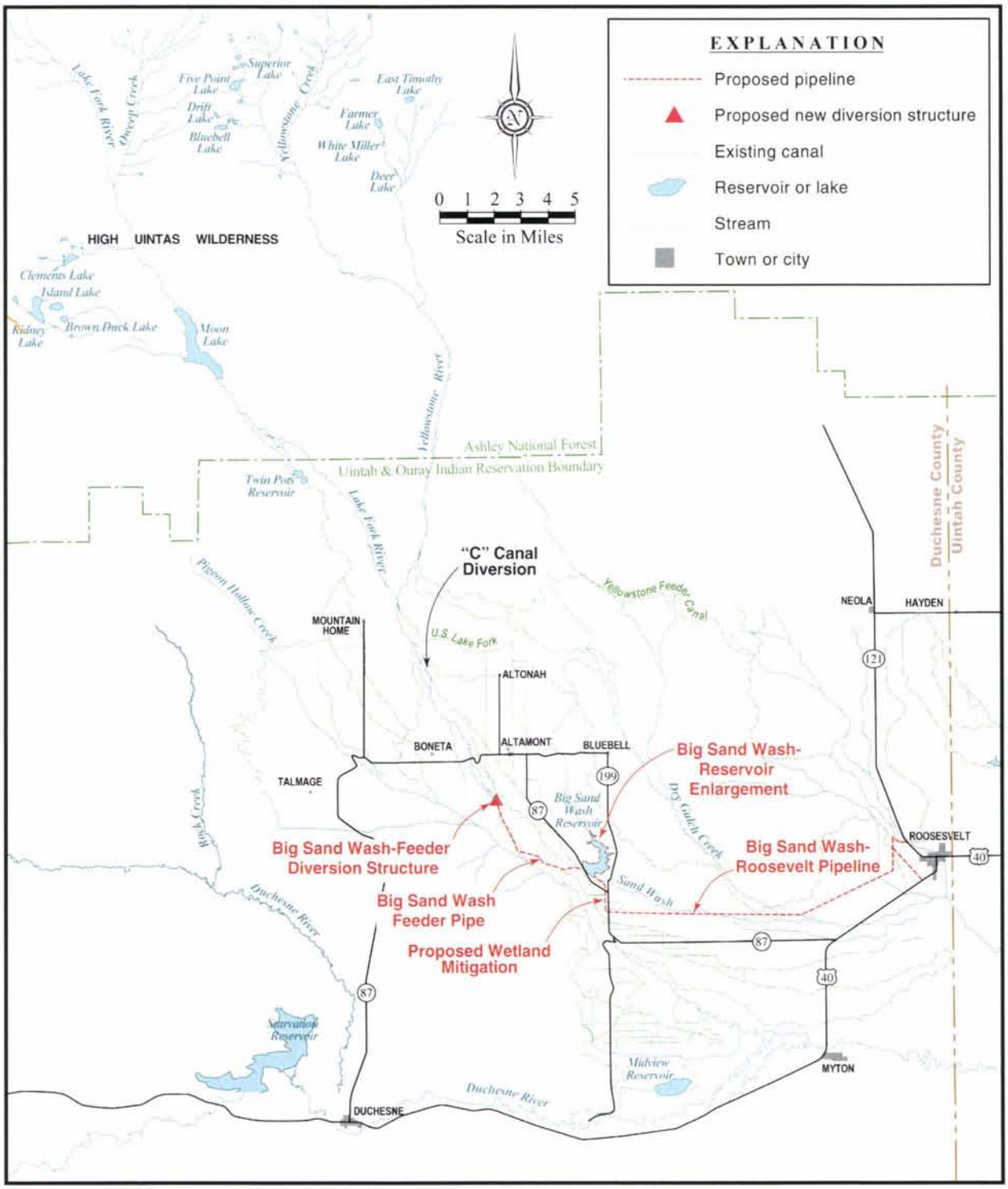
Map 2-6
Wasatch County Water Efficiency Project



Section 203(a) Uinta Basin Replacement Project

The Section 203(a) Uinta Basin Replacement Project (see Map 2-7 on next page) was authorized through the following features in Section 203(a) of CUPCA: 1) Pigeon Water Dam and Reservoir with an enclosed pipeline conveyance system; 2) McGuire Draw Dam and Reservoir; 3) Clay Basin Dam and Reservoir; and 4) Farnsworth Canal rehabilitation. Project replacement features were developed from the authorized features in the Section 203 legislation. These replacement features were included and evaluated in the alternatives formulation and development process described in the Final Environmental Assessment/Finding of No Significant Impact for the Section 203(a) Uinta Basin Replacement Project dated October 2001. Feasibility of a Section 203 project was discussed and evaluated in the Uinta Basin Replacement Project Final Feasibility Study dated October 2001. The Section 203(a) Uinta Basin Replacement Project provides variations of those replacement features and alternatives to meet project needs to manage the water resources within the project area to provide early- and late-season irrigation water, M&I water supplies, water conservation, and to enhance facilities for environmental purposes. Under the October 2001 plan, the Section 203(a) Uinta Basin Replacement Project includes enlargement of Big Sand Wash Reservoir (12,000 acre-feet increased capacity), the new Big Sand Wash Feeder Diversion Structure, a new Big Sand Wash Feeder Pipeline, a new Big Sand Wash-Roosevelt Pipeline to deliver 2,500 acre-feet of irrigation water and, 3,000 acre-feet of M&I water to the city of Roosevelt, Utah, modification of the Moon Lake Dam outlet works to allow for winter operation to release minimum in-stream flows, and stabilization of thirteen high Uinta Mountain lakes.

Map 2-7
Unita Basin Replacement Project



Local Development

Section 206 of CUPCA authorized the development of projects for counties electing not to participate in the CUP. Funding for the projects are provided from federal appropriations and a rebate of ad valorem tax contributions previously paid by an eligible county to the District. Counties eligible for local development include Sanpete, Garfield, and Piute counties. Projects have been implemented in Sanpete and Garfield counties.

Ute Indian Water Rights Settlement

Title V of CUPCA, administered by DOI, contains a variety of provisions for the benefit of the Ute Indian Tribe that, 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 CUP, by quantifying the Tribe's reserved water rights, allowing increased beneficial use of such water, and providing funds for economic development through agriculture and other enterprises that would put the Tribe in the same economic position it would have enjoyed had the 1965 Deferral Agreement been fully implemented.

Conjunctive Use of Surface Water and Groundwater

Conjunctive use of surface water and groundwater 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 authorized federal funding for that purpose. This program has the following objectives: to provide greater efficiency in the use of water for federally-funded facilities as well as local sources, to prevent the further degradation of useable groundwater into aquifers of poor quality water, to reduce groundwater pumping costs, to conserve Utah's water resources, and to facilitate maintenance of year-round streamflows for fish, wildlife, and water quality valued in streams such as the Provo River. The program is intended to build upon studies and demonstration projects that have been undertaken by local entities in those counties. This program contributed toward the construction of the Salt Lake County High Runoff Treatment and Storage Project developed and operated by the Jordan Valley Water Conservancy District.

Additional Studies of Utah Lake Salinity and Provo River Water Supply

Section 202 of CUPCA authorized several studies involving water management in the Bonneville Unit. One feasibility study, completed in August 1992, documented several potential alternative plans for reducing salinity levels of Utah Lake. Two other studies involved water supplies of the Provo River. The first consisted of an operations study including development of a model to simulate river system operation (CUWCD 1998). A report on the computer model development for the Provo River was completed in January 1998. A final report on the second study, direct delivery of Colorado River Basin water from Strawberry Reservoir to the Provo River Basin, was completed in June 1997 (CUWCD 1997).

CENTRAL UTAH PROJECT COMPLETION PROGRAM

Chapter 3

October 2004

SOURCES OF WATER FOR THE BONNEVILLE UNIT

The primary sources of water for the Bonneville Unit are the Provo River System, which flows into Utah Lake, and the Strawberry/Duchesne River System, which flows through the Uinta Basin into the Colorado River System.

Provo River Basin Supply

Runoff feeds the Provo River from the western end of the Uinta Mountains and from portions of the Wasatch Range. The amount of natural runoff from snowmelt and other precipitation is approximately 208,000 acre-feet per year. After diversions at various points, the flow of the Provo River discharges into Utah Lake, from which water is further diverted by means of the Jordan River and various smaller diversions around the perimeter of the lake. Provo River flows that exceed the need for diversion from or storage space in Utah Lake spill into the Jordan River and flow into the Great Salt Lake.

The natural runoff of the Provo River is augmented by transbasin diversion from the upper Duchesne River and upper Weber River. Provo River water users have rights to divert water from the Weber River and the Duchesne River. The Weber River diversion was created in the late 1920s by constructing the Weber-Provo Diversion Canal from the upper Weber River to the Provo River and was enlarged to 1,000 cfs in the 1940s as part of the Provo River Project (PRP).

Diversions through the Duchesne Tunnel and Weber-Provo Diversion Canal are limited to the excess flows over established water rights along the Duchesne and Weber Rivers. The Duchesne River diversion was completed in 1952 by lining the previously completed Duchesne Tunnel located between the North Fork of the Duchesne River and the Provo River. The Bonneville Unit will not affect these transbasin diversions.

Historically, the water supply of the Provo River Basin was supplemented by a transbasin diversion from the upper Strawberry River to Daniels Creek. This diversion served the lands of the Daniel Irrigation Company on the south side of the Heber Valley and averaged about 2,900 acre-feet per year. This diversion has now been terminated as stipulated by CUPCA.

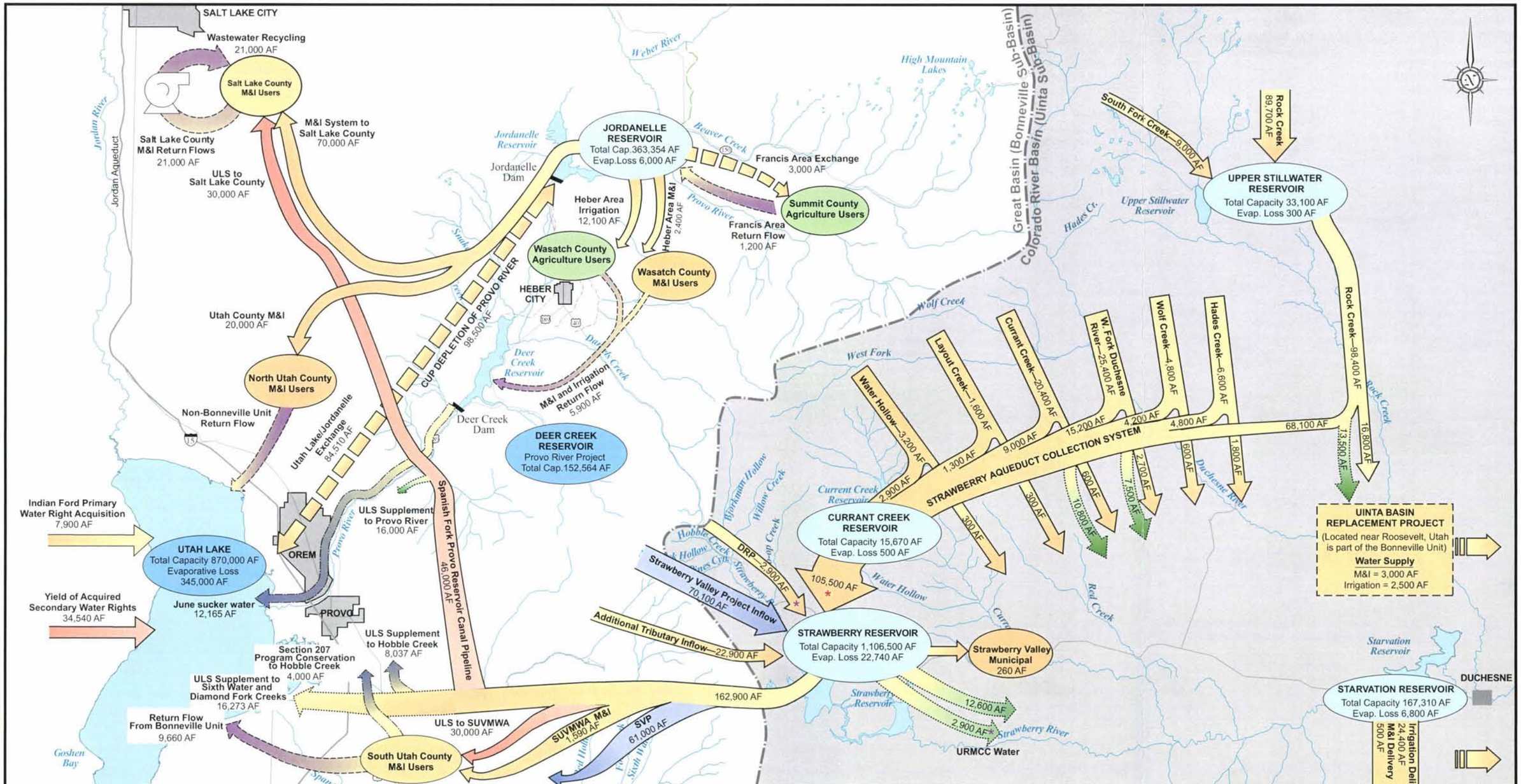
Duchesne River Basin Supply

The Duchesne River and its tributaries provide water from the Uinta Basin for use in the Bonneville Unit service area. These tributaries are fed by runoff from the south slope of the Uinta Mountains and runoff from the eastern slope of the Wasatch Range.

The Strawberry Aqueduct, which is part of the Strawberry Collection System, collects water from these tributaries for a transbasin diversion through the Diamond Fork System. The Strawberry Aqueduct bypasses a portion of the natural flow of each stream for downstream use and distributes the 44,400 acre-feet of fishery flows among the following four streams - Rock Creek, Currant Creek, West Fork Duchesne, and Strawberry River.

The water supply of the entire Bonneville Unit is shown schematically in Figure 3-1, with the average annual quantities of water involved. The flows shown on the schematic drawing include an average diversion of 61,000 acre-feet per year of Strawberry Valley Project (SVP) water.

The Bonneville Unit will deplete 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 operation.



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

OVERVIEW OF OPERATIONAL RELATIONSHIPS UNDER THE CURRENT BONNEVILLE UNIT PLAN

Since the 1988 DPR, the quantity of water available from Strawberry Reservoir for transbasin diversion has been reduced. However, the basic operating pattern of Strawberry Reservoir has remained essentially unchanged. And 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. Important relationships to the operating plan for the Bonneville Unit include –

- State Engineer's Water Distribution Plan;
- 1991 Operating Agreement with Strawberry Water Users Association;
- 1980 Streamflow Agreement;
- Upper Strawberry River Flow Restoration Water (2,900 acre-feet)
- Reduction in Transbasin Diversion from 142,500 acre-feet to 101,900 acre-feet;
- Deer Creek Reservoir/Jordanelle Reservoir Operating Agreement;
- Strawberry – Jordanelle Exchange; and
- June sucker Recovery Implementation Program (JSRIP)

The following sections describe the relationships listed above under current operating conditions.

State Engineer's Water Distribution Plan

In 1992, the Utah State Engineer completed and distributed a plan entitled "Distribution of Water Within the Utah Lake Drainage Basin" (Distribution Plan) (Utah Division of Water Rights, 1992). The purpose of the Distribution Plan was to establish a general framework within which the water rights within the basin could be administered. A detailed description of the Distribution Plan is provided in Water Supply Appendix, Volume 6, Attachment A, Interim Water Distribution Plan for the Utah Lake Drainage Basin. Figure 3-2 is a schematic drawing of various storage terms used in the Distribution Plan. The Distribution Plan sets forth the quantity of Utah Lake storage associated with the primary and secondary Utah Lake-Jordan River water rights and the relationship between Utah Lake water rights and the water rights on tributary streams.

The plan provides that the Utah Lake drawdown be limited to 8.7 feet below the compromise level, resulting in 160,000 acre-feet of inactive capacity and 710,000 acre-feet of active capacity for Utah Lake. The first 125,000 acre-feet of active storage is dedicated to providing for primary water rights during drought periods. The remaining 585,000 acre-feet of active storage is referred to as system storage and is used to supply the diversion requirements of both primary and secondary water rights.

The system storage may be held in Utah Lake or upstream storage, subject to call for Utah Lake uses. To establish the relationship between water rights in Utah Lake and water rights in upstream reservoirs, which are generally later in priority, criteria were developed to maximize beneficial use of water while still protecting prior rights. The plan requires a system storage target of 585,000 acre-feet from November 1 through April 14. The target value gradually decreases thereafter to a minimum of 125,000 acre-feet on October 31.

Whenever the total system storage in Utah Lake and upstream reservoirs exceeds the specified target values for system storage, any excess system storage may be converted to priority storage in upstream reservoirs according to the priority of the upstream rights. Once converted, priority storage is under the full control of the owner and no longer subject to call by Utah Lake users.

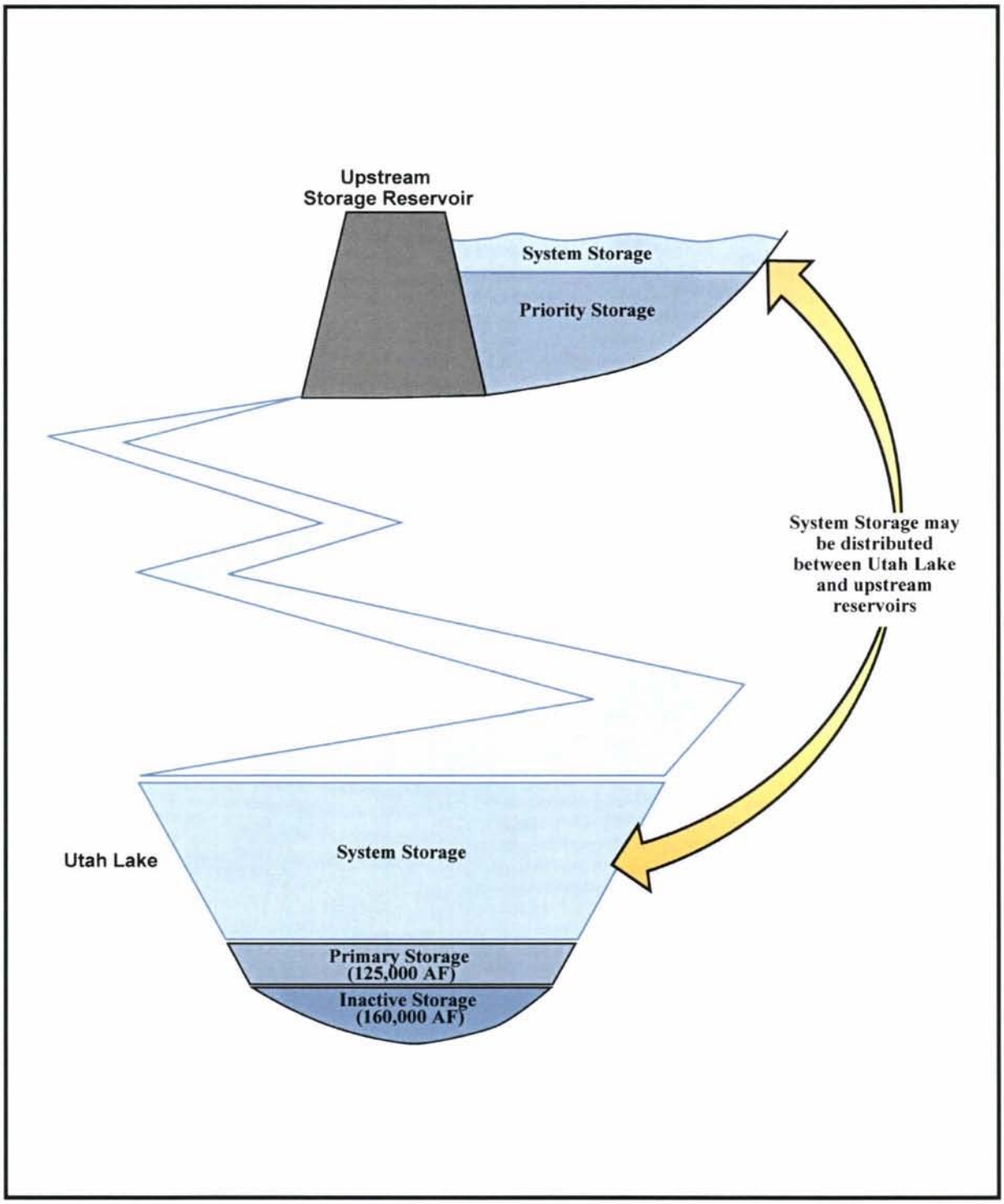


Figure 3-2
Utah Lake Distribution Plan

1991 Operating Agreement with SWUA

In 1991, the United States, the Central Utah Water Conservancy District (District), and the Strawberry Water Users Association (SWUA) entered into an operating agreement covering storage in, and delivery from, Strawberry Reservoir. Although some of the provisions of this agreement are currently a matter of litigation, it 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 Strawberry Valley Project (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 water, which in years when less than 61,000 acre-feet were used, had been stored in the 50,000 acre-foot storage space. Pursuant to the 1991Operating Agreement, conveyance of up to 600 cfs of SVP water through the natural stream channels and the Diamond Fork System to the confluence with the Spanish Fork River will be provided as described in the September 2004, Utah Lake Drainage Basin Water Delivery System Final Environmental Impact Statement.

1980 Stream Flow Agreement (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 in the Uinta Basin established pursuant to the 1980 Stream Flow Agreement and its amendment. The effect of the CUPCA requirement cited above was to reduce the usable project water supply in Strawberry Reservoir by 37,900 acre-feet annually (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 Strawberry Aqueduct and Collection System (SACS) to provide the recommended distribution, to the extent possible, while meeting water supply objectives. 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 concluded 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 FWS 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.

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. Section 303 (b)(3) of CUPCA authorized the termination of this transbasin diversion, to restore summer streamflow in the upper Strawberry River. As compensation for the average 2,900 acre-foot reduction of Daniels Creek flow, the Daniel Irrigation Company is being provided with water from the Daniel Replacement Project, described in Volume I of the Water Supply Appendix. 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.

Reduction in 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, proposed together with the yield of Utah Lake water rights to be acquired, plus useable return flows. The Bonneville Unit transbasin diversion from the Colorado River Basin to the Bonneville Basin has been reduced from 142,500 acre-feet to 101,900 acre-feet.

Deer Creek Reservoir/Jordanelle 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, and the Central Utah Water Conservancy District.

The agreement provides accounting procedures to allow 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, after final accounting is made at the end of the storage season, any PRP water remains in Jordanelle Reservoir, it would be released to Deer Creek Reservoir at the request of PRWUA and under the direction of the Utah State Engineer.

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 Bonneville Unit's Municipal and Industrial (M&I) System's water supply depends on the exchange of water from Utah Lake to Jordanelle Reservoir.

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 U.S. Department of Interior (DOI) acquiring the District's secondary water rights in Utah Lake to yield a firm 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 3-3 for a schematic of the exchange.

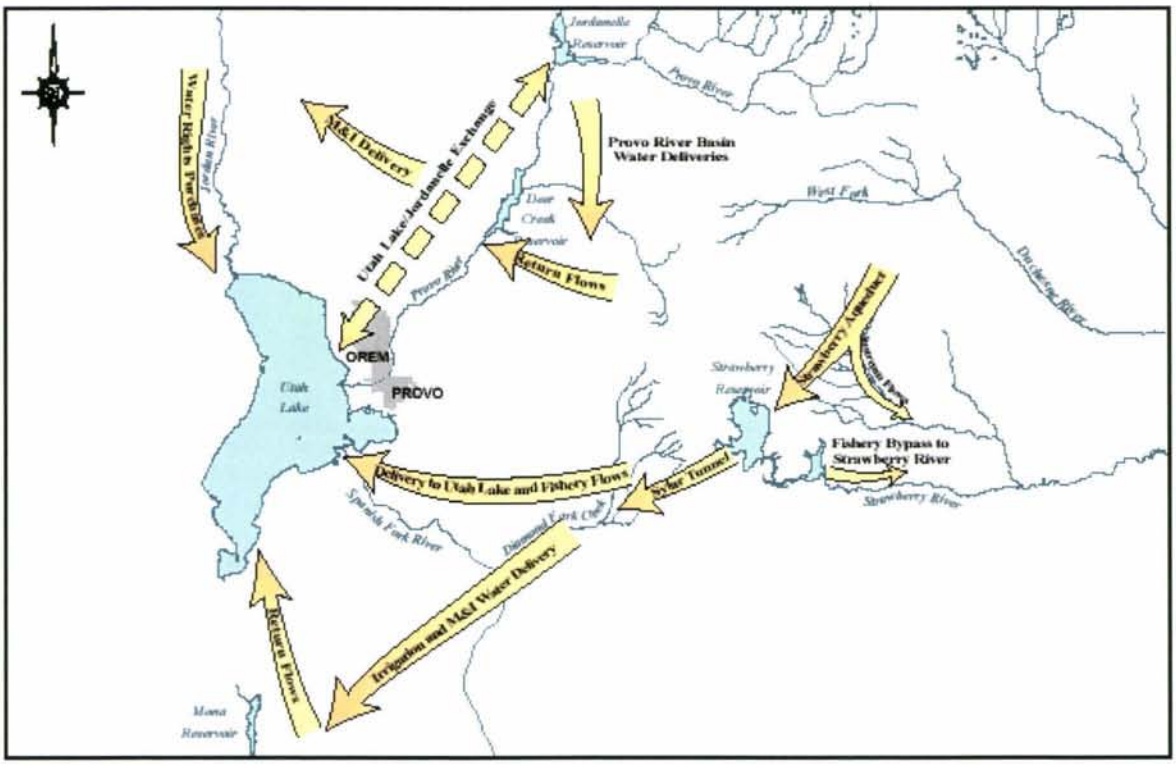


Figure 3-3
Exchange Mechanisms Between Strawberry and Jordanelle

June Sucker Recovery Implementation Program (JSRIP)

The June sucker (*Chasmistes liorus*), occurs naturally only in Utah Lake and its tributaries 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 Endangered Species Act (ESA) and the last 4.9 miles of the Provo River have been designated as critical habitat.

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.

In addition the ULS System will deliver water to Hobble Creek for the development of June sucker habitat to promote spawning.

STRAWBERRY AQUEDUCT AND COLLECTION SYSTEM

The SACs will be operated as described in the 1988 DPR except as modified (in Commissioner Underwood's 1990 Record of Decision) under the 1980 Stream Flow Agreement as summarized in previous sections.

STRAWBERRY RESERVOIR OPERATION UNDER CURRENT PLAN

Operational Model Used

The Strawberry Reservoir Spreadsheet Operations Model was used to analyze the operation of Strawberry Reservoir. This is a mass balance spreadsheet accounting model designed to calculate the monthly transbasin diversion demand on Strawberry Reservoir and simulate the operation of Strawberry Reservoir including inflows, transbasin diversion demands, other releases, and evaporation. The model also calculates monthly Strawberry Reservoir storage volumes and water levels. A 50-year period of analysis was used. In the model, Strawberry Reservoir was operated in accordance with specific criteria and constraints that were developed to achieve the following objectives:

- Protect existing water rights on the Spanish Fork River and Diamond Fork Creek;
- Meet minimum CUPCA flow requirements in Sixth Water and Diamond Fork Creeks;
- Meet SVP monthly transbasin diversion requirements;
- Supply M&I water to southern Utah County and Salt Lake County as needed monthly;
- Deliver water to the lower Provo River and Hobble Creek; and
- Deliver the remaining Bonneville Unit water to Utah Lake through the Spanish Fork River in the winter

Results of Current Model Operation

The model operation simulated 50 years of operation under the hydrologic conditions that historically occurred from 1950 to 1999, producing transbasin diversion demands and Strawberry Reservoir inflows that varied from year to year. In these 50 years the projected future demands on Strawberry Reservoir varied from 75 percent of average to 125 percent of average and the historically-based reservoir inflows varied from 25 percent of average to 188 percent of average.

The average transbasin diversion was 162,900 acre-feet (61,000 acre-feet SVP; 101,900 acre-feet Bonneville Unit). The transbasin diversions ranged from a yearly maximum of 203,727 acre-feet to a minimum of 122,211 acre-feet. The SVP annual diversions ranged from a yearly maximum of 79,616 acre-feet to a minimum of 36,225 acre-feet. The Bonneville Unit annual diversions ranged from a yearly maximum of 142,727 acre-feet to a minimum of 71,386 acre-feet. Table 3-1 presents the maximum annual and monthly transbasin diversions from the Strawberry Reservoir simulated by the model.

The maximum monthly diversions to meet the combined SVP and Bonneville Unit demands typically occurred in July or August, although in some years the maximum occurred in June. The month of maximum SVP diversion was generally July and the month of maximum Bonneville Unit diversion was generally August. The result of this interaction was that the 50-year average diversion in July was within 1 percent of the 50-year average in August.

TABLE 3-1
Maximum Modeled Transbasin Diversions

Time Period	SVP Diversion	CUP Diversion	Both Diversions
Annual Transbasin Volume			
50-year average	61,000 acre-feet	101,900 acre-feet	162,900 acre-feet
Maximum Year, CUP & Total[1]	61,000 acre-feet[2]	142,727 acre-feet	203,727 acre-feet
Maximum Year, SVP[3]	79,616 acre-feet	105,614 acre-feet	185,230 acre-feet
July Diversion Volume			
July 50-year Average	18,904 acre-feet	12,873 acre-feet	31,776 acre-feet
July with SVP maximum[4]	28,288 acre-feet	13,954 acre-feet	42,242 acre-feet
July with CUP maximum	15,868 acre-feet	15,729 acre-feet	31,597 acre-feet
July Diversion Flow Rate			
50-year Average July Flow	307 cfs	209 cfs	517 cfs
July flow with SVP maximum[4]	460 cfs	227 cfs	687 cfs
July flow with CUP maximum	258 cfs	256 cfs	514 cfs

Notes:
[1] This happens to be the maximum year for both CUP and Total transbasin diversions, resulting from hydrologic conditions in 1979.
[2] The SVP diversion was not high. By coincidence it was equal to the 50-year average.
[3] This is the maximum annual SVP transbasin diversion volume, resulting from hydrologic conditions in 1976.
[4] This is the maximum July SVP transbasin diversion, resulting from hydrologic conditions in 1964. This July also had the maximum combined monthly transbasin diversion for SVP and CUP water (687 cfs).

The flow rates for SVP transbasin diversions during the 50-year period of analysis averaged 307 cfs, as shown on Table 3-1. The 50-year maximum SVP transbasin flow rate was 460 cfs, based on July 1964 hydrologic conditions. As previously noted above, the SWUA has reserved the right to a transbasin flow rate of 600 cfs when needed. The peak average monthly flow through Syar Tunnel (capacity 660 to 800 cfs) ranges from 617 to 660 cfs, and the summer release through the Strawberry Tunnel was 27 cfs. If the SVP demand for irrigation water were to be exceptionally high for part or all of July, the combined transbasin diversions of SVP and Bonneville Unit could exceed the capacity of Syar Tunnel and the minimum average flow release through Strawberry Tunnel. That did not happen in the 50-year operational analysis made for this supplemental DPR. The maximum average monthly transbasin diversion flow for the combined SVP and Bonneville Unit releases was 687 cfs.

Other Releases from Strawberry Reservoir

Other releases to be made from Strawberry Reservoir are 260 acre-feet of M&I water for 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.

Summary of Releases from Strawberry Reservoir

Under the Bonneville Unit operation, releases would be made from Strawberry Reservoir for the following purposes. They are listed below and average annual volumes are quantified in Table 3-2.

- Transbasin Diversion of SVP water for Irrigation use;

- Transbasin Diversion of CUP water for delivery to Utah Lake for exchange to Jordanelle Reservoir;
- Transbasin Diversion of CUP water for delivery in the ULS System;
- M&I water for use in Strawberry Valley and Duchesne County;
- Fishery flow release to Strawberry River (part of the 44,400 fishery flow); and
- Release of the 2,900 acre-foot inflow from the upper Strawberry River flow restoration.

TABLE 3-2
Summary of Average Annual Releases from Strawberry Reservoir

Category	Average Annual Release in 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	**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
[3] The point(s) of release from Strawberry Reservoir may include exchange with Strawberry Aqueduct diversions.

Strawberry Reservoir Operating Levels

The capacity of Strawberry Reservoir is 1,106,500 acre-feet. However, of this volume, the bottom 155,140 acre-feet are inactive storage (i.e., the active capacity is depleted when the reservoir volume drops to 155,140 acre-feet).

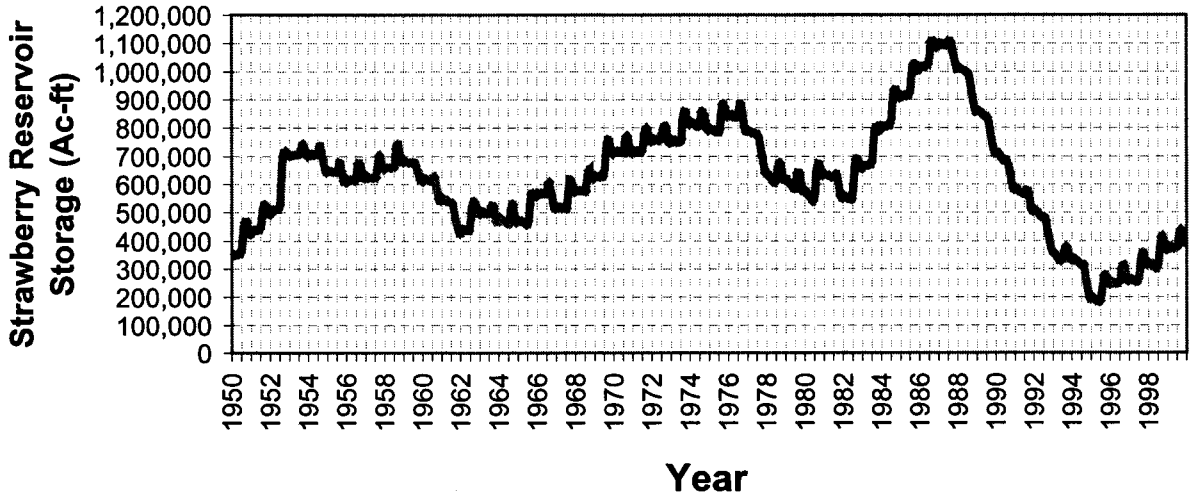
The modeled fluctuations in Strawberry Reservoir's total storage volume under the proposed operation are displayed in Figure 3-4. In the model, the active storage was essentially depleted by the end of the dry years of the 1990s.

The result of the current model analysis is similar to results portrayed in the 1988 DPR (USBR, 1988). The model analysis presented in the 1988 DPR was based on the hydrologic sequence of 44 years from 1930 to 1973. Under the operational plan analyzed at that time, the active storage was essentially depleted in the dry year of 1939 and in the dry years of the early 1960s.

General Conclusion

The current model analysis of Strawberry Reservoir shows that the presently proposed operation of Strawberry Reservoir is the same as that portrayed in the 1988 DPR, although changes have occurred in the anticipated reservoir inflow and the proposed transbasin diversions and uses of the CUP water supply from the reservoir.

Figure 3-4
Simulated Strawberry Reservoir Storage for Bonneville Unit Operations (acre-feet)



STARVATION COLLECTION SYSTEM

The Starvation Collection System develops water for irrigation and M&I use and provides flood control, recreation, and fish and wildlife benefits in the Uinta Basin. The facilities of the system have been constructed and are operational, and no significant physical or operational changes are proposed.

The formulation of the Starvation Collection System operating plan was set forth in the 1964 DPR (USBR, 1964). Construction was completed in 1970. The 1988 DPR confirmed the operating plan and potential yield of the Starvation Collection System, and apportioned 500 acre-feet of Starvation Reservoir water for M&I use. The following summarizes the information included in the 1988 DPR.

The water supply stored in Starvation Reservoir that exceeds the amount of water needed to compensate for irrigation water shortages resulting from the operation of the SACS and Starvation Collection System is listed on Table 3-3.

TABLE 3-3
Water Supply Developed for Duchesne County By Starvation Collection System

Water Supply	Amount (acre-feet)
M&I	500
Irrigation	24,400
Total	**24,900**

The water supply is based on the analyses contained in the 1988 DPR. As of this time, 21,400 acre-feet had been provided to irrigators under contract. It is anticipated that a block notice will be issued for the remaining 3,000 acre-feet prior to the beginning of the 2005 irrigation season. This will bring the total irrigation water to 24,400 acre-feet.

UINTA BASIN REPLACEMENT PROJECT

The Uinta Basin Replacement Project (UBRP), currently under construction, will develop supplemental irrigation and M&I water supplies for use in the Uinta Basin, and will provide enhancements to stream habitat, fish, wildlife, and recreation values. The project is described in the

October 2001 Final Feasibility Study and Final Environmental Assessment. Although the following summary of this project is provided, detailed information can be obtained from these documents.

The 5,500 acre-feet of storage space in the enlarged Big Sand Wash Reservoir for M&I water and new irrigation water is estimated to provide the water supply listed on Table 3-4. The 3,000 acre-feet of M&I water would be a firm annual supply, whereas the 2,500 acre-feet of irrigation water would periodically experience shortages.

TABLE 3-4
Water Supply Produced by UBRP

New Water Supply	Water Produced (acre-feet)
M&I water	3,000
Irrigation water	2,500
Total	**5,500**

TRANSBASIN DIVERSION THROUGH DIAMOND FORK FEATURES

Syar Tunnel and Sixth Water Aqueduct would convey about 145,854 acre-feet of Strawberry Reservoir water per year (see Table 3-5). The maximum flow capacity of these features is 800 cfs when Strawberry Reservoir is full and 660 cfs when the reservoir level is at its operational minimum.

Strawberry Tunnel would release about 17,046 acre-feet of Strawberry Reservoir water and 3,622 acre-feet of tunnel seepage per year.

The District would operate and maintain the Diamond Fork System to provide minimum flows in Sixth Water and Diamond Fork creeks. Delivery of water to maintain minimum stream flows in Sixth Water Creek of 32 cfs in summer and 25 cfs during the winter months (from Strawberry Tunnel to Sixth Water Aqueduct) and Diamond Fork Creek below Diamond Fork Creek Outlet would receive priority and would govern release of water to the creek. Flows in Diamond Fork Creek below the Diamond Fork Creek outlet would be 80 cfs during the summer and 60 cfs during the winter.

TABLE 3-5
Distribution of Transbasin Diversion From Strawberry Reservoir

Component	Average Acre-Feet per Year
Distribution of Transbasin Diversion Between the Tunnels	
Syar Tunnel release volume	145,854
Strawberry Tunnel release volume to Sixth Water Creek	17,046
Total	**162,900**
Distribution of Transbasin Diversion in Diamond Fork Creek and Diamond Fork Pipeline	
Total Diamond Fork Creek conveyance volume[1]	29,545
• Strawberry Tunnel Release (17,046 AF)	
• Diamond Fork System Release to Diamond Fork Creek (12,499 AF)	
Diamond Fork Pipeline conveyance volume	133,355
Total	**162,900**

[1] In addition to this Strawberry Reservoir water, 26,396 acre-feet of natural flow and about 3,622 acre-feet of seepage from Strawberry Tunnel would be conveyed in Diamond Fork Creek as measured below the Upper Diamond Fork Flow Control Structure.

UTAH LAKE DRAINAGE BASIN WATER DELIVERY SYSTEM

This section addresses the intended manner in which SVP and Bonneville Unit water from Strawberry Reservoir would be delivered under the full operation of the Bonneville Unit, through the Spanish Fork River and ULS System pipelines. Figure 3-5 shows the average annual flows in the ULS System and the Spanish Fork River.

The ULS System pipelines are intended to provide the services listed below:

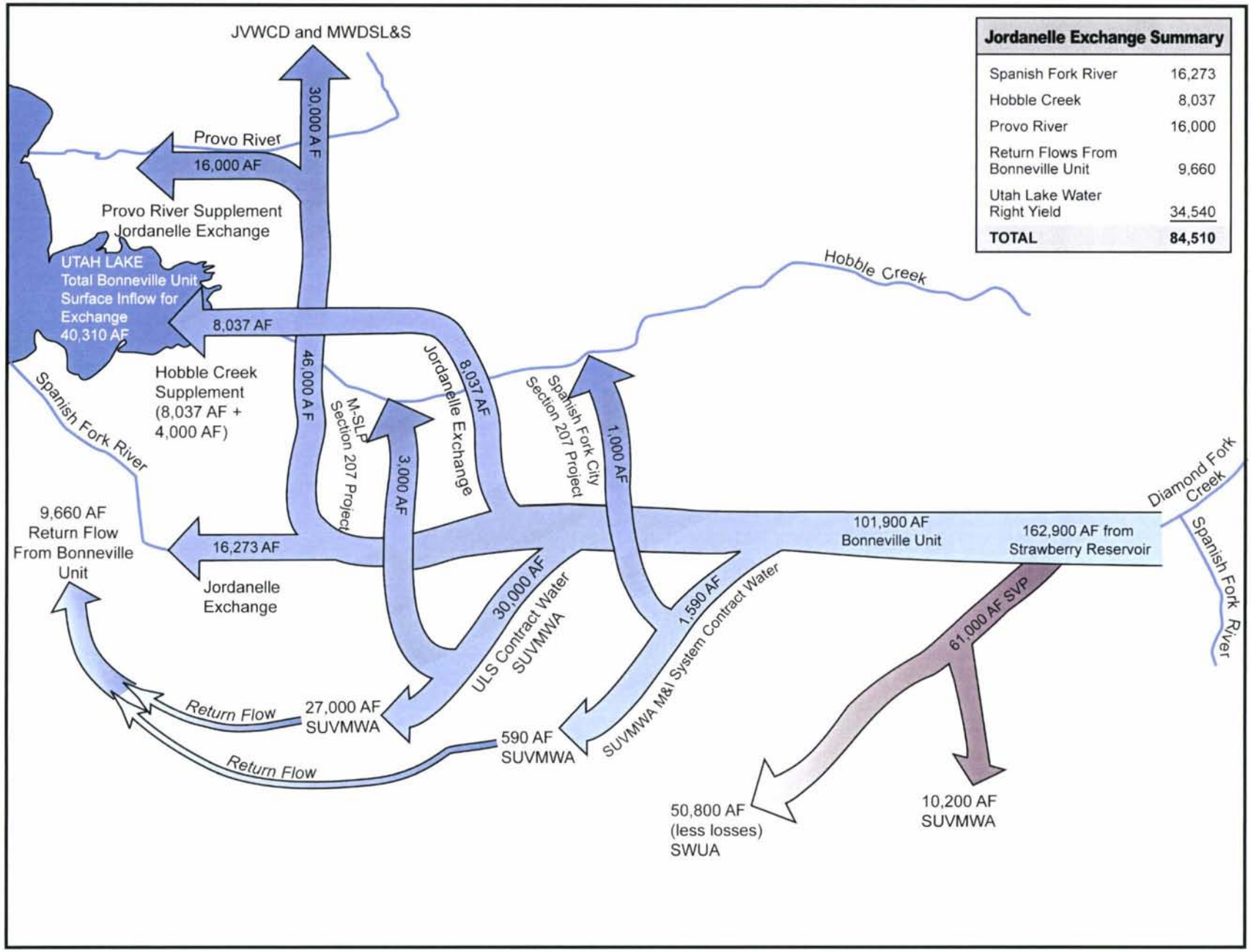
- Deliver CUP M&I water under pressure to communities in southern Utah County;
- Deliver CUP M&I water to the Provo Reservoir Canal and Jordan Aqueduct for conveyance to Salt Lake County;
- Deliver some SVP water under pressure to communities in southern Utah County, on a space-available basis;
- Deliver all Strawberry Reservoir SVP water currently conveyed in the Mapleton Lateral in a pipeline to conserve water and deliver water under pressure;
- Convey part of the CUP Utah Lake water to Hobble Creek for JSRIP and instream flow augmentation;
- Convey part of the CUP Utah Lake water to the lower Provo River for JSRIP and instream flow augmentation.

Redistribution of Conserved Water

Some of the water that is deliverable under the full operation of the ULS System will be conserved by local entities through their water conservation measures. Under ULS system operation, certain blocks of conserved water would be assigned to 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 3-6 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 and in Chapter 8 of this DPR Supplement.

TABLE 3-6
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**	



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 3-5
Utah Lake System Water Deliveries
Under the Bonneville Unit

The change in delivery for conserved waters cited on Table 3-6 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 3-7.

Routing Summary of Transbasin Diversion Water

Table 3-7 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 annual average amounts conveyed, under full operation of the Bonneville Unit. The quantities tabulated include the conveyance of SVP 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.

TABLE 3-7
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
Irrigated Lands	-	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**

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.
4. Only SVP storage water from Strawberry Reservoir can be conveyed through ULS pipelines due to the pressure of the pipelines. The values in Table 3-7 therefore do not include SVP rights to the natural flow of the Spanish Fork River which must be conveyed through other facilities or exchanged.

Delivery to Lower Provo River

Up to 16,000 acre-feet of Bonneville Unit water would be delivered to the lower Provo River to assist in meeting the 75-cfs in-stream flow target. This water 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. The interconnection between the ULS deliveries and the Provo River is shown schematically in Figure 3-6. The Provo River Discharge Structure is located just downstream of the Upper Union Diversion, as shown on Figure 3-6. 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 and for downstream natural flow diversions. The pattern of delivery of the 16,000 acre-feet of ULS water is shown in Table 3-8. It should be noted that during some wet years there would be no water delivered either because the flows were already adequate or because Utah Lake is full. Conveying water through ULS facilities for the 75 cfs target flow is subordinate to the need and timing for moving water from Strawberry Reservoir to Utah Lake to make the exchange to Jordanelle Reservoir to meet existing water contracts. At times when there is not a need to move water to Utah Lake for the Jordanelle exchanges, no water would be available from ULS facilities to supplement the Provo River.

Table 3-8
ULS DELIVERIES TO SUPPLEMENT THE LOWER PROVO RIVER

Estimated Average Deliveries to the Lower Provo River
Deliveries in cfs

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
Average	36	18	18	17	13	8	9	41	19	17	31	37	22
Wet Years	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry Years	38	11	26	20	1	1	24	65	30	25	14	37	25

Deliveries in acre-feet

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average	2,225	1,071	1,123	1,062	718	500	523	2,537	1,118	1,073	1,877	2,173	16,000
Wet Years	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry Years	2,313	670	1,572	1,243	51	80	1,440	3,971	1,800	1,559	865	2,204	17,768

Wet Years: Average of flows from 1952, 1983, and 1986
Dry Years: Average of flows from 1961, 1977, and 1992

Delivery to Provo Reservoir Canal

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.

MUNICIPAL AND INDUSTRIAL SYSTEM

Bonneville Unit M&I System conduits are currently in service and are delivering 50,000 acre-feet of Bonneville Unit M&I System water currently available for use as well as assisting in the distribution of Provo River Project water. Under full operation, the M&I System will deliver a total of 107,500 acre-feet including 70,000 acre-feet of Bonneville M&I water to Salt Lake County, 15,100 acre-feet of agricultural water to Summit

and Wasatch counties, 2,400 acre-feet of M&I water to Wasatch County, and 20,000 acre-feet of M&I water to northern Utah County.

Bonneville Unit M&I System diversions provide M&I water to northern and central Utah County. The aggregate diversion for Salt Lake County is 70,000 acre-feet (average annual amount) which is divided among the Jordan Valley Water Conservancy District and the Metropolitan Water District of Salt Lake and Sandy. Table 3-9 shows the division of M&I System water. In addition to the 107,500 acre-feet the M&I System provides 1,590 acre-feet for south Utah County M&I users. Of this amount, 1,000 acre-feet is conserved water that meets the needs of the June sucker.

Table 3-9
Bonneville Unit Municipal and Industrial System Water Allocation

		M&I System Existing Contracted Bonneville Unit Water	
Petitioner	Use	Contracted Amount (acre-feet)	Purpose of Use (acre-feet)
Summit County Irrigators	Summit County Irrigation	3,000	3,000
Wasatch County Irrigators	Wasatch County Irrigation	12,100	9,200
	Daniel Replacement Project		2,900
Wasatch County M&I Users	Wasatch County M&I	2,400	2,400
North Utah County M&I Users	North Utah County M&I	20,000	17,125
	June Sucker RIP (Section 207)		2,875
Salt Lake County M&I Users	Salt Lake County M&I		
	Jordan Valley Water Conservancy District	50,000	50,000
	Metropolitan Water District of Salt Lake and Sandy	20,000	20,000
	Totals	107,500	107,500

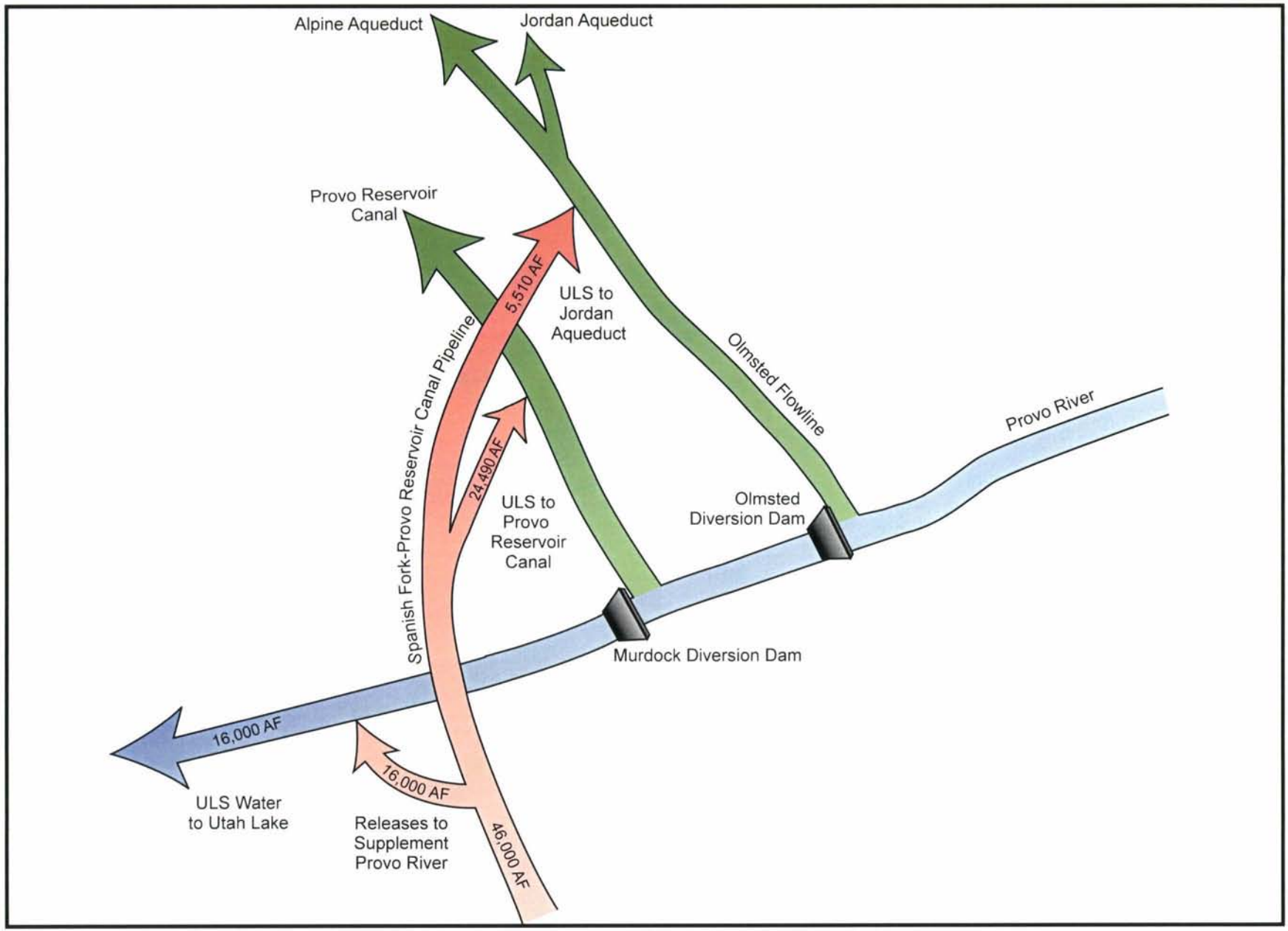


Figure 3-6
Utah Lake System Interconnections to the Provo River

WASATCH COUNTY WATER EFFICIENCY PROJECT

The Wasatch County Water Efficiency Project (WCWEP) is not, per se, a water supply project. It does not develop new, or additional supplies of water either for M&I or agricultural use. Instead, it uses the existing water supplies more efficiently, allowing water to be reallocated to meet environmental needs. In particular, WCWEP delivers Bonneville Unit M&I System water and natural flows of the Provo River to Heber Valley irrigation companies using pressurized sprinkler systems. Use of sprinklers rather than flood irrigation conserves sufficient water to allow 2,900 acre-feet of M&I System water to be delivered as a replacement supply to the Daniel Irrigation Company, and increases flow in Heber Valley streams by up to 22,900 acre-feet. Authority for use of the water for instream flow is provided for under the Section 207 Program of CUPCA. CUPCA specifically states that conserved water may be made available to the Secretary of Interior for instream flow uses that is in addition to the streamflow requirements mandated in Section 303 of CUPCA.

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, about 290 acre-feet of water conserved from Section 207 piping of the Timpanogos Canal, and 8,000 acre-feet of water conserved by enclosing the Provo Reservoir Canal or other future 207 projects in north Utah County.

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:

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

Total water released to the lower Provo River -- 12,165 acre-feet

MITIGATION COMMISSION 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 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 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.

This water comes from the following sources:

- 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 3-7 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 accumulation of conserved water flowing to Utah Lake is shown on Figure 3-7. An appropriate filing with the State Engineer will be made to implement this action.

UTAH LAKE AND ITS PIVOTAL ROLE

The operation of Utah Lake under full Bonneville Unit operation would not be significantly different from the operation of the past, or from future operation under the Distribution Plan without the project. The operation of the Bonneville Unit M&I System retains Provo River flow in Jordanelle Reservoir for delivery in Summit, Wasatch, northern Utah, and Salt Lake counties. However, the Bonneville Unit has been formulated to compensate for the reduction in Provo River inflow by delivering Strawberry Reservoir water to Utah Lake, retaining the water yield of the acquired rights in Utah Lake, and contributing return flows to Utah Lake from use of Bonneville Unit M&I water in Utah County.

Figure 3-8 shows the Utah Lake and Jordan River water balance under the ULS System. There would be no net change in Jordan River flows below Jordan Narrows. The change in average Utah Lake storage would be a minus 15,400 acre-feet.

End-of-Month Storage Content and Water Levels

Hydrologic Data Base. The Utah Lake Spreadsheet Model was developed to simulate Utah Lake operation for the 1950 to 1999 water years. Thus the inflow and outflow data from October 1949 through September 1999 were used. This period of study represents a broad range of historical runoff conditions and is consistent with the period of analysis used to analyze the operation of other Bonneville Unit systems.

