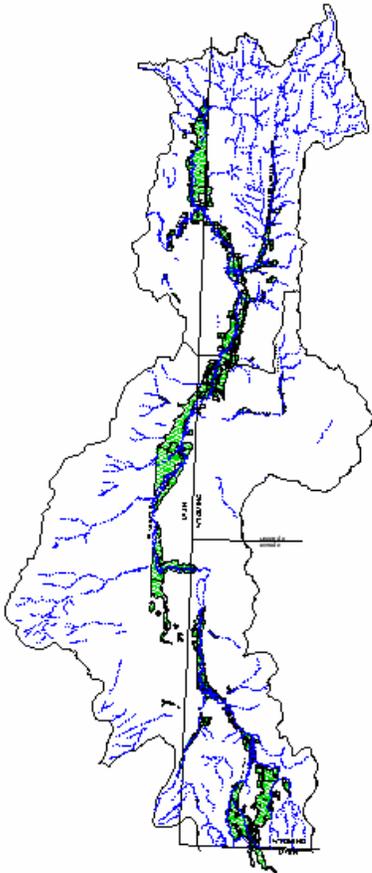


# Bear River Basin Water Plan

## Final Report

September, 2001



Prepared for the

**Wyoming Water  
Development Commission**



ANDERSON CONSULTING ENGINEERS, INC

Civil • Water Resources • Environmental

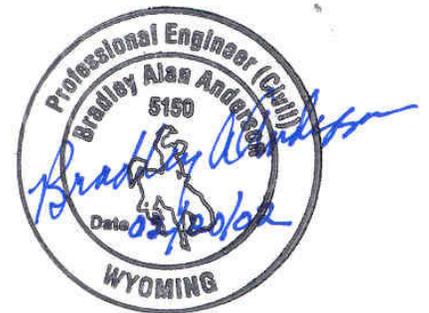
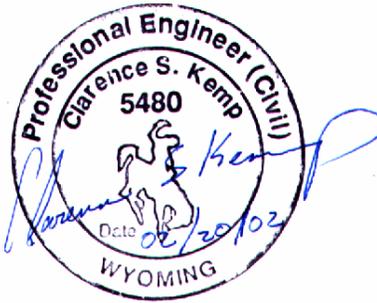
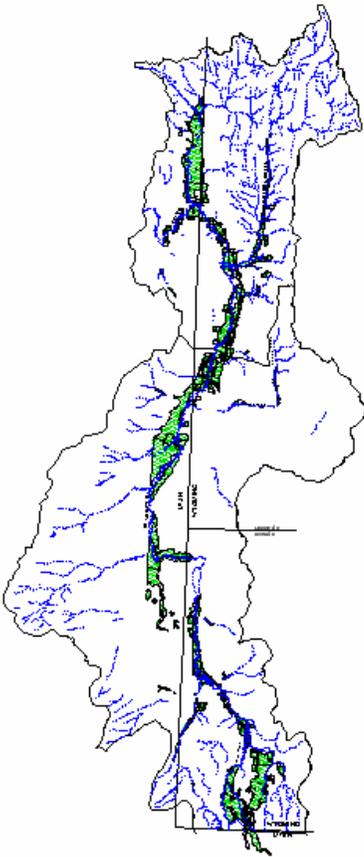


Leonard Rice Engineers, Inc.



# Bear River Basin Water Plan

## FINAL REPORT



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## **6.0 Demand Projections and Future Water Use Opportunities**

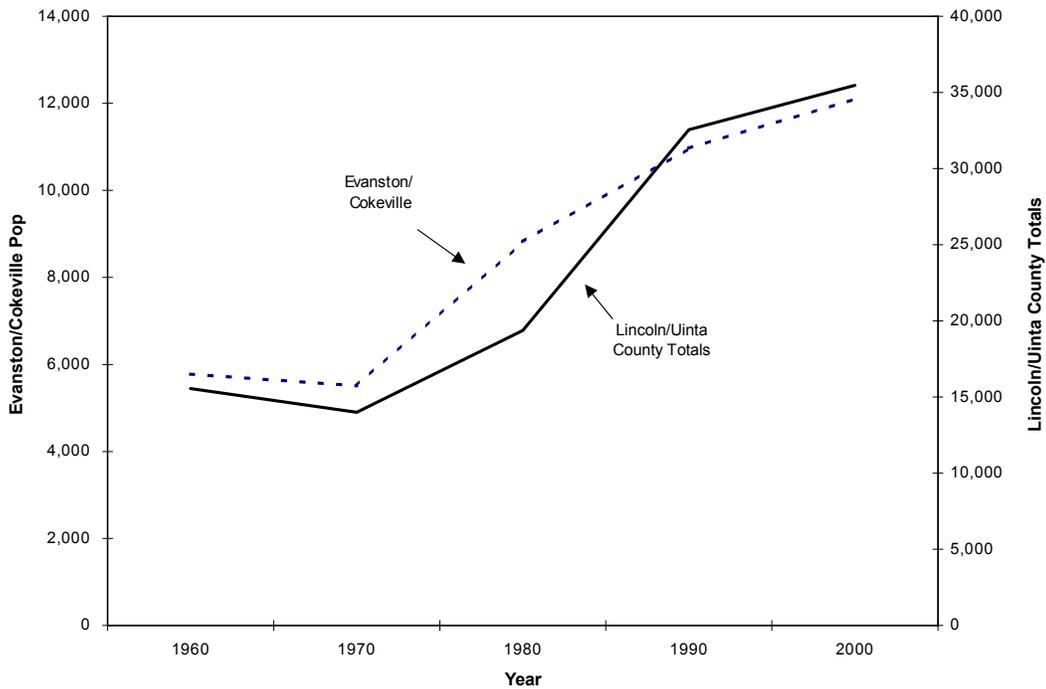
### **6.1 Historic and Current Economic and Demographic Conditions**

The starting point for the development of water demand projections requires an understanding of the current economic and demographic conditions in the basin. The identification of historic changes and trends in the basin, plus the evaluation of the most important sectors from an economic and water use standpoint, helped define the emphasis for future economic and demographic scenarios. A detailed analysis of historic and current economic conditions is described in the "Historic and Current Economic and Demographic Conditions " memorandum included in **Appendix Q**.

