6 Water Use Projections

This report updates the original Wind-Bighorn River Water Basin Plan water demand projections. The water use projections were developed for agricultural, industrial, municipal, recreational and environmental water use in the Basin. Projections for years 2020, 2040 and 2060 are provided.

6.1 Approach

The previous Basin Plan looked at existing conditions within key water use sectors and made specific supply-driven assumptions about future potential development opportunities in each sector. For example, the initial Basin Plan projections for agriculture were based solely on the future development of specific water infrastructure projects. For the Basin Plan Update, a demand-driven approach was taken that utilizes a modified economic base analysis for water use sectors.

Economic base analysis focuses on activities and sectors that drive economic and demographic change. This technique is less data intensive than econometric projections. Economic base analysis is well suited to the Basin as the study team was able to focus on the three key economic sectors, agriculture, industry and tourism. Agriculture and industry, particularly mining, are also the largest water using sectors in the Basin. The study team performed research on each key sector and conducted interviews to identify trends in the Basin since the previous Basin Plan. The projections for these economic sectors led to development of population projections. Additional information regarding the approach for developing water use projections can be found in Technical Memorandum 5B.

6.2 Future Economic and Demographic Scenarios

The previous Basin Plan provided one set of projections for major water use sectors to 2030. The Basin Plan Update provides three planning scenarios for each sector, as described below:

> **Low scenario** – This scenario represents the minimal likely development, or possible contraction, in the Basin. Although this scenario will not result in any new water demand pressures in the Basin due to socioeconomic activity, it provides a supportable lower limit for water planning purposes.
>
> **Medium scenario** – This scenario represents the most likely set of factors that will occur in the Basin over the planning horizon. This scenario represents the most probable future economic conditions in the Basin in the opinion of the study team.
>
> **High scenario** – This scenario represents the highest growth that could potentially occur in the Basin over the planning horizon. These conditions will provide an upper boundary for water planning in the Basin.

For each water use sector within the Basin, a set of assumptions was developed that would inform the low, medium and high projections. These assumptions were based upon Basin and state specific data as well as national and international prospects for economic sectors related to Basin activities.

6.3 Agricultural Demand Projections

Employment in agriculture represents about 5 percent of total employment and 2007 sales of agricultural goods in the Basin were more than $272 million. Agriculture has a high multiplier effect, which means that expenditures in this sector have a large impact as they ripple through the local economy. The Basin has a large percentage of public lands that present a constraint to expansion of agriculture but which also provide grazing opportunities for many of the cattle in the Basin. Cattle are the predominate livestock in the Basin, accounting for about 67 percent of all animal units in the Basin.

Under the previous Basin Plan, the future completion of potential water development projects determined the three planning scenarios, with the low scenario including no development. Projections regarding livestock and cropping patterns were not made. This update utilizes the driving forces and assumptions above to develop projections of agricultural activity in the Basin to the year 2060. Planning scenario assumptions and future water demand projections are presented in the following sub-sections.

6.3.1 Agricultural Planning Scenario Assumptions

Big Horn County has a stable agriculture industry that is likely to remain at about the same level of activity in the future. About 80 percent of grazing in the county is on federal lands. The county is a net exporter of alfalfa. Irrigated acres have been stable, although cropping patterns change over time. There is little in the way of development pressure in the county, and that is likely to continue in the future. It will be important for farmers and ranchers to adopt new technologies to improve efficiencies in order to remain profitable (Dallen 2009).

Fremont County saw a decrease in cattle as a result of the drought, but cattle inventory in the county is expected to return to near pre-drought levels. A best case scenario for cattle would be an increase from current inventory of approximately 97,000 head to 120,000 head. The county is a net exporter of alfalfa and hay crops. Ranchers are very dependent on federal lands for grazing. There has been a small amount of conversion of irrigated lands to ranchettes, but those lands maintain their water supplies and will still be irrigated. Pressure from development could increase somewhat in the long run. Cropping patterns in the county are stable and likely to remain relatively unchanged over time (Cunningham 2009).

Hot Springs County is limited in the expansion of agriculture due to the large amount of public land. Ranchers are very dependent on grazing allotments on federal lands. Most farming in the county is traditional and there has not been a move to more high intensity land use, such as truck farming or organic farming. This change might happen within the planning horizon of this update. A stable or slightly declining agriculture sector is expected for the long term (Campbell 2009).

Park County has experienced a decline in cattle due to rising production costs and falling commodity prices. Most grazing occurs on BLM and Forest Service lands. The cost and availability of public lands grazing is a constraint for some ranchers. There has been a trend of wealthy individuals purchasing ranches, and although the level of production usually goes down, they are not usually subdivided. Consistent with these ranch purchases, land costs have also risen in the county, exceeding the value of crops production. Sugar beet production in the county is stable and processing capacities are near or at capacity. Overall, agricultural activity in the county is expected to be stable in the future (Craig 2009).

Washakie County cattle inventory is expected to increase over current numbers, but may not return to pre-drought levels. Ranchers heavily depend on federal lands for grazing. The county is a net exporter of hay and alfalfa. A resurgence of small feed lots in the county may reduce the amount of hay exported. Cropping patterns in the county, especially hay and alfalfa crops, are related to livestock patterns. Sugar beet production in the county has decreased somewhat in recent years, but the local processing plant should continue operation into the future. There is also an expanding seed industry in the county, producing primarily alfalfa seed, red clover and dry bean seed varieties, which may increase crop production in the county over the long run (Gill 2009).

Overall demand, prices, and the cost of inputs are critical to determining agricultural output. Whereas forecasting each of these factors over a period of 50 years entails a great deal of uncertainty, it was determined, through research and knowledge of the Basin economy, that certain underlying forces will drive future demand, output price and input costs for agricultural activities in the Basin, including U.S. and international markets, production costs, pressure from development, government payments, grazing on public lands, and water development projects.

These driving influences and local insights led to development of assumptions for low, medium and high planning scenarios. These assumptions are provided in Table 31.

Table 31. Planning Scenario Assumptions for Agriculture

Sector	Low	High	Medium
General Influences	Weak economic conditions in U.S. and international markets	Strong economic growth in U.S. and international markets	Annual variations within narrow range long-term
	Costs of production rise faster than prices	Costs of production rise slower than prices	Costs of production balanced to prices
	Increasing ranchettes reduce agricultural intensity	Number of ranchettes stabilizes	Number of ranchettes stabilizes
Cattle	Authorized AUM's on public lands diminish further	Authorized AUM's recover moderately	Authorized AUM's stabilize
	Grass and stubble remain poor	Grass and stubble improve considerably	Grass and stubble improve somewhat
Crops	Crops and agricultural industry do not come back from recent drought/ downturn	Crops and agricultural industry recover to pre-drought conditions	Crops and agricultural industry stay at present levels
	Alfalfa and grass hay affected by cattle prospects	Alfalfa and grass hay affected by cattle prospects	Alfalfa and grass hay affected by cattle prospects
	Sugar demand declines, one mill closes	Sugar demand rises, more beet production, one new sugar beet mill built	Sugar beets stable, plant capacities unchanged
	Westside Irrigation District project undeveloped	Westside Irrigation District project developed	Westside Irrigation District project undeveloped

The following is a narrative of each planning scenario

High Scenario. The high scenario for agriculture includes the most favorable, realistic conditions that the study team envisions for the sector over the planning horizon. In order for this to be realized, input prices, such as fuel and fertilizer would be favorable to commodity prices. A strong U.S. economy and growth in international markets would increase demand for beef and other agricultural products.

Under this scenario, feed stocks are plentiful and contribute to growth in cattle production. Improved conditions on public lands allows for the increase in AUMs. By the end of the planning horizon in 2060, it is projected that the Basin will have roughly 330,000 head of cattle and 57,000 head of sheep, an increase of about 35 percent.

Under these favorable conditions, sugar beet production would expand in the Basin as demand for sugar increases. Croplands would increase about 8 percent, as conversion of agricultural lands for other purposes decline. Development of the Westside Irrigation Project would allow for an additional 9,300 irrigated acres. Increased production of alfalfa and hay grasses would be driven by a strong cattle market. Total irrigated acres under the high scenario would rise from about 635,000 acres under current conditions to 685,000 acres in 2060, not including any increases on the Wind River Indian Reservation, which are addressed separately later in this chapter. These additional irrigated acres would mostly come from acres that were previously irrigated or currently used for dry land crops. The crop mix is expected to remain about the same with conversion of some acres from other crops to sugar beet production.

