OVERVIEW
OF THE PROPOSED
LOWER BEAR RIVER
WATER DEVELOPMENT PLAN

Proposed by the
Division of Water Resources
Department of Natural Resources

December 1988
# TABLE OF CONTENTS

## PART 1  OVERVIEW OF THE LOWER BEAR RIVER WATER DEVELOPMENT PLAN

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Review of Legislative History</td>
<td>1</td>
</tr>
<tr>
<td>II. Lower Bear River Water Development Plan</td>
<td>2</td>
</tr>
<tr>
<td>Background</td>
<td>2</td>
</tr>
<tr>
<td>Plan Features</td>
<td>4</td>
</tr>
<tr>
<td>Unit Descriptions</td>
<td>6</td>
</tr>
<tr>
<td>Estimated Costs</td>
<td></td>
</tr>
<tr>
<td>III. Planning Process</td>
<td>7</td>
</tr>
<tr>
<td>Water Supply</td>
<td>7</td>
</tr>
<tr>
<td>Future Water Needs</td>
<td>7</td>
</tr>
<tr>
<td>Reimbursable and Non-Reimbursable Costs</td>
<td>9</td>
</tr>
<tr>
<td>Matching Water Supply and Needs</td>
<td>9</td>
</tr>
<tr>
<td>Geotechnical Investigations</td>
<td>10</td>
</tr>
<tr>
<td>Environmental Considerations</td>
<td>10</td>
</tr>
<tr>
<td>Public Involvement</td>
<td></td>
</tr>
<tr>
<td>IV. Planning Implementation</td>
<td>11</td>
</tr>
<tr>
<td>Schedule</td>
<td>11</td>
</tr>
<tr>
<td>Organization</td>
<td>11</td>
</tr>
<tr>
<td>Financing</td>
<td>12</td>
</tr>
<tr>
<td>V. Water Rights</td>
<td>13</td>
</tr>
<tr>
<td>Utah Water Rights</td>
<td>13</td>
</tr>
<tr>
<td>Amended Bear River Compact</td>
<td>13</td>
</tr>
<tr>
<td>Project Water Rights</td>
<td>13</td>
</tr>
</tbody>
</table>

## PART 2. BEAR RIVER TO WASATCH FRONT UNIT

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Bear River to Wasatch Front Unit Plan</td>
<td>14</td>
</tr>
<tr>
<td>Background</td>
<td>14</td>
</tr>
<tr>
<td>Unit Description &amp; Purpose</td>
<td>15</td>
</tr>
<tr>
<td>Unit Features</td>
<td>15</td>
</tr>
<tr>
<td>Unit Construction Cost Estimate</td>
<td>17</td>
</tr>
<tr>
<td>II. Overview of Phased Construction Proposal for the Wasatch Front M&amp;I Unit</td>
<td>18</td>
</tr>
<tr>
<td>Phased Construction</td>
<td>18</td>
</tr>
<tr>
<td>Water Leasing from Water Suppliers in the Weber River Basin</td>
<td>20</td>
</tr>
<tr>
<td>Water Quality</td>
<td>21</td>
</tr>
<tr>
<td>Environmental Impacts</td>
<td>21</td>
</tr>
<tr>
<td>Implementation Schedule</td>
<td></td>
</tr>
</tbody>
</table>

12-9-88
TABLE OF CONTENTS (continued)

III. Detailed Description of Phase I of the
      Wasatch Front M&I Unit                      22
      Willard Reservoir to Weber River            22
      Weber River to Regulating Reservoir         22
      Regulating Reservoir to Salt Lake County Treatment Plant 23

   IV. Cost Estimate for Phase I of the Wasatch Front M&I Unit      25
       Willard Reservoir to Regulating Reservoir    25
       Regulating Reservoir to Treatment Plant      25
       Total Phase I Project Cost Estimate         26

LIST OF MAPS AND FIGURES

Location Map                             General Location Map of Plan and Units  3
Figure 1                                 Wasatch Front M&I Unit Layout            16
Figure 2                                 Layout of Phased Wasatch M&I Unit         19
Figure 3                                 Detailed Layout of Phase I                24
INTENT NOTICE

This document is a preliminary planning document intended for informational purposes only. The primary purpose of this document is to present the concept of interconnecting the water supplies of the lower Bear River Basin, the Weber River Basin, and the Jordan River Basin along the Wasatch Front. Part 1 of the document presents material on the Lower Bear River Water Development Plan. This material covers the presently identifiable water development needs of the Lower Bear River Basin in Utah and compares these needs with the water supply available. Part 2 of the document deals with the proposal and cost of bringing Bear River water south along the Wasatch Front. In addition, Part 2 of the document details a phased approach to serving the needs of the Wasatch Front with water from the Bear River.
PART 1. OVERVIEW OF THE LOWER BEAR RIVER WATER DEVELOPMENT PLAN

I. Review Of Legislative History

As part of the State Water Planning Program, the Division of Water Resources has conducted planning and preliminary feasibility studies of potential water resource develop projects in the Box Elder County and Cache County portions of the lower Bear River Basin. Recent legislation has provided funding and direction to the Division to accelerate formulation and implementation of the State Water Plan for all areas of the state, but with particular emphasis on the Bear River Basin.

