6. Water Demand

To effectively plan for meeting future water resource needs, it is important to understand current use trends as well as future changes that may be anticipated. This section includes an evaluation of historical and current water use by sector (Section 6.1), an evaluation of population and economic trends and projections of future population (Sections 6.2 and 6.3), a discussion of water conservation for the San Juan planning region (Section 6.4), and projections of future water demand (Section 6.5).

6.1 Historical and Present Uses

The most recent assessment of water use in the region was compiled by OSE for 2010, as discussed in Section 5.5. In addition to the NMOSE Water Use Report for 2010 (Longworth et al., 2013), other information was used to provide a complete evaluation of historical or current diversions by category of use for the San Juan Basin Water Planning Region. Additionally, for consistency with NMISC water use reporting to the USBR and UCRC of consumptive uses and losses from the San Juan River Basin in New Mexico and the 2006 New Mexico Schedule of Anticipated Upper Basin Depletions, some water use categories used for this update to the 2003 RWP are different than those used in the NMOSE Water Use Report for 2010. Total diversions under historical or current conditions for each category of use are summarized in Sections 6.1.1 through 6.1.8.

6.1.1 Irrigation

The maximum historical annual diversion from Navajo Reservoir for the NIIP was about 234,300 acre-feet in 2012 based on metered diversions. Annual diversions from the San Juan River for the Fruitland and Hogback irrigation projects recently have averaged a total of about 114,600 ac-ft/yr based on diversions for these projects of about 100 cubic feet per second (cfs) and 170 cfs, respectively, over an irrigation season of April-October. These diversion amounts are recognized in recommendations for San Juan River operations and administration in New Mexico that have been agreed to since 2002 by major water users on the San Juan River and accepted by the State Engineer. The current diversion demand for Navajo ephemeral tributary irrigation uses was estimated at about 14,300 ac-ft/yr based on the Navajo Supplemental Decree irrigation diversion rights that were determined in consideration of historical irrigation uses and an aggregate project diversion requirement for these uses of about 28,500 ac-ft/yr less an average water supply shortage of about 50 percent.

Annual diversions for non-Navajo irrigation uses recently have averaged a total of about 291,900 ac-ft/yr based on:

- Diversions from the San Juan River for irrigation uses at rates adjudicated by the Echo Ditch Decree for the Turley, Citizens and Jewett Valley ditches, plus an additional 11.6 cfs under License 2870 for the Bloomfield Irrigation District, maintained over the bulk of
the irrigation season of April-October, as recognized in the recommendations for San Juan River operations and administration in New Mexico

- (2) Combined diversions from the San Juan River and/or Animas River of about 93 cfs for irrigation uses under the Farmers Mutual Ditch maintained over the bulk of the irrigation season (information provided by the NMOSE San Juan Basin Watermaster)

- The annual diversion limit for the Hammond Irrigation District based on licenses and permits approved by the State Engineer

- Ditch diversions from the Animas River for irrigation uses at rates adjudicated by the Echo Ditch Decree and maintained over the bulk of the irrigation season as currently administered by the NMOSE, with two exceptions: (1) the diversion rate for the Aztec Ditch was increased 2 cfs for transfers of irrigation rights into the ditch, and (2) the diversion rates for irrigation uses under the Lower Animas, Halford-Independent, Echo and North Farmington-Wright Legget ditches were reduced to about 49 cfs, 38 cfs, 50 cfs and 10 cfs, respectively (information provided by the NMOSE San Juan Basin Watermaster)

- An estimated average divertible supply of about 35 cfs at the La Plata River at the Stateline gage for April-October (only the top priority ditches may divert from low flows of La Plata River during the summer and fall periods)

- Calculated project diversion requirements for remaining portions of the Archuleta Ditch now supplied by pump in the San Juan River and of ditches diverting from the Pine River for uses above Navajo Reservoir

- Jicarilla Apache Nation decreed irrigation diversion rights.

To compute annual irrigation diversions from recognized current irrigation diversion rates for non-Navajo uses, it was assumed that (1) the irrigation ditches are maintained full during May-September and at 80 to 85 percent full in April and October (information provided by the NMOSE San Juan Basin Watermaster), or about 95 percent full averaged over the irrigation season, and (2) small amounts of diversion in March or November for irrigation or stock are not significant to the computation.

Thus, the total amount of diversion for irrigation uses in the San Juan River Basin in New Mexico under historical or recent conditions is as much as about 655,100 ac-ft/yr. This includes diversions of water for the irrigation of crops grown on farms, ranches, and wildlife refuges in the basin, and it excludes diversions made by the San Juan-Chama Project (SJCP) and exported from the basin for irrigation uses in the Rio Grande Basin in New Mexico.

6.1.2 Livestock

The total amount of diversion for livestock uses in the San Juan River Basin in New Mexico
under historical or recent conditions is about 4,400 ac-ft/yr. This includes (1) about 700 ac-ft/yr of diversion for livestock watering plus (2) about 3,700 ac-ft/yr of diversion into reservoir storage to replace evaporation losses calculated based on average stock pond storage and surface area conditions as limited by available water supply. It excludes diversions into storage to replace any seepage losses from stock ponds. Livestock watering uses include livestock water consumption, maintenance of self-supplied livestock facilities, and on-farm processing of poultry and dairy products.

6.1.3 Municipal/Domestic

Public water supply includes community water systems that consist of common collection, treatment, storage, and distribution facilities operated for the delivery of water to multiple service connections. This includes municipalities (which may serve residential, commercial, and industrial water users), mutual domestic water user associations, prisons, residential and mixed-use subdivisions, and mobile home parks. Annual diversions for municipal or domestic water uses in the San Juan River Basin that are served by public water supply systems have recently approached somewhat less than 27,700 ac-ft/yr. This includes:

- About 22,200 ac-ft/yr of diversions for municipal uses by the cities of Farmington, Aztec, and Bloomfield, plus domestic uses of surface water by mutual domestic water user associations and other public water suppliers, based on maximum amounts of diversion of surface water for municipal or domestic uses by these entities in recent years.

- About 2,600 ac-ft/yr of diversions from surface water for Navajo and Jicarilla municipal or domestic water uses served by the NTUA and BIA, respectively.

- About 2,900 ac-ft/yr of scattered rural domestic uses supplied with groundwater mostly from IHS, NTUA or other public water systems or community wells, but also including some water uses from self-supplied private residential domestic wells drilled prior to declaration of the San Juan Underground Water Basin or under well permits issued by the NMOSE pursuant to §72-12-1.1 NMSA 1978.

The total amount of municipal/domestic diversions noted above excludes diversions made by the SJCP and exported from the basin for municipal or domestic uses in the Rio Grande Basin in New Mexico and diversions of groundwater by the City of Gallup for export to the Little Colorado River Basin.

Some of the recent diversions for municipal or domestic water uses in the San Juan River Basin by non-Indian public water providers reportedly were made pursuant to ALP diversion permits; however, neither these entities nor the NMOSE has made an accounting of diversions by specific decreed right, license, or permit. Also, given recent agreements resolving litigation and other water right issues affecting the cities of Farmington, Aztec, and Bloomfield and other members of the SJWC, and with litigation pending regarding the administration of the ALP water supply
in Colorado, much of the diversions that historically might have been made by the SJWC’s member entities under ALP diversion permits may in the future be accounted for under other water rights. Therefore, for purposes of this update to the 2003 RWP, all the non-Indian and Indian municipal and domestic diversions from surface water were included in the public water supply (non-project) subcategory for the analysis of historical or current conditions.

