

## IMPACTS OF DEPLETIONS ON LEE FERRY FLOWS

Article III(d) of the Colorado River Compact requires that the Upper Basin not deplete the flow at Lee Ferry below 75 million acre-feet in any period of ten consecutive years. Thus, the depletion under Article III(d) must be measured at the point of delivery (i.e., Lee Ferry). The 1965 Comprehensive Framework Study at pages 39 and 48 notes that the on-site depletions used therein in schedules of depletion for the Upper Basin for planning purposes are not to be construed as depletions charged to the states under the provisions of the Colorado River and Upper Colorado River Basin compacts because they do not necessarily reflect direct relationships to streamflow diminishment at Lee Ferry. Carrying the Comprehensive Framework Study at-site depletions forward in subsequent depletion schedules through 2000 should not be construed as altering that preface. The depletion of flow at Lee Ferry is less than the depletion of the flow at the place of use because a portion of the streamflow used would have been lost to evaporation or evapotranspiration had the water remained in the stream. The savings in river channel loss above Lee Ferry resulting from putting the water to use in the Upper Basin constitutes salvage by use. Only depletion of the flow at Lee Ferry is chargeable against a state's apportionment of the yield available to the Upper Basin at Lee Ferry under Article III of the Colorado River Compact.

### A. 1948 Engineering Advisory Committee Report to UCRBCC.

Salvage by use was included in the 1948 Engineering Advisory Committee report to the Upper Colorado River Basin Compact Commission, whereby stream depletions at sites of use were reduced for reductions in channel losses resulting from the use of water. The following is a summary of the procedure used to determine salvage by use described at pages 42-55 of the 1948 EAC report.

To determine channel loss rates, river bottom areas exposed to evaporation were measured and estimated from available aerial photography and mapping for reaches of stream from Lee Ferry to the headwater areas, water surface evaporation rates were estimated as a function of elevation for the Colorado, Green and San Juan rivers based on available pan evaporation and other meteorologic data, and average channel losses were then estimated for the period 1914-1945 with allowance made for the effect of turbulence on evaporation rates. The report at page 46 indicates that the results are minimum channel loss estimates.

As a check on the method, channel losses for several years also were estimated using the hydrometric method for the San Juan River between Rosa and Bluff and for the Colorado

River and tributaries between Green River, Cisco and Bluff and Lee Ferry. The hydrometric method compares daily inflow and outflow hydrographs for the reaches and evaluates losses under varying conditions of rising, steady or falling flows and of wet or dry channel conditions, and considering any intervening tributary runoff and base inflows and any known man-made depletions. Application of the hydrometric method for the subject reaches resulted in estimates of channel losses that were greater than those estimated using the evaporation rate method, and the evaporation rate method was used to reflect the average historic channel loss to be more conservative. The hydrometric method would include consumptive use of water by riparian phreatophytes, which is likely not very sensitive to reductions in streamflow unless overbank flooding occurs.

However, for both reaches, the annual channel losses computed using the hydrometric method were related to the annual inflows to the reaches with both losses and inflows expressed as percentage of mean. The resulting relationships were applied to these and other river reaches based on channel similarities whereby the channel losses in percent of mean for each reach were determined from the mean inflows to the reaches, and the annual channel loss amounts were then estimated for the 1914-1945 period from the mean loss amounts for the reach derived using the elevation for the reach and the average evaporation rates for the given elevations.

The historic estimated depletions and loss curves were then used to determine what additional channel losses would have occurred under virgin flow conditions for the period 1914-1945 when average historic streamflow would have been increased by the amount of man-made depletions. The difference between the indicated channel losses under virgin conditions and the historic channel losses was considered the amount of water salvaged due to historic uses. Similarly, the difference between channel losses derived using the same approach under reductions in streamflow from the 1914-1945 average can be determined. Using this approach and routing of flows through stream reaches, the 1948 report found that salvage by use in New Mexico between sites of use and Lee Ferry amounted to about 2,700 acre-feet per year average for the 1914-1945 period. Depletions at Lee Ferry resulting from use in New Mexico were thus estimated to be 2,700 acre-feet less than at-site depletions.