Inflow to Utah Lake for Bonneville Unit conditions was developed by modifying the historical monthly inflow to reflect project water withheld on the Provo River, releases from Strawberry Reservoir to Utah Lake, return flow from the Municipal and Industrial (M&I) System, return flow from ULS System deliveries of CUP water, reduced return flows associated with the ULS inter-related actions, and retention of the acquired water rights yield in Utah Lake.

Storage Projections. The model simulation for Bonneville Unit conditions produced maximum and minimum Utah Lake storage contents varying from about 219,000 acre-feet in 1963 to about 1,121,000 acre-feet in 1983, with an average of 687,200 over the 1950 to 1999 period. Table 3-10 presents the projected end-of-month storage content of the lake in terms of 50-year average, wet year, and dry year conditions. Based on inspection of the inflow data, the years 1961, 1977 and 1992 were selected as dry years and 1952, 1983 and 1986 were selected as wet years. The model results of the three-year sets were then averaged to calculate dry- and wet-year monthly average storage volumes. The entire 50-year simulation was averaged to calculate monthly average-year results. Figure 3-9 shows the monthly values graphically. The complete monthly results of the operational modeling are presented in Water Supply Appendix, Volume 6, Utah Lake, Attachment C, Utah Lake Water Budget Analysis - Bonneville Unit Conditions.

The change in delivery for conserved waters cited on Table 3-6 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 3-7.

Routing Summary of Transbasin Diversion Water

Table 3-7 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 annual average amounts conveyed, under full operation of the Bonneville Unit. The quantities tabulated include the conveyance of SVP 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.

TABLE 3-7
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
Irrigated Lands	-	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**

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.
4. Only SVP storage water from Strawberry Reservoir can be conveyed through ULS pipelines due to the pressure of the pipelines. The values in Table 3-7 therefore do not include SVP rights to the natural flow of the Spanish Fork River which must be conveyed through other facilities or exchanged.

Delivery to Lower Provo River

Up to 16,000 acre-feet of Bonneville Unit water would be delivered to the lower Provo River to assist in meeting the 75-cfs in-stream flow target. This water 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. The interconnection between the ULS deliveries and the Provo River is shown schematically in Figure 3-6. The Provo River Discharge Structure is located just downstream of the Upper Union Diversion, as shown on Figure 3-6. 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 and for downstream natural flow diversions. The pattern of delivery of the 16,000 acre-feet of ULS water is shown in Table 3-8. It should be noted that during some wet years there would be no water delivered either because the flows were already adequate or because Utah Lake is full. Conveying water through ULS facilities for the 75 cfs target flow is subordinate to the need and timing for moving water from Strawberry Reservoir to Utah Lake to make the exchange to Jordanelle Reservoir to meet existing water contracts. At times when there is not a need to move water to Utah Lake for the Jordanelle exchanges, no water would be available from ULS facilities to supplement the Provo River.

Table 3-8
ULS DELIVERIES TO SUPPLEMENT THE LOWER PROVO RIVER

Estimated Average Deliveries to the Lower Provo River													
Deliveries in cfs													
Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
Average	36	18	18	17	13	8	9	41	19	17	31	37	22
Wet Years	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry Years	38	11	26	20	1	1	24	65	30	25	14	37	25
Deliveries in acre-feet													
Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average	2,225	1,071	1,123	1,062	718	500	523	2,537	1,118	1,073	1,877	2,173	16,000
Wet Years	0	0	0	0	0	0	0	0	0	0	0	0	0
Dry Years	2,313	670	1,572	1,243	51	80	1,440	3,971	1,800	1,559	865	2,204	17,768

Wet Years: Average of flows from 1952, 1983, and 1986
Dry Years: Average of flows from 1961, 1977, and 1992

Delivery to Provo Reservoir Canal

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.

MUNICIPAL AND INDUSTRIAL SYSTEM

Bonneville Unit M&I System conduits are currently in service and are delivering 50,000 acre-feet of Bonneville Unit M&I System water currently available for use as well as assisting in the distribution of Provo River Project water. Under full operation, the M&I System will deliver a total of 107,500 acre-feet including 70,000 acre-feet of Bonneville M&I water to Salt Lake County, 15,100 acre-feet of agricultural water to Summit

and Wasatch counties, 2,400 acre-feet of M&I water to Wasatch County, and 20,000 acre-feet of M&I water to northern Utah County.

Bonneville Unit M&I System diversions provide M&I water to northern and central Utah County. The aggregate diversion for Salt Lake County is 70,000 acre-feet (average annual amount) which is divided among the Jordan Valley Water Conservancy District and the Metropolitan Water District of Salt Lake and Sandy. Table 3-9 shows the division of M&I System water. In addition to the 107,500 acre-feet the M&I System provides 1,590 acre-feet for south Utah County M&I users. Of this amount, 1,000 acre-feet is conserved water that meets the needs of the June sucker.

Table 3-9
Bonneville Unit Municipal and Industrial System Water Allocation

		M&I System Existing Contracted Bonneville Unit Water	
Petitioner	Use	Contracted Amount (acre-feet)	Purpose of Use (acre-feet)
Summit County Irrigators	Summit County Irrigation	3,000	3,000
Wasatch County Irrigators	Wasatch County Irrigation	12,100	9,200
	Daniel Replacement Project		2,900
Wasatch County M&I Users	Wasatch County M&I	2,400	2,400
North Utah County M&I Users	North Utah County M&I	20,000	17,125
	June Sucker RIP (Section 207)		2,875
Salt Lake County M&I Users	Salt Lake County M&I		
	Jordan Valley Water Conservancy District	50,000	50,000
	Metropolitan Water District of Salt Lake and Sandy	20,000	20,000
	Totals	107,500	107,500

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**

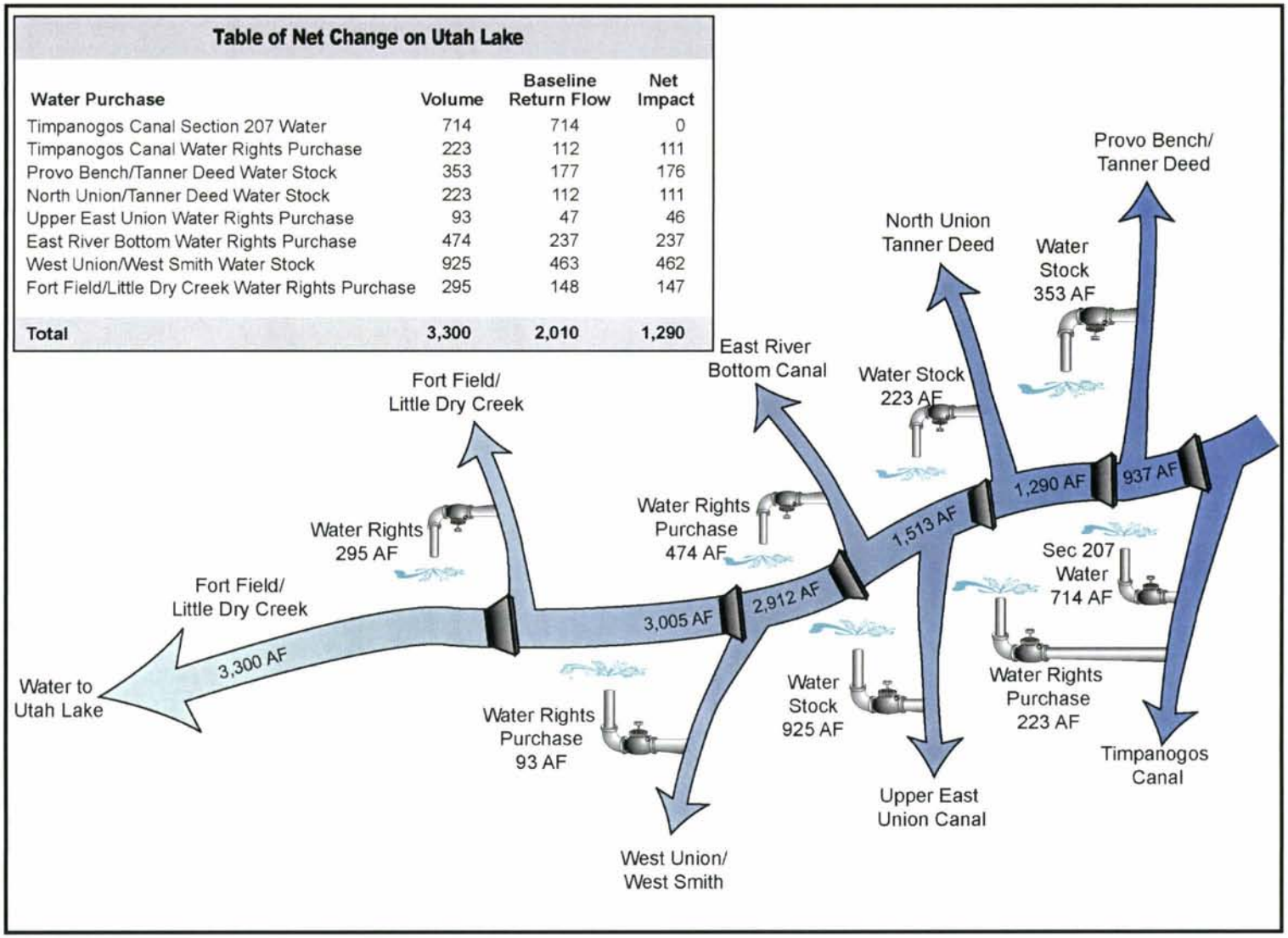


Figure 3-7
Water Acquired With Mitigation Commission Funds
For 75-cfs Target Flow in the Lower Provo River

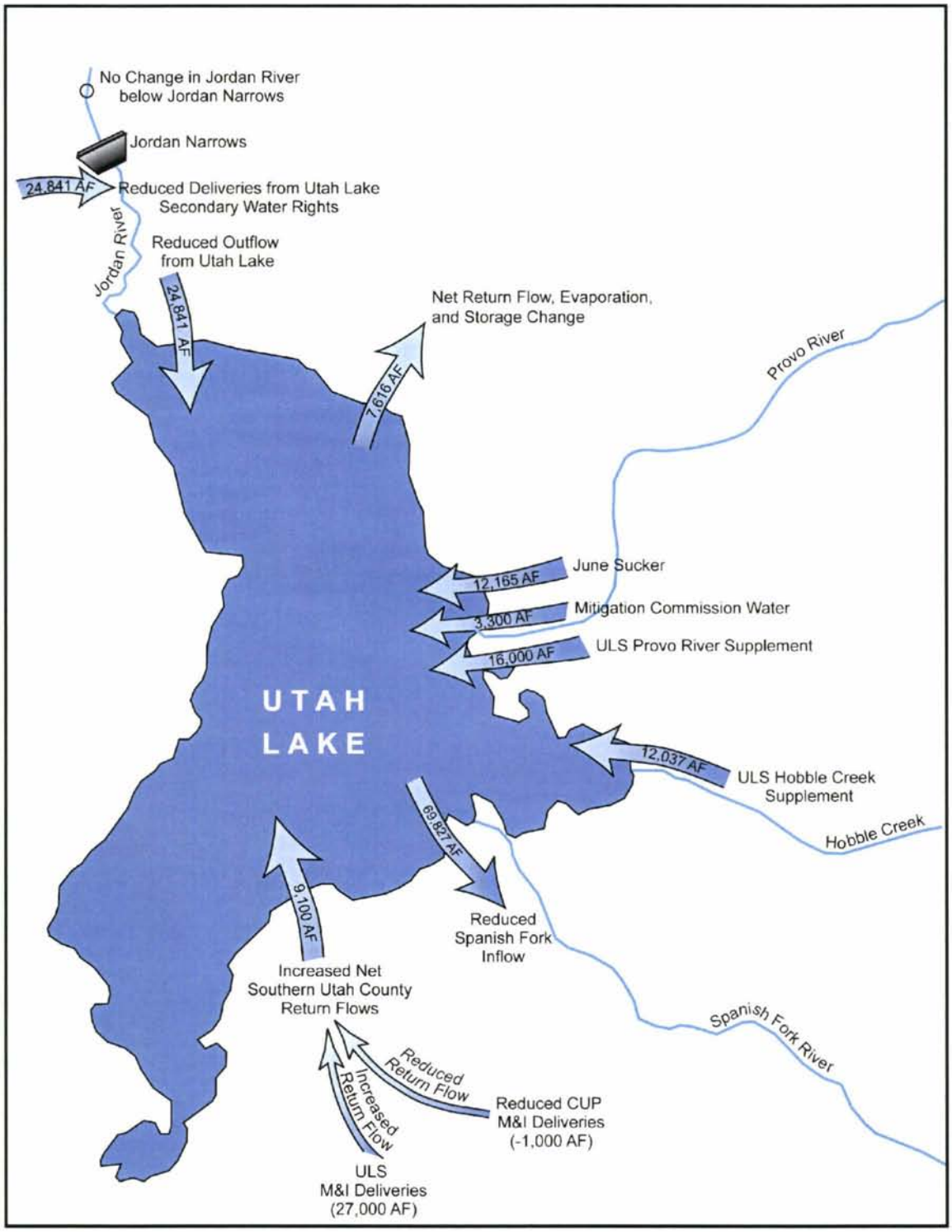


Figure 3-8
Utah Lake and Jordan River Water Balance Under the ULS Proposed Action

Utah Lake contents, surface area, and elevation are summarized in Attachment B, Utah Lake Modeling Results of that report.

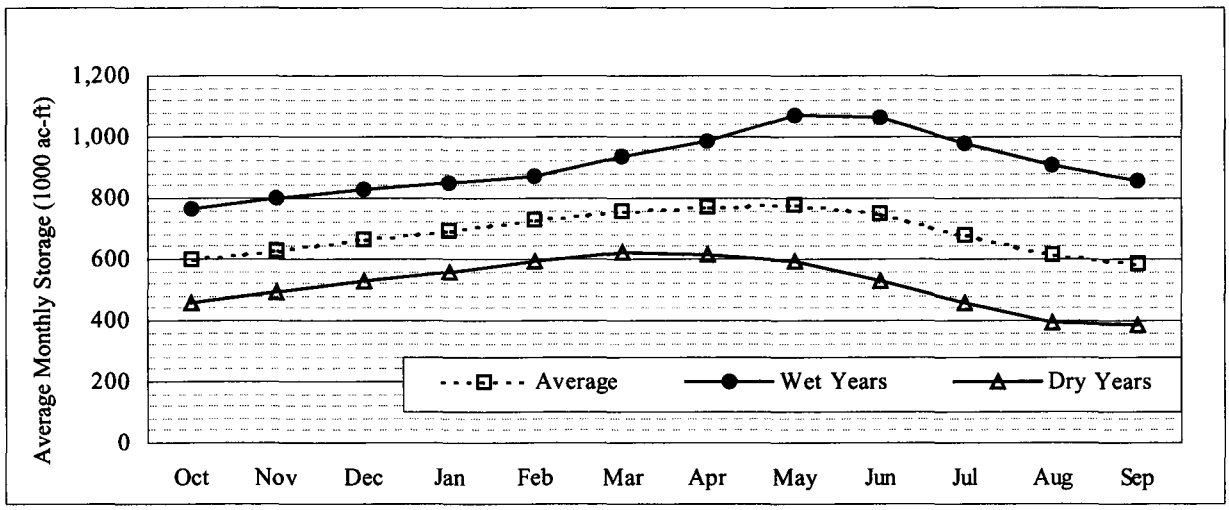
Points of comparison for the contents of Utah Lake are the storage at the Compromise Level (essentially the full storage condition) of about 870,000 acre-feet, of which 710,000 acre-feet is the active storage capacity. The inactive storage pool is about 160,000 acre-feet. The top of the inactive pool is 8.7 feet below the Compromise Level, or approximate elevation 4480.3 feet. This elevation was set by the Utah State Engineer's Distribution Plan, which was described previously and in Water Supply Appendix Volume 6. This 160,000 acre-feet minimum elevation corresponds approximately to the minimum water surface elevation at which the outlet pumps can operate. The tabulated average values show a range of Utah Lake contents from approximately 587,000 acre-feet to 781,000 acre-feet. The average for the three wet years ranged from approximately 760,000 acre-feet to 1,073,000 acre-feet. The wet years include the 50-year high of approximately 1,121,000 acre-feet that occurred in simulated June 1984. The average for the three dry years ranged from 387,000 acre-feet to 620,000 acre-feet. The dry years include the 50-year low of simulated October 1963 when the contents dropped to approximately 219,000 acre-feet.

TABLE 3-10
Utah Lake Monthly Content Under Bonneville Unit Operation
(Units: 1,000 acre-feet)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ave
Average	597.0	628.3	660.9	695.6	728.9	755.1	770.3	781.2	750.8	676.1	615.4	587.5	687.3
Wet Years[1]	763.9	798.9	827.4	847.9	873.3	938.7	985.6	1,072.8	1,065.0	977.0	909.2	854.7	909.5
Dry Years[2]	458.2	492.0	528.5	559.4	594.3	620.0	617.2	594.0	530.7	455.3	396.3	387.5	519.5

Notes:
[1] The three wettest years (1952, 1983, and 1986) were averaged to calculate the values shown in the table.
[2] The three driest years (1961, 1977, and 1992) were averaged to calculate the values shown in the table.

Figure 3-9
Utah Lake Monthly Content Under Bonneville Unit Operation



With the acquisition of Utah Lake water rights from the CUWCD, the average secondary water right demand on Utah Lake would be reduced to an estimated 55,666 acre-feet under full Bonneville Unit operation. With shortages comparable to the historical condition, the average release for this demand would be about 44,844 acre-feet annually. Simulated annual releases to secondary users vary from 8,500 acre-feet in 1992 to 55,666 acre-feet in most years. Water associated with the acquired water rights would remain in Utah Lake and be used to offset the decrease in inflow to the lake under Bonneville Unit conditions.

The average reduction in Provo River inflow to Utah Lake is about 98,500 acre-feet. This reduction includes the Indian Ford Exchange (contract dated February 19, 1977, between U.S. Department of the Interior and the CUWCD). The Strawberry Reservoir releases to Utah Lake average about 40,310 acre-feet, and the ULS System return flows to Utah Lake average about 9,660 acre-feet annually.

Evaporation losses for Bonneville Unit conditions averaged 345,000 acre-feet over the 1950 to 1999 period, ranging from 281,000 acre-feet to 387,000 acre-feet annually. The evaporation loss under Bonneville Unit conditions would be about the same as under historical conditions.

Spills from Utah Lake would average about 118,000 acre-feet per year under Bonneville Unit conditions as compared to an average of 127,000 under historical conditions. This change is largely due to operations under the Utah Lake Distribution Plan. The comparative annual spills are exactly the same under pre-ULS and Bonneville Unit conditions.

Water Level Elevations. The model simulation for Bonneville Unit conditions produced Utah Lake water levels varying from about 4,481.2 feet in 1963 to about 4,491.6 feet in 1983 for the 1950 to 1999 period. Table 3-11 presents the projected end-of-month water levels of the lake in terms of average, wet year, and dry year conditions. As noted above, years 1961, 1977 and 1992 were selected as dry years and 1952, 1983 and 1986 were selected as wet years. The model results of the three-year sets were then averaged to calculate dry- and wet-year average water levels. The entire 50-year simulation was averaged to calculate average-year results. Table 3-11 lists the monthly values, rounded to the nearest foot. The water levels for all months of the study recorded to the nearest tenth of a foot are presented in Water Supply Appendix, Volume 6, Utah Lake, Attachment B, Utah Lake Modeling Results.

TABLE 3-11
Utah Lake Monthly Water Level Under Bonneville Unit Operation
(Units: feet above mean sea level)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ave
Average	4,486	4,486	4,487	4,487	4,487	4,488	4,488	4,488	4,488	4,487	4,486	4,486	4,487
Wet Years[1]	4,488	4,488	4,489	4,489	4,489	4,490	4,490	4,491	4,491	4,490	4,489	4,489	4,489
Dry Years[2]	4,484	4,485	4,485	4,486	4,486	4,486	4,486	4,486	4,485	4,484	4,484	4,483	4,485

Notes:
[1] The three wettest years (1952, 1983, and 1986) were averaged to calculate the values shown in the table.
[2] The three driest years (1961, 1977, and 1992) were averaged to calculate the values shown in the table.

A point of comparison for the water levels is the Compromise Level of 4,489.045 feet above mean sea level. A water level rise to that elevation during the natural runoff period triggers spill releases to the Jordan River until the water surface elevation declines back to that level. Conversely, a historical lake drop of more than 8.7 feet below that level (below elevation 4480.3) has required dredging to provide a flow channel from the lake to the pumps that provide water to the Jordan River. The maximum depth of the lake is about 14 feet below the Compromise Level, or approximately 4,475 feet. Historical water surface elevations have ranged from a low of about 4,477.2 feet in 1935 to a high of 4,494.7 feet in June of 1984.

The tabulated values show that the average monthly Utah Lake water levels are within approximately 3 feet of the Compromise Level. Wet year average values range from 1 foot below to 2 feet above the Compromise Level. The dry year average ranges from 3 feet to 6 feet below compromise level. The minimum water level produced by the model simulation was 4,481.2, or four feet above the historical minimum.

Utah Lake Water Quality

Utah Lake receives water from about 80 different sources, ranging from high quality water from Wasatch Front streams, to irrigation drainage and treated municipal wastewater of lower quality. Evaporation from the lake has a concentrating effect on the dissolved minerals in the lake and the dissolved solids carried in by inflows. Outflows from the lake consist of releases to the Jordan River and one or more direct irrigation diversions, which are the sole means of discharging dissolved minerals from the lake.

The lake serves as the "salinity balance." This means the lake's salinity increases to the concentration at which the TDS of the water released to the Jordan River is in balance with the weighted average TDS of the inflows. In other words, the salinity of Utah Lake stabilizes at the TDS at which the mass of salt released to the Jordan River is equal the mass of salt in all the inflows to the lake. For perspective, an acre-foot of water at a TDS of approximately 735 milligrams per liter (mg/L) contains one ton of salt. The numerous sources of inflow to Utah Lake result in a highly complex process for analyzing water quality. TDS in the tributaries and in the lake vary markedly over time.

Water quality in Utah Lake is strongly affected by the lake's large net evaporation loss, which concentrates the total dissolved solids in the lake. The high levels of TDS are further compounded by mineral springs that occur in the lake bed. This has resulted in typical TDS concentrations of 900 parts per million (ppm), or mg/L, through much of the lake (Fuhriman et al. 1981). Because of its shallow depth, winds commonly suspend the sediments of the lake, giving the nutrient-rich waters a milky-gray, turbid appearance during most of the year. The lake is used to temporarily store irrigation water and also receives effluents from municipal and industrial wastewater treatment facilities.

Method of Analysis. Utah Lake was modeled as a storage reservoir that has inflows with various salinities and outflows reflecting the Lake's salinity. A computer model (LKSIM2000) was used as the basis for estimating Utah Lake TDS under Bonneville Unit conditions. Relationships between monthly inflow and TDS were established for each of about 80 different sources of inflow. The model was developed and calibrated for historical conditions prior to modeling future Bonneville Unit conditions.

LKSIM2000 TDS Model

TDS modeling was performed using the LKSIM model. This model is essentially a mass balance model that calculates water and salt balances for Utah Lake on a monthly time step. Early versions of the model were developed in the 1970's by Drs. LaVere Merritt and Dean Fuhriman, and since about 1985 Dr. Wood Miller, professors of civil

and environmental engineering at Brigham Young University. This model includes input for 57 surface sources, 19 fresh and mineral groundwater sources, and precipitation. The current version, LKSIM2000, is used routinely by the District and their consultants to evaluate lake salt concentrations associated with various water management scenarios for Utah Lake.

Database

Water quality (TDS) data used as input to the model were based on extensive historical monitoring. These inputs were combined in the model to produce Utah Lake TDS concentrations for the corresponding 50-year time period (October 1949 to September 1999) under Bonneville Unit operating conditions. Background on LKSIM2000, the methods used to develop inflows, inflow water quality data, and model calibration are contained in Water Supply Appendix, Volume 6, Utah Lake, Appendix E.

Modeling Results

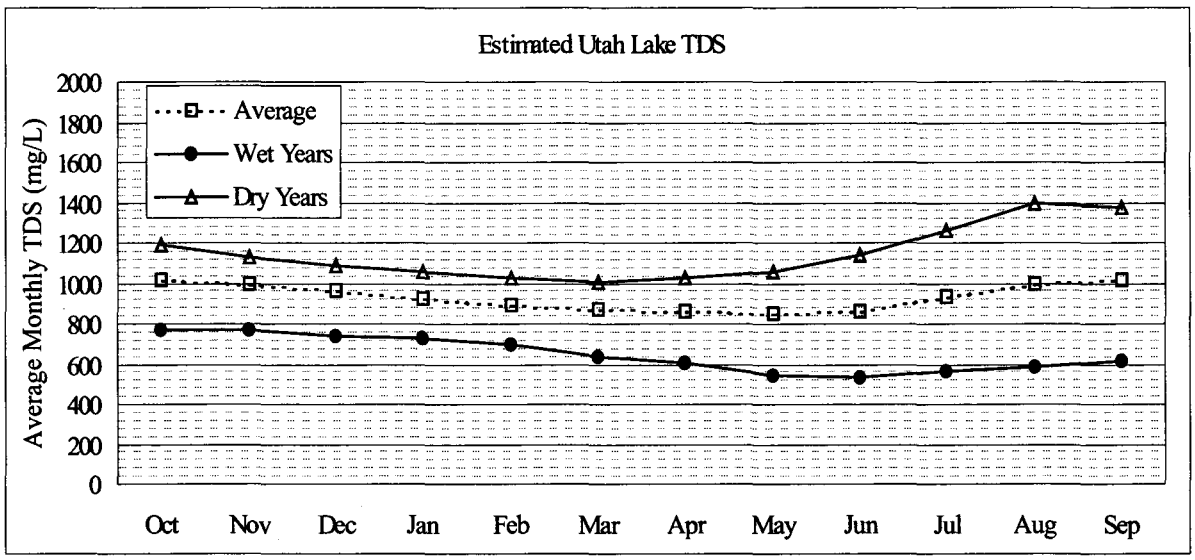
Figure 3-10 and Table 3-12 show the average, wet year, and dry year TDS concentrations in Utah Lake for the 1950 to 1999 period under the simulated Bonneville Unit operating conditions. The wet years (1952, 1983 and 1986) and the dry years (1961, 1977 and 1992) were those selected in the storage analysis. The entire 50-year simulation was averaged to calculate average-year results. The 50-year modeled average was 932 mg/L. The highest modeled TDS concentration, 1,700 mg/L, occurred in 1961, the year of lowest historical inflow. During the high Utah Lake water level in 1984, the modeled TDS reached a low of about 445 mg/L. Attachment E of Water Supply Appendix, Volume 6 contains the details of the analysis. These TDS concentrations also apply to the Jordan River to the Jordan Narrows. The TDS concentrations for each month of the 50-year period of analysis are in Water Supply Appendix, Volume 6, Utah Lake, Attachment E, Utah Lake Salinity Analysis (LKSIM2000) - Bonneville Unit Conditions.

TABLE 3-12
Utah Lake Average, Wet, and Dry Year TDS Concentrations (mg/L)

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average
Average	1,019	994	961	925	896	874	867	849	863	929	991	1,014	932
Wet Years[1]	774	766	743	724	696	640	604	545	532	564	588	614	649
Dry Years[2]	1,185	1,131	1,086	1,052	1,021	1,008	1,029	1,054	1,135	1,266	1,399	1,374	1,145

Notes:
[1] The three wettest years (1952, 1983, and 1986) were averaged to calculate the values shown in the table.
[2] The three driest years (1961, 1977, and 1992) were averaged to calculate the values shown in the table.

Figure 3-10
Utah Lake TDS Concentrations



COLORADO RIVER DEPLETIONS

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 operation.

CENTRAL UTAH PROJECT COMPLETION PROGRAM

Chapter 4

October 2004

INTRODUCTION

The Diamond Fork System is the link between Strawberry Reservoir and features of the proposed Utah Lake Drainage Basin Water Delivery System (ULS System). The Diamond Fork System conveys water from Strawberry Reservoir through tunnels located near the crest of the Wasatch Mountain range into the Sixth Water Creek drainage basin located in Rays Valley. From there the water flows through a series of tunnels, and pipelines down Diamond Fork Canyon to the confluence of Diamond Fork Creek and Spanish Fork River where it would be connected to the ULS System's Spanish Fork Canyon Pipeline at the Spanish Fork River Flow Control Structure.

The following features comprise the Diamond Fork System:

- Syar Tunnel and Inlet Portal;
- Sixth Water Aqueduct consisting of a pipeline, shaft and flow control structure;
- Sixth Water Connection to Tanner Ridge tunnel;
- Tanner Ridge Tunnel;
- Upper Diamond Fork Pipeline;
- Upper Diamond Fork Flow Control Structure;
- Diamond Fork Vortex Shafts;
- 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; and
- Diamond Fork Pipeline

The primary features of the Diamond Fork System are described in the following subsections. Table 4-1 shows the feature name, length, diameter and capacity and facilities constructed by the U.S. Bureau of Reclamation and those constructed under CUPCA. Map 4-1 shows the location of these features. Additional maps are contained in Diamond Fork System Final Supplement of the Final Environmental Impact Statement of July 1999, amended 2001 and 2002.

WATER DELIVERY

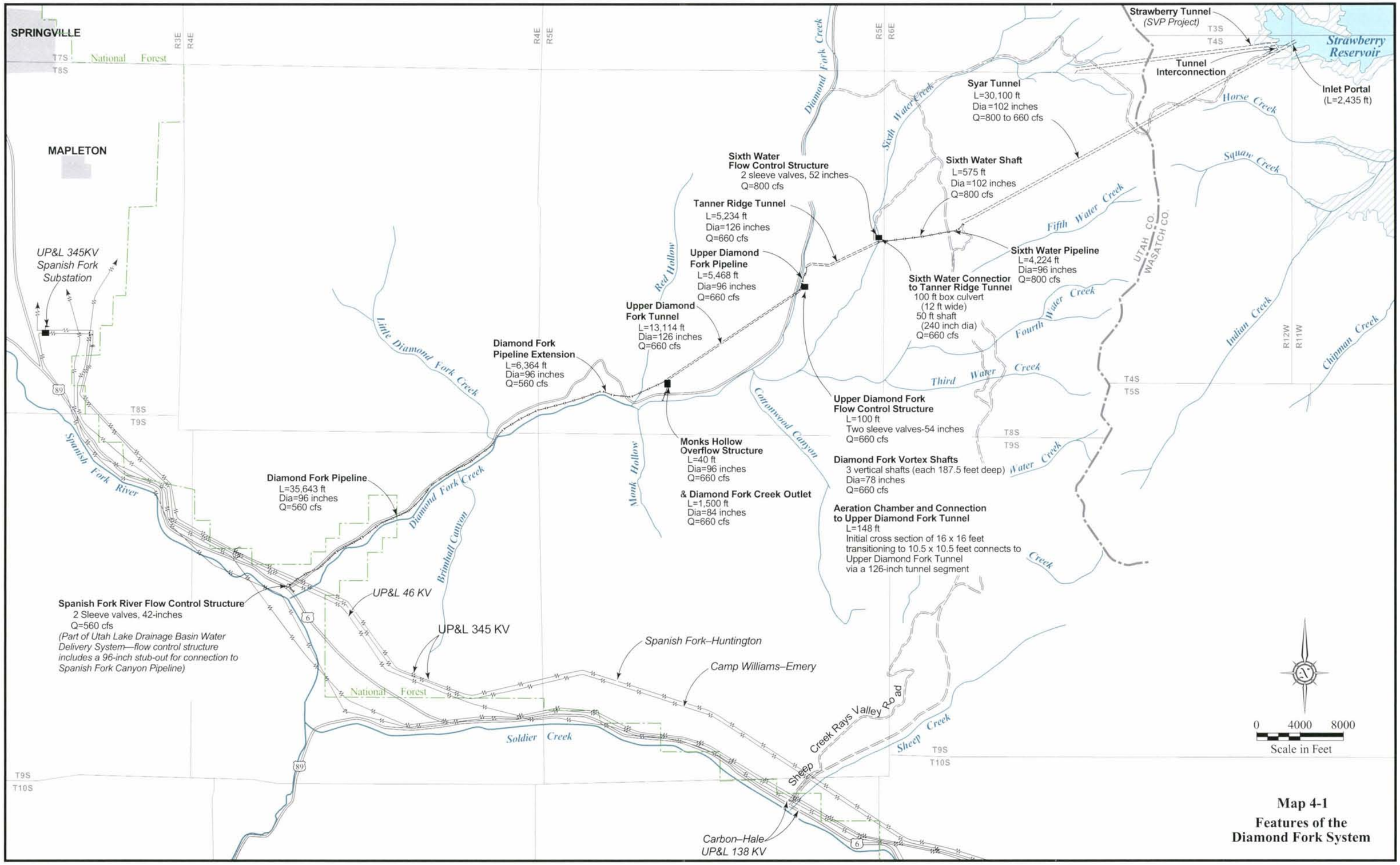
Syar Tunnel and Sixth Water Aqueduct would convey about 145,900 acre-feet of Strawberry Reservoir water per year (see Table 4-2). The maximum flow capacity of these features is 800 cfs when Strawberry Reservoir is full and 660 cfs when the reservoir level is at its operational minimum.

Strawberry Tunnel would release about 17,000 acre-feet of Strawberry Reservoir water and 3,600 acre-feet of tunnel seepage per year.

The District would operate and maintain the Diamond Fork System to provide minimum flows in Sixth Water and Diamond Fork creeks. Delivery of water to maintain minimum stream flows in Sixth Water Creek (from Strawberry Tunnel to Sixth Water Aqueduct) and Diamond Fork Creek below Diamond Fork Creek Outlet would receive priority and would govern release of water to the creek. Most of the time the water needed for SVP irrigation demand and CUP M&I exchange would flow through the Diamond Fork Pipeline until it is operating at maximum capacity of 560 cfs. Up to 600 cfs of SVP water would be provided through the natural stream channel and Diamond Fork Facilities.

Strawberry Reservoir water would be released as necessary to maintain minimum stream flows for Sixth Water Creek as specified in Section 303(c) of CUPCA. These minimum flows are not less than 32 cfs from May - October and not less than 25 cfs from November through April for Sixth Water Creek in the 6-mile stretch between the outlet of Strawberry Tunnel and the outlet of the Sixth Water Aqueduct.

TABLE 4-1 Summary of Diamond Fork System Features	
Syar Tunnel and Inlet Portal	Conveys water from Strawberry Reservoir to Sixth Water Aqueduct. The inlet portal extends 2,435 feet into Strawberry Reservoir. Tunnel dimensions are - Length: 30,100 feet; capacity: 800 to 660 cfs, depending upon Strawberry Reservoir water levels
Sixth Water Aqueduct (pipeline, shaft and flow control structure)	The aqueduct connects Syar Tunnel to a pipeline leading to the Sixth Water Flow Control Structure. The pipeline is 4,224 feet in length with a diameter of 96 inches and a capacity of 800 cfs. The Sixth Water Shaft is 575 feet in length; a diameter of 102 inches and a capacity of 800 cfs
Sixth Water Connection to Tanner Ridge Tunnel	This connection conveys water by gravity flow from the existing Sixth Water Flow Control structure at the end of Sixth Water Aqueduct to the Tanner Ridge Tunnel. *Length & Diameter:100 feet box culvert 12 foot wide and a 50 foot shaft of 240 inch diameter: Capacity of connection: 660 cfs*
Tanner Ridge Tunnel	The tunnel conveys water through Tanner Ridge, which lies between Sixth Water Canyon and Diamond Fork Canyon. *Length: 5,234 feet; Diameter: 126 inches; Capacity: 660 cfs*
Upper Diamond Fork Pipeline	This pipeline connects the Tanner Ridge Tunnel with the Upper Diamond Fork Flow Control Structure. *Length: 5,485 feet: Diameter: 96 inches: Capacity: 660 cfs*
Upper Diamond Fork Flow Control Structure	This structure consists of 2 sleeve valves and associated piping. *Length: 100 feet: Diameter: Two – 54 inch:; Capacity 660 cfs,*
Diamond Fork Vortex Shafts	The Diamond Fork Vortex Shafts consist of three vertical shafts – each 187.5 feet deep and 78 inches in diameter. One shaft is for venting and two for conveying a combined flow of 660 cfs.
Aeration Chamber and Connection to Upper Diamond Fork Tunnel	The chamber extends from the bottom of the Diamond Fork Shafts to the Upper Diamond Fork Tunnel. Length: 148 feet; The initial cross section is 16' x 16' transitioning to 10.5' x 10.5'. It connects to the Upper Diamond Fork Tunnel via a 126 inch diameter tunnel segment with a capacity of 660 cfs.
Upper Diamond Fork Tunnel	This tunnel conveys water from the Upper Diamond Fork Flow Control Structure to the Monks Hollow Overflow Structure, *Length: 13,114 feet; Diameter: 126 inches; Capacity; 660 cfs*
Monks Hollow Overflow Structure	This structure is located at the Upper Diamond Fork Tunnel outlet portal and connects to the Diamond Fork Creek Outlet. *Length: 40 feet; Diameter: 96 inches; Capacity: 660 cfs*
Diamond Fork Creek Outlet	Diamond Fork Creek Outlet consists of a concrete pipeline from the Monks Hollow Overflow Structure to an energy dissipation structure discharging to a 350-foot long open channel tributary to Diamond Fork Creek. *Length: 1,500 feet; Diameter: 84 inches; Capacity: 660 cfs.*
Diamond Fork Pipeline Extension	This pipeline extension connects the Upper Diamond Fork Tunnel to the upstream end of the Diamond Fork Pipeline. *Length: 6,364 feet: Diameter: 96 inches; Capacity: 560 cfs*
Diamond Fork Pipeline	Conveys Bonneville Unit water from the end of the Diamond Fork Pipeline Extension to the Spanish Fork River Flow Control Structure where it will connect to the Spanish Fork Canyon Pipeline of the ULS System. *Length: 35,643 feet; diameter: 96 inches; capacity: 560 cfs*



Map 4-1

Features of the Diamond Fork System

Minimum flows in Diamond Fork Creek, from Diamond Fork Creek Overflow Structure near Red Hollow to the Spanish Fork River, would be not less than 80 cfs from May through September and not less than 60 cfs from October through April. Average annual releases from Strawberry Tunnel (about 17,000 acre-feet) and Diamond Fork Creek Outlet (12,500 acre-feet) would be combined with the average annual natural flow of Diamond Fork Creek (about 29,400 acre-feet) to maintain required minimum flows in Diamond Fork Creek downstream from Diamond Fork Creek Overflow Structure.

DESCRIPTION OF FEATURES

The following paragraphs provide more detailed descriptions of the primary features of the Diamond Fork System.

Syar Tunnel and Inlet Portal

Syar Tunnel begins at the west bank of Strawberry Reservoir. The tunnel, about 30,100 feet long, is a pressure type tunnel, 8.5 feet in diameter, with a capacity of about 800 cfs when Strawberry Reservoir is full and 660 cfs when the reservoir level is at its operational minimum. The outlet portal is located at the western border of Strawberry Ridge in Rays Valley.

The completed Syar tunnel includes a 2,435-foot long inlet portal that was completed as part of the Strawberry Tunnel inlet rehabilitation. The principal features of the inlet rehabilitation are the inlet structure, the new tunnel, a connecting tunnel to the existing Strawberry Tunnel, and the control structure with the gate shaft and two 8 foot 6 inch by 10 foot slide gates. The inlet structure is reinforced concrete and consists of a trash rack structure, a seat for the inlet bulkhead gate, and a square-to-round transition to the new tunnel. The gate chamber contains two 8 foot 6 inch by 10 foot hydraulically operated outlet gates with steel frames to control the flow from Strawberry Reservoir into the new inlet tunnel. The new inlet tunnel is a 10-foot 9-inch diameter, reinforced concrete, pressure tunnel.

TABLE 4-2
Distribution of Transbasin Diversion From Strawberry Reservoir

Component	Average Acre-Feet per Year
Distribution of Transbasin Diversion Between the Tunnels	145,900
• Syar Tunnel release volume	17,000
• Strawberry Tunnel release volume	**162,900**
Total	
Distribution of Transbasin Diversion in Diamond Fork Creek and Diamond Fork Pipeline	
• Diamond Fork Creek conveyance volume[a]	29,500
• Diamond Fork Pipeline conveyance volume	133,400
Total	**162,900**

[a] In addition to this Strawberry Reservoir water, 29,400 acre-feet of natural flow and about 3,600 acre-feet of seepage from Strawberry Tunnel would be conveyed in Diamond Fork Creek as measured below the Upper Diamond Fork Flow Control Structure.

Sixth Water Aqueduct (Pipeline, Shaft and Flow Control Structure)

The Sixth Water Aqueduct is located in the vicinity of Rays Valley and Fifth Water Ridge. The aqueduct connects Syar Tunnel to a pipeline leading to the Tanner Ridge Tunnel and consists of – a pipeline, shaft and flow control structure. The pipeline is 4,224 feet in length with a diameter of 96 inches and a capacity of 660 cfs. The Sixth Water Shaft is 575 feet in length with a diameter of 102 inches and a capacity of about 800 cfs.

Sixth Water Connection to Tanner Ridge Tunnel

This structure, at Sixth Water Creek, conveys water from the existing outlet structure at the end of Sixth Water Aqueduct to the Tanner Ridge Tunnel inlet portal. An inlet box is constructed adjacent to the existing weir, which is part of the existing flow-control facility, with an overflow weir that allows a discharge of water from Sixth Water Aqueduct to Sixth Water Creek.

The existing Sixth Water Aqueduct outlet bifurcation will accommodate hydroelectric generating facilities of the ULS System. The 108-inch-diameter pipeline is about 100 feet long with a capacity of 660 cfs and connects the inlet box to the Tanner Ridge Tunnel inlet portal.

Tanner Ridge Tunnel

Tanner Ridge Tunnel will convey water through Tanner Ridge, which lies between Sixth Water Canyon and Diamond Fork Canyon. The concrete-lined, 660 cfs tunnel is about 5,234 feet long with a finished diameter of 126 inches. The tunnel inlet portal is at nearly the same elevation as the outlet of Sixth Water Connection at the bottom of Sixth Water Canyon. Tunnel access is through the connection inlet box on the east side of Sixth Water Creek. The outlet portal is located in Diamond Fork Canyon, 2.3 miles upstream of Three Forks. It is set back horizontally 2,250 feet from the creek, about 385 feet higher than Diamond Fork Creek. A permanent, 30-inch-diameter, limited-access portal provides access for maintenance personnel.

Upper Diamond Fork Pipeline

The pipeline is 96-inches in diameter and about 5,485 feet long with a capacity of 660 cfs. The pipeline connects Tanner Ridge Tunnel to the Upper Diamond Fork Flow Control Structure.

Upper Diamond Fork Flow Control Structure

The Upper Diamond Fork Flow Control Structure consists of a 0.4 acre filled building pad, a buried pipeline bifurcation, a 45-foot wide by 80 foot underground vault housing cone valves with the roof slab at ground level, a 20-foot by 25-foot concrete-masonry control building, a vinyl-covered fence surrounding the building pad and a 110-foot long access road and 20-foot long box culvert bridge across Diamond Fork Creek.

The pipeline bifurcation splits the 660-cfs flow into two 54-inch diameter pipes that conveys the water to two sleeve valves, dissipating the pressure in the water before it enters the Diamond Fork Shaft.

Diamond Fork Vortex Shafts

The Diamond Fork Vortex Shafts consists of three vertical shafts, including two vortex shafts for conveying water down to the aeration chamber and Upper Diamond Fork Tunnel, and one vent shaft. The 78-inch diameter vortex shafts, dissipates most of the remaining energy as the water is forced through the shafts in a vortex motion. The 78-inch diameter vent shaft connects to the aeration chamber at the bottom of the shafts and provides maintenance access. Each shaft is about 187.5 feet deep.

The two vortex shafts have a combined capacity of 660 cfs.

Aeration Chamber and Connection to Upper Diamond Fork Tunnel

The aeration chamber and connection to the Upper Diamond Fork Tunnel is approximately 148 feet long from the bottom of the Diamond Fork Vortex Shafts to the existing Upper Diamond Fork Tunnel. The initial dimensions of the aeration chamber are 16' x 16' transitioning to 10.5' x 10.5' connecting the Upper Diamond Fork Tunnel via a 126-inch diameter curved tunnel segment lined with reinforced concrete.

The aeration chamber and connection structure have a capacity of 660-cfs.

Upper Diamond Fork Tunnel

Upper Diamond Fork Tunnel conveys water through Red Mountain (which lies between Diamond Fork Canyon and Red Hollow) connecting the Upper Diamond Fork and Diamond Fork pipelines. The concrete-lined, 660-cfs tunnel is about 13,114 feet long, with a finished diameter of 126 inches.

Upper Diamond Fork Tunnel is a gravity tunnel that conveys water from the Upper Diamond Fork Flow Control Structure to the Monks Hollow Overflow Structure. The tunnel is constructed primarily in siltstone and conglomerate rock at a slope of 0.003 to 0.005 feet per foot. The tunnel is lined with concrete and has fiber optic cables in conduit attached to the ceiling throughout its length.

The tunnel outlet portal is located upstream of Monks Hollow and Red Hollow on the hillside north of Diamond Fork Creek, with an invert elevation of about 5,550 feet Mean Sea Level (MSL). The outlet portal is constructed at the toe of a southwest-facing hillside, and the existing slope and ground surface has been restored to approximately the original contour. The restored slope has been covered with topsoil and revegetated with native plants. The tunnel portal finished yard elevation is about 5,560 feet MSL.

Monks Hollow Overflow Structure and Diamond Fork Creek Outlet

Monks Hollow Overflow Structure is a concrete structure approximately 90'-by-20'- located at the Upper Diamond Fork Tunnel outlet portal. The concrete structure contains two chambers mostly buried in the portal yard, with only the top of the structure visible at the portal yard surface. The first chamber would receive flow from the pipeline exiting the tunnel and would connect to the 96-inch diameter Diamond Fork Pipeline Extension, with a capacity of 560 cfs. This chamber would have an internal overflow weir at about 5,555 feet MSL matching the existing design head for the Diamond Fork Pipeline. The overflow weir would discharge into the second chamber connected to the 96-inch-diameter emergency overflow and bypass pipeline to Diamond Fork Creek Outlet. The second chamber would be connected to the floor culvert and slide gate by a concrete channel to receive the bypass flows. The emergency overflow and bypass pipeline would have a capacity of 660 cfs, terminating at the Diamond Fork Creek Outlet. Water that would flow over the weir at 5,555 feet MSL would be released only in the event of an emergency overflow or requirement for bypass of the Diamond Fork Pipeline. The overflow structure and tunnel portal yard would be fenced with a 6-foot-high chain-link fence to prevent public access.

The Overflow Structure is necessary to be sure that maximum head on the Diamond Fork Pipeline of 5,555 is not exceeded. The structure also provides a means for releasing water to Diamond Fork Creek for minimum flow maintenance.

Diamond Fork Pipeline Extension

Diamond Fork Pipeline Extension, with a length of 6,364 feet and a capacity of 560 cfs, would connect Monks Hollow Overflow Structure to the upstream end of the existing Diamond Fork

Pipeline. The mortar-lined steel pipeline is installed underground following the ground surface, with a minimum 3-foot cover over the pipeline. It has air release and air vacuum valves, and vaults incorporating manway access at various points along its length, with the same design and surface features as the existing Diamond Fork Pipeline. The location of these appurtenances were determined as part of the design process. All vent structures are screened with vegetation, rocks and/or soil mounds and colored using appropriate earth-tone colors.

Diamond Fork Pipeline

The Diamond Fork Pipeline receives water from the Upper Diamond Fork Tunnel and Overflow Structure, via the Diamond Fork Pipeline Extension. The Diamond Fork Pipeline conveys water to the Spanish Fork River Flow Control Structure a feature of the Utah Lake Drainage Basin Water Delivery System. The water is then discharged either back to Diamond Fork Creek at its junction with the Spanish Fork River which reduces erosion and provides considerable enhancement to the fishery in Diamond Fork, or it is conveyed in the Utah Lake System down the canyon. The buried pipeline has a diameter of 96 inches and a capacity of 560 cfs. The pipeline has a length of 35,643 feet.

CENTRAL UTAH PROJECT COMPLETION PROGRAM

Chapter 5

October 2004

INTRODUCTION

The purpose of the ULS System is to distribute a portion of the water developed by the other parts of the Bonneville Unit to areas along the Wasatch Front for municipal and industrial uses. The ULS System provides physical means of linking the operation of the other systems to make the overall management of the Bonneville Unit more efficient in meeting projected water needs. The system conveys water received from the Diamond Fork System to points of use in southern Utah County and to the Provo Reservoir Canal in northern Utah County for eventual M&I use in Salt Lake County. Proposed structural features of the ULS System include:

- Sixth Water Power Plant and Transmission Lines;
- Upper Diamond Fork Power Plant and Underground Transmission Cable;
- Spanish Fork Canyon Pipeline;
- Spanish Fork-Santaquin Pipeline;
- Santaquin-Mona Reservoir Pipeline;
- Spanish Fork-Provo Reservoir Canal Pipeline; and
- Mapleton – Springville Lateral Pipeline

The primary features of the ULS System are shown on Map 5-1 (pipelines) and Map 5-2 (powerplant and transmission lines). Tables 5-1 and 5-2 contain a summary of information on the features of the ULS System. It should be noted that the Spanish Fork River Flow Control Structure is a part of the ULS System and has already been constructed.

DISTRICT WATER RIGHTS

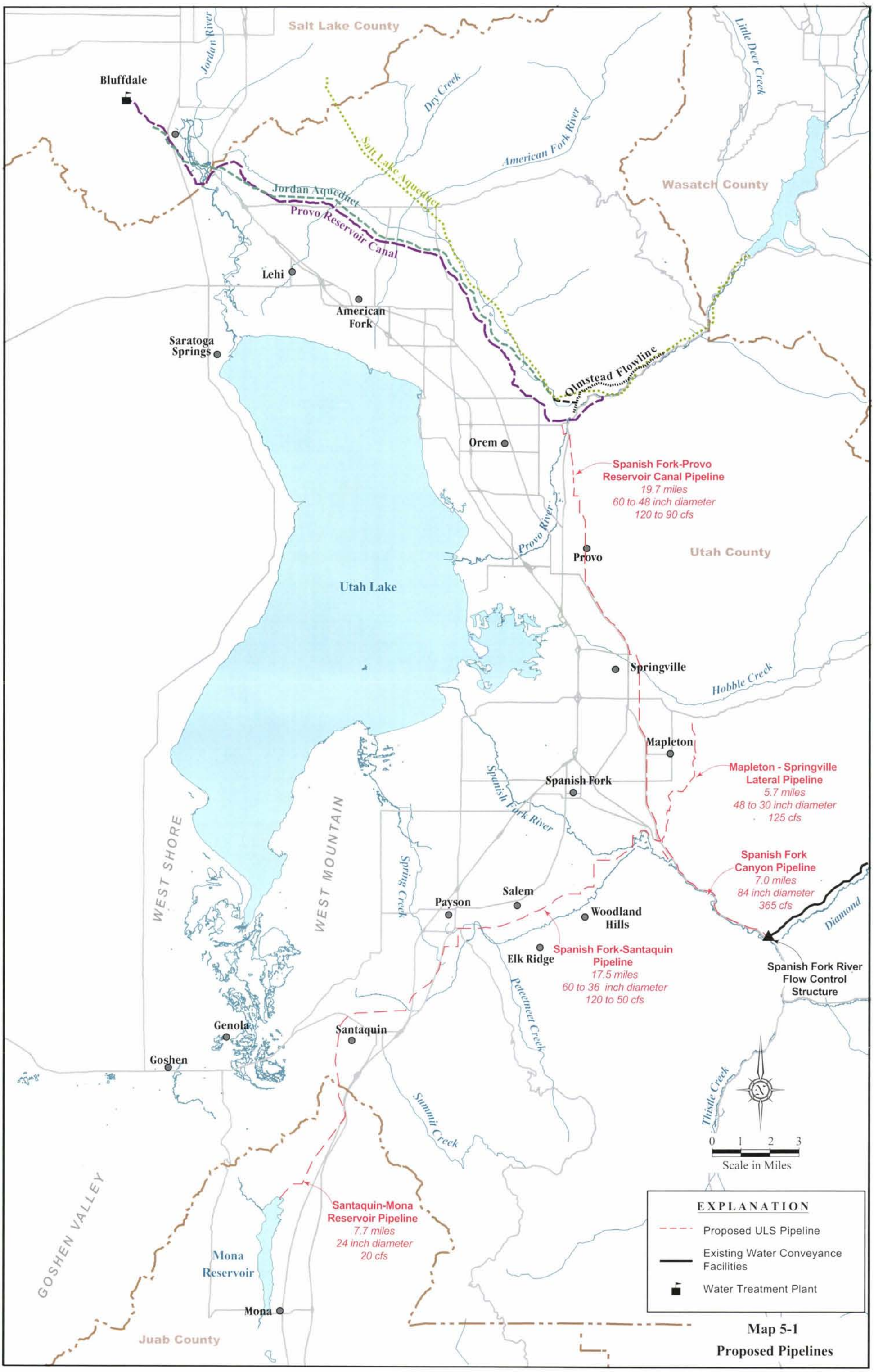
The District owns primary and secondary water rights in Utah Lake. Under the ULS System Proposed Action, the DOI would acquire all of the District's secondary rights. These rights would amount to approximately 57,000 acre-feet and would yield at least 34,540 acre-feet of water annually. The acquired 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.