6.1.4 Industrial (self-supplied)

The annual amount of diversion for self-supplied industrial uses in the San Juan River Basin in New Mexico under recent conditions has been about 400 ac-ft/yr. This includes water use for self-supplied industrial uses not related to mineral production, such as the processing of raw materials, the manufacture of durable or nondurable goods, or construction projects. It excludes industrial uses that are supplied from municipal or domestic public water supply systems. For purposes of this regional water plan update, a very small amount of self-supplied commercial use for recreation areas and businesses was included in the industrial water use category. Commercial uses, including for irrigation of golf courses, that are supplied from public water supply systems were included in the municipal and domestic water use category, and irrigation of other golf courses from ditches was included in the irrigation water use category.

6.1.5 Power

The power category includes self-supplied power generating facilities and water used in conjunction with coal-mining operations that are directly associated with a power generating facility.

The maximum historical annual diversion for thermal electric power generation at the SJGS, including mining and reclamation activities at the San Juan and La Plata mines that have supplied coal for the power plant, was about 24,800 acre-feet in 2009. After 2009, the maximum annual diversion for power generation at the SJGS was about 22,200 acre-feet, but water use at the power plant might have been reduced in part due to outages at generation units for installation of emissions control equipment.

At the FCPP, three of the five coal-fired generation units were retired at the end of 2013. It was estimated that the annual diversion demand for the FCPP—including for water consumption at the power plant, coal mining activities at the Pinabete extension of the Navajo Mine, and replacement of Morgan Lake blowdown releases—will average about 26,500 ac-ft/yr after installation of emission control equipment over the next couple of years, assuming that the remaining generation units operate as planned. This estimate was based on information provided by APSCo regarding anticipated water consumption at the FCPP and on data regarding recent water uses at the Navajo Mine and recent blowdown discharges at Morgan Lake.

Thus, the total amount of diversion for power generation uses in the San Juan River Basin in New Mexico under recent or current conditions is about 51,300 ac-ft/yr. This excludes:
• Water diverted by the City of Farmington for uses at the Animas Power Plant (APP) and the Bluff View Power Plant (BVPP), uses for which are included in the City’s municipal and industrial water use amount

• Up to 138 cfs of diversion from the Animas River for hydropower generation at the City of Farmington hydroelectric power plant, for which the diverted water is quickly returned to the river in a short distance downstream from the point of diversion

• Water released from Navajo Reservoir through penstocks connected to the Navajo Dam power plant operated by the City of Farmington, which is used to generate hydropower only as a corollary of USBR operation of Navajo Dam for other purposes.

6.1.6 Minerals

The annual amount of diversion for mineral production in the San Juan River Basin in New Mexico under recent conditions has been about 1,600 ac-ft/yr. This includes self-supplied diversions of water used for extraction or production of oil, natural gas, gravel, water, or metals. It excludes diversions of water for mining of coal used for thermal electric power generation at the SJGS or FCPP, for which diversions are accounted under the power water use category for Upper Basin planning purposes. If in the future coal is extracted from within the region and transported to other states or regions, the water used to mine this coal would be accounted under the minerals or mining water use category.

6.1.7 Reservoir Evaporation:

The average annual amount of diversion into reservoir storage to replace reservoir evaporation losses in the San Juan River Basin in New Mexico is about 29,900 ac-ft/yr under current conditions. This includes:

• A long-term average annual amount of diversion into Navajo Reservoir storage to replace evaporation losses from the reservoir of about 27,900 ac-ft/yr, as calculated based on the USBR’s San Juan River Basin hydrologic modeling prepared for the 2006 ROD on operations of Navajo Reservoir

• Diversion of 2,000 ac-ft/yr from scattered small reservoirs that store water for irrigation, recreation, or fish and wildlife purposes, as calculated based on average reservoir storage and surface area conditions as limited by available water supply.

The average reservoir diversion amount excludes evaporation losses from off-stream reservoirs that are filled from metered diversions that are included in other water uses. For example:

• Evaporation from Cutter Reservoir, which regulates irrigation water deliveries on the NIIP, is included in the NIIP’s irrigation uses.

• Evaporation from Farmington Lake is included in the City of Farmington’s municipal
uses.

- Evaporation from Morgan Lake is included in the power generation uses at the FCPP.
- Evaporation from Heron Reservoir is replaced by SJCP exports (Heron Reservoir in the Rio Grande Basin regulates SJCP diversions for delivery to project contractors).

The Navajo Reservoir evaporation amount is based on average monthly net evaporation rates, which reflect reductions in physical evaporation from the reservoir surface for the salvage of evaporation and evapotranspiration losses that would have occurred within the reservoir pool area under pre-dam conditions, thus indicating the amount of net losses caused by filling of the reservoir.

6.1.8 Exports

Annual diversions from the San Juan River stream system in Colorado for export to the Rio Grande Basin in New Mexico for municipal, industrial, domestic and irrigation uses historically have ranged from about 6,300 to 174,900 acre-feet depending on (1) the streamflow available for diversion at the project’s diversion structures and (2) storage conditions at Heron Reservoir, which after exportation regulates SJCP water deliveries. Based on an operation study for the SJCP prepared by the NMISC (Whipple, 2007), it is estimated that the long-term average annual diversion by the SJCP under existing conditions is about 105,200 ac-ft/yr. Also, in recent years the City of Gallup has diverted up to about 600 ac-ft/yr of groundwater from the southern end of the San Juan River Basin for export to help meet its municipal water demands.

6.1.9 Total Regional Historical and Present Uses

The total amount of diversion in the San Juan River Basin for uses in New Mexico under historical or current conditions averages about 879,000 ac-ft/yr including SJCP diversions for export to the Rio Grande Basin, or about 773,800 ac-ft/yr excluding the SJCP exports. The predominant water use in the San Juan Basin region under current conditions is for irrigated agriculture, and nearly all the water use in the region is supplied from surface water. The historical or current diversions for the San Juan Basin region are summarized by category of use in Table 6-1 and Figure 6-1.

Less than 1 percent of the total withdrawals in the region are supplied by groundwater. Most of the groundwater use in the San Juan Basin region is for scattered uses, including domestic uses supplied from public water supply systems and self-supplied domestic uses. Groundwater also supplies some industrial and livestock watering uses. Groundwater points of diversion are shown in Figure 6-2.

In addition to diversions from the San Juan River stream system, streamflows in the river system are affected by unquantified additional categories of water use, including riparian
evapotranspiration losses from stream channels and instream flow maintenance for fish and wildlife habitat.

- **Riparian evapotranspiration**: Some research and estimates have been made for riparian evapotranspiration in selected areas, such as along the Rio Grande (Thibault and Dahm, 2011; Coonrod and McDonnell, Undated; Bawazir et al., 2009), but riparian evapotranspiration has not been quantified statewide. Historical riparian evapotranspiration losses from the San Juan River stream system are reflected in the historical streamflow and available water supply. Possible changes in riparian evapotranspiration losses might be considered in future regional and state water plan updates.

- The New Mexico Water Resources Research Institute is currently developing those estimates but the results are not yet available. Though riparian evapotranspiration is anticipated to be a relatively large use statewide, it will not affect the calculation of the gap between supply and demand using the method in this report, because the gap reflects the difference between future anticipated uses and present uses, and if both present and future uses do not include the riparian evapotranspiration category, then the difference will not be affected. The only impact to the gap calculation would be if evapotranspiration significantly changes in the future. There is potential for such a change due to warming temperatures, but anticipated changes have not been quantified and would be subject to considerable uncertainty. Anticipated changes in riparian and stream evapotranspiration are areas that should be considered in future regional and state water plan updates.