Legislation in 1984 provided funds to "cover expenses of the development and implementation of a State Water Plan. The plan shall focus particular emphasis on the Bear River and Utah Lake drainage, but will include all hydrologic areas of the state."

In 1985, legislation provided funds for "implementation of the State Water Plan, including, but not limited to, engineering studies of the Bear River upstream diversion and storage projects."

During the 1983 to 1986 period, studies authorized by the Legislature focused primarily on the feasibility of breaching the Southern Pacific Causeway across the Great Salt Lake, increasing evaporation from the lake by pumping lake brine into the West Desert, and upstream development of the Bear River Basin. Studies of the Bear River indicated upstream development was not a feasible way to control flooding around the lake. There simply could not be enough water impounded and consumed in the Bear River area to control the massive inflows to the lake. Nevertheless, some of the reservoir sites identified in the Great Salt Lake Flooding Studies are currently being investigated in greater detail as part of the State Water Plan.

Senate Bill 150 of the 1988 General Session of the Utah State Legislature directed the Division of Water Resources to identify long term water development opportunities upstream of the Great Salt Lake.
II. Lower Bear River Water Development Plan

A. Background

A Lower Bear River Water Development Plan, as identified in the following pages, has been developed by the Division of Water Resources after evaluating many alternatives. The proposed plan has been formulated to meet the anticipated municipal, industrial, agricultural, recreational, and wildlife demands within the Utah portion of the Bear River Basin for the foreseeable future as well as meeting some future municipal demands along the Wasatch Front. This plan provides benefits to a multitude of users, maximizes use of the water supply, and minimizes impacts. This proposed plan should be viewed as being flexible, easy to modify, and a best estimate of how the water may be used over the next 50 years. Some features of the plan may never be constructed while others may be added.

Major portions of the Lower Bear River Water Development Plan are based on requests from local water users for additional water development in Cache and Box Elder Counties. These requests have led to several studies which form a large part of the background for the proposed plan. Input from concerned Bear River water users has helped to shape the plan and has been invaluable in identifying and analyzing the various components presented in this plan.

B. Plan Features

Implementing the proposed Lower Bear River Water Development Plan will require construction of several new reservoirs as well as water conveyance and distribution systems. The reservoirs will provide the storage necessary to develop a significant portion of the waters allocated to Utah under the Amended Bear River Compact. The conveyance and distribution systems will make it possible to transport the water from the reservoirs to the various areas of use. Individual reservoir sites are not generally dedicated to any particular unit. But they can be used, in most cases, to supply all or part of a unit's demand in combination with other reservoirs.

At present, the most favorable reservoir sites are: 1) Avon, 2) Barrens, 3) East Promontory, 4) Honeyville, 5) Mill Creek, and 6) Oneida Narrows (see map for general locations).

Alteration of Bear River flows through additional storage and release will change the hydroelectric regime of the river. Facilities may have to be provided to maintain this capacity, and close coordination and cooperation with Utah Power and Light are necessary.
PROPOSED UNIT DIVERSIONS

<table>
<thead>
<tr>
<th>Project</th>
<th>Diversion (Ac. FL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box Elder W &amp; I</td>
<td>35,000</td>
</tr>
<tr>
<td>Bear River Waterfowl &amp; Wildlife Unit</td>
<td>124,000</td>
</tr>
<tr>
<td>Bonneville Bench Irrig.</td>
<td>70,000</td>
</tr>
<tr>
<td>Supplemental Irrg.</td>
<td>20,000</td>
</tr>
<tr>
<td>Cache Valley W &amp; I</td>
<td>26,000</td>
</tr>
<tr>
<td>South Cache Irrg. Unit</td>
<td>20,000</td>
</tr>
<tr>
<td>Wauach Front W &amp; I</td>
<td>100,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>365,000</strong></td>
</tr>
</tbody>
</table>

LOWER BEAR RIVER WATER DEVELOPMENT PLAN LOCATION MAP
November 1988
C. Unit Descriptions

The proposed Lower Bear River Plan has been divided into seven major units for simplicity in describing the plan. Completion of all of the proposed units will allow the diversion of the estimated 395,000 acre feet of water. The general geographic locations of these units are shown in Figure 1. The proposed units, with a brief general description, are as follows:

- **The South Cache Irrigation Unit.** Interest is currently being expressed to convert existing dry farm land in the south end of the Cache Valley to sprinkler irrigated land. This unit would need 20,000 acre feet of water to provide irrigation for up to 7,000 acres in the south part of Cache Valley. Water would be provided via a canal transmission and gravity pressure distribution system from storage developed on the Little Bear River system. The Cache County RC&D Committee has asked the Division to update its previous study of this project.

