

**Colorado River Basin Study
Water Demands Assessment Questionnaire
State of New Mexico**

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1. *What geographic scope(s) (i.e., statewide, service area, etc.) were considered in determining your demand schedules?*

The State of New Mexico's 2006 Upper Basin depletion schedule (copy attached) was developed for use in the Bureau of Reclamation's 2007 Hydrologic Determination of Water Availability from Navajo Reservoir and the Upper Colorado River Basin for Use in New Mexico. The purpose of the 2007 Hydrologic Determination was to evaluate whether water is reasonably likely to be available from Navajo Reservoir to service the anticipated uses of the Navajo Nation under the Navajo-Gallup Water Supply Project. The geographic scope of New Mexico's depletion schedule is the San Juan River Basin in New Mexico, including authorized exports from the basin for uses in the Rio Grande and Little Colorado River basins in New Mexico under the San Juan-Chama Project and the Navajo-Gallup Water Supply Project. The State of New Mexico has not developed depletion schedules for the Lower Basin in New Mexico, including the Little Colorado River Basin or the Gila River Basin in New Mexico.

Only small amounts of surface water use totaling approximately 6,000 acre-feet per year, on average, of at-site consumptive use are made in the Little Colorado River Basin in New Mexico due to little availability of surface water. Approximately 3,000 acre-feet per year of at-site consumptive use in the basin in New Mexico is made from mining deep ground water sources.

In the Gila River Basin in New Mexico, current total at-site depletions amount to about 18,000 acre-feet per year, on average, from surface water and shallow ground water combined. These depletions include those made by irrigation uses in the Virden Valley in New Mexico adjudicated by the Globe Equity Decree, plus those made within the consumptive use limitations imposed on the State of New Mexico by the decree in *Arizona v. California*. Many of the irrigation uses that are subject to the decree in *Arizona v. California* suffer water supply shortages each year due to lack of supply and inefficient diversion works. The State of New Mexico is conducting a planning process to determine whether and how to develop some or all of its 14,000 acre-feet per year of additional consumptive use allocation from the basin in New Mexico authorized by the Arizona Water Settlements Act of 2004. Any such additional development of water from the Gila River stream system in New Mexico is subject to certain bypass flows and is contingent upon delivery downstream of exchange water from the Central Arizona Project so as to prevent impairment to downstream water right holders in Arizona. Because the water supply in New Mexico available for diversion after meeting the bypass flow requirements varies greatly from year to year, the demand for Central Arizona Project exchange water from the Colorado River mainstream to replace flows depleted from the Gila River by such additional water development in New Mexico may fluctuate substantially about the average.

2. *How does your demand schedule relate to nodes in Reclamation's long-term planning model (CRSS)?*

The depletion schedule does not segregate estimated depletions from the San Juan River Basin for uses in New Mexico between CRSS nodes. The CRSS model includes two nodes for the San Juan River Basin: the San Juan River near Archuleta, New Mexico, and the San Juan River near Bluff, Utah. All of the depletions included in New Mexico's Upper Basin depletion schedule occur above the San Juan River near Bluff, Utah, gage. The following depletions shown in the depletion schedule occur above the San Juan River near Archuleta gage: (1) non-Navajo irrigation above Navajo Dam; (2) about 3,800 acre-feet per year of the Navajo Nation's future uses under the Navajo-Gallup Water Supply Project; (3) all of the Jicarilla Apache Nation's municipal and domestic uses, including uses under the Navajo-Gallup Water Supply Project and excluding uses under Navajo Reservoir water supply subcontracts; (4) San Juan-Chama Project exports; (5) Navajo Reservoir evaporation; and (6) minor amounts of depletion under scattered stockpond evaporation and livestock uses, scattered rural domestic uses, and scattered small reservoir evaporation. These depletions total to approximately 141,000 acre-feet per year.

In addition, the Navajo Indian Irrigation Project diverts directly from Navajo Reservoir for uses below the San Juan River near Archuleta gage. Based on the Bureau of Indian Affairs' 1999 Biological Assessment for the Navajo Indian Irrigation Project, the long-term average annual diversion by the project under full development conditions is anticipated to be in the range of about 337,500 to 372,000 acre-feet per year depending upon the effectiveness of planned water conservation measures for the project, and the long-term average annual depletion by the project under full development conditions and after the build-up of ground-water storage beneath project lands reaches equilibrium conditions is anticipated to be about 270,000 acre-feet per year. Therefore, the anticipated long-term average annual depletion for uses in New Mexico from the San Juan River above the Archuleta gage totals approximately 478,000 to 513,000 acre-feet per year including Navajo Indian Irrigation Project diversions bypassing the gage, and the corresponding anticipated long-term average annual net depletion for uses in New Mexico from the river below the Archuleta gage totals approximately 164,000 to 129,000 acre-feet per year, respectively, including the effect of return flows to the river from the Navajo Indian Irrigation Project. The total anticipated depletion from the San Juan River near Bluff for uses in New Mexico is anticipated to approach 642,000 acre-feet per year by about 2040, not factoring in the salvage of channel losses from the San Juan River by uses in New Mexico.

3. *How do your demand schedules arrive at an expression of the water resources you will need from the Colorado River (i.e., "net" Colorado River demand where "net" Colorado River demands = diversion/depletion of Colorado River water from a CRSS node)?*

The State of New Mexico Upper Basin demand schedule is of depletions from the Colorado River system, as opposed to diversion demands, assuming that historic climatic and hydrologic conditions are indicative of future climatic and hydrologic conditions. Small amounts of at-site consumptive uses of surface water in ephemeral tributary drainages in New Mexico far from the San Juan River were reduced for salvage of channel losses in the ephemeral tributaries by use, and depletions from the San Juan River for the Navajo Indian Irrigation Project and the Four Corners Power Plant include losses on return flow discharges to ephemeral tributary channels. No salvage by use of channel losses from the San Juan or Animas rivers was considered, even though the Department of the Interior's July 1965 projections of depletions at Lee Ferry were reduced for salvage estimated to be 4 percent of at-site depletions by projects or uses in the Upper Basin and the Bureau of Reclamation in preparing long-range operating criteria for the Colorado River in July 1969 also considered salvage

by use estimated to be about 4 percent of at-site depletions in its projections of depletions of the flow at Lee Ferry by uses in the Upper Basin. Small amounts of ground-water use in the basin, particularly near the southern basin boundary, have little impact on San Juan River flows. Possible use of 4,950 acre-feet per year of ground water by the Navajo Nation for operation of the proposed Desert Rock Power Plant for the anticipated forty-year plant life would not have a significant impact on San Juan River flows based on the available ground-water flow modeling used to evaluate potential impacts of this project.

4. *How did you factor in local, non-Colorado River water supplies and how are the uses of those supplies prioritized in relationship to Colorado River supplies?*

Local water supplies outside the San Juan River Basin but within the service area of the San Juan-Chama Project were not considered. The Navajo-Gallup Water Supply Project authorized diversion amount from the San Juan River to meet municipal and domestic water demands within the service area of the project incorporated a reduction from the total Navajo Nation municipal and domestic water demand within the service area both inside and outside the basin for planned uses of small amounts of local ground water. There is no prioritization regarding the use of San Juan River water or local ground water. Possible future uses of water produced in association with oil and gas production in the San Juan River Basin were not considered.

5. *What role does Colorado River water play in meeting water management objectives with regard to the management of local supplies (i.e., controlling ground-water overdraft, managing alternative supply shortfalls/shortages, etc.)?*

The contracted yield of the San Juan-Chama Project since 1996 has been fully delivered below Heron Dam in the Rio Grande Basin for direct diversion, use by exchange, or storage. For the City of Albuquerque, diversion and use of San Juan-Chama Project surface water imported to the Rio Grande provides a renewable water supply and replaces a portion of its previous ground-water withdrawals, thus reducing ground-water overdraft. The City of Albuquerque's drinking water project completed in 2009 provides the City with the capability to fully utilize its project water allocation via direct diversion from the Rio Grande. For the City of Santa Fe, San Juan-Chama Project water supplements the use of limited local surface water and ground water supplies, thus reducing impacts of recurrent watering restrictions. For the Middle Rio Grande Conservancy District, San Juan-Chama Project water provides supplemental water supplies for irrigation and allows operational flexibility with its Rio Grande water to deal with endangered fish species issues in the Middle Rio Grande or with Rio Grande Compact issues.