The 1948 EAC report estimated that salvage in the Upper Basin by historic uses during the period 1914-1945 amounted to about 73,300 acre-feet, which equated to a basin-wide average of about 3.8 percent of average at-site depletions for the period. The salvage associated with uses in New Mexico of 2,700 acre-feet equated to about 3.7 percent of at-site depletions for the period.

#### **B. 1965 Tipton and Kalmbach report to the UCRC.**

Tipton and Kalmbach in 1965 prepared a report for the Upper Colorado River Commission on water supplies available for use by the Upper Division States that included the Department of the Interior's July 1965 projections of depletions at Lee Ferry that were reduced for salvage estimated to be about 4 percent of at-site depletions by projects in the Upper Basin (see Water Supplies of the Colorado River Available for Use

by the States of the Upper Division and for Use from the Main Stem by the States of Arizona, California and Nevada in the Lower Basin, Tipton and Kalmbach, Inc., July 1965, Table A-2). Interior's projections allowed 101,000 acre-feet for salvage by use in the Upper Basin as of 1965 conditions, which equated to an average of about 3.50 percent of at-site depletions basin-wide as of 1965. Interior's projections also allowed 164,000 acre-feet of estimated salvage in the Upper Basin under 2030 conditions, which equated to a basin-wide average of about 3.44 percent of projected 2030 at-site depletions. The Tipton and Kalmbach report did not segregate the quantities of salvage by state.

### **C. Colorado River Basin Projects Act.**

Hydrologic studies prepared by the Bureau of Reclamation for consideration of the Colorado River Basin Projects Act included salvage by uses in the Upper Basin in its projections of the flow at Lee Ferry available to the Lower Basin (see Hearing before the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, House of Representatives, 89<sup>th</sup> Congress, First Session, on H.R. 4671 and similar bills, Lower Colorado River Basin Project, August 23-September 1, 1965, Serial No. 17, pages 229-230 and 463-464). The Secretary of the Interior and the Commissioner of Reclamation provided Congress tabulations showing estimated depletions by the Upper Basin that Reclamation used as the basis of its forecast of Colorado River water supply available to the Lower Basin. The tabulation reduced the total depletion at sites of use in the Upper Basin for salvage to determine depletion at Lee Ferry. Reclamation estimated salvage to be 4 percent of at-site uses.

### **D. Long-Range Operating Criteria.**

The Bureau of Reclamation in the preparation of long-range operating criteria for the Colorado River pursuant to Public Law 90-537, including development of the 602(a) storage algorithm, in 1969 included salvage by uses in the Upper Basin in its projections of the flow at Lee Ferry (see: (1) Meeting of Federal and State Representatives for Review of Basic Data Pertinent to the Preparation of Operating Criteria for the Colorado River Pursuant to Section 602 of Public Law 90-537, US Department of the Interior, Bureau of Reclamation, July 25, 1969, table entitled "Upper Colorado River Water Uses with Projected Depletions at Lee Ferry"; (2) Upper Basin Depletions, report of Task Force on long-range reservoir operating criteria, August 1969; and (3) Report of the Committee on Probabilities and Test Studies to the Task Force on Operating Criteria for the Colorado River, Bureau of Reclamation, October 30, 1969, page 12). Reclamation in its Colorado River Storage Project studies allowed 115,000 acre-feet for salvage by use in the Upper Basin as of 1968, which equated to an average of about 4 percent of at-site depletions basin-wide as of 1968. Reclamation also allowed 191,000 acre-feet of estimated salvage in the Upper Basin under 2030 conditions, which equated to a basin-wide average of about 4 percent of projected 2030 at-site depletions. Of these amounts, the salvage associated with uses in New Mexico was estimated at 5,000 acre-feet (or 3.45 percent of at-site depletions) in 1968 and projected to be 21,000 acre-feet (or 3.57 percent of at-site depletions) in 2030.