Low Scenario. The low scenario includes potential negative effects that would create the lowest likely scenario in the Basin over the planning horizon in the view of the study team. Under these conditions, weak economic conditions would depress overall demand, especially for beef and sugar. Input prices for fuel and fertilizers would rise faster than commodity prices, putting pressure on profitability.

Poor conditions on public lands would result in decreased grazing allotments putting additional pressure on cattle production. In addition, development pressure from conversion of agricultural lands to ranchettes and for other development would reduce agriculture's intensity or take land out of production. Much of this conversion would likely occur in Park County. Sheep inventories would fall about 45 percent. Under the low scenario, cattle inventories would fall from 245,000 under current conditions to 210,600 in 2060. The Westside Irrigation Project would not be developed. Irrigated acres would decline about 10 percent from 635,000 under current conditions to 570,000 in 2060.

Mid Scenario. This represents the most likely set of circumstances that will occur in the Basin over the planning horizon. Under these conditions, agriculture will see little change in current conditions. In interviews with knowledgeable, local officials, most stated that future conditions would remain relatively unchanged.

Under this scenario, economic conditions would vary within a narrow range. Inputs, such as fuel costs and fertilizers, would be balanced to commodity prices. Grazing on federal lands would stabilize, with little change from current allotments. Alfalfa and hay cropping would remain steady along with cattle productions. Sugar beet production would also remain at, or near, current levels. The Westside Irrigation Project would not be developed under this scenario. The 2007 Draft EIS found the project was not financially viable under current financing and cropping conditions (BLM 2007).

Although there will certainly be some shifts in cropping and some variations in cattle and sheep inventory, overall the situation will be static.

Farm employment is expected to change in relationship to irrigated acres. That is, under the high scenario, employment would increase about 8 percent over current levels, remain about the same under the mid scenario, and decrease about 11 percent under the low scenario.

6.3.2 Future Agricultural Water Demands

Water Demand for Crops

Alfalfa and hay crops account for about 67 percent of crops in the Basin. Spring grains, sugar beets, corn and beans are the other top crops in the Basin. Crop irrigation requirement (CIR) is that water needed for crop production under ideal conditions where a portion of the required water needs are met by precipitation and the balance is provided by irrigation. The current average CIR for the Basin is 1.86 acre-feet of water per irrigated acre. In addition to CIR, total diversions required for Basin crops must take into account conveyance losses. These losses occur when water is transported from the point of diversion to the farm. Additional losses on the farm occur depending on the method of water application (see Section 5.1).

Section 4.3 calculated total current diversion requirements for irrigated acres in the Basin, about 3.1 million acre-feet per year. Within the sub-basins, average acre-foot per acre diversion requirements range from 4.29 to 6.98, with an average use of 4.96 acre-feet of water per irrigated acre.

Projections of full supply diversions for crops were made by applying the average of 4.96 acre-feet of water per acre to projected cropland acreage under the three scenarios. The additional irrigated acreage projected under the high scenario will come mostly from previous irrigated acres and dryland cropped acres. Projected diversion requirements are provided in Table 32. These calculations do not include WRIR demands which are addressed separately. As described in Section 5.1, current full supply diversion requirements are about 3.1 million acre-feet per year for crops and approximately 6,400 acre-feet for livestock. Under the low scenario, fully supply requirements fall as total acres and livestock populations are reduced. Under the medium scenario, diversions remain constant for crops and grow modestly for livestock. The high scenario experiences increases in both irrigated acres and livestock. Increases in irrigated acres will likely come from the conversion of dryland acres to irrigation under very favorable economic conditions. Irrigated croplands are a small percentage of all agricultural lands in the Basin and irrigated agricultural acreage have reached these levels in the Basin, historically.

Table 32. Projected Irrigated Acres and Diversion Requirements for Crops, by Scenario, 2020, 2040 and 2060

	Low		Medium		High	
Year	Irrigated Acres	Total Diversions (ac-ft)	Irrigated Acres	Total Diversions (ac-ft)	Irrigated Acres	Total Diversions (ac-ft)
Current	634,949	3,149,400	634,949	3,149,400	634,949	3,149,400
2020	619,400	3,075,100	635,000	3,152,700	646,200	3,208,300
2040	594,200	2,950,000	635,000	3,152,700	665,300	3,303,200
2060	570,000	2,830,000	635,000	3,152,700	685,000	3,400,900

Note: Data does not include Tribal Futures Projects.

For Tribal Futures Projects, under the low scenario, water demands will not change over the planning horizon. Under the medium scenario, Riverton East will be complete by 2040, resulting in 3,814 acres of additional irrigated acres and 17,500 acre-feet of diversions. Under the high scenario, all

"futures" acreage would be developed, amounting to an estimated 209,342 acre-feet of new diversions. Consumptive use would follow non-Indian consumptive use patterns. A summary of consumptive use and diversion requirements for Tribal Futures Projects is presented in Table 33.

Table 33. Summary of CIR and Diversion Requirements for Tribal Futures Projects

Model Sub-Basin	Irrigated Acres	Annual CIR [1] (ac-ft)	Annual CIR [1] (ac-ft/ac)	Diversion Requirement [1] (ac-ft)	Diversion Requirement [1] (ac-ft/ac)
North Crowheart	38,773	78,083	2.01	147,726	3.81
South Crowheart	4,695	10,634	2.27	20,142	4.29
Arapahoe	3,808	9,947	2.61	16,717	4.39
Riverton East	3,814	10,164	2.67	17,549	4.60
Big Horn Flats	2,670	4,349	1.63	7,209	2.70
Total	53,760	113,177	2.11	209,342	3.89

Notes:

(1) Diversions amounts are adjudicated values, while CIR is "back-calculated" from decreed diversion requirements using estimated monthly efficiencies. See Technical Memorandum 3A.

Water Demand for Livestock

In 2007, there were about 270,000 cattle and calves in the Basin, accounting for almost 70 percent of all animal units. Sheep numbered about 77,000, or 19 percent of all livestock. Other animals raised in the Basin include horses, goats, pigs, llamas and mules. Water use for livestock in the Basin is estimated at 0.023 AF per head of cattle per year, and 0.008 AF per head of sheep. These factors were applied to the projections to determine annual water diversions for cattle and sheep. Water demand for cattle, sheep and all other livestock by scenario are provided in Figure 35.

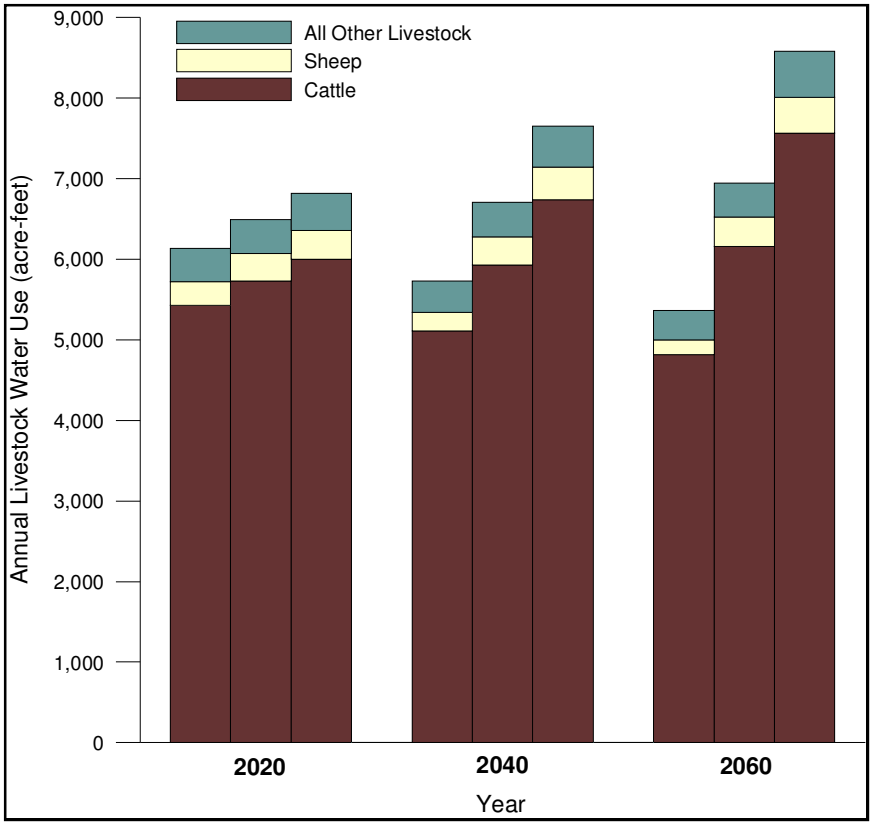

Figure 35. Low, Medium and High Water Demand Livestock Projections

As with crops, in 2060, the difference in the low and high scenarios is distinct. Total demand for livestock in 2060 under the high scenario is projected to 8,600 AF, about 60 percent higher than the low scenario projection of 5,300 AF.