The authorized Navajo-Gallup Water Supply Project will provide a reliable, renewable water supply from the San Juan River for Navajo Nation municipal and domestic water uses in the San Juan, Little Colorado and Rio Grande basins in New Mexico. With development of this project, the Navajo Nation expects to improve the standard of living for much of its people in New Mexico who currently are limited in their domestic water use due to lack of local ground-water yield, lack of supplies of adequate water quality for domestic uses, or lack of infrastructure connecting their homes to public water supply systems. Many members of the Navajo Nation haul water to their homes in trucks from nearby rural water system watering stations. The planned amount of water export from the San Juan River Basin under the Navajo-Gallup Water Supply Project will meet future water demands as well as replace local mining of ground water that is exhausting local water reserves and causing severe water level declines in the vicinity of the City of Gallup.

6. *When is the last time your demand schedule was updated? How often do you update it?*

The State of New Mexico schedule of anticipated depletions for the San Juan River Basin was last updated in May 2006 for use in the Bureau of Reclamation's 2007 Hydrologic Determination. The Upper Colorado River Commission's schedules of anticipated Upper Basin depletions adopted for planning purposes in December 2007 incorporated New Mexico's May 2006 depletion demand schedule. The depletion schedule may be updated as needed for planning purposes, and there is no set time interval for updating the schedule. Prior to December 2007, the Upper Colorado River Commission last updated Upper Basin depletion schedules for planning purposes in December 1999. After 1999, revisions to the State of New Mexico's depletion schedule were prepared for consideration in Navajo-Gallup Water Supply Project planning activities.

7. *What are the primary assumptions used for your projected municipal and industrial demands (i.e., population projections, per-capita use or per-unit use, water conservation projections, effluent use, energy development, other)? Please supply details regarding changes in assumptions over the planning horizon and the basis for those assumptions.*

- a. Current municipal and domestic uses: The depletions for current municipal and domestic uses in the San Juan River Basin for 2000 were based on 1990 municipal and domestic diversions from the San Juan River and its tributaries, assuming: (1) a conservative 30% return flow rate from full diversion of the City of Farmington's municipal water supply rights under the Echo Ditch Decree and under State Engineer License No. 2995 (the principal water right for Farmington Lake) after consideration of possible future reuse of treated wastewater for cooling purposes at the recently completed Bluff View Power Plant; and (2) return flow rates ranging from 40% to 60% for other municipal and domestic water uses in the basin. The City of Farmington is by far the largest user of water for municipal and domestic purposes, and the amount of water use by the City of Farmington as of 1990 was consistent with the amount of water rights then owned by the City and available for municipal use without transfers of irrigation rights. The current municipal and domestic depletions do not reflect transfers of irrigation rights to municipal or domestic uses, and excludes depletions from the San Juan River to be made under the Animas-La Plata Project and the Navajo-Gallup Water Supply Project. The current municipal and domestic depletions also exclude depletions in the Rio Grande Basin supplied by San Juan-Chama Project exports. For the purposes of the 2007 Hydrologic Determination, the depletions for "current" municipal and domestic uses in the San Juan River Basin for 1990 included Indian and non-Indian uses and were continued through 2060, and the depletion schedule did not speculate as to future rates of transfer of irrigation rights or any additional appropriations of water to meet future municipal or domestic water demands.
- b. Animas-La Plata Project: Municipal and domestic depletions under the Animas-La Plata Project were based on the depletion allocations from the project to New Mexico entities (the San Juan Water Commission, the Navajo Nation, and the La Plata Conservancy District) made by the Colorado Ute Settlement Act Amendments of 2000, plus the State of New Mexico share of Ridges Basin Reservoir evaporation estimated from the hydrologic analysis used for the 2000 Final Environmental Impact Statement for the project. A small amount of direct flow was being used under Animas-La Plata Project diversion permits issued by the State Engineer as of 2000.

- c. Navajo-Gallup Water Supply Project: The municipal and domestic depletions of the Navajo Nation under the Navajo-Gallup Water Supply Project were based on: (1) year 2040 total Navajo municipal and domestic water demands estimated by the Nation assuming a population growth rate of 2.48 percent per year throughout its reservation and a per-capita water use rate of 160 gallons-per-capita-per-day to reflect an increase in the standard of living once renewable surface water supplies become available under the project; and (2) the portions of the year 2040 total Navajo municipal and domestic water demands remaining to be met after deduction of the amounts of the estimated demands to be supplied by the Navajo Nation's Animas-La Plata Project allocation and small amounts of rural domestic ground water use. In addition, a small amount of depletion was included in the Navajo-Gallup Water Supply Project for industrial food processing uses by the Navajo Nation on the Navajo Indian Irrigation Project. Of the Navajo-Gallup Water Supply Project water to be used by the Navajo Nation along the San Juan River valley, it was assumed that 50 percent would return to the river. All other project diversions were assumed to be fully depleted with no return flows to the San Juan River. The water rights of the Navajo Nation for its uses under the Navajo-Gallup Water Supply Project proposed by the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement reflect the depletions included in the depletion schedule.

The relatively small municipal and domestic depletion of the Jicarilla Apache Nation under the Navajo-Gallup Water Supply Project was provided by the Nation and reflects plans for domestic and commercial development in the southern portion of its reservation. No per-capita use rates were provided for the amount of domestic use by the Jicarilla Apache Nation under the project. Project diversions for the Jicarilla Apache Nation were assumed to be fully depleted with no return flows to the San Juan River.

The municipal and domestic depletion of the City of Gallup under the Navajo-Gallup Water Supply Project was provided by the City and reflects a long-standing request of the City for renewable water supply from the San Juan River or Navajo Reservoir. The total municipal and domestic water demand of the City of Gallup by 2040 is estimated to exceed the City's Navajo-Gallup Water Supply Project allocation based on water demands estimated by the City assuming a population growth rate of 1.82 percent per year within its service area and a per-capita water use rate of 160 gallons-per-capita-per-day. The future gap between water available to the City under its Navajo-Gallup Water Supply Project allocation and its total water demand will be supplied by local ground-water withdrawals or possibly re-use. Project diversions for export from the basin were assumed to be fully depleted from the Upper Basin. Wastewater discharge or other return flows into the Little Colorado River Basin from uses supplied by the City were not credited in any way. The City's uses under the Navajo-Gallup Water Supply Project were assumed to be serviced from the Navajo Reservoir water supply via subcontract with the Jicarilla Apache Nation.

- d. Navajo Nation future municipal use: A small amount of depletion for future Navajo Nation municipal and domestic uses from the San Juan River was included in the depletion schedule in addition to the depletions for the Navajo Nation's uses under the Animas-La Plata Project and the Navajo-Gallup Water Supply Project. This small depletion reflects reserved water rights of the Navajo Nation that are proposed by the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement and based on historic uses of water for domestic purposes by the Navajo Tribal Utility Authority in the vicinity of Shiprock.