#### **E. Colorado River System Consumptive Uses and Losses Reports.**

Public Law 90-537 does not specify how the Bureau of Reclamation's Colorado River System consumptive uses and losses reports are to be prepared. Reclamation in said reports includes on-site consumptive uses and does not include salvage. Minutes of the Upper Colorado River Commission's Subcommittee on Consumptive Use meeting of April 7-8, 1976, state that the report should document that the on-site consumptive uses should not be construed as consumptive use at Lee Ferry. In its comments to Reclamation on the CU&L report for 1971-1975, the Upper Colorado River Commission noted that the report states that no attempt was made to deal with the question of channel losses and salvage by use, and that Reclamation, to be consistent with Article VI of the Upper Colorado River Basin Compact, should report the consumptive use by Upper Basin States as depletion of the virgin flow at Lee Ferry (see Ival Goslin's January 28, 1977, letter to Commissioner Gilbert Stamm). In its response, Reclamation recognized the value of reporting consumptive use by the Upper Basin as depletion at Lee Ferry, and stated that Reclamation intends prior to issuing the subsequent CU&L report to conduct studies of channel losses and salvage that would permit conversion of the on-site uses to depletions at Lee Ferry (see Commissioner Keith Higginson's April 11, 1977, letter to Ival Goslin).

In comments on a proposed plan of study for the 1976-1980 CU&L report, the Upper Colorado River Commission noted that Reclamation did not plan to attempt to account for possible channel-loss salvage, and pointed out that consumptive uses in the Upper Basin must be determined in terms of man-made depletions of the virgin flow at Lee Ferry for compact purposes, that salvage is an important factor in the determination of consumptive uses, and that future CU&L reports will need to consider salvage by use as the use of water in the Upper Basin approaches the limit of the apportionment (see Paul Billhymer's December 7, 1981, letter to Clifford Barrett). In its response, Reclamation agreed that the value of the CU&L report would be enhanced by inclusion of channel-loss salvage, but felt that salvage will have to be addressed in future CU&L reports because insufficient data were available at that time to confidently estimate salvage (see Clifford Barrett's February 2, 1982, letter to Paul Billhymer). In comments on the draft CU&L report for 1976-1980, the Commission reiterated its earlier comments on the plan of study, stated that future Reclamation reports must consider the compact provisions, and suggested that Reclamation work with the Commission staff and the states so that salvage can be considered in the next CU&L report (see Paul Billhymer's May 23, 1983, letter to Clifford Barrett). In addition, Wyoming and New Mexico submitted comments indicating that salvage by use is a compact consideration that becomes more important as uses increase and it should be included in the next CU&L report (see John Buyok's May 31, 1983, and Philip Mutz' June 6, 1983, letters to Clifford Barrett). Subsequent CU&L reports did not address salvage by use.

#### **F. Hydrologic Determinations Pursuant to Public Law 87-483.**

The Bureau of Reclamation in the 1984 Hydrologic Determination prepared for contracting water from Navajo Reservoir did not include salvage by uses in the Upper

Basin. In commenting to Reclamation on the December 1983 draft of the Hydrologic Determination, New Mexico noted that the draft takes no account of salvage by use (see Steve Reynolds' January 18, 1984, letter to Cliff Barrett). The Upper Colorado River Commission's Resolution of March 20, 1984, stated that the Commission does not endorse the projections of depletions in the Upper Basin or the study assumptions set forth in the December 1983 draft.

The Bureau of Reclamation in the 1988 Hydrologic Determination largely used the same depletion schedules used in the 1984 Hydrologic Determination, with only minor variations, and did not include salvage by use. The Upper Colorado River Commission's Resolutions of June 2, 1987, and October 22, 1987, stated that the Commission does not endorse the projections of depletions, the study assumptions or the analytical methodologies that are contained in drafts of the Hydrologic Determination.

#### **G. States' Depletion Schedules for Colorado River Basin Planning Studies.**

After the 1988 Hydrologic Determination, the Commission has not objected to the use for planning and water supply studies in the Colorado River Basin of depletion schedules that the Upper Division States prepared in 1994 and updated in 1999, which schedules are of on-site depletions and do not include or consider salvage. These later two schedules include a qualifying note that the depletion schedules do not attempt to interpret the Colorado River Compact, the Upper Colorado River Basin Compact or any other element of the "Law of the River," and that the schedules should not be construed as an acceptance of any assumption that limits the Upper Colorado River Basin's depletion (see the Commission's July 13, 1994, Resolution regarding the July 1994 States' Depletion Tables and the associated depletion schedule dated July 1994, and the Commission's December 15, 1999, Resolution regarding the January 2000 States' Depletion Tables and the associated depletion schedule dated January 2000).