- **The Cache Valley Municipal and Industrial (M&I) Unit.** Based on current state population estimates, the need for M & I water in Cache Valley will continue to grow. Many communities have a good supply of additional M & I water already developed in springs and wells. Studies are needed to determine which communities will need additional water development and how best to meet these needs. The Lower Bear River Water Development Plan addresses this need by allowing for up to 26,000 acre feet of additional water to be developed for this unit. Surface water storage may be needed in some communities along with water treatment plant and transmission facilities.

- **The Box Elder M&I Unit.** The Box Elder County area does not have the local springs and groundwater resources that are available in Cache Valley. Currently, Box Elder County is trying to identify municipal needs and supplies. In the interim, 35,000 acre feet of water is contemplated and allowed for this purpose. This unit would provide raw water for exchange or treatment to those areas in the county that will require additional water due to growth. The unit may require some water storage development, construction of municipal water treatment plans, and transmission lines to the entities needing the water.
The Bonneville Bench Irrigation Unit. This unit could provide irrigation water for up to 20,000 acres in the Bonneville Bench area north of Tremonton. This unit would require up to 70,000 acre feet of storage on the Bear River and an extensive transmission and distribution system. The Division has been asked by the Bear River Water Development Committee to update a previous Division study.

The Bear River Supplemental Irrigation Unit. This unit could provide up to 20,000 acre feet of supplemental water to presently irrigated lands in Cache County and the Lower Bear River portion of Box Elder County which could benefit from additional late season flow. This unit would require development of storage on the Bear River.

The Wildlife and Waterfowl Unit. This unit would provide additional water for late summer instream flows and for maintaining wildlife and waterfowl habitat. This unit will require the construction of a water storage reservoir to provide the water.

The Wasatch Front M&I Unit. This unit of the Lower Bear River Water Development Plan would provide up to 100,000 acre feet of Bear River water annually for distribution to communities and industries along the Wasatch Front. The potential service area is from Willard on the north to the southern part of Salt Lake County. The Wasatch Front M&I Unit will consist of an intake structure and pump station on the Bear River at the Honeyville Reservoir site with a 75 mile raw water transmission line south to Salt Lake County and a 24,000 acre-foot regulating reservoir in the North Davis County area. The Wasatch Front M&I unit is a raw water delivery system that would require treatment for culinary use. Treatment facilities would be the responsibility of the agencies that purchase the water.
D. Estimated Costs

The following costs (1988 dollars) are for completion of all units of the proposed Lower Bear River Water Development Plan. Reservoir storage costs are based on the cost of building sufficient storage to develop water for all the proposed units. Transmission and conveyance costs are associated with moving the water from storage on the river to the place of use. Recreation facility costs are primarily those associated with developing flat water recreation on the proposed reservoirs. The hydropower replacement facilities costs are associated with possible loss or replacement of generating facilities at the UP&L Oneida and Cutler plants. The cost for M & I transmission does not include treatment costs; the proposal is for raw water delivery.

- Reservoir Storage Development $104 million
- Irrigation Transmission and Conveyance $33 million
- Recreation Facilities $6 million
- M & I Transmission $225 million
- Hydropower Replacement Facilities $20 million
- TOTAL $388 million
III. Planning Process

A. Water Supply

The average annual flow from the Bear River into the Great Salt Lake is about 1 million acre feet. However, not all of this water is available for future development. It is estimated the average annual developable flow of water in the lower Bear River Basin (below Bear Lake) is 600,000 acre feet. This figure is estimated by using modified streamflow records based on the 1940-1978 time period assuming a 1975 level of development. Of this amount, under the Amended Bear River Compact, Utah would be allocated 385,000 acre feet of depletion. Idaho would be allocated 215,000 acre feet. Further explanation of the Bear River Compact is found in Section V.B of this report. Based on the diversions proposed by this plan of 395,000 acre feet, it is estimated that a depletion of 275,000 acre feet will occur.

B. Future Water Needs

Water uses with potential needs for additional future supplies have been identified from requests for water development projects. They include:

1. Irrigation

   If agricultural economic conditions improve, it is estimated that up to 42,000 acres of irrigable land could be brought under irrigation in the next 30-50 years in Box Elder and Cache counties. This would require a diversion of about 110,000 acre feet of new water. This includes the Bonneville Bench, South Cache, and Bear River Supplemental Irrigation Units as shown in the location map.