Summary Agricultural Demands

Total agricultural diversions by scenario are shown in Table 34 and additional water resources required as compared to current use is shown in Table 35. The previous Basin Plan projected no new diversions in 2030 under the low scenario, 270,000 acre-feet under the medium or most likely scenario, and 792,000 acre-feet under the high scenario.

Table 34. Full Supply Diversions for Agriculture, by Scenario

	Full Supply Diversion (ac-ft)		
Year	Low	Medium	High
2020	3,081,200	3,155,900	3,211,200
2040	2,955,700	3,156,000	3,308,900
2060	2,835,400	3,156,300	3,409,500

Note: Data does not include Tribal Futures Projects.

Table 35. New Full Supply Diversion Requirements for Agriculture, by Scenario

	Difference from Current Use (ac-ft)		
Year	Low	Medium	High
2020	-75,000	100	55,000
2040	-200,000	200	153,000
2060	-320,000	500	254,000

Note: Data does not include Tribal Futures Projects.

6.4 Municipal and Domestic Demand Projections

In the previous Basin Plan, three population growth scenarios were presented to 2030. The projected 2030 population under the low, medium and high scenarios were 90,403, 94,600 and 114,407, respectively. This report updates those projections based on recent trends and provides low, medium and high population scenarios and projections to 2060.

6.4.1 Population Projections

Existing projections. The study team reviewed the projections in the previous Basin Plan and sought to identify any demographic projections that have been made since that time. Although the study team was unable to locate projections specific to the Basin for the planning horizon, two sources of moderate-term projections were found:

- U. S. Census Bureau – The *Interim Population Projections for States* project population for the State of Wyoming to 2030, by total population and by age cohort. The projections were developed using the cohort-component method, which projects births, deaths, internal migration, and international migration, based on recent trends.

- State of Wyoming – the Wyoming Department of Administration and Information, Economic Analysis Division (EADIV) prepared population projections by county, starting with Census Bureau estimates to 2007, and then developed projections to 2030 based on trends of demographic and economic variables.

Local planners within the Basin rely on the EADIV for projections, and do not produce their own local projections. The EADIV prepared a 10-year economic and demographic forecast, 2007 to 2016, and employment projections by occupation for the region. However, these projections are short term and were not suited to a long-term planning horizon. The Census Bureau projections and the EADIV projections were utilized in the population projections described below.

Historical Wind-Bighorn Basin Population Trends. The population of the Basin grew at an average annual rate of about 0.5 percent per year between 1960 and 2008. Historical population figures for the five Basin counties since 1960 are shown in Table 36.

Table 36. Basin Population, by County, 1960 through 2008

County	1960	1970	1980	1990	2000	2008
Big Horn	11,898	10,202	11,896	10,525	11,461	11,322
Fremont	26,168	28,352	38,992	33,662	35,804	38,113
Hot Springs	6,365	4,952	5,710	4,809	4,882	4,622
Park	16,874	17,752	21,639	23,178	25,786	27,574
Washakie	8,883	7,569	9,496	8,388	8,289	7,821
Basin Total	**70,188**	**68,827**	**87,733**	**80,562**	**86,222**	**89,452**

2008 population is estimated

Source: U.S. Census Bureau and Wyoming Department of Administration and Information, Economic Analysis Division.

Although the overall population of the Basin has grown since 1960, Big Horn, Hot Springs and Washakie Counties have lost population. This was also true between 2000 and 2008. Declines were greatest in Hot Springs County, which lost an average 0.7 percent of its population each year from 1960 to 2008.

Growth, or decline, in municipal and domestic population and resulting water use in the Basin will be influenced by the economic sectors discussed above. Populations will tend to grow as major economic sectors grow. In addition to direct employment in these sectors, the multiplier effect of these jobs will induce additional employment and economic expansion within the Basin.

There is evidence that the area is also likely to attract some level of retirees from outside the Basin. Most retirees will not come for jobs, but their presence in the Basin will also have a modest multiplier effect as they spend money in the local economy. For some Basin counties, this impact will be muted as there are limited opportunities to purchase goods locally and consumers travel outside of the county to shop. For example, some Basin consumers travel to Sheridan or Billings, Montana, especially for large purchases (Frederick 2009).

The Basin population is older than that of the state and the median age is rising. These projections are made by age cohort and show the impact of an aging population. In 2000, the Wyoming population had an old age dependency ratio of 19.8; the 2030 ratio is projected to be 50.7.[7] Over the same period, the youth dependency ratio is projected to fall from 50.0 to 40.6.[8] This trend will tend to limit natural population growth within the Basin. In-migration will be key to Basin population growth.

High Scenario. The high scenario for population growth represents the most favorable conditions for economic and population growth over the planning horizon that can reasonably be expected. Under these conditions, growth will occur in all key basin economic sectors. In addition, growth will occur from retirees relocating to the area. As the job picture in the Basin improves, it is expected that in-migration will occur and that the pattern of migration will likely attract a younger population. This will drive increases in natural population growth over the long run.

As discussed in the medium scenario, quality of life priorities and technological advances may increase telecommuting enabling more people to choose the rural lifestyle available in the Basin.

[7] Old age dependency ratio = Age 65 and over/Age 20-64 x 100.
[8] Youth dependency ratio = Age under 20/Age 20-64 x 100.

To forecast population under the high scenario, it was assumed that all Basin counties would experience an increased rate of growth, but that growth would be strongest in Fremont and Park Counties. Population projections under the high scenario are provided in Table 37.

Table 37. High Scenario Population Projections

Year	Big Horn	Fremont	Hot Springs	Park	Washakie	Total
2020	12,010	42,170	4,850	30,400	8,300	97,730
2030	12,620	46,120	5,100	33,250	8,720	105,810
2040	13,270	50,440	5,360	36,360	9,170	114,600
2050	13,950	55,170	5,630	39,770	9,640	124,160
2060	14,660	60,340	5,920	43,500	10,130	134,550

Under these conditions, the population would increase by about 46,000, or 0.8 percent per year for the Basin as a whole over the planning horizon.

Low Scenario. Under the low scenario, economic conditions for each of the key sectors are as described above, resulting in slow growth across the Basin. The U.S. Census Bureau (Census 2009) projections for the state through 2030 project very slow growth in the state. These projections were developed using a cohort-component method, which applies the components of population change, births, deaths, internal international migration, to each birth cohort (persons born in a given year). These projections assume that past trends will continue into the future.

The Census projections for Wyoming project about a 6 percent increase in the Wyoming population from 2000 to 2030. These projections exhibit a slower trend in growth than has been seen in recent years across the Basin as a whole. However, under the low economic scenarios describe above in combination with an aging population and limited in-migration, the study team believes that these projections represent a defensible low population scenario for the Basin.

The growth rate for the State of Wyoming was applied to the Basin as a whole, allocated to the counties and extrapolated out to 2060. Low scenario population projections for Basin counties are provided in Table 38.

Table 38. Low Scenario Population Projections

Year	Big Horn	Fremont	Hot Springs	Park	Washakie	Total
2020	11,140	39,740	4,410	28,010	7,640	90,940
2030	11,250	40,910	4,270	28,830	7,430	92,690
2040	11,210	42,360	4,140	29,540	7,240	94,490
2050	11,160	43,850	4,010	30,240	7,050	96,310
2060	11,110	45,360	3,880	30,950	6,870	98,170

Source: U. S. Census Bureau – The *Interim Population Projections for States*, Harvey Economics 2009.

These projections result in a total change in population from 2008 to 2060 of about 9,300 persons.

Medium Scenario. This scenario of population growth in the Basin is the most likely in the view of the study team. Modest growth in economic sectors will spur in-migration. The more positive economic outlook of the region will attract retirees. As technology improves, more jobs will become "portable" as workers are able work from home. The technology infrastructure in the Basin is good and those seeking a rural lifestyle may choose to relocate to the Basin.