- e. Jicarilla Apache Nation municipal use: A small amount of depletion for future Jicarilla Apache Nation municipal and domestic uses from the Navajo River, a perennial tributary to the San Juan River, in the vicinity of Dulce was included in the depletion schedule based on the remainder of its Navajo Reservoir water supply contract rights after subcontracting the bulk of its contract depletion rights for uses at the San Juan Generating Station and at the City of Gallup under the Navajo-Gallup Water Supply Project.
- f. Scattered rural domestic uses: The depletion schedule included a small amount of depletion for scattered rural domestic, commercial and recreational uses, including uses under rural domestic water supply systems served by ground-water withdrawals or self-supplied domestic ground-water wells. A small amount of diversions for rural domestic or commercial uses are made from shallow ground-water that is connected to the San Juan River stream system.
- g. Thermal electric power generation uses: The depletion schedule includes for the Public Service Company of New Mexico the full amount of Navajo Reservoir supply water subcontracted from the Jicarilla Apache Nation for the Company's uses at the San Juan Generating Station. The Company has fully utilized the subcontracted water supply, and it was assumed that the subcontract would be extended from 2027 to 2060. The Navajo Reservoir supply water subcontracted from the Jicarilla Apache Nation provides approximately two-thirds of the total water supply for the San Juan Generating Station. The San Juan Generating Station is a zero discharge facility.

The depletion schedule also includes the uses of water under BHP-Billiton's rights associated with State Engineer Permit No. 2838, which includes uses at the Four Corners Power Plant, the San Juan Generating Station, the Navajo Mine and the San Juan Mine. The Navajo Mine produces coal for the Four Corners Power Plant and would also produce coal for the proposed Desert Rock Power Plant if constructed. The San Juan Mine produces coal for the San Juan Generating Station. It was assumed that there are no return flows to the San Juan River from the relatively small amounts of water use for the mining activities, and that 70 percent of the return flow discharges from Morgan Lake at the Four Corners Power Plant into ephemeral tributaries to the San Juan River actually reach the river. An evaluation of measured Morgan Lake discharge data and available streamflow gage data for the Chaco River near Waterflow suggests that about 30 percent of Morgan Lake discharges are lost from surface channels in transit before reaching the San Juan River.

The current (2000) depletions under Permit No. 2838 were based on the sum of the maximum historic annual diversion from the San Juan River for the Four Corners Power Plant and Navajo Mine, less estimated return flows to the river resulting from Morgan Lake discharges, plus the maximum historic annual diversion from the San Juan River for the San Juan Generating Station and San Juan Mine, less the full amount of water diverted pursuant to the Public Service Company of New Mexico's Navajo Reservoir water supply subcontract with the Jicarilla Apache Nation. Future depletions under Permit No. 2838 are based on the maximum total at-site consumptive use allowed in any one year under the permit. While the San Juan River depletion for power production at the Four Corners Power Plant exceeds the at-site consumptive use by an average of approximately 2,000 acre-feet per year of channel loss on Morgan Lake discharges into ephemeral tributaries, it was anticipated that the consumptive use rights under Permit No. 2838 will not be fully exercised every year.

- h. Bloomfield industrial uses: The depletions by self-supplied industrial uses in the vicinity of Bloomfield were based on a continuation of historic uses or water rights for these uses into the future. Except for discharges of industrial wastewater treated at the Bloomfield wastewater treatment plant, there are no significant return flows from these industrial uses.
- i. Shiprock industrial uses: The depletion schedule includes a small amount of industrial use in the vicinity of Shiprock that reflects inclusion of the same amount of depletion in the reserved water rights of the Navajo Nation for municipal and domestic uses proposed by the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement. The Shiprock industrial use depletion also reflects recent ground-water withdrawals from the San Juan River floodplain for land reclamation purposes near Shiprock.
- j. Small Navajo Reservoir contracts: The depletion schedule includes a small amount of depletion estimated based on current uses under Navajo Reservoir water supply contracts, including Jicarilla Apache Nation subcontracts, for small irrigation or industrial uses.
- k. San Juan-Chama Project exports: San Juan-Chama Project exports to the Rio Grande Basin in New Mexico are used primarily for municipal, domestic, irrigation and reservoir evaporation purposes. All uses of water in the Rio Grande Basin supplied from the San Juan-Chama Project are included within the project depletion amount shown in the depletion schedule, and the amounts of the exported water used for the various project purposes are not broken out by use. The biggest category of use under the contractual yield of the project, however, is for municipal or domestic uses.

The 105,200 acre-feet per year of depletion for the San Juan-Chama Project shown in the depletion schedule for 2000-2060 is based on the average annual amount of water anticipated to be exported by the project from the San Juan River Basin to the Rio Grande Basin assuming historic hydrology for the period 1929-2000, as previously estimated by the Bureau of Reclamation. The actual annual San Juan-Chama Project exports will vary from year to year, ranging from less than 7,000 acre-feet in extremely dry years such as 2002 to approximately 200,000 acre-feet in very wet years. Thus, current and future depletions for the project shown in the depletion schedule are based on long-term average annual project exports anticipated under future operating conditions and are not expected to reflect actual annual exports in any given year.

8. *What are the primary assumptions behind your projected agricultural demands (i.e., acreages, water use per acre, agricultural conservation and efficiency improvements, other)? Please supply details regarding changes in assumptions over the planning horizon and the basis for those assumptions.*

- a. Navajo Nation irrigation uses: The long-term depletion for the Navajo Indian Irrigation Project was based on the average annual project depletion estimated by the Bureau of Indian Affairs' 1999 Biological Assessment for the Navajo Indian Irrigation Project after the build-up of ground-water storage beneath project lands reaches equilibrium conditions, under which return flow discharges equal deep percolation losses. The long-term depletion for the Navajo Indian Irrigation Project was estimated using the Hargreaves-Semani method based on irrigation of the full 110,630 authorized acres for the project assuming historic cropping patterns (primarily alfalfa, corn, potatoes, dry beans, spring grain and winter grain) and no fallow land or conservation acreage, and amounts to an average depletion rate of about 2.44 acre-feet per water

right acre per year including crop consumptive use and incidental irrigation depletions associated with on-farm sprinkler evaporation losses (10 percent of farm deliveries), canal evaporation losses (3 feet per acre water surface per year) and non-crop vegetation and wet soil losses (3 feet per acre per year). The long-term average annual depletion of 270,000 acre-feet per year also was included for the Navajo Indian Irrigation Project water rights (average annual depletion limit for any period of ten consecutive years) proposed by the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement. Based on weather data for the period 1929-1993, actual irrigation depletions on the Navajo Indian Irrigation Project might vary from year to year by up to about plus or minus 14 percent of the long-term average annual project depletion depending upon actual weather conditions. The average annual project depletion as of 2000 was based on information available for project water uses during the mid 1990s, including deep percolation losses to ground-water storage, and the average annual project depletions were then assumed to develop over time to the full project depletion amount by 2030.

Full use of the Navajo Indian Irrigation Project water right each year after 2030 without any land fallowing that might be expected under normal farm management practices was a conservative assumption made for purposes of the 2007 Hydrologic Determination. In addition, pursuant to the Navajo Nation Water Rights Settlement Agreement, it is anticipated that a portion of the Navajo Indian Irrigation Project depletion rights in some years will need to be transferred to supply parts of the depletions under the Fruitland or Hogback irrigation projects that are also included in the depletion schedule so as to avoid a priority administration of upstream non-Indian water rights.

The future depletions for both the Fruitland and Hogback irrigation projects that were included in the depletion schedule were based on the annual maximum depletion rights for each project proposed by the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement. The annual depletion limits for each project were computed based on the amounts of acres allotted within the project service areas to the Navajo Nation or its members for farming purposes pursuant to Bureau of Indian Affairs' land use permits, on the spatial extrapolation of consumptive irrigation requirements determined for non-Indian irrigation ditches in the San Juan River Basin in New Mexico by the State Engineer's 1938 Hydrographic Survey of the basin using the Lowery-Johnson method and then available crop and weather data, and on incidental depletions estimated from irrigation depletions derived by the 1971 Upper Colorado Region Comprehensive Framework Study to be about 16 percent of crop consumptive use. Based on the proposed water right acreage for each project, the annual depletion limits for both projects amount to an average depletion rate of about 2.40 acre-feet per water right acre per year including crop consumptive use and incidental irrigation depletions. Full use of the water rights for the Fruitland and Hogback irrigation projects each year is not likely to occur because of normal farm management practices, including management of cropping patterns and farm deliveries on these projects by the Navajo Nation to stay within the annual depletion rights for the projects. Full use of the depletion rights of the Hogback Irrigation Project is not expected to occur until about 2020 after completion by the United States of the project rehabilitation to be provided as a condition of the Navajo Nation Water Rights Settlement Agreement.