#### ***6.1.1 Historic Population Growth***

Since 1960, the combined population of Evanston and Cokeville has increased at an average annual rate of about four percent. This long-term average, however, masks considerable fluctuation during this 40-year period. As shown in **Figure 33**, the population of the two communities actually declined during the 1960s, but grew rapidly during the decades of the 1970s and 1980s. The 1990s have been characterized by comparatively slow, but steady, growth, with the combined population of Evanston and Cokeville increasing at an average annual rate of less than one percent over the past ten years. In general, the rates of population growth in Evanston and Cokeville closely correspond to the rates of population growth for Uinta and Lincoln Counties as a whole, also shown in **Figure 33**, over the past four decades.

**Figure 33**  
**Population of Evanston and Cokeville and the Remainder of Lincoln and Uinta Counties, 1960 to 2000**



**6.1.2 Historic and Current Employment**

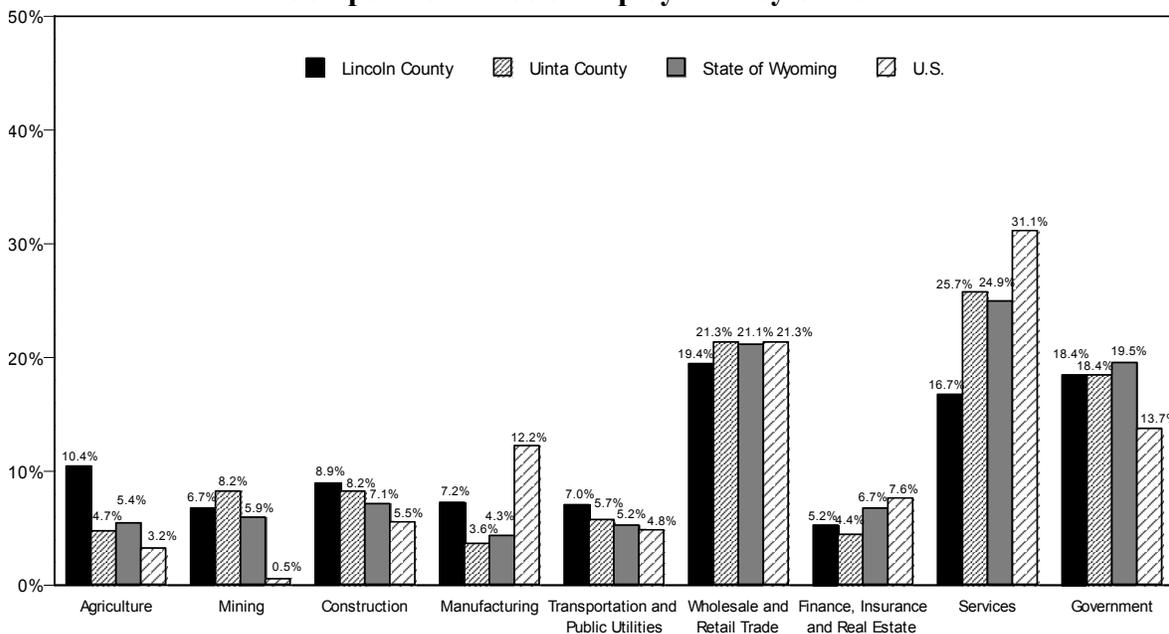
It is estimated that there are currently 20,000 full and part-time jobs located in Uinta and Lincoln Counties. Approximately 10,000 of these jobs are located within the Bear River Basin portions of the two counties, with approximately 9,500 jobs located in the Uinta County part of the Basin (principally in and around Evanston) and about 500 jobs located in the Lincoln County portion.

Uinta County employment grew rapidly from the late 1970s through the mid-1980s during the period of intense oil and gas development activity, now known locally as "The Boom." After experiencing a slight decline in total employment during the late 1980s, Uinta County jobs have grown steadily at about the same rate as the State as a whole during the 1990s. In general, Lincoln County employment growth during the past three decades has been slower than either Uinta County or the State as a whole. An exception was the brief period of power plant construction during the mid-1980s; county employment fell back shortly thereafter to levels comparable to the pre-construction period.

**Figure 34** shows the shares of total employment in Lincoln County, Uinta County, the State of Wyoming, and the U.S. for major industry divisions. The following conclusions can be drawn from this figure and information gathered for the basin:

- The three largest employment sectors in both basin counties are services, retail trade, and government. These industries are also the largest employment sectors for Wyoming and the U.S.
- Both basin counties have disproportionately large shares of employment in the mining sector compared to the national average. In Uinta County, these jobs are predominately related to oil and gas production. In Lincoln County, many of these jobs are located at the coal mine near Kemmerer, which is outside the Bear River basin.
- Both counties also have relatively large construction sectors; related both to the importance of road construction and maintenance as an economic activity in many parts of Wyoming and to the local energy sectors which also support numerous construction jobs.
- Agricultural employment in the basin counties, and particularly in Lincoln County, is relatively large compared to the national average.
- There are a relatively large number of government sector jobs in the basin counties, and the State as a whole, reflecting, in part, the large amount of federal lands that are administered in each area.
- The share of employment in retail trade in the basin counties is only a little higher than the national average, however, it is relatively large for economies the size of Lincoln and Uinta counties. This is an indicator of the importance of tourism and visitor dollars in the local economic base.

**Figure 34**  
**Composition of 1998 Employment by Sector**



## 6.2 Future Economic and Demographic Scenarios

An economic base analysis was used to project future growth in the Bear River Basin, as described in the "Future Economic and Demographic Scenarios" memorandum included in **Appendix Q**. This "bottom up" method has the advantages of focusing directly on specific activities that are likely to drive economic and demographic changes in the future. This approach involved the following five steps:

1. Identify the existing and potential basic economic activities in the region through analysis of economic statistics and local interviews.
2. Identify the current statistical relationships: a) between total employment in economic base activities and other employment in the economy (termed "local service employment"); and b) between total employment and population.
3. Conduct industry studies for each of the basic economic sectors to identify trends in employment and production and factors affecting potential future growth of those sectors.
4. Develop specific projections of future basic economic activity levels based upon the results of step 3 and clearly defined scenario assumptions.
5. Develop overall employment and population projections based upon the basic activity projections developed in step 4 and the statistical relationships developed in step 2.

Two planning scenarios were developed using the economic base approach. The planning horizon was 30 years, therefore growth was estimated through the year 2030. The High Case Scenario incorporates the most growth in each of the key sectors that is reasonably likely to occur over the forecast horizon. This scenario incorporates the aggressive assumption that each of the key sectors will achieve its highest likely growth at the same time, providing an upper bound for water planning purposes.

The Low Case Scenario incorporates the lowest growth reasonably likely to occur in each of the key sectors. This provides the lower bound for planning purposes. Although this scenario will not impose pressure on regional water resources, it can be used to determine the financial risk involved with potential water resource enhancements.