2. M&I

   Based on population projections and industrial growth for Box Elder and Cache counties, the need for M&I water is expected to increase over the next 50 years. Twenty-thousand acre feet of water is proposed for the Box Elder M&I unit and 26,000 acre feet of water is proposed for the Cache Valley M&I unit which should meet anticipated needs. In addition, local officials in the Box Elder area have indicated a desire for additional water for industrial development above the proposed 20,000 acre feet and have an engineering study currently underway to determine the amount. In the interim, an additional 15,000 acre-feet has been added to the 20,000 acre feet for a total of 35,000 acre feet for the Box Elder M&I unit to cover this contingency. As much as 100,000 acre feet of water is available for M&I use outside of the Bear River Basin. This could be exported south along the Wasatch Front. Initial need for this water may start to occur as soon as the year 2000 by the Salt Lake County Water Conservancy District.
3. Wildlife/Waterfowl

Approximately 281,000 acre feet of water are presently available annually to the Bear River Migratory Bird Refuge within the pattern of need. An additional annual supply of up to 124,000 acre feet of water could be used to enhance waterfowl management on existing areas.

4. Recreation and Fishery

Projections show participation in water-based recreation activities in the Bear River Basin and along the Wasatch Front will more than double by the year 2020. The creation of reservoirs will increase the amount of flat water activities such as boating and reservoir fishing.

5. Hydropower

Population and industrial growth will increase demands for electrical power generation and its capacity in the Bear River system. Some of the proposed water development projects in the Bear River basin will require power for operation. The proposed reservoirs have hydroelectric potential that should be considered for development during project analysis.

6. Flood Control

Flows in the Bear River can exceed stream channel capacity and flood adjacent lands. This flooding has caused damage along the main Bear River as well as along tributary streams. Properly designed and managed water development projects can reduce flood damages.

7. Water Quality

Studies show that the quality of Bear River water varies greatly depending on location and time of year. While reservoirs can improve some water quality parameters, the overall impacts must be carefully analyzed.
C. Reimbursable and Non-Reimbursable Costs

The features of a project that benefit the public as a whole are considered as in the public interest. The Lower Bear River Water Development Plan includes some features such as recreation components, wildlife and waterfowl habitat improvement, flood control, and water quality improvement which could be classified as falling into this category. Since it is difficult to recoup the cost of these types of benefits through direct user fees, the allocated cost of these feature has been historically paid for by the federal government from public funds and classified as non-reimbursable. The payment of these non-reimbursable costs by the State of Utah would be a new direction in state policy.

Costs that can be directly attributed to the development and delivery of water, within the user's ability to pay, are classed as reimbursable and are repaid from revenues generated by the delivery and sale of water.

D. Matching Water Supply and Needs

In order to formulate a water development plan for the lower Bear River Basin, many alternatives were evaluated for matching water uses, demands and supplies, and in addressing critical issues and problems. In order to meet the projected diversion requirements of 395,000 acre feet, several large storage reservoirs will be required. These will be located in various places throughout the basin in order to obtain the best combination of engineering, economic, and environmental features.

E. Geotechnical Investigations

Many potential reservoir storage sites exist on the Bear River and its tributaries. Previous investigations of sites ranged in details from cursory reviews to preliminary feasibility studies. The initial list of sites was reduced to nine after reviewing the data and considering topography, land availability, geologic conditions, proximity to water source and use, existing facilities and environmental features. The nine sites were again reviewed after the preliminary geotechnical investigative work was completed and six were selected for further analysis. The six sites are: 1) Avon, 2) Barrens, 3) East Promontory, 4) Honeyville, 5) Mill Creek, and 6) Oneida Narrows (see map, page 3, for general locations).
F. Environmental Considerations

A preliminary environmental overview of each reservoir site was made as part of the investigations. These overviews included preliminary identification of important issues such as archaeological sites, threatened and endangered species, historical sites, wildlife habitat and fishery classifications. These issues will be addressed as part of the environmental impact process during the preconstruction phase of the project.

G. Public Involvement

1. Beginning in May 1985, a public involvement program was conducted in Box Elder and Cache counties by the Utah Association of Conservation Districts under contract with the Division of Water Resources.

   The process used by the work team to enhance public involvement consisted of information dissemination; interviewing; classification of issues raised; analysis; problem identification; identification of alternative solutions; feedback and report; and compromise and consensus building. Over 250 local people participated in the program and over 650 issues or concerns were expressed and analyzed.

2. An independent analysis of the Bear River development strategy was completed in June 1986. This work was done to supplement the findings of the earlier public involvement program.
IV. Implementation

A. Schedule

The sequence, size, and timing of construction of the various units will be influenced by actual water demands, weather, funding availability, appropriate sponsors, physical and legal constraints, environmental concerns, and social acceptance. Construction on the Wasatch Front M&I unit could begin within the next 5 years. Complete construction of all phases of the Lower Bear River Water Development Plan could take 50 years. This includes environmental studies, obtaining permits and approvals, detailed investigations and design, construction and utilization of stored water for allocated purposes. The major thrust of implementing the plan is building water storage reservoirs.