The depletions for scattered small Navajo Nation irrigation uses in the drainages of ephemeral tributaries to the San Juan River, including in the Chaco River drainage and in the Chinle Creek drainage (near Crystal), were estimated based on the 1965-condition average amounts of acres irrigated that were used for these drainages in New Mexico in developing the 1971 Upper

Colorado Region Comprehensive Framework Study. Per-acre crop consumptive use requirements were estimated using the modified Blaney-Criddle method, 2003 cropping patterns, and available weather data from the period 1929-2003. It was assumed that incidental irrigation depletions for these ephemeral tributary flood irrigation uses average about 18 percent of the crop consumptive use. The water supplies for these irrigation uses are undependable during the summer months, and the estimated depletions were reduced for assumed average annual water supply shortages of 50 percent based on the amount of shortage indicated for these irrigation uses by backup material for the 1971 Upper Colorado Region Comprehensive Framework Study using Type I study supply cutoff methods. Also, the at-site irrigation depletions were further reduced by 30 percent to reflect salvage by use of channel losses from the ephemeral tributaries. Since it can be demonstrated that 30 percent of Morgan Lake discharges are lost in transit in ephemeral tributaries, salvage by use for ephemeral tributary irrigation projects located significantly farther from the San Juan River than Morgan Lake should be more than 30 percent of the at-site depletion. The channel distance between these ephemeral tributary irrigation uses and the San Juan River ranges from approximately 40-180 miles. While some of the previously irrigated acreage under these small Navajo projects is no longer in use, the Navajo Nation desires to rehabilitate some of the more potentially fruitful small projects in the future.

- b. Non-Navajo irrigation uses: For irrigation uses under non-Navajo irrigation ditches or projects diverting from the Animas or San Juan rivers (the Upper San Juan area, the Hammond Irrigation Project, the Animas River ditches, the Farmers Mutual Ditch, and the Jewett Valley Ditch), the long-term average annual depletion demands were estimated based on the 1965-condition average amounts of acres irrigated in New Mexico from these sources that were used in developing the 1971 Upper Colorado Region Comprehensive Framework Study; except, that the irrigated acres by stream reaches from the Comprehensive Framework Study were distributed to specified ditches or irrigation areas based on interpretations of the study backup material, and future irrigated acreage for the Hammond Irrigation Project was assumed equal to the authorized project acreage of 3,900 acres. Annual per-acre crop consumptive use requirements were estimated using the modified Blaney-Criddle method, weather data available for the period 1929-2003, and average cropping patterns and irrigation methods distributions determined from field irrigation crop surveys conducted during 2000, 2003, 2004 and 2005. The predominant crops grown under the non-Navajo irrigation ditches or projects currently are alfalfa and pasture, and it was assumed that there would be no change in market conditions that would materially affect the cropping patterns. Possible effects on irrigation depletions of any future implementation of agricultural water conservation or efficiency measures were not considered for the depletion schedule. Incidental depletions factors of 18 percent and 24 percent of crop consumptive use were used for flood irrigated lands and sprinkler irrigated lands, respectively (assuming sprinkler evaporation losses of about 6 percent of the crop consumptive use). It was assumed that these irrigation uses have a full water supply without any curtailments of use due to physical or administrative shortages to the San Juan River stream system, and that there are no changes in ground-water storage beneath lands irrigated under the irrigation ditches and projects along the river valleys. The average annual depletion rates, including crop consumptive use and incidental irrigation depletions, for these non-Indian irrigation uses range from about 2.95-3.10 acre-feet per acre irrigated per year in the San Juan River valley depending upon location to about 2.60 acre-feet per acre irrigated per year in the Animas River valley. Based on weather data for the period 1929-2003, actual irrigation depletions under non-Indian irrigation ditches and projects might vary from year to year by up to about plus or minus 20 percent of the long-term average annual depletions depending upon actual weather conditions.

The 1965-condition average amounts of acres irrigated in New Mexico that were used in developing the 1971 Upper Colorado Region Comprehensive Framework Study essentially reflected remaining irrigation rights under active ditches in New Mexico and an assumption that about 5 percent of the farmland was fallow in any given year. Since 1965, a significant amount of farmland has been developed for non-agricultural purposes, some of the irrigation rights associated with the lands developed for non-irrigation purposes have been acquired by municipal and domestic water providers, and some of the irrigation rights acquired by the water providers have been transferred to municipal or domestic use. Municipal and domestic water providers may hold water rights unused to meet projected water demands under a forty-year planning horizon without the rights being subject to forfeiture or abandonment. The disposition of all of the currently unused non-Indian irrigation rights in the San Juan River Basin in New Mexico remains to be determined by the court in the San Juan River Adjudication. For the purposes of the 2007 Hydrologic Determination, the depletion schedule incorporated a continuation of the irrigation uses included in the Comprehensive Framework Study. The depletion schedule did not speculate as to rates of transfer of irrigation rights or any additional appropriations of water to meet future municipal, domestic or industrial water demands, and did not speculate as to possible forfeiture or abandonment of non-Indian irrigation rights. The total non-Indian average annual irrigation depletions in New Mexico from the Animas and San Juan rivers combined is currently less than that shown in the depletion schedule, and might be less than that shown in the depletion schedule in the future; whereas, the total of all non-Indian municipal, domestic and industrial depletions in the San Juan River Basin in New Mexico in the out years might be greater than that shown in the depletion schedule.

For irrigation uses diverting from the La Plata River, the long-term average annual depletion was estimated based on the 1965-condition nominal amount of acres irrigated in New Mexico from the river that was used in developing the 1971 Upper Colorado Region Comprehensive Framework Study, although the actual acreage irrigated can fluctuate from year to year in response to actual water supply conditions. In most years, the flow in the La Plata River at the Interstate Station is sufficient to provide for a full supply during the summer and fall months for only a few hundred acres. Annual per-acre crop consumptive use requirements were estimated using the modified Blaney-Criddle method, weather data available for the period 1929-2003, and average cropping patterns and irrigation methods distributions determined from field irrigation crop surveys conducted during 2000, 2003, 2004 and 2005. Incidental depletions factors of 18 percent and 24 percent of crop consumptive use were used for flood irrigated lands and sprinkler irrigation lands, respectively (assuming sprinkler evaporation losses of about 6 percent of the crop consumptive use). The estimated depletions were reduced for assumed average annual water supply shortages of 50 percent based on the amount of shortage indicated for the La Plata River irrigation uses in New Mexico by Animas-La Plata Project planning documents and backup material for the 1971 Upper Colorado Region Comprehensive Framework Study using Type I study supply cutoff methods. The depletion rate, including crop consumptive use and incidental irrigation depletions, for these uses averaged about 1.30 acre-feet per acre irrigated per year.

The irrigation depletions in the San Juan River Basin in New Mexico above Navajo Dam consist of depletions by non-Indian irrigation uses (principally under the Pine River Project) and by the Jicarilla Apache Nation (principally in the Navajo River drainage). The total irrigated acreage above Navajo Dam used to develop the depletion schedule was assumed based on consideration

of the non-Indian irrigated acreage remaining after filling of Navajo Reservoir, decreed irrigation use limits, normal land fallowing, and physical availability of water supply. Annual per-acre crop consumptive use requirements were estimated using the modified Blaney-Criddle method, average cropping patterns and irrigation methods distributions determined from field irrigation crop surveys conducted in 2003, and weather data available for the period 1929-2003. Incidental depletions factors of 18 percent and 24 percent of crop consumptive use were used for flood irrigated lands and sprinkler irrigation lands, respectively. For Jicarilla Apache Nation irrigation uses in drainages of ephemeral tributaries to the San Juan River (such as the La Jara Creek drainage), water supply shortages and salvage of ephemeral tributary losses were considered. The depletion rate, including crop consumptive use and incidental irrigation depletions, for these uses above Navajo Dam averaged about 2.10 acre-feet per acre irrigated per year.