The EADIV produced population projections for Wyoming counties to the year 2030. These projections incorporate the cohort-component method, time-series trend analysis and employment projections. Under the EADIV projections, the population of the Basin would increase by almost 10,000 by the year 2030, or at an average annual rate of 0.4 percent. These projections are specific to the Basin and utilize standard projection methodology, making them well suited for this planning effort.

The study team adopted the EADIV projections to 2030, and then extrapolated them out to 2060, using the same rate of growth as projected for the 2007 to 2030 time period. Medium scenario projections are provided in Table 39.

Table 39. Medium Scenario Population Projections

Year	Big Horn	Fremont	Hot Springs	Park	Washakie	Total
2020	11,240	40,110	4,450	28,270	7,710	91,800
2030	11,650	42,370	4,420	29,860	7,690	96,000
2040	11,820	44,690	4,360	31,160	7,640	99,700
2050	12,000	47,140	4,310	32,520	7,580	103,500
2060	12,170	49,720	4,250	33,930	7,530	107,600

Source: EADIV 2009a

Under these conditions, the population of the Basin would increase by about 19,000 by 2060 and about double the increase projected under the low scenario.

6.4.2 Future Municipal and Domestic Demand Projections

Projections for future domestic and municipal water demands are based on the population projections. Municipal and domestic water demands account for a small percentage of total water use in the Basin. Total current use is about 17,000 acre-feet per year. Current per capita water use is 170 gallons per capita per day (gpcd) in the Basin. Projected municipal and domestic water use in the Basin, by planning scenario, is provided in Figure 36.

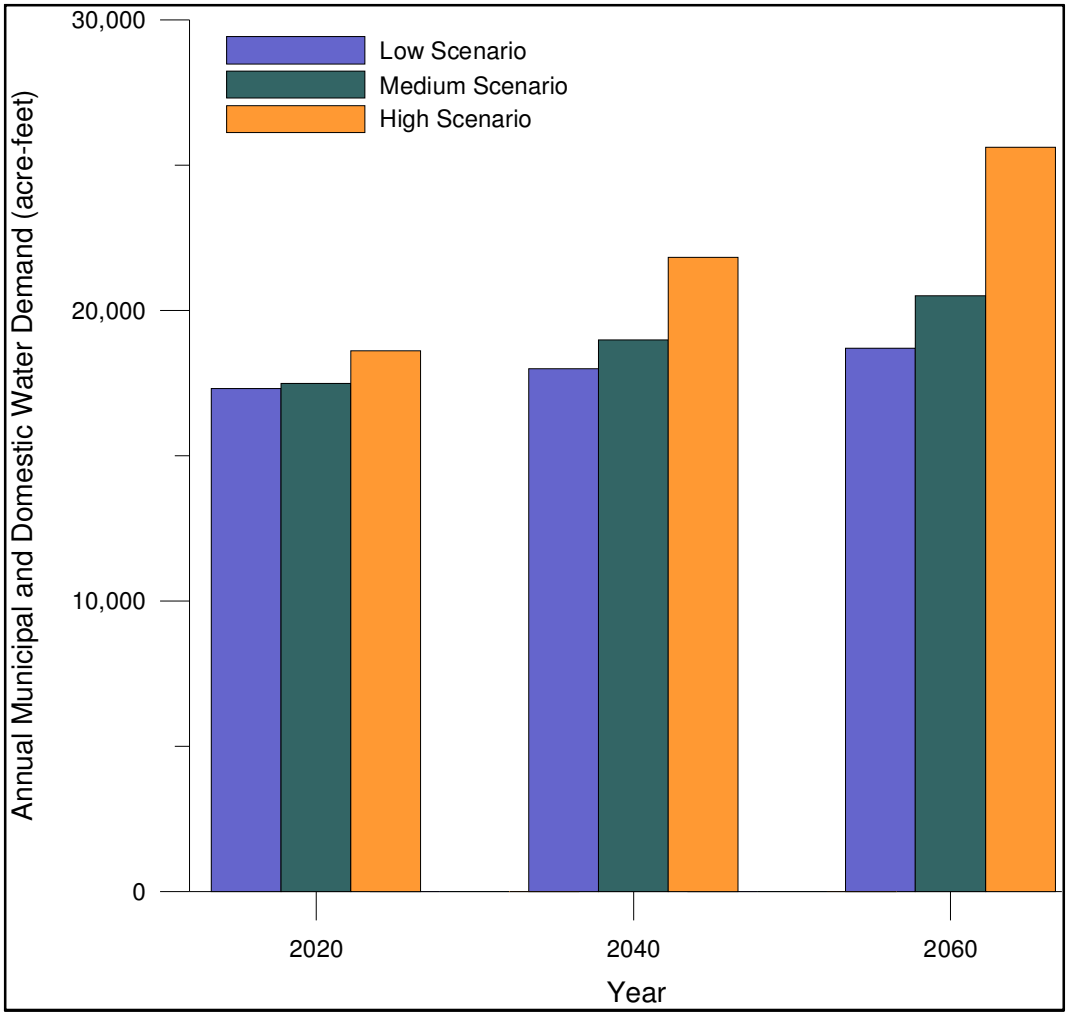

Figure 36. Future Municipal and Domestic Water Demand

Under the previous Basin Plan, municipal and domestic water use was projected to be 21,900 acre-feet in 2030 under the most likely scenario. The lower figures provided in this update are due primarily to a difference in gpcd. The previous Basin Plan used a gpcd of 207, or about 22 percent higher than the gpcd calculated for this update, which is based on current estimates of per capita water use.

Consumptive water use for municipal and domestic use in the Basin is estimated to be 41 percent of municipal and domestic diversions. Additional water resources required as compared to current use are shown in Table 41. Future consumptive use by scenario provided in Table 40 and Table 41 assume that the percentage of water use from surface and groundwater sources will remain about the same over the planning horizon. These projections indicate that domestic and municipal water use will continue to be a small, though vital, percentage of overall water use in the Basin over the planning horizon.

Table 40. Consumptive Water Demand for Domestic and Municipal Use

Year	Low		Medium		High	
	Ground Water (ac-ft)	Surface Water (ac-ft)	Ground Water (ac-ft)	Surface Water (ac-ft)	Ground Water (ac-ft)	Surface Water (ac-ft)
2020	3,020	4,080	3,050	4,120	3,250	4,380
2040	3,140	4,240	3,310	4,470	3,810	5,140
2060	3,260	4,400	3,570	4,830	4,470	6,040

Table 41. New Water Demand Requirements for Domestic and Municipal Use

Year	Low		Medium		High	
	Ground Water (ac-ft)	Surface Water (ac-ft)	Ground Water (ac-ft)	Surface Water (ac-ft)	Ground Water (ac-ft)	Surface Water (ac-ft)
2020	130	170	210	290	680	920
2040	430	570	850	1,150	2,040	2,760
2060	720	980	1,490	2,010	3,660	4,940

6.5 Industrial Demand Projections

The previous Basin Plan projected that industrial water use in the Basin would grow only as a result of additional power generating facilities. The low scenario assumed no growth in industrial water use, the mid scenario included one 200 MW coal-fired steam turbine facility and the high scenario envisioned an additional 500 MW gas-fired combination turbine facility. The high scenario projected total industrial water use of 115,000 acre-feet by 2030.

In this update, it is assumed that for each scenario a number of factors will come into play to determine total industrial water use in the Basin. Planning scenario assumptions and future water demand projections are presented in the following sub-sections.

6.5.1 Industrial Planning Scenarios Assumptions

Various mining activities, including oil and gas production, account for about 99 percent of all industrial water use in the Basin and the bulk of this is attributable to petroleum industry by-product. In 2009, oil and gas production occurred in all of the Basin counties. Much of the existing oil and gas production in the Basin is from wells that are old, and production from them is declining. Fremont County dominates natural gas production in the Basin. There is one operational coal mine in the Basin. Other minerals produced in the Basin include bentonite and gypsum. Although resources exist, uranium is not currently mined in the Basin.

Driving forces that will impact future mining and other industrial activity in the Basin include:

- **U.S. and International Demand.** Continued population growth and demand from developing nations will impact worldwide energy demands and prices.

- **Advances in Technology.** Further, technological advances, if they occur, will impact mining in a variety of ways. Potential innovations include improved recovery techniques and advances in renewable energy and alternative fuels.