B. Organization

In order for the water development plan to be implemented, organizations will have to exist to finance, build, operate and maintain the various units. It is envisioned several different organizations may be needed. The umbrella organization for overall plan coordination and implementation could be the state of Utah acting through the Division of Water Resources.

Several organizations such as the Cache County RC&D Committee, the Bear River Water Conservancy District, and local irrigation companies have expressed interest in additional development of water resources in the Bear River. These entities have requested and provided valuable input to the studies which form the foundation of the Lower Bear River Water Development Plan. These types of organizations, as well as others yet to be formed, could fill the role of sponsor for various portions and units of the plan.
C. Financing

Completion of the proposed Lower Bear River Water Development Plan will be very expensive and will require the commitment of a large amount of state funds (over $388 million) over an extended period of time. This is a long-term investment to ensure future water supplies.

The traditional approach of a local sponsor seeking funding from the Board of Water Resources for project construction may play a large role in the construction of many features of the Lower Bear River Water Development Plan. Other features of the plan, due to the large expenditures involved, may require direct sponsorship by the state of Utah.

The money to build, operate, manage, and maintain the various units in the plan may come from several sources. It is anticipated initial funding for construction of most of the units will be provided by the state of Utah through the Board of Water Resources from direct appropriations or bonding authorized by the Legislature. Some funds may be available for construction from other state agencies, local municipalities, private industries, irrigation companies, conservancy districts, county governments, and various federal agencies.

Repayment of reimbursable costs as well as O & M would come from the revenues produced through the sale of the water developed by the plan. Non-reimbursable costs would be borne by the public as a whole.
V. Water Rights

A. Utah Water Rights

Existing Utah water rights on the Bear River and its tributaries are on record in court decrees, water applications or use permits, and claims in pending adjudication proceedings. At present, the Utah Division of Water Rights is conducting an adjudication of all water rights of Box Elder and Cache counties. When completed, all previous decrees will be consolidated and both surface and groundwater rights will be defined for numerous rights claimed by established water use. Any water development on the Bear River will have to consider existing water rights, applications, and the Amended Bear River Compact.

B. Amended Bear River Compact

Future water development on the Bear River will have to be in accord with the terms of the 1980 Amended Bear River Compact, an agreement among the states of Wyoming, Idaho and Utah. The compact allocates the waters below Bear Lake and between Utah and Idaho as follows:

1. Idaho is granted the first right to develop and deplete 125,000 acre feet, including groundwater.

2. Utah is granted the second right to develop and deplete 275,000 acre feet, including groundwater.

3. The next 150,000 acre feet of water, including groundwater, will be divided equally between Utah and Idaho.

4. All water in excess of the above allocations will be split between Utah and Idaho, with Idaho receiving 30 percent and Utah receiving 70 percent.

This allocation includes water not applied to beneficial use prior to January 1, 1976.

C. Project Water Rights

Water right applications already exist that would cover the storage of water required to implement the Lower Bear River Water Development Plan. These rights are currently in the name of private water companies, the federal government, and the state of Utah acting through the Board/Division of Water Resources.
PART 2.

BEAR RIVER TO WASATCH FRONT UNIT

I. Bear River to Wasatch Front Unit Plan

A. Background

In 1986, the Salt Lake County Water Conservancy District (SLCWCD) submitted an application to the Board of Water Resources for assistance in locating and developing additional water supplies from the Bear River and/or other sources. These supplies are to be above and beyond water supplies developed by the Bonneville Unit of the federal Central Utah Project. The application requests 50,000 acre feet of water be developed and initial water deliveries commence by the year 2000. The SLCWCD request is based on the district's projections for future water supply needs.

Through the following ongoing activities of the State Water Plan, the Division of Water Resources is, in part, responding to this application with the following actions:

1. The Division has engaged the Utah Water Research Laboratory at Utah State University to develop a Wasatch Front water demand computer model. This model will identify and quantify community and industrial water needs along the Wasatch Front.

2. The Division is engaged in the identification of water use with ongoing land use and hydrologic inventory studies in the Bear, Weber, and Jordan rivers areas.

3. The Division is currently performing follow up studies on reservoir sites in the lower Bear River.

As a result of these studies, the Division of Water Resources recommends that a detailed feasibility report and preliminary design be completed for Phase I of the Wasatch Front M&I unit. Phase I will consist of facilities to link the Weber River Basin with the Jordan River Basin along the Wasatch Front.
B. Unit Description & Purpose

When completed, the Wasatch Front Municipal and Industrial (M&I) unit of the Lower Bear River Water Development Plan would be capable of providing up to 100,000 acre feet of Bear River water annually for distribution to communities and industry along the Wasatch Front. The potential service area is from Willard on the north to the southern part of Salt Lake County.