**Instream flow**: It is recognized that there is value in preserving instream flow for ecosystem, fish and wildlife habitat, and tourism benefits. Water demands for instream flow in the San Juan Basin Water Planning Region were not quantified for this regional plan update. However, the 2006 ROD on Navajo Reservoir operations provides for operating the reservoir to meet water demands under Navajo Reservoir water supply contracts while also meeting the SJRBRIP’s flow recommendations to provide adequate habitat for the conservation of endangered fish species in the San Juan River downstream of its confluence with the Animas River. The operation of Navajo Dam in accordance with the ROD allows for further development of the Navajo Reservoir supply consistent with existing contracts and the Endangered Species Act. It is possible under certain conditions that the SJRBRIP’s flow recommendations for the San Juan River, or a reasonable alternative, might impair the ability of the Navajo Nation to fully utilize the NIIP for some period of time, in which case future water plan updates might consider any such gap between supply and demand for the NIIP. Until the NIIP and the NGWSP are fully developed and utilized, the ROD also allows flexibility in operating the reservoir to
maximize, to the extent possible, benefits to the recreational trout fishery below Navajo Dam. Physical habitat improvements are also being made to the river channel below Navajo Dam for the benefit of the trout fishery.

Also, there is significant oil and gas development in the region, and produced water from oil and gas development is not included in the NMOSE water use by category report. Produced water is generally high in total dissolved solids and as part of the oil and gas extraction process is withdrawn from formations that are deeper than those that supply groundwater for beneficial use, such as domestic, livestock, irrigation, or industrial uses. Approximately 10 barrels of water are produced for every barrel of oil produced (Simpson, 2006). The produced water is generally treated and re-injected or discharged to the surface. Produced water is not considered to impact flow in the San Juan River, and it might not be an economically viable or significant part of the water supply available to meet future beneficial use demands in the region.

6.2 Demographic and Economic Trends

To project future water demands in the region, it is important to first understand demographics, including population growth and economic and land use trends, in addition to authorized water uses and water supply projects under construction or in other stages of development. As previously noted, the San Juan Region includes almost all of San Juan County and small portions of McKinley, Rio Arriba, and Sandoval counties. The 2013 population of San Juan County was 130,044 (U.S. Census Bureau, 2014a). A significant portion of the region lies within the Navajo Reservation.

As shown in Table 3-1, San Juan and Sandoval counties experienced a high rate of population growth from 2000 to 2010, while McKinley and Rio Arriba counties experienced declines. Since 2010, there have been declines in San Juan and Rio Arriba counties and growth in McKinley and Sandoval.

The largest employment categories in the region are education/healthcare, mining, agriculture, and forestry, retail trade, tourism-related services (arts, entertainment, recreation, hospitality, and food services), transportation and utilities, construction, and professional and scientific services. Agriculture is the largest water user in San Juan County, followed by power generation, reservoir evaporation, and municipal and domestic use.

The San Juan Region includes virtually all of San Juan County, which constitutes the Farmington Metropolitan Statistical Area (MSA). The Farmington MSA is the major wholesale and retail trade center for northwest New Mexico and southwest Colorado. It also contains much of the state’s mining and power production and the San Juan oil and gas basin.

As noted in Table 3-1d, vegetables, melons, and potatoes are the most valuable agricultural commodities in San Juan County. Other crops and hay and livestock are also important.
Specific information regarding the population and economic trends in each county is provided in Sections 6.2.1 through 6.2.3. The information provided in these sections was obtained primarily from telephone interviews with government officials and other parties with knowledge of demographic and economic trends in the four counties; the list of interviewees is provided in Appendix 6-A. The information in these following subsections was used to project population and economic growth, and was considered in developing alternative future water demand projections, as presented in Sections 6.3 and 6.5.

### 6.2.1 San Juan County

The City of Farmington comprises over one-third of the population of San Juan County. Other significant incorporated communities are Aztec and Bloomfield. San Juan County experienced steady growth from 1950 to 2010, with the population increasing from 18,292 in 1950 to 53,306 in 1960, 81,433 in 1980, and 130,044 in 2010. Although growth was relatively steady overall, it did experience some fluctuations due to a series of booms and busts in the coal, uranium, and oil and gas industries. Since 2010, there has been considerable out-migration from San Juan County, with the population in 2013 estimated to be 126,503, down from 130,044 in 2010 (U.S. Census Bureau, 2014a).

The Arrowhead Center at New Mexico State University (NMSU) analyzed the economy of San Juan County and identified the basic industries that support the economy (Arrowhead Center, 2013). Basic industries bring outside dollars into the economy. A basic industry frequently has a location quotient (LQ) greater than 1.0, which means that its relative share of the local economy is greater than that industry’s relative share of the state economy. In San Juan County, the primary basic industries in 2011 were mining (LQ of 4.16) and utilities (LQ of 3.84). There were 7,662 jobs in mining (which includes oil and gas extraction) and 1,031 jobs in utilities, mostly related to power generation at the FCPP and the SJGS). Other basic industries were agriculture (LQ of 1.31), wholesale trade (LQ of 1.26), retail trade (LQ of 1.11), and transportation and warehousing (LQ of 1.10).

After mining, the largest private employment sector was retail trade with 7,325 employees. Wage and salary employment overall has increased slightly during the past three years, from 50,171 in 2010 to 51,704 in 2013.

The region’s dependence on mining has led to a series of boom and bust cycles. With the recent decline in natural gas prices, there has been a decline in natural gas drilling activity. Gas volumes in San Juan County have declined from roughly 650 million cubic feet in 2004 to just over 400 million cubic feet in 2013. At the same time, the use of horizontal hydraulic fracturing has led to an increase in oil drilling, particularly in the Mancos Shale formation in the eastern portion of the region. Oil production has increased from about 1,100,000 barrels in 2011 to more than 1,500,000 barrels in 2013. It is estimated that there are 30 billion barrels of shale oil (not all
of which is recoverable) in the San Juan Basin (NMDOT, 2014). About 200 new wells are being drilled per year in the Mancos formation, and this number is expected to increase. Coal mining in the region is expected to decline due to the retirement of three coal-fired generation units at the FCPP at the end of 2013 and the anticipated replacement of two coal-fired generation units at the SJGS with gas-fired units by the end of 2017. However, power generation projects such as the proposed Desert Rock Power Plant possibly could develop new coal-fired generation units if pursued in the future, or demand for coal also could increase if a proposed rail line from Farmington to Gallup is constructed and makes feasible the export of coal from San Juan County to other regions or states.

The New Mexico Department of Workforce Solutions (2014) has projected employment growth for the Farmington MSA (San Juan County) from 2010 to 2020. It is projected that 8,650 new jobs will be created, for a gain of 16.8 percent. The largest job gains are projected in the following sectors:

- Health care and social assistance: 1,760
- Mining: 1,360
- Educational services: 1,230
- Retail trade: 1,060
- Accommodation and food services: 990

Despite the recent out-migration, there are some bright spots on the economic horizon accompanying the growth in oil production. Several developers are working on the west side of Farmington, where more than 1,000 housing units are planned over the next couple of years. Additional restaurants and retail are being built in the county.

Several industries are being targeted by 4CED Inc. (formerly San Juan Economic Development Service). These include agriculture, oil and gas, and manufacturing. The New Mexico Legislative Job Council (2013) has targeted “integrated IT and cyber,” as well as manufacturing and extractives, in the Northwest District of New Mexico (which includes San Juan County). It is projected that 16,500 jobs could be created in these three sectors during the next ten years if limitations in broadband, transportation, workforce quality, leadership, and tax and regulatory areas could be overcome. A feasibility study has been funded to explore building a rail line from Farmington to Thoreau or Gallup. This would allow for the export of coal, crude oil, fly ash, agricultural products, and manufactured goods, which could significantly impact the region’s economy. The rail line is also being addressed in the 2040 Statewide Multi-Modal Transportation Plan (NMDOT, 2014). Such a line would allow for the import of fertilizer, oil field supplies, and other products, as well as the export of goods.
The largest agricultural enterprise in San Juan County is the Navajo Agricultural Products Industry (NAPI), which manages the NIIP. The NIIP is authorized for build out to irrigate up to 110,630 acres south of Farmington, but completion of the project will not likely occur until about 2040 given current rates of annual federal appropriations for project construction. The NIIP diverts water from Navajo Reservoir, and the annual diversion demand for the NIIP is anticipated to average about 353,000 ac-ft/yr. Major crops supplied by water from the NIIP are potatoes, corn, alfalfa, beans, hay, barley, wheat, and oats. Potatoes are shipped to a Frito-Lay plant in Texas, wheat is shipped to southern Arizona, and much of the hay is used for feed within New Mexico. Potatoes in future years may be processed by NAPI in New Mexico as it has planned for development of a french fry processing facility on the NIIP and the NGWSP includes water for use at the planned facility.