PEAK DESIGN FLOW IN PIPELINES

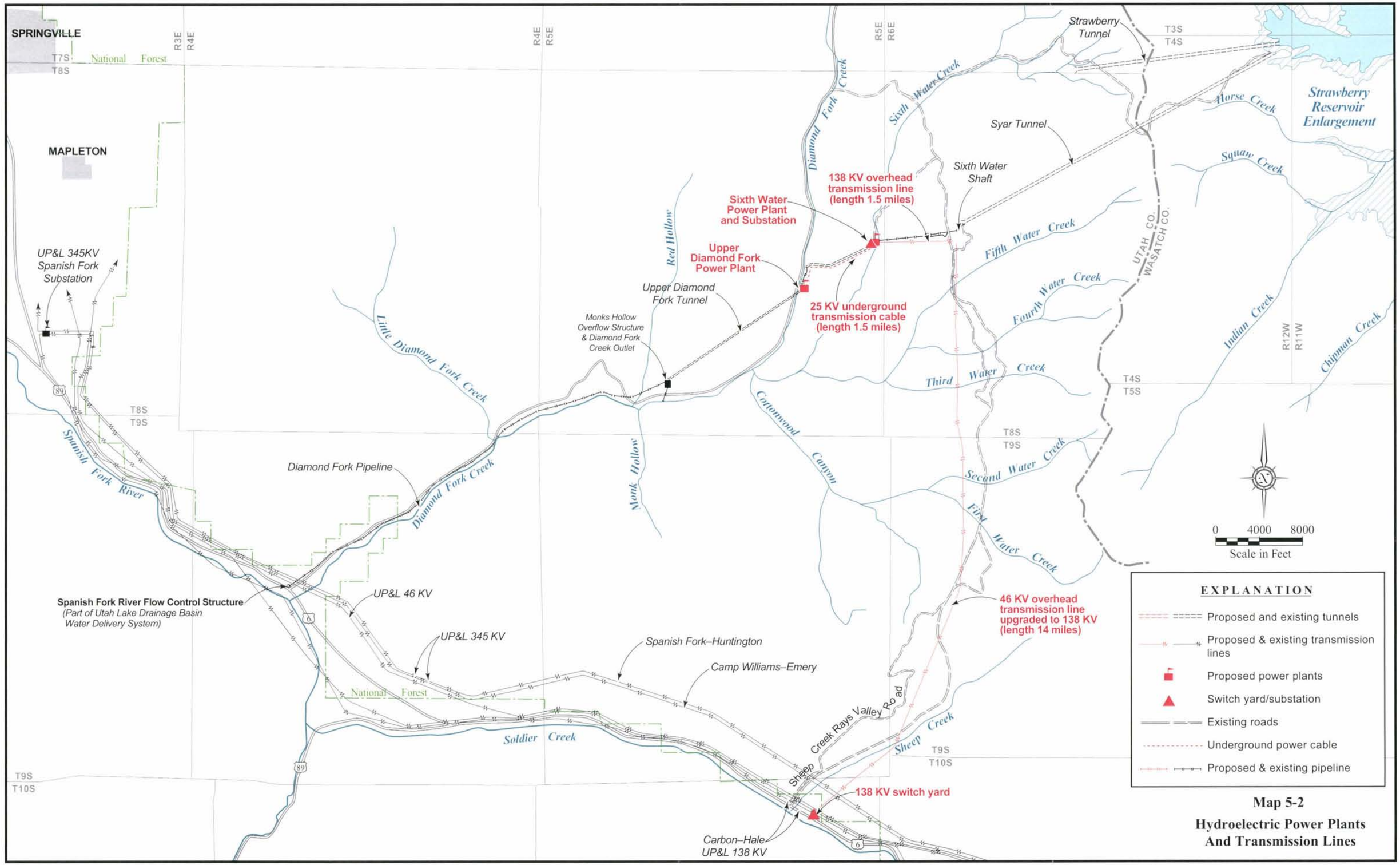
The ULS System facilities would deliver approximately 85,627 ac-ft of Bonneville Unit water on an average annual basis. Salt Lake County would receive an average of 30,000 ac-ft annually, via the Spanish Fork – Provo Reservoir Canal Pipeline, for M&I use. The Provo River would receive an average of 16,000 ac-ft annually to assist in meeting instream flow objectives and for exchange to Jordanelle Reservoir. Southern Utah County would receive an average of 39,627 ac-ft annually. Of this volume, the Spanish Fork – Santaquin Pipeline would convey an average of 27,590 ac-ft annually for delivery to the southern Utah County communities. Through conservation and exchange an average of 11,037 ac-ft of ULS water would be delivered annually to Hobble Creek through the Mapleton – Springville Lateral Pipeline to provide attraction flows for the endangered June sucker. The peak projected operating flows through the ULS System pipeline facilities were obtained from the Water Supply Appendix Volume 5, and are summarized in Table 5-3.

CONSERVED WATER (SECTION 207 FUNDING)

Features that would be constructed under Section 207 funding include the Provo Reservoir Canal Enclosure, partial funding of the Mapleton-Springville Lateral Piping and the Spanish Fork Canyon Pipeline, and numerous other smaller Section 207 projects. The cost for the Mapleton-Springville Lateral Pipeline is presented as part of the ULS System cost estimate. The Provo Reservoir Canal Enclosure is not a part of the ULS System but under a cost sharing arrangement the Federal government would contribute funding to the construction of the project with this cost being reflected in the financial and economic analyses along with the other remaining Section 207 projects.



Map 5-1
Proposed Pipelines



Map 5-2

Hydroelectric Power Plants And Transmission Lines

TABLE 5-1
Summary of Generation Plants and Transmission Lines

Feature Name	Transmission Line Length (miles)	Capacity
Sixth Water Power Plant	n/a	45 MW
Sixth Water Transmission Line	12.9 (overhead type)	138 kV
Upper Diamond Fork Power Plant	n/a	5 MW
Upper Diamond Fork Underground Transmission Cable	1.6 (existing underground)	25 kV

TABLE 5-2
Summary of Pipeline Dimensions

	Length (miles)	Diameter (inches)	Capacity (cfs)
Spanish Fork Canyon Pipeline	7.0	84	365
Spanish Fork-Santaquin Pipeline	17.5	60 to 36	120 to 50
Santaquin-Mona Reservoir Pipeline	7.7	24	20
Mapleton – Springville Lateral Pipeline	5.7	48	125
Spanish Fork-Provo Reservoir Canal Pipeline	19.7	60 to 48	120 to 90

TABLE 5-3
Design Flows for Pipelines

Pipeline	Station Limits	Peak Flow (cfs)
Spanish Fork Canyon Pipeline	Station 100+00 to 468+08	365
Spanish Fork-Santaquin Pipeline	Station 13+21 to 354+54 Station 354+54 to 393+25 Station 393+25 to 523+59 Station 523+59 to 790+80 Station 790+80 to 875+95 Station 875+95 to 938+26	120 110 105 70 60 50
Santaquin – Mona Reservoir Pipeline	Station 12+28 to 419+10	20
Mapleton – Springville Lateral Pipeline	Station 10+00 to 310+41	125
Spanish Fork – Provo Reservoir Canal Pipeline	Station 53+38 to 1011+00 Station 1011+00 to 1092+41	120 90

FLOWS THROUGH POWER GENERATION PLANTS

Flows used to size and analyze the power generation plants were compiled from the Water Supply Appendix, Volume 5. At both the Sixth Water and the Upper Diamond Fork Power Generation Plants, approximately 35% of the average monthly flows are SVP water with the remaining 65% of the flow being Bonneville Unit water. Table 5-4 summarizes the total (SVP and Bonneville Unit) average, minimum and maximum flows through both power generation plants. Refer to the Water Supply Appendix that accompanies this 2004 Definite Plan Report Supplement for monthly flows from 1950 through 1999.

SPANISH FORK RIVER FLOW CONTROL STRUCTURE

The Spanish Fork River Flow Control Structure, located at the terminal end of the Diamond Fork Pipeline, is a feature of the Utah Lake Drainage Basin Water Delivery System and has already been constructed. Main elements include: (1) an extension of the Diamond Fork Pipeline of approximately 1,200 feet of 96-inch diameter steel pipe; (2) a reinforced concrete flow control structure, consisting of the valve operator vault, control building, and sleeve vault; (3) associated piping and appurtenances, including two 42-inch sleeve valves, two 48-inch spherical valves, two flow meters, and two stainless steel vault liners; and (4) discharge weir structure to convey 560 cfs maximum flow into Diamond Fork Creek. This structure spans approximately 65 feet.

SPANISH FORK CANYON PIPELINE

The Spanish Fork Canyon Pipeline would connect to the existing 96-inch welded steel pipe bypass adjacent to the Spanish Fork River Flow Control Structure at the mouth of Diamond Fork Canyon and follow the U.S. Highway 6 alignment to the mouth of Spanish Fork Canyon near the intersection with U.S. Highway 89. The Spanish Fork Canyon Pipeline would cross the Wasatch Fault in Spanish Fork Canyon and would incorporate seismic design measures to minimize the risk of pipeline rupture.

The Spanish Fork Canyon Pipeline would be buried under the northeast shoulder of U.S. Highway 6 and along 0.8 miles of U.S. Highway 89. The steel pipeline would descend about 300 feet in elevation from the Spanish Fork Flow Control Structure to the mouth of Spanish Fork Canyon. The pipeline would have about 15 air release valves; about 6 vacuum relief valves and about 6 drain valves and pipes located along its alignment. Valves would be located in concrete vaults offset from the pipeline alignment. The Spanish Fork Canyon Pipeline would connect with three ULS System pipelines near the Highway 6 and 89 junction:

- Mapleton – Springville Lateral Pipeline;
- Spanish Fork – Santaquin Pipeline; and
- Spanish Fork-Provo Reservoir Canal Pipeline

TABLE 5-4
Projected Flows through ULS Power Plants
(flows in cfs)

Sixth Water and Upper Diamond Fork Power Plants												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average	100	70	71	65	60	51	98	227	398	491	483	289
Maximum	222	190	182	147	138	135	181	460	570	649	622	423
Minimum	38	25	30	25	25	20	43	102	159	353	275	183

As noted above, the Spanish Fork Canyon Pipeline would generally parallel the north side of U.S. Highway 6 for approximately 6.2 miles. However there are several tight spots along the canyon where rock outcrops and talus slopes pinch the roadway against the river, resulting in little or no space to the north of the highway to place the pipeline. In these locations it will be necessary to either cut into the slope, extend the road shoulder, tunnel through the hillside, or place the pipeline in the road.

The hydraulic profile and plan view of the Spanish Fork Canyon alignment are located in the Designs and Estimates Appendix that accompanies this 2004 Supplement. The alignment was selected to incur minimum environmental impact, as well as for access and ease of construction.

Flows in the pipeline would be controlled by demands in the Mapleton-Springville Lateral, Spanish Fork-Santaquin-Mona Reservoir, and Spanish Fork-Provo Reservoir Canal pipelines. The 84-inch diameter pipeline would be designed with a capacity of 365 cfs, which reflects the combined capacity of the three pipelines. In addition, the 84-inch pipeline could carry up to 10,200 acre-feet annually of SVP irrigation water acquired by the cities in southern Utah County on a space-available basis.

SPANISH FORK - SANTAQUIN PIPELINE

The Spanish Fork -Santaquin Pipeline would connect to the Spanish Fork Canyon Pipeline about 0.8 miles northwest of the Highway 6/Highway 89 junction, and traverse approximately 17.5 miles in southern Utah County terminating just west of the Union Pacific Railroad tracks near Summit Creek Reservoir. Wherever possible, the alignment would be installed adjacent to existing roads and Union Pacific Railroad rights-of-way, or in farmed or open areas to minimize environmental impacts and to accommodate construction access. Four pipeline segments totaling approximately 5.1 miles would be buried in non-road, farmed or open areas. This includes:

- About 0.3 miles from Highway 89 to 2400 east at Sutro,
- 0.4 miles along the western border of the Spanish Fork Golf Course,
- 0.7 miles from Salem Canal Road to 700 South in Payson,
- Approximately 3.7 miles from I-15 to the end of the pipeline

Other factors influencing the alignment include hydraulic grade line, desired turnout locations and individual community preferences for minimum turnout pressures. The hydraulic profile and plan view of the Spanish Fork – Santaquin Pipeline alignment are located in the Designs and Estimates Appendix.

This pipeline would be designed to accommodate a maximum flow of 120 cfs. Hydraulic capacity along the full length of the pipeline would range from 120-50 cfs. The pipe size would range from 60-inch diameter at the connection to the Spanish Fork Canyon Pipeline to 36-inch diameter past the Santaquin turnout. The pipeline would also accommodate SVP irrigation water acquired by the cities on a space-available basis.

Design of the Spanish Fork – Santaquin Pipeline would include turnouts to eight SUVMWA member communities in southern Utah County. The size and capacity of each turnout would vary depending on the off-peak demand for each turnout, which would be higher than the capacity dedicated to each turnout during peak operation. For example, suppose peak operating flows occur in the pipeline from 10 p.m. until 6 a.m. Santaquin, with an installed turnout capacity of 50 cfs and a dedicated capacity of 45 cfs, could only call 45 cfs during this peak period. However, once the peak demand was over, Santaquin could call up to their full 50 cfs to refill depleted storage tanks.

Dedicated turnout capacities were determined by combining historical and projected SVP and CUP secondary M&I deliveries for each city and applying typical annual distribution pattern for those deliveries to allocate the water throughout the year. An additional 5-10 cfs was added to each turnout to provide adequate capacity for peaking.

Tables 5-5 and 5-6 summarize the annual distribution pattern as well as the dedicated and installed turnout capacity for each of the eight communities requesting turnouts.

TABLE 5-5
Secondary M&I Deliveries
Typical Monthly Distribution Pattern
(% of annual volume)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
0%	0%	0%	2%	12%	18%	22%	25%	20%	0%	0%	0%

TABLE 5-6
Hydraulic Capacity and Pipe Size
Spanish Fork – Santaquin Pipeline

Turnout	Pipe Diameter (inches)	Pipeline Capacity (cfs)	Dedicated Turnout Capacity (cfs)	Installed Turnout Capacity (cfs)
Spanish Fork	60	120	15	25
Woodland Hills	54	120	5	10
Salem	54	120	25	25
Elk Ridge	48	110	5	10
Payson	48	105	25	40
West Payson	48	70	10	20
Genola	42	60	5	20
Santaquin	36	50	25	50
Mona Reservoir Turnout	24	20	5	20

SANTAQUIN – MONA RESERVOIR PIPELINE

The Santaquin – Mona Reservoir Pipeline would begin at Station 12+28 and connect to the Spanish Fork – Santaquin Pipeline immediately after the Union Pacific railroad track crossing. The alignment traverses approximately 7.7 miles to Mona Reservoir. The 24-inch diameter pipe would have a capacity of 20 cfs. Pipeline design would include a pressure reducing valve, weir box and a rip-rap lined outfall to minimize scouring and erosion at the turnout location. Hydraulic profiles for the pipeline and alignment are contained in the Designs and Estimates Appendix.

MAPLETON – SPRINGVILLE LATERAL PIPELINE

The Mapleton - Springville Lateral Pipeline with a design capacity of 125 cfs would begin at station 422+00 of the Spanish Fork Canyon Pipeline. The flow would enter a pressure reducing station where the pressure carried from the Diamond Fork System would be regulated to produce a beginning hydraulic gradeline of 5,155 feet. Approximately 5.7 miles of the 48-inch diameter pipe would be installed within and thus replace the Mapleton Lateral Canal. The last mile of the existing lateral would be reconstructed and retained to convey the Maple Creek flows to Hobble Creek. The remaining one mile of 48-inch pipeline would be constructed parallel to the retained canal to convey water to the existing Hobble Creek siphon for the Springville Irrigation District.

As a related action, Mapleton and Springville cities would install secondary systems under a combined CUPCA Section 207 Project. The alignment described above was selected to continue service to existing turnout locations, as well as the ability to utilize the Canal right-of way wherever possible to minimize impacts to the environment and to provide for construction access. The hydraulic profile and plan view of the Mapleton – Springville Lateral alignment are located in the Designs and Estimates Appendix.

Strawberry Valley Project (SVP) water historically carried through the lateral would be conveyed through the Mapleton - Springville Lateral Pipeline, as well as an annual average of 11,037 ac-ft of ULS water to Hobble Creek to provide attraction flows for the endangered June sucker and to be exchanged to Jordanelle Reservoir.

Eleven valved turnouts would be installed along the Mapleton - Springville Lateral Pipeline to continue service to existing irrigation turnouts. Nine of these will be 7-cfs turnouts and two will be 14-cfs turnouts. Water delivered to the Fingerhut property at the mouth of Spanish Fork Canyon would be by exchange with Spanish Fork City. In addition, a 90 cfs turnout at Maple Creek, and a stubbed 36 cfs turnout to the Springville Irrigation District would be installed. Table 5-7 summarizes the design capacity, pipe sizes and turnout capacity for the Mapleton-Springville Lateral Pipeline.

TABLE 5-7
Hydraulic Capacity and Pipe Size
Mapleton – Springville Lateral Pipeline

Turnout	Pipe Diameter (inches)	Pipeline Capacity (cfs)	Dedicated Capacity (cfs)	Installed Capacity (cfs)	Turnout Diameter (inches)
Turnout #2A[1]	-	-	2	-	-
Turnout #4	48	125	7	7	18
Turnout #5	48	125	7	7	18
Turnout #6	48	125	7	7	18
Turnout #7	48	125	7	7	18
Turnout #9	48	125	7	7	18
Turnout #10	48	125	7	7	18
Turnout #10A	48	125	7	7	18
Turnout #11	48	125	7	7	18
Maple Creek	36	125	90	125	48
Hopla Turnout	36	64	7	7	18
Mendenhall Turnout	36	64	14	14	24
Fulmer Turnout	36	50	14	14	24
Springville Irrigation District	30	36	36	36	36

SPANISH FORK - PROVO RESERVOIR CANAL PIPELINE

The Spanish Fork – Provo Reservoir Canal Pipeline would be constructed from the Spanish Fork Canyon Pipeline along U.S. Highway 89 through Mapleton, 400 East in Springville, then back to Highway 89 en route to Provo, and through residential streets in Provo, discharging to the Provo River, the Provo Reservoir Canal at 800 North in Orem, or the Jordan Aqueduct, a distance of 18 miles. The Provo Reservoir Canal would convey ULS water to Salt Lake County water treatment plants. Past the Provo Reservoir Canal turnout, the Spanish Fork – Provo Reservoir Canal Pipeline would continue to parallel the Provo Reservoir Canal for about another 1.5 miles, connecting to the Jordan Aqueduct near the Utah Valley Water Treatment Plant. This extended pipeline segment would allow conveyance of ULS water to Salt Lake County water treatment plants through the Jordan Aqueduct during the winter months (November – March), when the Provo Reservoir Canal is non-operational or at other times on a space-available basis.

The pipeline alignment was selected to minimize impacts to the environment as well as traffic as it traverses through Mapleton, Springville and Provo, and generally follows existing roadways through those towns. Six pipeline segments would be buried in non-road, open or farmed areas as follows:

[1] This inactive turnout would be provided service indirectly by exchange with the Spanish Fork City secondary system if necessary.

- 0.5 mile across State Hospital land near Seven Peaks Center in Provo
- 0.5 mile across a semi-wooded area in Provo that is planned to be cleared for the extension of Seven Peaks Boulevard.
- 0.3 mile across Rock Canyon Park in Provo
- 0.9 mile from 4525 North at Canyon Road across a field and hillside to U.S. Highway 189 in Provo
- 0.3 mile from Heritage Road in Provo to State Route 52 (800 North) in Orem
- 1.5 miles along the Provo Reservoir Canal to the Jordan Aqueduct in Orem

The hydraulic profile and plan view of the Spanish Fork – Provo Reservoir Canal Pipeline alignment are presented in the Designs and Estimates Appendix.

The Spanish Fork – Provo Reservoir Canal Pipeline would be designed with a capacity of 120 to 90 cfs. The pipe size would range from 60-inch diameter at the connection to the Spanish Fork Canyon Pipeline to 48-inch diameter at the Jordan Aqueduct.

The pipeline would be designed with three turnouts. The first turnout out would be for discharging water to the lower Provo River to assist in the maintenance of instream flows, and would be located at the crossing site near Heritage Park. An isolation valve and a pressure-reducing valve would be installed in a concrete vault that would discharge water to the river over a weir. A maximum turnout capacity of 75 cfs would be installed at this location. The second turnout would be approximately one half mile past the Provo River turnout at the Provo Reservoir Canal. Dissipation valves to relieve excess pressure would be required at the discharge point into the Provo Reservoir Canal. Pressure reducing valves would be installed in a concrete vault to dissipate the excess energy. Up to 120 cfs would flow into a weir structure and discharge into the Provo Reservoir Canal. The pipeline would continue past the Provo Reservoir Canal approximately another 1.5 miles to another overflow weir structure at the Jordan Aqueduct, near the Utah Valley Water Treatment Plant. The turnout would be designed with a capacity of 90 cfs. Table 5-8 summarizes hydraulic capacity, pipe sizes and turnout capacity for the Spanish Fork to Provo Reservoir Canal Pipeline.

TABLE 5-8
Hydraulic Capacity and Pipe Size
Spanish Fork – Provo Reservoir Canal Pipeline

Turnout	Pipe Diameter (In)	Pipeline Capacity (cfs)	Installed Turnout Capacity (cfs)	Turnout Diameter (In)
None	60	120	N/A	N/A
Provo River	54	120	75	48
Provo Reservoir Canal	54	120	120	54
Jordan Aqueduct	48	90	90	48

ULS SYSTEM HYDROELECTRIC POWER PLANTS

Two hydroelectric power plants will be located in Diamond Fork Canyon. The site selections for the Sixth Water and Upper Diamond Fork Hydroelectric Power Plants were dictated by the location of the following flow control structures:

- Sixth Water Flow Control Structure
- Upper Diamond Fork Flow Control Structure

Flow releases through the Diamond Fork System and the ULS System aqueducts and pipelines would be dictated by CUP and SVP water needs and would be used for electric energy generation at the hydroelectric power plants as a secondary purpose. Furthermore, the supply of water to meet downstream demands would be maintained at all times even when the hydroelectric power plants would be out of service due to scheduled and unscheduled outages.

The hydroelectric powerplants would be located adjacent to the flow control structures. In addition, the turbine(s) at the hydroelectric powerplants would be linked to the associated flow control valve(s) in order to provide an uninterrupted flow in the water conveyance system (pipeline or aqueduct), should the plants be out of service.

See the Power Appendix for a more in-depth discussion on the hydropower facilities.

Sixth Water Hydroelectric Power Plant

The hydroelectric powerplant of 45 MW capacity would be adjacent to the existing Sixth Water Flow Control Structure and the centerline of the unit(s) would be at an elevation of approximately 6,330-ft. Under normal operations, the Sixth Water Aqueduct draws water from the Strawberry Reservoir and discharges it into the Tanner Ridge Tunnel, but discharging to Sixth Water Creek is possible. The conveyance conduit to the powerplant is approximately 34,300 ft long and includes the Syar tunnel, and the Sixth Water pipeline, shaft, and tunnel. The water level in the Strawberry Reservoir varies between elevations 7,604 ft and 7,560 ft, which are the normal maximum and minimum reservoir operating water levels, respectively. Therefore, the gross head in the hydroelectric power plant would vary between 1,289 ft and 1,245 ft.

Upper Diamond Fork Hydroelectric Power Plant

The Upper Diamond Fork hydroelectric power plant of 5 MW capacity would be located in the upper reach of the Diamond Fork Canyon in the mountains of Central Utah. The plant would be located adjacent to the Upper Diamond Fork Flow Control Structure and the centerline of the unit(s) would be at an elevation of approximately 5,765 ft.

Substations and Transmission Lines

The Sixth Water Hydroelectric Powerplant would be comprised of a powerhouse in the vicinity of the existing Sixth Water Flow Control Structure, an associated 25/138 KV substation and a 15.5 mile long, 138 kV transmission line connecting the plant with the electrical grid at the existing UP&L 138 KV transmission line that runs along Highway 6. The powerhouse would contain a single, vertical shaft, generating unit. Power to operate the flow control valves is currently supplied by a 1.5 mile long, 7.2 kV line running from a trailer mounted 46/7.2 kV step-down transformer located approximately 1/4 mile south of the outlet of the Syar Tunnel. However, the plant output is expected to largely exceed the line capacity. A 45 MW installed capacity was selected for the Sixth Water Power Plant. Transmission voltage of 138 kV would be required to maintain the voltage drop and transmission losses within acceptable limits. In addition, a new 138 kV switchyard would likely be required by UP&L to provide operational flexibility to their transmission system.

The Upper Diamond Fork Hydroelectric Powerplant would be comprised of a surface powerhouse in the vicinity of the Upper Diamond Fork Flow Control Structure. It would connect to the electrical grid via the substation associated with the Sixth Water power plant. The power plant would have a rated installed capacity of 5 MW at the generator terminals. A 1.5-mile long, 25 kV transmission line currently exists between the Sixth Water and Upper Diamond Fork Flow Control Structures. The

line consists of a 4/0 cable is attached to the ceiling of the concrete lining of the Tanner Ridge Tunnel (1.05 miles) and in a trench (0.45 miles), and would connect the generator with the step up transformer in the Sixth Water substation. The operating voltage would be 138 kV, which would preclude the need for a transformer at Upper Diamond Fork hydroelectric power plant.

Table 5-9 summarizes the interconnection point to the grid and transmission line length and voltage selected for the various hydroelectric power plants.

Net Energy Generated

The net energy generated (gross energy minus transmission losses is shown on next page in Table 5-10.

TABLE 5-9
Summary of Power Generation Plants and Transmission Lines

	Interconnection to Grid			Transmission Line Length (miles)		
Power Plant	**Point of Intersection**	**Owner**	**Transmission Voltage (kV)**	**Overhead**	**Buried**	**Total**
Sixth Water	Transmission Line	UP&L	138	15.5	--	15.5
Upper Diamond Fork	Substation(1)	--	25	--	1.5(2)	1.5

(1)The Upper Diamond Fork hydroelectric power plant would interconnect to the substation of the Sixth Water hydroelectric power plant.
(2)The line from Upper Diamond Fork hydroelectric power plant to Sixth Water substation is an existing line and consists of a 4/0 cable installed in the top of the Tanner Tunnel (1.05 miles) and in a trench (0.45 miles).

TABLE 5-10
Net Energy Generated (Kilowatt-hours)

	Sixth Water (45 MW Plant)	Upper Diamond Fork (5 MW Plant)
October	See footnote[2]	887,668
November	6,764,660	2,897,593
December	3,740,125	1,841,050
January	5,630,533	2,272,205
February	5,865,647	2,289,426
March	4,940,069	2,169,365
April	4,972,873	2,143,837
May	8,807,533	2,882,354
June	14,800,265	3,375,009
July	23,678,890	3,435,885
August	27,897,696	3,396,971
September	27,186,007	3,282,314
TOTAL	**134,269,417**	**30,873,677**

[2] The power plant would not be operated for generation of electricity when flows through the Powerplant reach a value that is less than 10% of the rated flow for the power plant. This condition is described as the parasitic load and is discussed more thoroughly in Attachment A of the Power Appendix.

CENTRAL UTAH PROJECT COMPLETION PROGRAM

Chapter 6

October 2004

PURPOSE AND SCOPE

The purpose of this chapter is to document the changes that have occurred in the Bonneville Unit agricultural acreage since the preparation of the *Bonneville Unit Definite Plan Report*, 1964 (1964 DPR) and the 1988 DPR Supplement. The Lands Appendix to the 1988 DPR Supplement dealt exclusively with agricultural lands in the Sevier River basin, which is no longer included in the Bonneville Unit. Of particular interest in this chapter, are the irrigable acres which by definition are those arable lands certified by the Secretary of Interior and for which there is a Bonneville Unit water supply. The certification signifies that when irrigated, the land would generate sufficient revenue to provide an income to the farm operator and repay the cost of water delivery facilities.

Included in this chapter is a discussion on –

- USBR land classification system;
- Listing of maps of classified acreage;
- Bonneville Unit Agricultural Areas;
- Areas excluded from the Bonneville Unit;
- Elimination of agricultural drainage from project plan;
- History of certification of lands;
- Duchesne River Lands;
- Heber-Francis Lands;
- Southern Utah County and Juab County Lands; and
- Summary of Arable and Irrigable Acreage Changes

USBR LAND CLASSIFICATION SYSTEM

Bonneville Unit agricultural lands were classified under the federal classification system used by the USBR. Land classification under this system includes both an examination of the physical and chemical characteristics of land (including soil, topography, and drainage), and an economic evaluation of the lands' agricultural suitability expressed in terms of relative net farm income or payment capacity.

The land classification system contains six classes of land, which are as follows:

- *Class 1* - Lands that are suited for irrigated farming in the area under study.

- *Class 2* - Lands that are moderately suitable for irrigated farming.

- *Class 3* - Lands that are suitable but are approaching minimal quality for irrigated farming and have distinct soil, topographic, or drainage deficiencies which singly or in combination severely limit the success of irrigated agriculture.

- *Class 4* - Lands involving unique situations. In the Bonneville Unit geographic area this class consists of land unsuitable for field crops but suitable for irrigated orchard use, designated as Class 4F, or for irrigated pasture, Class 4P.

- *Class 5* - Lands that are non-arable under existing conditions but (1) have enough potential to warrant special study prior to completion of the classification, or (2) lands in existing projects whose arability is dependent upon additional project construction or land improvement such as installation of drainage facilities. For example, lands located in the Bonneville Unit geographic area with potential drainage problems were initially placed in Class 5D for further evaluation. The lands were later placed in Classes 1, 2, or 3 if they otherwise qualified but needed drainage facilities, in Class 6std if they did not meet the federal criteria qualifications for irrigated agriculture and were non-irrigated, or in Class 6w if they did not meet the federal criteria for irrigated agriculture but were nevertheless irrigated. (Note: The letters "std" indicate that the deficiencies relate to "soils, topography, and/or drainage".)

- *Class 6* - Lands that are considered non-arable because of failure to meet the minimum requirements for the other classes of land. Class 6 land that was irrigated with water from local sources at the time the soil survey was made was designated Class 6w.

The detailed land classification criteria used for the Bonneville Unit are shown on Table 6-1. The lands classified as part of the 1964 DPR are shown in Table 6-2. In order to be eligible for irrigation water from a federal reclamation project, the acreage must be certified as "arable" by the Secretary. In the Bonneville Unit only lands in Classes 1, 2, 3, and 4F defined above were certified by the Secretary. In addition, certain agricultural lands lying within townsite boundaries were certified as arable without being classified under this system.

Typically, only a portion of the certified arable acreage is irrigated, depending on the water supply, the layout of the water distribution system, rights of way, and other factors. That portion is referred to as the "irrigable" acreage. The relationship between the arable acreage and irrigable acreage is illustrated by the following definitions:

Arable Acreage. Acreage that has been certified by the Secretary as having sufficient potential payment capacity to warrant further consideration for irrigation development. Two certifications were made for the Bonneville Unit, the first in 1965 for the entire Bonneville Unit and the second in 1992 for lands in the ULS System service area.

Irrigable Acreage. That portion of the arable acreage for which there is a Bonneville Unit water supply. The selection of the irrigable acreage is based on such factors as the statutory boundaries of the proposed service area, the location with respect to water delivery facilities, and specific criteria developed to achieve an equitable and efficient distribution of the available water supply. As stated previously the irrigable acreage for the Bonneville Unit has decreased significantly from that in 1964.

MAPS OF CLASSIFIED ACREAGE

This section contains a list of maps that show the classified acreages for the Bonneville Unit. These maps were originally prepared by the USBR. Because of the shift from a predominantly irrigation water supply in 1964 to a largely M&I water supply in 2004, the maps are not included in this 2004 Supplement to the 1988 DPR. However they were included in the Lands Appendix to the 1964 DPR, except for one showing the Spanish Fork area acreage at South Shore Farms and Fowers Fruit Ranch, which was contained in the 1992 Supplement to the Lands Appendix (USBR 1992). The maps have been updated to show the location of I-15. A list of maps showing agricultural land classes within the Bonneville Unit serve area are presented in Table 6-3.

The serial number of each map assigned by the USBR has been retained for convenience in comparing the maps in this appendix with the maps in the 1964 and 1992 Land documents prepared by the USBR.

TABLE 6-1
Specifications for Detailed Bonneville Unit Land Classification[1]

Land Characteristics	Class 1 Arable	Class 2 Arable	Class 3 Arable	Class 4P Pasture	Class 4F Orchard	Class 5 Temporarily Non-arable
SOILS						
Texture	Sandy loam to friable clay loam	Loamy sand to very permeable clay	Loamy sand to permeable clay	Loamy sand to slowly permeable clay	Gravelly loam to gravelly clay loam	Loamy sand to permeable clay
Depth to: Sand, Gravel or Cobble	36" minimum for all texture except sandy loam which must have 42" minimum	24" minimum for loams and heavier, 30" minimum for sandy loams, 36" minimum for loamy sands	18" minimum for loams and heavier, 24" minimum for sandy loams, 30" minimum for loamy sands	12" minimum for loams and heavier, 18" minimum for sandy loams, 24" minimum for loamy sands	30" minimum	18" minimum for loams and heavier, 24" minimum for sandy loams, 30" minimum for loamy sands
Solid Rock, Shale or other impenetrable layer	60", 6" less if rapid permeable layer overlies the strata	48", 6" less if rapid permeable layer overlies the strata	36", 6" less if rapid permeable layer overlies the strata	24", if on sloping topography, 30" if on flat topography	60" minimum	36", 6" less if rapid permeable layer overlies the strata
Penetrable lime zone	18" with 60" penetrable	14" with 48" penetrable	10" with 36" penetrable	Penetrable lime layer may be exposed on surface	18" with 60" penetrable	10" with 36" penetrable
Alkalinity	pH 8.7 or less	pH 9.0 or less	pH 9.0 or less	pH 9.0 or less	pH 8.7 or less	pH 9.0 or less
Salinity	0.2% soluble salt or less	0.5% soluble salt or less	0.5% soluble salt or less	0.75% soluble salt or less	0.2% soluble salt or less	Unlimited, but must leach readily from soil
TOPOGRAPHY						
Uniform Slopes	0.5 to 3%	3 to 7%	7 to 11%	Up to 11%	Up to 20%	Up to 11%
Size of area, in minimum length of irrigation runs	500 feet or more	300 to 500 feet	150 to 300 feet	150 to 300 feet	500 feet or more	150 to 500 feet
Undulating slope, maximum to make level	0 to 400 cubic yards per acre	400 to 600 cubic yards per acre	600 to 1,000 cubic yards per acre	0 to 400 cubic yards per acre	0 to 400 cubic yards per acre	0 to 1,000 cubic yards per acre
Clearing, cost of clearing rock or vegetation (1964)	$0 to 60	$60 to 90	$90 to 170	$0 to 60	$0 to 60	$0 to 170
DRAINAGE						
Water Table	Below 60" at all times	Below 36" at all times	Below 36" except for brief periods only	At or near surface under salinity free conditions	Below 60" at all times	May be at or near the surface

[1] Transcribed from the 1964 DPR, Lands Appendix, Table 6.

Table 6-2
Land Classified As Part of 1964 Bonneville Unit Definite Plan Report

Service area	Irrigated Class 1	2s	2t	2st	2d	2nd	Total class 2	3s	3t	3st	3d	3sd	3std	Total class 3	Total classes 1-2-3	4F	4P	6W	Total irrigated
Arable acreage																			
Duchesne River area	1,153	4,419	2,552	2,371	49	74	9,465	1,916	404	3,358	73	87		5,838	16,456			5,208	21,664
Heber-Francis area		1,980		3,175			5,155	4,445		7,042		1,276	5,145	17,908	23,063			2,854	25,917
Spanish Fork area	7,036	20,223	2,041	3,753			26,017	8,843	305	5,516				14,664	47,717	1,271	2,917	1,912	53,817
Peteetneet area	737	197	234	197			628	242	11	97				350	1,715	66			1,781
Mona-Nephi area	6,432	672	393	1,237			2,302	275	8	91				374	9,108			2,618	11,726
Elberta-Mosida area	2,395	358	110	86			554			90				90	3,039				3,039
Provo Bay area	2,152	568					568	134						134	2,854		76		2,930
Total classified	19,905	28,417	5,330	10,819	49	74	44,689	15,855	728	16,194	73	1,363	5,145	39,358	103,952	1,337	2,993	12,592	120,874
Irragable acreage																			
Duchesne River area	1,150	4,420	2,560	2,370	50	70	9,470	1,910	400	3,360	70	90		5,830	16,450				
Heber-Francis area		1,900		2,920			4,820	4,440		6,410		1,220	4,640	16,710	21,530				
Spanish Fork area	6,860	19,800	2,020	3,720			25,540	8,630	300	5,370				14,300	46,700				
Peteetneet area	700	190	220	180			590	230	10	90				330	1,620				
Mona-Nephi area	6,150	560	380	1,170			2,110	50	10	80				140	8,400				
Elberta-Mosida area	2,270	340	110	80			530			90				90	2,890				
Provo Bay area	2,060	530					530	130						130	2,720				
Total irrigable	19,190	27,740	5,290	10,440	50	70	43,590	15,390	720	15,400	70	1,310	4,640	37,530	100,310				

Service area	Nonirrigated Class 1	2s	2t	2st	Total class 2	3s	3t	3st	Total class 3	Total classes 1-2-3	4F	4P	Total non-irrigated	Class 6st	Right-of way3/	Total classes 1-2-3	Town-site2/	Total classified area	Midview exchange lands	Total project
Arable acreage																				
Duchesne River area	10	212	152	137	501	143	57	421	621	1,132			1,132	18,970	1,084	17,588		42,850		
Heber-Francis area				23	23			337	337	360			360	13,304	1,187	23,423	1,022	41,790		
Spanish Fork area	24	914			914	703		5	708	1,646	1,096		2,742	7,852	2,589	49,363	2,600	69,600		
Peteetneet area	487	130	811	749	1,690	174	432	948	1,554	3,731	1,917		5,648	1,051		5,446	390	8,870		
Mona-Nephi area	6,883	2,646	3,287	2,993	8,926	281	91	4,299	4,671	20,480	3,040		23,520	13,208	864	29,588	1,282	50,600		
Elberta-Mosida area	8,141	2,638	4,574	4,619	11,831	363	338	3,760	4,461	24,433	3,682		28,115	12,119	137	27,472		43,410		
Provo Bay area	6,590	1,372			1,372	173			173	8,135		815	8,950			10,989		11,880		
Total classified	22,135	7,912	8,824	8,521	25,257	1,837	918	9,770	12,525	59,917	9,735	815	70,467	66,504	5,861	163,869	5,294	269,000		
Irragable acreage																				
Duchesne River area																16,450		16,450	10,000	
Heber-Francis area																21,530		22,040		
Spanish Fork area	20	900			900	670			670	1,590						48,290	510	49,470		
Peteetneet area	470	120	760	700	1,580	170	410	380	960	3,010						4,630	1,180	4,860		
Mona-Nephi area	5,420	1,980	2,280	1,970	6,230	230	70	1,140	1,440	13,090						21,490	230	22,050		
Elberta-Mosida area	6,730	2,280	3,650	3,290	9,220	350	260	2,710	3,320	19,270						22,160	560	22,160		
Provo Bay area	5,400	1,240			1,240	140			140	6,780						9,500		9,500		
Total irrigable	18,040	6,520	6,690	5,960	19,170	1,560	740	4,230	6,530	43,740						144,050	2,480	146,530	10,000	

1/ 10,000 equivalent acres of nonclassified Moon Lake project land benefitting from Midview Exchange.

2/ This is the area inside the city limits that was not classified.

3/ Includes public rights-of-way: State and county roads, main canals, etc.

TABLE 6-3
Listing of Bonneville Unit Land Classification Maps

Document Sources:
(1) Central Utah Project, Bonneville Unit Definite Plan Report, August 1964, U.S. Bureau of Reclamation
(2) Central Utah Project, Bonneville Unit, Lands Appendix, U.S. Bureau of Reclamation, August 1964 and January 1992)
(3) Central Utah Project, Upalco Unit, Definite Plan Report, Appendix C, Project Lands, March 1980.
(4) Central Utah Project, Bonneville Unit, Supplemental Lands Appendix, U.S. Bureau of Reclamation, January 1992.

Map Title	Map Number	Where Source Document Can Be Located
Spanish Fork Area, Sheet 1 of 3	66-418-1581	Central Utah Water Conservancy District, Orem, Utah
Spanish Fork Area, Sheet 2 of 3	66-418-1582	Same as above
Spanish Fork Area, Sheet 3 of 3	66-418-1583	Same as above
Spanish Fork Area, South Shore Farms and Fowers Fruit Ranch	66-418-7865	Same as above
Peteetneet Area Map	66-418-1802	Same as above
Elberta Area Map	66-418-1461	Same as above
Mona-Nephi Area, Sheet 1 of 2	66-418-1743	Same as above
Mona-Nephi Area, Sheet 2 of 2	66-418-1744	Same as above
Provo Bay Area	66-418-2573	Same as above
Duchesne River (Valley Area)	66-418-2034 66-418-2055 66-418-2114 66-418-2102 66-418-2050 66-418-2038 66-418-2040	Same as above
Duchesne River (Taylor Canal)	66-418-1471	Same as above
Heber-Francis (Heber area)	66-418-1597 66-418-1598	Same as above
Heber-Francis (Francis area)	66-418-1854 66-418-1855	Same as above
Upalco Unit	987-418-44 987-418-45 987-418-46 987-418-47 987-418-48	Same as above

BONNEVILLE UNIT AGRICULTURAL AREAS

Agricultural areas in the Bonneville Unit are grouped according to the following locations:

- Spanish Fork Area
- Elberta area
- Mona – Nephi Area
- Heber-Francis Area
- Duchesne River Area

Spanish Fork Area

Portions of the Spanish Fork subarea agricultural lands are irrigated with water from local sources, and from the earlier Strawberry Valley Project (SVP). However, the water supply from these sources was insufficient for a full year's supply for much of the irrigated acreage. In addition, there is agricultural acreage for which there is no water supply. In 1964 the Bonneville Unit originally intended to provide additional supplemental water for these irrigable lands, to the extent of water availability. However, under the current plan described in this 2004 Definite Plan Report Supplement, only a temporary irrigation water supply of 20,000 acre-feet annually is available for the area.

Elberta Area

The Elberta Area lies in the Goshen Valley of Utah County at the south end of Utah Lake and is separated from the Santaquin area by a ridge running south from Genola. A total of 6,274 acres with an irrigation history were identified in the area. The Elberta area currently receives irrigation water from Mona Reservoir, supplemented by limited well pumping. Under the current CUP plan, no irrigation water is available for the Elberta area.

Mona-Nephi Area

The Mona-Nephi area of the Bonneville Unit is located in the northeastern part of Juab County. Primarily, the agricultural lands extend from Levan Ridge located about two miles south of Nephi to York Ridge north of Mona on the Utah County and Juab County line. There were a total of 50,600 acres classified in 1964 by the U.S. Bureau of Reclamation. Under the current CUP plan, no irrigation water is available for the Mona-Nephi area.

Heber-Francis Area

Arable and irrigable acreages in the Heber-Francis area were presented in the 1964 DPR, and the arable acreage was included in the 1965 Secretarial land certification. Since 1964 additional acreage in the Francis area has been designated as irrigable, qualifying it to receive water from the Bonneville Unit M&I System.

In 1992 CUPCA authorized the Wasatch County Water Efficiency Project (WCWEP) in the Heber Valley of Wasatch County. The WCWEP program has improved irrigation efficiency on Bonneville Unit M&I System lands as well as adjacent lands irrigated with the pre-project water supply, but does not alter the designations of arable or irrigable lands in Heber Valley. An annual average of 15,100 acre-feet of CUP water has been made available to this area.

Duchesne River Area

Starvation Collection System. In the Duchesne River area, acreage along the river downstream from the mouth of the Strawberry River was classified and included in the 1965 Secretarial certification in order to receive water from the Starvation Collection System. That system has been constructed and is delivering water to the certified lands.

Uintah Basin Replacement Project. The UBRP was added to the Bonneville Unit by CUPCA. The UBRP is a proposed water conservation project that will be physically located in portions of the Upalco and Uinta Units that are now de-authorized. UBRP will provide additional water to irrigate lands situated in the former Upalco Unit. However, under the provisions of CUPCA, the economic evaluation of the Bonneville Unit must include the benefits and costs of UBRP. Consequently the agricultural lands in the Upalco Unit are discussed in this chapter because they would apply to UBRP. A total of 26,900 acre-feet of CUP water is available in this area on an average annual basis.

AREAS EXCLUDED FROM THE BONNEVILLE UNIT

Five other areas were classified in connection with the I&D System, but have since been eliminated from the Bonneville Unit. These are

the Mosida, Provo Bay, Sevier River Basin, Levan, and Mills areas. The reasons for their exclusion are explained in the following paragraphs.

Mosida Area

The Mosida area lies along the southwestern side of Utah Lake, directly north of the Elberta area. The classified land in the Mosida area consisted of 19,935 acres of full service acreage. Development of this land was precluded when CUPCA specifically prohibited delivery of Bonneville Unit water to this area.

Provo Bay Area

The Provo Bay area, which is adjacent to the Spanish Fork area, contains 10,989 acres of Class 1, 2 and 3 land, most of which is inundated by Utah Lake. Under the original I&D System plan, the shallow Provo Bay would have been diked off from the rest of Utah Lake, and the lake-bottom land developed for agriculture. Development of the inundated land was precluded in 1992 when CUPCA prohibited the diking of Provo Bay, and the Provo Bay area was deleted from the development plan. However, in 1996 some irrigated irrigable land in the Provo Bay area was included with the Spanish Fork area for plan formulation purposes. That land is currently being irrigated with water from the Spanish Fork River.

Sevier River Basin

Sevier River Basin lands were included in the I&D System development plan subsequent to the 1964 DPR, and were to be served by extending the Bonneville Unit conveyance system 29 miles from Nephi to Sevier Bridge Reservoir on the Sevier River. Agricultural lands in the Sevier River basin were classified and approximately 102,000 acres were found to be eligible to receive a supplemental supply of Bonneville Unit water. However, the lands were not certified by the Secretary. These lands are described in the 1988 "Supplement to the Bonneville Unit DPR (1988 DPR Supplement), Lands Appendix." The Sevier River Basin lands were subsequently deleted from the Bonneville Unit[1].

Levan and Mills Areas

The Levan and Mills areas, in eastern Juab County (south of Nephi), were classified but not included in the I&D System service area. Responding to expressions of interest from irrigators in those areas, the Central Utah Water Conservancy District (District) classified the areas' lands in 1992. The lands meeting Bonneville Unit standards for Classes 1, 2, and 3 amounted to 7,680 acres in the Levan area and 760 acres in the Mills area. However, they were not certified by the Secretary. The descriptions and classifications of these lands are in the District's files. These lands lie in the Sevier River drainage basin and are not eligible for water from the ULS System.

ELIMINATION OF AGRICULTURAL DRAINAGE FROM PROJECT PLAN

The water table under irrigated land needs to be at sufficient depth to permit drainage of the root zone. Various drainage criteria apply to the classification of agricultural land. Where the drainage criteria are not met by topography and soil permeability, drains are typically needed.

The drainage characteristics of the potential Bonneville unit arable lands were investigated

[1] CUPCA authorized the delivery of Bonneville Unit irrigation water the Sevier River Basin. However, Millard County (in the Sevier River Basin) subsequently opted to exclude itself from the Central Utah Project, which eliminated the entire Sevier River Basin from the I&D System water delivery because of complex water right laws. This change led to the formulation of the SFN System, an alternate plan to deliver waters to areas of southern Utah County and the portion of eastern Juab County that lies within the Utah Lake drainage. This alternate system has subsequently been re-formulated as the ULS System, and re-named to more accurately reflect its location and function.

for the 1964 DPR, considering topography, soil type, and depth to groundwater. The water application rates analyzed were based on irrigation practices prior to 1964, which consisted primarily of furrow or flood irrigation. Under those conditions of irrigation, it was found that certain lands with shallow water tables would require drains to keep the water table from rising into the crop root zone.

Drainage facilities are no longer needed for lands in the Bonneville Unit because of improvements in on-farm efficiency. Sprinkler irrigation and improved methods of flood and furrow irrigation cause far less deep percolation of irrigation water than the irrigation practices contemplated in 1964. This reduces the amount of applied water that percolates down beneath irrigated areas, and generally reduces the effect on the water table to an amount that will not impede drainage. The sizing of the Bonneville Unit irrigation water delivery systems are predicated on efficient irrigation water use, and landowners who contract for Bonneville Unit water are required to meet certain standards for irrigation water use efficiency.

HISTORY OF CERTIFICATION OF LANDS

Two certifications by the Secretary of Interior have been made for the Bonneville Unit. The first occurred in 1965 for the entire Bonneville Unit and the second certification was made in 1992 for lands in southern Utah County. A third certification was made for the Upalco Unit of the Central Utah Project in 1998 and is discussed under the paragraph entitled – "Relationship of UBRP Lands to Upalco Unit)

1965 Certification

In the 1950s and early 1960s the United States Bureau of Reclamation (USBR) classified agricultural lands within the Bonneville Unit area. The land classification process identified arable lands potentially suitable for Bonneville Unit water delivery. The process is documented in the 1964 Bonneville Unit DPR's Lands Appendix. In 1965, land suitable for field crops, including some farmed lands within townsites, was certified as arable by the Secretary of the Interior (Secretary).

The 1964 DPR presented a determination of "irrigable acreage," meaning the arable acreage for which a water supply could be made available from the Bonneville Unit, and on which the economic and financial analyses were based. The Bonneville Unit irrigable acreage has changed significantly since 1964 because of increased emphasis by the project on fish and wildlife and because of the growth in urban population placing a higher demand for municipal and industrial water.

1992 Supplemental Certification

Since the 1964 DPR, numerous changes have occurred in project acreages. The amount of arable land was increased in 1992 when the Secretary certified additional lands in southern Utah County, including orchard land that had been classified in 1964 but omitted from the 1965 certification. Certain areas that were once proposed to receive irrigation water were deleted from the plan, along with decreased acreage in other areas for reasons explained in this Lands Chapter.

DUCHESNE RIVER LANDS

Starvation Collection System

The Duchesne River area of the Bonneville Unit consists of lands lying along the Duchesne River bottom upstream from the mouth of the Strawberry River and in the South Myton Bench and Pleasant Valley areas along the Duchesne River. These lands were provided with a supplemental water supply by the Starvation Collection System through storage provided by Starvation Reservoir. A total of 17,588 acres of Class 1, 2, and 3 lands in the Duchesne River area were classified, which were certified in December 1965. Of that amount, 16,450 acres were designated as irrigable (see Table 6-4).

TABLE 6-4 Agricultural Acreage Duchesne River Area	
	Acres
Arable acres	17,588
Certified acres	17,588
Irrigable acres	16,450

The soil survey disclosed various isolated tracts of land having a depth to ground water less than three feet in the Myton Bench and Pleasant Valley areas. To control water tables in these areas, approximately 7 miles of closed drains and 0.8 mile of existing drain improvement were proposed. However, the use of sprinkler irrigation in these areas has reduced deep percolation to the water table, and eliminated the need to construct the drainage facilities.

Relationship of UBRP Lands to Upalco Unit

The Section 203(a) Uinta Basin Replacement Project (UBRP) was authorized by Section 203 (a) of CUPCA to increase water use efficiency, enhance beneficial use, and achieve greater water conservation on lands of the Upalco Unit of the CUP. The UBRP features includes enlargement of Big Sand Wash Reservoir (12,000 acre-feet increased capacity), the new Big Sand Wash Feeder Diversion Structure, a new Big Sand Wash Feeder Pipeline, a new Big Sand Wash-Roosevelt Pipeline to deliver 3,000 acre-feet of M&I water to the city of Roosevelt, Utah, an additional 2,500 acre-feet of irrigation water, and stabilization of thirteen high Uinta Mountain lakes.

The lands to be served by the Unita Basin Replacement Project, lie within the area covered by the formerly proposed Upalco Unit. Land classification performed for the Upalco Unit by the U.S. Bureau of Reclamation identified and mapped 11,917 acres of arable lands and 5,080 acres of 6W lands (non-arable, but irrigated with certified water rights). The Upalco Unit arable lands were certified on September 7, 1979 by the Secretary of Interior.

A supplemental land classification of the lands within the UBRP project area was completed by the District in June 1997 as part of the Upalco Unit Replacement Project. The lands were certified to Congress by the Secretary of the Interior on March 24, 1998. The classification covered only the presently irrigated secondary water-righted lands that were previously unclassified or classed as 6W lands. The objective of the supplemental classification was to delineate the lands into the following irrigation suitability classes – (1) arable; (2) arable, irrigable if sprinkled; and (3) non-arable.

The results of the land classification completed by the USBR and the supplemental land classification are summarized in Table 6-5.

TABLE 6-5
Land Classification Section 203(a) Unita Basin Replacement Project
(Source: Unita Basin Replacement Project, Final Feasibility Study, Central Utah Water Conservancy District, October 2001)

Land Classification	USBR Classified (acres)	Supplemental Classified (acres)	Total (acres)
Arable			
Class 2	6,121	310	6,431
Class 3	5,796	348	6,144
Class S2		143	143
Class S3		673	673
Class S3 (pasture only)		20	20
Arable (irrigable if sprinkled)			
Class 6 (S2)		87	87
Class 6 (S3)		431	430
Class 6 (S3P)(pasture only)		706	706
Sub-total, Arable	**11,917**	**2,718**	**14,634**
Non-Arable			
Class 6W	5,080	223	5,303
Non-soil (H, ROW, Oil, etc.)		81	81
Sub-Total, Non-Arable	**5,080**	**304**	**5,384**
Total Project	**16,997**	**3,022**	**20,018**

HEBER-FRANCIS AREA LANDS

The Heber-Francis area consists of the Heber Valley, between Jordanelle and Deer Creek Reservoirs, and the Francis subarea upstream of Jordanelle Reservoir. The completed Bonneville Unit M&I System provides irrigation water to these two areas.

The initial land classification and certification for these areas are documented in the Lands Appendix to the 1964 DPR. During the preparation of the 1964 DPR, soil surveys in the Heber and Francis areas identified 23,423 acres of arable land in Classes 1, 2, and 3. In addition to the classified arable land, 1,022 acres of townsite land had also been designated as arable. The classified arable acreage was certified in December 1965. However, the townsite land was not certified. The acreages cited were previously shown on Table 6-2. The resulting irrigable acreage in the Heber-Francis area is summarized on Table 6-6.

The arable acreage in the Heber-Francis area was increased in 1972 when the District annexed certain tracts of agricultural land adjoining the northern boundary of the Francis subarea. The land lies in Summit County, roughly two miles northeast of the eastern end of Jordanelle Reservoir, in Sections 18 and 19 of Township 2 South, Range 6 East. The annexed land contains 321 acres of irrigated land, of which 317 acres had been certified as arable by the Secretary as part of the Weber Basin Project (Four acres were Class 6w land). A legal description of the annexation is on file at the District.

The irrigable acreage in the Heber-Francis area was reported to consist of 21,530 acres of classified land and 510 acres of townsite land in 1964. However, because townsite land was not included in the 1965 certification, it was ultimately omitted from the irrigable acreage. Since 1965 the irrigable acreage of the Heber-Francis area has been increased by 695.2 acres, which lie in two tracts. One tract consists of the 1972 Francis area annexation, cited above, which contains 317 acres of irrigable land (39.2 acres in Class 2, and 282.7 acres in Class 3). The other tract, also in the Francis area, lies in the northern half of Sections 28 and 29 of Township 2 South, Range 6 East, and contains 378.3 acres of Class 3 irrigable land which had been included in the 1965 certification but not designated as irrigable at that time.