Based on the analysis of historic and current employment, four key sectors were identified that are the most likely to continue to be important to future economic growth in the Bear River Basin as follows:

- Agriculture
- Energy
- Tourism
- Manufacturing

### ***6.2.1 Agriculture Sector***

Agriculture sector projections were based on historic trends and assumptions about 1) future BLM grazing policies and 2) whether the Cokeville Meadows Wildlife Refuge will be fully implemented by the end of the projection time horizon.

Crop production in the Bear River Basin consists mainly of hay (irrigated meadow and alfalfa) used for supplemental livestock feed. The vast majority of hay grown within the basin is consumed by basin livestock during the winter months. Since livestock are the most important cash crop of the basin agricultural sector, the analysis of the agricultural sector is based largely on livestock inventory. In order to standardize the analysis in terms of livestock forage levels, livestock inventories are converted to "Animal Units." This is equal to the sum of cattle inventories divided by two and sheep inventories divided by five.

#### High Case Scenario

The High Case Scenario for agricultural production reflects the assumptions that the BLM will continue historical grazing policies and that the Cokeville Meadows Wildlife Refuge will remain largely unimplemented. Under this scenario, cattle production continues to increase and sheep production continues to decline by about one percent annually. By the end of the planning horizon, there are projected to be 31,000 cattle animal units and 10,000 sheep animal units within the Bear River Basin. Under this scenario, irrigated acreage would increase slightly to about 69,000 acres in the year 2030. The number of ranches and total farm jobs would remain at approximately current levels, assuming increased labor efficiency.

#### Low Case Scenario

The Low Scenario for agricultural production reflects changes in the two assumptions. The first is that the BLM will expand its "no-conversion of sheep to cattle" grazing policy to other allotments in the basin, producing a decline in grazing capacity on public lands. This would reduce the projected animal units by 4,000. The second is that the Cokeville Meadows Wildlife Refuge will be fully implemented, reducing the basin animal units by approximately 4,000 at the end of the planning horizon. Therefore, the total projected cattle animal units at the end of the planning horizon would be about 24,000. Under this scenario, irrigated acreage would decrease slightly to about 61,000 acres in the year 2030. The basin would lose a total of 50 farm jobs by the year 2030.

### ***6.2.2 Energy Sector***

Energy sector projections were based upon local insights into the life cycle of the Bear River Basin oil and gas fields, USDOE Energy Information Administration (EIA) long range projections of energy supply and statistical analyses to project first Wyoming production, then basin production. Essentially, the low and high scenarios reflect

differing assumptions regarding: a) national and regional total gas and oil production, and b) the proportion of Wyoming gas production, and Rocky Mountain Region oil production, that will be supplied by operations within the Basin.

#### High Case Scenario

The High Case Scenario for natural gas production reflects EIA High Technology Case projections for natural gas production in the Rocky Mountain Region, with a slower decline in the Basin proportion of total Wyoming gas production due to renewed exploration and enhanced recovery techniques. Under this scenario basin production and associated processing will be approximately 15 percent more than current production. Oil production reflects EIA High Technology Case projections for natural gas production in the lower 48 states. Under this scenario, basin production and processing decreases by approximately 50 percent from current production.

#### Low Case Scenario

The Low Case Scenario for natural gas and oil production reflects EIA Reference Case projections for natural gas production in the Rocky Mountain Region, plus information regarding existing oil and gas fields in the basin. Under this scenario basin gas production and processing will cease by 2027. Basin oil production and processing will cease by 2026.

### ***6.2.3 Tourism Sector***

Tourism sector projections were based upon 1) increases in traffic counts projected by the Wyoming Department of Transportation at the Evanston East traffic counter station, and 2) projected population growth for the Davis, Morgan, Salt Lake and Weber Counties in the Wasatch Front region of Utah. Note that water related recreational uses are expected to increase significantly in the next 30 years, which will contribute to tourism in the basin. Projected increases in recreational uses are detailed in the "Future Recreational Demands" memorandum included in **Appendix Q**.

#### High Case Scenario

The High Case Scenario for tourism reflects, in part, the assumption that basin visitation will increase in proportion with projected increases in I-80 traffic in the Evanston area. Estimated tourist related employment in Evanston would be more than two times current levels, reflecting an average annual growth of 2.9 percent.

#### Low Case Scenario

The Low Case Scenario for tourism reflects the assumption that growth in the basin will occur at the same rate as growth in the population of the Wasatch Front region in Utah, the primary source of non-highway visitors. Estimated tourist related employment in

Evanston would rise by slightly more than 60 percent, reflecting an average annual growth of 1.6 percent.

#### ***6.2.4 Manufacturing Sector***

The high scenario for the manufacturing sector is based on the historic trend in manufacturing job growth in the Evanston area. The low manufacturing sector scenario reflects, in part, an anticipated slowdown in growth in manufacturing employment in the nearby Wasatch Front and reflects the close economic ties between Evanston and the Utah economic centers and the fact that Evanston is a potential alternative for firms looking to be near, but not in the midst of, the Salt Lake City Metropolitan Area.

##### High Case Scenario

The High Case Scenario for manufacturing, light industrial, and business service activities, is projected to increase at an average annual growth rate of six percent per year. Total employment in these activities will rise from a current level of about 650 jobs to over 3,000 jobs by 2030.

##### Low Case Scenario

The Low Case Scenario for manufacturing, light industrial, and business service activities, is projected to increase at an average annual growth rate of two percent per year. Total employment in these activities will rise from a current level of about 650 jobs to over 1,200 jobs by 2030.

#### ***6.2.5 Overall Economic and Demographic Projections***

The future economic projections were incorporated into a model of Bear River Basin employment and population in order to develop aggregated estimates of total residents and total jobs in 2030 under the Economic Base High Scenario and Economic Base Low Scenario. **Table 21** shows the current and projected employment breakdown, by sector, in the Bear River Basin.