According to the Census of Agriculture, the most valuable agricultural commodities in San Juan County are vegetables, melons, and potatoes. Other crops and hay, livestock, and wool are also important (USDA NASS, 2014). The number of farms and ranches increased by 39 percent, from 1,897 in 2007 to 2,628 in 2012. The average farm size also increased, from 860 acres to 982 acres in 2012. Between 2007 and 2012 irrigated acreage increased from 78,438 acres to 85,890 acres, a gain of 9.5 percent, due to increased build-out at NIIP.

In 2012, the average payment to a farmer participating in agricultural support programs was $2,787, down 73 percent from 2007, with a total of $1,023,000 in government payments going to farmers in San Juan County, an increase of 14 percent from the $900,000 distributed in 2007. The average farm had a net cash operating loss of $247. The average age of a farmer in 2012 was 60.5.

The majority of farms in the county are less than 15 acres in size, family-owned, and located on the Navajo Reservation. Sheep and beef cattle comprise the largest livestock categories. Alfalfa is the main crop in terms of acreage. In recent years, there have been few sales of agricultural land.

6.2.2 Rio Arriba County

The western portion of Rio Arriba County is included within the San Juan Region. It is a rural area that is partially located on the Jicarilla Apache Reservations. A considerable amount of oil and gas drilling takes place in this portion of the county. In 2010 the portion of the county within the planning region had a population of 3,889.

6.2.3 McKinley County

The northern portion of McKinley County is included within the San Juan Region. It is a rural area that is largely on the Navajo Reservation. In 2010 it had a population of 11,396.
6.2.4 Sandoval County

The San Juan Region includes the far northwestern portion of Sandoval County. It is a rural area that includes some oil and gas drilling. The portion of Sandoval County in the San Juan planning region had a population of 1,032 in 2010.

6.3 Projected Population Growth

The 2003RWP (SJWC, 2003) provided a single population projection for the planning horizon through 2044. The forecast was based on an average of linear and exponential regressions of historical population data. An increase in the regional population was projected, from 97,028 in 2000 to 202,150 in 2044. This is equivalent to a compound annual growth rate of 1.68 percent.

Since 2008, the drought, lower natural gas prices, and the national recession that started in 2007 have resulted in slower population growth in San Juan County than was anticipated. The BBER has continued to revise population projections downward to reflect the slower growth (BBER, 2012; 2008).

Persons who were interviewed for this project were, on the whole, somewhat pessimistic about the near-term future of the region’s economy. In the longer term, it appears that the economy will recover and grow, especially if the boom in oil production is realized.

Population projections through 2020 were developed by Trib Choudhary, formerly the demographer for the Navajo Nation. Mr. Choudhary optimistically projected that annual growth will average approximately 2 percent throughout the Reservation.

For the population projections through 2060 (Table 6-3), two population forecasts were developed: one based on a moderately optimistic view of the economy for this region over the long-term and one that portrays a more pessimistic picture. All the projections are for those portions of the counties within the San Juan Basin region.

The high projection for the portion of San Juan County in the planning region was based on the population forecasts currently being updated by the SJWC. The high population projections for the three partial counties were based on the BBER forecasts for water planning provided to the Interstate Stream Commission in 2008. Under the high forecast, by 2060 population within the region will reach 313,900 in San Juan County, 16,326 in McKinley County, 5,966 in Rio Arriba County, and 2,014 in Sandoval County.

The current (2012) BBER population projections through 2040 were used as a starting point for the low population projection for San Juan County, extrapolated through 2060, except that they were dampened for the 2010 to 2020 period to take into account the slower rate of growth that has actually occurred since 2010. For the other three counties, the low forecasts were for annual growth at half of the rate projected by BBER in 2008 (which was used as the high projections),
except that, as with San Juan County, no growth was projected for the period 2010 through 2020. Under the low forecast, the population of the partial counties in 2060 will reach 177,057 in San Juan County, 13,001 in McKinley, 4,472 in Rio Arriba, and 1,295 in Sandoval. The population projections are detailed in Table 6-3.

### 6.4 Water Conservation

Water conservation is often a cost-effective and easily implementable measure that a region may use to help balance supplies with demands. The cost-effectiveness of certain water conservation measures may depend on the specific physical, legal, and financial issues affecting water diversion and storage, water treatment, and water delivery. The State of New Mexico is committed to water conservation programs that encourage wise use of our limited water resources. In support of that commitment, the NMOSE, when evaluating water rights transfers or 40-year water development plans that hold water rights for future use, considers whether adequate conservation measures are in place, limiting transfers or holding of water rights when conservation measures could instead be used to meet demand. It is therefore important when planning for meeting future water demand to consider the potential for conservation.

To develop demand projections for the region, some simplifying assumptions regarding conservation have been made. These assumptions were made only for the purpose of developing an overview of the future supply-demand balance in the region and are not intended to guide policy regarding required conservation for individual water rights holders. The approach to considering conservation in each sector for developing water demand projections is discussed below. Specific recommendations for conservation programs and policies for the San Juan Basin region, as identified by the regional steering committee, are provided in Section 8.

**Public water supply.** In theory, public water suppliers that have large per capita water usage rates may have a greater potential for water conservation than those that have low per capita usage rates; however, this is not necessarily an indication that those with low per capita usage rates are using water more efficiently. For example, the City of Farmington’s high average per capita usage rate is due in part to the following conditions

- The City has a significant amount of bulk raw water sales for commercial irrigation uses (for example, at golf courses), and the sold raw water is accounted under its municipal use water rights.

- Farmington delivers water diverted through its municipal water system to its APP and BVPP for use in gas-fired thermal electric power generation, and this water use is counted under its municipal use rights.
• The City has a high hotel and motel occupancy rate as compared to the population, which results in a comparatively higher per capita usage rate calculated using only its resident population.

• The amount of reservoir evaporation from Farmington Lake, the City’s municipal water supply reservoir, is relatively significant.

Annual fluctuations in the City’s per capita use also occur due to changes each year in the net amount of water diverted into storage or withdrawn from storage at Farmington Lake for municipal use (the lake is located downstream of the points where the City’s diversions are metered).

On the other hand, IHS or NTUA public water systems on the Navajo Reservation within the region currently have low per capita usage rates in part because they (1) have limited well yields and groundwater supply available for sustained use and (2) supply both households connected to the water systems and those who haul water from system watering stations to their homes for use.

Through a cooperative effort with seven public water suppliers, the NMOSE developed a GPCD (gallons per capita per day) calculation to be used statewide, thereby standardizing the methods for calculating populations, defining categories of use, and analyzing use within these categories. The GPCD calculator was used to arrive at the per capita uses for public water systems in the region in 2010 that are shown in Table 6-4.

The system-wide per capita usage for each water supplier may include uses such as irrigation of golf courses and parks, reservoir evaporation, uses at hotels and motels, industrial uses, and commercial enterprises that are supplied by the system. Hence there can be large variability among the systems.

Considering that water supply from the San Juan and Animas rivers and water rights held by public water providers are not limiting factors to municipal or domestic water uses in the region within a reasonable planning horizon, it is assumed that there is little pressure on public water providers to implement substantial water conservation measures within the next few decades as opposed to developing proof of beneficial use of their permitted water allocations. Thus, while updates to other regional water plans may assume that water conservation targets are met in projecting future municipal or domestic water uses, this water plan update does not do so.