- **Environmental Concerns**. Pressure from environmental concerns regarding future development will compete with the need for energy security for the nation.
- **Nuclear Energy**. A revival of nuclear energy production in the U.S. would likely impact uranium prospects in the Basin.
- **Demand for Sugar**. Sugar beet processing in the Basin will be impacted by changes in the demand for sugar.
- **Construction**. The state of the construction industry will impact gypsum mining and wallboard production, as well as Basin gravel mining.
- **Demand for Bentonite**. Bentonite use is closely tied to the petroleum industry, although it has a wide variety of uses.
- **Power Generation**. Population growth and transmission capacity will in part determine the prospects for new generation in the Basin.

In 2008, total oil production in the Wind-Bighorn Basin was about 17.1 million barrels. New wells are expected to be drilled during the planning horizon, however they will likely be smaller, more expensive and more difficult to access. Future production is expected to decline as existing wells play out, even with the new production. If carbon dioxide flood technology becomes feasible, oil production will decline, but at a slower rate (BLM 2009d).

In 2008, natural gas production in the Wind-Bighorn Basin was 172,000,000,000 MCF (million cubic feet). Almost all of this production occurred in Fremont County, in the Wind Basin. Future production in the Wind Basin is projected to grow during the planning horizon. Shale gas production in the later years of the planning horizon is remotely possible, and would increase total production (BLM 2009b).

The Big Horn Basin will likely see a decline in gas production over the planning horizon. Significant new discoveries in the Basin would cause the decline to occur more slowly. There is potential for CBNG in the Big Horn Basin that might be exploited in the last half of the planning period (BLM 2009b).

As of 2009, only one coal mine was active in the Wind-Bighorn Basin. Although coal resources are located in the area, much larger and more economically advantageous reserves are available in other parts of the state. Increased future production would require economic viability of large underground mines.

Uranium is present in the Wind-Bighorn Basin, but as of 2009 there was no market for it. A re-emergence of the nuclear power industry in the U.S. would likely result in a resumption of Basin uranium development.

Miscellaneous minerals and industry are likely to play a minor future role. Bentonite and gypsum production are expected to stay at current levels or to increase modestly (BLM 2009a). The most favorable potential biofuel production in the Basin is ethanol from cellulosic biomass from forest and primary mill residues (USDOE 2009).

Planning scenario assumptions related to mining and industrial sectors and arising from the driving influences and local insights are set forth in Table 42.

Table 42. Planning Scenario Assumptions for Industry

Sector	Low	High	Medium
Petroleum	Slight net increase in natural gas production	New technologies generate increasing production after 2030	Declines in Big Horn Basin more than offset increases in Wind Basin (i.e. increase in net Basin production)
Bentonite	Stable to declining	20% increase in output	Slight increase
Coal	Small operation closes	Two relatively small mines operate <300,000 tons/year	One operation continues, expands slightly
Uranium	No resumption	Three new operations; industry reborn	One operation with moderate output
Power Plants	No new plants	One steam powerplant	No new plants
Beet Processing	Slight decline in acres/processing	Increased acreage/one new processing facility	Steady output/processing
Ethanol/Other	No ethanol/biofuel production	One production facility for ethanol from cellulosic biomass (forest and primary mill residues)	No ethanol/biofuel production

The following is a narrative of each planning scenario

High Scenario. Under the high scenario, the most favorable conditions for mining and industry that are reasonable for the Basin over the planning horizon are assumed. This scenario assumes high demand for fossil fuels will continue. Increased production of natural gas will occur due to application of new technologies. In the Bighorn Basin, this increased production could be from shale gas. Mowry shale has been identified as a potential resource. In the Wind Basin, new technology could make coal gasification economically feasible (BLM 2009a; BLM 2009b). The high scenario also assumes that two small coal mines in the Basin will produce less than 300,000 tons of coal annually.

Increased bentonite demand for mining and other uses is likely under this scenario. The increase in sugar beet production under the high agriculture scenario would require an additional processing facility. The U.S. Department of Energy Alternative Fuels and Advanced Data Center have identified potential for ethanol production from cellulosic biomass in the Basin. Under the high scenario, one production facility using forest and primary mill residues would be in operation (USDOE 2009).

The market for uranium in the U.S. fell sharply as concerns developed regarding the safety of nuclear power plants. Wyoming is second only to New Mexico in uranium reserves, some of which are in the Basin. If construction of new nuclear power facilities in the U.S. resumes, uranium mining would likely resume in the Basin. Under the high scenario, it is assumed that three uranium mines are in operation. In addition, it is assumed that one steam generated power plant will be constructed.

Low Scenario. This scenario assumes that there will be modest growth in gas production over the long term, accounting for a modest increase in water demand. Oil production in the Basin

is projected to fall to about 4,000,000 barrels per year by 2060. Gas production is expected to rise to about 425,000,000 MCF, primarily in the Wind River Basin. The market for bentonite is projected to be stable or possibly decline modestly. It is also assumed that there will be no resumption of nuclear power plant construction in the U.S. and as a result there will be no uranium mining in the Basin.

The large amount of coal reserves in other parts of Wyoming make them better candidates for power generating facilities. No additional transmission capabilities would be available in the Basin under the low scenario. Thus, no power generating facilities in the Basin are envisioned. No ethanol or biofuel production facilities are constructed under these circumstances. As in the low agriculture scenario, there is a decline in sugar beet production, reducing beet processing somewhat.

Mid Scenario. The middle scenario represents the most likely set of circumstances in the Basin in the view of the study team. In this setting, gas production will rise to about 650,000,000 MCF, with the bulk of the production taking place in the Wind Basin. Oil production would fall to about 11 million barrels per year by 2060. Overall industry increases will contribute to an increase in bentonite production. Improved technologies in coal mining would allow for one operation with minimal output to continue.

As in the low scenario, no new power generating facilities would be constructed, since locations in other parts of the state offer proximity to coal and transmission infrastructure. As in the mid agriculture scenario, sugar beet production and processing would remain stable over the long term.

Current industrial production and projections by scenario for 2060 are provided in Table 43.

Table 43. Current and Projected Industrial Production

Annual Production	Current	Low	Medium	High
Oil (barrels)	17,808,000	4,000,000	10,975,000	13,170,000
Natural Gas (MCF)	194,988,183	425,600,000	659,680,000	791,616,000
Bentonite (tons)	1,500,000	1,500,000	1,600,000	1,800,000
Coal (tons)	1,100	—	2,000	300,000
Beet Processing (tons)	620,000	600,000	800,000	1,200,000
Ethanol	—	—	—	one facility
Fossil Fuel Power Generation	—	—	—	one facility

* Sugar beet yields are variable. 2006 production was more than 700,000 tons.

Source: NASS , WYOGCC, Yearbook,

Employment from industrial growth over the long term is uncertain. Although there will certainly be additions to employment under the medium and high scenarios, advances in technology tend to reduce employment. Therefore it is expected that employment under the medium and high scenarios will not be in direct proportion to production.

6.5.2 Future Industrial Water Demands

Mining

Current water use for mining in the Basin is about 91,200 acre-feet per year. Only about 200 acre-feet of that total is from surface water; the balance is from groundwater. All groundwater used for

mining, except about 600 acre-feet, is from saline groundwater wells. Water demand projections for mining activity in the Basin for low, medium and high scenarios are provided in Figure 37. New saline groundwater use for mining is provided in Table 44.