The depletions for scattered small non-Indian irrigation uses by spreader dams in the Chaco River drainage were estimated based on the 1965-condition average amounts of acres irrigated that were used for these uses in New Mexico in developing the 1971 Upper Colorado Region Comprehensive Framework Study. Per-acre crop consumptive use requirements were estimated using the modified Blaney-Criddle method, 1938 cropping patterns, and available weather data from the period 1929-2003. It was assumed that incidental irrigation depletions for these flood spreading irrigation uses average about 18 percent of the crop consumptive use. The water supplies for these irrigation uses consist of summer thunderstorm runoff, and the estimated depletions were reduced for assumed average annual water supply shortages of 50 percent. Also, the at-site irrigation depletions were further reduced by 30 percent to reflect salvage by use of channel losses from the ephemeral tributaries. The channel distance between these ephemeral tributary irrigation uses and the San Juan River ranges from approximately 120-180 miles. It is believed that most, if not all, of these spreader dams are breached and are likely no longer effective irrigation facilities; however, the water rights associated with these uses have not been found by the court in the San Juan River Adjudication to be forfeited or abandoned.

- c. Stockpond evaporation and livestock watering uses: Scattered stockpond evaporation in the San Juan River Basin in New Mexico was estimated based on the numbers of active stockponds in the basin in 1970 by county compiled from data provided by the agencies that constructed most of the stockponds (namely, the US Forest Service, the Bureau of Land Management, the Bureau of Indian Affairs, and the Soil Conservation Service), reported average surface acres for the ponds they constructed, and average small pond evaporation rates for each county determined from a map showing lines of equal evaporation from shallow reservoirs in New Mexico derived using weather data available prior to 1967 and topographic considerations. Average fullness factors ranging from 25 to 43 percent were applied to the estimated total stockpond water surface area in each county in computing stockpond evaporation. Most stockponds are supplied from surface water.

Livestock watering depletions in the San Juan River Basin in New Mexico were estimated based on numbers of specific types of livestock in the basin in 1970 by county obtained from New Mexico Agricultural Statistics; except, that information on numbers of horses were obtained from state property appraisal or tax records. The following per-capita water use rates were used: 10 gallons per capita per day (gpcd) for horses and beef cattle, 25 gpcd for milk cows, 2 gpcd for sheep and hogs, and 0.05 gpcd for chickens. Of the total livestock watering use, about half is assumed to be supplied by surface water and half is assumed to be supplied by ground water.

The total of the estimated at-site depletions for stockpond evaporation and livestock watering combined in the San Juan River Basin under 1970 conditions was estimated at about 4,300 acre-feet per year. Given uncertainties regarding siltation of existing stockponds, construction or replacement of stockponds, amounts of water actually stored in stockponds at any time of the year, future livestock numbers in light of reduced grazing capacities, actual net evaporation rates, and salvage of downstream channel losses by storage and use of water (especially for stockpond and livestock uses in Sandoval and McKinley counties near the southern boundary of the basin), the estimated total depletion for stockpond evaporation and livestock watering included in the depletion schedule was rounded down to 4,000 acre-feet per year for current and future conditions.

- d. Reservoir evaporation: Future average annual Navajo Reservoir evaporation included in the depletion schedule was based on the September 2005 Biological Assessment for the Navajo-Gallup Water Supply Project. The hydrologic modeling performed for the Biological Assessment using historic hydrology for the period 1929-1993 and using the Bureau of Reclamation's monthly average net evaporation rate coefficients for Navajo Reservoir indicates that the total Navajo Reservoir net evaporation will average about 27,900 acre-feet per year with operation of the reservoir to meet the diversion demands of the full Navajo Indian Irrigation Project and the Navajo-Gallup Water Supply Project and to meet habitat needs of populations of endangered fish species in the San Juan River as described by the San Juan River Basin Recovery Implementation Program's 1999 flow recommendations for the river below Farmington. Of this amount, it was estimated based on the proportion of use of the Navajo Reservoir supply for Navajo-Gallup Water Supply Project uses in Arizona that about 200 acre-feet per year of Navajo Reservoir evaporation would be allocated to the State of Arizona's Upper Basin apportionment pursuant to article V of the Upper Colorado River Basin Compact. The Bureau of Reclamation's monthly average net evaporation rate coefficients for Navajo Reservoir reflect reduction in gross reservoir evaporation losses for salvage of pre-dam losses within the reservoir pool area. The actual net evaporation loss from Navajo Reservoir in any year will fluctuate significantly depending upon actual storage and climatic conditions. The average annual reservoir evaporation under current water development conditions is somewhat greater than under full water development conditions when reservoir storage will be reduced, on average, due to increased water demands on the Navajo Reservoir supply. The largest sector of use of the Navajo Reservoir water supply is for irrigation purposes.

Average annual scattered small reservoir evaporation includes evaporation from small man-made reservoirs used for irrigation, fish and wildlife, or recreational purposes in the San Juan River Basin in New Mexico. The average annual evaporation losses from these small reservoirs were estimated based on maximum reservoir water surface areas for each reservoir compiled by the New Mexico Office of the State Engineer and average annual net reservoir evaporation rates for each reservoir determined by reservoir location and elevation and presumably using maps showing lines of equal gross annual lake evaporation and lines of equal normal annual precipitation prepared by the Soil Conservation Service in 1972. The net reservoir evaporation rates ranged from about 0.8 feet per year for high elevation reservoirs on the Jicarilla Apache Indian Reservation to as much as about 4.3 feet per year for low elevation reservoirs in the basin in New Mexico. Reservoir fullness factors apparently were not considered. The estimated at-site reservoir evaporation amounts for reservoirs in the drainages of ephemeral tributaries to the San Juan River were not reduced for salvage of downstream channel losses by storage and use between the reservoirs and the river.

Evaporation losses from off-stream reservoirs used for municipal water supply (for example, Farmington Lake) are included within the depletions for current municipal and domestic uses. Evaporation losses from off-stream reservoirs used for thermal electric power generation (for example, Morgan Lake) or industrial uses are included within the depletions for power generation or industrial uses, respectively. Evaporation losses from off-stream reservoirs used solely for regulation of irrigation water (for example, Cutter Reservoir on the Navajo Indian Irrigation Project) are included within the depletions for irrigation uses.

9. *Do you anticipate needing additional Colorado River water to meet all of your unmet needs, or does your planning include other projects coming online? Please cite types of other projects being considered (at a macro scale).*

The impacts of authorized water projects on San Juan River flows are included in the depletion schedule. The actual water demands from the natural flow of the San Juan River for uses in New Mexico can be anticipated to vary significantly from year to year depending upon weather, runoff, storage and other conditions (see answers to questions 7 and 8), especially if Navajo Reservoir storage changes are considered. The depletion schedule for planning purposes does not include any long-term change in reservoir storage. Actual depletions from the San Juan River for uses in New Mexico in recent years have totaled about 450,000 acre-feet per year, on average, excluding reservoir storage changes. This is less than the average annual total depletion shown in the depletion schedule for 2010 conditions due in large part to slower than anticipated build out of the Navajo Indian Irrigation Project and inclusion of currently unused irrigation rights in the depletion schedule. Possible occurrences of shortage to the depletion demands for irrigation, municipal, domestic and industrial uses from the San Juan and Animas rivers in New Mexico are not factored into the depletion schedule.