Another target or criterion if applied to this region would assume that per capita usage rates for Navajo Nation municipal or domestic uses would not change from current rates; however, planning reports for the NGWSP assume that Navajo Nation per capita usage rates will significantly increase to as much as 160 gpcd once the project is delivering a renewable water supply to communities throughout the Navajo Reservation, IHS and NTUA public water systems.
are expanded to reduce water hauling, and residents have adequate water supplies to irrigate a yard or garden and have certain amenities such as a washing machine that come with an improved standard of living. Thus, although municipal or domestic water providers in the region should routinely explore water conservation measures to evaluate if and when they might be cost-effective to implement, implementation of water conservation was not explicitly considered in the development of water use projections for the San Juan Basin region. This is a conservative approach for planning purposes.

**Self-supplied domestic.** Homeowners with private wells can achieve water savings through household conservation measures. These wells are not metered, and current water use estimates were developed based on a relatively low per capita use assumption (Table 6-4; Longworth et al., 2013). Therefore, no additional conservation savings were assumed in developing the water demand projections.

**Irrigated agriculture.** As the largest water use in the region, conservation in this sector may be beneficial. However, when considering the potential for improved efficiency in agricultural irrigation systems, it is important to consider how potential conservation measures may affect the overall water balance in the region.

Irrigation withdrawals include both consumptive and non-consumptive uses and incidental losses:

- Consumptive uses are permanently removed from the stream system and are due to a crop’s potential for evapotranspiration (i.e., evaporation and transpiration), which is determined by factors that include crop variety, soil type, climate and growing season, on-farm management, and irrigation practices.

- Additional water is used non-consumptively for conveyance requirements and is returned to the surface or groundwater system from which it was withdrawn without loss.

- Incidental losses are permanently removed from the stream system and occur through both seepage and evapotranspiration during conveyance through the irrigation system.

  - Seepage losses occur when water leaks through the conveyance channel or below the root zone after application to the field. The water remains in the soil column or is lost to the atmosphere and does not return to the shallow groundwater or stream system.

  - Evapotranspiration occurs as a result of (1) evaporation during water conveyance in canals or with some irrigation methods (e.g., flood, spray irrigation) and (1) transpiration by ditch-side vegetation.

Some agricultural water use efficiency improvements (commonly referred to as agricultural water conservation) reduce the amount of water diverted, but may not reduce depletions or may
even have the effect of increasing consumptive use per acre on farms and ultimately within a stream system. These efforts can result in economic benefits, such as increased crop yield, but have the adverse effect of reducing return flows and therefore downstream water supply. For example, methods such as canal lining or piping may result in reduction of seepage losses associated with conveyance, but that seepage will no longer provide return flow to other users. Other techniques such as drip irrigation and center pivots may reduce the amount of water diverted, but if the water saved from such reductions is applied to on-farm crop demands, water supplies for downstream uses will be reduced.

Due to the complexities in agricultural irrigation efficiency, no quantitative estimates of savings are included in the projections. However, the regions are encouraged to explore strategies for agricultural conservation, especially those that result in consumptive use savings through changes in crop type or fallowing of land while concentrating limited supplies for greater economic value on smaller parcels. Section 8 outlines strategies developed by the San Juan Basin steering committee to achieve savings in agricultural water use within the region.

*Self-supplied commercial, industrial, livestock, and mining.* Conservation programs can be applicable to these sectors, but since uses are low in these categories within the region, no additional conservation savings are assumed in the water demand projections.

*Power.* The power sector may benefit from additional conservation measures in San Juan County, but no quantitative projections of conservation savings have been included.

*Reservoir evaporation.* Reservoir evaporation is the third highest water demand in the San Juan Basin region. Some areas outside of the region have considered aquifer storage and recovery as a means to replace reservoir storage and reduce reservoir evaporation losses. It may also be possible in some circumstances to gain a reduction in evaporation by storing more water at higher elevations that tend to experience cooler temperatures and consequently lower evaporation rates, on average, or by constructing deeper reservoirs with less surface area from which evaporation might occur. However, due to the legal, financial, and other complexities of implementing these techniques, no conservation savings are assumed in developing the reservoir evaporation demand projections for this region.

### 6.5 Projections of Future Water Demand for the Planning Horizon

Water use projections for each category of use were made for 10-year intervals beginning with 2020 and ending with 2060. To assist in bracketing the uncertainty of the projections, low water use and high water use estimates were developed for each category. For a high water use scenario, diversion demand projections for the San Juan Basin Water Planning Region generally were made considering:

- Historical and current diversion demands in the region through 2014
• The 2006 State of New Mexico Schedule of Anticipated Upper Basin Depletions (USBR, 2007; Whipple, 2010)

• Full development of authorized water uses, including the ALP, the NGWSP, File No. 2883 litigation settlement allocations for non-project uses, and Indian reserved water rights

• Population growth projections for the region

• Additional information currently available relating to future uses.

For a low water use scenario, diversion demand projections for the region were made considering also delays in developing uses under these water projects.

This update to the regional water plan for the San Juan Basin region generally did not incorporate the methodology described in the Updated Regional Water Planning Handbook (NMISC, 2013) for projecting water uses because much of the methodology was not applicable to this region and did not adequately address (1) available reservoir storage, (2) authorized full development of federal water supply projects, (3) actual diversion practices and reservoir operations on the San Juan and Animas rivers, (4) water apportionments made by the Colorado River and Upper Colorado River Basin compacts, (5) average annual diversions for water use demands that vary considerably from year to year, as compared to annual diversion amounts in 2010, and (6) other water use or water rights considerations.

Specific assumptions and methods used to project future diversion demands in the San Juan Basin Water Planning Region are as follows for each category of use. The resultant projected future amounts of diversion in the region for each category of use through the 2060 planning horizon are summarized in Table 6-1 and Figure 6-2.

6.5.1 Irrigation

Under full build-out and development of the NIIP to irrigate up to 110,630 acres of land as authorized by Public Law 87-483, the average annual diversion demand for the NIIP was estimated in the 1999 NIIP Biological Assessment to range from a low of about 337,500 ac-ft/yr, assuming that planned water management changes and water conservation measures for the project are implemented and fully effective, to a high of about 372,000 ac-ft/yr, assuming no effective water conservation (KBE and ERI, 1999). The Biological Assessment also anticipated that construction of the project would be completed by the end of 2032; however, based on recent low levels of annual federal appropriations for project construction and current needs to refurbish existing sprinkler systems on the project, it is assumed that completion of the NIIP now will not occur until about 2040.
For the Fruitland and Hogback irrigation projects, the Navajo Decree adjudicated to the Navajo Nation rights to divert at rates of up to 100 cfs and 221 cfs, respectively. If the current NMOSE administration practice of not limiting annual irrigation diversions to project diversion requirements (PDR) continues, the Navajo Nation in the future might divert up to 321 cfs throughout the irrigation season, assuming that rehabilitation of the Fruitland Project does not allow irrigation needs to be met with diversion rates of less than 100 cfs. For both projects combined this irrigation rate is equivalent to about 136,300 ac-ft/yr. If future NMOSE administration of irrigation diversions from the San Juan River limits annual diversions to the PDR, then under the Navajo Decree the Navajo Nation might be limited to annual diversion amounts of 18,180 ac-ft/yr for the Fruitland Project and 48,550 ac-ft/yr for the Hogback Project, or about 66,700 ac-ft/yr for both projects combined. Rehabilitation of the Fruitland and Hogback projects is expected to be completed by 2020. To be conservative for planning purposes, it was assumed for both the low water use and high water use scenarios that the NIIP and the Fruitland and Hogback projects are fully utilized.