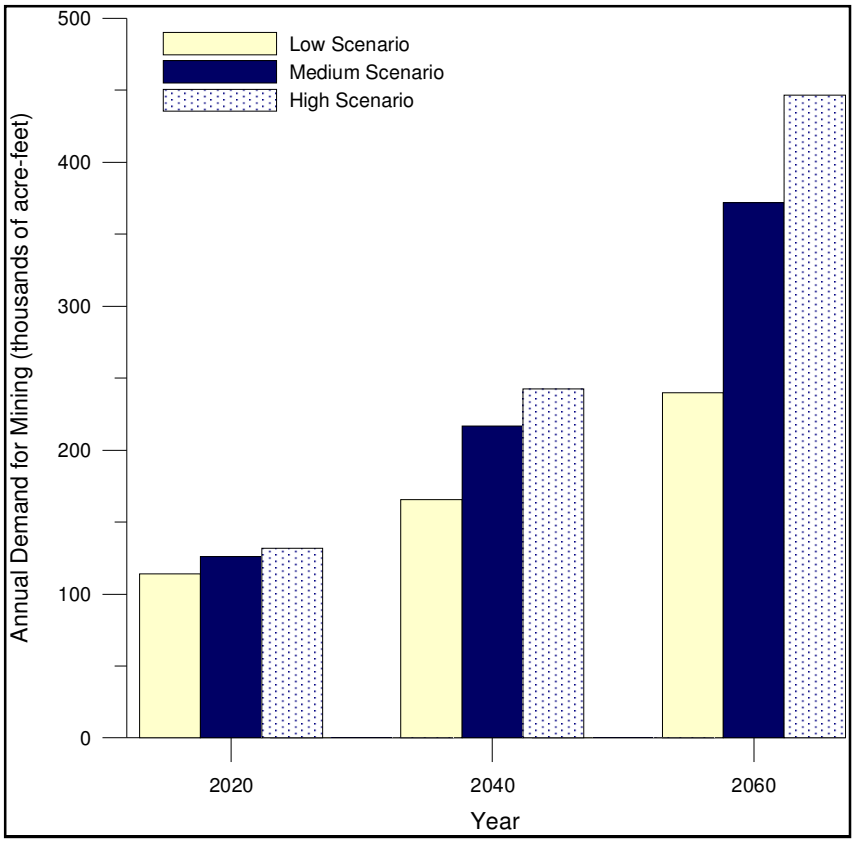

Figure 37. Future Total Water Demand for Mining, by Scenario

Table 44. New Saline Groundwater Requirements for Mining

Year	Low (acre-feet)	Medium (acre-feet)	High (acre-feet)
2020	23,500	35,600	41,100
2040	74,800	125,900	151,700
2060	149,300	280,900	355,200

Other Industrial Uses

Industrial water, other than for mining, accounts for a small portion of water use in this sector. Projected conditions are described in Technical Memorandum 5b. About 67 percent of other industrial water use is from surface water. Sugar beet processing, bentonite processing, drywall production and other light industry take place in the Basin. Water demand projections for industrial use are based on the relationship between current production levels and water use, assuming water use will rise or fall in proportion to production levels. Additionally, one power generation facility requiring 3,000 acre-feet of water per year is assumed under the high scenario. Projected industrial water demand is presented in Figure 38. Increased water demands for industrial purposes over the planning horizon for each scenario are provided in Table 45.

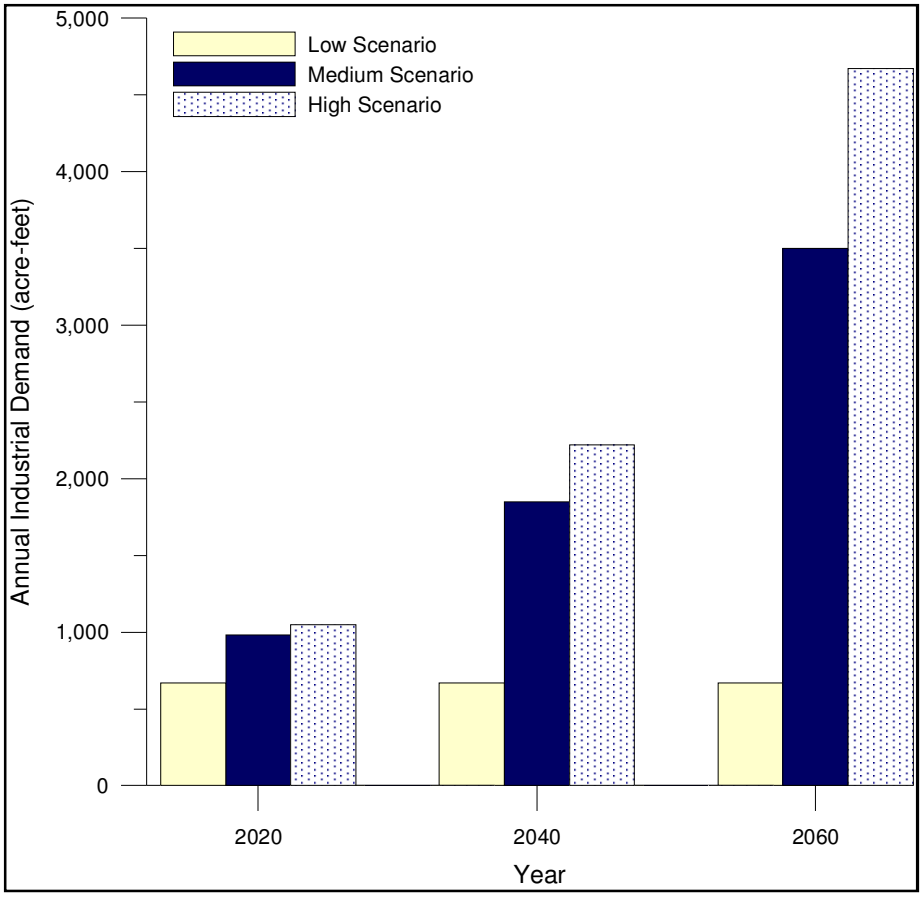

Figure 38. Industrial Water Demand Projections

Table 45. New Water for Industrial Use

Year	Low (acre-feet)	Medium (acre-feet)	High (acre-feet)
2020	0	310	380
2040	0	1,180	1,550
2060	0	2,830	4,000

6.5.3 Summary of Industrial Demands

The previous Basin Plan projected that water demand would be unchanged for the mining and industry sector under the low scenario. Under the medium scenario, demand was projected to increase 4,000 acre-feet per year. The high scenario added another 5,000 acre-feet of demand for a total increase in 2030 of 9,000 acre-feet. Projected water use for all industrial use, including mining, by source is shown in Figure 39. As shown above, very little surface water will be required for industrial purposes over the planning horizon.

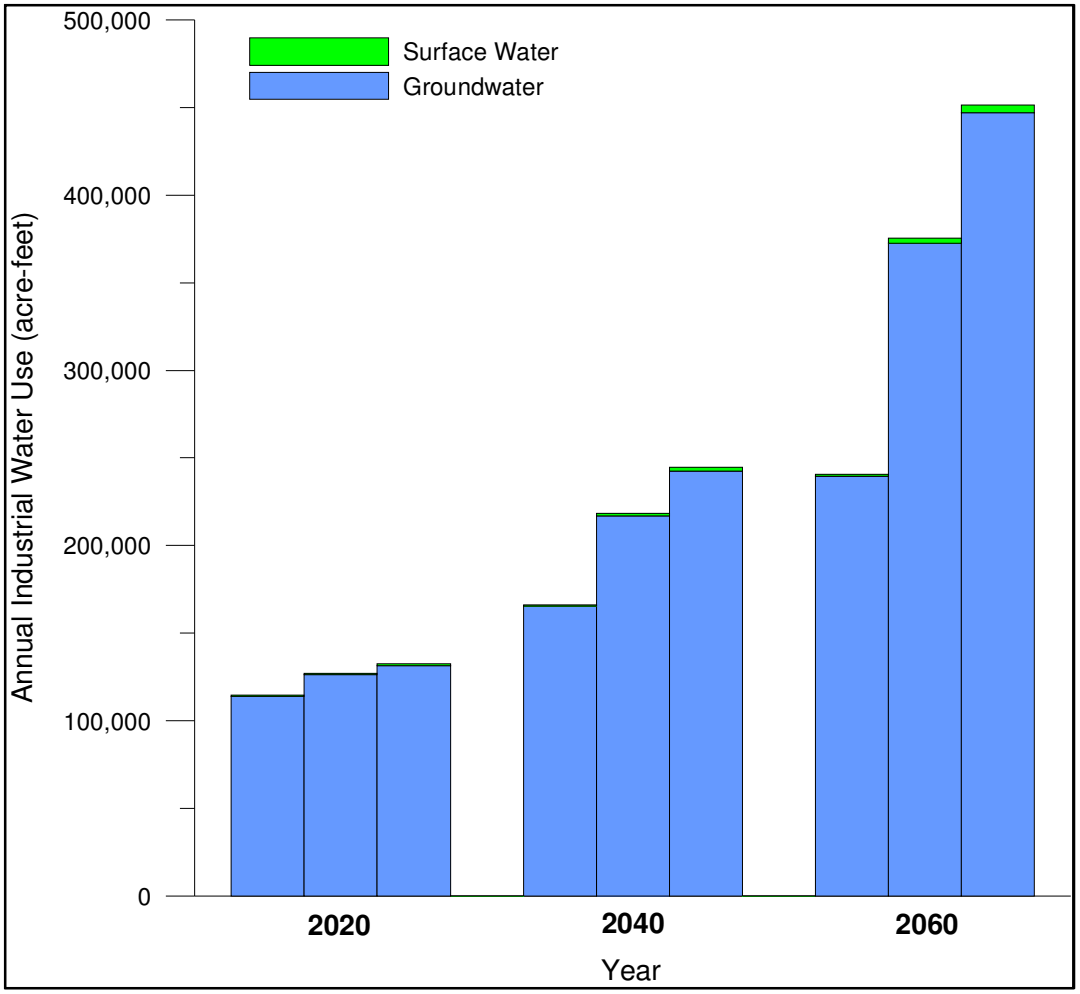

Figure 39. Projected Industrial Water Use by Source

Consumptive use in industrial applications is about 16 percent; for mining uses it is about 21 percent. Total future consumptive water use for industry, including mining, is provided in Table 46.