TABLE 6-6
Agricultural Acreages in Heber – Francis Area

Area	Arable Acres	Certified Acres	Irrigable Acres
Heber-Francis area	24,762[a]	23,751[b]	22,225[c]

[a] Consists of 23,432 acres of classified land and 1,022 acres of townsite land designated as arable in 1964, plus 317 acres of land that were annexed to the CUWCD in 1972 (in Sections 18 and 19 of T25, R6E) which had previously been classified as arable for the Weber Basin Project.
[b] Consists of 23,432 acres of arable Bonneville Unit land certified in 1995, plus the 317 acres of Weber Basin Project certified land that were annexed to the CUWCD in 1972.
[c] Consists of 21,530 acres of certified land that were designated as irrigable in 1964, plus 378 additional acres of Francis area arable land that was designated as irrigable in 1972 (Sections 28 and 29 of T25, R6E), plus the 317 acres annexed to the CUWCD in 1972.

SOUTHERN UTAH COUNTY AND JUAB COUNTY LANDS

The original land classification for the Bonneville Unit's I&D System, now reformulated as the ULS System, was presented in the 1964 DPR. In 1989, a supplemental classification was made for certain lands in the Spanish Fork area. The land classification process identified the lands that were "arable", meaning that if irrigated they would provide sufficient revenue to warrant consideration for

irrigation development. When the classification was made, there was irrigated agriculture on "townsite" lands (within the city limits) of towns in several areas. A portion of the townsite lands were designated as arable because they were commercially cropped and were an established part of the area's agricultural enterprise.

Land Classification

Land classification studies were completed in 1964 for the entire Bonneville Unit. A supplemental land classification was made in 1989.

1964 Land Classification

The acreages classified in the 1964 DPR were shown previously in Table 5-2, which is a reproduction of Table 67 in the 1964 DPR's Lands Appendix. The classified acreage was differentiated between that irrigated at the time of classification and that which was non-irrigated. In addition, agricultural acreage within townsites was also included in the classification. The arable acreage within the townsites was not classified according to the system presented earlier in this chapter, but was simply designated "townsite" acreage.

Spanish Fork Area. In the 1964 Spanish Fork area land classification, 49,363 acres of land in Classes 1, 2, and 3 were designated as arable. Of that total, 47,717 acres were designated as "supplemental service" lands (lands already receiving some irrigation water) and 1,646 acres as "full service" lands (lands not previously irrigated). In addition, 2,600 acres of townsite lands were designated as arable land.

Peteetneet Area. The original land classification for the Peteetneet area categorized 5,446 acres of land in Classes 1, 2, and 3. It consisted of 1,715 acres of irrigated land and 1,968 acres of non-irrigated land in the Santaquin subarea, and 1,763 acres of non-irrigated land in the Goosenest subarea. The classification also included 1,983 acres of Class 4F land, of which 66 acres were under irrigation and 1,917 acres were non-irrigated. Additionally, 390 acres of townsite lands were identified as agricultural lands.

Elberta Area. In the Elberta area 7,537 acres were determined to be Classes 1, 2, and 3, consisting of 3,039 acres of irrigated land and 4,498 acres of non-irrigated land. This acreage is tabulated on Table 60 of the 1964 DPR's Lands Appendix.

Mona-Nephi Area. The classified land in the Mona-Nephi area consisted of 29,588 acres in Classes 1, 2, and 3. Of these 29,588 acres, 9,108 were irrigated at the time of classification and 20,480 were not irrigated. Additionally, 1,282 acres of townsite lands were included as arable land.

1989 Supplemental Land Classification Survey

In 1989, additional land was classified at West Mountain (Spanish Fork area), which is located along the shore of Utah Lake. Soil surveys on approximately 812 acres lying in 2 tracts known as South Shore Farms and Fowers Fruit Ranch were completed. Of these 812 acres, approximately 661 acres were designated in Classes 2, 3, and 4F. The balance of 151 acres were Class 6 land or was designated for rights-of-way.

Table 6-7 shows the acreage in the 1989 supplemental classification survey. The supplemental survey is documented in a report entitled *Central Utah Project (CUP) Bonneville Unit - Utah, Supplement to the DPR, Project Lands Appendix*, U.S. Bureau of Reclamation, January 1992 (1992 Lands Supplement).

Acreage Certification

In order to qualify for irrigation water from a federal irrigation project, the acreages classified as arable must be certified as such by the Secretary. Two certifications were made for the lands located in the Spanish Fork area of the

Bonneville Unit, the original in 1965 and a supplementary certification in 1992.

1965 Certification

The lands determined to be arable in the 1964 DPR were certified by the Secretary in 1965. The acreage certified in southern Utah County and Juab County is shown on Table 6-8 The certification included the townsite lands that had been designated as arable in the 1964 DPR.

1992 Supplemental Certification

In 1992, additional acreage in the Spanish Fork and Peteetneet areas was certified. The acreages certified included lands that had been classified prior to 1964 but not certified in 1965, and newly classified lands.

Spanish Fork Area. The 1992 supplemental certification included land in two parts of the Spanish Fork area; (1) West Mountain and (2) parts of the southeastern portion of the Spanish Fork area.

The first part lies on the west side of West Mountain, along the shore of Utah Lake. In 1989, soil surveys were made of approximately 812 acres lying in 2 tracts known as the South Shore Farms and Fowers Fruit Ranch. Of these 812 acres, approximately 661 acres were designated as Classes 2, 3, and 4F were certified for inclusion in the ULS System. The total Class 4F land was 313 acres. Approximately 75 percent of those acres had been previously irrigated with SVP water but irrigation was discontinued when the canal serving the area washed out. The 151 acres not certified were Class 6 land. The soil survey and classification process is documented in a 1992 report by the U.S. Bureau of Reclamation.

The second part consists of scattered acreage in the southeastern portion of the Spanish Fork area that was designated as Class 4F land in the 1964 Bonneville Unit DPR, but had not been certified in 1965 when the lands in Classes 1, 2, and 3 were certified. The amount of Class 4F land certified in 1992 was 2,367 acres. The acreage at West Mountain, certified in 1992, was previously summarized in Table 6-2.

Peteetneet Area. In the Peteetneet area, 1,983 additional acres were certified in 1992. Those acres had been classified as Class 4F, but were not certified in 1965.

TABLE 6-7
1989 Supplemental Land Classification Survey at West Mountain (Spanish Fork Area)

Irrigated Acreage					Non-Irrigated Acreage								
Classes				Total Irrigated	Classes					Total Non-irrigated	Total Arable	Total Non-arable	Total Classified
2	3	4F	6		2	3	4F	6	ROW				
84.4	225.2	204.9	0.3	514.8	0	39.2	107.7	143.2	7.5	297.6	661.4	151.0	812.4

Note: Acreages shown are from 1992 Lands Supplement.

TABLE 6-8
Certified Southern Utah County and Juab County Acreage

Area	1965 Certification	1992 Supplemental Certification	Total Certification
Spanish Fork	52,517[a]	3,028[c]	55,545
Peteetneet	5,836[b]	1,983[d]	7,819
Elberta	7,537	0	7,537
Mona-Nephi	30,870[e]	0	30,870
Total	**96,760**	**5,011**	**101,771**

[a] From Table 5-2, 47,717 irrigated acres plus 1,646 non-irrigated acres in Classes 1, 2, and 3, plus 2,600 acres of townsite land, plus 554 acres in the former Provo Bay area.
[b] From Table 5-2, 1,715 irrigated acres plus 3,731 non-irrigated acres in Classes 1, 2, and 3, plus 390 acres of townsite land.
[c] From Table 5-2, 1,271 irrigated plus 1,096 non-irrigated acres Class 4F, and Table 4-2, 661 acres.
[d] From Table 5-2, 66 irrigated and 1,917 non-irrigated acres of Class 4F land.
[e] From Table 5-2, 9,108 irrigated plus 20,480 non-irrigated acres in Classes 1, 2, and 3, and 1,282 acres of townsite land.

Irrigable Acreage

The term "irrigable acreage" denotes the agricultural acreage that has been certified by the Secretary based on its economic cropping potential, and for which a water supply can be made available from the Bonneville Unit. The irrigable acreage for the I&D System was first determined in 1964, and revised in the 1988 DPR. The irrigable acreage has been updated for use in formulating the ULS System. The irrigable acreage revisions are in response to variations in estimated water availability from the Bonneville Unit and the locations of delivery facilities.

Irrigable Acreage Determinations in 1964 and 1988

Determinations of irrigable acreage for the ULS System area were originally published in the 1964 DPR, and revised in the 1988 DPR Supplement. Table 6-9 shows the irrigable acreage at various times, in relation to the certified acreage.

TABLE 6-9
1964 and 1988 Acreage Tabulations
Summary of Arable and Irrigable Acreage

Area	Category	1964 Acreage[a]	1988 Acreage[b]
Spanish Fork	Arable	51,963	51,963
	Irrigable[e]	49,470	47,880.[f]
Peteetneet	Arable	5,836	5,836
	Irrigable[i]	4,860	4,860
Elberta	Arable	7,537	7,537
	Irrigable	7,160	7,160
Mona-Nephi	Arable	30,870	30,870
	Irrigable[l]	22,050	21,230
TOTALS	Arable	96,206	96,206
	Irrigable	83,540	81,130

[a] From the 1964 DPR. Also reproduced in the 1988 DPR.
[b] From the 1988 DPR, page 101.
[c] The increase in 1992 results from the certification of 3,028 additional acres that year.
[d] The increase in 1996 results from the inclusion of 554 acres of irrigable land from the Provo Bay area into the Spanish Fork area.
[e] Includes 1,180 acres of townsite land.
[f] Unirrigated land in the Beer Creek area was deleted (1,590 acres).
[g] The irrigable portion of the lands certified in 1992 were added (2,769 acres.)
[h] The increase in 1992 results from the certification of 1,983 additional acres that year.
[i] Includes 230 acres of townsite land in 1964, 1988, and 1996.
[j] A determination of irrigable acreage was not made in this year.
[k] Excludes non-irrigated land in the Elberta area.
[l] Includes 560 acres of townsite land in 1964 and 1988, and 793 acres in 1996.
[m] The increase results mainly from the addition of Nephi area acreage that has been developed for agriculture but is unirrigated.in the Goosenest area was omitted because of location higher than the High Line Canal and isolation from other irrigable lands.

Spanish Fork Area. The irrigable acreage on Class 1, 2, and 3 lands in the Spanish Fork area was determined to be 49,470 acres in the 1964 DPR, including 1,180 acres of townsite land. In 1988, the irrigable acreage was reduced through the deletion of non-irrigated land.

Peteetneet Area. The irrigable acreage on Class 1, 2, and 3 lands in the Peteetneet area was determined to be 4,860 acres in the 1964 DPR. Those lands lay entirely in the Santaquin subarea.

Elberta Area. In the Elberta area, the irrigable acreage on Class 1, 2, and 3 lands was determined to be 7,388 acres in the 1964 DPR, which included 230 acres of townsite land. Approximately 40 percent of the arable acreage in the Elberta area was irrigated when the land surveys were made for the 1964 DPR. Since then various other tracts of land have been irrigated, some only sporadically during years of abundant water supply, to the effect that at present approximately 88 percent of the arable acreage has been irrigated. The historic water supply from Mona Reservoir and local wells has not been sufficient to irrigate all this acreage in a single year.

Mona-Nephi Area. Based on the land surveys made for the 1964 DPR, and recognizing the limitation on Bonneville Unit irrigation water available, 21,490 acres of land in Classes 1, 2, and 3 were categorized as irrigable. Additionally, 560 acres of irrigated land within the townsite boundaries of Mona and Nephi

were designated as irrigable, making a total of approximately 22,050 acres of irrigable land.

A strip of land lying around the perimeter of Mona Reservoir, some of which was irrigated, was excluded from the 1964 irrigable acreage. The strip of land was defined as acreage lying below elevation 4,907 feet, which was the normal water surface elevation of Mona Reservoir after its proposed enlargement, plus another 10 feet of elevation to insure adequate subsurface drainage.

Drainage studies, conducted in the early 1960's for the I&D System, indicated a shallow groundwater depth around the reservoir that would impede agricultural drainage under Bonneville Unit operating conditions. It was determined that to qualify as irrigable, lands around the reservoir need to be 10 feet above the normal water surface elevation.

The 10-foot exclusion above normal water surface is required to insure that the drain outlets will be above the reservoir's water surface elevation, therefore permitting the lands to drain without pumping.

The proposed enlargement of Mona Reservoir was omitted from the development plan in a later refinement in the project plan. Consequently, the elevation, below the potential for drainage problems, was lowered from elevation 4,907 feet to 4,893 feet. This permitted an increase in irrigable acreage around Mona Reservoir. However, the increase was offset by reductions in irrigable acreage elsewhere in the Mona-Nephi area.

2004 Determination of Irrigable Acreage

As stated previously in this Chapter, irrigable acreage is defined as certified acreage that can be provided with Bonneville Unit water. The amount of irrigation water available for distribution has been a limiting factor in Bonneville Unit irrigation development in southern Utah and eastern Juab Counties. With the execution of the 1980 StreamFlow Agreement, its 1990 amendment, and the CUPCA provisions for its implementation, the available water for irrigation has been reduced. The most reasonable approach to formulating an irrigation supply from the ULS System is to characterize it as a temporary supplemental irrigation water supply to improve the productivity of the irrigable areas. This temporary supply would be available to the individual farmers through direct contracts with the District. It is likely that only irrigators in southern Utah County who can take direct delivery from the Spanish Fork River would request the temporary irrigation water.

The irrigable acres to be served with temporary irrigation water through the ULS System are shown in Table 6-10. Table 6-8 shown previously, compares the current total irrigable acreage with that presented in the 1964 DPR and the 1988 DPR.

The distribution of the irrigable acreage in the Spanish Fork area by class of land (e.g., Classes 1, 2, 3, and so forth) is shown on Table 6-10.

SUMMARY OF ARABLE AND IRRIGABLE ACREAGE CHANGES

Table 6-11 lists the irrigation water service areas of the Bonneville Unit and indicates the areas in which changes have occurred.
The changes since the 1964 and 1988 tabulation occur primarily for the following reasons:

- In 1972 additional land in the Francis area was annexed to the District. That land contained 217 acres of arable land, all irrigable, which had previously been in the Weber Basin Project area.
- In 1989 additional land in the Spanish Fork area was classified. As the result of this classification, there is an increase of 3,028 acres of arable acreage.
- In 1992 CUPCA prohibited the diking-off of Utah Lake's Provo Bay. This precluded the agricultural development of 8,946 acres of arable acreage in the Provo Bay area that was subject to intermittent inundation without the

dikes. This action left only 554 acres of arable land in the Provo Bay area.

- In 1992 CUPCA excluded the delivery of CUP water to the Mosida area of Utah County.
- Increase in M&I demand due to population growth along the Wasatch Front.
- A portion of the land certified under the Upalco Unit will now be served by the Unita Basin Replacement Project. The irrigable acres is now 14,634 acres.

TABLE 6-10
ULS System Irrigable Acreage by Class of Land

	Irrigated (acres)					Townsite Acreage	Total Acres
	Class 1	Class 2	Class 3	Class 4F	Total		
Spanish Fork[a]	7,058	27,185	15,570	210	50,023	1,180	51,203

[a] Includes 554 acres in Provo Bay area. The Provo Bay is currently irrigated with Spanish Fork River water and is included in the Spanish Fork Area.

TABLE 6-11
Bonneville Unit Agricultural Land Update
Year 2004

Agricultural Area[a]	Bonneville Unit Components Involved	Cumulative Changes Since the 1964 DPR, 1988 DPR Supplement and 1965, 1992 and 1998Certifications
Spanish Fork	ULS System	Additional lands were certified in 1992 Irrigable acreage is 51,203 acres.
Peteetneet	ULS System	Additional lands were certified in 1992 Irrigable acreage is now zero because of a lack of irrigation water supply from the Bonneville Unit.
Elberta	ULS System	Irrigable acreage has decreased to zero due to no agricultural water supply from the Bonneville Unit.
Mona-Nephi	ULS System	Irrigable acreage has decreased to zero due to no agricultural water supply from the Bonneville Unit.
Mosida	[b]	Area was deleted from plan
Provo Bay	[b]	Area was deleted from plan
Heber-Francis	Municipal and Industrial System (M&I System); Wasatch County Water Efficiency Project (WCWEP)	Arable and irrigable acreages have increased
Duchesne River	Starvation Collection System	Irrigable acreage has increased because water supply has increased from 21,400 acre-feet to 24,400 acre-feet.
Duchesne River	Unita Basin Replacement Project (UBRP)	A portion of the irrigable acres classified under the Upalco Unit will be irrigated under UBRP. The irrigable acreage is now 14,634 acres.

[a] Excludes the Sevier River Basin area which was added to the Irrigation and Drainage System (I&D System) after 1964, but has withdrawn from the Bonneville Unit.
[b] This area was part of the I&D System, but was deleted by the Central Utah Project Completion Act (CUPCA).

CENTRAL UTAH PROJECT COMPLETION PROGRAM

Chapter 7

October 2004

INTRODUCTION

This chapter summarizes the Fish and Wildlife Appendix to the 2004 Definite Plan Report (DPR) for the Bonneville Unit of the Central Utah Project (CUP). It describes the Bonneville Unit mitigation program subsequent to the 1988 Supplement to the DPR; identifies the agencies responsible for developing, planning and implementing fish, wildlife and recreation mitigation measures; reviews the Bonneville Unit environmental commitments; and describes the Bonneville Unit fish, wildlife and recreation program activities since 1988 to meet the environmental commitments.

The Fish and Wildlife Appendix to the 2004 DPR has the following purposes:

- Supplement the 1988 DPR by documenting the status of the environmental commitments that remained uncompleted by 1988, and documenting revisions to the commitments occurring since 1988
- Document the fish and wildlife programs of the Utah Reclamation Mitigation and Conservation Commission (Mitigation Commission) since its creation under the Central Utah Project Completion Act (CUPCA)
- Provide a comprehensive overview of fish, wildlife, threatened and endangered species, and recreation for the entire Bonneville Unit subsequent to the 1988 DPR

CUPCA and the Mitigation Commission

The CUP environmental program was greatly expanded with the passage of the CUPCA in 1992. The CUPCA established the need for a better balance between federal Reclamation regional water resource development and the previously under-emphasized needs of fish and wildlife, and thereby established the Mitigation Commission. The Mitigation Commission was charged with coordinating, planning, and administering about $32 million dollars to complete any Bonneville Unit mitigation commitments remaining from the 1988 DPR, and about $141 million for new measures and supplemental funding to complete measures that had been identified in the DPR. CUPCA provided for an expanded fish and wildlife program from that in the 1988 DPR and gave the Mitigation Commission the responsibility and authorized funding to carry them out.

Bonneville Unit Mitigation Program

The mitigation planning and implementation of the Bonneville Unit fish, wildlife, and recreation programs are shared by seven agencies, including the Mitigation Commission, U.S. Fish and Wildlife Service (FWS), Central Utah Water Conservancy District (District), U.S. Department of the Interior (DOI), U.S. Forest Service (Forest Service), Ute Indian Tribe and the Utah Division of Wildlife Resources. All except the District, Ute Indian Tribe and Utah Division of Wildlife Resources are federal agencies. Each agency has specific responsibilities and roles in the Bonneville Unit mitigation program, which are briefly described in the following sections.

Mitigation Commission. The Mitigation Commission is a Federal agency. The Mitigation Commission was created by Section 301 of CUPCA to coordinate the implementation of mitigation and conservation provisions of the Bonneville Unit among the involved Federal, Tribal, State, and local agencies. The Mitigation Commission's responsibilities include formulating implementation policies, administering CUPCA mitigation funds, developing plans (including action plans), and setting up contracts, leases, and agreements with other cooperating entities to implement mitigation plans and completing NEPA compliance for mitigation actions. Its program includes the uncompleted fish, wildlife, and recreation provisions of the 1988 DPR and the new provisions prescribed in CUPCA. It works within applicable environmental laws and other laws addressing fish, wildlife and recreation resources within the State of Utah.

Utah Division of Wildlife Resources. The Utah Division of Wildlife Resources is the wildlife authority for Utah, and is trustee and custodian of protected wildlife in the State of Utah. The

agency is responsible to protect, propagate, manage, conserve, and distribute protected wildlife throughout the state. The Utah Division of Wildlife Resources manages several wildlife management areas in the State under management agreements for purposes of mitigating impacts from the CUP on fish and wildlife habitat. The Utah Division of Wildlife Resources will assume the responsibilities of the Mitigation Commission when the Commission ceases to exist 20 years following completion of the CUP. They share a responsibility with the FWS under the Fish and Wildlife Coordination Act (FWCA) and participate in recovery of threatened and endangered species. The Utah Division of Wildlife Resources participates on interagency planning teams and performs many mitigation projects for fish and wildlife resources that have been or will be affected by the CUP.

Fish and Wildlife Service. The FWS has been given the main role by Congress in federal water projects of overseeing the FWCA and Endangered Species Act (ESA). They advise federal agencies on their evaluation of environmental impacts and on their roles of mitigation and conservation of threatened or endangered species.

Forest Service. The Forest Service is responsible for administering National Forest System lands. The Forest Service has served in essential roles on interagency planning teams and has been instrumental in facilitating or completing various documents. Much of the mitigation for Bonneville Unit impacts on fish, wildlife and recreation resources has occurred or will occur on National Forest System lands. The Forest Service either provides approval for the construction and operation of mitigation features on National Forest System lands or provides those mitigation services and features under agreements with the Mitigation Commission.

Central Utah Water Conservancy District. The District oversees all facets necessary for actual completion of the CUP water collection and delivery features, including engineering, planning, preparing designs and specifications, permit acquisition, construction, and compliance with the National Environmental Policy Act (NEPA).

Ute Indian Tribe. The Ute Indian Tribe shares responsibilities with the Mitigation Commission and DOI for planning and implementing wetland mitigation projects to offset impacts of the Bonneville Unit water collection and delivery systems on wetlands in the Uinta Basin, and to complete commitments made in the 1965 Deferral Agreement.

U.S. Department of the Interior. The DOI is charged with overseeing all federal responsibilities in the process of completing the CUP, which include budget, finance and fund administration, review, negotiations, compliance, and other CUPCA coordination provisions.

Key Documents in Development of the Mitigation Program

There are 12 environmental documents/laws that are considered milestones in the Bonneville Unit mitigation program, 8 before the 1988 DPR was completed and 4 following. A detailed description of each is provided in Chapter 1 of the Fish and Wildlife Appendix. The list includes the following.

- Pre-1988 DPR: Fish and Wildlife Coordination Act Report of 1965, Deferral Agreement (1965), National Environmental Policy Act of 1969, Bonneville Unit of the CUP Programmatic Environmental Impact Statement (1973), Endangered Species Act of 1973, 1980 Stream Flow Agreement, 1987 Terrestrial Mitigation Plan, and 1988 Aquatic Mitigation Plan for the Strawberry Aqueduct and Collection System (SACS)

- Post-1988 DPR: 1990 Stream Flow Agreement Amendment, 1992 CUPCA, 1997 Mitigation and Conservation Plan, and 2002 Mitigation and Conservation Plan

Bonneville Unit Systems

The 1988 DPR covered four of the six Bonneville Unit systems. These systems included: Starvation Collection System;

Strawberry Aqueduct and Collection System (SACS); Municipal & Industrial (M&I) System; and Ute Indian Tribal Development. The two remaining systems, the Diamond Fork Power System and the Irrigation and Drainage (I&D) System, were subsequently re-authorized by the CUPCA in 1992 and later amendments. In that re-authorization, the Section 202 Diamond Fork System replaced the Diamond Fork Power System, and the Section 202 Utah Lake Drainage Basin Water Delivery System (ULS) ultimately replaced the I&D System.

Although not considered original systems under the Bonneville Unit, several additional projects were authorized by CUPCA---Wasatch County Water Efficiency Project (WCWEP) and Daniel Replacement Project (DRP), and the Uinta Basin Replacement Project (UBRP)---as part of the Bonneville Unit. In addition to these projects, four additional program components were added under CUPCA that had environmental features. These four included: Conjunctive Use of Surface and Groundwater; Utah Lake Salinity and Provo River Study; Title III Fish, Wildlife and Recreation Mitigation and Conservation; and Title V Ute Indian Water Rights Settlement.

ENVIRONMENTAL COMMITMENTS

The Fish and Wildlife Appendix outlines the environmental commitments on the Bonneville Unit of the Central Utah Project (CUP) that were uncompleted under the 1988 Definite Plan Report (DPR), new environmental commitments or modifications to environmental commitments made since the 1988 DPR, and additional commitments to fish and wildlife authorized by the Central Utah Project Completion Act (CUPCA). As Bonneville Unit features were developed and constructed, new environmental commitments were made in National Environmental Policy Act (NEPA) compliance documents, record of decision documents, and biological opinions on these features.

Many of the commitments made in previous Bonneville Unit documents have been fulfilled, including providing in-stream flows for fish, land acquisition for wildlife habitat mitigation, water quality monitoring, and actions to benefit threatened and endangered species and their habitat. These fulfilled commitments have been incorporated into the Strawberry Aqueduct and Collection System (SACS), Municipal and Industrial (M&I) System and Diamond Fork System. Additional environmental commitments come from the reformulated Diamond Fork System and new programs under CUPCA including the Wasatch County Water Efficiency Project (WCWEP) and Daniel Replacement Project (DRP), Provo River Restoration Project (PRRP), Uinta Basin Replacement Project (UBRP), and Utah Lake Drainage Basin Water Delivery System (ULS). Some commitments are no longer valid or applicable because of changes in the Bonneville Unit.

Table 2-1 in the Fish and Wildlife Appendix provides the details of environmental commitments on the Bonneville Unit of the CUP. It includes a commitment description, comments relating its history to other actions and documents, exclusive or shared agency responsibility, status of required mitigation, and the source document, i.e., whether it was included in the 1988 DPR, a subsequent document such as the CUPCA, or Diamond Fork System Record of Decision (ROD) (1999). There are a total of 92 commitments; one in the Diamond Fork System has 12 sub-parts; two in the Provo River Restoration Project have five and seven sub-parts respectively, and one in the Uinta Basin Replacement Project has 13 sub-parts.

Summary of Environmental Commitments

Table 7-1 provides a summary of environmental commitments by Bonneville Unit system and the federal documents in which they were included. Twenty-one commitments were included in the 1988 DPR, but a number of those have been modified or augmented since then; several were included in additional documents following the 1988 DPR. The remaining 71 were not included in the 1988 DPR but have been made in

subsequent documents. These subsequent documents include the 1992 CUPCA, the 1997 WCWEP/DRP ROD, 1998 Provo River Restoration Project ROD, 1999 Diamond Fork System ROD, the 2001 Uinta Basin Restoration Project Final EA/FONSI, and the ULS Final EIS. Several commitments are no longer considered applicable or have been superseded, and several are included in other documents.

Table 7-2 presents a summary of the 92 environmental commitments and identifies the responsible agency or agencies, mitigation status, and the source document. Most of the responsibility for completion resides with the Joint-Lead Agencies, which include the DOI, the District, or the Mitigation Commission. Other agencies with responsibility for at least one commitment include the FWS, Reclamation, U.S. Forest Service, BIA or Ute Indian Tribe, Utah Division of Wildlife Resources, and Utah Division of Parks and Recreation. The mitigation status is identified in one of three categories: completed (C), ongoing (O), or pending (P). A number of commitments have several components and may fall into more than one status category.

BONNEVILLE UNIT FISH, WILDLIFE AND RECREATION PROGRAMS

The fish and wildlife mitigation and related recreation programs associated with Bonneville Unit systems and features are described in Chapter 3 of the Fish and Wildlife Appendix and summarized in this section. The environmental commitments described include those unfulfilled in the 1988 DPR and those established by the CUPCA, its amendments, and other environmental documents subsequent to the 1988 DPR. Overviews of fish, wildlife and related recreation programs on the Bonneville Unit of the CUP are presented for the following:

- Strawberry River and Duchesne River watersheds
- Provo River and Utah Lake watersheds
- Diamond Fork and Spanish Fork watersheds and southern Utah County
- Colorado River Storage Project and statewide programs

Commitments Unfulfilled in the 1988 DPR

There were 37 environmental commitments unfulfilled in the 1988 DPR, which addressed aquatic and wildlife resources, wetland mitigation, stream habitat, recreational improvements (campgrounds, trailheads, angler access), fishery enhancement and studies, and minimum stream flows. Of those 37, 23 have been completed, 9 are ongoing, and 5 have been deleted. The ongoing environmental commitments from the 1988 DPR involve angler access, wetland mitigation, minimum in-stream flows in Rock Creek, wetland and wildlife mitigation in the Duchesne River area, diversion dam modifications, fishery studies, deer mortality reduction, water quality monitoring, and day-use and campground recreation facilities.

Commitments Established by CUPCA and Amendments and from Other Environmental Documents

Title II of CUPCA authorized about $32 million for completion of the mitigation commitments in the 1988 DPR and Title III authorized about $141 million for new mitigation measures and to provide funding for measures to complement and/or supplement the 1988 DPR mitigation commitments.

TABLE 7-1
Environmental Commitments Summarized from Table 2-1 of the Fish and Wildlife Appendix

Total No. of Environmental Commitments per Bonneville Unit System	Commitment Source Documents (*number attributed to specific document*)	Bonneville Unit System or Project	Reference Nos. in Fish & Wildlife Appendix Table 2-1
12	1965 Deferral Agreement 1988 Bonneville Unit DPR (*8*) 1988 Aquatic Mitigation Plan (*2*) 1992 CUPCA (*2*) 1990 Stream Flow Amendment 1997 FWS Planning Aid Letter 1999 Final EA on Angler Access Mitigation Program, SACS	Strawberry Aqueduct and Collection System (SACS)	1 through 12
1	1988 Bonneville Unit DPR	Starvation Collection System (SCS)	13
10	1987 M&I System FS-FEIS (*2*) 1988 Bonneville Unit DPR (*10*) 1989 FWCA Report on M&I System 1991 FWCA Report on M&I System 1992 CUPCA 1997 FWS Planning Aid Memo (*2*) 1999 PRRP ROD (*2*)	Municipal and Industrial (M&I) System	14 through 23
23	1988 Bonneville Unit DPR (*2*) 1984 Diamond Fork Power System FEIS 1988 Aquatic Mitigation Plan (*2*) 1990 FS-FEIS Diamond Fork System (*3*) 1992 CUPCA 1992 FWCA Report DFS 1999 DFS ROD (*17*)	Diamond Fork System (DFS)	24 through 46
4	Superseded/Not Applicable	I&D System/Utah Lake System (ULS)	47 through 50
7	1992 CUPCA 1997 WCWEP/DRP Final EIS and ROD (*7*)	Wasatch County Water Efficiency Project & Daniel Replacement Project (WCWEP & DRP)	51 through 57
6	1992 CUPCA 1998 PRRP ROD (*6*)	Provo River Restoration Project (PRRP)	58 through 63
11	2001 UBRP Final EA/FONSI (*11*)	Uinta Basin Replacement Project (UBRP)	64 through 74
18	1999 Diamond Fork System ROD 2004 ULS FEIS (*16*) 2004 Water Quality Certification	Utah Lake System (ULS)	75 through 92

Table 7-2
Summary of the 92 Environmental Commitments on the Bonneville Unit of the Central Utah Project

Summary of Environmental Commitment[1]	Responsible Agency[2]										Mitigation Status			Source Document							
	Mitigation Commission	District	DOI	FWS	BIA	Ute Indian Tribe	USFS	Reclamation	UDWR	UDPR	Completed	Ongoing	Pending	1988 DPR	CUPCA 1992	DFS 1999 FS-FEIS & ROD	WCWEP/DRP FEIS & ROD	1998 PRRP ROD	2001 UBRP Final EA/FONSI	ULS FEIS	Miscellaneous[3]
1. SACS-wildlife mitigation for SACS, M&I System, DFS	■										■	■		■							■
2. SACS-bypass water to protect historic trout habitat		■						■			■	■		■							
3. SACS-Daniels-Strawberry Exchange, restore natural flows	■	■		■			■				■		■	■	■						
4. SACS-acquire angler access	■							■				■		■							■
5. SACS-fish habitat improvement measures	■										■	■		■				■			■
6. SACS-Strawberry River egg taking station	■							■			■			■							■
7. SACS-DRACR wetland and riparian mitigation	■		■					■				■		■							
8. SACS-Duchesne River waterfowl management areas	■		■		■	■						■		■							
9. SACS-44,400 ac-ft Duchesne River water		■		■									■								■
10. SACS-Rock Creek 25 cfs minimum in-stream flow		■										■									■
11. SACS-Transfer Midview Reservoir to Ute Indian Tribe, minimum fish pool					■	■					■			■							
12. SACS-800 acres fishing lakes on Ute Indian Tribe lands			■									■			■						
13. SCS-acquire/develop big game winter range								■			■			■							
14.M&I-Deer Creek land transfer to UDWR; funding	■										Not applicable Superseded										■
15. M&I-acquire West Hills land area for mitigation	■							■			■			■							
16. M&I-manage Jordanelle Reservoir lands for wildlife	■							■	■	■			■	■							
17. M&I-stabilize 12 upstream Provo River reservoirs	■						■				■			■	■						
18. M&I-construct campground and trailhead	■						■	■			■			■							
19. M&I-Provo River minimum in-stream flows		■						■			■	■		■	■						■

Table 7-2
Summary of the 92 Environmental Commitments on the Bonneville Unit of the Central Utah Project

Summary of Environmental Commitment[1]	Responsible Agency[2]										Mitigation Status			Source Document							
	Mitigation Commission	District	DOI	FWS	BIA	Ute Indian Tribe	USFS	Reclamation	UDWR	UDPR	Completed	Ongoing	Pending	1988 DPR	CUPCA 1992	DFS 1999 FS-FEIS & ROD	WCWEP/DRP FEIS & ROD	1998 PRRP ROD	2001 UBRP Final EA/FONSI	ULS FEIS	Miscellaneous[3]
20. M&I-Provo River post-project fish habitat studies	■	■										■		■	■						■
21. M&I-acquire middle Provo R. angler access	■							■				■		■				■			
22. M&I- replace middle Provo River diversion dams	■											■		■				■			
23. M&I-reduce deer mortality on Jordanelle Reservoir highways	■												■	■							■
24. DFS-510 cfs capacity in Diamond Fork Pipeline		■	■								■					■					■
25. DFS-monitor Diamond Fork Creek WQ, dissolved oxygen, temperature	■	■										■				■					
26. DFS-continue Diamond Fork Creek water quality monitoring		■										■				■					
27. DFS-Sixth Water Creek and Diamond Fork Creek minimum in-stream flows		■									■	■			■	■					
28. DFS-Diamond Fork Creek channel rehabilitation	■											■		■		■					■
29. DFS-modify Spanish Fork River diversion dams, provide fish passage		■									Superseded					■					
30. DFS-Spanish Fork River receive Diamond Fork Creek flows		■									Superseded					■					
31. DFS-interagency team on 6th Water Creek and Diamond Fork Creek flows	■												■			■					
32. DFS-monitor 6th Water/Diamond Fk. Cr. DO	■	■										■				■					
33. DFS-mitigate low dissolved oxygen levels if found in Diamond Fork Creek	■	■										■				■					
34. DFS-conduct water quality monitoring throughout Diamond Fork System	■	■										■				■					
35. DFS-acquire public access on Diamond Fork Creek	■											■		■							

Table 7-2
Summary of the 92 Environmental Commitments on the Bonneville Unit of the Central Utah Project

Summary of Environmental Commitment[1]	Responsible Agency[2]										Mitigation Status			Source Document							
	Mitigation Commission	District	DOI	FWS	BIA	Ute Indian Tribe	USFS	Reclamation	UDWR	UDPR	Completed	Ongoing	Pending	1988 DPR	CUPCA 1992	DFS 1999 FS-FEIS & ROD	WCWEP/DRP FEIS & ROD	1998 PRRP ROD	2001 UBRP Final EA/FONSI	ULS FEIS	Miscellaneous[3]
36. DFS-provide Diamond Fork recreation facilities	■										■	■	■	■	■						■
37. DFS-Long-term riparian vegetation monitoring	■											■	■			■					
38. DFS-coordinate with Fish and Wildlife Service on monitoring program	■												■			■					
39. DFS-mitigate wetland/riparian habitat impacts	■												■			■					
40. DFS-plan/implement 6th Water and Diamond Fork Creek habitat restoration, Spanish Fork River	■												■			■					
41. DFS (12 subparts)-Ute ladies'-tresses habitat monitoring and conservation measures	■	■										■	■			■					
42. DFS-provide permanent June sucker flows in lower Provo River		■	■									■				■					
43. DFS-develop/apply operational scenarios for June sucker flows in lower Provo River		■									■	■				■					
44. DFS-establish June sucker refugium in Red Butte Reservoir		■										■				■					
45. DFS-June sucker RIP sufficient progress	■	■	■	■								■	■			■					
46. DFS-prepare ULS EIS/address environmental commitments	■	■	■								■		■			■					
47. I&D/ULS-Utah Lake minimum pool at 4,480 ft msl											Not applicable										
48. I&D/ULS-water for Goshen Bay wildlife management	■										Superseded										
49. I&D/ULS-acquire land /water rights Goshen Bay	■										Superseded										
50. I&D/ULS-aqueduct/canal wildlife crossings											Not applicable										
51. WCWEP/DRP-restrict land uses to those that will not impair water quality		■									■						■				

Table 7-2
Summary of the 92 Environmental Commitments on the Bonneville Unit of the Central Utah Project

Summary of Environmental Commitment[1]	Responsible Agency[2]										Mitigation Status			Source Document							
	Mitigation Commission	District	DOI	FWS	BIA	Ute Indian Tribe	USFS	Reclamation	UDWR	UDPR	Completed	Ongoing	Pending	1988 DPR	CUPCA 1992	DFS 1999 FS-FEIS & ROD	WCWEP/DRP FEIS & ROD	1998 PRRP ROD	2001 UBRP Final EA/FONSI	ULS FEIS	Miscellaneous[3]
52. WCWEP/DRP-canal fish loss studies		■									■						■				
53. WCWEP/DRP-cutthroat trout mitigation	■											■			■		■				
54. WCWEP/DRP-leatherside chub surveys	■										■						■				
55. WCWEP/DRP-Heber Valley leatherside chub habitat protection and enhancement	■											■					■				
56. WCWEP/DRP-wetlands monitoring	■	■										■					■				
57. WCWEP/DRP-road closure and revegetation		■					■				■						■				
58. PRRP-perform monitoring & reporting program	■											■			■			■			
59. PRRP-restoration in accordance with SOPs	■											■						■			
60. PRRP-leatherside chub surveys	■										■							■			
61. PRRP-fish passage facilities incorporated into plan	■											■						■			
62. PRRP-Ute ladies'-tresses preservation	■										■	■						■			
63. PRRP-spotted frog impact mitigation	■								■		■	■						■			
64. UBRP-in-stream flow commitments-Lake Fork River	■	■											■						■		
65. UBRP-in-stream flow commitments-Yellowstone River		■											■						■		
66. UBRP-fish passage facilities for projects		■	■								■								■		
67. UBRP-Big Sand Wash Feeder Pipeline screening feasibility		■	■								■								■		
68. UBRP-prevent contaminant release with Big Sand Wash Power Plant dismantling		■	■								■								■		
69. UBRP-high mountain lake stabilization	■												■						■		
70. UBRP-wetland mitigation	■											■							■		

Table 7-2
Summary of the 92 Environmental Commitments on the Bonneville Unit of the Central Utah Project

Summary of Environmental Commitment[1]	Responsible Agency[2]										Mitigation Status			Source Document							
	Mitigation Commission	District	DOI	FWS	BIA	Ute Indian Tribe	USFS	Reclamation	UDWR	UDPR	Completed	Ongoing	Pending	1988 DPR	CUPCA 1992	DFS 1999 FS-FEIS & ROD	WCWEP/DRP FEIS & ROD	1998 PRRP ROD	2001 UBRP Final EA/FONSI	ULS FEIS	Miscellaneous[3]
71. UBRP-Ute ladies'-tresses population evaluation		■	■								■								■		
72. UBRP-Uinta Basin hookless cactus survey		■									■								■		
73. UBRP-implement RAP alternative for listed Colorado River fish species	■	■	■									■							■		
74. UBRP-survey bat roosting sites - pipeline corridors		■									■	■							■		
75. ULS-complete all ULS mitigation commitments	■												■		■						
76. ULS-comply with water conservation goals		■											■							■	
77. ULS-annual report of per capita water use by District's ULS water petitioners		■											■							■	
78. ULS-recycle 18,000 AF return flow by 2030		■											■							■	
79. ULS-recycle 18,000 ac-ft annually through 2050		■											■							■	
80. ULS-12,165 ac-ft conserved water in lower Provo River for June sucker spawning/rearing		■	■										■							■	
81. ULS-acquire water shares for Provo River 75 cfs flows	■	■										■			■					■	
82. ULS-3,300 ac-ft water shares Provo River 75 cfs flows	■	■	■									■			■					■	
83. ULS-16,000 ac-ft delivery to Provo River as needed		■											■							■	
84. ULS-12,037 ac-ft average annual water in Hobble Cr. for June sucker		■	■										■							■	
85. ULS-10 acres of Mona Springs Wetland Unit provided for wetland impact mitigation	■												■							■	
86. ULS-participate in Utah Lake TMDL process		■										■								■	

Table 7-2
Summary of the 92 Environmental Commitments on the Bonneville Unit of the Central Utah Project

Summary of Environmental Commitment[1]	Responsible Agency[2]										Mitigation Status			Source Document							
	Mitigation Commission	District	DOI	FWS	BIA	Ute Indian Tribe	USFS	Reclamation	UDWR	UDPR	Completed	Ongoing	Pending	1988 DPR	CUPCA 1992	DFS 1999 FS-FEIS & ROD	WCWEP/DRP FEIS & ROD	1998 PRRP ROD	2001 UBRP Final EA/FONSI	ULS FEIS	Miscellaneous[3]
87. ULS-cooperative feasibility study of June sucker passage/removal at Fort Field Diversion Dam	■											■								■	
88. ULS-Ute ladies'-tresses monitoring program	■	■										■								■	
89. ULS-Ute ladies'-tresses possible management changes in response to monitoring results	■	■	■										■							■	
90. ULS-Leatherside chub conservation & mitigation	■												■							■	
91. ULS-consult Tribes on any Proposed Action changes		■	■										■							■	
92. ULS-use BMPs to minimize erosion-sediment load, and comply with 401 WQ Certification conditions		■											■								■
Total	**55**	**47**	**17**	**3**	**2**	**2**	**4**	**10**	**2**	**1**	**29**	**43**	**29**	**22**	**12**	**21**	**7**	**9**	**11**	**16**	**14**

Notes:

[1]SACS = Strawberry Aqueduct and Collection System; SCS = Starvation Collection System; M&I = Municipal and Industrial System; DFS = Diamond Fork System; I&D/ULS = Irrigation and Drainage/Utah Lake System; ULS = Utah Lake System; WCWEP/DRP = Wasatch County Water Efficiency Project and Daniel Replacement Project; PRRP = Provo River Restoration Project; UBRP = Uinta Basin Replacement Project

[2]Mitigation Commission = Utah Reclamation Mitigation and Conservation Commission; District = Central Utah Water Conservancy District; DOI = U.S. Department of the Interior; FWS = Fish and Wildlife Service; BIA = Bureau of Indian Affairs; Tribe = Ute Indian Tribe; Reclamation = Bureau of Reclamation; USFS = U.S. Forest Service; UDWR = Utah Division of Wildlife Resources; UDPR = Utah Division of Parks and Recreation

[3]Includes one or more of the following sources: 1997 Fish and Wildlife Service Planning Aid Letter, 1999 Final EA on the Angler Access Mitigation Program (SACS), 1988 Aquatic Mitigation Plan, 1990 Streamflow Amendment, 2004 Supplement to 1998 Duchesne River Biological Opinion, 1965 Deferral Agreement, 1987 M&I System FS-FEIS, 1989 Fish and Wildlife Coordination Act Report on the M&I System, 1984 FEIS on Diamond Fork Power System, 1998 Final EA Diamond Palmyra Campground, and 2004 Water Quality Certification Letter from Utah DEQ.

Title III, Section 301 of CUPCA created the Mitigation Commission and made it responsible for coordinating, planning and administering the funding of Bonneville Unit mitigation programs to meet ongoing and new commitments. Sections 302 through 315 (excluding 310) of Title III are important fish, wildlife and recreation provisions. Commitments were established in the following Title III CUPCA sections:

- Section 301 – Utah Reclamation Mitigation and Conservation Commission
- Section 302 – Increased Water Capability
- Section 303 – Stream Flows
- Section 304 – The Definite Plan Report
- Section 305 – Wildlife Lands and Improvements
- Section 306 – Wetlands Acquisition, Rehabilitation and Enhancement
- Section 307 – Fisheries Acquisition, Rehabilitation and Enhancement
- Section 308 – Stabilization of High Mountain Lakes in the Uinta Mountains
- Section 309 – Stream Access and Riparian Habitat Development
- Section 311 – Jordan and Provo River Parkways Natural Areas
- Section 312 – Recreation
- Section 313 – Fish and Wildlife Features in the Colorado River Storage Project
- Section 314 – Concurrent Mitigation Appropriations
- Section 315 – Fish, Wildlife and Recreation Schedule

The primary priority for the Mitigation Commission is to complete unfulfilled mitigation commitments of the Bonneville Unit of the CUP. The new CUPCA provisions were applied to expand the program of fish and wildlife provisions that had been included in the Bonneville Unit up to 1988. The Fish and Wildlife Appendix documents the environmental plan for the completion program. This environmental plan has evolved over several decades as water systems planning progressed to the currently proposed configuration and operational program. The environmental commitments documented in the 1988 DPR are integrated with those subsequent to the 1988 DPR, along with projects or features authorized by Title III of the CUPCA. Many of the projects authorized by CUPCA have been implemented to supplement or complement measures included in the 1988 DPR.

Overview of Fish, Wildlife and Related Recreation Programs Associated with the Strawberry and Duchesne River Watersheds

The fish and wildlife mitigation program in the Uinta Basin has a long evolutionary period as planning and implementation of Bonneville Unit components progressed from the early 1960s to present. The program of mitigation and conservation measures has evolved through planning, development and analyses until a comprehensive plan for the Bonneville Unit has been developed that incorporates significant mitigation measures for fish and wildlife. The process involved re-evaluations of some measures originally proposed and substitution of other measures where conditions or perceived needs have changed.

A mitigation provision accompanies virtually every major Uinta Basin stream affected by the Bonneville Unit operation and every constructed facility. In combination, these provisions are designed to preserve fish and wildlife resources and their availability for fishing, hunting and other outdoor recreation. The Bonneville Unit impacts on fish, wildlife, and recreation resources were analyzed on a facility-by-facility basis. Many of the program elements described in the Strawberry and Duchesne river watersheds arise from mitigation needs for the SACS project.
The Final Aquatic Mitigation Plan for the SACS was transmitted to Reclamation in 1988 by the FWS. The plan revised the 1984 Draft Aquatic Mitigation Plan for SACS that had been presented in the 1988 Bonneville Unit DPR. The identified aquatic mitigation measures for the SACS encompassed four categories: 1) purchase and/or exchanges of water to provide in-stream flows; 2) acquisition of angler access; 3) in-stream habitat improvement measures; and 4) replacement of a trout egg-taking station on the upper Strawberry River near Strawberry Reservoir.

The following sections briefly summarize key elements of 14 fish, wildlife and related recreation programs in the Strawberry and Duchesne River drainages.

Daniel – Strawberry Exchange. This program restores the natural flows in 16.3 miles of the upper Strawberry River and 9.8 miles in Bjorkman Hollow, Murdock Hollow, Point of Pines Canyon, and Willow and Hobble Creeks. These streams are traditional cutthroat trout spawning habitat and restoring flows in them would provide approximately 27 percent of the required mitigation for the SACS.

Fish Habitat Improvements - 1988 SACS Aquatic Mitigation Plan. The 1988 Aquatic Mitigation Plan for the SACS identified 14 stream segments totaling over 119 miles as potential sites for stream habitat improvement work. The 1988 SACS Aquatic Mitigation Plan stated that mitigation credit from habitat improvement should not exceed 9,790 angler days. Of that, 6,115 angler days were achieved on streams in the Uinta Basin and Bonneville Basin affected by Bonneville Unit features. A balance of 3,675 angler days needed to complete this mitigation requirement for the SACS has been met by implementing the PRRP, which improved fish habitat conditions on the Provo River between Jordanelle Dam and Deer Creek Reservoir.

Angler Access and Related Facilities. The purpose of this program element is to fulfill the angler-access component of the 1988 SACS Aquatic Mitigation Plan. The 1988 Aquatic Mitigation Plan identified the acquisition of approximately 51 miles of stream access on the West Fork Duchesne, Duchesne, Currant Creek and Strawberry Rivers to provide partial mitigation for lost angling opportunities. An Environmental Assessment (EA) addressing the impacts of acquiring the remaining lands or easements and management of the angler-access corridors was released November 13, 1999. The EA documented impacts of slightly revised stream segments and access lengths. The access length on Currant Creek was reduced and access length was added on the North Fork of the Duchesne River.

Duchesne Area Canal Wetland Mitigation. This program element is intended to satisfy the 1988 DPR requirement to mitigate for losses of wetlands and wildlife habitat caused by implementing the Duchesne River Area Canal Rehabilitation (DRACR) program. The original mitigation plan to develop wetland mitigation areas around the shoreline of Starvation Reservoir was determined to be infeasible in 1987. An alternative mitigation plan was developed by Reclamation and approved by the Fish and Wildlife Service involving wetlands development on about 1,087 acres acquired by the Federal government along the Duchesne River for this purpose. Development plans are pending. The Mitigation Commission is pursuing a joint plan with the Ute Indian Tribe which may fulfill both the DRACR project and SACS Wetland Mitigation (see below) mitigation commitments.

SACS Wetland Mitigation. The SACS Wetland Mitigation program fulfills a long-standing commitment made to the Ute Indian Tribe and mitigates impacts of constructing and operating the SACS on wetland resources along the lower Duchesne River corridor. The long-standing mitigation commitment to the Ute Indian Tribe is based on a 1965 agreement that deferred development of a portion of Indian water rights so they could instead be used for the Bonneville Unit. A portion of the agreement included mitigation for losses of fish, wildlife, and recreational values caused by the project.

There were five elements of the 1965 deferral agreement that required fish and wildlife developments. Four have been completed or satisfied in other ways (refer to Title V, CUPCA). The following four elements have been fulfilled.

- Mitigation of the loss of 37,200 angler-days from constructing and operating the SACS
- Transfer of Midview Reservoir to BIA and Ute Tribe
- Bottle Hollow Reservoir and Lower Stillwater Reservoir
- Minimum flow in Rock Creek

The Fish and Wildlife Appendix provides details of these four elements. The fifth element,

described in the 1964 DPR and the 1973 Bonneville Unit Final Environmental Impact Statement (EIS), was a commitment to develop waterfowl areas along the Duchesne River as mitigation for waterfowl losses sustained by the Ute Indian Tribe and anticipated with constructing and operating the SACS. This was a required element of the 1965 Deferral Agreement. A draft EIS on the Lower Duchesne River Wetlands Mitigation Project plan that would complete this commitment was issued by the Mitigation Commission and DOI in November 2003. The proposed action involves acquiring private lands to be restored and managed for wetlands values, re-watering 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, removing non-native invasive species, and changing management of areas adjacent to wetlands to benefit wildlife.

Uinta Basin Replacement Project Mitigation. The Uinta Basin Replacement Project (UBRP) was authorized by CUPCA. The Mitigation Commission is responsible for participating with the DOI, District and other cooperating agencies in designing and implementing mitigation for the proposed project. Project-related fish and wildlife features that would be realized under UBRP include new or modified diversion structures to provide fish passage, in-stream flows, and stabilization of high mountain lakes (fish and wildlife/wilderness benefits). In addition, the District will provide funding to extend the existing boat ramp to the new high water line of the enlarged Big Sand Wash Reservoir for continued public access.

Strawberry Area Assessment, Watershed and Wildlife Habitat Restoration. CUPCA authorized additional funds for improving watershed and fishery conditions in the Strawberry Valley and Strawberry River watershed, areas highly involved with Bonneville Unit development and mitigation programs. The Mitigation Commission and Uinta National Forest together conducted an Area Assessment, designed to identify resources and areas in the watershed that were not currently in a properly functioning condition. The assessment has been used to guide further evaluations. The Uinta National Forest completed the 2004 Strawberry Valley Watershed Restoration Report which identified numerous measures to help restore healthy range, riparian and watershed conditions in Strawberry Valley. The Mitigation Commission may become involved with the Forest Service and other partners in implementing selected projects within the scope of the Bonneville Unit authority.

Sage Grouse Conservation and Recovery. Sage grouse population decline is a concern in the Strawberry Valley. The enlargement of Strawberry Reservoir as part of the SACS inundated four of the five then-known sage grouse leks in Strawberry Valley. A number of other factors beyond lek destruction are believed involved in the population decline, including increased predation by non-native red fox, and by ravens and other species. The Mitigation Commission and others will support protective or restorative measures as they are identified.

Wildlife Habitat Acquisition. Section 305 of the CUPCA directed the Mitigation Commission to acquire big game winter range lands from willing sellers to compensate for the impacts of Reclamation projects in Utah, in addition to those lands required by the 1988 DPR. Lands acquired for this purpose that lie within the boundaries of Federal land ownership are to be transferred to the appropriate Federal agency for management as big game winter range. Other lands acquired under this provision of the CUPCA are to be transferred to the Utah Division of Wildlife Resources for such management.

In-stream Flow Management. The major impact of the SACS has been a significant reduction of flows in several Uinta Basin streams. The 1973 Bonneville Unit Final EIS called for releases of 6,500 acre-feet per year for fisheries purposes. This was to have been divided between Rock Creek (3,500 acre-feet per year) and the Strawberry River (3,000 acre-feet per year). No minimum flow requirements were established for eight other impacted streams. The Stream Flow Agreement of 1980 was executed which recognized that 54,900 acre-feet was needed to

retain 50 percent of the historic trout habitat in the four major streams impacted, which would require 44,400 acre-feet of fishery flow releases annually. A process of securing the water was initiated. A commitment was made in the 1990 Amendment to the Stream Flow Agreement to provide the 44,400 acre-feet per year from the SACS, in addition to 10,500 acre-feet of spills or bypasses on an average annual basis. Brief summaries of the main provisions of the 1980 Stream Flow Agreement and the 1990 Amendment are provided in the Fish and Wildlife Appendix.

Modification of Diversion Structures. The Duchesne River and Strawberry River in Duchesne County provide irrigation and municipal water supplies and quality sport and native non-sport fisheries. However, some diversion structures impact fish habitat or inhibit fish passage and delivery of in-stream flows as identified under the Stream Flow Agreement of 1980 and its 1990 amendment. Section 203 of CUPCA authorized funds for the rehabilitation or replacement of diversion dams on the Duchesne and Strawberry rivers to reduce their impacts on fish and wildlife and their habitats. A total of 24 diversions are located in the project area and were evaluated for this project. The project area includes reaches along the Duchesne River, from its confluence with the North Fork and West Fork downstream to its confluence with the Strawberry River, and reaches along the Strawberry River, from its confluence with Red Creek downstream to its confluence with the Duchesne River.