For Navajo ephemeral tributary irrigation uses, the high water use scenario assumes that the historical diversion demand quantified for this regional water plan continues throughout the planning horizon, and the low water use scenario assumes that about half the amount of acres that could be irrigated under the Navajo Nation ephemeral tributary irrigation water rights might not be available for use in any year due to lack of adequate rehabilitation and maintenance of historical Navajo irrigation projects and lands. The amount of acres currently irrigated on Navajo lands by diversions from ephemeral tributaries is less than the amount of acres that were historically developed and irrigated and for which water rights to the Navajo Nation were adjudicated under the Navajo Supplemental Decree; however, to be conservative for planning purposes, it was assumed that historical Navajo irrigation projects and lands will be rehabilitated to allow the Navajo Nation to better utilize its decreed diversion rights for these uses. The annual diversions for Navajo irrigation uses from ephemeral tributaries amount to about 2 percent or less of total irrigation diversions in the San Juan Basin region, and have little effect on San Juan River flows below Shiprock and no effect on river flows above Shiprock.

Future annual diversions for non-Navajo irrigation uses are anticipated to continue to total about 291,900 ac-ft/yr based on recent non-Navajo irrigation diversions and assuming the continuation of the current NMOSE administration practice of not limiting annual irrigation diversions under water rights adjudicated by the Echo Ditch Decree to the PDR. If future NMOSE administration of irrigation diversions from the San Juan River limits annual diversions to the PDR, then the total annual amount of diversion for all non-Navajo irrigation uses combined might be limited in the future to about 174,000 ac-ft/yr. This amount of irrigation diversion for the low water use scenario was calculated considering:
• The number of acres under each ditch with decreed or licensed irrigation rights from the 
San Juan River or its tributaries, excluding La Plata River, and the per-acre PDR rates for 
these ditches provided in the 1938 State Engineer Hydrographic Survey report for the San 
Juan River stream system, without adjustments to the PDR rates for current evaluation 
methodologies and cropping patterns

• The annual diversion amounts provided by licenses or permits for the Hammond 
Irrigation Project

• Diversion rights adjudicated to the Jicarilla Apache Nation in the San Juan River 
Adjudication for irrigation uses

• The estimated average annual diversion for irrigation uses from La Plata River under 
current conditions

• An estimate of the possible reduction in the total annual PDR for irrigation rights that 
have been transferred to municipal, domestic, industrial, or commercial uses.

To be conservative for planning purposes, it was assumed that the remaining non-Indian 
irrigation water rights that were used historically but are associated with lands that have not been 
irrigated in recent years would be available for future use for irrigation or other purposes. The 
diversion demand projections did not speculate regarding possible future transfers of irrigation 
rights to other uses.

The consequent range for the total annual irrigation diversions in the San Juan River Basin in the 
future between the low water use and high water use scenarios is about 585,200 ac-ft/yr to about 
814,500 ac-ft/yr beginning about 2040. This range is believed to bracket possible future 
diversion amounts that might occur depending on the adjudication of irrigation rights in the San 
Juan River Adjudication and the promulgation of rules and regulations for AWRM in the basin, 
and assuming that the Navajo irrigation projects are fully developed as authorized and as 
provided for by the Navajo Nation’s water rights for the projects. This range excludes diversions 
made by the SJCP and exported for irrigation uses in the Rio Grande Basin.

6.5.2 Livestock

Recent or current diversions in the San Juan River Basin for livestock uses, including stock 
watering and stock pond evaporation, were based on the water rights for stock watering uses and 
stock ponds that were adjudicated to the Navajo Nation by the Navajo Supplemental Decree, 
data on county livestock counts from the New Mexico Agricultural Statistics reports published 
by the New Mexico State University Agricultural Extension Service, and data on stock ponds 
provided by federal agencies involved in approving, funding, or constructing stock ponds in the 
basin. It is believed that approximately 70 percent of the total livestock use in the basin occurs
on Navajo lands. The Navajo Nation’s water rights for stock ponds are based on a 2012 hydrographic survey of existing stock ponds, and their water rights for stock watering were based on estimated peak annual animal units on Navajo Nation lands since the mid-1970s (Whipple, 2012).

Livestock uses at the NAPI feedlot on the NIIP are supplied from and accounted within the diversions for the NIIP. Based on NMISC five-year reports of consumptive uses and losses in the Upper Colorado River Basin in New Mexico and on periodic NMOSE water use by county reports prepared beginning the mid-1970s, the total annual amount of livestock use in the basin has not significantly changed from the mid-1970s to the present. Therefore, it is assumed that total livestock use in the basin is likely to remain near recent levels at about 4,400 ac-ft/yr under both the low water use and high water use scenarios.

6.5.3 Municipal/Domestic

Future municipal and domestic water uses include new uses under the authorized ALP and NGWSP water allocations, File No. 2883 litigation settlement allocations, and reserved water rights of the Navajo Nation and Jicarilla Apache Nation. The development of future diversion projections for municipal and domestic uses under the high water use scenario was based on the following:

- Projections of future water demands for non-Indian municipal and domestic public water providers and for the Jicarilla Apache Nation through 2060 that were included in the 2003 San Juan Hydrologic Unit Regional Water Plan (SJWC, 2003)

- Projections of future demands for water from the ALP and the NGWSP and groundwater for Navajo Nation municipal and domestic uses that were included in the 2001 NGWSP Technical Memorandum (Navajo Nation DWR et al., 2001)

- Projected future populations in the San Juan Basin region under the high growth rate scenario that were prepared in 2014 by Poster Enterprises for use in updating the 2003 RWP (Table 6-3)

- Existing water rights, including those pursuant to transfers of irrigation rights to municipal or domestic use, and water allocations under federal water projects for municipal or domestic uses

- Projected future depletions for municipal and domestic uses under federal water projects included in the 2006 State of New Mexico Schedule of Anticipated Upper Basin Depletions (USBR, 2007; Whipple, 2010).
The methodology for water uses based on these information sources is described in the following subsections.

6.5.3.1 Non-Indian Uses

The projected total diversions for non-Indian municipal and industrial uses by the cities of Farmington, Aztec, and Bloomfield and for non-Indian domestic uses supplied by other public water providers combined were obtained from the 2003 RWP for the period 2020-2060. The resultant total diversion for non-Indian municipal and domestic uses supplied from public water systems for 2060 was about 147 percent greater than that for 2010. This possible increase in diversions could include water for development by the City of Farmington of additional gas-fired power generation units at the BVPP or elsewhere (the City may close the gas-fired APP and either double the size of the BVPP or add an equivalent gas-fired unit by 2020). In comparison, the population projections for San Juan County made for this RWP update by Poster Enterprises in 2014 (Table 6-3) indicated that under a high population growth scenario the county combined non-Indian and Navajo population by 2060 might be about 142 percent greater than that in 2010.

The total diversions for non-Indian municipal and domestic uses supplied by public water providers were distributed by subcategories as follows:

- Public water supply (non-project), up to the level of current water use
- ALP
- File No. 2883 settlement allocations
- Public water supply (non-project) future uses under other decreed, licensed or permitted rights

6.5.3.2 Navajo Nation Uses

Projected total diversions for Navajo Nation municipal and domestic uses were determined from the projected uses of water by the ALP, the NGWSP, and ground water for 2040 by chapter or other geographic area as presented in the 2001 NGWSP Technical Memorandum (Navajo Nation DWR et al., 2001), which assumed a significantly higher rate of population growth on the Navajo Reservation through 2040 than the future high population growth rates for each county in the San Juan Basin region developed for this RWP update (Table 6-3).