C. Unit Features

The completed Wasatch Front M&I Unit will consist of an intake structure and pump station on the Bear River at the Honeyville Reservoir site with a raw water pipeline south to the Weber River and Jordan River basins. Figure 1 illustrates a typical layout for the completed system. The pipeline will be approximately 75 miles in length and consist of pipe ranging in diameter from 96 inches to 54 inches. Several booster pump stations may be required. Turn outs will be provided along the pipeline where purchasing agencies may take delivery of the raw water. A regulating reservoir will be provided in the north Davis County area. This reservoir will provide equalizing storage and peaking storage for the southern portion of the service area. The size of this reservoir was set at 24,000 acre feet for cost estimating. Sufficient open space is available to build a larger reservoir if additional storage is desired. The reservoir will also allow the use of a smaller pipeline size to deliver water to the reservoir since the flow into the reservoir will be constant rather than variable. The Wasatch Front M&I unit is a raw water delivery system and will require treatment for M&I use. Treatment facilities are not included as part of the proposed unit and would be the responsibility of the agencies that purchase the water.

The completion of the Wasatch Front M&I unit will require storage of water on the Bear River system. It appears that when all units of the Lower Bear River Water Development Project are developed, this storage would be most feasible at the Honeyville site. However, until all the other units are fully developed, storage could be provided at any of the proposed upstream reservoirs.
D. Unit Construction Cost Estimate

Estimated costs (1988 dollars) for construction of the Wasatch Front M&I Unit are as follows:

CONSTRUCTION COSTS
Intake structure $1,400,000
Pipeline $139,200,000
Pump stations $4,700,000
Equalizing reservoir $11,600,000
(based on 24,000 AF)
Bear River storage costs* $26,900,000
Contingency cost (15%) $27,200,000

Subtotal $211,000,000

NON-CONSTRUCTION COSTS
Land and right-of-way $3,000,000
Engineering, legal & admin. $26,000,000

Subtotal $29,000,000

TOTAL PROJECT COSTS $240,000,000

ANNUAL COST

<table>
<thead>
<tr>
<th></th>
<th>(50 years 5.5%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital</td>
<td>$14,157,000</td>
</tr>
<tr>
<td>O &amp; M</td>
<td>$2,231,000</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$16,388,000</td>
</tr>
</tbody>
</table>

Unit costs** ($/acre-foot) $164

* Costs for storage based on building the Honeyville Reservoir

** Unit costs based on full delivery of 100,000 acre feet per year for the 50-year period. Does not include cost of treating water.
II. Overview of Phased Construction Proposal for the Wasatch Front M&I Unit

A. Phased Construction

Construction of the Wasatch Front M&I unit in its entirety will be an expensive project. The Division of Water Resources, therefore, proposes that the unit be built in phases. This approach will allow for greater flexibility during construction and will reduce the initial construction outlays while providing water to satisfy growing demands in the Salt Lake County Water Conservancy District service area. Revenues from Phase I could help finance the construction of following phases. Figure 2 shows a schematic of the phases which are briefly described as follows:

1. Phase I

The first phase would include the expansion of some facilities of the Weber Basin Water Conservancy District (WBWCD) and the construction of a pipeline and regulating reservoir to bring water from the Weber River drainage to the Salt Lake County area in the vicinity of 2100 South and 40th West. The water to be transported would be water leased from users in the Weber Basin. The WBWCD facilities that would need expansion include pump stations on the Willard Canal and increasing the capacity of the Layton Canal and associated pump stations. With the completion of Phase I, water could be delivered from the Weber drainage to the Salt Lake County area.

2. Phase II

The second phase would involve the construction of facilities to bring Bear River water to Willard Reservoir of the Weber Basin Water Conservancy District. This phase would be initiated when sufficient water is no longer available for lease from users in the Weber Basin. The water from the Bear River would be wheeled through Weber Basin facilities for delivery to the Phase I portion of the unit. Phase II will also involve the development of water storage facilities in the Bear River system. This portion of the phase may be in conjunction with other units of the proposed Lower Bear River Water Development Plan or by itself. Completion of Phase II would allow the delivery of Bear River water through the Weber Basin to the Salt Lake County area.

3. Phase III

The third phase of the unit would involve construction of facilities to bypass the Weber Basin Water Conservancy District facilities used in Phases I and II. This phase would only be built when the facilities of Weber Basin Water Conservancy District are no longer available to be used for wheeling Bear River water due to in-basin needs for water delivery by these facilities. With the completion of Phase III, the Wasatch Front unit would be essentially completed as envisioned in the proposed Lower Bear River Water Development Plan.