Recreation Improvements. These improvements include expanded public recreation access, information and facilities with priority on supplementing resources provided by the SACS mitigation measures. Funding is from Section 312 of the CUPCA.

Watershed Stabilization, Wildlife Enhancement, and Access Management. This program utilizes funding provided under CUPCA Sections 307 and 309 to stabilize watersheds, improve wildlife habitat, and manage public access in the SACS area. Priority is on actions that complement measures on Bonneville Unit mitigation properties in the watershed, but other projects are considered.

Endangered Species. In compliance with the Endangered Species Act of 1973 and subsequent amendments, Reclamation consulted with the FWS regarding threatened and endangered species known or suspected to occur within the project area. These species included the bald eagle, peregrine falcon, Colorado squawfish (now Colorado pikeminnow) and humpback chub. Reclamation provided the FWS with additional information regarding water depletions from the Green River system and requested a Biological Opinion from them to conclude formal Section 7 consultation. The FWS recommended additional information collection to determine Colorado River Storage Project operation sensitive to the environmental needs of the endangered fish. Two additional fish species were listed and included in the Section 7 consultation: bonytail and razorback sucker. 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 FWS 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.

Overview of Fish, Wildlife and Related Recreation Programs Associated with the Provo River Watershed, Utah Lake and Hobble Creek

The fish and wildlife program for the Provo River watershed, Utah Lake area and Hobble Creek addresses environmental commitments of the Bonneville Unit and a description of other fish and wildlife programs authorized by CUPCA in these drainages. Five Bonneville Unit systems or projects have generated environmental commitments in the Provo River drainage, near Utah Lake, and in Hobble Creek,

including the SACS, M&I System, WCWEP and DRP, PRRP, and ULS, plus some new programs authorized under CUPCA.

Provo River Watershed Fish and Wildlife Program. The Provo River watershed has been a high priority resource area for the Mitigation Commission since its first 5-year plan. Priority goals are to complete unfulfilled mitigation requirements of the Bonneville Unit and ongoing Title II projects, and to implement through CUPCA's Title III program measures that are complementary and supplemental to those in Title II. An ecosystem approach has been utilized to develop a comprehensive program for fish, wildlife and recreation mitigation and conservation. The upper Provo River program includes stabilizing the 12 upper Provo River reservoirs, the Washington Lake campground, Crystal Lake trailhead, and mitigation for increased deer mortality associated with relocating highways around Jordanelle Reservoir. The middle Provo River program includes the WCWEP and DRP, which integrates water efficiency and water conservation in the Heber Valley with the Daniel/Strawberry water exchange, and the PRRP, which involves angler access acquisition, recreation facilities planning and development, fish and riparian habitat restoration, in-stream flow studies, diversion dam modifications, and the Jordanelle Wetlands Mitigation Area. The lower Provo River program includes study of excess flows and in-stream flow studies, water rights acquisition, stream restoration and diversion dam modifications, water quality improvements, and multiple activities associated with the June sucker Recovery Implementation Program.

Utah Lake and Surrounding Area Fish and Wildlife Program. Fish and wildlife programs for Utah Lake and the surrounding area involve commitments for tributary flow augmentation, conservation of Utah Lake wetlands, maintaining a minimum pool in Utah Lake, fish management related to improving warm-water fishery and June sucker recovery, and completing mitigation and other commitments for the ULS. The lower Provo River would be augmented under the ULS to provide 16,000 acre-feet of water per year for in-stream flows and would receive an additional 12,165 acre-feet of water per year for June sucker spawning and rearing. Two wetland areas have been planned adjacent to Utah Lake, in the Benjamin Slough area and the Goshen Bay area, comprising the Utah Lake Wetland Preserve. The Mitigation Commission has funded acquisition of about 5,500 acres to date in the Benjamin Slough and Goshen Bay areas to provide waterfowl and wildlife habitat and preserve natural wetlands adjacent to Utah Lake.

The minimum pool elevation of 4,480 feet mean sea level in Utah Lake was established by the Utah State Engineer's Office in the 1992 Utah Lake Water Distribution Plan. Utah Lake fish management focuses on improving the lake as a warm-water fishery, promoting more natural tributary inflow, implementing measures that restore the Utah Lake ecosystem, aid recovery of the endangered June sucker, and aid sport fish management. Mitigation and new commitments for the ULS include water conservation and recycling, in-stream flows in the lower Provo River as part of June sucker recovery actions, flow supplements toward meeting the lower Provo River 75 cfs target flows, and in-stream flows in Hobble Creek to support June sucker spawning and rearing. A portion of the Mona Springs unit of the Burriston Wildlife Management Area would be used to provide wetland mitigation for impacts on riparian wetlands under the ULS. Other mitigation and new commitments are identified in the ULS Final EIS.

Hobble Creek Flow Supplementation. Data and information on Hobble Creek were not included in the 1988 DPR because the proposed plans did not affect that resource. The ULS Proposed Action would provide supplemental in-stream flows for potential June sucker recovery actions and game fish habitat. Total wild trout biomass in Hobble Creek would increase by 5,340 pounds with the supplemental in-stream flows. A firm supply of 4,000 acre-feet of water per year would be delivered to Hobble Creek to support June sucker spawning and rearing. In dry years, the firm supply would be supplemented with

Bonneville Unit water to attempt to meet target flows for June sucker spawning and rearing.

Overview of Fish, Wildlife and Related Recreation Programs Associated with the Diamond Fork and Spanish Fork Watersheds and Southern Utah County

The fish, wildlife and related recreation programs associated with completion of Bonneville Unit features in Diamond Fork Canyon, portions of Spanish Fork Canyon, and in southern Utah County cover the following Bonneville Unit systems: 1) Diamond Fork System for transbasin diversion of water from Strawberry Reservoir; and 2) ULS for water delivery to southern Utah County communities and Utah Lake for exchange to Jordanelle Reservoir. The reformulated Diamond Fork System begins operating in 2004 and will result in removing high irrigation flows from Sixth Water Creek and Diamond Fork Creek, providing opportunities to restore aquatic resources in these streams. Aquatic resources will change in the Spanish Fork River under Diamond Fork System operation, and under ULS operation as that project is implemented. The following sections summarize the aquatic resources in the Diamond Fork and Spanish Fork watersheds under Bonneville Unit operations, and describe elements of the fish and wildlife programs for Diamond Fork Creek and Spanish Fork River.

Overview of Diamond Fork and Spanish Fork Aquatic Resources.

Bonneville Unit Plan Reformulation. The Bonneville Unit of the CUP has been substantially reformulated in the Diamond Fork and Spanish Fork watersheds since the 1988 DPR. The Diamond Fork System was reformulated four times, finally resulting in a combination of tunnels, pipelines, shafts, flow control structures, and outlet structures. The final system of the Bonneville Unit described in the 1988 DPR was the proposed Irrigation and Drainage (I&D) System. It was subsequently reformulated under the CUPCA as the Spanish Fork Canyon-Nephi Irrigation System, and then abandoned after a Draft EIS was released for public review and comment. The ULS plan is proposed as the final system of the Bonneville Unit and would consist of pipelines, flow control structures, and outlet structures.

These changes in the Bonneville Unit plan have led to corresponding changes in the fish, wildlife and related recreation programs in the Diamond Fork and Spanish Fork watersheds. The Diamond Fork System will provide opportunities, through water management, to help achieve recovery of the Sixth Water and Diamond Fork Creeks riparian corridors. The Sixth Water/Diamond Fork ecosystem has been impacted by the operation of a prior Reclamation project for over 75 years. The construction of the Diamond Fork System will lead to a substantial reduction of the excessive flows as the Diamond Fork System operates in the future. The extent to which ecosystem restoration can occur is in large measure dependent upon the quantities, timing and duration of flows to be released. Implementing hydrologic regimes that recover and maintain a diversity of aquatic and riparian habitats is a central tool in the restoration of riverine ecosystems.

Aquatic Resources in the Diamond Fork Watershed Under Bonneville Unit Operations. As the Diamond Fork System begins to operate, two reaches of Sixth Water Creek and five reaches in Diamond Fork Creek will be affected. Trout biomass in the two Sixth Water Creek reaches is estimated to increase by 4,594 pounds under the Bonneville Unit operation. Minimum in-stream flows of 25 cfs from November through April and 32 cfs from May through October are committed to Sixth Water Creek, flowing from the Strawberry Tunnel. Trout biomass in the five Diamond Fork Creek reaches is estimated to increase by 8,229 pounds under the Bonneville Unit operation. Minimum in-stream flows of 60 cfs from October through April and 80 cfs from May through September are committed to Diamond Fork Creek below the Diamond Fork Creek Outlet near Monks Hollow. The increased trout biomass occurs because of a more stabilized flow regime, less erosion and turbidity, suitable water temperatures and improved water quality conditions. Maintenance and emergency

operations will have minimal impacts on the restored trout fisheries in these streams.

Aquatic Resources in the Spanish Fork Watershed Under Bonneville Unit Operations. As the ULS begins to operate, four distinct reaches of Spanish Fork River would be affected. Trout biomass would increase by an estimated 354 pounds in the upper two reaches of Spanish Fork River, and would decrease by an estimated 4,279 pounds in the lower two reaches of the Spanish Fork River. Maintenance and emergency operations would have no measurable impacts on the trout fisheries in the Spanish Fork River.

Summary of Fishery Benefits Under Diamond Fork System and ULS Operations. Diamond Fork and Sixth Water creeks would support a total estimated increase of 12,823 pounds (191 percent increase) in wild trout biomass under the Bonneville Unit operations. After the ULS begins to operate, Spanish Fork River wild trout biomass would decrease by 3,925 pounds (21 percent decrease). The net fishery benefit would be an increase of 8,898 pounds (36 percent increase) in wild trout biomass under Diamond Fork System and ULS operations.

Elements of Diamond Fork Creek and Spanish Fork River Fish, Wildlife and Recreation Programs. The Mitigation Commission identified eight program elements in 1996 to encompass the environmental commitments of the 1988 DPR and subsequent plan revisions, and to incorporate the new provisions of CUPCA into a comprehensive program for these watersheds. The following sections briefly describe the eight program elements.

Diamond Fork Area Assessment. The Mitigation Commission and Uinta National Forest prepared the 2000 Diamond Fork Area Assessment to determine the condition of various natural resources in the area already affected by or to be affected by Diamond Fork System completion and subsequent Bonneville Unit features on National Forest System lands.

Angler Access Acquisition. Three of the five miles committed for angler access along lower Diamond Fork Creek from the Uinta National Forest boundary to the confluence with the Spanish Fork River had been acquired as of the 1988 DPR. Reclamation acquired the remaining 155 acres of land encompassing the remaining lowest two miles of Diamond Fork Creek following enactment of the CUPCA in 1992. The Mitigation Commission, Reclamation and the Forest Service entered into an interim management agreement for the property in 2000. Upon completion of initial developments and riparian habitat improvements on the property, Reclamation will transfer administration of the lands to the Forest Service under a management agreement.

Sixth Water Aquatic and Riparian Habitat Restoration. The FWS proposed in the 1991 FWCA Report on the 1990 Final Supplement to the Final EIS that a feasibility study be performed on providing delivery of up to 49 cfs during the summer and 32 cfs during the winter to Sixth Water Creek. The CUPCA required the project to provide minimum flows of 32 cfs during May through October, and 25 cfs during November through April, which have been met since 1996. Another recommendation was to develop and implement an aquatic and riparian habitat restoration and monitoring plan for Sixth Water Creek. Preliminary plans were developed with an interagency team in 1997 through 1999. The Mitigation Commission will reconvene an interagency team following completion of the Diamond Fork System in 2004, after which time high irrigation-influenced stream flows of the past will be removed from Sixth Water Creek.

Diamond Fork Aquatic and Riparian Habitat Restoration. The FWS proposed in the 1991 FWCA Report on the 1990 Final Supplement to the Final EIS that a feasibility study be performed on providing and maintaining a minimum stream flow of 80 cfs in Diamond Fork Creek to protect the stream fishery. The CUPCA required the project to provide minimum flows of 80 cfs during May through September, and 60 cfs during October through April. The Mitigation Commission committed to develop and implement a monitoring program to measure responses to flow changes in Diamond Fork Creek by operation of the reformulated Diamond

Fork System. The Forest Service developed an aquatic and riparian habitat restoration plan for Diamond Fork Creek with Commission funding. The Mitigation Commission plans to reconvene the interagency team now that the Diamond Fork System is operating and high irrigation-influenced stream flows have been removed from Diamond Fork Creek.

Water Quality and Temperature Monitoring Study. The 1984, 1990, 1999, 2000 and 2002 NEPA documents for the Diamond Fork System and the 1988 DPR recommended a water quality and water temperature monitoring program in Diamond Fork Creek. The District and Mitigation Commission have been monitoring water quality during construction, and the Mitigation Commission will monitor water quality during Diamond Fork System operation. Corrective measures will be identified and implemented if problems with low dissolved oxygen, temperature or other parameters are identified.

Diamond Fork Campground and Recreation Facilities. The reformulated Diamond Fork System resulted in changes to the recreation features of the project. Revised recreation features include Diamond Fork Campground, Sawmill Hollow Trail, Fifth Water Trail, angler access, and education and interpretation sites. The Diamond Fork and Palmyra campgrounds have been combined, and a NEPA document is planned for fall 2004 to evaluate the impacts of developing group camping sites in Diamond Fork Canyon.

Diamond Fork System Mitigation. The Mitigation Commission program for the Diamond Fork System places priority on completing unfulfilled mitigation responsibilities identified in the 1988 DPR and subsequent NEPA documents. Most of the environmental commitments have already been discussed as part of previously described programs. New commitments since 1988 include a Mitigation Commission plan for a long-term riparian vegetation monitoring program in conjunction with monitoring programs for Sixth Water and Diamond Fork creeks. The Mitigation Commission will continue to coordinate with the FWS, Forest Service, Utah Division of Wildlife Resources and others regarding results of the monitoring program. The Joint-Lead Agencies will mitigate any losses or detrimental impacts on wetland and riparian habitats that cannot be restored.

The 1987 Wildlife Mitigation Plan was revised in 1997 because of Bonneville Unit reformulation and includes mitigation land purchases for the SACS, M&I System, and the Diamond Fork System. The plan required mitigation for 630 acres of wooded riparian vegetation impacted by the M&I System. One hundred-sixty five acres have been mitigated through acquisition and habitat improvements on part of the Moon properties on Currant Creek, and 237 acres have been mitigated as part of the Camelot properties on the Strawberry River. The remaining 228 acres of riparian development is being achieved by the PRRP. For terrestrial mitigation, a total of 14,315 acres were acquired and credited as mitigation for the SACS; 12,226 acres were acquired and credited as mitigation for the M&I System; and 4,038 acres were acquired and credited as mitigation for the Diamond Fork System.

Threatened and Endangered Species Environmental Commitments. Environmental commitments for federally listed species, the Ute ladies'-tresses orchid (Spiranthes diluvialis) and the June sucker (Chasmistes liorus), have been expanded since the 1988 DPR.

Ute Ladies'-Tresses Orchid. The Ute ladies'-tresses orchid has been found in Diamond Fork Canyon since it was listed in 1992 as threatened under the ESA. A Draft Recovery Plan for this species was prepared by the FWS in 1995. The District has requested that the FWS initiate action to de-list the species. The plant has subsequently been observed in Spanish Fork Canyon. Environmental commitments in the form of conservation measures made for the Ute ladies'-tresses orchid are summarized in Table 7-2.

June sucker. The June sucker is known to occur naturally only in Utah Lake and that population currently is known to spawn naturally only in Provo River. Numerous conservation measures adopted since the 1988 DPR for the June sucker,

identified in the recovery plan (FWS 1999b), are being coordinated through the June Sucker Recovery Implementation Program (JSRIP). As a part of the environmental commitments for the completion of the Diamond Fork System, the District, DOI and Mitigation Commission have been participating in the JSRIP to support June sucker recovery.

Overview of Fish, Wildlife and Related Recreation Programs Associated with the Colorado River Storage Project or Statewide Programs

The following sections briefly summarize the recreational benefits of the Bonneville Unit of the CUP and the fish and wildlife benefits of the Mitigation Commission's program. The fish, wildlife and related recreation programs in the Bonneville Unit of the CUP are authorized as part of the Colorado River Storage Project and generate benefits derived from user-days associated with recreational activities at Bonneville Unit features. The recreational benefits and fish and wildlife benefits have changed as several Bonneville Unit systems were reformulated. In addition to those programs previously discussed in this chapter, the CUPCA authorized funding for the Mitigation Commission to improve wetlands around the Great Salt Lake and to improve fish and riparian habitat along the Jordan River. The Mitigation Commission has specific and programmatic authorizations under CUPCA to plan and implement fish and wildlife mitigation and conservation activities in a statewide program that extends administratively and geographically beyond the Bonneville Unit.

Fish and Wildlife Benefits. Fish and wildlife benefits are based on visitations to Bonneville Unit features for fishing recreation, measured in "angler-days" representing a day of visitation by one person. Expenditures made for fishing recreation are based on a FWS estimated value of $33.00 per angler-day in 2001, then adjusted to a present-day value of $35.35 using the Consumer Price Index. Angler-days per year are projected to increase by 430,200 under the Bonneville Unit operation, with an additional 18,300 angler-days per year realized from the CUPCA-authorized UBRP. The total annual recreational fishing benefit is $16,300,000 in June 2004 dollars. Upland game hunting benefits are not included because the ULS was reformulated from an irrigation project to a M&I water supply project, eliminating vegetative cover for upland game that would have used the irrigated lands.

Recreational Developments and Benefits of Bonneville Unit Systems. Recreational developments are incorporated into Bonneville Unit features to provide non-anglers and non-hunters with opportunities for boating, water skiing, hiking, horseback riding, nature study, and other related activities. Recreational facilities at Bonneville Unit reservoirs include boat ramps and slips, docks, camping and picnic areas, restrooms, and food service. The recreational opportunities and facilities provided at Bonneville Unit features generate benefits measured in "recreation user days." Recreational user days are projected to increase by 1,429,300 days per year under the Bonneville Unit operation. The total annual recreation benefit is $11,440,000 in 2003 dollars. The CUPCA authorizes the Mitigation Commission to fund additional recreation facilities to mitigate for impacts on pre-Bonneville Unit recreation use of the outdoors. Recreation facilities include interpretive signs and sites, public access to streams, and enhancement of public touring and recreation opportunities at projects planned by state and local agencies.

Great Salt Lake Wetlands Improvement. The Great Salt Lake has extensive wetlands adjacent to its eastern and southern shorelines, providing diverse habitat for migratory birds and other wildlife. This important wetland ecosystem has been significantly impacted by development and its indirect effects of groundwater quality contamination, degraded surface water inflows, solid waste disposal, invasive species, and air pollution. Section 306 of the CUPCA authorized $14 million for Mitigation Commission use in planning and implementing projects to preserve, rehabilitate and enhance wetland areas around the Great Salt Lake. The Mitigation Commission has formulated a program to consolidate ownership and management of selected portions of the lake's wetlands in partnership with other governmental

agencies and non-governmental organizations, mitigate former impacts, address future impacts, create public awareness and support, and improve wetlands management by involved agencies, organizations, and private landowners. The program is continuing with acquisition of high-value Great Salt Lake wetlands and development of wetlands protection plans.

Jordan River Watershed Improvement Program. The history of water development and use in the Jordan River watershed covers more than 150 years. Since settlement of the Salt Lake Valley, riparian forests have been cleared, the river has been channelized, water quality has been degraded, oxbows and wetlands filled, and much wildlife has been displaced. The Mitigation Commission program for the Jordan River initially focused on acquiring and restoring selected wetlands and riparian habitat in cooperation with local governments and non-governmental organizations as mitigation for impacts on wetland riverine systems caused by CUP or other Federal Reclamation programs. The initial program priority was land acquisition in three key areas, which has been completed. In subsequent years, restoring wetlands and riparian habitat on acquired lands will continue. No additional acquisitions are anticipated. The Mitigation Commission has participated in planning efforts to identify long-term protective measures for managing natural areas along the Jordan River corridor and funded cooperative efforts with local agencies.

Statewide Fish and Wildlife Program. The Mitigation Commission's statewide fish and wildlife program involves planning and implementing fish and wildlife mitigation and conservation activities that may extend administratively and geographically beyond the Bonneville Unit. The following are elements of the statewide fish and wildlife program: fish hatchery restoration and construction; sensitive species inventory and database; stream and riparian restoration enhancement; small dam improvements; native cutthroat trout restoration; and wetlands ecosystem education plan.

CENTRAL UTAH PROJECT COMPLETION PROGRAM

Chapter 8

October 2004

INTRODUCTION

This chapter presents the water conservation authorities and projects associated with the Bonneville Unit of the Central Utah Project. CUPCA authorized a water management improvement program to encourage water conservation projects to make better use of water. Conservation is a key facet of the Bonneville Unit that will contribute to the region's future water needs.

The Chapter has the following sections:

- Authorities and Support for Water Conservation and Water Recycling
- Water Conservation Through Reduction in Municipal Per Capita Water Use Rate
- Water Conservation Through Conveyance Systems Improvement
- Water Conservation Through Overall Basin-Wide Water Use Efficiency

AUTHORITIES AND SUPPORT FOR WATER CONSERVATION AND WATER RECYCLING

The authorities and support for water conservation and recycling stem from federal and state laws and regulations and local initiatives that encompass all facets of water use in the Bonneville Unit service area. The agency programs facilitate planning and contribute to investments necessary to achieve the local conservation goals.

Federal Goals and Requirements

The DOI requires certain fundamental efforts of water conservation by agencies that contract for water from a federal project such as the CUP. The Reclamation Reform Act of 1982 requires the preparation and regular updating of a water conservation plan by the water petitioner. Moreover, contractors for M&I water from the ULS System will need to include certain conservation requirements set by the State of Utah in their conservation plans.

The U.S. Bureau of Reclamation (USBR) has two types of water conservation programs in the Bonneville Unit service area. One is the Water Conservation Field Services Program. The program provides technical and financial assistance to water districts in four key aspects: (1) Water Management Planning; (2) Water Education and Training; (3) Demonstration of New Technologies; and (4) Implementation of Efficiency Measures. The second program is an agricultural conservation partnership called "Bridging-the-Headgate" to encourage Federal, State and local water resource and conservation agencies and organizations to work more closely together to achieve sustainable and efficient use of western agricultural water supplies.

CUPCA Provisions

Enlarging on this background, CUPCA added specific conservation requirements and authorized funding for water conservation programs and facilities. Section 207 of CUPCA, entitled; "Water Management Improvement", authorized a comprehensive program to study and improve water management within the Central Utah Water Conservancy District (District). Section 207(e)(2) authorizes $50,000,000 in federal funds to finance up to 65 percent of the cost of implementing water conservation measures within the District. The remaining funding, a minimum of 35 percent, comes from local sources.

Section 207 of CUPCA directed the District to develop a broad water management improvement program (WMIP) with an objective basis for measuring its achievement. The program is based on providing encouragement and financial assistance to local water districts and purveyors to develop their own conservation projects, which are discussed later in this chapter. Section 207 of CUPCA authorized federal funding to share the cost of implementing water conservation measures within the District.

The District was authorized to take the following actions:

- Establish an overall water conservation goal;
- Complete a water management improvement inventory and a comparative analysis of each proposed measure;
- Establish a five-year schedule of implementation;
- Assess the performance of previously; implemented conservation measures;
- Complete a water conservation pricing study to formulate and evaluate potential rate designs and pricing policies, estimate demand elasticity, quantify estimated monthly water savings from the various rate designs; pricing policies, and identify a water pricing system that rewards effective water conservation programs; and
- Update the WMIP, goal and schedule every three years.

Public Law 107-366 Provisions

Public Law 107-366, signed on December 19, 2002, amended CUPCA to increase funding for local water conservation measures, either in conjunction with the ULS System or in other ways consistent with the intent of the amended CUPCA. The conservation measures cited include the use of reverse osmosis membrane technology, which is a key to direct use of water from Utah Lake and the Jordan River for M&I purposes, and water recycling of return flows from wastewater treatment plants. Ways and means to accomplish these uses are discussed later in this chapter.

State of Utah Provisions

The State of Utah has established per capita M&I water use goals and provides assistance to local agencies for water conservation. The Utah Water Conservation Act of 1998 (revised 1999) requires water conservancy districts and water purveyors with more than 500 connections to submit a water conservation plan to the Utah Division of Water Resources and to update the plan every five years. The Act sets conservation goals building up to a 25 percent reduction in the rate of M&I per capita water use by consumers.

The State has invested considerable energy to facilitate water conservation. It provides planning guides and offers assistance to water purveyors on a personal basis and by means of its M&I water conservation Internet site at http://www.conservewater.utah.gov/.

Additionally, the Utah Water Resources Board provides financial assistance to water purveyors for developing water conservation projects.

Central Utah Water Conservancy District

The Central Utah Water Conservancy District participates in water conservation on the Central Utah Project through three programs of CUPCA. These are:

- Water Management Improvement Program (Section 207 of CUPCA;
- 2005 Repayment Contract Water Conservation Requirements; and
- 2005 Repayment Contract Water Recycling Requirements.

Water Management Improvement Program. The District, which has been authorized by CUPCA to complete the Bonneville Unit, plays a strong central role in water conservation, including funding of projects. To implement provisions of CUPCA Section 207 the District created its Conservation Credit Program, which systematically stimulates local proposals for water conservation projects and provides cost-shared funding for their implementation.

The Conservation Credit Program serves two purposes. The first purpose is to identify, evaluate and implement water conservation measures so the District can achieve its goal. The second purpose is to allocate the federal funds made available under CUPCA. Section 207(b)(5) states that "the District shall establish a continuous process for the identification, evaluation, and implementation of water conservation measures." The Act further clarifies that it is through this process that the District is to achieve its water conservation goal.

While not all conservation measures selected by the District may require federal funds, in order to be "credited" toward achieving the conservation goal, all conservation measures are processed through the Water Conservation Credit Program.

The Section 207 program began with the approval of three projects for funding in 1995. As of Fiscal Year 2003, 48 local water conservation projects have been selected for implementation. The projects are described later in this chapter, with the application numbers assigned by the District. The amount of water conserved per year varies annually for some projects, depending on spring runoff, weather, and length of irrigation season. In addition to the physical projects, various "Water Education" programs have been conducted by local water agencies under the 207 Program.

Applications for financial assistance are accepted at any time and subjected annually to a formal screening process administered by the District. Projects providing genuine water conservation benefits are placed on a prioritized Active Inventory List of potential projects, and each year projects at the top of the list are selected for funding subject to availability of federal funds for that purpose. The prioritization committee is composed of seven individuals representing the District, local and state agencies, and private organizations all of whom are experienced in rural and domestic water delivery and utilization.

The "207 projects" reduce localized water demands, and collectively make a sizeable contribution to balancing Bonneville Unit water needs and supply. The investments in conservation under this program provide water supply benefits analogous to the investments in the Bonneville Unit facilities. In other words, it takes a monetary investment in conservation measures to attain the objectives, and CUPCA has contributed funding that meet CUPCA objectives for Bonneville Unit facilities. A notable aspect of the program is that various cities are committing part of their conserved water to the Central Utah Water Conservancy District or to the DOI for use to augment streamflows for fisheries.

P.L. 107-366 increased the funding available for the 207 program, particularly for reverse osmosis membrane technologies for brackish water treatment, water recycling and conjunctive use of groundwater.

The District's water conservation goal was originally established at 39,294 acre-feet of savings per year. However, strong local support has indicated greater potential exists, and the District has increased its goal to 62,100 acre-feet of water savings per year.

2005 Repayment Contract Water Conservation Requirements. Through Repayment Contract No. 04-WC-40-120, between the District and the Department of the Interior, the District has agreed to comply with the State's water conservation goals of reducing per capita water use within the District's service area by 12.5 percent by the year 2020, and by 25 percent by the year 2050. Beginning in the year 2005 and continuing through 2050, the District will prepare an annual report for the Utah Division of Water Resources and the Secretary of the Interior. The report will include: the average annual per capita water use within the District's service area by each of the District's petitioners of ULS Water; the annual conservation savings and progress toward achieving the Conservation Goals; and which petitioners have not made annual progress towards meeting the Conservation Goals and by what amount.

Those petitioners, who fail to substantially comply with the annual per capita water use reduction, will be assessed a surcharge by the District. The surcharge for non-compliance will be based on the petitioner's annual repayment obligation for all project water available to the petitioner. After the first year of non-compliance the petitioner will be required to pay the District five percent of their annual repayment obligation. The second year a surcharge of ten percent will be applied. After

the third year, and for every year thereafter, a surcharge of fifteen percent will be required. Any collected surcharge will be deposited into an interest-bearing account that will be maintained and managed by the District to help fund water conservation projects developed under Section 207 of CUPCA.

2005 Repayment Contract Water Recycling Requirements. In addition to the water conservation requirements in Repayment Contract No. 04-WC-40-120, the District has also agreed to recycle 18,000 acre-feet of return flows from the Bonneville Unit Project Water by the year 2030. Beginning in the year 2016 and continuing until the year 2033, the District will demonstrate its annual progress towards recycling 18,000 acre-feet by the year 2033 and shall continue to maintain the recycling of 18,000 acre feet from 2034 through 2050.

In the event the District fails to achieve the annual progress toward the water recycling goal, the District shall assess itself a surcharge of five percent of its annual ULS per-acre foot repayment rate for each acre-foot of recycled water the District falls short of its annual goal for recycling of water for that year. The second consecutive year the surcharge will be assessed at ten percent. The third year, and in each consecutive year thereafter a surcharge equal to fifteen percent will be applied. Any collected surcharge will be deposited into an interest-bearing account that will be maintained and managed by the District. Surcharges collected and deposited to the Recycling Account, together with accrued interest thereon, will be used by the District to help fund water recycling projects developed under Section 207 of CUPCA within its service area.

Local Water Agency Programs

Local water agencies have developed their own water conservation projects and pledged to meet project conservation goals. Three major wholesale water agencies are responsible for developing local supplies and contracting for federal water for use in major urbanizing areas of the ULS System service area along the Wasatch Front. In Salt Lake County they are the Jordan Valley Water Conservancy District and the Metropolitan Water District of Salt Lake and Sandy. In southern Utah County it is the South Utah Valley Municipal Water Association. These agencies do not cover the entire Wasatch Front service area, but their water conservation programs – and their success with the technical aspects of water recycling – will influence water conservation elsewhere in the region.

Jordan Valley Water Conservation District (JVWCD). The JVWCD is a wholesale water agency serving various member agencies on whose behalf it arranges for additional water supply. The JVWCD currently has rights to CUP water from the Bonneville Unit M&I System and would receive water from the ULS System. Other water sources within its service areas include local surface water and groundwater, and rights to Utah Lake water formerly used for irrigation. The JVWCD has a 50,000 acre-foot allocation of water from the Bear River, which is contingent upon construction of the Bear River Project by the State of Utah. With water from the ULS System the need for developing the Bear River would be delayed approximately 20 years, from 2020 to after year 2040.

The JVWCD has prepared a water conservation plan describing its water conservation measures and the way its requested ULS water would be integrated with its local water sources. Elements of the plan include reduction in per capita water use, membrane treatment of brackish water from Utah Lake, recycling and reuse of wastewater, and public education on residential water conservation, including the creation of demonstration gardens to show the practicality and attractiveness of residential landscaping with low-water-using vegetation.

Metropolitan Water District of Salt Lake and Sandy (MWDSLS). The MWDSLS is a wholesale water agency serving Salt Lake City, Sandy City, and other water supply agencies in the Salt lake Valley. The MWDSLS currently

has rights to CUP water from the Bonneville Unit M&I System and would receive water from the ULS System. The MWDSLS has prepared a water conservation plan describing its water conservation program and the way its requested ULS water would be integrated with its local water sources. Elements of the plan include reduction in per capita water use, recycling and reuse of wastewater, conjunctive use of groundwater, and public education on residential water conservation.

Southern Utah Valley Municipal Water Association (SUVMWA). The SUVMWA is a wholesale water agency formed to evaluate M&I water needs in southern Utah County and to contract with the Department of the Interior for ULS System M&I water for use by its member cities and communities. The SUVMWA has conducted studies of water conservation and wastewater management in its area, which extends from Springville to the Juab County line. The SUVMWA is preparing to contract for 30,000 acre-feet of M&I water from the ULS System for redistribution among its member agencies.

WATER CONSERVATION THROUGH MUNICIPAL WATER DEMAND REDUCTION

This section focuses on the three entities that encompass the ULS System service area for M&I demands – the Jordan Valley Water Conservancy District, Metropolitan Water District of Salt Lake and Sandy, and Southern Utah Valley Municipal Water Association.

Jordan Valley Water Conservancy District

Description of Entity

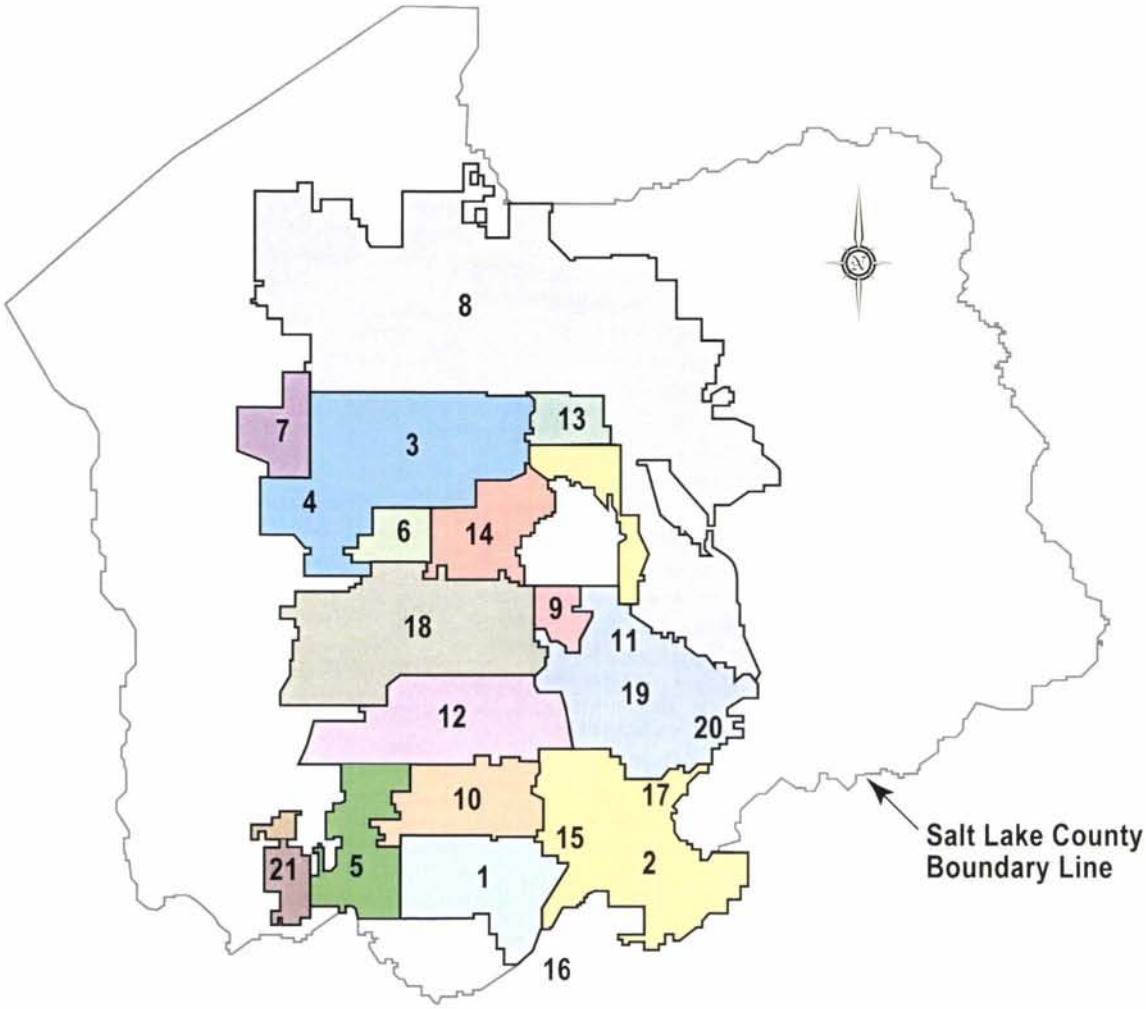
Jordan Valley Water Conservancy District (JVWCD) was created in 1951 by the Utah legislature under the Water Conservancy Act. JVWCD was organized as a regional water supply agency to develop a water supply for rapidly growing areas in the south and southwestern portions of Salt Lake County. JVWCD is primarily a wholesaler of water to cities and improvement districts within the County. It has over 20 member agencies that include cities, improvement districts, state agencies, and private water companies. In addition, JVWCD operates a direct retail system in certain portions of Salt Lake County. Retail deliveries constitute approximately 15% of JVWCD total municipal and industrial water deliveries. Figure 8-1 is a map showing the JVWCD service area and the general location of each of its customer member agencies. JVWCD is the largest petitioner for Bonneville Unit M&I water.

Population Projections

Many of Utah's fastest growing communities are located in the JVWCD service area. Table 8-1 shows the population projections for those communities in the JVWCD service area.

TABLE 8-1
Population in JVWCD Service Area

Community Name	2000	2002	2005	2010	2020	2030
Bluffdale City	4,700	5,230	6,723	10,591	28,282	46,279
Draper City	25,220	28,555	32,185	40,719	47,208	51,309
Herriman City	1,523	3,223	9,097	15,000	28,307	37,415
Holladay City [a)]	1,050	1,050	1,075	1,100	1,150	1,200
Midvale City [a)]	27,029	16,500	16,700	17,000	18,000	19,000
Riverton City	25,011	28,935	37,046	56,167	63,298	65,195
Sandy City [b)]	88,418	1,000	1,000	1,000	1,000	1,000
South Jordan City	29,437	32,218	37,689	48,118	68,610	92,474
South Salt Lake City	22,038	22,190	22,252	23,240	25,903	26,829
Taylorsville City	58,764	59,656	60,001	63,876	72,134	74,996
West Jordan City	78,714	83,577	96,310	126,021	144,941	152,393
West Valley City	108,896	112,168	116,496	124,621	135,354	140,904
Remainder of Salt Lake County [c)]	82,381	84,859	81,010	83,709	118,419	147,397
Total population in JVWCD service area	**553,181**	**479,161**	**517,584**	**611,162**	**752,604**	**856,392**



Location of Member Agencies

1. Bluffdale City
2. Draper City
3. Granger-Hunter Improvement District
4. Hexcel Corporation
5. Herriman
6. Kearns Improvement District
7. Magna Water Company
8. Metropolitan Water District of Salt Lake & Sandy
9. Midvale City
10. Riverton City
11. Sandy City
12. City of South Jordan
13. City of South Salt Lake
14. Taylorsville-Bennion Improvement District
15. Utah State Department of Corrections
16. Utah State Department of Public Safety
17. WaterPro, Inc.
18. West Jordan City
19. White City Water Improvement District
20. Willow Creek Country Club
21. Hi-Country Estates Phase II

Figure 8-1
Jordan Valley Water Conservancy District Service Area

Existing Water Usage Rate (gpcd) for JVWCD

In 2000, the water usage rate within the JVWCD service area was approximately 250 gallons per capita per day (gpcd). There is insufficient data to categorize the use accurately, but it is estimated that approximately 70% is consumed for residential use, and 30% is consumed for commercial, industrial, and institutional uses.

JVWCD has implemented conservation programs that are beginning to yield promising results. In 2002, the water usage rate within the JVWCD service area was calculated to be 224 gpcd.

Conservation Plans for JVWCD

Jordan Valley Water Conservancy District (JVWCD) has made a long term commitment to water conservation. JVWCD recognizes that the tremendous projected growth cannot be sustained without a reduction in per capita water use. Water conservation will not only extend limited water supplies, but have the added benefit of deferring costly infrastructure and future water development projects.

The State of Utah has recently under-gone a five year prolonged drought cycle from 1999 to 2003. The drought has exposed many limitations of existing water supplies. As rapid growth along the Wasatch Front and in the State of Utah continues, JVWCD's fear is that the next drought cycle will have far reaching and much greater impacts on the citizens of the state. Water conservation is not only important in response to this drought cycle, but will be essential in providing for the future health of the state.

(1) Water Conservation Master Plan. In 1999 JVWCD adopted a water conservation plan in response to the "Water Conservation Plan Act" which was signed into State law in 1998. The objectives of the JVWCD plan were as follows:

1. To become a leader in the implementation of water conservation programs and activities and in the dissemination of water conservation educational information.

2. To gain public recognition and support for meaningful water conservation programs and efforts.

3. To reduce the demand for water and delay costly water infrastructure and development projects.

4. To extend limited water supplies to provide for future growth in JVWCD's service area.

The plan focused on demand-side conservation. An inventory of water conservation activities implemented by comparable water agencies elsewhere in the Western United States was prepared and 37 conservation measures were subsequently evaluated based on water savings, benefits and costs. Eleven measures were determined to have potential for significant water savings and cost effectiveness. These eleven conservation measures were further evaluated based on their benefits and costs, affordability and other non-quantifiable impacts. As a result, the plan recommended four water conservation measures to be implemented in 1999, including:

1. A public education/information program.
2. A water conservation demonstration garden.
3. The development of model landscape ordinances.
4. A residential water auditing program ("Water Check" Program).

Following adoption of the Water Conservation Plan in March 1999, JVWCD immediately implemented these programs, hired a full time water conservation programs coordinator and submitted a conservation programs funding request to the Central Utah Water Conservancy District under Section 207 of CUPCA, Conservation Credit Program.

JVWCD has continued to develop and build on these initial programs since implementation in 1999. Additional programs have also been developed and implemented and a Water Conservation Programs cost effectiveness evaluation performed as further described herein.

(2) Water Conservation Goal. As part of the 1999 Water Conservation Plan, JVWCD's Board of Trustees adopted a conservation goal of reducing total water demand by 10% by the year 2020. This was based on a 20% savings in outdoor water use which would be approximately equivalent to a 10% overall savings. JVWCD's Board of Trustees subsequently adopted the State of Utah's goal of reducing water consumption statewide by 25% by the year 2050.

More recently, due to additional studies in year 2002, JVWCD's Board adopted a new and more aggressive water conservation goal of reducing water demand within JVWCD's service area by 25% by year 2025. This goal would be measured in terms of per capita water use reduction beginning in year 2000. The water use per capita in year 2000 was calculated to be 250 gpcd. Therefore, in order for JVWCD to meet this goal, District-wide water use will need to be reduced to 188 gpcd by 2025.

(3) Current Water Conservation Programs and Activities.

(3a) Public Education and Information Campaign. With the adoption of the District's Water Conservation Plan in 1999, JVWCD retained a public relations/media consultant to assist in developing a water conservation information and education program. Working with JVWCD staff, the "Slow the Flow, Save H_2O" campaign was created. Since that time, the campaign has continued to be developed, receiving significant recognition and market penetration statewide. The "Slow the Flow, Save H_2O" public education and information campaign represents the core of all JVWCD's conservation programs and activities.

The campaign includes the development and dissemination of water conservation educational information through printed materials, radio and television advertisements, and media and community events in order to create heightened public awareness of the benefits of reduced water use. JVWCD has been involved with this campaign for four years and plans to continue developing and building on this campaign in the future.

In August of 2001, the Governor of the State of Utah met with water and other governmental officials across the State to develop a statewide water conservation initiative. The purpose of this initiative was twofold as follows:

- To immediately increase public awareness and educate the citizens of the state on water saving measures to address the current drought;
- To generate a long-term water conservation ethic to address Utah's rapid population growth.

A water conservation team was formed to develop a statewide water conservation campaign. The funding members of the team include the State Division of Water Resources, JVWCD, Central Utah Water Conservancy District, Metropolitan Water District of Salt Lake & Sandy, Weber Basin Water Conservancy District, Washington County Water Conservancy District, and more recently the Utah Water Users Association and the Rural Water Association of Utah.

The team agreed that the statewide initiative should broaden the "Slow the Flow, Save H_2O" campaign created by JVWCD and expand the campaign statewide. This would provide for greater market penetration and greater awareness of water conservation on a statewide basis and provide an umbrella campaign for local conservation activities throughout the state.

The main focus of this campaign is to create a long-term conservation ethic through television and radio advertisements and dissemination of

educational materials on water conservation, in order to meet the long-term water conservation goal of 25% reduction in water use.

(3b) Water Conservation Demonstration Garden. JVWCD recognized that the greatest potential for water conservation is through a reduction in outdoor water use. This reduction can take place through efficient irrigation systems, correct watering schedules and planting design and other principles of water-efficient landscaping. JVWCD designed and constructed a water conservation demonstration garden to show waterwise alternatives to the traditional landscape. The Garden demonstrates water conservation principles by emphasizing proper landscape design, irrigation technologies, the use of hardscape and mulches, and a wide variety of low water use plants. The basic premise behind the garden is to show how to create an attractive landscape suited to the Utah climate which will save water by using alternatives to the traditional blue grass lawn landscape.

The Water Conservation Demonstration Garden consists of three main sections:

- The Neighborhood Garden;
- The Garden Park; and
- The Commercial Landscape.

A brief description of each garden area is provided below:

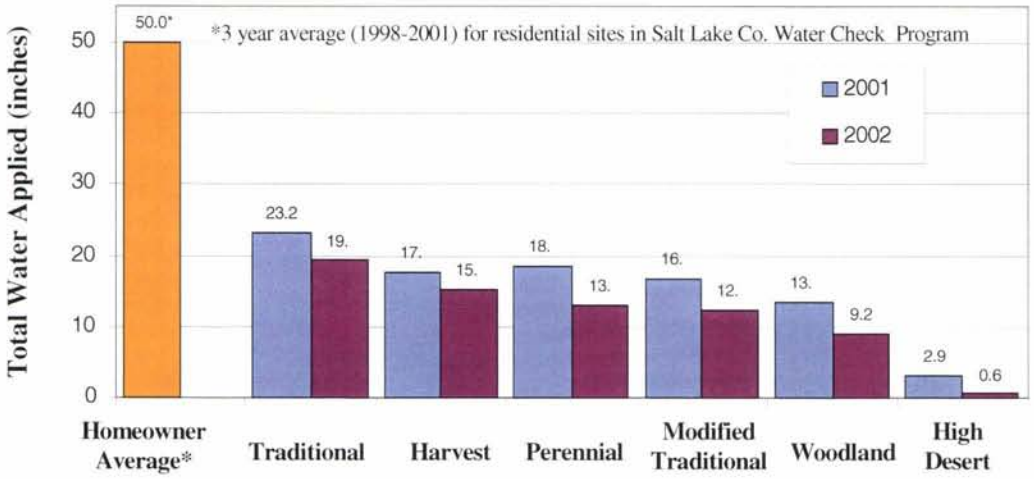
The Neighborhood Garden: Construction of this area of the Garden was completed during the fall of year 2000. It features six themed yards or landscapes, along a mock residential street. These landscapes demonstrate water efficient practices that can be used as attractive alternatives to a typical predominantly bluegrass landscape. Each yard has its own water meter to monitor the actual amount of water being applied. The water usage of each yard is posted for comparison purposes with average homeowner water use. The six themed yards include:

- Traditional Landscape;
- Modified Traditional Landscape;
- Woodland Landscape;
- High Mountain Desert Landscape;
- Harvest Landscape; and
- Perennial Landscape.

A graph showing the amount of water applied to each landscape as compared to average homeowner use is provided in Figure 8-2.

Figure 8-2

JVWCD Demonstration Garden - Total Water Applied to Each Landscape in 2001 and 2002

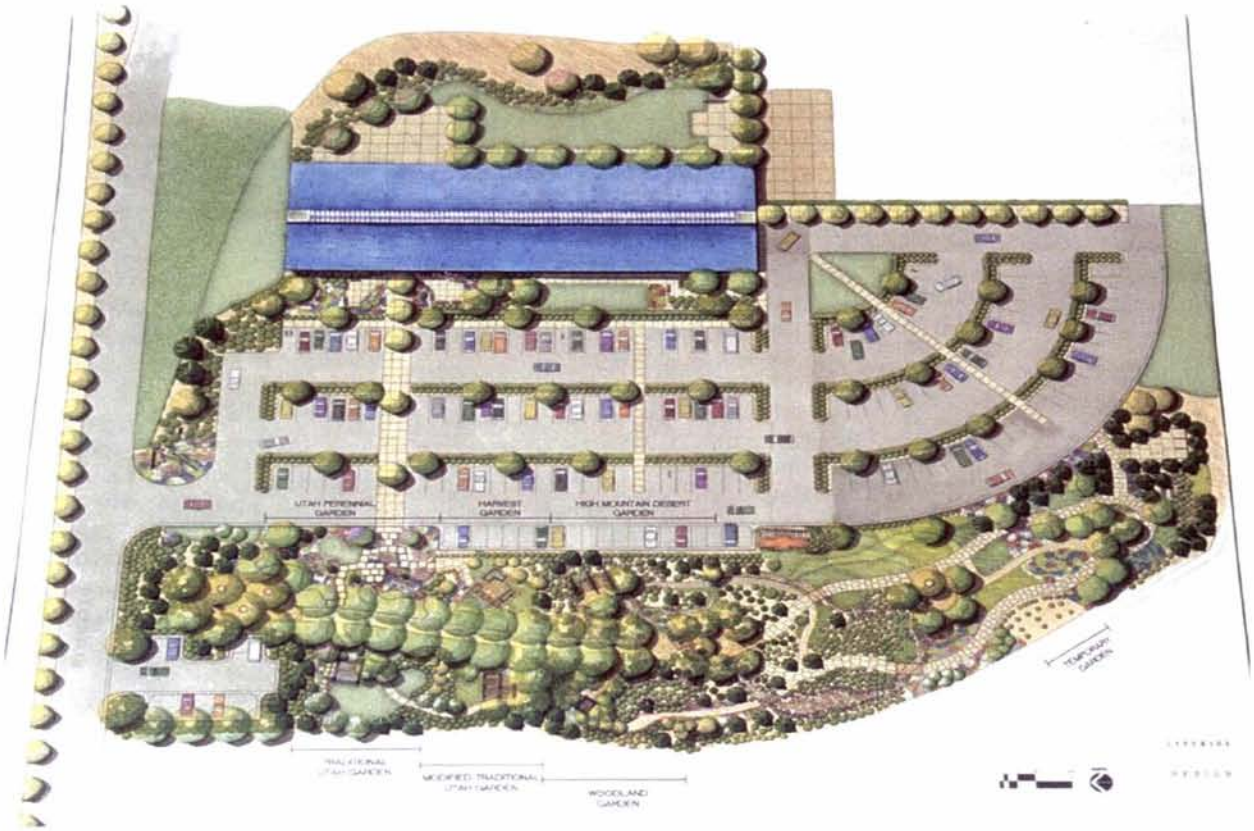


The Garden Park: Construction for this area of the Garden was completed in the fall of year 2001. The Garden Park is less formal, with wandering paths, a dry creek bed and bridges. Plants in the Garden Park range from Utah natives to vegetables, turf grasses and ornamental grasses. A range of alternative turf grasses are shown in plots, each with its own water meter. Water use data is shown for each turf plot for comparison purposes. This section of the Gardens includes a weather station which measures evapo-transpiration and precipitation, and controls the irrigation schedule for the Neighborhood Garden and Garden Park.

The Commercial Landscape: JVWCD re-landscaped the area immediately surrounding its administration buildings at its headquarters site in the summer of 2000. This was to provide an example of a waterwise commercial landscape. The turf area surrounding the building was reduced by 76% through the use of low water use plants, hardscapes and mulches. The design concepts utilized for the commercial landscape area are in accordance with the criteria identified in a model commercial landscape ordinance developed by JVWCD as further described herein.

A plan view drawing showing the Water Conservation Demonstration Garden is shown in Figure 8-3. The Garden is open and free to the public during spring, summer

Figure 8-3
Water Conservation Demonstration Garden



and fall months. The Garden is promoted through the "Slow the Flow, Save H_2O" public education and information campaign print materials and advertisements.

Thousands of people visit the Garden each year. Garden activities include Garden Fairs, dissemination of waterwise landscaping educational materials, volunteers, educational tours and free waterwise landscaping workshops.

(3c) Residential and Commercial Water Audits. Since adoption of the Water Conservation Master Plan in 1999, JVWCD and partnering agencies have pooled financial resources and contracted with Utah State University Extension to provide residential and commercial water audits (Water Checks) which are free to the public. Water audits target outdoor water usage and include an evaluation of the customer's soil type, plant root depth, sprinkler pressure, sprinkler distribution uniformity, and sprinkler precipitation rate. Following the audit, the customer is left with recommendations for sprinkler system repairs and adjustments to improve distribution uniformity and a customized irrigation schedule to improve watering efficiency. Water use records are obtained from each customer three years prior to and following the Water Check to measure the effectiveness of the water audit.

The Water Check program is now in its fifth year. More recently, there has been special emphasis placed on providing Water Checks for large water users including commercial, industrial and institutional water users. The Water Audit Program has grown each year in terms of the number of Water Checks

TABLE 8-2
Water Checks[1]

	1999	2000	2001	2002	Total
Residential	446	638	882	1,066	**3,032**
Commercial	n/a	n/a	20	50	**70**

[1] Totals include all Water Checks for Salt Lake County

completed. Table 8-2 summarizes the total number of Water Checks performed within Salt Lake County during 1999 through 2002.

Based on an evaluation of water use records of a randomly selected group of participants who received Water Checks in 1999, JVWCD and Utah State Extension Services have concluded that an average 15% reduction in water use has been achieved by participants receiving Water Checks. The Water Check data shows that 66% of a resident's total water use is used outdoors and 34% is used indoors.

(3d) Model Commercial and Residential Landscape Ordinances. In 2000 JVWCD formed a working group which included representatives from the landscape and irrigation industry, Utah State University, and the Division of Water Resources to develop model commercial and residential landscape ordinances. With input from the working group, the model ordinances were developed over an 18-month period. The purpose of these ordinances is to provide models which JVWCD's member agencies, cities, counties and others can adopt to promote water-efficient landscaping of all new and rehabilitated commercial landscapes, and new residential landscapes.