Table 46. Consumptive Water Use for Mining and Other Industry

	Low (ac-ft)		Medium (ac-ft)		High (ac-ft)	
Year	Mining	Industry	Mining	Industry	Mining	Industry
2020	24,000	110	26,500	150	27,600	170
2040	34,700	110	45,500	290	50,900	350
2060	50,400	110	78,100	550	93,800	740

As indicated in the above bar chart, almost all of the consumptive use water requirements will be mining-related groundwater.

6.6 Recreational Demand Projections

Tourism is an important economic sector in the Basin, with $497 million visitor spending in 2008. However, employment in tourism and related occupations tend to be low-paying, seasonal and do not spur sustained, year-round economic development (EADIV 2009b).

6.6.1 Planning Scenario Assumptions

The Wyoming Office of Travel and Tourism has adopted an advertising campaign to increase awareness of the State as a destination. Recent efforts have focused on nearby markets such as Denver and Salt Lake City (SMR 2009a).

Driving forces that will impact future tourism and recreation in the Basin include:

- **U.S. Economic Conditions.** Economic conditions impact vacation and recreational spending.
- **Fuel Cost.** Because the Basin is somewhat remote, high fuel costs would likely have a negative impact on Basin tourism. Almost 80 percent of Wyoming visitors travel by automobile (SMR 2009b).
- **Population Growth**. Population growth, particularly in neighboring states, would have a positive impact on Basin tourism and recreation.
- **Perception of Wyoming.** Awareness of Wyoming as a vacation destination will improve Basin tourism.
- **Trends in Tourism.** The Basin is primarily attractive to those interested in outdoor activities, such as hiking, climbing, hunting, fishing, rafting and wildlife viewing. If outdoor, active vacations and activities become more popular, this would increase recreation in the Basin.

The Basin offers a wide variety of recreational opportunities, many of which include water based activities. Tourism has increased in recent years, though at a modest rate. Major constraints to increased recreation in the area are a lack of easy access and competition from other recreation and tourist areas in the region.

The National Outdoor Leadership School (NOLS) is located in Fremont County. About 1,000 visitors come to the school for training each year. Increased attendance at NOLS may contribute to awareness of the Basin to those who are particularly interested in the type of activities that occur there (Lamb 2009).

Although an old ski resort is being reopened in 2009, world class skiing is available in nearby Teton County and in Utah and Colorado. This resort will likely capture those already living in the area. Additional golf courses are also unlikely without meaningful population growth.

Immigration trends might also impact Basin tourism. There is evidence that Hispanic and Asian immigrants prefer city vacation experiences over national parks (EADIV 2009b). If the bulk of regional population growth are immigrants, wilderness outdoor recreation will not increase much.

Many opportunities for boating and fishing are available in the Basin, but they are not over-used as of 2009 (Gritten 2009). If neighboring states or other regions of Wyoming experience overcrowding at reservoirs or fishing locations, the Basin might benefit if boaters and anglers seek less crowded facilities. However, this growth can occur in the Basin without the need for additional recreation related water resource development.

Planning scenario assumptions for tourism and recreation based on the above driving influences are identified in Table 47.

Table 47. Planning Scenario Assumptions for Tourism and Recreation

	Low	High	Medium
U.S. Economic Conditions	1.5% growth per year	3% growth per year	2% growth per year
Fuel Costs	Fuel costs high relative to income	Fuel costs low relative to income	Fuel costs stable relative to income
Population Growth	Slow growth	High growth	Moderate growth
Perception of Wyoming	Little improvement in awareness of Wyoming as a vacation destination	Wyoming enjoys increased awareness and perception as a tourist destination	Moderate improvement in awareness of Wyoming as a vacation destination
Trends in Tourism	Increased immigration dampens growth in outdoor experience tourism	Consumer preference for outdoor/active vacations and recreation increases substantially	Consumer preference for outdoor/active vacations and recreation increases moderately

6.6.2 Future Recreation Water Demands

Abundant resources for recreational water use in the Basin are adequate for all projected development scenarios in the Basin. No additional resources will be required over the planning horizon. However, future development could threaten existing uses. Existing resources are important for recreation, a key economic sector in the region, but are not protected by law. Future planning for water development projects should consider impacts to recreational water uses in order maintain this vital economic sector.

6.7 Environmental Demand Projections

Environmental water uses include wetlands and instream flows, which, like recreation, and boating, rafting, fishing and other related activities are non-consumptive. Environmental water use includes activities that are taken to maintain or improve environmental conditions such as fish and wildlife habitat. Environmental water use is also non-consumptive.

Future instream flow permits might increase non-consumptive water demand in the Basin over the planning horizon. Future water use scenarios for instream flows are provided in Table 48.

Table 48. Future Environmental Water Demand Scenarios (Non-consumptive)

	Current	Low	Medium	High
Number of Instream Flow Permits	21	21	24	25
Minimum Flows (cfs)*	531	531	548	710
Maximum Flows (cfs)*	999	999	1,046	1,396
Annual ac-ft/Minimum*	385,000	385,000	397,380	514,668

* Does not include flow data for Jakeys Fork or Tensleep stream segments.

Water use by invasive species, such as salt cedar (tamarisk) and Russian olive, were not quantified as part of the water use projections. However, continued proliferation of these species could potentially have a detrimental effect on surface water availability along mainstem rivers and tributaries throughout the basin.

6.8 Wind River Indian Reservation Development Scenarios

Located within the Wind-Bighorn River Basin, the WRIR is a reservation encompassing two Indian tribes, the Northern Arapaho and the Eastern Shoshone (Tribes). Although there are several small communities and commercial activities on the reservation, almost all the economic activity and water use is related to agriculture. As previously discussed, through the Big Horn Adjudication (BHA), the courts determined that the Tribes were entitled to divert 499,862 acre-feet per year with a July 3, 1868 priority date, and those waters would be utilized to irrigate about 108,000 acres of land within the reservation or utilized for "subsumed" uses. Besides irrigated agriculture, these waters could be used to meet legally compliant, subsumed purposes, such as municipal, commercial and light industrial water uses, presumably to support the agricultural economy. In addition, the courts also granted the WRIR 79,796 acre-feet per year of additional water rights, known as the Walton Awards, for existing water diversions on Indian fee land (Indian or non-Indian privately held lands that were originally allotted to individual Indians) within the reservation.

Since only about 290,500 acre-feet of these water rights have been historically diverted on the reservation, the permitted water rights from the BHA represent a large potential diversion and future water use (McCann 2009). The study team evaluated the potential for development of these water rights over the forecasting horizon in the context of low, high and medium scenarios, consistent with the Wind-Bighorn Basin Plan. In establishing future scenarios for WRIR development, aspects of the decree and Draft Wind River Water Plan, dated 2007, were reviewed. In addition, interviews were conducted with Sheridan Nicholas, the Wind River Irrigation Project (WRIP) Manager, Baptiste Weed, the Tribal Water Engineer, and attendance at a presentation by Ms. Catherine Vandemoer, entitled, "Our Water, Our Future", given in Lander on June 18, 2009 (BAG 2009b).

The potential for additional agricultural development on WRIR lands was evaluated as part of the BHA. Future practicably irrigable agricultural lands, referred to as "Futures" lands, consist of five projects: North Crowheart, South Crowheart, Arapahoe, Riverton East, and Big Horn Flats. The courts decreed a total of 53,760 acres in the Futures awards. Separately, the Tribes compiled their own set of non-agricultural water development prospects, as described in the Draft Wind River Water Plan of 2007, although water for such development would come out of the total Futures awards. This plan identified such activities as a bottled water plant, a rangeland water system, small-scale hydrogeneration, off-stream storage for recreation and other purposes, light industrial uses, cultural water uses, and community parks and gardens. The non-agricultural water development challenges facing the WRIR were clearly stated in the Draft Wind River Water Plan, described as an aspirational document (BAG 2009b).