For irrigation uses in New Mexico made from the La Plata River, the depletion schedule incorporates a 50 percent average annual shortage to the irrigation depletion demand. Therefore, an additional demand for up to about 6,000 acre-feet of water per year from the San Juan River stream system or from other water sources might exist to reduce or eliminate this amount of shortage to La Plata River irrigation uses if such water could reasonably be made available for this purpose. In addition, the depletion schedule incorporates a 50 percent average annual shortage to the irrigation depletion demands of small Navajo irrigation projects in the drainages of ephemeral tributaries to the San Juan River, primarily in the Chaco River drainage. Therefore, an additional demand for several thousand acre-feet of water per year from the San Juan River stream system or from other water sources might exist to reduce or eliminate shortages to these Navajo irrigation uses. The United States currently is preparing a hydrographic survey of small scattered Navajo irrigation projects in the ephemeral tributary drainages to assist in quantifying historic irrigation uses and water rights for such projects. Until the hydrographic survey and associated water rights adjudication is completed, it is not clear how much additional water demand might exist for full water supply to these Navajo projects. Even then, it is not clear that additional water supply could reasonably be made available to these small scattered Navajo projects.

The depletion schedule includes a total of over 25,800 acre-feet per year of depletion from the flow of the San Juan River by 2060 for Navajo Nation municipal, industrial and domestic uses within New Mexico (including about 400 acre-feet under current municipal and domestic water uses, about 2,340 acre-feet under the Animas-La Plata Project, about 20,780 acre-feet under the Navajo-Gallup

Water Supply Project, about 2,000 acre-feet under non-project future municipal use rights, about 300 acre-feet under industrial uses at Shiprock, and an unspecified amount included within the scattered rural domestic uses). The 2001 Navajo-Gallup Water Supply Project Technical Memorandum prepared by the Navajo Nation and others projected: (1) a total depletion demand from the flow of the San Juan River by surface water diversions for Navajo municipal and domestic uses within New Mexico of about 23,120 acre-feet per year by 2040; and (2) a total diversion demand from local ground water sources within the San Juan River Basin in New Mexico for Navajo municipal and domestic uses within the basin of about 1,670 acre-feet by 2040, for which the impact on river flow would be minimal. The water use projections of the Technical Memorandum were made assuming a high population growth rate of 2.48 percent per year and a per-capita diversion rate of 160 gpcd; however, the actual growth rate on Navajo lands in New Mexico during the past decade averaged less than 2.48 percent per year, and it is not clear if and when actual per-capita water use rates for communities and residents on Navajo lands in New Mexico as a whole will approach an average of 160 gpcd.¹ In addition, the capacities of the Navajo-Gallup Water Supply Project pipelines are limited by the authorizing legislation, and it is not clear that it would be economically or financially feasible to construct additional pipeline capacity to supply additional water to scattered municipal and domestic uses throughout Navajo lands in New Mexico soon after the United States completes construction of the project at a cost of about \$870 million (in 2007 dollars).

The depletion schedule also includes a total of about 20,500 acre-feet per year of depletion by surface water diversions in the San Juan River Basin in New Mexico by 2060 for non-Indian municipal and domestic uses in the basin (including about 9,300 acre-feet under current municipal and domestic water uses by municipalities and domestic water user associations diverting from the San Juan River and its tributaries and about 11,200 acre-feet under the Animas-La Plata Project depletion allocations to the San Juan Water Commission and the La Plata Conservancy District). The 2003 San Juan Hydrologic Unit Regional Water Plan prepared by the San Juan Water Commission projected that the total depletion demand for all non-Indian municipal and domestic uses in the basin in New Mexico would approach approximately 16,000 acre-feet per year by 2060. The water use projections of the Regional Water Plan were made assuming per-capita diversion rates of 300 gpcd for uses in the Animas River watershed and 160 gpcd for uses elsewhere in the basin, and did not explicitly incorporate water conservation measures or plans. The San Juan Water Commission pursuant to its Amendatory Funding Agreement and Repayment Contract for the Animas-La Plata Project is to provide to the Bureau of Reclamation an effective water conservation program prior to it or its members receiving storage water from Lake Nighthorse. The Regional Water Plan also assumed increases in self-supplied industrial uses totaling several thousand acre-feet of depletion, but actual self-supplied industrial uses (excluding for thermal electric power generation) have been on the decline. Therefore, if a substantial amount of the currently unused non-Indian irrigation rights are placed back into irrigation service or are transferred to municipal, domestic or industrial uses, it is anticipated based on the Regional Water Plan that there would likely not be an increase in the total demand for actual depletions for uses in the basin in New Mexico within a 2060 planning horizon over and above the 642,000 acre-feet of total depletion demand

¹ Inclusion and consideration of water demand information from the Navajo-Gallup Water Supply Project Technical Memorandum in this discussion is for planning purposes of the Colorado River Basin Study only, and should not be construed as agreement of the State of New Mexico to the Technical Memorandum's water demand assumptions or projections.

shown in the depletion schedule.² The Regional Water Plan assumed that there would be no increases in non-Indian irrigation depletions in the basin in New Mexico above current depletion levels.

Depending upon resolution of the competition for water between the completion of federal water projects in the basin to supply uses in New Mexico and the maintenance of suitable habitat for the San Juan River populations of endangered fish species, augmentation of flows in the San Juan River might be needed if shortages to some of the depletion demands shown in the depletion schedule were to be avoided. The San Juan River total depletion demand included in the State of New Mexico's 2006 Upper Basin depletion schedule assumes that the total average depletion will not exceed an allocation of consumptive use to the State of New Mexico reflected by the 2007 Hydrologic Determination, and that the consumptive use rights of the Navajo Nation for its uses under the Navajo Indian Irrigation Project and the Navajo-Gallup Water Supply Project will be fully utilized. The 2009 Biological Opinion for the Navajo-Gallup Water Supply Project requires that the Navajo Nation provide a depletion guarantee whereby the Nation will reduce depletions on the Navajo Indian Irrigation Project by as much as 20,780 acre-feet per year as necessary to offset its depletions under the Navajo-Gallup Water Supply Project if total depletions in the San Juan River Basin exceed a certain threshold beyond which the Bureau of Reclamation's ability to operate Navajo Reservoir to meet the San Juan River Basin Recovery Implementation Program's flow recommendations for the San Juan River might be impaired. Timing as to when the threshold might be reached depends upon future water development and use in the San Juan River Basin in Colorado and New Mexico and from the San Juan River in Utah. To eliminate the depletion guarantee, there is a possible demand for an additional 21,000 acre-feet of water per year, over and above the natural flow historically available, in the San Juan River at Farmington if the natural flow is augmented.³ Additional flow augmentation might be required to eliminate the depletion guarantee depending upon possible revisions to the flow recommendations for the San Juan River and possible reductions in natural flow resulting from future climate change. Because the full Navajo Indian Irrigation Project average annual depletion right is included in the depletion schedule, this additional water demand would not increase the amount of depletion demand shown in the depletion schedule.

Based on the above answers and discussion, it appears likely that no Colorado River water in excess of the 642,000 acre-feet per year of average annual depletion identified in the depletion schedule would be needed prior to 2060 to meet average water demands from the San Juan River stream system for uses in New Mexico assuming historic climatic and hydrologic conditions.⁴ The depletion schedule does not consider impacts on actual depletions of increases in water demands, declines in water supplies, and occurrences of water shortage in the San Juan River Basin in New Mexico that might result from possible climate change described by recent global warming theories. For example, compared to depletions for historic climatic and hydrologic conditions shown in the

² Inclusion and consideration of water demand information from the San Juan Hydrologic Unit Regional Water Plan in this discussion is for planning purposes of the Colorado River Basin Study only, and should not be construed as agreement of the State of New Mexico to the Regional Water Plan's water demand assumptions or projections.

³ Inclusion and consideration of the Navajo Nation depletion guarantee in this discussion is for planning purposes of the Colorado River Basin Study only, and should not be construed as agreement of the State of New Mexico to the depletion guarantee concept or amount or to the Biological Opinion for the Navajo-Gallup Water Supply Project. The San Juan River Basin Recovery Implementation Program's flow recommendations are subject to change through adaptive management.