The model commercial water-efficient landscape ordinance can be used for all new commercial and industrial developments. The main features of the ordinance include: the submission of a landscape plan documentation package by the developer, which is prepared by a landscape design professional, including a planting plan, irrigation plan, grading plan, soils report, a landscape water allowance worksheet and irrigation schedule; the landscape plan documentation package being approved prior to issuance and a building permit; the landscape irrigation systems being installed by a contractor certified by the Irrigation Association; a required water audit conducted by an independent Irrigation Association certified landscape irrigation auditor; and a requirement for the irrigation system to meet certain minimum efficiencies as certified by the irrigation auditor. The model residential water-efficient landscape ordinance was designed for all new residences and is intended to heighten public awareness of water-efficient landscaping through the distribution of a landscape education packet for new homeowners. The residential packet includes information regarding waterwise landscaping, JVWCD Demonstration Garden activities and the Water Audit program.

JVWCD has been involved with its member agencies to form committees and working groups to assist with adoption of these landscape ordinances. To date, five of JVWCD's member agencies have adopted forms of the commercial landscape ordinance based on JVWCD's model. In terms of water deliveries, the combined total of member agencies adopting the ordinance represents 54% of JVWCD's current yearly water delivery contract commitments.

(3e) Ultra Low Flush Toilet Pilot Replacement Program. In 2002 JVWCD implemented a pilot toilet replacement program within its retail service area. The program involved replacing 275 high flush toilets with flushing rates between 2.1 and 6.7 gallons per flush with new ultra low flush toilets (ULFTs) rated at 1.6

gallons per flush. The purpose of this program was to measure the water savings and calculate the cost effectiveness of replacing older high flush toilets with new ULFTs.

Three models of ULFTs were used for this program as follows: a Caroma Tasman 270, dual flush toilet with 0.8/1.6 gallons per flush (gpf); a Niagara Flapperless, with a tipping bucket flushing mechanism; and a Gerber Aqua Saver traditional style ULFT. Fifteen percent of the toilets installed were equipped with water measuring and flush counting equipment to determine water savings.

The water savings achieved from this program were found to be twofold. First, there were water savings associated with the reduced flush volume. Second, water savings were achieved through a reduction of toilets leaks associated with the older high flush toilets. Based on the preliminary evaluation of the data, Table 8-3 shows the water savings results:

TABLE 8-3
Water Saving Results

	Average Water Saved Per Day Per Toilet (gallons)	Average Water Saved Per Year Per Toilet (gallons)
Flush Volume	22.7	8,286
Savings due to leaks	19.2[1]	7,225
Total:	**42**	**15,511**

[1] The leak volume is calculated based on winter time water use records by the participants in the program. It should be noted that approximately 74% of the participants with water measuring and flush counter equipment had their new ULFT installed during winter months; therefore the full extent of toilet leaks cannot be calculated until water use records are obtained after the ULFT is in place for a full winter period. This data will be obtained in March 2004. The savings due to leaks will then be revised accordingly.

TABLE 8-4
Pilot Toilet Replacement Program

Description	Cost
Toilet Installation	$25,127
Purchase of 275 ULFTs	25,046
Toilet Flush Measuring Equipment	3,130
Mailing Expenses	1,207
Legal Advertising	2,728
Less Participant Cost	(5,500)
JVWCD's Staff Time	3,262
Total Cost:	**$55,000**
($200 per toilet)	

The total cost of the pilot toilet replacement program is summarized in Table 8-4 above.

(3f) Waterwise Classes and Workshops. In 2001, JVWCD hired a Conservation Horticulturalist as an addition to its Conservation Department staff. Among the duties included in this position are arranging for and teaching several waterwise landscaping classes throughout the spring and summer of each year. These classes are free to the public and include instruction on Utah native plants, designing efficient irrigation systems and waterwise landscapes, blue grass lawn care and alternatives and other topics emphasizing water conservation. Year 2003 marks the third year of these classes which are advertised through the "Slow the Flow, Save H_2O" campaign.

In addition, JVWCD staff and Utah State University Extension Services developed a new workshop series for large water users in 2001. This program was developed to educate large water users about landscape water conservation through proper landscape management, and targets decision makers and the maintenance staff of large water users throughout Davis,

Weber, Salt Lake and Utah Counties. The workshop series began in 2002 and consists of a one-day instructional workshop including a morning classroom session followed by an afternoon field session. The curriculum includes irrigation system maintenance, irrigation scheduling, turf grass management, ornamental plant maintenance, irrigation auditing and field exercises. Attendees are given a work book, 24 catch cups and a soil probe.

The Large Water User Workshops are heavily subsidized by JVWCD, Weber Basin Water Conservancy District, State Division of Water Resources, Metropolitan Water District of Salt Lake & Sandy and Central Utah Water Conservancy District. The cost to each attendee is $10 which includes an approximate $90 subsidy. This program was largely successful in 2002 with 244 attendees spread over eleven workshops. Twelve workshops were held in 2003, and were hosted by the five funding agencies.

(3g) Conservation Programs Cost and Cost Effectiveness. Table 8-5 shows the level of conservation funding in terms of cost per capita over the last three fiscal years.

(3h) Conservation Cost Effectiveness. Table 8-6 on next page shows the amount expended for each of JVWCD's water conservation years. The cost effectiveness of water conservation programs which primarily focus on public education and information is very difficult to calculate. However, it can be concluded that there has been tremendous water conservation savings over the past three years which is substantially due to the information being conveyed as part of the "Slow the Flow, Save H_2O" campaign. Table 8-7 below shows the calculated cost effectiveness, in terms of cost per acre foot saved, for the Pilot Toilet Replacement Program and the Water Audit Program, since actual water savings have been measured. The cost of these two programs can be compared with the estimated cost of future water development projects currently being considered and planned by JVWCD.

TABLE 8-5
Conservation Funding

Year	Total Conservation Programs Cost	JVWCD Service Area Population	Cost Per Capita
2000	$765,082	464,773	$1.65
2001	$938,548	471,967	$1.99
2002	$481,615	479,961	$1.00
2003*	$506,125		

* Total cost for 2003 is estimated.

TABLE 8-6
Amount Expended on JVWCD's Water Conservation Years

Conservation Programs	Program Cost			
	2000	2001	2002	2003*
Water Check / Hotline	$49,954	$93,225	$54,801	$54,615
Demonstration Garden	$465,661	$549,421	$91,061	$60,000
ULFT Program	$0	$0	$51,134	$55,000
Large Water User Workshops	$0	$0	$5,644	$5,645
State Media Campaign	$0	$34,333	$50,000	$50,000
JVWCD Media Campaign	$223,848	$250,693	$176,377	$213,623
Conservation Plan/Consulting	$19,003	$8,376	$48,892	$61,434
Education/Training/Member Dues	$6,616	$2,500	$3,706	$5,808
Total:	**$765,082**	**$938,548**	**$481,615**	**$506,125**

* Total cost for 2003 is estimated.

TABLE 8-7
Conservation Calculated Cost Effectiveness

Program/Project	Annual Cost ($/acre foot)
Pilot Toilet Replacement Program[1]	$313
Water Audit Program[2]	$252
Jordan River Shallow Groundwater RO Treatment	$180 - $400 (3)
Wastewater Recycling	$350 - $470
Utah Lake Agricultural Conversion – RO Treatment	$400 - $600 (3)

Notes:
1. Assumes 20 year life of toilet, savings of 42 gals/day/toilet, 4% interest
2. Assumes 15% reduction in outdoor water use for 5 years after Water Check, 4% interest
3. See Table 7-13.

3i) CUPCA Section 207 Funding. In 1999, JVWCD submitted an application to Central Utah Water Conservancy District for CUPCA Section 207 funding under its Conservation Credit Program. The application was approved for a 65% cost share of JVWCD's Water Conservation Demonstration Garden and other demand-side conservation programs. Table 8-8 shows the funding amounts which have been approved under CUPCA Section 207.

TABLE 8-8 CUPCA Section 207 Funding Amounts	
Fiscal Year	**Funding Amount**
2000	$400,000
2001	$200,000
2002	$300,000
2003	$200,000
Total	**$1,100,000**

In accordance with CUPCA Section 207 (b)(4) requirements, JVWCD will turn over 500 acre-feet of conserved water per year, for a five year period to the Central Utah Water Conservancy District to enhance Provo River instream flows for environmental purposes.

(3j) Conservation Results. In order to achieve the water conservation goal of 25% water use reduction by 2025, a reduction in per capita use of 1% per year must be achieved. Table 8-9 shows that the actual per capita water use reduction has exceeded JVWCD's goal of 1% per year.

TABLE 8-9
JVWCD Service Area Population and Water Usage
(Updated May 23, 2003)

Year	[a]Population	System Demand (AF)	Calculated Water Usage Rate (gpcd)	[b]Water Usage Rate Goal (gpcd)
2000	464,773[c]	129,868	250	250
2001	471,967 [d]	128,617	243	248
2002	479,161	119,963	224	245
2005	517,584	N/A	N/A	238
2010	611,162	N/A	N/A	225
2020	752,604	N/A	N/A	200
2025	804,498	N/A	N/A	188
2030	856,392	N/A	N/A	188
2040	975,062	N/A	N/A	188
2050	1,119,779	N/A	N/A	188

(a) Population based on data furnished by the Governor's Office of Planning and Budget and Wasatch Front Regional Council.
(b) JVWCD's conservation goal is to reduce per capita water use 25% by year 2025, or 1% per year.
(c) Sandy City population (88,418) was part of JVWCD service area in 2000, but to provide a common reference for future water usage rates, Sandy City population and water uses is omitted from this data.
(d) Population estimated by interpolation.

(4) Potential Future Programs. JVWCD is meeting the objectives set forth in the Water Conservation Master Plan adopted in 1999. JVWCD is recognized as a leader in conservation and has been influential statewide in its implementation of a comprehensive and complete water conservation plan.

In 2002, JVWCD adopted an aggressive water conservation goal of 25% water use reduction by the year 2025. As shown in Table 8-9 on previous page, significant water use reduction has occurred since year 2000.

JVWCD is committed to continue its leadership role in the area of water conservation and implement those programs which are necessary to meet its conservation goal. JVWCD recognizes that in order to achieve its conservation goal, its existing conservation programs will need to continue to be assessed, improved and refined. JVWCD will look to develop additional programs which will be effective in encouraging the structural changes needed within its service area to provide for long term water conservation.

(4a) Public Information and Education Program. Public education/information will continue to be the essence of JVWCD's water conservation programs. As an added feature in 2003, JVWCD implemented a waterwise reality home program that serves as an education tool for the public to learn ways to save water on their landscapes. This program is named "Water Quest, Saving Water by the Yard" and includes the selection of a family/homeowner from JVWCD's retail service area and replacing the homeowner's existing traditional blue grass landscape with a water efficient landscape.

The replacement work includes the removal of the homeowner's existing turf, plants and irrigation system and the installation of drought tolerant plants and turf, hardscaping features, mulches and an efficient irrigation system. The family participated in the re-landscaping work and the media will track the progress of the landscape conversion process throughout the summer of 2003. In addition, the family's water use is monitored and compared to past years water use to show the public the water savings that can be achieved through the structural changes made to the landscape.

(4b) Water Audit Program. Additional emphasis will be placed on performing water audits for large water users. This is because of the tremendous waste occurring due to inefficient irrigation schedules and systems belonging to commercial, institutional and industrial water users.

In addition, Water Savings Kits were offered free of charge to homeowners who requested Water Checks in 2003. The Water Savings Kits include a low flow shower head, two low flow faucet aerators, a displacement bag for the homeowner's toilet tank and toilet leak detection dye tablets.

(4c) Expanded Toilet Replacement Program. In the coming years, JVWCD has plans to enlarge its toilet replacement program by building on what was learned from the pilot toilet replacement program and other toilet replacement programs across the west. In fiscal year 2003/2004 (Year 1), JVWCD plans to replace at least 1,000 high flush toilets with a low flush flapperless toilet, which was determined to be the most effective in the pilot program. It is anticipated that JVWCD will offer these toilets at no charge to qualifying homeowners in its retail area and assist its member agencies in providing these toilets to homeowners within their respective service areas.

The proposed plan for Year 1 is as follows:

1. The program will be advertised through the use of billing stuffers.

2. Interested participants will mail or e-mail pertinent information back to the JVWCD and the JVWCD will confirm the

information and determine if the participant qualifies.

3. If the participant qualifies, a voucher will be mailed to the participant which can be redeemable at JVWCD's offices for the flapperless ULFT.

4. The qualifying participant will be responsible to install the new toilet and dispose of the old toilet.

5. JVWCD will prepare and update a toilet replacement data base which will be used to confirm the participant's information and follow up on successful installation.

JVWCD is providing assistance to its member agencies in implementation of a similar program in Year 1. In future years, JVWCD's Board of Trustees is interested in further enlargement of a toilet replacement program by expanding the program county-wide or along the Wasatch Front if other water districts are willing to participate and if partial funding can be obtained. A successful toilet replacement program is a good example of a structural means of achieving water conservation.

(4d) Water Conservation Pricing. In 2002, JVWCD retained a consultant to assist with a comprehensive financial review and water rate study. With assistance from its consultant, JVWCD considered several alternative water rate structures for both retail and wholesale service areas which would encourage the efficient use of water.

On June 11, 2003, JVWCD's Board of Trustees adopted seasonal water conservation rate structures for both retail and wholesale water deliveries, to become effective on July 1, 2003. The new seasonal rates are divided into winter months (November 1 through April 30) and summer months (May 1 through October 31), and are designed to be revenue neutral with a 25% differential between the winter and summer rate. This seasonal rate structure was adopted to encourage long term conservation and the efficient use of JVWCD's water supply in order to sustain the tremendous growth expected.

(4e) Water Conservation Demonstration Gardens Master Plan. JVWCD's existing Water Conservation Demonstration Gardens have become a tremendous community asset and educational tool to demonstrate water conservation principles to the public. JVWCD owns additional property at its headquarters site which would provide for expansion of its existing Demonstration Gardens.

In May, 2003, JVWCD's Board of Trustees approved the selection of a consultant to assist JVWCD in the preparation of a Water Conservation Demonstration Gardens Expansion Master Plan. As part of the Master Plan, consideration was given to additional educational features and displays which could be implemented in expanded garden areas which would further assist the District in showing the public how it can reduce per capita water use. A total of 17 acres of undeveloped property was considered as part of the Master Plan. The work included development of conceptual plan view drawings for the site, including plans for pathway expansion, additional parking, plant groupings, potential building space allotments and an additional innovative and interpretive design features for public education purposes. The work included construction phasing, construction schedules and cost estimates.

(4f) Additional Water Conservation Programs Master Planning Work. JVWCD will update its Master Plan work for future conservation programs and activities as needed. JVWCD will continue to monitor water use (on a per capita basis) and implement programs which are necessary to meet its water conservation goal.

JVWCD will continue to be involved with its member agencies and enlist their participation in meeting its conservation goal. Furthermore, JVWCD will look for opportunities to encourage its member agencies to implement water conservation measures within their own retail

service areas. The following activities will be considered by JVWCD for its member agencies:

1) Provide funding assistance or a mechanism to provide funding assistance for implementation of water conservation programs among member agencies.

2) Require that member agencies prepare, submit and continue to update water conservation plans to meet the per capita water use reduction goal of the District.

3) Establish working groups with each member agency to assist in the implementation of effective and meaningful water conservation activities and programs.

METROPOLITAN WATER DISTRICT OF SALT LAKE AND SANDY (MWDSLS)

The Metropolitan Water District of Salt Lake & Sandy (MWDSLS / or District) was created on August 30, 1935 pursuant to the provisions of the Metropolitan Water District Act of Utah.

Salt Lake City was the only member city of the District from 1935 to 1990. The District annexed Sandy City in 1990 and since that time those two cities have been member cities of the District. MWDSLS functions primarily as a wholesale provider of water to its member cities. Customers of MWDSLS collectively provide retail service to over 800,000 persons in Salt Lake County. Salt Lake City and Sandy City, as member cities of the District, have a statutory preferential right to purchase all of the District's water supplies for use within each city.

The other major customer of MWDSLS, on a surplus basis, is the Jordan Valley Water Conservancy District (JVWCD), which supplies water to its customer agencies and individuals in southern Salt Lake County outside of MWDSLS boundaries. Figure 8-4 shows the service area of MWDSLS.

Salt Lake City, as the capital of Utah and the major business center for the Wasatch Front, has experienced steady growth in connections to its water system. It has major areas of developable ground on the west side of the City in what is called the Northwest Quadrant. Sandy City has experienced rapid growth in its service area over the last 20 years and has been struggling to meet the water needs that rapid growth has created. MWDSLS has been actively pursing additional water supplies for its member cities to meet the existing and future needs.

Population For MWDSLS Service Area

Table 8-10 shows the population projections for the service area of MWDSLS which includes Salt Lake City, Sandy City, portions of Midvale City, Holladay City, and major areas of unincorporated Salt Lake County.

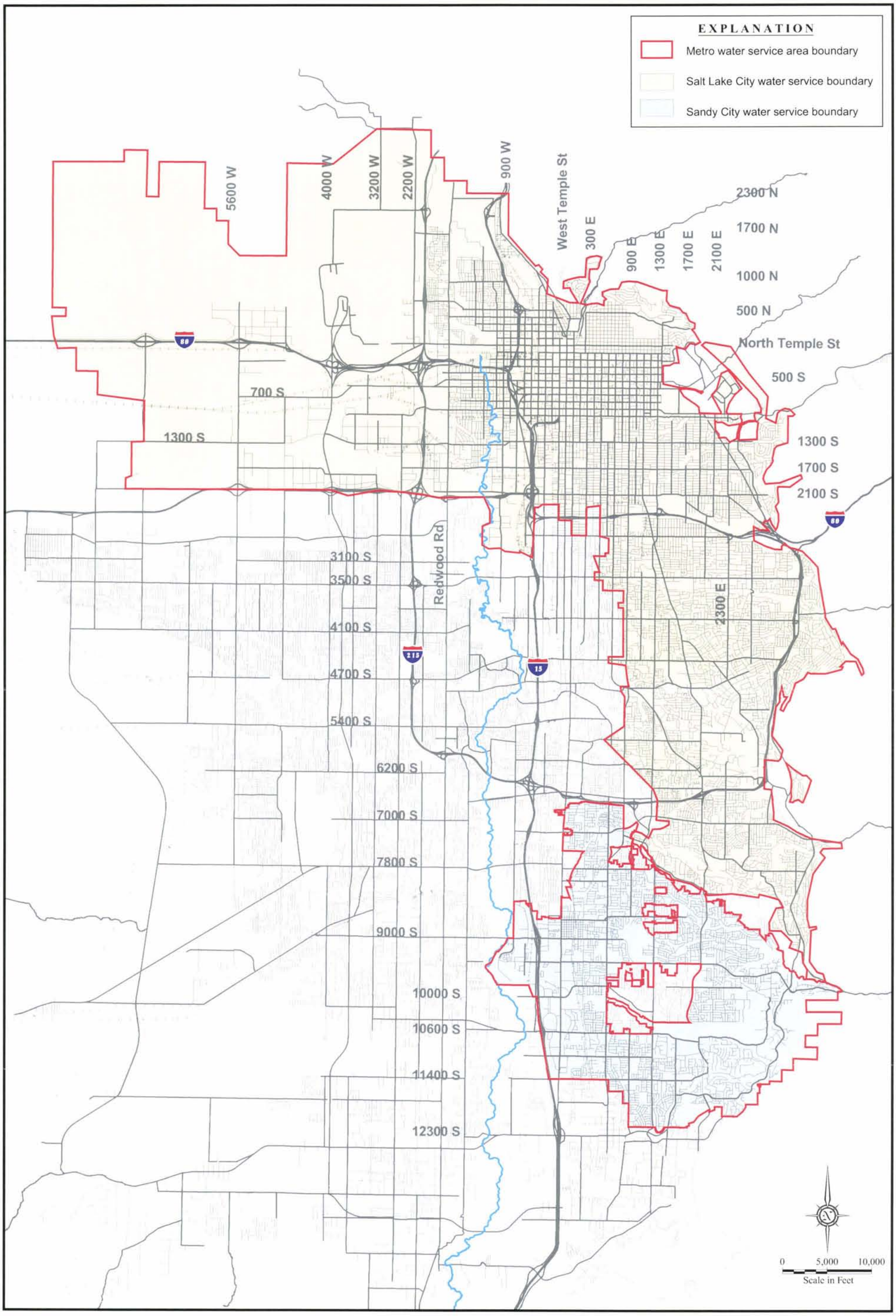


Figure 8-4
Metropolitan Water District of Salt Lake and Sandy
Water Service Area Boundaries

Table 8-10
Population in MWDSLS Service Area

	Years					
Community Name	**2000**	**2002**	**2005**	**2010**	**2020**	**2030**
Holladay City [a)]	18,196	18,278	18,330	18,636	21,376	23,496
Midvale City [a)]	10,529	11,198	11,858	12,581	13,310	13,270
Sandy City [b)]	87,418	92,399	98,967	107,000	118,292	121,357
Salt Lake City	181,743	184,092	185,336	187,259	193,130	197,079
Remainder of Salt Lake County [c)]	110,873	103,717	99,012	102,311	144,734	180,153
Total population in MWDSLS service area	**408,759**	**409,684**	**413,503**	**427,787**	**490,842**	**535,355**

Notes:
a Population shown is only for that portion of the community within the MWSDSLS service area.
b Sandy City's population with reduction of 1,000 for JVWCD minor service areas within the City.
c Salt Lake City serves major unincorporated areas on the east side of Salt Lake County, including water service to Holladay, Murray and Midvale City. In addition, Sandy City provides retail service to some county areas.
d Calculated estimate assuming MWDSLS population remains at 37 percent of total population in Salt Lake County after 2030.

MWDSLS Water Usage Rate (gpcd)

Table 8-11 presents historic and projected municipal and industrial (M&I) water demand, in gallons per capita per day, for each of the service areas of MWDSLS. The projections assume that the State's water conservation goals would be met, which call for reductions in per capita use by 12 ½ percent by 2020 and 25 percent by the year 2050. The 2002 numbers reflect the conservation efforts of the member cities over the last several years of drought. Salt Lake City's numbers reflect a seven percent reduction in per capita usage in past two years even with 2002 being an extremely dry summer. Sandy City essentially met the 25 percent goal for conservation between 2000 and 2002 due to increased conservation awareness and a new water rate structure that promotes water conservation within the City's service area. MWDSLS provides assistance to Sandy City and Salt Lake City in achieving the State's water conservation goals into the future.

TABLE 8-11
Unit Water Demand with Conservation Element Included
(12 ½ Percent by Year 2020 and 25 Percent by Year 2050)
(Units: Gallons per Capita per Day)

	Year						
MWDSLS Area	**2000** (actual)	**2002** (actual)	**2010**	**2020**	**2030**	**2040**	**2050**
Sandy	250	189	235	220	209	199	188
Salt Lake	251	234	235	220	209	199	188

Salt Lake City's per capita usage rates are higher even with an aggressive conservation program because of the unique nature of their water system. Their per capita usage is affected by the following.

1. They are a regional economic hub with a transient daytime population approaching their resident population.

2. They have major industrial customers such as their largest customer, a refinery.

Salt Lake City's per capita usage for their residential customers is in the range of the State's proposed conservation guideline.

MWDSLS Conservation Plans

MWDSLS has made a long-term commitment to water conservation. MWDSLS recognizes that the projected growth in its service area cannot be sustained by existing or future water sources without a reduction in per capita water use. Water conservation will not only extend limited water supplies, but have the added benefit of deferring costly infrastructure and future water development projects.

(1) Water Conservation Master Plan. In 2000, MWDSLS adopted a water conservation plan in response to the "Water Conservation Plan Act" which was signed into state law in 1998. The District adopted an overall Master Plan in 2001 which provided for the development of additional water conveyance facilities and treatment capacity to enable the District to supply water to its member cities to meet their anticipated needs through the year 2025. Water conservation is a key component of the Master Plan. MWDSLS's conservation plan summarizes the water conservation measures undertaken and efforts by MWDSLS to promote water conservation by its member cities.

The plan focused on supply-side conservation. MWDSLS is a water wholesaler and has no retail customers. Therefore, the plan focuses on supply-side conservation and working with and financially supporting its member cities, Salt Lake City and Sandy, to promote demand side conservation.

(2) Water Conservation Goal. MWDSLS's Master Plan assumes that MWDSLS will meet the State of Utah's goal of reducing water consumption statewide by 25 percent by the year 2050.

(3) Current Water Conservation Programs and Activities.

(3a) Public Education and Information Campaign. MWDSLS has been assisting in funding, the "Slow the Flow, Save H_2O" campaign. The campaign includes the development and dissemination of water conservation educational information through printed materials, radio and television advertisements, and media and community events in order to create heightened public awareness of the benefits of reduced water use. The MWDSLS is a member of a water conservation team formed to develop this statewide water conservation campaign. As discussed earlier in the section about the JVWCD program, the water conservation team was formed as a statewide water conservation initiative with the support of the Governor of the State of Utah. The development of the campaign is continuing, with significant recognition and market penetration statewide.

TABLE 8-12
Water Checks[1]

	1999	2000	2001	2002	Total
Residential	446	638	882	1,066	**3,032**
Commercial	n/a	n/a	20	50	**70**

[1] Totals include all Water Checks for Salt Lake County

(3b) Residential and Commercial Water Audits. Since adoption of the 1999 Water Conservation Master Plan, partnering agencies have pooled financial resources and contracted with Utah State University Extension to provide residential and commercial water audits (Water Checks) which are free to the public. Water audits target outdoor water usage and include an evaluation of the customer's soil type, plant root depth, sprinkler pressure, sprinkler distribution uniformity, and sprinkler precipitation rate.

Following the audit, the customer is left with recommendations for sprinkler system repairs and adjustments to improve distribution uniformity and a customized irrigation schedule to improve watering efficiency. Water use records are obtained from each customer three years prior to and following the Water Check to measure the effectiveness of the water audit.

The Water Checks Program is now in its fifth year. More recently, there has been special emphasis placed on providing Water Checks for large water users including commercial, industrial and institutional water users.

The Water Audit Program has grown each year in terms of the number of Water Checks completed. Table 8-12 summarizes the total number of Water Checks performed within Salt Lake County during 1999 through 2002.

Based on an evaluation of water use records of a randomly selected group of participants who received Water Checks in 1999, Utah State Extension Services have concluded that an average 15 percent reduction in water use has been achieved by participants receiving Water Checks. The Water Check data shows that 66 percent of a resident's total water use is used outdoors and 34 percent is used indoors.

(3c) Water Conservation Pricing. Both member cities of MWDSLS now have in place water rates that encourage water conservation through charging higher rates for higher water use on a seasonal basis. Each city's rates are briefly discussed below.

- **Sandy City.** In 2001, Sandy City adopted a water rate structure to encourage conservation. The rate structure has a much higher rate (186 percent) during the summer months of May through September when the City is trying to encourage conservation of outside water use. Historically, the City's outside water use accounted for 65 percent of the water used by City customers. The rate structure has resulted in lower water use during the last two years as reflected by decreasing per capita consumption and total water deliveries.

- **Salt Lake City.** Salt Lake City's Council adopted a seasonal water conservation rate structure for retail water deliveries for the 2003 water season. This seasonal rate structure was adopted to encourage long-term conservation and the efficient use of the City's water supply. In spring of 2003, Salt Lake City adopted an inclining-block rate structure with three blocks. The first block is set to provide adequate supplies of water for indoor use based on the consumption levels of the average utility customer. The second block is set at 10 percent less than the average outdoor summer consumption. Block 3 is all the water consumed exceeding Block 2.

Commercial customers are billed under a three block structure, with the first block based on

each meter's average winter consumption; Block 2 is 100 to 300 percent of Block 1 (the same ratio as established for residential customers); and Block 3 is all the water consumed outside of Block 2.

For those accounts connected to meters used only during the irrigation season, targets were established based on permeable area and historic evapo transpiration (ET) data; water used within the target is billed at the Block 2 rate and water used exceeding the target is billed in Block 3.

The rate restructuring was accompanied by a redesign of the utility bill to provide adequate information to the consumer regarding current and historical use.

Salt Lake City Conservation Activities.

(1) Web-page Development. In 2001, the Salt Lake City Public Utilities Department (Public Utilities) launched a water conservation web page, designed to provide information for saving water indoors and outdoors to Public Utilities customers, both commercial and residential.

(2) High Performance Building Guidelines. The City developed High Performance Building Guidelines, a tool to guide the design and construction of water and energy efficient buildings constructed in partnership with Salt Lake City. The water section addresses landscape design and maintenance, indoor efficiencies, stormwater protection, and reclaimed water opportunities.

(3) Landscape Ordinance and Guidelines. Public Utilities worked with the Planning Department to update the park strip ordinance, and is involved in evaluating existing landscape ordinances to ensure that those ordinances meet broader administrative goals of encouraging water conservation. Public Utilities is also updating the Water-wise Landscape Plant list, first published in 1995.

(4) Water Efficiency Study. The City performed a study which provided a planning-level evaluation of water conservation and efficiency opportunities with existing irrigation of City-owned open-space, secondary water system and source development, and landscaping requirements for new development. This report provided information as a planning resource for development, funding, and implementation of capital improvement programs needed to achieve the City's increased water conservation and efficiency goals.

(5) Demonstration Gardens. Public Utilities is constructing a number of demonstration gardens throughout its service area. Two gardens have been constructed, one at Washington Square and the second at Concord Lift Station. Three more gardens are in the planning or design stage. Public Utilities has partnered with other city or regional projects as a subject-specialist to ensure that water conservation and sustainability continue to be addressed in all landscape designs. Some of those projects include Library Square, Pork Chop Park, the 10th East Senior Center, and the Intermodal Hub (a LEED-qualified project).

(6) Water Audit Project. Public Utilities conducted full irrigation audits at 17 City-owned sites, including six golf courses in order to 1) determine specific irrigation efficiency; 2) generate repair action-items lists; 3) develop long-term capital improvements goals; and 4) provide adequate data to establish economic incentives for improvements.

(7) Water Shortage Contingency Plan. The contingency plan was adopted by the City council in July 2003, and includes the following four (4) components:

(7a) Ordinance authorizes the Mayor to declare one of five water shortage stages; compels Public Utilities to draft and maintain a Water Shortage Plan; establishes fines; authorizes Public Utilities to enforce mandatory actions; and establishes an appeals process.

(7b) Water Shortage. Plan identifies and defines five stages of water shortage; establishes

triggering criteria for the implementation and termination of the stages; outlines public education and notification process; defines terms; and describes hearing and appeals process.

(7c) Response Summary. Provides quick reference to the five water shortage stages, dividing water customers into three categories (residential, commercial and industrial, and municipal), articulates specific response actions, assigns voluntary and or mandatory status to each response action, and identifies Best Management Practices (BMP) (this has been designed to be web and brochure ready).

(7d) Appendices. Provides a collection of BMP for a broad spectrum of water customers and uses, including residential; commercial carwashes; hotels and restaurants; pools; and the nursery and landscape industry.

The contingency plan is being modeled by a number of other communities, including Draper and Murray, and Grand Junction and Denver, Colorado.

(8) Media.

- Salt Lake City was the focus of several news stories relating to the drought and water conservation, and appeared in two Associated Press (AP) stories which appeared in Colorado newspapers.
- Participated in a number of radio programs on KSL, KUER, and KCPW, and were featured on an hour-long syndicated morning news program which airs all non-clear channel stations.
- Provide weekly information, including water-use charts, to several local news networks for use on weather segments.

(9) Brochure List. The City developed brochures for customers that provided guidance to customers for the following subjects.

- Lawn Watering Guide
- Parkstrip Guide
- Water Shortage Contingency Plan-BMP
- Rate Restructuring
- Residential
- Commercial

Sandy City Conservation Activities. In 1996, Sandy City completed a Water Conservation Plan. The detailed plan was the first of its kind in Sandy City. As a result of that conservation study, Sandy City implemented a number of conservation measures to reduce water usage. Some of these are identified below:

(1) Water Meters. All residential, industrial and institutional connections to the City's water system are metered. The City meters water that is used in public areas such as parks and streetscapes.

(2) Pipeline Corrosion Protection. Sandy City requires the installation of corrosion protection on all ductile iron pipes in acidic soil. This measure is designed to reduce leaks in pipelines.

(3) Conjunctive Use of Surface and Groundwater. Sandy City, by having membership in the MWDSLS, more efficiently utilizes surface waters when available and only uses groundwater supplies during periods of peak demand.

(4) Public Education. Sandy City constructed a xeriscape demonstration garden called Sego Lily Gardens at its Zone 5 water tank site to illustrate landscape practices that conserve water. The gardens are open to the public during the warm weather months. The gardens provide an opportunity for the City to inform the public of low-water use that are available and landscaping techniques that promote water conservation. In addition, the City and its residents are able to learn, by first hand experience, which plant varieties and irrigation methods are the most effective at providing an aesthetically pleasing yet water saving landscape for the sandy soils prevalent in the area.

(5) Use of Secondary Water on Parks. Sandy City has retrofitted two parks within the City (Lone Peak and Crescent) for use of secondary irrigation water for landscape watering. Two additional parks (Eastridge and Storm Mountain) are currently being considered for secondary water. The City also continues to investigate other potential uses for secondary water.

(6) Renewed Emphasis on Conservation. The past few years have born a renewed emphasis on conservation in Sandy City and its neighboring communities. This is the result of both the recent period of drought and Sandy City's need to conserve water to meet future demands. The result of this renewed conservation effort is the implementation of several additional conservation measures[1] listed below.

(6a) Seasonal Rate Structure, In December 2000, the City council adopted a new water rate structure intended to provide an incentive for water users to conserve. The key element of the rate structure is an increased peak season overage rate during the months of May through September. The goal is to reduce peak system demands and reduce the waste of water on outdoor landscaping uses.

(6b) Monthly Billing. As part of the implementation of the water rate structure, the City has opted to begin billing customers on a monthly basis. Historically, the City billed on a bi-monthly basis. Monthly billing allows consumers to receive more frequent feedback on their water use habits and adjust their use accordingly.

(6c) Water Conservation Coordinator. The City hired a water conservation coordinator with a background in horticultural training with a specific emphasis on institutional water conservation. The duties of the water conservation coordinator include acting as a park visitor guide at Sego Lily Gardens, developing conservation education material, and performing irrigation system audits and low-water use landscape consulting throughout the City. The water conservation coordinator also gives presentations on conservation to community groups (schools, churches, businesses, residents, etc.).

(6d) Expanded Public Education Program. Sandy City has greatly expanded their public education program in recent years to include a number of new components:

- *"Slow the Flow" Campaign* – Sandy City has provided financial support to the "Slow the Flow – Save H2O" water education campaign. This campaign was developed in conjunction with JVWCD and municipalities along the Wasatch Front to provide water education information, irrigation system water checks, advertising campaign, and related conservation efforts.

- *Water Conservation Education Program* – Sandy City supports a program to educate school-aged children about water and the importance of conservation. This program is specifically designed to motivate children to use water wisely and grow up with a conservation ethic. It is hoped that this effort will motivate the children to encourage their parents to use water more wisely as well.

- *Improved Xeriscape Demonstration Gardens* – In 2002 and 2003, the Sego Lily Gardens were divided into different landscaped areas, each with separate metering. This will allow water use to be measured for specific landscaping themes.

- *Water Conservation Classes* – Six water conservation classes were offered in 2002 at Sego Lily Gardens. Topics discussed at the classes included low-water use landscape design, irrigation systems, varieties of turf, low-water use plants, native plants, and performing a home water check. All classes are free to the public.

[1] From the Sandy City Memo " Summary of Conservation Measures" dated February 5, 2002

- *Sandy City Newsletter* – The City has utilized the City newsletter to educate and inform the public regarding conservation and other water issues.

- *Water Conservation Web Site* – On the Sandy City web site, there is a page devoted to water conservation (http://www.sandy-city.net/Public_Utilities_Dept/water-conservation-tips.htm). It provides water conservation tips (both indoors and outdoors), announcements, pictures, and links to other water conservation related sites.

- *Free Water Saving Material* – The City has distributed water saving material to schools, community groups, and at Sego Lily Gardens. The material includes an indoor and outdoor water conservation kit, soil probes, and other educational information. The water conservation material is also sent to individual water users upon request.

(7) Line Replacement Program – A new component has been added to the Sandy City Water Fund Budget for pipeline replacement. Funds reserved for this purpose will be used to replace old and failing water lines in the Sandy City water system. In addition to maintaining the system in good working order, it is hoped that this effort will reduce the number and severity of water leaks in the system. The budget item for pipeline replacement was initially $500,000 in FY 2000-2001 and will grow to $1.5 million by FY 2005-2006.

(8) Irrigation Restrictions. Sandy City has coordinated with other water agencies to develop a six-phase water restriction protocol to be implemented in times of drought or other water emergency. In 2001, the City went to the phase of recommending no outdoor watering between 10:00 a.m. and 6:00 p.m. The City Council took this concept a step further in December of 2001 by adopting an ordinance specific to the Sandy City water system that permanently restricts sprinkler irrigation between 10:00 a.m. and 6:00 p.m. for all water users. Violations of this ordinance are generally met with friendly reminders from the City, but the ordinance does allow the City to assess fines to chronic violators.

(9) Water Efficient Landscape Ordinance. In January of 2002, the City Council adopted the Water Efficient Landscape Ordinance. This new ordinance was designed to promote water conservation in the landscaping of new development. The ordinance requires new commercial and multifamily developments, as well as new City-owned properties, to submit landscape and irrigation plans during the development review process. The plans are required to be designed by certified professionals in both landscape and irrigation systems. The landscaped areas of the new developments are required to meet certain irrigation system efficiency standards once installation is completed. In addition, water conserving plants are now required for slopes greater that 30 percent.

(10) Conversion of Public Landscapes – Many changes have been implemented in the landscaping of public areas. A parking strip at a public utilities booster station has been converted to a low-water use ground cover. The Parks and Recreation Department is experimenting with the conversion of streetscapes to bark and/or low-water use trees and plants. At Flat Iron Park, the Parks and Recreation Department has planted trees and shrubs on several existing inclines. Water use in these areas will be restricted once the plants are established. At the new 40-acre Hidden Valley Park, only two acres are planted with turf, with native plants being preserved in the remaining area.

(11) Water Audits. Sandy City has begun the process of identifying which water users use excessive water on their landscape compared to plant needs. For those users with excessive water use, Sandy City will provide information and resources to help in their efforts to save water. Currently, the focus is on the top 100 non-residential water users and the top 25 residential water users. Sandy City

residential water users may also request water audits through the "Slow the Flow" conservation campaign.

(12) Water Conservation Hotline. Sandy City has a water conservation hotline. This hotline allows residents to report violations of irrigation restrictions and to ask questions regarding water conservation.

(13) Charging True Water Costs to All Water Users. In the past, Sandy City has not charged City departments the true cost of their water. For example, the Parks and Recreation Department paid an annual charge based on a budget number rather that the amount of water actually used. Although the Parks and Recreation Department has traditionally done a commendable job of managing their water use, not charging the true cost of water gave the department little motivation to conserve. This policy has been changed and City departments are now charged for water based on actual water consumption. There is currently a cap on the amount charged to the Parks and Recreation Department to help the department make the transition to the new rate structure. Eventually, this cap should be removed and all departments should be charged the full cost of their water use.

(14) Park Computerization. Over half of the City's large parks have been equipped with computerized irrigation systems. These systems allow the Parks and Recreation Department to closely monitor conditions at each park and maximize irrigation efficiency. The Parks and Recreation Department plans to computerize an additional three parks each year. It is expected that all parks will receive computerized irrigation systems by the year 2005.

(15) Drought and Water Emergency Measures. In addition to its efforts to achieve long-term water use reductions through conservation, Sandy City has a plan for reducing water consumption in times of drought or other water emergency. The current Sandy City drought and water emergency policy consists of two major components. First, Sandy City is a member agency of the Salt Lake Valley Conjunctive Management Team. This team consists of the water directors of Sandy City, Salt Lake City, MWDSLS, and JVWCD. During a water emergency, this team convenes to pool resources that can be used to resolve the emergency.

SOUTHERN UTAH VALLEY MUNICIPAL WATER ASSOCIATION (SUVMWA)

The population of southern Utah County lies primarily in the 10 cities that are members of the South Utah Valley Municipal Water Association (SUVMWA). (See Figure 8-5 for location.) The ten communities are Elk Ridge, Genola, Goshen, Mapleton, Payson, Salem, Santaquin, Spanish Fork, Springville, and Woodland Hills. The population projections, revised in 2002, for cities and unincorporated areas of southern Utah County are presented in Table 8-13. The shaded areas on Table 8-13 for Elk Ridge, Springville and Woodland Hills represent build-out populations, which are expected to occur prior to 2050. Build-out in most of the other communities will not occur until after 2050.

Water Conservation Master Plan

The SUVMWA will prepare a water conservation plan describing its water conservation measures and the way its requested ULS water would be used in conjunction with its local water sources. Elements of the plan will include reduction in per capita water use, recycling and reuse of wastewater, and public education on residential water conservation. This plan will be developed for each participating city within SUVMWA and will provide the description of how the cities current water supply would be managed to meet the acceptable water usage rate goal. The water conservation plan is being prepared in response to the "Water Conservation Plan Act" signed into Utah law in 1998. The water conservation master plan will focus on demand-side conservation. The plan will recommend the

following five water conservation measures to be implemented by the SUVMWA cities.

TABLE 8-13
Revised Population Projections for Southern Utah County

Community	Year					
	2000 Census	2010	2020	2030	2040	2050
Incorporated Communities of SUVWMA						
Elk Ridge	1,838	3,093	4,391	5,024	6,000	6,000
Genola	965	1,565	2,392	4,744	11,467	18,191
Goshen	874	1,249	1,682	1,970	2,611	3,251
Mapleton	5,809	9,403	14,928	20,990	27,507	34,024
Payson	12,716	20,606	27,750	30,583	55,673	80,763
Salem	4,372	7,351	12,101	17,016	24,212	31,409
Santaquin	4,834	9,822	16,865	24,263	43,442	62,621
Spanish Fork	20,246	27,693	32,745	35,771	50,900	66,028
Springville	20,424	28,866	34,132	37,286	59,658	59,658
Woodland Hills	941	1,891	3,247	4,014	4,793	4,793
Total	73,019	111,539	150,233	181,861	286,263	367,738

(1) A Public Education/Information Campaign. SUVMWA will retain a public relations/media consultant to assist in developing a water conservation information/education program.

(2) The Development of Model Landscape Ordinances. SUVMWA will form a working group that will include representatives from the landscape and irrigation industry, Utah State University, and the Division of Water Resources to develop model commercial and residential landscape ordinances. With input from the working group, the model ordinances will be developed over an 18-month period. The purpose of these ordinances will be to provide models which SUVMWA member cities and others can adopt to promote water-efficient landscaping of all new and rehabilitated commercial landscapes, and new residential landscapes.

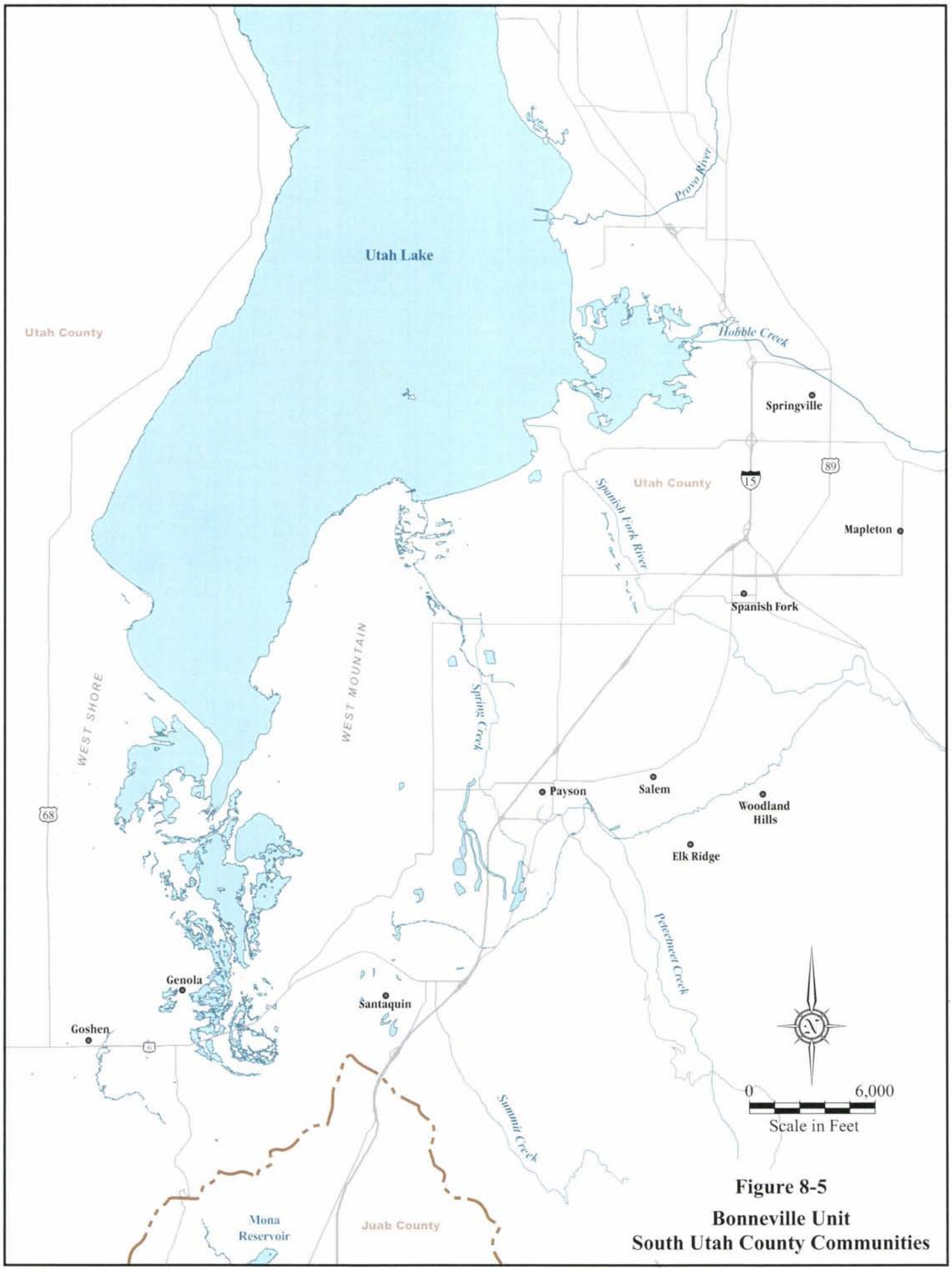


Figure 8-5

Bonneville Unit
South Utah County Communities

(3) A Residential Water Auditing Program ("Water Check" Program). When the Water Conservation Master Plan is adopted, SUVMWA and member cities will pool financial resources and contract with Utah State University Extension to provide residential and commercial water audits (Water Checks) that are free to the public. Water audits will target outdoor water usage and include an evaluation of the customer's soil type, plant root depth, sprinkler pressure, sprinkler distribution uniformity, and sprinkler precipitation rate. Following the audit, the customer will be left with recommendations for sprinkler system repairs and adjustments to improve distribution uniformity and a customized irrigation schedule to improve watering efficiency. Water use records will be obtained from each customer three years prior to and following the Water Check to measure the effectiveness of the water audit.

(4) Ultra Low Flush Toilet Pilot Replacement Program. SUVMWA will implement a pilot toilet replacement program within its service area. The program will involve replacing high flush toilets with flushing rates between 2.1 and 6.7 gallons per flush with new ultra low flush toilets (ULFTs) rated at 1.6 gallons per flush. The purpose of this program will be to measure the water savings and calculate the cost effectiveness of replacing older high flush toilets with new ULFTs.

(5) Waterwise Classes and Workshops. SUVMWA will hire a Conservation Horticulturalist whose duties will include arranging for and teaching several waterwise landscaping classes throughout the spring and summer of each year. These classes will be free to the public and include instruction on Utah native plants, designing efficient irrigation systems and waterwise landscapes, blue grass lawn care and alternatives and other topics emphasizing water conservation.

SUVMWA Water Conservation Goal. As part of the water conservation plan, the SUVMWA cities will adopt a conservation goal of reducing total water demand by 12½ percent by the year 2020. This is based on an estimated 20 percent savings in outdoor water use which would be approximately equivalent to a 10 percent overall savings.

After completing the Water Conservation Master Plan, SUVMWA will adopt a new and more aggressive water conservation goal of reducing water demand within the SUVMWA service area by an overall 25 percent by 2050. This goal would be measured in terms of per capita water use reduction beginning in year 2005. Therefore, in order for the SUVMWA cities to meet this goal, water use will need to be reduced to 220 gpcd by 2050.

SUVMWA Water Conservation Results. In order to achieve the water conservation goal of 12½ percent water use reduction by 2020, a reduction in per capita use must be achieved. Table 8-14 shows that the actual per capita water use reduction will exceed the SUVMWA goal of 0.5 percent per year.

TABLE 8-14
Achievement of SUVMWA Area-Wide Water Conservation of 25 Percent
(Note: An average area wide reduction of 25% will be achieved, some cities may be above 220 gpcd and some below 220 gpcd)

Community	2000 Per Capita Use (gpcd)	2050 Per Capita Use (gpcd)	Percent Reduction
Elk Ridge	256	220	-14%
Genola	234	220	-6%
Goshen	413	220	-47%
Mapleton	536	220	-59%
Payson	275	220	-20%
Salem	230	220	-4%
Santaquin	344	220	-36%
Spanish Fork	233	220	-6%
Springville	311	220	-29%
Woodland Hills	151	190	+26%
Weighted Average Percent Reduction in Water Use for SUVMWA Communities			**-25%**

WATER CONSERVATION THROUGH CONVEYANCE SYSTEM IMPROVEMENTS

Water system improvements such as converting ditches to pipelines and, developing urban secondary water systems produces a considerable amount of water conservation. This section discusses the water conservation aspects of two programs. One program is being carried out under CUPCA Section 207 funding and the second program is under the jurisdiction of the U.S. Bureau of Reclamation.

Table 8-15 shows the accomplishments of water conservation under the CUPCA Section 207 program based on yearly reports by sponsoring water agencies. A narrative description of these projects is presented in the following sub-sections of this chapter.

MUNICIPAL WATER PIPELINE (CUPCA SECTION 207)

Provo Reservoir Canal Enclosure. The Provo River Water Users Association (PRWUA) operates and maintains the Provo Reservoir Canal (PRC). The PRC runs for approximately 23 miles from the Murdock Diversion Dam located on the Provo River in Provo Canyon to the Point-of-the Mountain near the Utah County/Salt Lake County boundary. From the period 1995-1999, the average seepage and evaporation loss in the canal was estimated at 8% of the diverted flows. Replacing the canal with either a pipeline or a concrete box culvert would result in the conservation of an estimated 8,000 acre-feet per year that would otherwise be lost to seepage and evaporation.

Table 8-15 -- Water Conservation Credit Program -- Anticipated Progress to the Year 2016 Water Conservation Goal

Project #	Project Name	Annual Acre-Feet of Water Conserved								
		1995	1996	1997	1998	1999	2000	2001	2002	2003
712	West Ridge Golf Course Irrigation Project	527	527	527	527	527	527	527	527	527
		415	290	316	576	576	931	623	405	377
724	Terra Diamond Water Cooling Tower	2	2	4	4	5	5	7	7	7
		0	1	2	4	4	8	8	6	6
734	Strawberry West Mountain Sprinkler Irrigation Project	626	626	626	626	626	626	626	626	626
		565	618	621	626	624	639	640	612	588
713	Draper Pressure Irrigation		5,159	5,161	5,164	5,164	5,164	5,167	5,167	5,171
			5,018	5,056	5,198	5,115	6,362	5,000	4,718	5,399
717	Sunshine Pipeline Project		1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
			960	984	847	935	1,111	1,111	1,313	1,260
721	Alpine Dry Creek/Fort Canyon Pipeline Project		3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600
			1,837	330	3,686	3,798	2,111	1,826	2,340	1,886
733	Kay Family Farm Sprinkler Irrigation Project		63	63	63	63	63	63	63	63
			63	63	63	63	76	58	58	76
745	Provo Lion's and South Fork Parks Secondary Systems		45	45	45	45	45	45	45	45
			13	17	22	19	21	19	32	34
746	Provo Kiwanis Park Secondary System		55	55	55	55	55	55	55	55
			0	3	0	31	52	67	44	51
764	Wiser Water Use in Salt Lake City		18	18	18	18	18	18	18	18
			18	18	18	18	18	18	18	18
765	Development of Landscape Education Package		26	26	26	26	26	26	26	26
			0	0	26	26	26	26	26	26
732	Salt Lake County Runoff Groundwater Recharge						5,800	5,800	5,800	5,800
						1,328	5,282	5,800	5,800	5,800
735	Wasatch County Water Efficiency Project								5,000	8,000
							1,220	13,560	24,492	25,376
768	Island Ditch Pipeline Project					1,748	1,748	1,748	1,748	1,748
						1,747	1,779	1,891	1,198	1,767
782	Manti Pressurized Irrigation System Improvements						1,720	3,790	4,820	4,820
							2,065	4,500	4,820	4,900
739	Riverton City Secondary Water System Improvements						782	2,095	3,628	4,003
							432	3,287	4,102	4,604
770	East Juab Water Efficiency Project						1,500	2,000	3,000	4,000
						3,393	5,105	5,105	5,105	5,100
798	Thanksgiving Point Water Conservation Project				668	876	538	538	538	538
					647	647	723	606	606	606
738	Econs/PacifiCorp Multi-Family Retrofit Project					277	277	277	277	277
						277	268	268	268	268
802	Alpine City Secondary Irrigation Project							2,741	2,741	2,741
									2,379	2,790
806	Pleasant Grove Pressure Irrigation & Telemetry System						735	747	758	770
							157	425	526	649
716	Lindon Pressurized Secondary Irrigation System						3,073	3,290	3,436	3,667
							3,179	2,847	3,521	3,834
794	Highland City PressurizedIrrigation System						3,163	3,339	3,524	3,719
							3,160	3,477	3,615	3,824
812	Jordan Valley Water Conservation Project						157	157	157	157
							157	157	157	157
758	Mona Pressurized Secondary Irrigation Project							774	812	852
								843	1,364	1,364
812	Jordan Valley Water Conservation Project							314	314	314
								314	314	314
813	Orchard Mesa Canal Piping Project							975	975	975
								1,292	2,785	2,400
814	Timpanogos Canal Piping Project							1,004	1,004	1,004
							1,771	2,211	2,271	1,880
812	Jordan Valley Water Conservation Project								236	236
									236	236
809	Magna Water Company Secondary Water System									
812	Jordan Valley Water Conservation Project									157
										157
822	Salt Lake City Water Conservation and Education									157
										157
825	Spanish Fork City Secondary Water System									3,885
										2,240
	PROJECTED TOTALS	**1,155**	**11,221**	**11,225**	**11,896**	**14,130**	**30,722**	**40,823**	**50,002**	**59,058**
	ACTUAL TOTALS	**980**	**8,818**	**7,410**	**11,713**	**18,601**	**34,882**	**55,980**	**73,131**	**78,143**

* No Annual Report

LIGHT SHADED AREAS REPRESENT ACTUAL CONSERVATION

DARK SHADED AREAS REPRESENT CONSTRUCTION PERIOD

URBAN SECONDARY WATER SYSTEMS (CUPCA SECTION 207)

A considerable amount of the domestic water supply is used for outdoor watering and irrigation of parks and other community facilities. In larger cities outdoor watering is directly from the drinking water system. In smaller cities separate, often unlined, ditch systems running through urban and suburban areas provide water for outside uses. Effective conservation strategies involve measures that substitute non-potable water from secondary systems for outdoor residential uses and in-community farm plots, and convert ditches to pipe systems to reduce seepage and provide pressurized water.