The agricultural and non-agricultural water development opportunities will require capital investment, operating monies, plus management and ongoing operational skills. Hence, on Indian lands as well as non-Indian lands, the demand for the products of the water's beneficial use, the prices which can be gained for that output, and the financial and operational feasibility are paramount considerations in determining whether or not any development at all will take place. Notwithstanding private monies, public funds have not been forthcoming in sufficient amounts to move agricultural or non-agricultural developments forward on the WRIR, even in 2009 when major investments in infrastructure were underway throughout the U.S.

After careful consideration of the foregoing information, three water development scenarios for the WRIR were devised:

- Low scenario – "*Improving the Status Quo*". The WRIP is a priority for the WRIR. It is an existing irrigation project, which is not fully funded from an operational and maintenance standpoint. This project began in the 1920's and includes 60,000 potentially irrigated acres, with 37,000 acres actually developed (Nichols 2009). Under the low scenario, it is assumed that the two tribes will bring this BIA project up to economic sustainability. This will include the completion of rehabilitation work on Ray Lake and improving existing irrigation systems.

- High scenario – "*Futures Lands Fully Developed for Irrigation*". Under this scenario, agricultural prospects are bright (see high scenario assumptions for agriculture). Demand, prices and costs justify investment and development of the full complement of Futures lands, amounting to 53,760 acres. A portion of the water rights granted under the Big Horn Adjudication would also be dedicated to subsumed and legally compliant uses indicated in the Draft Tribal Water Plan.

- Middle scenario – "*Low Scenario Plus One Major New Development*". Of the five separate agricultural Futures properties, Riverton East is perhaps the most likely to be developed. It is located near exiting canals and close to the town of Riverton. It will require less money for development, and it has been studied more closely than development of the other Futures projects. It is assumed that, under the middle scenario, this project will be developed, amounting to an additional 3,814 irrigated acres. In addition, Washakie Lake will be expanded.

The large range in development prospects on the WRIR reflect the considerable uncertainty associated with the development of their water rights. Although water development opportunities are large, constraints to development are equally considerable, even over a 50 year time horizon.

Future water demands on the WRIR will be driven by the development scenarios described in Technical Memorandum 5B. Historically, diversions have been about 290,500 acre-feet per year. Under the low scenario, water demands will not change over the planning horizon. Under the medium scenario, Riverton East will be complete by 2040, resulting in 3,814 acres of additional irrigated lands. This would amount to about 17,500 acre-feet of new demand. Under the high scenario, all "Futures" acreage would be developed, amounting to an estimated 500,000 acre-feet of total demand or about 209,300 acre-feet of new diversions. Diversion requirements for Futures Projects were previously presented in Section 6.3.2. It is expected that consumptive use would generally be consistent with existing irrigated land consumptive use patterns.

6.9 Summary of Future Demand Projections

Future new water requirements in the Basin under the medium, most likely, scenario will reach 306,600 acre-feet in 2060. This demand includes agricultural, industrial, municipal and tribal water demand. New surface water demand in 2060 under the medium scenario will be about 24,000 acre-feet. Under the same scenario, new environmental water use would be about 12,000 acre-feet, which would be met by existing flows through new instream flow water rights. Total new water requirements for agriculture and municipal, and industrial use are provided in Table 49. New surface water requirements for agriculture, municipal and industrial use are provided in Table 50, while new groundwater requirements for agriculture, municipal and industrial use are provided in Table 51.

Table 49. Total New Water Requirements for Agriculture, Municipal and Industrial Use

Sector	Change in Diversions (ac-ft) Low	Medium	High
2020			
Agriculture	-75,000	100	55,000
Municipal and Domestic	300	500	1,600
Industry	22,800	35,300	40,800
WRIR	0	0	0
2020 Total	**-51,900**	**35,900**	**97,400**
2040			
Agriculture	-200,000	200	153,000
Municipal and Domestic	1,000	2,000	4,800
Industry	74,200	126,600	152,700
WRIR	0	19,000	75,000
2040 Total	**-124,800**	**147,800**	**385,500**
2060			
Agriculture	-320,000	500	254,000
Municipal and Domestic	1,700	3,500	8,600
Industry	148,800	283,600	359,200
WRIR	0	19,000	209,000
2060 Total	**-169,500**	**306,600**	**830,800**

Table 50. New Surface Water Requirements for Agriculture, Municipal and Industrial Use

Sector	Change in Diversions (ac-ft) Low	Medium	High
2020			
Agriculture	-75,000	100	55,000
Municipal and Domestic	170	290	920
Industry	50	280	340
WRIR	0	0	0
2020 Total	**-74,800**	**700**	**56,300**
2040			
Agriculture	-200,000	200	153,000
Municipal and Domestic	570	1,150	2,760
Industry	160	1,060	1,370
WRIR	0	19,000	75,000
2040 Total	**-199,300**	**21,400**	**232,100**
2060			
Agriculture	-320,000	500	254,000
Municipal and Domestic	980	2,010	4,940
Industry	330	2,500	3,450
WRIR	0	19,000	209,000
2060 Total	**-318,700**	**24,000**	**471,400**

Note: Values in “Total” row are rounded.

Table 51. New Groundwater Requirements for Agriculture, Municipal and Industrial Use

Sector	Change in Diversions (ac-ft) Low	Medium	High
2020			
Agriculture	0	0	0
Municipal and Domestic	130	210	680
Industry	22,750	35,020	40,460
WRIR	0	0	0
2020 Total	**22,900**	**35,200**	**41,100**
2040			
Agriculture	0	0	0
Municipal and Domestic	430	850	2,040
Industry	74,040	125,540	151,330
WRIR	0	0	0
2040 Total	**74,500**	**126,400**	**153,400**
2060			
Agriculture	0	0	0
Municipal and Domestic	720	1,490	3,660
Industry	148,470	281,100	355,750
WRIR	0	0	0
2060 Total	**149,200**	**282,600**	**359,400**

Note: Values in "Total" row are rounded.

The previous Basin Plan projected new water uses in 2030; these were primarily a function of increased agricultural water demand resulting from the development of Tribal Futures Projects and several non-Tribal projects on irrigable land throughout the Basin. Nearly all of the new water uses were projected to be surface water use. A comparison of future water use as developed in the Basin Plan Update with the previous Basin Plan is presented in Figure 40. For purposes of the comparison, estimated 2030 uses for the Basin Plan Update are an average of 2020 and 2040 demands. The Basin Plan Update projects lower 2030 water use than the previous Basin Plan. Projected 2060 uses are approximately the same as 2030 uses in the previous Basin Plan. However, the Basin Plan Update projects that approximately 43 percent of new water use will be groundwater primarily associated with industrial uses, with the remaining 57 percent being surface water primarily associated with agricultural development.

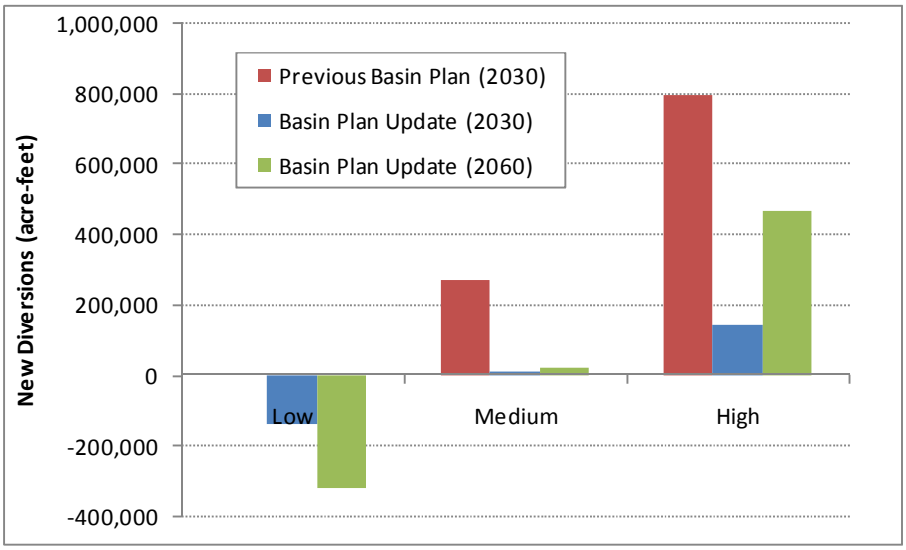

Figure 40. Comparison of Future Water Use with Previous Basin Plan