**Table 21**  
**Current and Projected Employment Breakdown**

	<u>Current Employment Bear River Area Only</u>		<u>2030 -- High Scenario Bear River Area Only</u>		<u>2030 -- Low Scenario Bear River Area Only</u>	
	Uinta Co	Lincoln Co	Uinta Co	Lincoln Co	Uinta Co	Lincoln Co
<b>Basic Employment</b>						
Agriculture	260	265	260	265	245	230
Tourism/ Visitor Related	640	50	1,500	130	1,040	100
Energy Related	900	0	900	0	0	0
Other Industry (Manuf./ Bus. Services)	650	0	3,700	100	1,170	0
Highway/ Railroad Construction and Service	100	0	100	0	100	0
State/ Federal Government	500	0	500	0	500	0
Net Outcommuting	<u>800</u>	<u>NA</u>	<u>1,500</u>	<u>NA</u>	<u>1,200</u>	<u>NA</u>
<b>Subtotal</b>	3,850	315	8,460	495	4,255	330
<b>Indirect Basic/Local Service Employment</b>						
<b>Subtotal</b>	<u>5,650</u>	<u>185</u>	<u>11,000</u>	<u>300</u>	<u>5,530</u>	<u>200</u>
<b>Total Employment</b>	<b>9,500</b>	<b>500</b>	<b>19,460</b>	<b>795</b>	<b>9,785</b>	<b>530</b>
<b>Total Employment/Direct Basic Ratio*</b>	2.5	1.6	2.3	1.6	2.3	1.6

The two scenarios portray markedly different potential futures for the region. Under the high case scenario, activity and employment in the energy producing sector would remain relatively stable, agricultural production and irrigated acreage would increase modestly, and there would be substantial growth in tourism related employment and, especially, in new manufacturing and commercial activities targeted toward customers outside the region. Under the low case, there would be modest declines in agriculture due to public land grazing availability and implementation of the Cokeville Meadows Wildlife Refuge, energy activity would essentially cease by 2030, and growth in tourism and manufacturing/commercial activity would essentially be just sufficient to offset the loss of jobs in the energy sector.

Projected Bear River Basin population in 2030 under the high case would exceed 29,000 residents, compared a little more than 15,000 residents under the low case, which is similar to year 2000 basin population.

### 6.3 Future Water Demand Projections

Water demands are derived by multiplying current or projected demographic or economic activity by the water use factors for each activity. These water use factors are based on

existing water use estimates, described in **Section 3.0**. Total water diversions and consumptive use are presented and discussed for each sector for both High Case and Low Case scenarios. A detailed analysis is discussed in the "Future Demand Projections" memorandum included in **Appendix Q**.

### 6.3.1 High Case Scenario Projected Water Use

Total basin water diversion requirements are projected to increase by about seven percent from year 2000 to year 2030 under the High Case Scenario. Under normal water year conditions, this amounts to about 21,400 acre-feet; under dry hydrologic conditions (high demand year) the increase would be about 29,000 acre-feet. **Table 22** shows the current and projected water diversion demand for the High Case Scenario. **Table 23** shows the corresponding consumptive use under the High Case Scenario.

**Table 22**  
**Current and Projected Annual Bear River Water Diversion Demand in Acre-Feet**  
**High Case Scenario**

	Current Demands		2030 High Scenario Demands	
	Normal Demand Year	High Demand Year	Normal Demand Year	High Demand Year
<b>Demand by Type of Use</b>				
Agriculture				
Irrigation	294,668	419,185	311,577	443,239
Livestock	<u>528</u>	<u>528</u>	<u>611</u>	<u>611</u>
Agriculture Subtotal	295,196	419,713	312,188	443,850
Municipal				
Evanston				
Residential	2,087	2,286	4,228	4,631
Commercial	638	705	1,310	1,447
Institutional	<u>1,067</u>	<u>1,386</u>	<u>2,162</u>	<u>2,807</u>
Subtotal	3,792	4,377	7,700	8,886
Cokeville	<u>653</u>	<u>653</u>	<u>664</u>	<u>664</u>
Municipal Subtotal	4,446	5,030	8,364	9,550
Rural Domestic	500	500	959	959
Industrial	<u>459</u>	<u>680</u>	<u>494</u>	<u>731</u>
<b>Total Demand</b>	300,601	425,923	322,005	455,091
<b>Demand by Source of Supply</b>				
Surface Water	293,454	416,212	314,042	444,416
Ground Water	<u>7,147</u>	<u>9,710</u>	<u>7,963</u>	<u>10,675</u>
<b>Total Demand</b>	300,601	425,923	322,005	455,091

\*Note that High Demand Year corresponds to Dry Hydrologic Conditions

**Table 23**  
**Current and Projected Annual Bear River Water Consumptive Use in Acre-Feet**  
**High Case Scenario**

	Current Demands		2030 High Scenario Demands	
	Normal Demand Year	High Demand Year	Normal Demand Year	High Demand Year
<b>Demand by Type of Use</b>				
Agriculture				
Irrigation	94,528	136,251	99,953	144,070
Livestock	<u>528</u>	<u>528</u>	<u>611</u>	<u>611</u>
Agriculture Subtotal	95,056	136,779	100,564	144,681
Municipal				
Evanston				
Residential	1,262	1,468	2,557	2,973
Commercial	387	455	794	935
Institutional	<u>655</u>	<u>976</u>	<u>1,326</u>	<u>1,977</u>
Subtotal	2,304	2,899	4,678	5,885
Cokeville	<u>505</u>	<u>507</u>	<u>513</u>	<u>516</u>
Municipal Subtotal	2,809	3,406	5,192	6,400
Rural Domestic	500	500	959	959
Industrial	<u>459</u>	<u>680</u>	<u>494</u>	<u>731</u>
<b>Total Demand</b>	98,825	141,365	107,209	152,772
<b>Demand by Source of Supply</b>				
Surface Water	95,829	137,460	103,629	148,229
Ground Water	<u>2,996</u>	<u>3,906</u>	<u>3,580</u>	<u>4,543</u>
<b>Total Demand</b>	98,825	141,365	107,209	152,772

\*Note that High Demand Year corresponds to Dry Hydrologic Conditions

The following summarizes uses for the High Case Scenario:

- Total agricultural water demand grows slightly over the planning period, whether measured in terms of diversions or consumptive use. Despite a lack of growth in the sector, agriculture continues to comprise the vast majority of total water demand under the High Case Scenario; agriculture is responsible for 97 percent of total water diverted and 94 percent of total consumptive use in the year 2030.
- Municipal water demand almost doubles over the 30-year planning period, however, it remains a relatively small sector, accounting for only 2.6 percent of total water diversions, and 4.8 percent of total consumptive use within the Basin.
- Water demand is projected to more than double in all municipal sectors in Evanston, however, water demand in Cokeville remains almost constant over the planning period. This is because the projected population growth of Cokeville is offset by the assumption that per capita water demand will decline sharply due to the implementation of usage based water rates in the town during the planning period.

- Rural domestic water demand of households not connected to a public water system is projected to almost double over the next 30 years, due in large part to the projected population growth around the Evanston area.
- Water demand within the industrial sector is not projected to change substantially over the planning period.
- Changes in overall water demand over the 30-year planning period are relatively small because of the continued domination of the agricultural sector.