Water conservation projects of these types are being built in communities along the Wasatch Front. Historically, community development along the Wasatch Front included systems of unlined ditches to convey creek water through communities for watering gardens and yards. Today many of these ditch systems still serve parts of cities that were part of the original development, and in some cases irrigation ditches were converted to such use as farmland was urbanized. Such "old systems" provide basic opportunities for development of secondary systems. Expansion becomes possible as the older systems are converted to pressurized pipe systems to force water into distribution networks in communities.

The CUPCA Section 207 Program has assisted approximately 14 secondary water system projects. The average annual amount of water conserved by these systems is, or will be after completion, approximately 62,100 acre-feet per year. The conserved amounts vary from year to year depending on natural runoff and climatic conditions, affecting the supply and demand of secondary water. The sponsoring agencies of some projects will turn over a portion of the conserved water to the District, which will make the water available to the Secretary of Interior for instream flows in accordance with CUPCA Section 207 (b)(4). This will be CUP water that will be retained in Jordanelle Reservoir until needed. Projects approved through 2002 are presented in the following sections.

Salt Lake County

Draper Pressurized Irrigation System (Application #713). This project involved the installation of a pressurized secondary irrigation system throughout Draper. The pipe system provides water for outdoor residential irrigation and provides farmers with pressurized water for sprinkler irrigation. With 1800 hookups in total, water savings have ranged between 4,600 and 6,400-acre feet per year, depending on weather.

West Ridge Golf Course and Commerce Park Irrigation (Application #712 approved in 1996). This project in West Valley City in Salt Lake County consists of facilities to provide water from the Utah and Salt Lake Canal water to West Ridge Golf Course and Commerce Park. The target amount of annual water conservation is 726 acre-feet, of which approximately 73 percent have been achieved; the rest awaits buildout of Commerce Park.

Riverton City Secondary Water System Improvements (Application #739). The project involves the installation of a secondary system for residential outdoor water use. By substituting water from the Utah Lake Canal, Rose Creek drainage, and the Collard Well, the project conserved approximately 4,102.5 ac-ft in the 2002 water year. The project includes 10 acres of constructed wetlands with ponds, through which the secondary water supply is routed to reduce suspended solids and odor in the secondary water supply.

Magna Water Company Secondary Water System (Application #809 approved in 2002). This Salt Lake County project is the main distribution component of the water company's secondary water system, providing secondary water to public schools, parks, a golf course, and for stabilizing an existing wetlands area that has problems with water table fluctuations. The

estimated amount of water conservation is 3,600 acre-feet.

Utah County

Provo City Lions and South Fork Park Secondary Systems (Application #745). The Lions Park project provides water from the adjacent Spring Creek Canal to irrigate the park. The South Fork Park project involves pumping water from the South Fork of the Provo River to irrigate the park. The drinking water conserved was approximately 32 acre-feet in 2002, and is projected to increase.

Provo City Kiwanis Park Secondary System (Application #746). This project delivers water from the Upper East Union Canal to Kiwanis Park. The amount of drinking water saved ranged from 44 to 67 acre-feet during years 2000 to 2002.

Thanksgiving Point Water Conservation Project (Application # 798). The project involves the conversion to low water use landscape design and water saving irrigation equipment for this park complex along Interstate 15. The amount of water conserved annually from years 2000 to 2002 ranged from approximately 610 acre-feet to 720 acre-feet.

Alpine City Secondary Irrigation Project (Application #802). This project consists of converting an open ditch system that supplied culinary water for outdoor use to a closed pipe secondary system that will deliver non-potable water for outdoor use without seepage losses. The amount of culinary water conserved in 2002 was approximately 2,340 acre-feet.

Pleasant Grove Pressure Irrigation & Water Telemetry System (Application #806). This project consists of the construction of a pressurized secondary irrigation system for large water users (yard and park irrigation; industrial use), and the installation of a radio telemetry system to better control pumps and storage in culinary water system. These customers are presently served from the culinary system. The amount of culinary water conserved in 2002 was 526 acre-feet; the amount will grow in the future. As part of the project, Pleasant Grove will turn over 500 acre-feet of conserved water, in perpetuity, to the District for instream flow use as described above.

Lindon Pressurized Secondary Irrigation System (Application #716 approved in 2000). This versatile secondary system can obtain raw surface water from any one of several canals and provide it throughout the City of Lindon as irrigation water for homes, municipal parks, orchards, and pastures. Amounts conserved in years 2000 to 2002 were 3,200 to 3,800 acre-feet, respectively. Variations are caused by runoff, weather, and lately, increasing public efforts to reduce water waste. As part of the proposed project, Lindon City will turn over 500 acre-feet of conserved water, in perpetuity, to the District for instream flow use.

Highland City Pressurized Irrigation System (Application #794 approved in 2000). This Utah County project secondary water system provides water within the city limits for residential watering and gardening. The water supply for the project consists of American Fork River water from two irrigation company ditches, and Provo River water from the Provo Reservoir Canal and Reach III of the Alpine Aqueduct. The amount of water conserved in 2002 was approximately 3,600 acre-feet, and is increasing as residential growth occurs. As part of the proposed project, Highland City will turn over 500 acre-feet of conserved water, in perpetuity, to the District for instream flow use.

American Fork City Secondary Water System (Application #820 approved in 2002). This project would provide a secondary water system covering the city to its "build-out" limits. Under full build-out conditions, the system will conserve an annual average 12,295 acre-feet of culinary water. While the project was approved for Section 207 funding, American Fork City decided not to pursue Section 207 funding. Nevertheless, the city turned over to the District 1,000 acre-feet of conserved water annually, in

perpetuity, for instream flow use as described above. The District will credit American Fork City with the proportionate share of the District's repayment savings for reductions in deliveries of project water under this agreement.

Spanish Fork City Secondary System (Application #825 approved in 2003). This project involves the installation pipe to deliver secondary water throughout the City. The project water supply will come from existing wells, the city's Spanish Fork River water rights, and Strawberry Reservoir water requested from the ULS System. The project anticipates conservation of 7,769 acre-feet of culinary water by the year 2028, and the city will turn back 1,000 ac-ft of water to the District for instream flow use.

Juab County

Mona Pressurized Secondary System (Application #758 approved in 2000). This project improves the efficiency of irrigation water use and conserves culinary water at the town of Mona in Juab County. By substituting conveyance pipelines for open ditches, the project would reduce seepage losses and the pipe pressure would facilitate conversion from flood to sprinkler irrigation of residential areas and adjacent irrigated lands. The amount of water conserved in 2002 was approximately 1,360 acre-feet.

207 Projects Anticipated in Future Years

As of 2003, the "Active Inventory" list contains four (4) M&I projects that have been screened but not yet approved for funding. In addition, The District anticipates that additional applications will be submitted for future projects, in view of the strong local interest in the program and the program's application to reverse osmosis membrane treatment, wastewater recycling, and conjunctive use. However, the scheduling of future projects approved for funding depends on the future availability of funding for the program.

IRRIGATION WATER CONSERVATION PROJECTS (CUPCA SECTION 207)

Most of the irrigated agriculture in the Bonneville Unit service area is basically "water-short" because of insufficient water supply during average and dry years. The sustaining streamflow declines in the late season, and stored irrigation water is usually not sufficient to fill out the irrigation season. Irrigation water supplies provided from Starvation and Jordanelle reservoirs have contributed much to the agricultural economy but the irrigation waters available are still less than a reliable full-season supply. While there is considerable interest in expanding the water supply through conservation, there is meager financial ability to line canals or develop pressurized delivery systems.

Financial assistance through the CUPCA 207 Program has contributed to the conservation of irrigation water in rural areas, improving crop production and economic stability in farming communities. The 207 Program has assisted 10 projects expressly for irrigation water conservation. The average annual amount of water conserved by irrigation water projects approved through 2002 is approximately 46,000 acre-feet per year, with annual variations caused by natural runoff conditions and weather. Projects approved through 2002 are as follows.

Uinta Basin

Island Ditch Pipeline (Application #768). This Uinta Basin project involves the conversion of irrigation ditches to a pressurized pipe distribution system. Sprinkler irrigation systems have been installed to serve the approximately 1,200 acres involved. Conserved water in recent years, which varies with the amount of runoff, has varied between approximately 1,200 acre-feet and 1,900 acre-feet.

Sunshine Pipeline Project (Application #717). This project replaced approximately 7.7 miles of the Sunshine Canal along a hillside. The canal created a high groundwater table which caused

foundation and basement flooding problems nearby, and represented a flooding hazard to down-slope development. Water conserved ranges from approximately 1,100 to 1,300 acre-feet per year.

Utah County

Strawberry West Mountain Sprinkler Project (Application #734 approved in 1995**).** The project was sponsored by 35 farmers in the West Mountain area west of Payson, Utah, who have upgraded their on-farm irrigation systems from flood to sprinkler (hand lines, wheel lines, and pivot) and gated pipe. (The upgrade was made possible by the recent conversion of open channel canals to pressurized pipelines by the SWUA). The new pressurized systems increases on-farm water use efficiency. Water savings reported over the past 3 years average approximately 625 acre-feet.

Alpine Dry Creek/Fort Canyon Pipeline (Application #721). This Utah County project consists of a pipeline from a point on Dry Creek northeast of Alpine City to nearby Fort Canyon Creek to improve the efficiency of irrigation water delivery to the Lehi Irrigation Company and North Bench Irrigation Company. Conserved amounts in recent years have varied between approximately 1,800 acre-feet and 3,700 acre-feet.

Orchard Mesa Canal Piping Project (Application #813). Under this project the unlined section of the Orchard Mesa Canal north of Duchesne, Utah, was converted to a pipeline. The amount of water conserved by this project in 2002 was approximately 2,785 acre-feet (calculated as the 5-year average diversion prior to the project minus deliveries with the project).

Timpanogos Canal Piping Project (Application #814). Under this project, approximately 5 miles of the open canal was converted to a pipeline to conserve water lost through seepage. During 2002 the project conserved 2,271 acre-feet. The project was sponsored by the District, which is working with the Department of Interior on arrangements to devote the conserved water to minimum flow maintenance in the lower Provo River for fishery purposes.

Juab County

Kay Family Farm Sprinkler Irrigation (Application #733). The project involved the conversion of approximately 53 acres of land from flood to sprinkler irrigation on a farm north of the city of Mona in Juab County. The project has conserved 63 acre-feet and has increased crop yields.

East Juab Water Efficiency Project (Application #770). The project consists of a major upgrade of the irrigation system serving farm land in Juab County at Nephi City, conserving water lost to seepage and otherwise improving the water supply for this water short area. The work involved the construction of a pipe distribution system, and integration of five irrigation wells owned by Nephi City into the system. On-farm irrigation systems on 1,600 acres are being converted from flood to sprinkler irrigation. The new system conserved 5,105 acre-feet of water in 2003, which will increase as land is converted to sprinkler irrigation.

Wasatch County

Wasatch County Water Efficiency Project (Application #735). As it is now designated, the Wasatch County Water Efficiency Project (WCWEP)/Daniel Replacement Project (DRP) has improved water use efficiency in nine of the 12 Heber Valley irrigation companies by replacing canals and ditches with approximately 40 miles of pressure pipelines, allowing farmers to convert from flood irrigation to sprinklers. This extensive project was authorized under Section 202 (a)(3) of CUPCA. The formulation process included the DRP, which was authorized under Section 303 of CUPCA to provide irrigation water delivery to the Daniel area from Jordan Reservoir in exchange for the discontinuation of the diversion from the upper Strawberry River. The DRP was planned and

constructed in conjunction with WCWEP to provide the most efficient layout of Heber Valley irrigation facilities. The project was included in the 207 Program to provide financial assistance for construction of distribution facilities. The project conserved 24,492 acre-feet of irrigation water in 2003.

Sanpete County

Manti Pressurized Irrigation System Improvements (Application #782). This project involved the improvement of irrigation systems in the vicinity of Manti to permit sprinkler irrigation of the entire 3,700-acres served by the Manti Irrigation Company and the Manti Irrigation and Reservoir Company. (Approximately 43 percent of the irrigated acreage (1,610 acres) was still flood irrigated.) Water conserved in 2001 was approximately 4,500 acre-feet, and in 2002, approximately 4,900 acre-feet.

207 Projects Anticipated in Future Years

As of 2003, the "Active Inventory" list contains four (4) irrigation water projects that have been screened but not yet approved for funding. The scheduling of future projects approved for funding depends on the future availability of funding for the program.

INDUSTRIAL WATER CONSERVATION (CUPCA SECTION 207)

Industrial water conservation measures involve water use for outside landscaping and employee personal uses as described above under Household Water Conservation. In addition, industries that use significant amounts of water in their production processes have other opportunities for conservation, including process water recycling and reuse. The following industrial project was included in the 207 Program.

Salt Lake County

Water Cooling Tower for Terra Diamond (Application #724). The project, located in the Price Industrial Park in Salt Lake City, involved the installation of a water cooling tower to allow for the recycling of industrial process cooling water that was discharged to a sanitary sewer. The annual water conservation was estimated at 22 acre-feet by 2009. As of 2002, an average of 7.3 acre-feet per year has been saved, and the savings are projected to be 220 acre-feet by 2009 as additional phases of the manufacturing process are added.

WATER CONSERVATION EDUCATION (CUPCA SECTION 207)

Public "water awareness" is vital to achieving the M&I water conservation goals, and is addressed by "Water Education" programs of larger water agencies. The role of educational programs is to develop public understanding of the ways that the households and businesses can reduce waste and otherwise conserve water. Also important are public awareness of the difficulty and cost of developing new water supplies. Some of the educational programs include structural projects. For example, the JVWCD educational efforts include a set of demonstration gardens and other activities to inform the public about ways and means to reduce landscape water requirements with attractive landscaping that requires less water.

Major education programs have been included in the 207 Program. Like structural 207 Projects, the prioritization committee ranks water education programs in terms of their potential for reducing municipal water use. Water education programs funded by the 207 Program are listed below.

Salt Lake County

Wiser Water Use in Salt Lake City (Application #764). Funded in 1996, this program involved 1) working with the top 50

public water users in the city's service area to prepare water use assessment and develop a conservation plan for each entity, and 2) conducting residential landscape watering workshops and otherwise publicizing residential water conservation. This program was formulated by three agencies, including the Great Salt Lake Audubon Society, but was officially submitted by the MWDSLS.

Jordan Valley Water Conservancy District Water Conservation Project (Application #812). Funded annually from 2000 to 2003, this program consists of (1) residential water survey for single family homes, (2) public information through written materials and media ads, (3) landscape ordinances for new non-residential development, and (4) Xeriscape demonstration gardens. Parts of this program have already been funded in different years, while other parts will be proposed for further consideration in future years. The program remains on the Active Inventory List for consideration of additional efforts in future years. In consideration for the water conserved, the JVWCD will turn over 500 ac-ft to the District for a 5-year period. The District will make the water available to the Secretary of Interior for instream flows in accordance with CUPCA Section 207 (b)(4).

Salt Lake City Water Conservation & Education Program (Application #812). This program involves installation of new technology watering systems, public education materials, and demonstration areas in the city.

Statewide Development of Landscape Education Package (Application #765). Funded in 1996, this program involved the development of an education package on landscape water auditing and irrigation scheduling, including video tapes, interactive software, and written materials. Utah State University developed the program.

USBR – WATER CONSERVATION FIELD SERVICES PROGRAM

The purpose of the Water Conservation Field Services Program (WCFSP) is to actively encourage water conservation by assisting irrigation and other water districts with their responsibility to develop and implement water conservation plans. It is intended to complement other state and local conservation efforts such as CUCPA Section 207.

The emphasis of the WCFSP is intended to fulfill the USBR legal responsibility under the Reclamation Reform Act (RRA) of 1982 to encourage water conservation on USBR projects. For the purposes of the WCFSP, the term "conservation" means "efficient use," and not merely "saving water for other purposes." It includes assisting districts, both urban and agricultural, in their efforts to manage water more effectively; measuring water to know how much is being diverted and delivered; accounting for deliveries of water to know where and how it's being used and, encouraging efficient water management practices to maximize the beneficial use of diversions from reservoirs, streams, and aquifers, while minimizing the environmental impacts to instream and other watershed resources.

The four key aspects of the WCFSP are:

- Water Management Planning
- Water Education and Training
- Demonstration of New Conservation Technologies
- Implementation of Effective Efficiency Measures

Water Management Planning (USBR)

Through the WCFSP, technical and financial assistance are made available to encourage the development of quality water management plans by districts. In many cases, this is one-on-one assistance provided by USBR staff. In others, it may be financial assistance through cost-sharing to support the district in development of its plan.

Typical activities include:

- Conduct field visits to assist with resource inventories and water conservation plans;
- Assist with planning surveys and designs, water budgets and investigations, studies, and evaluations;
- Facilitate planning among districts by encouraging and developing partnerships and agreements; and
- Coordinate technical assistance through partnerships and agreements among organizations.

Water Education Training (USBR)

The WCFSP promotes activities designed to create partnerships in conservation education, information dissemination, and training. Through a variety of means, local area offices of the USBR are finding ways to develop information and education outreach programs through the WCFSP that support and emphasize conservation awareness.

Typical activities include:

- Conducting field tours;
- Distributing information guides and materials;
- Conducting workshops including an annual water management seminar;
- Providing on-the-ground educational services for general and specific activities;
- Arranging partnerships with governmental, state, and local educational organizations;
- Participating in water fairs and other children's education activities; and
- Establishing and supporting Water Conservation Information Centers.

Demonstration of New Conservation Technologies (USBR)

Area programs are supporting local demonstration of projects such as improved water measurement, appropriate use of automation and telemetry control, new approaches to minimizing canal and ditch seepage, and innovative on-farm irrigation management methods.

Typical activities include:

- Assist with research, evaluation and demonstration;
- Sponsor specific conservation demonstration projects and activities; and
- Coordinate financial assistance for joint projects and partnerships with other agencies.

Implementation of Effective Efficiency Measures (USBR)

The implementation of effective efficiency measures is the ultimate objective of water management and conservation planning. The WCFSP is providing opportunities for both technical and financial assistance for water districts to begin implementing effective efficiency measures identified in their water conservation plans. Local programs provided cost-sharing, generally on a 50-50 basis, through cooperative agreements or grants.

Typical activities include:

- Assist water agencies with implementing water conservation plans and water management practices;
- Provide funds for implementation through cost sharing activities; and
- Facilitate partnerships with other organizations to conduct implementation activities.

USBR - UTAH'S "BRIDGING-THE-HEADGATE" ALLIANCE

In 1998, the USBR initiated an agricultural conservation partnership called "Bridging-the-Headgate" to encourage Federal, State and local water resource and conservation agencies and organizations to work more closely together to achieve sustainable and efficient use of western agricultural water supplies. The term "headgate" typically refers to the structure that acts like an "agricultural faucet," delivering

irrigation water to a farmer's field or ditch system from the water district's conveyance system.

The "Bridging-the-Headgate" Partnership is a six-party alliance that includes USBR, the Western States Water Council, the National Water Resources Association, the Natural Resources Conservation Service, the National Association of State Conservation Agencies, and the National Association of Conservation Districts.

The purpose of the Partnership is to encourage and support collaboration between local irrigation districts and conservation districts, state water resource agencies and conservation agencies, and local USBR and Natural Resources Conservation Service field offices throughout the western United States. A primary objective is to support the formation of active state-level "Bridging-the-Headgate" alliances that can serve to bring the partnership to life at the local level.

In the Bonneville Unit area of Utah, USBR's Provo Area Office has worked with the Utah Association of Conservation Districts, Utah Water Users Association, Utah Soil Conservation Commission, Utah Division of Water Resources, and local Natural Resources Conservation Service offices. During the last 5 years , the Utah alliance has met regularly to discuss resource management issues and partnership opportunities.

WATER CONSERVATION THROUGH OVERALL BASIN-WIDE WATER USE EFFICIENCY

This section addresses the strategies available to increase the use of water that is available locally or has been provided through the Bonneville Unit. Generally, these strategies involve –

- Conjunctive use of groundwater and surface water
- Water recycling; and
- Reverse Osmosis treatment

CONJUNCTIVE USE OF GROUND-WATER AND SURFACE WATER

Conjunctive use of groundwater is essentially the recharge of groundwater aquifers when surface water is available, and later withdrawal of the recharged water from the aquifer when needs exceed the surface water availability. This strategy would benefit northern Utah County and parts of the Salt Lake County.

Northern Utah County

Northern Utah County is experiencing conversion of irrigated acreage to community development, and evaluating the prospects for conversion of irrigation water to M&I use. The waters of the American Fork River and various creeks are used primarily for crop irrigation and secondary systems. Generally, conjunctive use is the key to the use of this water for M&I purposes because the irrigation water tends to be seasonal with low availability in the fall and winter. This would involve recharge from spring and early summer streamflow for recovery from wells later in the year. Section 202(a)(2) of CUPCA authorized funding for conjunctive use studies. The District has initiated a cooperative effort with the northern Utah County communities and the U.S. Geological Survey to conduct a three- to four-year study of conjunctive use potential.

Salt Lake County

The Salt Lake County Runoff Groundwater Recharge project under development will capture high-quality winter season flows from 5 creeks that are currently not stored or used, treat the water, and store the water underground for use during summer season peak demand periods. The underground storage will stabilize a declining groundwater aquifer. Direct flows from the Weber and Provo Rivers yielded by the Welby Jacob Exchange will be stored

underground. The average amount of water conserved annually is expected to average 5,800 acre-feet. The project, being developed by the JVWCD, is involved in the District's Conservation Credit Program (Application #732), but the JVWCD has not requested 207 Program funding. Nevertheless the amount of water conserved will be applied towards the Water Conservation Credit Program goal because JVWCD agreed to commit certain CUP water to the Central Utah Water Conservancy District for instream flow use flows for the five-year period 2001 through 2005, with provision for renewal of the agreement.

WATER RECYCLING

Water recycling along the Wasatch Front involves the reuse of municipal wastewater and the use of brackish water from Utah Lake and certain ground-water aquifers. Both types of recycling are aimed at providing water for municipal secondary systems after suitable treatment. This section discusses methods for recycling wastewater, and the potential amounts of wastewater available.

Wastewater reuse can be divided into two categories:

1. "Direct reuse" refers to the containment and delivery of wastewater from the treatment facility to the point of reuse by the agency that treats the wastewater. An example is delivery to municipal parks for landscape irrigation.

2. "Downstream reuse" refers to the utilization of discharged wastewater after it has been discharged to surface waters or groundwater. Such downstream reuse is usually indirect and "unintentional," i.e., not specifically under the direction of the agency providing the treatment. An example is release to Utah Lake where the wastewater adds to the irrigation water supply diverted from the lake.

The opportunities for direct reuse of treated municipal wastewater treatment plant effluent include crop irrigation in pressurized systems, certain municipal landscape purposes, and ultimately for residential landscaping. Heretofore, wastewater use in Utah has been limited to the watering of parks, golf courses, etc. Now projects in the planning stage would use recycled water for residential lawns and gardens. Such use requires separate distribution systems, the so-called secondary systems. The State of Utah is in the process of revising the regulations governing reuse of wastewater to allow for its use in secondary systems under stringent water quality controls. The technology is currently available to treat the wastewater to the tertiary level that is required for the secondary systems; however it is costly. Another potential use is as a firm water supply for the wildlife refuges.

JVWCD and MWDSLS Plans to Recycle Water

Existing wastewater treatment plants in the JVWCD's and MWDSLS's service area provide sources of recyclable water and studies of treatment methods and distribution strategies are underway. Approximately two-thirds of the return flow would occur at the Central Valley Wastewater Treatment Plant and one-third to the South Valley Wastewater Treatment Plant. Wastewater recycling has the potential to provide water for secondary M&I systems and for environmental purposes.

This water source involves the recycling and reuse of return flows from M&I water use that is conveyed to municipal wastewater treatment plants in Salt Lake County. The treated wastewater would be piped from the treatment plants to secondary water systems in various parts of Salt Lake County. Calculations of volumes of CUP Bonneville Unit water return flows to the significant wastewater treatment plants in Salt Lake County have been made. The three major wastewater plants in Salt Lake County are:

- Central Valley Water Reclamation Facility (CVWRF)
- South Valley Water Reclamation Facility (SVWRF)
- Salt Lake City Reclamation Facility (SLCRF)

The two most likely candidates for water recycling in the JVWCD service area are member agencies and service areas in the CVWRF and in SVWRF. The estimated CUP Bonneville unit return flows as sewage effluent to these facilities are estimated as shown in Table 8-16. Both current and future deliveries of Bonneville Unit M&I system from Jordanelle Reservoir are shown in Table 8-16.

The most practical use of recycled water from these wastewater treatment plants would be for outdoor watering, primarily on golf courses and other large, landscaped, urban areas. The following sections describe plans of JVWCD and MWDSLS.

Central Valley Water Reclamation Facility Planning. The CVWRF is a regional wastewater treatment facility located at 800 West 3190 South. It services seven local entities, involving three cities and four special improvement districts. Some of the CVWRF member agencies are JVWCD's and MWDSLS's member agencies, as shown in Table 8-17.

TABLE 8-16
Central Utah Project Bonneville Unit
Estimated Return Flows as Sewage Effluent

CUP Water Provided (AF/yr)			Resulting Sewage Effluent (AF/yr)		
CUP Component	**Treated Potable Water**	**Sewage Effluent**	**To CVWRF**	**To SVWRF**	**To SLCRF**
Bonneville Unit M&I System - JVWCD Petition	50,000	15,000	8,000	7,000	0
Bonneville Unit M&I System - MWDSLS Petition	20,000	6,000	2,000	1,000	3,000
ULS – JVWCD Allocation	21,429 (5/7 of 30,000)	6,430	3,000	3,430	0
ULS – MWDSLS Allocation	8,571 (2/7 of 30,000)	2,570	500	500	1,570
Totals	**100,000**	**30,000**	**13,500**	**11,930**	**4,570**

TABLE 8-17
Relationship of CVWRF Member Agencies
To JVWCD and MWDSLS Member Agencies

CVWRF Member Agency	Is CVWRF Member Agency a JVWCD Member Agency?	Is CVWRF Member Agency a MWDSLS Member City?
Cottonwood Improvement District	Partial, in JVWCD water retail delivery system	Partial, in MWDSLS water delivery system
Granger-Hunter Improvement District (GHID)	Yes	No
Kearns Improvement District (KID)	Yes	No
Murray City	Partial, in JVWCD water retail system in newly annexed perimeter of Murray City	Partial, in MWDSLS water system in newly annexed perimeter of Murray City
Salt Lake City Suburban Sanitary District #1	Partial, in JVWCD water retail service area	Partial, in MWDSLS water service area
City of South Salt Lake	Yes	No
Taylorsville-Bennion Improvement District (TBID)	Yes	No

CVWRF recently completed a "Water Reuse Market Feasibility Study". This study considered a tertiary treatment level (filtration) and delivery of recycled sewage effluent to large landscaped parcels, such as golf courses and parks, within the CVWRF member agencies service areas. A transmission system was developed consisting of four main trunk lines. Phase 1 transmission lines include a West Line that would serve parcels in the West Valley City area and a South Line that would serve parcels along the Jordan River in Murray City. The Phase 2 transmission lines include a Southwest Line through the Taylorsville-Bennion Improvement District to the east boundary of the Kearns Improvement District, and a Southeast Line that would serve other east side parcels within Murray City, Cottonwood Improvement District and Salt Lake Suburban Sanitary District #1. The CVWRF on-site facilities would include a new recycled water facility that would provide effluent filtration treatment to a level that would meet the State of Utah Type I reuse classification.

CVWRF concluded in its study that an ultimate quantity of 2,779 acres could be irrigated with a recycling project suitable for large landscaped areas. An annual recycling of 8,799 acre-feet, at a seasonal peak day demand of 31.9 million gallons per day (mgd), would be feasible. The details of the CVWRF study are shown in Table 8-18.

TABLE 8-18
CVWRF Estimated Recycled Water Demand by Member Agency

Member Agency	Irrigated Area (Acres)	Seasonal Demand (AF)	Seasonal Peak Day Demand (mgd)
Cottonwood Improvement District	190	600	2.2
Granger-Hunter Improvement District (GHID)	944	2,990	10.8
Kearns Improvement District (KID)	316 553 Ultimate	1,000 1,750 Ultimate	3.6 6.3
Murray City	628	1,990	7.2
Salt Lake City Suburban Sanitary District #1	128	405	1.5
City of South Salt Lake	0	0	0
Taylorsville-Bennion Improvement District (TBID)	336	1,064	3.8
Total	2,542 2,779 Ultimate	8,049 8,799 Ultimate	29.1 31.9 Ultimate

Utah water law gives preference to retail water distribution agencies being able to own and recycle their sewage effluent. The statute allows for a retail water distribution agency which owns water rights to recycle a portion of that water, within its sewage effluent flow, to service the same lands within its service area and within its original water rights beneficial uses.

JVWCD has estimated the portion of the CVWRF recycling project that could provide recycled water to its member agencies and service area. This amount is estimated to be 6,026 acre-feet per year. It would involve the highest deliveries of recycled water to GHID, TBID, and KID. It would also involve deliveries to JVWCD retail areas within Cottonwood Improvement District, Murray City and Salt Lake City Suburban Sanitary District #1. JVWCD has initiated discussion with CVWRF to pursue a joint effort recycling project.

South Valley Communities Recycling. The South Valley Water Reclamation Facility (SVWRF) serves eight cities in southern Salt Lake County, together with various unincorporated Salt Lake County areas. These communities have formed the Association of South Valley Communities ("South Valley Communities"). Most of the South Valley Communities are also member agencies of JVWCD. Table 8-19 lists these communities.

The South Valley Communities have commissioned a "Preliminary Analysis of Water Reuse" during 2003. This analysis considered the potential for recycling sewage effluent from the South Valley Communities at SVWRF for irrigation of large urban landscaped parcels, such as golf courses and parks. An additional treatment facility at the SVWRF site would deliver treated wastewater appropriate for Utah type I reuse.

The preliminary analysis study identified the current sewage effluent flow rate of the South Valley Communities as 27 mgd. This is an annual average, which has very little seasonal variation. A reliable flow of 25 mgd was identified. The contribution of the cities is shown in Table 8-20.

TABLE 8-19
South Valley Communities and JVWCD Member Agencies

South Valley Communities (Members of SVWRF)	JVWCD Member Agency	MWDSLS Member City
Bluffdale City	Yes	No
Draper City	Yes	No
Herriman City	Yes	No
Midvale City	Yes	Partial
Riverton City	Yes	No
Sandy City	Yes (limited to a contract of 315 AF per year)	Yes
South Jordan City	Yes	No
West Jordan City	Yes	No
Unincorporated Salt Lake County	Partial, in JVWCD retail service areas	Partial, in MWDSLS retail service areas

TABLE 8-20
South Valley Communities Sewage Flows to SVWRF

City	Flow (mgd)
Bluffdale City	0.6
Draper City	3.0
Herriman City	0.2
Midvale City	2.6
Riverton City	2.6
Sandy City	5.7
South Jordan City	3.1
West Jordan City	7.2
Total	25.0

In the preliminary analysis for a project, two project capacities were assumed. The first would have a peak delivery capacity of 10 mgd considered a 1st phase of the project. The second capacity would be 25 mgd. The assumed daily flow rate of recycled water potentially available to each city in SVWRF is shown in Table 8-21.

Two alternative transmission pipeline corridors were studied in this conceptual level preliminary analysis. The Jordan River Corridor Alternative involves a major transmission pipeline extending

southward along the Jordan River. The 1300 West Corridor Alternative involves a major transmission pipeline extending southward along 1300 West Street. Each of these two corridor alternatives involved an analysis of a constant flow rate project and a seasonal variable rate project. Annual delivery amounts and unit costs for the various project alternatives were calculated. Table 8-22 shows these various alternatives, together with construction costs, annual O&M costs, annual recycled water deliveries, and unit costs.

TABLE 8-21
Assumed Daily Sewage Effluent Recycled Flow Requirement for Each SVWRF City

City	Project Capacity	
	10 mgd	25 mgd
	Flow Requirements (mgd)	
Bluffdale City	0.0	3.0
Draper City	0.0	2.0
Herriman City	0.0	0.2
Midvale City	0.0	2.0
Riverton City	3.0	3.8
Sandy City	1.5	2.0
South Jordan City	3.0	4.0
West Jordan City	2.5	8.0
Total	10.0	25.0

TABLE 8-22
South Valley Communities Recycled Water Project Deliveries and Costs

Project Capacity (Source /Delivery Scenario)	Treatment & Transmission Cost		Annual Recycled Deliveries (AF)	Unit Cost ($/AF)
	Construction	Annual O&M		
10 MGD (SVWRF/Constant Rate)	$17,570,000	$360,000	5,600	310
10 MGD (SVWRF/Variable Rate)	$17,570,000	$210,000	3,300	470
25 MGD (SVWRF/Constant Rate)	$37,440,000	$1,000,000	14,000	290
25 MGD (SVWRF/Variable Rate)	$37,440,000	$590,000	8,300	440

The ultimate 25 MGD project alternatives represent the annual recycled water volumes most likely in this project. They range from 8,300 acre-feet to 14,000 acre-feet per year.

JVWCD is participating in the technical and managerial committees which are considering wastewater recycling. The majority of sewage effluent of the South Valley communities involves effluent from JVWCD member agencies and retail service areas. JVWCD estimates that at least 8,300 acre-feet of recycled water will result from its member agencies and service areas.

Magna Wastewater Plant. JVWCD serves Magna Water Company, a water improvement district. In 2002 JVWCD delivered 818 acre-feet. It is projected that JVWCD will commonly deliver at least 1000 acre-feet per year to Magna within the next five years.

Magna Improvement District operates its own sewage treatment plant. JVWCD estimates that at least 350 acre-feet per year of water provided by JVWCD results as sewage effluent at Magna's plant. JVWCD has not held discussions with Magna regarding a potential water recycling project. However, JVWCD anticipates the potential of participating in a water recycling project with Magna in a similar manner as with the CVWRF and SVWRF member agencies.

Projected Sewage Effluent Recycling

JVWCD plans on participating in wastewater recycling projects within its service area, as shown in Table 8-23.

Salt Lake City is presently performing a study to determine the potential for use of their plant effluent for a recycled water supply for various low quality water uses.

These recycled water volumes fall within the wastewater amounts resulting from CUP Bonneville Unit water received and delivered by JVWCD.

TABLE 8-23
Bonneville Unit Projected Wastewater Recycling in JVWCD and MWDSLS Service Area

Wastewater Facility	JVWCD Annual Wastewater Recycling (AF)	MWDSLS Annual Wastewater Recycling (AF)
CVWRF	7,500	1,750
SVWRF	7,500	1,250
Magna	0	0
SLCRF	0	3,000
Total	**15,000 AF**	**6,000 AF**

SUVMWA Plans for Water Recycling

Following appropriate treatment recycling of return flows from M&I water use could contribute to the future water supply of the area. This potential applies equally to M&I return flows from the use of local and SVP waters, and from the use of Bonneville Unit M&I water. In southern Utah County the most likely use of recycled water is the demand for M&I water beyond the ULS planning horizon of the year 2050.

The discussion in the following sections is presented to illustrate the potential amounts of return flow recognizing there are constraints to using this return flow.

Limitations on Use of Return Flows

Any future use of return flows will need to consider the fact that return flows from M&I or temporary irrigation uses in southern Utah County contribute to the water supply of Utah Lake. Any potential impact on the downstream users of Utah Lake waters would need to be fully assessed before the State Engineer would approve the use of the return flow. Another limiting factor regarding Utah water right laws, would be the amount of net consumptive use that would be allowable. Another factor to consider is that return flows from the ULS project that return to Utah Lake are part of the requirements to satisfy the M&I exchange to Jordanelle Reservoir that was briefly discussed in Chapter 3.

Accounting for M&I Return Flows

A distinction is drawn between M&I return flows from the use of local and SVP waters, and return flows from the use of Bonneville Unit M&I water. These two categories of return flow are accounted for differently because the water is supplied under different authorities.

Local Return Flows. Return flows from local and SVP sources that may be reclaimed are subject to local management arrangements. Generally, the wastewater-managing agency would make arrangements for recycling and reuse of this return flow with potential users of the recycled wastewater, under negotiated financial arrangements. The purchasers might be local, county, or federal agencies (e.g., federal purchase of wastewater for wildlife habitat maintenance).

Bonneville Unit Return Flow. The return flows from Bonneville Unit M&I water would return to Utah Lake and become part of the exchange with Jordanelle Reservoir.

Wastewater Treatment Facilities

Wastewater recycling would depend on configuring a wastewater treatment plant to provide sufficient treatment to meet the State quality requirements for the intended uses of the wastewater. With the exception of Santaquin City which uses its treated wastewater for alfalfa irrigation, little of the wastewater in southern Utah County is currently being recycled and reused. This section discusses the existing and proposed wastewater treatment facilities that may provide for wastewater recycling.

Southern Utah County currently has five wastewater treatment plants, which are listed in Table 8-24. Most of the wastewater treated by the existing plants is disposed of in evaporation ponds. On average, the plants in combination are operating at approximately 63 percent of capacity.

Considering the projected growth in the county reported at the beginning of this chapter, it is evident that increases in wastewater treatment plant capacity will be needed in the next decade or two.

TABLE 8-24
Wastewater Treatment Plants in Southern Utah County

Location of Plant	Design Capacity (MGD)	2000 Average Flow (MGD)	2000 Percent of Capacity
Payson	3.0	0.81	50%
Salem	1.25	1.02	82%
Santaquin	0.5	0.3	60%
Spanish Fork	5.0	3.53	70%
Springville	5.2	3.80	73%
Total (MGD)	**14.95**	**9.46**	**63%**
Total (acre-feet)	**16,760**	**10,600**	**63%**

In anticipation of increased future wastewater quantities in southern Utah County, SUVMWA is interested in promoting regionalization of wastewater treatment for reasons of economy and recycling potential. In October 2001, SUVMWA issued a report entitled *Wastewater Regionalization Feasibility Study for Southern Utah Valley Municipal Water Association* (Brown & Caldwell 2001). The report evaluated various alternatives for regionalizing the area's wastewater treatment through the construction of treatment plants at various locations that would serve two or more urban areas in common. The alternative recommended for further investigation featured the construction of three new regional plants, to be located west of Spanish Fork (west of the existing wastewater plant), northwest of Payson, and at the center of Goshen Valley. In addition, the existing Springville wastewater treatment plant would be expanded and upgraded as needed to meet Springville's growing needs. Wastewater from cities not cited in the preceding sentences would be piped to one of the new wastewater plants. Table 8-25 summarizes the locations and capacities of the new plants identified in the report.

This plan described is subject to refinement through the individual decision-making processes of the cities involved. Changes may occur in the locations and capacities of the three new wastewater treatment plants and the expansion of the existing Springville plant. However, the plan portrayed above indicates the potential amounts and locations of municipal wastewater that may become available, which would include the return flow from the use of Bonneville Unit M&I water in southern Utah County.

Table 8-25
Potential Return Flows from Regional Wastewater Treatment Plants for Southern Utah County
(Based on 2001 Feasibility Study. Subject to Consideration by Affected Cities)

Plant Designation	Plant Location	Cities Served	Year 2050	Buildout Design Capacity (MGD)[1]
WWTF 4A	West of Spanish Fork	Spanish Fork, Mapleton	Total M&I Demand Of 88,953 AF	16.2
WWTF 4B	NW of Payson	Payson, Salem, Woodland Hills, Elk Ridge		21.6
WWTF 4C	Goshen Valley	Goshen Valley, Genola		2.1
Springville	Springville	Springville		8.8
Total (MGD)				48.7
Total (acre-ft)			34,711 AF[2]	56,000

1 Source: *Wastewater Regionalization Feasibility Study for Southern Utah Valley Municipal Water Association,* October 2001. (Brown & Caldwell 2001)
2The 34,711 acre-feet is derived as shown in Table 5-18.

Estimation of Unit Rates of M&I Return Flow in Southern Utah County

The M&I return flow discussed here is defined as that which could be collected and conveyed to wastewater treatment plants where it may be treated for reuse. This section deals with 1) estimating what percentage of the M&I water used is collected and conveyed to wastewater treatment plants (WWTPs), and 2) estimating the proportion of wastewater that is CUP water. It should be noted that the estimates described are approximations based on the imprecise information available.

The first item enumerated, wastewater conveyed to treatment plants, stems from the amount of M&I water delivered to municipal users and the percentage of that which is used indoors. The per capita use of M&I water in southern Utah County is estimated to reduce to 220 gallons per capita per day (gpcd) by 2050. As noted there, the 2050 value is based on the application of State requirements for water M&I water conservation, which provide that between 2000 and 2020 per capita water use will be reduced by 12 ½ % through conservation, and then another 12 ½ % between 2020 and 2050 for a total of 25% for the planning period. There is uncertainty about the percentage of the M&I water that would be collected as wastewater and is related to uncertainty in geographic dispersal of growth in the county by 2050. However, a calculation was made for Salt Lake County that produced a value of 41 percent of delivered M&I water collected as municipal wastewater. However, in southern Utah County the plans are for the Bonneville Unit water to be delivered through secondary water systems. The return flow will contribute to the groundwater system and will reappear as water contributed to the water supply of Utah Lake. The return flow percentage for this water is 35% of the water delivered. Therefore a distinction needs to be made between the Bonneville Unit water supply and that supplied locally since the Bonneville Unit water would return to Utah Lake.

Under plan formulation work to date, it has been projected that southern Utah County would receive 30,000 acre-feet of ULS water plus the 1,590 acre-feet of Bonneville Unit currently allocated to communities in SUVMWA's service area. The resulting percentages of CUP and non-CUP water used in 2050, summarized on Table 8-26 on next page, indicate that approximately 23,339 acre-feet of wastewater would return to wastewater treatment plants in southern Utah County in year 2050. Approximately 9,660 acre-feet would be CUP water returned to Utah Lake.

Potential Uses of Recycled Wastewater

Assuming that constraints relating to return flows were resolved, the treated effluent from such plants could be used for the following:

1. Flow into Utah Lake and become a part of the overall Utah Lake water supply,
2. Be used in secondary water systems for some of the areas in southern Utah County;
3. Be used for crop irrigation as part of an exchange for irrigation water from the Spanish Fork River, and
4. Be used for wetlands enhancement in wildlife preserves around the southern boundaries of Utah Lake.
5. Power plant cooling water for new proposed plant in Payson.

The potential uses above would probably require exchange of water rights to offset increased consumption.

TABLE 8-26
Approximate Southern Utah County M&I Return Flow in 2050 and Division Between Non-CUP and CUP Waters
(Units: acre-feet except where noted otherwise)

Element	Attributed to Both Sources	Attributed to Non-CUP Water	Attributed to CUP Water
1. Water Supply Situation in 2050			
M&I water use in 2050 (Table 5-4)	88,953	N/A	N/A
Current M&I water supply	56,925	55,335	1,590
Shortage in 2050 with current supply (Table 5-22)	32,028	N/A	N/A
2. Estimated Return Flow Volume in 2050 (41% of Delivery)			
M&I wastewater to treatment plants in 2050 (41% of 56,925)	23,339	Determined below	Determined below
3. Estimated CUP/Non-Cup Return Flow			
ULS water	32,028	2,028	27,000
Total M&I water supply in 2050	88,953	57,363	27,590
Percentages of non-CUP and CUP water are computed to be approximately:		41%	35%
Approximate division of M&I return flow between non-CUP and CUP water		**23,339**	**9,660**

REVERSE OSMOSIS TREATMENT

Reverse osmosis is a membrane treatment process that removes salt and other contaminants from water. The process is expensive relative to standard water treatment to remove turbidity and biological contaminants. As it becomes necessary to recycle water, or to make use of available brackish water, membrane treatment may need to be included in the treatment of water for M&I use. As noted previously, Public Law 107-366 authorizes the use of Bonneville Unit funding to assist local agencies in developing membrane treatment processes. The JVWCD is currently testing a membrane process for conditioning brackish water unsuitable for M&I use.

Membrane treatment adds cost and complexity to water conditioning for M&I use. Forcing saline water through a membrane requires pressure, which results in added energy costs for treatment plant operation. Research and development efforts are being conducted nationwide to reduce the costs of membrane treatment through improvement in membrane performance and reduction in production costs. Lower pressure membrane processes such as nano-filtration are included in these efforts. Thus, while studies are currently needed on ways to incorporate membrane processes into the water supply management, the costs associated with membrane use will probably reduce during the next decade.

Generally, most of the water subjected to membrane treatment is useable "product water"; the remaining fraction of the water that does not pass through the membrane contains the salt and other contaminants that were "rejected" by the

membrane. The reject stream of water has an increased content of salt and other contaminants. Thus, another requirement of the desalting process is a means of disposing of the reject stream, or brine, from the membrane process. Typical methods of brine disposal are discharge to a saline water body, disposal in evaporation ponds, and deep well injection to unusable groundwater aquifers. The method adopted for each area is typically determined through economic comparisons of available options.

As noted above, and as will be discussed below, the JVWCD has begun a process of evaluating the use of a membrane process to desalt brackish water and, ultimately, to recycle wastewater.

Projected Volume of Yield Using Reverse Osmosis Treatment

Water demand projections and shortages that will result after all existing supplies have been developed will require the treatment of Utah Lake waters. This water will become available as the irrigated lands are converted as discussed above, and as the JVWCD makes use of additional Utah Lake water under other rights presently held or acquired in the future. Utah Lake water is classified as brackish water, with a concentration of total dissolved solids (TDS) projected to average 1,240 ppm under project conditions, which exceeds the allowable salinity of drinking water and the tolerance of landscape vegetation.

Feasibility studies by JVWCD have concluded that water from Utah Lake is expensive to treat for M&I use. Because of the high cost, it is likely that reverse osmosis (RO) treatment plants would be constructed in stages. A significant amount of waste byproduct results from RO treatment and its disposal would be an additional and substantial cost item. JVWCD projects a recovery rate of 75% for producing culinary grade water from the raw feed water delivered to reverse osmosis plants. This is based upon pilot reverse osmosis testing that JVWCD has performed.

The potential amount of water that could become available for RO treatment is estimated to be approximately 66,396 acre-feet. Note that 4,816 acre-feet of this feed water would be deep, brackish groundwater, to which JVWCD has water rights, to supplement irrigation stock from Utah Lake and the Jordan River. Of this feed water amount, it is anticipated that only about 50,000 acre-feet would be realized as product water.

Southwest Groundwater Treatment Project (Low Quality Source). Historic mining practices in southwestern Salt Lake County have created a deep groundwater contaminant plume covering approximately 50 square miles. Contamination includes acidic waters, elevated metals concentrations, and elevated sulfate concentrations. The proposed project combines a CERCLA clean-up response action with a CERCLA natural resource damage settlement to accomplish the following purposes:

1. Remediate the aquifer;
2. Contain and contract the contaminant plume; and
3. Produce a public water supply of approximately 7,000 acre-feet for drinking water

The project will produce potable water by pumping contaminated water from well fields and treating it with a reverse osmosis processes. The potable water will be delivered by the JVWCD through its existing water distribution system to the four communities affected by the contaminant plume, namely West Jordan City, South Jordan City, Riverton City, and Herriman City.

The project depends upon agreements being reached with Kennecott Utah Copper Corporation and with the Utah State Trustee holding the Natural Resource Damage Claim trust fund. The project relies upon a concentrate discharge permit for the reverse osmosis treatment process. These agreements and discharge permits are currently being negotiated by JVWCD. Although it is anticipated that they

will be executed during 2003, substantial difficulties still exist in reaching final agreements and a final permit.

JVWCD Membrane Treatment Of Groundwater Using Its Existing Utah Lake/Jordan River Water Rights (Low Quality Source). The Jordan Valley Water Conservancy District has a goal for purchasing between 50,000 and 70,000 acre-feet of water rights from Utah Lake and the Jordan River. At the present time, JVWCD has purchased 16,735 acre-feet of rights. In addition, JVWCD has negotiated the purchase of 6,000 – 7,000 acre-feet of Jordan River rights, subject to approval of change applications by the State Engineer. The change application has been submitted, and it is anticipated that this acquisition may be completed by JVWCD during 2004. However, substantial difficulties in overcoming protests of other potentially affected parties may exist.

The JVWCD has completed studies to determine the most economical means of utilizing the water available under these existing rights. The most economical strategy is to use the shallow aquifer along the Jordan River as "pretreatment" of the Utah Lake/Jordan River waters to remove suspended matter and particles by means of riverbank filtration. Through a series of shallow riverbank filtration wells the water would then be extracted and treated for culinary use through a demineralization membrane treatment process. This process has been identified as reverse osmosis.

Of the 16,735 acre-feet of current rights, the JVWCD anticipates 2,000-3,000 acre feet will be required to replace Utah County return flows associated with its Welby Jacob Exchange. In addition to this, because of losses associated with the membrane treatment process (e.g. lost through brine disposal), JVWCD anticipates its total usable water supply resulting from the existing Utah Lake rights may be as low as 9,000 acre-feet annually.

JVWCD is pursuing plans to treat between 1,235 acre-feet and 2,300 acre-feet per year as an additional component of the Southwest Groundwater Treatment Project. This will involve extraction of shallow groundwater near the Jordan River by means of 4 – 6 riverbank filtration wells, and demineralization of that water through reverse osmosis treatment. As with the Southwest Groundwater Treatment Project, challenges with the discharge of concentrate from this process will be encountered.

These amounts are presented in Table 8-27 below.

TABLE 8-27
Projected Yield of Converted Agricultural Water Using Reverse Osmosis Treatment (acre-feet)

Raw (Feed) Water Supply	Facility	Volume of Feed Water Treated	Culinary Grade Water Produced [1]	Byproduct Disposal [2]
Current JVWCD stock	Reverse Osmosis Plants	9,000	6,750	2,250
Future Conversion to JVWCD	Reverse Osmosis Plants	52,580	39,638	13,212
JVWCD Deep Brackish Groundwater	Reverse Osmosis Plants	4,816	3,612	1,204
Totals		**66,396**	**50,000**	**16,666**

1 A 75% recovery rate is assumed.
2 25% of feed water will be discharged as a byproduct (concentrate) flow.

CENTRAL UTAH PROJECT COMPLETION PROGRAM

Chapter 9

October 2004

Chapter 9 presents the economic and financial analyses of the Bonneville Unit, including the benefit cost analysis, the project cost allocation, and the repayment obligation determination. Additional details are found in the Financial and Economic (F&E) Appendix. The evaluation in this chapter includes all the authorized features of the Bonneville Unit, whether completed or proposed for completion.

ECONOMIC ANALYSIS

The purpose of the economic analysis is to determine the economic justification of the project, which is a comparison of monetary benefits with monetary costs. It is important to note that not all project benefits can be readily or cost-effectively quantified in monetary values; only those benefits that can be effectively quantified are included in the economic analysis.

BONNEVILLE UNIT BENEFITS

The following paragraphs describe the monetary benefits and how they were determined for each project purpose. Benefits include those for –

- Irrigation;
- Municipal and Industrial (M&I);
- Power Generation;
- Flood Control;
- Fish and Wildlife Enhancement; and
- Recreation;

Irrigation

The project plan has evolved over the years resulting in a shift from irrigation to M&I water. As a result irrigation water makes up a relatively small part of the Bonneville Unit project water supply. Irrigation benefits for the Bonneville Unit, including the Uinta Basin Replacement Project (UBRP), consist of: 1) increases in net farm income resulting from irrigation water developed; and 2) irrigation water conserved under the project. The total annual irrigation benefits for the Bonneville Unit are estimated to be approximately $6.5 million.

Table 9-1: Irrigation Benefits, shows the benefits for each area provided with irrigation water as well as the benefits derived from conservation of irrigation water.

M&I Water Supply

The benefits of M&I water developed by the Bonneville Unit were determined by approximating the cost of the next best alternative to the construction of the Bonneville Unit. In other words, the M&I benefits of the Bonneville Unit are assumed to be equal to or greater than the estimated cost of building a hypothetical all-M&I project that would provide an equivalent amount of water—the single-purpose alternative. The basis for this approach is the assumption that, if the Bonneville Unit had not been undertaken, the affected communities would have developed alternative sources of supply. The specific features included in the single-purpose alternative are described in detail in the F&E Appendix. In addition to the benefits developed by the single purpose alternative, the benefits associated with project M&I water conservation are also included in the total M&I benefits.

Table 9-2: Summary of M&I Water Benefits displays the results of the single-purpose alternative analysis: Cost of the single purpose alternative is estimated to be in excess of $1.4 billion. Total annual benefits are estimated to be $105.0 million per year.

TABLE 9-1
Irrigation Benefits

	Duchesne	Heber - Francis	South Utah County	UBRP	Section 207	Total
Direct Benefits						
Water Supply (AF)	24,400	15,100	14,400	2,500		56,400
Irrigation Benefit (2003)	$62	$82	$115	$62	$50	
Direct Benefit Sub-Total:	**$1,512,800**	**$1,238,200**	**$1,656,000**	**$155,000**		**$4,562,000**
Water Conservation Irrigation Benefits						$50
A. WCWEP						
Water Supply (AF)		23,658				23,658
Benefit		$1,182,900				$1,182,900
B. UBRP						
Water Supply (AF)				5,300		5,300
Benefit				$265,000		$265,000
C. Section 207						
Water Supply (AF)					9,611	9,611
Benefit					$480,550	$480,550
Water Conservation Benefits Sub-Total:	**$0**	**$1,182,900**	**$0**	**$265,000**	**$480,550**	**$1,928,450**
Total Annual Irrigation Benefits (Direct + Water Conservation):	**$1,512,800**	**$2,421,100**	**$1,656,000**	**$420,000**	**$480,550**	**$6,490,450**

Notes
1. Temporary irrigation benefits are based on the irrigation portion of the expected deliveries of irrigation and M&I water to South Utah County over 100 years under Block Notice 7B. A present value analysis of these streams of deliveries resulted in 14,400 AF of the block notice being allocated to irrigation.

2. Per acre-foot benefits for irrigation water conserved under Section 207 are specified in the act at $50 per acre-foot.