12-9-88
Figure 2

Phase II  Phase III  Phase I
B. Water Leasing from Water Suppliers in the Weber River Basin

Very little, if any, water is available for new appropriation in the Weber Basin. With spills available to be stored occurring only during years of extremely high flows, water to be leased to the Salt Lake County area will have to come from existing suppliers in Weber Basin. Future water use projections anticipate all in-basin water supplies will eventually be needed to meet needs in the Weber and Ogden drainage areas.

However, in-basin use has not yet reached this level and some water may be available for other uses on an interim basis. Approximately 30,000 acre feet of Willard Reservoir agricultural water remains unsold. The Weber Basin Water Conservancy District and the United States Bureau of Reclamation (USBR) are in the process of changing this allocation to municipal and industrial use. The availability of this water for lease is dependent upon approval of this change in allocation. Also, use of this 30,000 acre feet will require the restoration of the Author V. Watkins dike to original height. This restoration will provide the storage necessary to provide the additional water. It is also possible that some water users in the area would be willing to lease water that they may not be currently using.

Demand for additional water in the Salt Lake County area will increase with time. The initial phases of this demand could be met by leasing water from the Weber and Ogden drainage if the transmission facilities described in Phase I were in place. It must be emphasized that the lease of water would be on an interim basis until the water is needed for use in the Weber and Ogden drainage. When there is insufficient water to lease in the Weber and Ogden drainage, the additional phases of the Wasatch Front Unit would be needed to bring Bear River water to the Wasatch Front.

Such a leasing arrangement provides benefits to both the lessee and owner of the water. Leasing of water not currently being used would provide revenue to the owner, and the water would still be available for future use in the owner's local service area. The lessee would have water available at a lower initial capital investment (Phase I) and additional time to develop Phases II and III. Eventually, when demands in both the Weber and Ogden drainage and the Salt Lake County area exceed the supplies available under Phase I leasing agreements, then Phases II and III would be built to meet the additional demands.
C. Water Quality

Preliminary data indicates that water from the Bear River at Cutler is similar in quality to water in Willard Bay and water quality at the Slaterville diversion is comparable with other sources of water being contemplated for future use in the Salt Lake County area. The water will require conventional treatment to meet Safe Drinking Water Standards.

D. Environmental Impacts

A project of this magnitude will require the preparation of an environmental impact assessment or statement. Any time a large amount of water is transported for use, environmental consequences can arise. While, presently, little has been done to enumerate and define the environmental impacts, a detailed analysis will completed as part of the project investigative procedures.

E. Implementation Schedule

Based on the premise that water is to be delivered to the Salt Lake County area by Phase I of the Wasatch Front Unit starting in the year 2000, the Division of Water Resources estimates that the following schedule is representative of the sequence of events that will need to be undertaken and completed.

![Diagram showing implementation schedule for Wasatch Front M & I Unit - Phase 1]
III. Detailed Description of Phase I of the Wasatch Front M&I Unit

The following description of Phase I of the Wasatch Front M&I Unit is very preliminary and was developed in order that a cost estimate could be made. See Figure 3 for a layout on Phase I. Final location and alignment will be determined during the feasibility study and preliminary design phase of the project.

A. Willard Reservoir to Weber River

The Willard Canal is the proposed conveyance system from Willard Reservoir to the Weber River. The canal, designed without gradient, allows water to flow by gravity from the Slatersville Diversion to the reservoir when surplus waters are available in the Weber River. Also, the water stored in the reservoir can be pumped back through the same canal for use either along the route of the canal or downstream on the Weber River or farther south through the Layton Canal.

The additional capacity required to deliver 50,000 acre feet per year would be 120 cfs. This flow is in addition to the present flows pumped back through the Willard Canal and would require upgrading the pump stations on the Willard Canal. The capacity of the Willard Canal is 1,100 cfs. There are two pump stations on the Willard Canal. Pump station #1, at the Willard Bay, has a capacity of 500 cfs and pump station #2, approximately a mile north of the Slatersville diversion, has a capacity of 250 cfs. Currently all pumping capacity is used at times which means some additional pumps, or larger ones, must be installed at the two stations to achieve the additional required flows of this proposal.

Pump station #1 has an additional forebay and would not require extensive construction costs to install another pump. Pump station #2 has three pumps, one 150 HP and two 75 HP. One of the smaller pumps would be replaced with a 300 HP pump.

B. Weber River to Regulating Reservoir

The Layton Canal is to be used for the first part of this reach from the Slatersville Diversion, on the Weber River, to the Layton pump station. The pump station will be upgraded to handle the increased flows by replacing one or more of the
existing pumps with larger ones. The route will continue in the Layton Canal until the canal enters into a 54-inch reinforced concrete pipeline. The length of the canal is approximately 8.8 miles. The canal is presently used to its capacity in drought years, so it will need to be enlarged to accommodate the extra 120 cfs. The canal is lined with clay, which will need to be re-installed after enlargement is made to maintain water tightness. There are also approximately 15 siphons which, for capacity in drought years, will have to be either enlarged or paralleled with additional siphons.