### ***6.3.2 Low Case Scenario Projected Water Use***

Total water diversion requirements under the low case scenario are projected to be slightly lower in 2030 than they were in 2000. However, in any given year from 2000 to 2030, there might be the need for 120,000 more acre-feet in a high demand, dry year compared with a normal year. **Table 24** shows the current and projected water diversion demand for the Low Case Scenario. **Table 25** shows the corresponding consumptive use under the Low Case Scenario.

**Table 24**  
**Current and Projected Annual Bear River Water Diversion Demand in Acre-Feet**  
**Low Case Scenario**

	<u>Current Demands</u>		<u>2030 Low Scenario Demands</u>	
	Normal Demand Year	High Demand Year	Normal Demand Year	High Demand Year
<b>Demand by Type of Use</b>				
Agriculture				
Irrigation	294,668	419,185	277,139	394,249
Livestock	<u>528</u>	<u>528</u>	<u>487</u>	<u>487</u>
Agriculture Subtotal	295,196	419,713	277,627	394,736
Environmental				
Wetland Impoundments	0	0	15,305	21,434
Municipal				
Evanston				
Residential	2,087	2,286	2,126	2,329
Commercial	638	705	659	728
Institutional	<u>1,067</u>	<u>1,386</u>	<u>1,087</u>	<u>1,412</u>
Subtotal	3,792	4,377	3,872	4,468
Cokeville	<u>653</u>	<u>653</u>	<u>471</u>	<u>471</u>
Municipal Subtotal	4,446	5,030	4,342	4,938
Rural Domestic	500	500	504	504
Industrial	<u>459</u>	<u>680</u>	<u>0</u>	<u>0</u>
<b>Total Demand</b>	300,601	425,923	297,779	421,614
<b>Demand by Source of Supply</b>				
Surface Water	293,454	416,212	291,261	412,753
Ground Water	<u>7,147</u>	<u>9,710</u>	<u>6,518</u>	<u>8,860</u>
<b>Total Demand</b>	300,601	425,923	297,779	421,614

\*Note that High Demand Year corresponds to Dry Hydrologic Conditions

**Table 25**  
**Current and Projected Annual Bear River Water Consumptive Use in Acre-Feet**  
**Low Case Scenario**

	<u>Current Demands</u>		<u>2030 Low Scenario Demands</u>	
	<u>Normal</u> Demand Year	<u>High</u> Demand Year	<u>Normal</u> Demand Year	<u>High</u> Demand Year
<b>Demand by Type of Use</b>				
Agriculture				
Irrigation	94,528	136,251	88,905	128,146
Livestock	528	528	487	487
Agriculture Subtotal	95,056	136,779	89,393	128,634
Environmental				
Wetland Impoundments	<u>0</u>	<u>0</u>	<u>4,862</u>	<u>6,780</u>
Municipal				
Evanston				
Residential	1,262	1,468	1,286	1,495
Commercial	387	455	399	470
Institutional	655	976	667	994
Subtotal	2,304	2,899	2,352	2,959
Cokeville	<u>505</u>	<u>507</u>	<u>364</u>	<u>365</u>
Municipal Subtotal	2,809	3,406	2,716	3,324
Rural Domestic	500	500	504	504
Industrial	<u>459</u>	<u>680</u>	<u>0</u>	<u>0</u>
<b>Total Demand</b>	98,825	141,365	97,475	139,242
<b>Demand by Source of Supply</b>				
Surface Water	95,829	137,460	94,829	135,809
Ground Water	<u>2,996</u>	<u>3,906</u>	<u>2,646</u>	<u>3,433</u>
<b>Total Demand</b>	98,825	141,365	97,475	139,242

\*Note that High Demand Year corresponds to Dry Hydrologic Conditions

The following summarizes uses for the Low Case Scenario:

- Total water demand in the agricultural sector declines over the projection period by about 6 percent. The decline in livestock water demand directly reflects the impacts of a change in BLM grazing policy and the implementation of the Cokeville Meadows Wildlife Refuge.
- The environmental sector line item included in the low scenario specifically refers to the wetland water requirements within the Cokeville Meadows Wildlife Refuge. If the refuge is fully implemented, water impoundments will likely be made in order to augment existing waterfowl habitat area.
- In the municipal sector, the modest decline in both diversions and consumptive use is the direct result of two factors: constant population levels and the anticipated implementation of a usage based water rate system in Cokeville.

- The most significant change under the low scenario was the complete elimination of any industrial water demand within the Basin. This result is reflective of the assumed extraction of all remaining recoverable natural gas reserves within the Basin during the 30-year projection period.
- Changes in overall water demand over the 30-year time horizon are relatively small because of the continued domination of the agricultural sector.

## **6.4 Comparison of Projected Demand to Available Surface Water Supplies**

Available surface water, defined in **Section 5.2**, was compared to High Case Scenario projected demands for normal and dry hydrologic years. The geographic allocation of future monthly water demands reflects the following:

- Agriculture (irrigation and livestock use) demands were allocated based on the current geographic distribution of this type of water demand throughout the Bear River Basin.
- The "Other" category includes two types of demand -- surface supplied municipal demands and industrial demands. City of Cokeville demands were excluded from this analysis, since Cokeville is supplied with groundwater. For purposes of this analysis, Upper Division industrial demands include the surface water supplied to the Chevron gas processing facility. No additional surface supplied industrial demands were projected for the Central Division, since new industrial operations in that region are likely to be supplied with groundwater.

### ***6.4.1 Diversion Demands versus Available Surface Supply in Normal Years***

**Table 26** shows the projected monthly increase in required surface water supply to meet increased demands under the High Case Scenario for normal hydrologic year conditions in the Upper and Central divisions. These are compared to the available surface water, defined in **Section 5.2**, to show surpluses and shortages.