TABLE 9-2 M&I Water Supply Benefits	
	Total
Water Supply Benefits	
Investment Costs	
Construction of Single Purpose M&I Alternative	$1,312,196,000
Interest During Construction	$114,094,000
Investment Cost Sub-Total	**$1,426,290,000**
Annual Benefits	
Annual Investment Cost (Amortized for 50 Years @ 5.5 Percent)	$84,238,756
Annual OM&R Cost	$16,669,000
Annual Benefit from Single-Purpose Alternative	**$100,907,756**
Adjustment for Temporary Use of 20,000 AF as Irrigation Water	($1,656,000)
Net Annual Benefit	**$99,251,756**
Conservation Benefits	
Annual Benefits	
Conservation Water Supply (Acre-Feet)	28,832
Conservation Benefit @ $200.00	**$5,766,400**
Total Benefits	
Total (Water Supply Benefit + Conservation Benefit)	**105,018,156**

Power Benefits

Power benefits will derive from two power plants located in the Diamond Fork drainage—the Sixth Water Power Plant and the Upper Diamond Fork Power Plant. Long-term average annual net energy for the two power plants is estimated at 165,157,975 kilowatt-hours (kwh).

Power benefits were developed using a method similar to that used for the M&I benefits. Benefits are based on the costs associated with developing an alternative source for generating and transmitting an equivalent number of kilowatt-hours. The term used for the cost of the alternative source is "avoided cost." In this case, the avoided cost alternative is a hypothetical coal-fired base-load power plant and transmission connection, that would be developed without federal assistance and financed at 5.5 percent. Capacity costs for the alternative plant were estimated to be $187 per kilowatt. On average, these plants operate about 65% of the time. Therefore, the capacity costs expressed on a kilowatt-hour basis are 32.8 mils/kwh. Energy costs were estimated at 12.5 mils/kwh. The composite value for both capacity and energy is 45.3 mils/kwh. Power benefits are estimated at $7.5 million annually and are detailed in Table 9-3: Annual Power Benefits.

Water Supply for Instream Flows. In this analysis, no monetary benefits were computed for providing instream flow water.

Flood Control. Flood control benefits are based on U.S. Corps of Engineers estimates of possible flood control damage that will be avoided by the construction of the Bonneville Unit. These benefits are provided by Jordanelle and Starvation Reservoirs. In addition, benefits will occur around the perimeter of Utah Lake and along the Jordan River through the combined operation of these facilities. The current estimate of flood control benefits is $1.4 million annually.

Fish and Wildlife Enhancement. Fish and wildlife benefits are based on the increased opportunity for public fishing and hunting created by the project. They are based on the estimated number of annual daily visits to project reservoirs or enhanced streams for hunting and fishing. To arrive at the value of the benefit, the number of visits is multiplied by the estimated value (in dollars) of a day hunting or fishing. Table 9-4: Fish and Wildlife Benefits summarizes the fish and wildlife benefits based on a per-day, per-person value of $35.35. Total annual fish and wildlife benefits reach $16.3 million.

TABLE 9-3
Annual Power Benefits

	Unit of Measure	Sixth Water Power Plant	Upper Diamond Fork Power Plant	Total
Capacity				
Installed Capacity	Kilowatt (kw)	45,000	5,000	50,000
Energy				
Annual Net Energy	Kilowatt–hours (kwh)	134,284,298	30,873,667	165,157,965
Composite Power Value	mils/kwh	45.3	45.3	
Total Power Benefits	**$**	**$6,083,079**	**$1,398,577**	**$7,481,656**

TABLE 9-4
Annual Fish and Wildlife Benefits

Feature	Number of Days: Without Project	Number of Days: With Project	Number of Days: Project Increase	Value Per Day	Total Annual Benefit
Bonneville Unit					
Upper Stillwater Reservoir (a)	0	14,200	14,200	$ 35.35	$ 501,970
Midview Reservoir	3,000	21,000	18,000	$ 35.35	$ 636,300
Starvation Reservoir	0	26,500	26,500	$ 35.35	$ 936,775
Currant Creek (above Reservoir)	500	2,500	2,000	$ 35.35	$ 70,700
Currant Creek Reservoir	0	47,500	47,500	$ 35.35	$ 1,679,125
Strawberry Reservoir	207,600	300,000	92,400	$ 35.35	$ 3,266,340
Upper Provo Reservoirs	135,000	200,000	65,000	$ 35.35	$ 2,297,750
Jordanelle Reservoir	0	90,700	90,700	$ 35.35	$ 3,206,245
Sixth Water Creek	906	12,111	11,205	$ 35.35	$ 396,097
Diamond Fork River	1,402	20,703	19,301	$ 35.35	$ 682,290
Spanish Fork River (below confluence with Diamond Fork)	4	7,088	7,084	$ 35.35	$ 250,419
Lower Provo River	127,958	164,300	36,342	$ 35.35	$ 1,284,690
Total Fishing Benefits Bonneville Unit			**430,232**		**$ 15,208,701**
Uinta Basin Replacement Project					
Stabilization of High Mountain Lakes (b)					$ 403,700
Instream Flows					
Moon Lake Reservoir to Big Sand Wash Feeder Diversion			7,300	$ 35.35	$ 258,055
Yellowstone River to the Confluence of the Lake Fork River			6,000	$ 35.35	$ 212,100
Big Sand Wash Reservoir Enlargement			5,000	$ 35.35	$ 176,750
Total Fishing Benefits UBRP			**18,300**		**$ 1,050,605**
Project Total					**$ 16,259,306**

a - The $35.35 was computed from the 2001 Nation Survey of Fishing, Hunting and Wildlife Associated Recreation Utah, March 2003, published by the Department of the Interior and Department of Commerce. The amount was indexed from $33.00 using the June 2004 CPI.
b - Indexed from $367,000 using the June 2004 CPI.

Recreation Benefits

Recreation benefits are based on the increased opportunity for public recreation at Bonneville Unit Reservoirs. Benefits have been estimated based on the value of a day spent in recreation at each facility; these values were developed in coordination with the U.S. Forest Service (USFS) and the Utah Division of Parks and Recreation. Figure 9-5: Recreation Benefits summarizes recreation benefits at each facility. Total annual recreation benefits are $11.5 million.

Highway Improvement

The need to relocate roads and highways in order to construct project facilities will result in the upgrading of older sections of roads to current standards. In this analysis, no monetary benefits are ascribed to such highway improvements, which have been and will be completed with project funds.

Total Benefits

Table 9-6: Summary of Project Benefits includes the annual benefits generated by each project purpose. Total Bonneville Unit monetary benefits are estimated to exceed $148.2 million per year. The total annual benefits will be used in the benefit cost analysis.

Intangible Benefits

Other benefits will occur for which no monetary values have been claimed. For example, the security of knowing that clean, dependable water will be available in the future is a considerable public benefit. Also, the security of flood protection for those who are downstream of the major project features provides intangible benefits.

TABLE 9-5
Recreation Benefits

Feature	Recreation Days	Value	Total Annual Benefit
Upper Stillwater Reservoir	40,200	$8.27	$332,454
Currant Creek Reservoir	41,500	$8.27	$343,205
Strawberry Reservoir	694,000	$8.27	$5,739,380
Starvation Reservoir	56,000	$8.27	$463,120
Jordanelle Reservoir	475,000	$8.27	$3,928,250
Upper Provo River Lakes (New)	16,500	$8.27	$136,455
Upper Provo River Lakes (Enhanced)	45,700	$1.25	$57,125
Diamond Fork System	60,400	$8.27	$499,508
Total:	**1,429,300**		**$11,499,497**

Table 9-6
Summary of Project Benefits

	Area	Acre-Feet	Benefit/AF	Total
Irrigation				
Block Notice 1	Duchesne County	21,400	$62.00	$1,326,800
Block Notice 1A	Summit County	3,000	$82.00	$246,000
Block Notice 1A	Wasatch County	12,100	$82.00	$992,200
Block Notice 1B	Duchesne County	3,000	$62.00	$186,000
Temporary Irrigation Water	South Utah County	14,400	$115.00	$1,656,000
Block Notice UBRP 1	Duchesne County	2,500	$62.00	$155,000
WCWEP Water Conservation		23,658	$50.00	$1,182,900
UBRP Water Conservation		5,300	$50.00	$265,000
Other Water Conservation		9,611	$50.00	$480,550
Irrigation Sub-Total:				**$6,490,450**
M&I				
Water Supply				$99,251,756
Other Water Conservation				$5,766,400
M&I Sub-Total:				**$105,018,156**
Power				**$7,481,656**
Fish and Wildlife				**$16,259,306**
Recreation				**$11,499,497**
Flood Control				**$1,417,282**
Total:				**$148,166,347**

BONNEVILLE UNIT COSTS

The costs included in this economic analysis are: construction costs; interest during construction (IDC); Operation, Maintenance, and Replacement (OM&R) costs; and the Bonneville Unit's prorated share of the cost of the Colorado River reservoirs constructed under the Colorado River Storage Project (CRSP). All Bonneville Unit costs are summarized in Table 9-7: Summary of Bonneville Unit Costs.

Construction Cost

Construction of the Bonneville Unit is based on two Congressional authorizations that differ in their requirements for cost sharing and repayment. The Bureau of Reclamation (USBR) initiated construction in 1965 under the Colorado River Storage Project Act (PL 84 - 485) (CRSPA) which authorized full federal funding. In 1992, CUPCA authorized the District to complete the Bonneville Unit and added local cost sharing provisions. Consequently the Bonneville Unit construction costs are divided into two categories for this analysis--"USBR costs" and "CUPCA costs". The cost categories are defined as follows:

USBR Costs. These are federal expenditures for facilities authorized under CRSPA, all of which are substantially complete. No local cost sharing provisions apply to these expenditures.

CUPCA Costs. These are expenditures authorized under CUPCA for the completion of the Bonneville Unit. These costs have and will continue to be funded through federal appropriations and local cost share. The District is the lead construction agency.

The CRSPA created two additional funding sub-categories which apply to both USBR and CUPCA expenditures—Section 5 and Section 8.

Section 5 costs are for multipurpose features such as dams and reservoirs and for specific facilities such as canals and laterals. Section 5 costs are allocated to all Bonneville Unit purposes except recreation. Section 5 costs may be reimbursable or non-reimbursable depending on the project purpose to which they are allocated. Section 8 costs are for specific recreation and fish and wildlife facilities. They are non-reimbursable.

Expenditures authorized by CUPCA are divided into the following subcategories that relate to sections or subsections of CUPCA.

a. *Section 202 Costs (CUPCA).* These costs are for system facilities such as the Diamond Fork Pipeline, Utah Lake System, and WCWEP/DRP. With only minor exceptions, Section 202 costs were designated as Section 5 costs by CUPCA. Other Section 202 costs are for special studies that are required by CUPCA.

b. *Section 203 Costs (CUPCA).* These are the costs of implementing the Uinta Basin Replacement Project (UBRP), which consists of enlarging the Big Sand Wash Dam, restoring several high mountain lakes, and constructing pipelines and a diversion structure. Section 203 costs were designated as Section 5 or Section 8 costs by CUPCA.

c. *Section 206 Costs (CUPCA).* Section 206 authorizes certain counties not receiving project water to submit proposals for federal funds for construction of local water projects.

d. *Section 207 Costs (CUPCA).* These are water conservation costs and are treated as Section 5 costs. As stipulated in CUPCA, Section 207 costs are only allocated to irrigation and M&I purposes.

e. *Title III Costs (CUPCA).* These costs result from the mitigation and improvement of fish and wildlife habitats both in and out of the Bonneville Unit area. Generally, Title III costs are Section 8 costs allocated to either fish and wildlife or recreation.

f. *Title IV Costs (CUPCA).* These costs are associated with the Utah Reclamation Mitigation and Conservation Commission (Mitigation Commission), including the expenditures from the conservation fund that it administers. Sources of funding include the Federal Government, the State of Utah, the Central Utah Water Conservancy District (District), and the Western Area Power Administration. These costs are designated as Section 8 costs by CUPCA.

g. *Title V Costs (CUPCA).* Title V are costs associated with the Ute Indian Rights Settlement. In accordance with CUPCA, they are Section 5 costs.

Table 9-7:
Summary of Bonneville Unit Costs

FEATURE		Construction Costs	Interest During Construction (3.125 Percent)	Annual O&M&R
USBR SECTION 5 COSTS				
STARVATION COLLECTION SYSTEM				
Starvation Dam		$ 22,536,505	$ 19,457,314	$ 126,296
Duchesne Canal Rehab.		$ 37,883,920	$ -	$ -
Taylor Canal Drains		$ 1,798,272	$ -	$ -
Subtota		**$ 62,218,697**	**$ 19,457,314**	**$ 126,296**
STRAWBERRY AQUEDUCT & COLLECTION SYSTEM				
Upper Stillwater Dam		$ 247,353,876	$ 46,848,947	$ 268,700
Current Creek Dam		$ 30,303,928	$ 10,227,481	$ 101,678
Soldier Creek Dam		$ 51,708,000	$ 7,223,826	$ 114,955
Strawberry Aqueduct & Collection System		$ 266,036,397	$ 64,959,223	$ 310,608
Subtota		**$ 595,402,201**	**$ 129,259,477**	**$ 795,941**
M&I SYSTEM				
Jordanelle Dam		$ 356,705,956	$ 102,636,471	$ 218,565
Upper Provo River Reservoirs		$ 7,789,326	$ -	$ 19,022
Jordan Aqueduct System		$ 97,923,050	$ 23,540,420	$ 150,163
Jacob Welby Water Rights		$ 66,865	$ -	$ -
Subtota		**$ 462,485,197**	**$ 126,176,891**	**$ 387,750**
DIAMOND FORK SYSTEM				
Syar Tunnel		$ 76,405,796	$ 20,607,713	$ 27,048
Sixth Water Aqueduct		$ 35,664,601	$ 10,117,691	$ 79,834
Discontinued Power Investigations		$ 12,595,512	$ -	$ -
Diamond Fork Pipeline		$ 2,117,315	$ 5,791,688	
Subtota		**$ 126,783,224**	**$ 36,517,092**	**$ 106,882**
OTHER COSTS				
Irrigation Abandoned Investigations		$ 31,432,520	$ -	$ -
Service Facilities		$ 7,953,111	$ -	$ -
Utah Lake Water Rights		$ 71,036	$ -	$ -
O&M Not Associated with Features		$ -	$ -	$ 340,487
Subtota		**$ 39,456,667**	**$ -**	**$ 340,487**
T OTAL USBR SECTION 5 COSTS		**$ 1,286,345,986**	**$ 311,410,774**	**$ 1,757,356**
USBR SECTION 8 COSTS				
Recreation Facilities		$ 61,564,400		$ 5,458,000
Fish and Wildlife Facilities		$ 23,373,000		$ 413,000
TOTAL USBR SECTION 8		**$ 84,937,400**	**$ -**	**$ 5,871,000**
TOTAL USBR SECTIONS 5&8		**$ 1,371,283,386**	**$ 311,410,774**	**$ 7,628,356**
CUPCA SECTION 5 COSTS	**Sections**			
Title II				
Utah Lake System	201(a)(1)			
ULS Planning and NEPA (I&D, SFN, ULS)		$ 32,659,121		
Spanish Fork Flow Control Structure		$ 6,269,158		$ 30,000
Spanish Fork Canyon Pipeline		$ 60,003,743	$ 2,343,896	$ 20,000
Spanish Fork Provo Reservoir Canal Pipeline		$ 91,242,507	$ 4,847,258	$ 70,000
Spanish Fork - Santaquin Pipeline		$ 99,380,508	$ 4,192,615	$ 40,000
Mapleton Springville Lateral Pipeline		$ 28,179,804	$ 440,309	$ 10,000
Santaquin - Mona Pipeline		$ 18,077,632	$ 282,463	$ 10,000
North Utah County 207 Projects		$ 60,000,000		
Sixth water Power Plant		$ 33,830,454	$ 1,316,815	$ 1,850,000
Upper Diamond Fork Power Plant		$ 6,793,073	$ 105,673	$ 316,000
Subtotal ULS Features		**$ 436,436,000**	**$ 13,529,030**	**$ 2,346,000**
Conjunctive Use	202(a)(2)	$ 19,854,000		
Wasatch County Efficiency Study	202(a)(3)(A)	$ 1,092,000		
Wasatch County Efficiency Project	202(a)(3)(B)	$ 18,497,000	$ 982,577	$ 359,000
Utah Lake Salinity Control	202(a)(4)	$ 2,130,000		
Diamond Fork System 202(a)(6)	202(a)(6)	$ 147,574,000	$ 17,524,413	$ 260,000
UBRP 203	203(a)	$ 63,825,000	$ 1,975,000	$ 47,000
Local Development Options 206	206	$ 10,943,000	$ -	$ -
Studies, Reports, Coordinated Operations	207(e)	$ 6,632,000		
Water Conservation Credit Program 207	207(e)(2)	$ 180,198,000	$ -	
Title II Sub-Total:		**$ 887,181,000**	**$ 34,011,019**	**$ 3,012,000**
Title III				
Lease of Daniels Creek Water Rights	303(b)	$ 8,595,000		
Title V				
Ute Indian Water Rights Settlement	504, 505, 506	$ 240,034,000	$ -	
Indian Ford Exchange		$ 11,044,000		
TOTAL CUPCA SECTION 5		**$ 1,146,854,000**	**$ 34,011,019**	**$ 3,012,000**
CUPCA SECTION 8 COSTS				
Fish and Wildlife				
Section 201		$ 39,588,000		
Title II				
Spanish Fork Pipeline	302 (a)	$ 7,959,106		
Spanish Fork PRC Pipeline	302 (a)	$ 39,621,661		
Provo River Studies	202 (a) (5)	$ 2,098,000		
Uinta Basin Replacement Project	203 (a)	$ 15,489,000		
Diversion on Duchesne + Strawberry R.	203 (a) (5)	$ 4,111,000		
Title II Sub-Total:		$ 69,278,767		
Title III				
Spanish Fork Pipeline	302(a)	$ 4,657,490		
Spanish Fork PRC Pipeline	302(a)	$ 9,041,010		
Other Title III		$ 173,928,500		
Title III Sub-Total:		$ 187,627,000		$ 500,000
Title IV Mitigation and Conservation		$ 131,276,000		$ -
Total Section 8 Fish and Wildlife		**$ 427,769,767**	**$ -**	**$ 500,000**
Title III Recreation		$ 4,636,000		$ -
TOTAL CUPCA SECTION 8		**$ 432,405,767**		**$ 500,000**
TOTAL CUPCA SECTION 5 & 8		**$ 1,579,259,767**	**$ 34,011,019**	**$ 3,512,000**
TOTAL SECTION 5 (USBR & CUPCA)		**$ 2,433,199,986**	**$ 345,421,792**	**$ 4,769,356**
TOTAL SECTION 8 (USBR & CUPCA)		**$ 517,343,167**	**$ -**	**$ 6,371,000**
TOTAL BONNEVILLE UNIT		**$ 2,950,543,153**	**$ 345,421,792**	**$ 11,140,356**

Interest During Construction

As a project cost, IDC represents the economic cost of capital invested in the Bonneville Unit between initiation of construction and the first year of water delivery, at which time reimbursable costs become interest bearing under repayment contracts. For planning purposes, IDC is calculated at the project planning rate (3.125%). For repayment purposes, it is calculated at the project repayment rate (3.222%). For additional information on the calculation of IDC, please see the F&E Appendix.

OM&R Costs

Annual OM&R costs are expenditures for materials, labor, and supplies necessary to operate and maintain the Bonneville Unit and expenditures to replace equipment that has an expected service life of less than 100 years.

Bonneville Unit Proportion of CRSP Reservoirs

A large holdover storage capacity is required to enable the upper Colorado River Basin to use its Colorado River Compact-apportioned share of Colorado River water. This storage capacity is provided by reservoirs such as Glen Canyon, Flaming Gorge, Aspinall, and Navajo Dams. For economic evaluation, an equitable portion of the cost of these storage reservoirs is assigned to each participating project that will deplete the flow of the Colorado River and thereby benefit from the reservoirs. The CUP will deplete the Colorado River flow by an average of 139,760 acre-feet annually. Based on the assigned annual depletion cost of $2.00 per acre-foot, a cost of $279,520 annually is assigned to the Bonneville Unit. This cost is used only to compute the benefit-cost ratio; no repayment is required.

BENEFIT-COST RATIO

The benefit-cost ratio is a comparison of the annual project benefits and costs made by dividing the benefits by the costs. The result is expressed as a ratio. The annual benefits were previously summarized in Table 9-6: Summary of Project Benefits. Costs are summarized in Table 9-7: Project Costs. In this analysis, the benefit cost ratio is calculated in the following two ways.

Basic Analysis

Under the basic analysis approach, annual project construction costs and IDC are computed using the project planning rate authorized for the Central Utah Project—the federal rate that was in effect when the project was authorized. The project planning rate is 3.125 percent.

Principles and Guidelines Analysis

Section 205 (e) of CUPCA requires that the Supplement to the DPR include economic analyses consistent with the Water Resource Council's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (P&G), dated March 10, 1983. In compliance with this CUPCA provision, the P&G Analysis includes annual construction costs and IDC computed at 5.625 percent—the current P&G rate.

B/C Ratio

The benefit cost ratio is 1.27 when computed at the project planning rate and 0.71 at the P&G rate. Table 9-8: Benefit Cost Analysis shows the computation of the ratio at both rates.

TABLE 9-8
Benefit Cost Analysis

Item	Project Interest Rate 3.125%		P&G Planning Rate 5.625%	
Investment Costs				
Project Construction Cost	$ 2,950,543,153		$ 2,950,543,153	
Interest During Construction	$ 345,421,792		$ 621,759,226	*b*
Total Investment Costs	$ 3,295,964,945		$ 3,572,302,379	
Less Nonproject Costs				
Highway Improvement	$ 86,535,113	a	$ 101,764,638	*c*
Preauthorization Investigation Cost	$ 1,173,000		$ 1,173,000	
Investment Costs for B/C analysis	$ 3,208,256,833		$ 3,469,364,741	
Annual Costs				
Annual Equivalent	$ 105,102,152		$ 195,975,011	
Annual OM&R	$ 11,140,356		$ 11,140,356	
Cost of CRSP Regulatory Facilities				
139,760 AF Depletion @ $2.00	$ 279,520		$ 279,520	
Total Annual Costs	$ 116,522,028		$ 207,394,887	
Annual Benefits	$ 148,166,347		$ 148,166,347	
Benefit - Cost Ratio	**1.27**		**0.71**	
Net Annual Benefits	$ 31,644,318		$ (59,228,540)	

a-Includes $66,115,000 of construction cost and $20,471,213 of interest during construction
b- IDC at 3.125% interest adjusted to 5.625%. Factor 1.8
c- Includes $66,115,000 of construction cost and $35,738,850 of IDC at 5.625% interest

FINANCIAL ANALYSIS

The objective of the financial analysis is to allocate costs among project purposes and to determine the repayment obligations as required by CRSPA and CUPCA.

Allocation of Project Costs

Cost allocation is the process by which the costs of the Bonneville Unit are distributed efficiently and equitably among project purposes. The project purposes to which costs were allocated are: irrigation, M&I water, power, instream flows, flood control, fish and wildlife (including enhancement and mitigation), recreation, and highway improvements. The overlaying of Congressional authorities for construction of the Central Utah Project (construction was begun under CRSPA and will be completed under CUPCA) has created a complex cost allocation and repayment landscape

Cost Allocation Methodology

The cost allocation methodology for this Supplement to the 1988 DPR is different from that used in previous financial analyses of the Bonneville Unit; earlier analyses used the Separable Cost-Remaining Benefits (SCRB) method. Section 211 of CUPCA requires that the methodology be prescribed by the Comptroller General of the United States "not later than one year after the date of enactment of the Act." (Section 211 of CUPCA was amended by Public Law 104-316 to transfer the responsibilities of the Comptroller General to the Inspector General of the Department of the Interior.) This requirement was met when directions received from the General Accounting Office (GAO) recommended that the methodology for analysis under CUPCA be similar to that suggested for the Central Valley Project of California—the Use of Facilities (UOF) method.

The UOF method allocates specific costs to project purposes and assigns joint costs by

facility to project purposes according to use. Remaining joint costs are assigned according to the same percentage as the project-wide total of specific and assigned costs. Assigned costs are based on the delivery capacity of conveyance systems and the capacity and/or yield of storage facilities.

In this cost allocation, Bonneville Unit costs were allocated through the following series of steps.

a. Cataloging project costs by authorization, funding source, and feature/program;

b. Allocation of costs authorized under Section 8 of CRSPA;

c. Identification and deduction of costs attributable to a single purpose (specific costs);

d. Allocation of costs attributable to two or more purposes that could be divided on the basis of proportionate use of the facility (assigned joint costs).

e. Identification and allocation of remaining costs not clearly attributable to one or more project purposes (remaining joint costs).

f. Division of remaining joint costs among project purposes in proportion to the combined specific and assigned joint costs determined in steps c and d.

g. Summarizing of allocated costs (the cost allocated to each project purpose is the sum of the specific costs, assigned joint costs, and remaining joint costs).

Use of Facilities Principles Applied in the Allocation

The following UOF principles or approaches were employed in this cost allocation of the Bonneville Unit. Some of these may be departures from standard procedures but justification for those departures has been included in the discussion below. A detailed description of these principles (including examples) is contained in the F&E Appendix.

a. *Trace All Water Deliveries to Origin.* This means that each block of water has been fully traced up the system from the point at which it is delivered to the initial facilities that developed it. Along that full path, each block of water picks up its appropriate proportion of the costs of each facility that developed, stored, or conveyed it.

b. *Multiple Counting of Water Delivered for Multiple Purposes.* Because project water is delivered for non-consumptive uses (primarily in-stream flows and power generation), a single block of water may be delivered for multiple uses in the system. To assure full weight is given to each purpose, the same block of water may appear more than once—allowing costs to be accrued to both its non-consumptive and consumptive uses.

c. *Allocate Water That Serves Pre-Existing Rights to the Assigned Joint Costs of Associated Facilities.* There were interests in water that existed on streams and in reservoirs that are affected by the Bonneville Unit prior to the construction of the Bonneville Unit. In order to be able to construct and operate the project, it was necessary that the project be designed to accommodate these pre-project interests in water.

Because project facilities are used in meeting or compensating for these pre-project rights, it is appropriate that costs be allocated to those rights under a UOF approach. The meeting of these pre-project rights is a precondition for being able to build and operate the project. From this point of view, it is appropriate that these uses of facilities be allocated to remaining joint costs. However, a more precise approach requires that these uses be viewed as a precondition for building and operating certain facilities (as opposed to the entire project). This more precise point of view is the one that has been adopted for this cost allocation. As a result, the use of facilities to meet these pre-project rights has been allocated in the same proportion as the facilities that were made possible by serving

those pre-existing rights. In other words, these uses of facilities are allocated in the same proportion as the assigned joint costs for the facility for which serving the pre-project rights was a pre-condition of construction.

For example, the 61,000 AF of yield in Soldier Creek Dam and Reservoir for the Strawberry Valley Project is allocated in the same proportion as assigned joint costs for Soldier Creek Dam and Reservoir, because providing the 61,000 AF was a precondition for building and operating that facility.

d. *Limit Power Allocation to Power's Marketability.* If the first two principles (tracing all water deliveries back to their origin and multiple counting of water delivered for multiple purposes) were applied in allocating costs to power, the power allocation would exceed $540.3 million in construction and IDC costs. (Full allocation is based on average annual flows through the power plants of over 94,000 acre-feet annually.) When the 94,000 acre-feet are traced back through the system and are assigned joint costs in their full proportion, power is infeasible; the resulting energy values are too expensive to market.

Consequently, a modified UOF approach has been applied to the power allocation. Under this approach, the costs allocated to power have been limited to the total expected revenue and credits for power from all sources. In other words, the cost allocation will ensure that revenue and credits generated from power will equal power's costs.

This modified UOF approach to power is justified by the fact that inclusion of power in the project enhances the project's benefit/cost ratio, making the project more efficient. Also, power shares in joint costs. This reduces the costs allocated to other purposes. A comparative cost/benefit analysis of the project with and without power is included in Chapter 7 of the Power Appendix.

e. *Allocate Costs to South Utah County Temporary Irrigation Water.* The ULS provides a block of 30,000 acre-feet to south Utah County. This water may not be available and/or used by the cities in south Utah County until 2025. Hence, there will continue to be an opportunity for delivery of temporary irrigation water to south Utah County until approximately 2025. Delivery of a portion of this temporary irrigation water began in 1992.

Under this arrangement, this block of water for south Utah County will serve two purposes. To reflect this dual use of this project water, the 30,000 acre-feet has been distributed in this allocation between irrigation and M&I using a present value analysis. The analysis weights these streams of deliveries to irrigation and M&I, discounting them using the project interest rate of 3.222 percent. The result is irrigation being weighted at 47.97 percent and M&I at 52.03 percent.

These percentages allow the 30,000 acre-foot block of water to be distributed among irrigation (14,400 acre-feet) and M&I (15,600 acre-feet). As a result, in the cost allocation, this block is divided into a 14,400 acre-foot irrigation block and two M&I blocks totaling 15,600 acre-feet.

In keeping with the other UOF principles in this allocation, both the irrigation block and the M&I blocks are traced to their origin and each block collects its proportional amount of assigned joint costs along the way. Repayment implications of this treatment of the temporary irrigation water are fully discussed in Chapter 7 of the Financial and Economic Appendix.

f. *Minimize Remaining Joint Costs.* One objective of the allocation was to minimize the allocation to remaining joint costs. A proportionally large allocation to remaining joint costs may be an indication of a failure to fully dissect and analyze the actual uses of facilities. In the allocation, remaining joint costs have been kept to less than one percent of assigned joint costs. This was accomplished in two ways: first, by carefully considering the uses of facilities; and, second, by applying the principle of allocating the use of facilities for serving pre-project rights to the assigned joint costs of the specific facility instead of to full-project remaining joint costs.

Summary of Cost Allocation

The result of following the seven steps for cost allocation and the six principles (see above) is the allocation of both Section 5 and Section 8 project costs described in Table 9-9: Summary of Cost Allocation. A full description of the cost allocation process and results is contained in the F&E Appendix.

Repayment of Reimbursable Project Costs

After the completion of the allocation of costs, the analysis takes the following steps to transform the costs as allocated into the amounts subject to repayment:

1. Dividing reimbursable and non-reimbursable purposes;
2. Computing and deducting local cost share from reimbursable costs; and
3. Making authorized adjustments to reimbursable costs.

After producing the amounts subject to repayment, the analysis then determines the repayment obligations associated with irrigation, M&I, and power costs.

1. Division between Reimbursable and Non-Reimbursable Purposes

Expenditures authorized under Section 8 of CRSPA are for specific fish and wildlife (F&W) or recreation facilities. Section 8 costs are non-reimbursable.

TABLE 9-9
Summary of Cost Allocation

Project Purpose	Construction Cost	Interest During Construction	Total Construction and IDC	Annual OM&R
Flood Control	$39,736,976	$11,326,321	$51,063,298	$36,443
Fish and Wildlife	$700,231,251	$120,933,683	$821,164,934	$842,977
Highway Improvement	$66,115,000	$20,420,113	$86,535,113	$0
Irrigation	$356,924,313	$35,477,238	$392,401,551	$558,941
M&I Water	$1,131,463,952	$145,738,999	$1,277,202,951	$1,053,954
Power	$138,728,494	$22,247,488	$160,975,981	$2,277,041
Subtotal Section 5	**$2,433,199,986**	**$356,143,842**	**$2,789,343,828**	**$4,769,356**
Section 8	$517,343,167	$0	$517,343,167	$6,371,000
TOTAL Sections 5 & 8	**$2,950,543,153**	**$356,143,842**	**$3,306,686,995**	**$11,140,356**

Expenditures authorized under Section 5 of CRSPA are for water supply and power facilities. Whether expenditures of Section 5 funds are reimbursable depends on the purpose for which the funds were expended. In general, Section 5 costs allocated to the following purposes are reimbursable:

- irrigation construction (reimbursed without interest);
- municipal and industrial (M&I) (reimbursed with interest); and
- commercial power (reimbursed with interest).

Section 5 purposes for which reimbursement is not required are:

- F&W (including in-stream flows);
- flood control;
- highway improvement; and
- irrigation interest.

2. Computation and Deduction of Local Cost Share

Section 204 of CUPCA requires that non-reimbursable CUPCA costs be subject to local cost share requirements. Under this provision, the District is required to expend its proportion of total CUPCA costs concurrently with the expenditure of the Federal Share. The local cost share requirement only applies to costs allocated to reimbursable purposes. In general, the local cost share requirement for design, engineering, and construction costs is 35 percent. The requirement for studies and environmental compliance documents is 50 percent.

Table 9-10: Summary of Local Cost Share and Federal Obligation, shows the deduction of local cost share from reimbursable project costs--irrigation, M&I, and power. (It is important to note that for cost allocation IDC is calculated at the planning rate—3.125 percent. For repayment, it is calculated at the repayment rate—3.222 percent.)

3. Adjustments to Costs Subject to Repayment

The application of the following adjustments results in the final costs which are subject to repayment.

Irrigation: Non-Reimbursable Abandoned Investigations. Irrigation Abandoned Investigations were funded through Reclamation appropriations. They include all costs associated with planning of irrigation features that did not result in construction. These costs have been allocated 100 percent to irrigation. CUPCA Section 201 (b) states "all amounts previously expended in planning and developing the projects and features described in this subsection including amounts previously expended for investigation of power features in the Bonneville Unit shall be considered non-reimbursable and non-returnable." The amount that has been determined to be non-reimbursable is approximately $9.0 million.

Power: Non-Reimbursable Abandoned Investigations. Discontinued Power Investigations were funded through Reclamation appropriations. They include costs associated with planning of power generation that did not result in construction. These costs have been allocated 100 percent to power. These costs ($12.6 million) are non-reimbursable under CUPCA Section 201 (b).

TABLE 9-10
Summary of Local Cost Share and Federal Share

	Construction	IDC	Total Investment (Construction + IDC)	Local Cost Share	Net Investment (Total Investment - Local Cost Share)	Statutory and/or Other Adjustments	Reimbursable Net Investment	Non-Reimbursable Net Investment
Section 8 Costs								
Flood Control	$39,736,976	$11,326,321	$51,063,298	$0	$51,063,298	$0	$0	$51,063,298
Fish and Wildlife	$700,231,251	$120,933,683	$821,164,934	$0	$821,164,934	$0	$0	$821,164,934
Highway Improvement	$66,115,000	$20,420,113	$86,535,113	$0	$86,535,113	$0	$0	$86,535,113
Irrigation IDC	$0	$35,477,238	$35,477,238	$0	$35,477,238	$0	$0	$35,477,238
Irrigation Construction	$356,924,313	$0	$356,924,313	$48,214,831	$308,709,482	$9,696,772	$299,012,710	$0
M&I	$1,131,463,952	$145,738,999	$1,277,202,951	$172,060,375	$1,105,142,576	$10,740,000	$1,094,402,576	$0
Power	$138,728,494	$22,247,488	$160,975,981	$15,524,980	$145,451,002	$12,596,000	$132,855,002	$0
Sub-Total - Section 5:	**$2,433,199,986**	**$356,143,842**	**$2,789,343,828**	**$235,800,185**	**$2,553,543,643**	**$33,032,772**	**$1,526,270,288**	**$994,240,583**
Section 5 Costs								
Fish and Wildlife	$451,142,767	$0	$451,142,767	$0	$451,142,767	$0	$0	$451,142,767
Recreation	$66,200,400	$0	$66,200,400	$0	$66,200,400	$0	$0	$66,200,400
Sub-Total - Section 8:	**$517,343,167**	**$0**	**$517,343,167**	**$0**	**$517,343,167**	**$0**	**$0**	**$517,343,167**
Total-Sections 5 and 8:	**$2,950,543,153**	**$356,143,842**	**$3,306,686,995**	**$235,800,185**	**$3,070,886,810**	**$33,032,772**	**$1,526,270,288**	**$1,511,583,750**

TABLE 9-11
Bonneville Unit Repayment Contracts

Contract Number	Date	Provision
14-06-4286	28-Dec-65	Contract between the District and the United States for repayment of Bonneville Unit costs. The repayment amount is $156,808,000.
Supplement to 14-06-400-4286	26-Nov-85	Added $335,000,000 to the repayment amount for M&I water. This amount could be increased by 10 percent.
86-07-40-R0330	16-May-86	Contract between Jordan Valley Water Conservancy District, the District, and the United States to repay costs of Jordan Aqueduct reaches one through four.
86-07-40-R0330	16-May-86	Contract between the Metropolitan Water District of Salt Lake and Sandy, the District, and the United States to repay costs of Jordan Aqueduct reaches one through four. The combined repayment coverage of contract numbers 86-07-40-R0320 and 86-07-40-R0330 is $69,225,000.
Amendatory Contract No. 1 to 14-06-400-4286	9-Jan-97	The purpose of Amendatory Contract No. 1 between the United States and the District was to make the Repayment Contract, as supplemented, consistent with the provisions of CUPCA.
Supplement No. 2 to 14-06-400-4286	15-Nov-01	This water service contract between the United States and the District was executed under Section 9 (c) (2) of the 1939 Act. Under the contract, CUWCD is assessed for 3,000 AF of M&I water developed by the Uinta Basin Replacement Project. The contract also provides for conversion from a water service contract to a repayment contract.
Contract No. 04-WC-40-120	February, 2005	This repayment contract between the United States and the District provides for repayment of the obligation associated with 60,000 acre-feet of M&I water to be provided by the Utah Lake System.
Contract No. 04-WC-40-240	February, 2005	This water service contract between the United States and the District is under the authority of Section 9 (e) of the 1939 Act. It provides for the delivery of up to 20,000 acre-feet of temporary irrigation water to south Utah County until such water is no longer available (because of M&I delivery of the water).

Irrigation: Pre-Authorization Investigations. These are non-reimbursable investigations costs because they occurred before the project was authorized. They total $733,000.

M&I: Pre-Authorization Investigations. These are non-reimbursable investigations costs because they occurred before the project was authorized. They total $740,000.

M&I: Section 206 of the Water and Energy Appropriations Act of 1986. Under Section 206 of the Water and Energy Appropriations Act of 1986, Congress provided the District with a credit toward its M&I repayment obligation of

up to $10.0 million, if certain construction progress had not been achieved by FY 1996. The credit was applied to the District's repayment obligation in FY 1997 – 2000.

4. Summary of Repayment Contracts Between the United States and the District

Existing Repayment Contracts. The District has entered into the contracts for repayment listed in Table 9-11: Bonneville Unit Repayment Contracts.

M&I Water Supply Associated with Repayment Contract No. 14-06-400-4286). Contract No. 14-06-400-4286 (as amended and supplemented), dated December 28, 1965, provides for repayment of up to $560.6 million in project M&I costs. The $560.6 million obligation is associated with the development of the block of 94,750 acre-feet of M&I water described in Table 9-12: Water Supply Associated with the 1965 Repayment Contract (as Amended and Supplemented).

*M&I Water Supply **Not** Associated with Repayment Contract No. 14-06-400-4286).* The remaining project M&I water is comprised of the 3,000 AF to be developed by UBRP and the 60,000 AF to be developed by the Utah Lake System (ULS). The delivery of the UBRP M&I water is covered by the 2001 water service contract. The repayment obligation for the ULS M&I water is contained in Repayment Contract No. 04-WC-40-120.

5. Section 211 Deferral

Section 211 of CUPCA authorizes the deferral of "any amount allocated to municipal and industrial water in excess of the total maximum repayment obligation contained in repayment contracts dated December 28, 1965, and November 26, 1985," as long as the District is not in substantial non-compliance with Section 207 of CUPCA. Table 9-12: Water Supply Associated with the 1965 Repayment Contract (as Amended and Supplemented) displays the water supply associated with the repayment contracts is 94,750 AF and the associated contractual repayment ceiling of $560.6 million. Under Section 211, any M&I repayment obligation associated with the 94,750 acre-feet in excess of $560,594,000 is deferred.

TABLE 9-12
Water Supply Associated with the 1965 Repayment Contract (as Amended and Supplemented)

A. Bonneville Unit

Block Notice	Amt (AF)	Area Served	Type
2,3	500	Duchesne County	M&I
Special 1	260	Strawberry Basin (Wasatch County)	M&I
5B	2,400	Wasatch County	M&I
5D	1,590	South Utah County	M&I
4A, 4B	20,000	North Utah County	M&I
5A, 5C, 6, Special 2	70,000	Salt Lake County	M&I
Total:	**94,750**		

6. Determination of Repayment Obligations

Irrigation Repayment. As noted above, the total amount allocated to irrigation (total construction and IDC costs) is adjusted in three ways to arrive at the irrigation repayment obligation ($299.0 million). These adjustments include deductions for local cost share, non-reimbursable abandoned irrigation investigations, and pre-project authorization funds. The following describes the repayment of the remaining irrigation obligation.

(a) Irrigators' Obligation. Irrigation construction costs are reimbursable to the United States Treasury, but without interest. Costs associated with each block notice have a 50 year repayment period. Of the irrigation repayment obligation, irrigators, according to Reclamation law, are only obligated to repay that amount equal to their ability to pay, as determined by the Secretary of the Interior. In the 1964 DPR, this total repayment ability for the entire project was determined to be $16.4 million. This amount was included in the District's repayment obligation in the 1965 repayment contract. Under the current project plan, although irrigators will be assessed according to their full ability to pay (per Reclamation Law), the total revenue generated will not reach $16.4 million. The discrepancy between the District's irrigation repayment obligation and the Department of the Interior's ability to assess repayment is approximately $6.5 million. This issue will be addressed in future repayment contracts actions.

(b) Bonneville Unit Share of CRSPA Power Revenues. Of the $299.0 million repayment obligation (total construction costs less local costs share and adjustments), the District is obligated to repay $16.4 million, based on the irrigators' ability to pay. Under CRSPA, the remaining amount ($282.6 million) is to be paid from Utah's share of the apportioned revenues from Colorado River Storage Project power sales.

Table 9-13: Irrigation Repayment summarizes the development of the irrigation repayment obligation.

M&I Repayment. As noted above, the total amount allocated to M&I (total construction and IDC costs) is adjusted to arrive at the M&I repayment obligation. These adjustments are the deductions for local cost share and pre-project authorization funds. The following describes the repayment of the remaining M&I obligation.

Under Reclamation Law, M&I construction costs and IDC are reimbursable at the project interest rate. The Bonneville Unit rate is 3.222 percent. The repayment period for M&I obligations is 50 years under Water Supply Act. Under the Water Supply Act of 1958, water users may elect to invoke a 10 year deferral and then begin payment on 40-year terms at the end of the deferral.

(a) Repayment of M&I Costs under Repayment Contracts (94,750 AF). The portion of the M&I repayment obligation assigned to 94,750 AF is approximately $657.4 million. The Section 211 deferral applies to this amount; hence, the District is not responsible for repayment of the entire amount but is obligated to repay $560,594,000. The difference between the allocation to 94,750 AF and the obligation to repay is the amount of the deferral (approximately $96.7 million).

On May 16, 1986, the United States and the District entered into two agreements (86-07-40-R0320 and 86-07-40-R0330) to prepay a portion of the repayment obligation associated with the Jordan Aqueduct. These payments totaled $64,850,297. This credit to the District's obligation reduces the amount subject to M&I repayment to $495,743,703.

Based on a final net obligation of $495,743,703, the average cost of the 94,750 AF on a per-acre-foot basis is $5232.12. The annual cost per acre-foot is $227.23 under a 40-year amortization and $205.39 under a 50-year amortization.

TABLE 9 - 13:
Repayment of Irrigation Costs

Irrigation Repayment									
Cost									**Total**
Irrigation Investment									
Construction Cost									356,924,313
Reimbursable IDC		--	--	--					$0
Total Irrigation Investment		--	--	--					**$356,924,313**
Less:		--	--	--					
Local Cost Share (Construction)		--	--	--					($48,214,831)
Local Cost Share (IDC)		--	--	--					$0
Irrigation Abandoned Investigations									($8,963,772)
Pre-Authorization Investigation Funds		--	--	--					($733,000)
Net Irrigation Investment		**--**	**--**	**--**					**$299,012,710**
Irrigation Revenues									
Block Notice	**AF**	**Area Served**	**Annual Ammortized Per AF**	**OM&R Charge Per AF**	**Total Charge Per AF**	**Annual Revenue Applied to Repayment**	**Revenue from Other Sources**	**Years of Repayment**	**Repayment Revenue**
Block Notice 1	9,800	Duchesne	$1.90	$6.31	$8.21	18,620		50	931,000
Block Notice 1	11,600	Duchesne	$0.00	$0.00	$0.00	0	3,767,100	50	3,767,100
Block Notice 1A	3,000	Heber Francis	$3.10	$6.31	$9.41	9,300		50	465,000
Block Notice 1A	12,100	Heber Francis	$3.10	$6.31	$9.41	37,510		50	1,875,500
Block Notice 1B	3,000	Duchesne	$1.90	$6.31	$8.21	5,700		50	285,000
Temporary Irrigation Water	20,000	South Utah County	$5.60	$6.31	$11.91	112,000		20	2,240,000
Block Notice UBRP1	2,500	Big Sand Wash	$2.52	$4.43	$6.95	6,300		50	315,000
Total:	**62,000**								**9,878,600**
Irrigation Repayment									
Net Irrigation Investment									299,012,710
Obligation of Power Users (Net Irr Investment - CUWCD Obligation)									282,612,710
Obligation of CUWCD (per 1965 Repayment Contract, as Amended)									16,400,000
Total Irrigation Revenues									9,878,600
Remaining Obligation									6,521,400

(b) Repayment of ULS M&I Costs (60,000 AF). The portion of the M&I repayment obligation assigned to 60,000 AF is approximately $416.3 million. Because the ULS M&I water supply is not associated with the 1965 and 1985 repayment contracts, the Section 211 deferral does not apply; the Repayment Contract for the ULS water supply (Contract No. 04-WC40-120) obligates the District to repay the full amount. Based on a final net obligation of approximately $416.3 million, the average cost of the 60,000 AF on a per-acre-foot basis is $6,937.58. The annual cost per acre-foot is $301.29 under a 40-year amortization and $272.33 under a 50-year amortization.

(c) Repayment of UBRP M&I Costs (3,000 AF). The M&I water developed by UBRP will be provided under the water service contract (Supplement No. 2 to 14-06-400-4286, dated November 15, 2001). The water service contract contains provisions under which the obligation can be converted to a repayment obligation. If the District elects to convert its water service contract obligation to a repayment obligation, that conversion would likely take place on terms similar to the ULS repayment (with the potential for crediting of funds remitted under the water service agreement).

Table 9-14: M&I Repayment summarizes the development of the repayment obligation for the three major blocks of M&I water.

Hydro Power Repayment. Under the modified UOF approach that has been applied to power costs, the costs allocated to power have been limited to the total expected revenue and credits for power from all sources. The sources of revenue and/offsets to costs to be applied to power costs are: sales of power generated, local cost share, the lease of power privilege (LOPP) at Jordanelle, and non-reimbursable power investigations.

Table 9-15: Repayment of Power Costs shows the total allocation to power and the application of adjustments and revenues to power repayment. When deductions are made for local cost share and abandoned power investigations, the remaining power repayment obligation is approximately $132.9 million. The amortization of $132.9 million (over 50 years at 3.222 percent interest) results in an annual payment of approximately $5.4 million. The Jordanelle LOPP is expected to provide average annual revenue of approximately $115,000, leaving $5.3 million to be provided from sales of the power generated at the Upper Diamond Fork and Sixth Water power plants.

The power will be marketed at approximately 45 mils/kwh. Of the 45 mils/kwh, 13.1 mils/kwh is estimated to be required for operation, maintenance, and replacement of project facilities. This leaves approximately 31.9 mils/kwh to be applied to repayment. At 31.9 mils/kwh, the revenue generated is expected to average $5.3 million annually.

Non-Reimbursable Costs

Table 9-16: Non-Reimbursable Costs summarizes total Bonneville Unit non-reimbursable costs.

TABLE 9-14 M&I Repayment				
Cost	**Bonneville Unit (Initial)**	**Bonneville Unit (ULS)**	**Uinta Basin Replacement Project**	**Total**
M&I Investment				
Construction Cost				1,131,463,952
Reimbursable IDC	--	--	--	$145,738,999
Total M&I Investment	--	--	--	**$1,277,202,951**
Less:	--	--	--	
Local Cost Share (Construction)	--	--	--	($167,859,706)
Local Cost Share (IDC)	--	--	--	($4,200,668)
Pre-Authorization Investigation Funds	--	--	--	($740,000)
Sec 206 Construction Progress Credit	--	--	--	($10,000,000)
Net M&I Investment	--	--	--	**$1,094,402,576**
M&I Investment by BU Phases				
M&I Water Supply (AF)	94,750	60,000	3,000	157,750
M&I Water Supply (%)	60.06%	38.03%	1.90%	100.00%
Proportion of Net M&I Investment	$657,335,303	$416,254,546	$20,812,727	$1,094,402,576
Less Section 211 Deferment	$96,741,303	$0	$0	$96,741,303
Net M&I Investment	$560,594,000	$416,254,546	$20,812,727	$997,661,273
Less Credit for Jordan Aqueduct Buyout	$64,850,297	$0	$0	$64,850,297
Net M&I Investment Subject to Repayment	$495,743,703	$416,254,546	$20,812,727	$932,810,976
Average Cost Per Acre-Foot	**$5,232.12**	**$6,937.58**	**$6,937.58**	
40-Year Amortization:M&I Annual Costs by BU Phases				
Average Annual Cost Per Acre-Foot (Amortized over 40 Years @ 3.222 Percent)	$227.23	$301.29	$301.29	
OM&R Per Acre-Foot	$7.21	$7.21	$7.21	
Total Repayment Cost Per AF	**$234.44**	**$308.50**	**$308.50**	
50-Year Amortization:M&I Annual Costs by BU Phases				
Average Annual Cost Per Acre-Foot (Amortized over 50 Years @ 3.222 Percent)	$205.39	$272.33	$272.33	
OM&R Per Acre-Foot	$7.21	$7.21	$7.21	
Total Repayment Cost Per AF	**$212.60**	**$279.54**	**$279.54**	

* If not for the Section 211 deferment and the credit for Jordan Aqueduct prepayment, the average cost for the 94,750 AF would be the same as the average cost for the 60,000 AF of ULS M&I water.

TABLE 9-15 Repayment of Power Costs	
Power Investment	
Construction Cost	$138,728,494
Reimbursable IDC	$22,247,488
Total Power Investment	**$160,975,981**
Less:	
Local Cost Share (Construction)	($14,897,748)
Local Cost Share (IDC)	($627,231)
Abandoned Power Investigations Costs	($12,596,000)
Net Power Investment	**$132,855,002**
Power Revenues	**Total**
Amortization of Power Investment (50 Yrs @ 3.222%)	$5,383,200
Annual Revenue from Jordanelle LOPP	$114,700
Annual Revenue from Sales of Power (Paid by Power Users)	$5,268,500
Annual OM&R for Upper Diamond Fork and Sixth Water Power Plants (Paid by Power Users)	$2,166,000

TABLE 9-16 Non-Reimbursable Costs				
	Construction Cost	**Interest During Construction (3.222%)**	**Adjustments**	**Total**
Allocation to Non-Reimbursable Purposes				
Flood Control	$39,736,976	$11,326,321	$0	$51,063,298
Fish and Wildlife (includes in-stream Flows	$700,231,251	$120,933,683	$0	$821,164,934
Highway Improvement	$66,115,000	$20,420,113	$0	$86,535,113
Irrigation (IDC)	$0	$35,477,238	$0	$35,477,238
Sub-Total - Non-Reimbursable Sec 5:	**$806,083,228**	**$188,157,356**	**$0**	**$994,240,583**
Adjustments to Reimbursable Costs				
Irrigation: Non-Reimbursable Investigations	$0	$0	$8,963,772	$8,963,772
Power: Non-Reimbursable Investigations	$0	$0	$12,596,000	$12,596,000
Irrigation: Pre-Authorization Investigations	$0	$0	$733,000	$733,000
M&I: Pre-Authorization Investigations	$0	$0	$740,000	$740,000
M&I: Sec 206 Construction Progress Credit	$0	$0	$10,000,000	$10,000,000
Total	**$0**	**$0**	**$33,032,772**	**$33,032,772**

CENTRAL UTAH PROJECT COMPLETION PROGRAM

Chapter 10

October 2004

Brown & Caldwell. 2001. Wastewater Regionalization Study for South Utah Valley Municipal Water Association. Salt Lake City, Utah.

Central Utah Water Conservancy District (CUWCD). 1996. *Final Environmental Impact Statement - Wasatch County Water Efficiency Project and Daniel Replacement Project.* Prepared for the U.S. Department of the Interior. November 1996.

_____. 1997a. *Wasatch County Water Efficiency Project Feasibility Study.* Central Utah Water Conservancy District, Provo River/Utah Lake special studies.

_____. 1997b. *Final Report on the Direct Delivery of Colorado River Basin Water to the Provo River Basin.* Central Utah Water Conservancy District. Orem, Utah. June 1997.

_____. 1998. *Final report on the hydrologic model analysis of the Provo River Basin.* Central Utah Water Conservancy District. Orem, Utah.

_____. 2001. *Uinta Basin Replacement Project, Final Feasibility Study.* Central Utah Water Conservancy District, Orem, Utah.

_____. 2004a. *Utah Lake Drainage Basin Water Delivery System, Final Environmental Impact Statement, Bonneville Unit, Central Utah Project.* Central Utah Water Conservancy District, Orem, Utah.

_____. 2004b. *Surface Water Hydrology Technical Report for the Utah Lake Drainage Basin Water Delivery System Final Environmental Impact Statement.* Central Utah Water Conservancy District, Orem, Utah.

CH2M Hill. 1997. Duchesne River Hydrology and Water Availability Study "Final."

Fuhriman, D.K., L.B. Merritt, A.W. Miller, and H. Stock. 1981. Hydrology and Water Quality of Utah Lake. Great Basin B. Naturalist: Memoir No. 5: 43-67.

U.S. Bureau of Reclamation (Reclamation). 1964. *Bonneville Unit Definite Plan Report, Central Utah Project Bonneville Unit, Utah.* Upper Colorado Region, Bureau of Reclamation. Salt Lake City, Utah.

_____. 1988. *Supplement to the Definite Plan Report, Bonneville Unit, Central Utah Project.* Upper Colorado Region, Salt Lake City, Utah. 2 volumes, plus 17 volume appendices.

_____. 1992. *Central Utah Project (CUP) Bonneville Unit - Utah, Supplement to the DPR, Project Lands Appendix.* Upper Colorado Region, Salt Lake City, Utah.

U.S. Fish and Wildlife Service (FWS).1999. June sucker (*Chasmistes liorus*) Recovery Plan. U.S. Fish and Wildlife Service, Denver, Colorado. 61 pp.

U.S. Water Resources Council. 1983. *Economic and Environmental Principles and Guidelines for Water and Land Resources Implementation Studies.* Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

Utah Department of Natural Resources (UDNR), Division of Water Rights, 1992. Interim Water Distribution Plan for the Utah Lake Drainage Basin.