For cost estimating purposes, the following alignment was used. From the end of the Layton Canal to the regulating reservoir, a 54-inch pipeline, which follows the UP&L transmission powerline alignment, will be installed for approximately 12.5 miles. A pump station will be situated near the beginning of the pipeline to pressurize the system. The flow in this section will be 120 cfs throughout the irrigation season.

C. Regulating Reservoir to Salt Lake County Treatment Plant

A regulating reservoir would be built in northern Davis County on the shoreline of the Great Salt Lake. The reservoir is an embankment dike type similar to the Willard Reservoir. For cost estimating purposes, the size was set at 24,000 acre feet. This reservoir would provide peaking capacity for the system and some winter holdover storage so the Willard and Layton canals are not operated during the winter months. The reservoir allows for the use of a constant flow system from the Slaterville Diversion. A constant flow system is beneficial because smaller pipe may be used with lower attendant construction costs.

The section of the project from the regulating reservoir to the vicinity of 2100 South and 40th West will be 60-inch variable flow pipeline. The proposed alignment for this section, used for the cost estimate of the system, follows the UP&L power line right of way for about 7.5 miles. An additional 10 miles of pipeline is required to deliver water to the vicinity of 2100 South and 40th West. Alignments for this section are east of the Salt Lake International Airport to the vicinity of I-80. After passing under I-80, the pipeline heads west to approximately 4000 West and then south to 2100 South. A pump station will be required just downstream from the regulating reservoir to provide the required head. This line will deliver raw water for treatment at the terminus.
IV. Cost Estimate (1988 dollars) for Phase I of the Wasatch Front M&I Unit

A. Willard Reservoir to Regulating Reservoir
Annual Delivery of 50,000 Acre feet

Item

CONSTRUCTION COSTS

- Canal rehab/pumps $ 2,500,000
- Pump station $ 3,600,000
- Pipeline $ 16,500,000
- Reservoir (24,000 AF) $ 11,600,000
- Recreation facilities $ 1,000,000
- Contingency (15%) $ 5,300,000

Subtotal $ 40,500,000

NON-CONSTRUCTION COSTS

- Land & right-of-way $ 3,000,000
- Engineering, legal, & administration $ 5,000,000

Subtotal $ 8,000,000

TOTAL $ 48,500,000

B. Regulating Reservoir to Treatment Plant
Annual Delivery – 50,000 Acre Feet

Item

CONSTRUCTION COSTS

- Pump station $ 3,200,000
- Pipeline $ 19,400,000
- Contingency (15%) $ 3,400,000

Subtotal $ 26,000,000

NON CONSTRUCTION COSTS

- Land & right-of-way $ 700,000
- Engineering, legal, & administration $ 3,300,000

SubTotal $ 4,000,000

TOTAL $ 30,000,000
C. Total Phase I Project Cost Estimate (1988 dollars)

<table>
<thead>
<tr>
<th>TOTAL PHASE I PROJECT COSTS ($)</th>
<th>78,500,000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ANNUAL COSTS</strong></td>
<td>5.5% - 50 year</td>
</tr>
<tr>
<td>Capital</td>
<td>4,631,000</td>
</tr>
<tr>
<td>O &amp; M Canal/Pump</td>
<td>1,200,000</td>
</tr>
<tr>
<td>O &amp; M Pipeline/Pump</td>
<td>3,330,000</td>
</tr>
<tr>
<td>Total Annual Costs</td>
<td>9,161,000</td>
</tr>
</tbody>
</table>

* Unit Cost ($/acre foot) 183

* Unit Cost ($/mil gal) 561

* Unit costs based on full delivery of 50,000 acre feet per year for the 50-year period. Does not include the lease cost of water, nor the cost of treatment.
To assure continuity with the previous completed studies, the following assumptions were used in this report:

1. Flow conditions include an average annual delivery of 50,000 acre feet to the regulating reservoir in north Davis County. The flow to Salt Lake County is variable and reflects summer peaking capacity based on current Salt Lake County Water Conservancy District demand patterns.

2. A Hazen-Williams "C" factor of 140 was assumed for the hydraulic analysis for the pipeline.

3. Pumping station efficiencies were assumed to be 75 percent.

4. Power rate was assumed to be 5 cents per kilowatt hour with a 10 percent annual rate of increase over the first 5 years and a 4 percent increase after that.

5. Economic annual capital costs were determined using a 5.5% interest rate over a 50-year period.

6. Environmental mitigation costs and non-reimbursable project feature costs are not included.