**Table 26**  
**Projected Increase in Diversion Demands versus Available Supply**  
**Normal Year Conditions (all values in acre-feet)**

**Upper Division**

	<b>Projected Demand Growth by Month</b>			<b>Available Surface Supply</b>	<b>Surplus/ (Shortage)</b>
	<b>Agriculture</b>	<b>Other</b>	<b>Total</b>		
Jan	2	156	158	4,745	4,587
Feb	2	150	152	4,836	4,684
Mar	2	152	155	11,520	11,365
Apr	38	145	183	18,627	18,444
May	813	237	1,050	19,049	17,999
Jun	2,725	491	3,217	66,197	62,980
Jul	3,210	698	3,908	97	(3,811)
Aug	1,457	803	2,260	0	(2,260)
Sep	405	551	956	0	(956)
Oct	42	269	311	6,162	5,851
Nov	2	141	143	5,932	5,789
<u>Dec</u>	<u>2</u>	<u>143</u>	<u>145</u>	<u>5,260</u>	<u>5,115</u>
<b>Total</b>	<b>8,702</b>	<b>3,936</b>	<b>12,637</b>	<b>142,425</b>	<b>129,788</b>

**Central Division**

	<b>Projected Demand Growth by Month</b>			<b>Available Surface Supply</b>	<b>Surplus/ (Shortage)</b>
	<b>Agriculture</b>	<b>Other</b>	<b>Total</b>		
Jan	2	0	2	0	(2)
Feb	2	0	2	0	(2)
Mar	2	0	2	6,939	6,937
Apr	10	0	10	34,769	34,759
May	610	0	610	53,300	52,690
Jun	2,804	0	2,804	69,232	66,428
Jul	3,008	0	3,008	23,551	20,543
Aug	1,575	0	1,575	0	(1,575)
Sep	319	0	319	0	(319)
Oct	22	0	22	0	(22)
Nov	3	0	3	0	(3)
<u>Dec</u>	<u>2</u>	<u>0</u>	<u>2</u>	<u>0</u>	<u>(2)</u>
<b>Total</b>	<b>8,359</b>	<b>0</b>	<b>8,359</b>	<b>187,791</b>	<b>179,432</b>

During a normal year, the growth in demands are dominated by the agricultural sector in both the Upper and Central divisions, however, growth in demand for non-agricultural purposes will be an important factor only in the Upper Division. During the summer growing season agricultural demands constitute between 64 and 84 percent of total demand growth in the Upper Division. In the Central Division, agricultural demand growth constitutes 100 percent of the total increase in monthly demands through 2030. This difference is due mainly to the growth in municipal water demand projected for the Evanston area over the next 30 years. Therefore, while agricultural demands follow

roughly the same monthly distribution in both divisions, the monthly distribution of total demand growth between the divisions varies due to the influence of the non-agricultural sector.

The monthly distribution of available, uncommitted surface water supplies for a normal year is similar for both the Upper and Central divisions. Available supplies begin building with the spring runoff and peak in the month of June. In each division, available supplies stabilize throughout the fall and winter seasons. The main difference is that in the Upper Division some surface water supplies remain available nine months of the year, while in the Central Division supplies are available only during the spring runoff period.

**Table 26** also shows the difference in the growth of demands and the uncommitted surface water supplies on a monthly basis under normal conditions. In the Upper Division, shortages are projected to only occur during the peak irrigation periods. During the remaining months, uncommitted surface supplies are more than adequate to meet the projected growth in demand. In the Central Division, while monthly shortages are projected to occur from August through February, only August shortages are significant. From March through July, it is estimated that more than enough surface water will be available to meet the projected growth in demand.

#### ***6.4.2 Diversion Demands versus Available Surface Supply in Dry Years***

**Table 27** shows the projected monthly increase in required surface water supply to meet increased demands under the High Case Scenario for dry hydrologic year conditions in the Upper and Central divisions. These are compared to the available surface water, defined in **Section 5.2**, to show surpluses and shortages.

**Table 27**  
**Projected Increase in Diversion Demands versus Available Supply**  
**Dry Year Conditions (all values in acre-feet)**

**Upper Division**

	<b>Projected Demand Growth by Month</b>			<b>Available Surface Supply</b>	<b>Surplus/ (Shortage)</b>
	<b>Agriculture</b>	<b>Other</b>	<b>Total</b>		
Jan	2	180	183	1,972	1,789
Feb	2	173	176	1,665	1,489
Mar	2	176	178	3,744	3,566
Apr	51	168	219	3,934	3,715
May	1,128	274	1,403	0	(1,403)
Jun	3,789	568	4,356	9,524	5,168
Jul	4,463	806	5,269	0	(5,269)
Aug	2,025	927	2,952	0	(2,952)
Sep	561	636	1,197	0	(1,197)
Oct	58	311	369	1,735	1,366
Nov	2	163	165	2,255	2,090
<u>Dec</u>	<u>2</u>	<u>165</u>	<u>168</u>	<u>1,959</u>	<u>1,791</u>
<b>Total</b>	<b>12,088</b>	<b>4,547</b>	<b>16,635</b>	<b>26,788</b>	<b>10,153</b>

**Central Division**

	<b>Projected Demand Growth by Month</b>			<b>Available Surface Supply</b>	<b>Surplus/ (Shortage)</b>
	<b>Agriculture</b>	<b>Other</b>	<b>Total</b>		
Jan	2	0	2	0	(2)
Feb	2	0	2	0	(2)
Mar	2	0	2	0	(2)
Apr	12	0	12	0	(12)
May	847	0	847	0	(847)
Jun	3,899	0	3,899	0	(3,899)
Jul	4,183	0	4,183	0	(4,183)
Aug	2,189	0	2,189	0	(2,189)
Sep	441	0	441	0	(441)
Oct	30	0	30	0	(30)
Nov	3	0	3	0	(3)
<u>Dec</u>	<u>2</u>	<u>0</u>	<u>2</u>	<u>0</u>	<u>(2)</u>
<b>Total</b>	<b>11,612</b>	<b>0</b>	<b>11,612</b>	<b>0</b>	<b>(11,612)</b>

The distribution of demand growth during dry years has many of the same characteristics as normal years. The main difference is that in a dry year, the growth in demand for the agricultural sector increases to a much greater extent than in the non-agricultural sector. Demand growth in a dry year for the agricultural sector in both the Upper and Central divisions increased by 40 percent over what they were in a normal year. In contrast, the Upper Division non-agricultural growth in demand increased by only 16 percent. Overall demand growth in dry years is approximately 35 percent greater than under normal year climate and hydrologic conditions.

Annual uncommitted surface supplies declined dramatically in both divisions for dry year conditions versus normal year conditions. For the Upper Division, annual available supplies shrank to 19 percent of what they were under normal conditions. The largest monthly percentage declines comes during the months of May through September, when agricultural usage is at its highest. During this period, available supplies go to zero for all months except June, which declines to 14 percent of what was available in a normal year. For the Central Division, available supplies during dry year conditions go to zero during all months of the year.

The significant decline in available surface water supplies has important consequences for the monthly surplus/shortage totals projected for each division. Whereas under normal year conditions both the Upper and Central Divisions experienced very few months with significant projected shortages, under dry year conditions, both divisions experience significant projected shortages during the summer irrigation season. It should be noted that sequential dry years would aggravate these shortages considerably.