⁴ Availability of water from the San Juan or Animas rivers does not appear to have been a factor in, or cause of, the historic non-use of non-Indian irrigation rights.

depletion schedule, possible climate change might result in reductions in San Juan-Chama Project exports due to reductions in the supply available to the project for diversion, increases in irrigation requirements and depletion demands due to warmer temperatures, and increases in water supply shortages to all uses in the basin in New Mexico. Assuming future global climate change, additional water, whether from the Colorado River system or from other augmentation supplies, might be needed within a 2060 planning horizon to meet increased water demands and to reduce water shortages in the San Juan River Basin in New Mexico, and to reduce or replace shortages in contract deliveries to San Juan-Chama Project contractors in the Rio Grande Basin. Although the Navajo Nation irrigation depletions in the depletion schedule are limited by the water right amounts provided in the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement, augmentation water, if available, might be used to meet possible increases in Navajo irrigation depletion demands caused by climate change.

If water importation projects to augment the natural water supplies in the Colorado River system are pursued to reduce potential future water supply shortages or to allow for additional water development in the basin, additional water to meet future water demands in other river basins in New Mexico might be considered if such projects can accommodate reasonable access to supply some of these demands as well. Based on the 2004 Middle Rio Grande Regional Water Plan prepared by the Middle Rio Grande Council of Governments, the annual gap between renewable water supplies, including imported San Juan-Chama Project water, and projected water demands in the Middle Rio Grande Basin in New Mexico is anticipated to increase from about 55,000 acre-feet at the present to about 150,000 acre-feet by 2050. The current gap is met by mining ground water, and the Regional Water Plan recommended addressing the gap in the future by increasing ground water mining, developing deep saline ground water sources, increasing water imports to augment supplies in the Middle Rio Grande, or implementing water conservation. Since preparation of the Regional Water Plan, the State Engineer conditioned the City of Albuquerque's San Juan-Chama Project surface water diversion permit on the City reducing its per-capita diversion rate to 155 gpcd in the near future. Therefore, to provide for current water uses and for the projected 1.5 percent per year growth in population and associated municipal water demands in the Middle Rio Grande Basin in New Mexico, a water augmentation project might be tapped for up to approximately 150,000 acre-feet of water per year, or more under possible climate change scenarios, to supply uses in the Rio Grande Basin while reducing or eliminating possible ground water overdraft under 2060 conditions.⁵ The City of Gallup by 2060 also might be able to use a few thousand acre-feet of

⁵ Given the uncertainties in projecting future water demands to 2060, it is assumed that this volume of water would be sufficient to address also relatively small gaps between water supplies and projected demands within the San Juan-Chama Project service areas of the Upper Rio Grande Basin in New Mexico. In addition, the US Fish and Wildlife Service in 2003 issued a Biological Opinion on Middle Rio Grande Project water operations through 2012 that identified a need for additional flows in the Middle Rio Grande amounting to about 50,000 acre-feet of water per year for the conservation of the endangered Rio Grande silvery minnow. For current planning purposes, it is assumed that return flows from the use of up to 150,000 acre-feet per year of augmentation water in the Middle Rio Grande Basin might meet the need for additional flows in the Middle Rio Grande. Consultation between the Bureau of Reclamation and the Fish and Wildlife Service regarding Middle Rio Grande Project water operations after 2012 has begun, and flow targets for the Middle Rio Grande for the conservation of the silvery minnow are subject to change.

Inclusion and consideration of water demand information from the Middle Rio Grande Regional Water Plan in this discussion is for planning purposes of the Colorado River Basin Study only, and should not be construed as agreement of the State of New Mexico to the Regional Water Plan's water demand assumptions or projections. Inclusion and consideration in this discussion of flow demands for conservation of the Middle Rio Grande population of silvery minnow identified in the Biological Opinion on Middle Rio Grande Project water operations also is for planning purposes of the Colorado River Basin

additional augmentation supply, if reasonably available, to reduce its reliance on mining local ground water and bridge the gap between its renewable water supply under the Navajo-Gallup Water Supply Project and total City water demands.

Also, an average of up to 14,000 acre-feet per year of Central Arizona Project water would be needed from the Colorado River mainstream to allow the State of New Mexico to develop some or all of its additional consumptive use allocation from the Gila River stream system in New Mexico authorized by the Arizona Water Settlements Act of 2004. The State is conducting a planning process to determine whether and how to develop some or all of this additional consumptive use allocation, which could be used to meet water demands in the Gila River Basin or in the Silver City or Deming areas in adjoining basins in New Mexico. Silver City municipal uses currently are supplied, in part, from ground water mined and exported from the Gila River Basin.

In summary, based on the information provided in this water demands assessment questionnaire including in answer to question 11, the State of New Mexico by 2060 might have a demand for approximately 200,000 acre-feet of additional water, over and above the amount of water needed to supply the 642,000 acre-feet per year of average annual depletion identified in the depletion schedule, from renewable Colorado River system or non-Colorado River system sources to meet water needs within the Colorado River Basin and adjoining areas in New Mexico which are served by waters diverted from the Colorado River system while reducing ground-water overdraft.

10. How have you factored in the future costs of water into your demand schedule (i.e., the probable cost of water in the future versus conservation of existing supplies)?

Neither future costs of water or possible water conservation programs were factored into the depletion demand schedule. It was assumed that the municipal and domestic water users with allocations of water from federal projects (namely, the Animas-La Plata and Navajo-Gallup Water Supply projects) would enter into project repayment contracts and project operations and maintenance agreements as necessary to receive project water as planned.

11. How have you accounted for Tribal uses of water into your projections?

The current and future depletions associated with the proposed rights of the Navajo Nation and the decreed rights of the Jicarilla Apache Nation to divert and use waters of the San Juan River Basin in New Mexico were included in the depletion schedule (see answers to questions 7 and 8). The proposed water rights of the Navajo Nation are described in the San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement signed by the State of New Mexico and the Navajo Nation in April 2005, and the decreed rights of the Jicarilla Apache Nation are described in the partial final decree of the water rights of the Jicarilla Apache Nation that was entered by the court in the San Juan River Adjudication in 1999.

A portion of the Ute Mountain Ute Indian Reservation lies within the basin in New Mexico; however, the Ute Mountain Ute Tribe has no resident population within New Mexico. The depletion schedule includes scattered stockpond and livestock uses in the basin in New Mexico, which includes a very small amount of historic stockpond and livestock uses of the Ute Mountain Ute Tribe in New Mexico from ephemeral tributaries to the San Juan River or ground water. The Tribe has

Study only, and should not be construed as agreement of the State of New Mexico to the flow demands identified in the Biological Opinion.

filed with the court in the San Juan River Adjudication claims for federal reserved water rights totaling approximately 10,100 acre-feet per year of at-site consumptive use for possible future resort development and future operation of a hypothetical thermal electric power plant on the portion of its reservation in New Mexico. The Tribe's claimed future uses would be supplied from local groundwater sources. The State of New Mexico disagrees with the water right claims of the Ute Mountain Ute Tribe, and depletions from the San Juan River that might be associated with the Tribe's water right claims for future uses in New Mexico were not included in the depletion schedule. Future depletion demands on the San Juan River for uses in New Mexico could increase if the court in the San Juan River Adjudication decrees reserved rights to the Ute Mountain Ute Tribe for possible future uses in New Mexico in the amount claimed by the tribe, but the possible depletion impacts on San Juan River flows resulting from any such future uses would be small within a 2060 planning horizon because the claims submitted by the tribe in the adjudication are for use of ground water.

12. How have you factored in potential transfers of water from one type of use to another over time? How are the tradeoffs between different types of uses considered (i.e., relative priorities, economics, etc.)?

For purposes of the 2007 Hydrologic Determination, it was not necessary to speculate in the depletion schedule as to: (1) possible findings by the court in the San Juan River Adjudication that some of the non-Indian irrigation rights not currently in use in the San Juan River Basin in New Mexico might be forfeited or abandoned; (2) future transfers of irrigation rights to municipal, domestic or industrial use that might occur in the basin in New Mexico; or (3) any additional appropriations of water to meet projected future municipal, domestic or industrial water demands in the basin in New Mexico within a 2060 planning horizon. Under New Mexico law, water rights are property rights that may be sold or leased. Transfers of irrigation rights to other uses may occur over time, but such water right transfers would not result in an increase in man-made depletions from the San Juan River. Priorities of water use are set solely by priority dates, and are not dependent upon type or monetary value of use.