- Projections for 2040 to 2060: The Navajo diversion demands for municipal or domestic water uses in the San Juan River Basin in New Mexico for 2050 and 2060, excluding NAPI industrial uses under the NGWSP and NGWSP exports for uses in other basins, were extrapolated from the projected diversion demand for the uses in the basin in 2040 using the same percentage increases in demand during each respective decade as was used for non-Indian municipal and domestic uses in the basin in the 2003 RWP. The
2001 Technical Memorandum (Navajo Nation DWR et al., 2001) estimated that local aquifer sustained yields at various locations in the basin total about 2,400 ac-ft/yr, and this amount of groundwater use was subtracted to calculate the resultant Navajo municipal and domestic water demands from the San Juan River stream system for 2040-2060.

- **Projections for 2020 to 2040:** For diversion demands prior to 2040, the following was considered:
  - The NGWSP’s Cutter Lateral is scheduled to be completed by the end of 2017, after which the Navajo Nation may begin delivering project water to chapters on the Navajo Indian Reservation along the U.S. Highway 550 corridor.
  - The NGWSP’s San Juan River pipeline is scheduled to be completed by the end of 2024, after which the Navajo Nation may begin delivering project water to chapters along the San Juan River valley and along the U.S. Highway 491 corridor.
  - The NGWSP pipelines will connect to existing local NTUA or IHS public water supply systems that serve Navajo communities, and these systems will need to be extended to fully develop the Navajo Nation’s project water allocation by 2040.

The pre-2040 growth in NGWSP diversions for uses in the basin, including groundwater diversions but excluding NAPI industrial use and exports, is due to population growth on the Navajo Reservation within the basin that is anticipated by the Navajo Nation, expanded service areas for delivery and use of San Juan River water, increases in per-capita usage rates associated with a renewal water supply, an improved standard of living, and reduced water hauling. The total demand to divert surface water for Navajo Nation municipal and domestic uses supplied by the NTUA or IHS public water providers was distributed by subcategories as follows:

- Public water supply (non-project), up to the level of current surface water use
- ALP
- NGWSP
- Reserved municipal and domestic use rights
- File No. 2883 settlement allocations
- Transferred surface water rights or new groundwater uses over and above the identified sustained aquifer yields

Much of the local aquifer sustained yield has been developed by existing NTUA or IHS public water supply systems and is included in the scattered rural domestic use subcategory.
6.5.3.3 Jicarilla Apache Nation Uses

Projected total diversions for Jicarilla Apache Nation municipal and domestic uses, exclusive of uses in the Rio Grande Basin under its SJCP water allocation, were determined for the period 2020-2060 in two parts:

- Total water demand projections for municipal and domestic uses on the Jicarilla Reservation based on anticipated population growth were presented in the 2003 RWP, with much of this use being provided by the Dulce water system within the northern portion of the reservation in Rio Arriba County.

- Development of the Jicarilla Apache Nation’s NGWSP uses for domestic and commercial purposes in the southern portion of the reservation was assumed to begin prior to 2030 and be completed by 2060. The Jicarilla Apache Nation is responsible for constructing the infrastructure to deliver water from the NGWSP’s Cutter Lateral to the place or places of use.

The population-based annual diversion demand for the Jicarilla Apache Nation in the San Juan Basin region, excluding NGWSP deliveries, that was projected for 2060 is about 86 percent greater than that for 2010. In comparison, the population projections for Rio Arriba and Sandoval counties made by Poster Enterprises in 2014 (Table 6-3) indicated that the populations in these counties by 2060 might be about 53 percent and 95 percent greater, respectively, than those in 2010. The total non-NGWSP diversions for Jicarilla municipal and domestic uses supplied by public water providers were distributed by subcategories as follows: public water supply (non-project), up to the level of current water use, and public water supply (non-project) future uses.

6.5.3.4 Rural Domestic Uses

Groundwater diversions for scattered rural domestic uses, which include uses supplied from groundwater by public water providers such as NTUA and IHS or by self-supplied domestic wells, were assumed to increase by less than 10 percent between 2010 and 2060. The NTUA and IHS water systems on the Navajo Reservation are expected to serve additional customers over time through both population growth and expansion of their local water systems, thus reducing both water hauling and self-supplied domestic well use. There is little sustained yield from groundwater of suitable quality for domestic use that remains to be developed by the Navajo Nation from local aquifers currently tapped by community wells, and it is assumed that most growth in population and domestic water use will occur in areas served from surface water diversions by public water providers. Annexation of lands by cities and regionalization of municipal water systems may also result in reduced self-supplied domestic well use as rural areas connect to available public water systems.
**6.5.3.5 Total Regional Municipal/Domestic Uses**

Based on the above approach, and on coordinating federal water project diversion projections with depletion projections for them, the future total amount of diversion for municipal and domestic uses in the San Juan River Basin in New Mexico was projected to approach about 88,800 ac-ft/yr by 2060 under the high water use scenario. While a portion of the water rights for municipal or domestic uses might be used in the future for otherwise self-supplied industrial or commercial purposes instead, this assumption accounts for the effects that such possible transfers might have on the total diversion demand in the San Juan River Basin in New Mexico. This is a conservative assumption for planning purposes that reflects (1) the amount of water use for which water rights may be licensed or adjudicated and (2) water rights that may be exercised in the future for municipal or domestic use, or that might be acquired and possibly transferred for other uses. Under the high water use scenario, the ALP and NGWSP water allocations and uses in New Mexico would be fully developed within the 2060 planning horizon.

Projected future diversions for municipal and domestic uses in the San Juan Basin region under the low water use scenario were based on the 2014 Poster Enterprises population projections for San Juan County, which indicated that the county population by 2060 might be only about 37 percent greater than the county population was in 2010 under a low population growth scenario. The projected total diversions in 2060 for both non-Indian and Navajo Nation municipal and domestic uses supplied from surface water diversions made by public water supply systems under the low water use scenario thus were calculated as about 55 percent of the projected amounts of river diversion for these uses by 2060 under the high water use scenario. This percentage reflects the ratio of the San Juan County total population growth factor for 2010-2060 under the low population growth scenario to the total increase in the respective non-Indian and Navajo Nation municipal and domestic diversions from surface water under the high water use scenario (1.37/2.47=0.55) and includes diversions from the San Juan River, including Navajo Reservoir, and the Animas River, and exclude scattered domestic groundwater uses that are assumed under the low water use scenario to be only slightly lower than those under the high water use scenario.

The municipal and domestic diversion demands for 2060 for the Jicarilla Apache Nation, including for domestic and commercial diversions to be made through the NGWSP, under the low water use scenario were calculated as about 75 percent of the projected amounts of diversion for these uses by 2060 under the high water use scenario. This reflects the ratio of the total Rio Arriba County population growth factors for 2010-2060 indicated by the Poster Enterprises 2014 low and high population growth scenarios (1.15/1.53=0.75).

For all Indian and non-Indian municipal and domestic uses, the projected diversions between current or recent conditions and 2060 under the low water use scenario generally were determined by interpolation and considering water use growth trends under the high water use...
scenario. The projected future diversions under the low water use scenario were distributed by subcategories of use in the same manner that was used to distribute diversions by subcategories for the high water use scenario. Under the low water use scenario, the ALP and the NGWSP water allocations and uses in New Mexico would not be fully developed within the 2060 planning horizon. The future total amount of diversion for municipal and domestic uses in the San Juan River Basin in New Mexico was projected to approach about 52,900 ac-ft/yr by 2060 under the low water use scenario.

6.5.4 Industrial (self-supplied)

This category excludes industrial or commercial uses supplied by municipal or domestic public water providers or that might be developed by the Jicarilla Apache Nation from diversions made through the Cutter Lateral of the NGWSP, which for purposes of this RWP update are included in the municipal and domestic use category.

For the low water use scenario, it was assumed that the annual amount of diversion for self-supplied industrial uses in the San Juan River Basin in New Mexico under recent conditions of about 400 ac-ft/yr would continue through the 2060 planning horizon. For the high water use scenario, it was assumed that the annual amount of diversion for these industrial uses could range up to about 700 ac-ft/yr through the planning horizon based on historical uses. The high water use scenario includes a sufficient amount of water to cover an anticipated growth in self-supplied industrial uses of up to about 10 percent per decade that was estimated by economists based on interviews with industrial users and information from the New Mexico Department of Workforce Solutions (2014).