### ***6.4.3 Supplemental Supplies***

Projected future water supply demands will require supplemental water from storage or from ground water, since there is essentially no available water for diversion during dry years. Storage or supplemental ground water is required for normal and wet years if future water use is to occur in other than the high runoff months.

It is estimated that supplemental storage, limited by Bear River Compact restrictions, is feasible in the Bear River Basin. In addition, increased ground water development could be a viable source for meeting the projected demands.

## **6.5 Future Water Use Opportunities**

### ***6.5.1 Economic Development Opportunities***

Wyoming's approach to basin planning includes the identification and prioritization of future water use opportunities. Specifically, it was the intent of the planning process to generate a "long-list" of opportunities to be presented to the BAG. Based on the comments from the BAG and others, a "short-list" would then be generated reflecting the more attractive and feasible opportunities for further consideration as an outcome to the plan.

This process involved extensive interviews with representatives from government, larger industrial entities, agriculture, energy, and tourism. These interviews did not result in the identification of any extraordinary economic plans or opportunities beyond the growth scenarios previous discussed in Section 6.2.

These findings were presented to the BAG for their comment and concurrence. The BAG expressed consensus relative to the economic planning scenarios presented herein. In addition, members of the public and the BAG were unable to identify additional specific economic opportunities impacting water use. No short-list, therefore, is included in the Bear River Basin Plan. As opportunity(s) are identified in the future, the spreadsheet modeling software created as part of the planning effort will be a valuable tool in ascertaining the feasibility and/or impacts of individual projects.

### ***6.5.2 Storage Opportunities***

As indicated above, projected future water supply demands will require supplemental water from storage or from ground water, since there is essentially no available water for diversion during dry years. Storage potential is discussed as follows:

#### Bear River Compact Storage Limitations

The original 1958 Bear River Compact acknowledged the right of each member state to store water in existing water storage reservoirs constructed upstream of Stewart Dam prior to February 4, 1955. In the case of Wyoming, the compact indicates that Wyoming's pre-compact (pre-1955) storage rights total 2,150 acre-feet. It is interesting to note that Wyoming's actual developed pre-compact permitted storage totals 3284.43 acre-feet. This information is summarized in Appendix I.

The Bear River Compact also granted additional storage rights above Stewart Dam, of 35,500 acre feet in a given water year, to be split evenly between Wyoming and Utah (17,750 acre-feet each). These storage allocations are subordinate to direct flow and fill during the non-irrigation season. Between 1959 and 1976, the State of Wyoming permitted storage reservoirs totaling 17,759.56 acre-feet. (See Appendix I)  
The 1978 Amended Bear River Compact granted further storage entitlements in the amount of 70,000 acre-feet above Stewart Dam. Again, this storage entitlement was split evenly between Wyoming and Utah. These storage rights are also subordinate to direct flow and diversion rights. In addition, these reservoirs cannot be filled when the water surface elevation of Bear Lake is below 5911.00 feet.

#### Bear River Compact Storage Availability

In the event that the water surface elevation of Bear Lake drops below 5911 feet, compact restrictions on storage go into effect as indicated above. These restrictions, however, do not impact storage rights granted under the original 1958 compact. Hence, Wyoming is entitled to fill the following storage under the 1958 Compact.

Pre-1976 Permitted Volume:	13,183
Additional Woodruff Narrows Allocation:	<u>250</u>
	<b>13,433 acre-feet</b>

Note that the Needle Rock Reservoir on Yellow Creek was permitted, but never constructed. In addition, Keith Putnam elected not to construct a reservoir on Rabbit Creek and has been granted the right to transfer his compact depletion to other lands. Both of these pre-1976 allocations totaling 163.5 acre-feet are available for re-allocation. An application is still pending for the Ferney Glade Reservoir on the Smiths Fork which was filed on 8-1-1960 for 5201 acre-feet of storage. The 4,100 acre-feet allocated to Smith's Fork was primarily intended for this project. No development has occurred on the Thomas Fork in Wyoming. Therefore, Wyoming's remaining 1958 Compact allocations are as follows:

Smiths Fork	4,100
Thomas Fork	55
Putnam Allocation	63
Needle Rock Allocation	<u>100.5</u>
	<b>4318.5 acre-feet</b>

As indicated above, the pre-compact (pre-1955) storage developed in Wyoming totals 3284.43 acre-feet. This, combined with the 13,433 acre-feet of storage developed under the 1958 compact, totals 16,717.43 acre-feet of storage that can be filled in Wyoming even when the Bear Lake level drops below 5911 feet in elevation. It is worth noting that Wyoming temporarily assigned additional 1958 compact allocations to other reservoirs (Woodruff Narrows, Broadbent, and Sulphur Creek) in the basin when Bear Lake levels dropped below 5911 feet in the early 1990's.

Available Physical Supply (Direct Diversion vs. Storage Potential)

There are essentially 8 dry years in the 28 year study period, during which a new direct diversion project would not receive any water (about 3 out of every 10 years there are no divertible flows). As previously shown in Tables 19 and 20, there are virtually no available flows in either division during dry year periods, in any months. To guarantee a firm yield beyond existing allocations during these dry year periods, additional storage reservoirs would be required.