13. Have you included "depleting or consumptive uses" other than uses for agricultural and municipal and industrial use in your demand schedules (i.e., uses for the environment, recreation, etc., either locally or Colorado River-related)?

Depletions in the San Juan River Basin in New Mexico for small reservoirs used solely for fish and wildlife purposes or recreation were included in the depletion schedule under small reservoir evaporation. To the extent that operation of Navajo Dam to both meet water demands of Navajo Reservoir water supply contractors and provide sufficient flows in the San Juan River below Farmington to support the populations of endangered fish species in the river might result in increased reservoir evaporation as compared to operating the dam only to meet contractor demands, the increase in evaporation would be included within the Navajo Reservoir evaporation included in the depletion schedule. Minor amounts of water use at self-supplied recreational facilities in the basin in New Mexico, such as those at Navajo Lake State Park, were included in the depletion schedule under scattered rural domestic depletions.

14. Do your estimated demands include assumptions regarding climate change? If so, what are those assumptions and how are they incorporated or reflected in your projections?

The depletion schedule does not consider or incorporate possible climate change impacts on water demands or anticipated depletions in the San Juan River Basin in New Mexico (see answers to questions 7, 8 and 9).

STATE OF NEW MEXICO SCHEDULE OF ANTICIPATED UPPER BASIN DEPLETIONS
(Units: 1000 acre-feet per year)

Year	2000	2010	2020	2030	2040	2050	2060
IRRIGATION USES (1)							
Navajo Nation Irrigation:							
Navajo Indian Irrigation Project	150.0	215.0	250.0	270.0	270.0	270.0	270.0
Fruitland-Cambridge Irrigation Project	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Hogback-Cudei Irrigation Project	15.5	15.5	21.3	21.3	21.3	21.3	21.3
Chaco River drainage irrigation	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Crystal area irrigation	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Navajo Nation Irrigation Subtotal	176.9	241.9	282.7	302.7	302.7	302.7	302.7
Non-Navajo Irrigation:							
Above Navajo Dam (including Jicarilla)	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Upper San Juan (excluding Hammond)	10.3	10.3	10.3	10.3	10.3	10.3	10.3
Hammond Irrigation Project	12.1	12.1	12.1	12.1	12.1	12.1	12.1
Animas River ditches	40.7	40.7	40.7	40.7	40.7	40.7	40.7
La Plata River ditches	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Farmers Mutual Ditch	11.2	11.2	11.2	11.2	11.2	11.2	11.2
Jewett Valley Ditch	3.7	3.7	3.7	3.7	3.7	3.7	3.7
Chaco River drainage irrigation	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Non-Navajo Irrigation Subtotal	86.5	86.5	86.5	86.5	86.5	86.5	86.5
Irrigation Total	263.4	328.4	369.2	389.2	389.2	389.2	389.2
STOCKPOND EVAPORATION AND STOCK USE							
	4.0	4.0	4.0	4.0	4.0	4.0	4.0
MUNICIPAL AND DOMESTIC USES (1)							
Current Municipal and Industrial Uses							
Animas-La Plata Project:	9.7	9.7	9.7	9.7	9.7	9.7	9.7
San Juan Water Commission	1.0	5.0	10.4	10.4	10.4	10.4	10.4
Navajo Nation	0.0	1.0	2.0	2.3	2.3	2.3	2.3
La Plata Conservancy District	0.0	0.0	0.8	0.8	0.8	0.8	0.8
Ridges Basin Reservoir Evaporation - NM share	0.0	0.0	0.1	0.1	0.1	0.1	0.1
Animas-La Plata Project Subtotal	1.0	6.0	13.3	13.6	13.6	13.6	13.6
Navajo-Gallup Water Supply Project: (2)							
Navajo Nation	0.0	0.0	7.9	10.2	12.5	12.5	12.5
Jicarilla Apache Nation	0.0	0.0	0.8	1.0	1.2	1.2	1.2
Navajo-Gallup Project Subtotal (within Basin)	0.0	0.0	8.7	11.2	13.7	13.7	13.7
Navajo Nation Municipal Use, Future (exc. NGWSP)	0.0	0.0	1.0	1.0	2.0	2.0	2.0
Jicarilla Apache Nation Municipal Use (exc. NGWSP)	0.0	0.0	0.0	0.4	0.6	0.6	0.6
Scattered Rural Domestic (including Jicarilla)	1.0	1.0	1.0	1.1	1.1	1.2	1.2
Municipal and Domestic Total	11.7	16.7	33.7	37.0	40.7	40.8	40.8
POWER AND INDUSTRIAL USES							
PNM - Navajo Reservoir contract (3)	16.2	16.2	16.2	16.2	16.2	16.2	16.2
BHP Billiton	37.0	37.0	38.0	39.0	39.0	39.0	39.0
Bloomfield Industrial	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Navajo Nation - Shiprock	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Navajo-Gallup Water Supply Project - NAPI (2)	0.0	0.0	0.7	0.7	0.7	0.7	0.7
Small Navajo Reservoir Contracts	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Power and Industrial Total	56.1	56.1	57.8	58.8	58.8	58.8	58.8
EXPORTS							
San Juan-Chama Project	105.2	105.2	105.2	105.2	105.2	105.2	105.2
Navajo-Gallup Water Supply Project: (2)							
Navajo Nation in New Mexico	0.0	0.0	4.0	5.8	7.6	7.6	7.6
City of Gallup	0.0	0.0	4.7	6.1	7.5	7.5	7.5
Navajo-Gallup Project Subtotal (Export)	0.0	0.0	8.7	11.9	15.1	15.1	15.1
Export Total	105.2	105.2	113.9	117.1	120.3	120.3	120.3
RESERVOIR EVAPORATION							
Navajo Reservoir Evaporation	28.3	28.0	27.7	27.7	27.7	27.7	27.7
Small Reservoir Evaporation	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Reservoir Evaporation Total	29.5	29.2	28.9	28.9	28.9	28.9	28.9
TOTAL DEPLETIONS (4)							
State Share of Upper Basin Yield (5)	642.4	642.4	642.4	642.4	642.4	642.4	642.4
Remaining Available (5,6)	172.5	102.8	34.9	7.4	0.5	0.4	0.4
Percent of State Share Remaining	26.9%	16.0%	5.4%	1.2%	0.1%	0.1%	0.1%

NOTES:

- (1) Does not reflect post-1965 transfers from irrigation to municipal and industrial uses.
- (2) Proposed Navajo-Gallup Water Supply Project depletions in New Mexico total 29,500 acre-feet per year. Exports to Gallup are anticipated to be supplied through a subcontract with the Jicarilla Apache Nation. Exports for Navajo Nation uses in Arizona are not included.
- (3) Supplied through a subcontract with the Jicarilla Apache Nation.
- (4) This is a schedule of anticipated depletions for planning purposes only. It is not a tabulation or determination of water rights or actual uses. Total depletions exclude New Mexico's share of reservoir evaporation from the major reservoirs constructed under the Colorado River Storage Project (CRSP) Act that are used principally to regulate compact deliveries at Lee Ferry and generate CRSP hydroelectric power. These include Lake Powell, Flaming Gorge Reservoir and the Aspinall Unit.
- (5) This depletion schedule does not attempt to interpret the Colorado River Compact, the Upper Colorado River Basin Compact, or any other element of the "Law of the River." This schedule should not be construed as an acceptance of any assumption that limits the Upper Colorado River Basin's depletion or New Mexico's depletion. Of the water available to the Upper Basin at Lee Ferry, the allocation for use by New Mexico is listed in this schedule, for planning purposes, as 642,400 acre-feet. This amount does not include New Mexico's share of CRSP reservoir evaporation other than Navajo Reservoir evaporation.
- (6) Reserved.