6.5.5 Power

The projections for future power generation uses in the San Juan Basin region are based on information provided by PNM and APSCo. PNM is scheduled to retire two of the four coal-fired generation units at the SJGS by the end of 2017 and to replace the retired units with two gas-fired generation units. It is anticipated that this will result in a reduction in the average annual water demand for power generation at the SJGS to about 16,000 ac-ft/yr, including water uses for coal mining activities at the San Juan Mine. Based on information provided by APSCo regarding expected water consumption at the FCPP’s two remaining coal-fired generation units, the annual diversion demand for the FCPP under current conditions, including for water consumption at the power plant, coal mining activities at the Pinabete extension of the Navajo Mine and replacement of Morgan Lake blowdown releases, is anticipated to average about 26,500 ac-ft/yr beginning about 2020. Thus, the future total amount of diversions for power generation uses in the San Juan River Basin in New Mexico was assumed to average about 42,500 ac-ft/yr through the 2060 planning horizon under the low water use scenario.
For the high water use scenario, it was assumed that the water rights historically developed for power generation uses at the SJGS and the FCPP might be exercised in the future by PNM, APSCo, the Navajo Nation, or others for additional power generation units that might be constructed at the SJGS, the FCPP, or elsewhere in the region, or for other uses depending on future energy demands, regulatory environments, and economic conditions. These water rights include (1) the appropriation of water made pursuant to NMOSE File No. 2838 and (2) the portion of the Jicarilla Apache Nation’s Navajo Reservoir water supply contract rights that was subcontracted to PNM for use at the SJGS. The historical maximum annual diversion amount for the SJGS and related mining activities was about 24,800 acre-feet in 2009, and the maximum for the FCPP and related mining activities was about 36,200 acre-feet in 1987. Thus, the future total amount of diversions for power generation uses in the San Juan River Basin in New Mexico was assumed to average about 61,000 ac-ft/yr through the 2060 planning horizon under the high water use scenario. While a portion of the water rights historically used for power generation might be used in the future for other purposes, this projection accounts for the effects that such possible transfers might have on the total diversion demand in the San Juan River Basin in New Mexico. This is a conservative assumption for planning purposes that reflects (1) the amount of water that has been applied to beneficial use and for which water rights may be licensed or adjudicated and (2) valid water rights that may be exercised in the future at their historical place and purpose of use or that might be acquired and possibly transferred for other uses.

6.5.6 Minerals

For the low water use scenario, it was assumed that the annual amount of diversion for mineral production in the San Juan River Basin in New Mexico under recent conditions of about 1,600 ac-ft/yr would continue through the 2060 planning horizon. This projection excludes diversions of water for mining of coal used for thermal electric power generation at the SJGS or FCPP.

For the high water use scenario, it was assumed based on historical uses that the annual amount of diversion for mineral production could range up to about 2,300 ac-ft/yr through the planning horizon. Alternatively, the high water use scenario can be viewed to cover an increase in water use associated with new drilling for hydraulic fracturing in the San Juan Basin region. Based on interviews with individuals involved in or knowledgeable about the mining sector, it is anticipated that the amount of water use for hydraulic fracturing might increase in all four counties in the region.

6.5.7 Reservoir Evaporation

Projections of reservoir evaporation for other water planning regions consider evaporation rates reported in the *Upper Rio Grande Impact Assessment* (USBR, 2013), which evaluated possible climate change impacts in New Mexico. This report predicted that under possible climate
change, by 2060 there might be (1) a small increase in lake evaporation rates due to a possible increase in temperatures and (2) a decrease in average annual reservoir evaporation amounts overall due to a possible increase in drought frequency and consequent reduction in average reservoir inflows that might result in lower reservoir storage levels and reduced average water surface areas. Further, if in the future the average annual NIIP diversion increases to an amount greater than the low water use scenario amount of 337,500 ac-ft/yr, which was the amount of diversion assumed for modeling project impacts in the 1999 NIIP Biological Assessment (KBE and ERI, 1999), the modeled long-term average annual evaporation amount for Navajo Reservoir might be somewhat less than the 27,900 ac-ft/yr of Navajo Reservoir evaporation used in this RWP update for current conditions, depending upon whether other parameters for Navajo Dam release decisions or shortage determinations might result in reductions in withdrawals from storage to offset a tendency for lower storage levels with greater diversion amounts. To be conservative for planning purposes, and considering the substantial uncertainty in the report’s climate change predictions and their applicability to Navajo Reservoir or other reservoirs in the San Juan Basin region, for this RWP update the long-term average annual reservoir evaporation amount for the basin was assumed to remain unchanged at about 29,900 ac-ft/yr throughout the planning horizon under both the low water use and high water use scenarios.

6.5.8 Exports

Future annual diversions from the San Juan River stream system for export to the Rio Grande Basin or Little Colorado River Basin in New Mexico for municipal, industrial, domestic, or irrigation uses are anticipated to average about 120,600 to 120,900 ac-ft/yr by about 2040 under the high water use scenario and by about 2070 under the low water use scenario. This includes:

- The estimated long-term average annual diversion by the SJCP under existing conditions of about 105,200 ac-ft/yr (as there are no current plans to construct facilities to increase the project’s diversion capability)

- Development of about 15,100 ac-ft/yr of diversion from the San Juan River or Navajo Reservoir under the NGWSP for export to be used in other basins in New Mexico, including 7,600 ac-ft/yr of project water allocated to supply domestic uses of the Navajo Nation in the Little Colorado River or Rio Grande basins in New Mexico and 7,500 ac-ft/yr of water to supply municipal uses by the City of Gallup in the Little Colorado River Basin

- Diversion and export of groundwater for Gallup’s municipal uses in the recent amount of 600 ac-ft/yr through 2024 until NGWSP exports begin, to be reduced to 300 ac-ft/yr thereafter.
The City of Gallup has entered into a subcontract with the Jicarilla Apache Nation to lease 7,500 ac-ft/yr of the Jicarilla’s Navajo Reservoir water supply contract allocation to source its water uses under the NGWSP. Construction of the NGWSP diversion works, water treatment plants, and pipeline distribution systems is scheduled for completion by the end of 2024. These NGWSP exports are anticipated to be fully developed by about 2040 under the high water use scenario and by about 2070 under the low water use scenario.

The Northwestern New Mexico Rural Water Projects Act (Public Law 111-11, Title X, Subtitle B) also authorized diversions from the San Juan River under the NGWSP to supply up to 6,400 ac-ft/yr for municipal and domestic uses by the Navajo Nation in the Little Colorado River Basin in Arizona. This authorized exportation of water from the San Juan River Basin in New Mexico to the Little Colorado River Basin in Arizona is expected to begin upon completion of the NGWSP facilities by the end of 2024. Pursuant to the provisions of the Upper Colorado River Basin Compact, the diversions for these uses in Arizona are subject to non-impairment of water uses made within the State of New Mexico’s Upper Basin apportionment. Therefore, the NGWSP exports for uses in Arizona are excluded from the projected export diversion amounts for the San Juan Basin region.

6.5.9 Total Regional Water Demand Projections

The total annual amount of diversion in the San Juan River Basin for uses in New Mexico under current or historical conditions was estimated to be about 876,200 ac-ft/yr including basin exports, or about 770,400 ac-ft/yr excluding exports. Under 2060 conditions, it is projected that the potential range of annual total diversions in the basin, depending on the water use scenario, is:

- Including exports: About 836,400 to 1,122,500 ac-ft/yr
- Excluding exports: About 716,900 to 1,001,600 ac-ft/yr