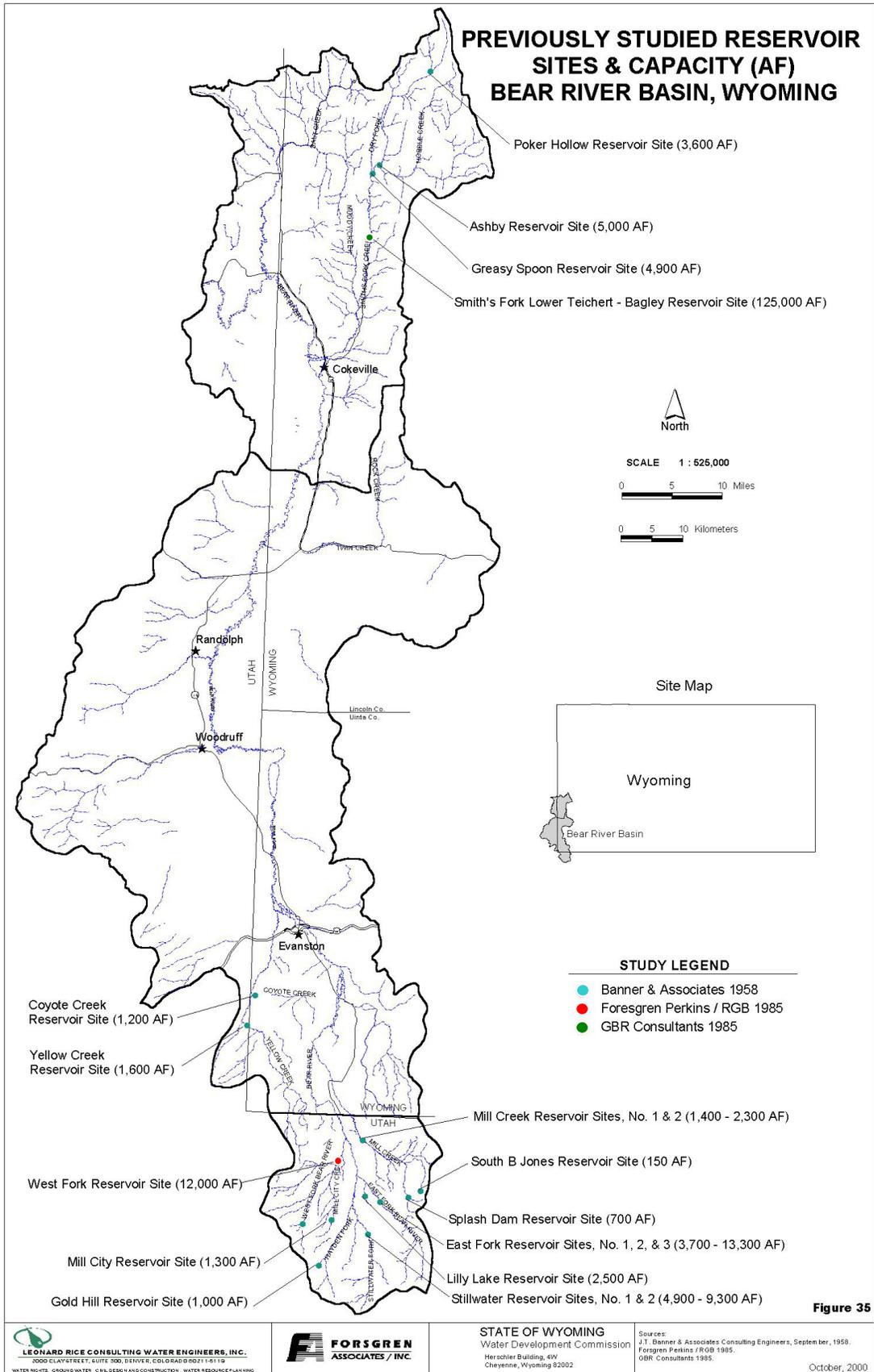
Based on the normal year hydrology, the best development plan would be the construction of storage up to the yield available during these years - 150,000 and 190,000 acre-feet in either the Upper or Central Divisions respectively. There would be the need to carry over some storage to guard against dry year yields (zero) and to take into account evaporation and seepage losses from the reservoir(s). The firm yield, therefore, would be on the order of 75,000 acre-feet in the Upper Division and 95,000 acre-feet in the Central Division. It should be noted that storage facilities this large would exceed Wyoming's compact allocation.

A review of the wet years shows much higher available flows, but they occur only in three years out of 28 years or about 11 percent of the time. Planning and constructing facilities on these occurrences would result in an oversized reservoir and would not

significantly increase the firm yield of a water supply, even though there is up to 500,000 acre-feet available during these wet periods years.

### Alternative Reservoir Sites

There have been several previous studies directed toward the feasibility and capacity of various reservoir sites within the Bear River Basin. In 1958, Banner & Associates studied potential sites on Twin Creek, Upper Bear River (East & West Forks), Mill Creek (13 sites), Yellow Creek (2 sites), and Smith's Fork (3 sites) under contract to the Wyoming Natural Resources Board. Forsgren Perkins Engineering completed a detailed study of the West Fork site in 1985 for the WWDC. GBR Consultants completed a study of the Smiths Fork (Teichert-Bagley) site for the WWDC that same year. These sites and their potential capacities are shown schematically on **Figure 35**.



The potential for future reservoir construction was presented to the BAG on several occasions for discussion. The consensus of the BAG was to not pursue or list storage as a short-list option at this time. This feeling was, in part, due to economic concerns (cost vs. benefit) and environmental permitting concerns. Nonetheless, storage is a viable option in the future as the need and/or economic desirability of storage changes.

#### Smiths Fork Reservoir Sites

Near the completion of the planning study, water users from the Cokeville area approached the Wyoming Water Development Commission to initiate discussions relative to developing storage on Smith's Fork. Based on the modeling efforts, Smith's Fork has excellent storage potential from a hydrologic standpoint. As indicated above, there is a permit pending for the Ferney Glade Reservoir on Smith's Fork which was filed in 1960 for 5201 acre-feet. A larger reservoir would likely require the partnership and participation of downstream states, and perhaps an amendment to the Bear River Compact.

#### ***6.5.3 Conservation Opportunities***

The state of Wyoming is supportive of water conservation as an environmentally responsible policy. In many cases, water conservation offers an economic benefit to water users. In the case of municipalities, for example, reduced water consumption translates into reduced treatment and operational costs. The same can be true of industrial water users.

In the case of irrigation, one would expect agricultural users to benefit through increased overall water availability due to conservation measures. However, in the Bear River Basin, as in many basins in the west, this is not necessarily the case. Current land application practices in the Upper Division almost exclusively involve flood irrigation. As a result of this inefficient practice the Bear River is recharged, with up to 50% of the return flows re-entering the streams later in the irrigation season when divertible flows would normally be much less. This essentially in-ground storage actually benefits water users late in the irrigation season. Irrigation conservation may be more economically attractive in the Central Division where Water Emergency conditions typically occur earlier in the season.

There are various voluntary conservation and preservation programs in place that could benefit water users in the basin. These programs include:

- **Conservation Reserve Program (CRP):** This program is administered by the USDA Farm Service Agency (FSA). The program offers rental payments, incentive payments, and cost-share assistance for certain conservation practices. This is a voluntary program for private land owners. The objective of the

program is to improve wildlife habitat, water quality, improve air quality and reduce erosion.

- **Wetlands Reserve Program (WRP):** This program is administered by the USDA Natural Resources Conservation Service (NRCS) offering technical and financial assistance for restoring wetlands. This is also a voluntary program for private landowners.
- **Wildlife Habitat Incentives Program (WHIP):** This voluntary program is also administered through the USDA Natural Resources Conservation Service. Technical and financial assistance is offered for qualifying projects intended to improve wildlife habitat.