#### **Additional Considerations:**

1. Article VI of the Upper Colorado River Basin Compact provides for the use of the inflow-outflow method to account historic consumptive uses in the Upper Basin. The inflow-outflow method would account for the net of all impacts of man's activities on streamflow, including salvage, by measuring the net effect of depletions at the downstream point (i.e., the delivery point at Lee Ferry) after actual depletions and new losses.

2. The reverse of salvage by use (decreasing evaporation losses with reductions in flow and river surface area) is incremental channel loss (increasing evaporation losses with increases in flow and river surface area). If the Upper Colorado River Commission pursuant to Article IV were to require curtailments of use in order to increase the flow at Lee Ferry by a defined amount, the Commission and the Upper Division States must necessarily consider incremental channel losses in determining how much at-site use must be curtailed to deliver the defined quantity at Lee Ferry.

3. If the salvage by use in New Mexico amounts to about 3.5 percent of at-site uses, then at-site depletions in New Mexico of about 611,400 acre-feet per year should salvage about 21,400 acre-feet per year. Under the 1988 Hydrologic Determination, the yield available to the Upper Basin at Lee Ferry is at least 6,000,000 acre-feet, of which New Mexico's apportioned share is at least 611,400 acre-feet. Thus, New Mexico could deplete about 632,800 acre-feet at sites of use and remain within her apportioned share of the yield at Lee Ferry. Without allowing for salvage, New Mexico would not develop her share of the yield because at-site uses of 611,400 acre-feet would result in a depletion of flow at Lee Ferry of only about 590,000 acre-feet. The amount of salvage would be increased if the yield to the Upper Basin, and New Mexico's apportionment, were increased relative to the 1988 Hydrologic Determination. For example, if the Upper Basin yield is 6.3 MAF, New Mexico's apportioned share of the yield would be about 703,100 acre-feet measured at Lee Ferry and 727,700 acre-feet of at-site depletion after allowing for about 24,600 acre-feet of salvage.

4. Although water uses from perennial streams in the Upper Basin may have a full impact on the flow of the stream adjacent to the site of use, water uses from other sources may not. For example, consumptive uses from ground water may have a delayed impact on streamflow over time if the ground water is tributary to Upper Basin streams such as the San Juan, Upper Colorado or Green rivers, and may have no impact on these streams or the flow at Lee Ferry if the ground water is non-tributary. Also, uses of surface water on ephemeral tributaries do not have a full impact on the perennial tributaries. For example, uses on washes tributary to the ephemeral Chaco River do not have a full impact on San Juan River flows in New Mexico because much of the water if not used would be lost in transit due to evaporation, evapotranspiration and seepage losses into dry channels (i.e., water also is salvaged in the ephemeral channels). Salvage on ephemeral tributary channels in the Chaco River drainage would be in addition to salvage on the San Juan River computed above for uses on perennial tributaries.

5. While the 1965 Comprehensive Framework Study made no attempt to account for changes or differences in natural river channel losses that are referred to as salvage by use, it did account for a considerable amount of such salvage water within reservoir areas in the computation of net reservoir losses in mainstem reservoirs which include Lake Powell, Flaming Gorge Reservoir and the three reservoirs comprising the Curecanti Unit (see the 1965 CFS at pages 46 and 52). Mainstem reservoir evaporation for inclusion in the Colorado River System Consumptive Uses and Losses reports, and consequently, for use in determining natural flows at Lee Ferry, are computed based on average monthly lake surface areas and predetermined average monthly net evaporation rates. Evaporation from other reservoirs in the CU&L reports are computed based on average annual lake surface areas and average annual net evaporation rates. The net evaporation rates were determined from estimated gross evaporation rates, taking into account also precipitation on the lake surface and runoff salvage from within the reservoir pool area (see the first CU&L report for 1971-1975 at pages 11-12).

6. Allowing for salvage by use of river channel losses outside of reservoir areas would be consistent with allowing for salvage by inundation of river channel losses

within reservoir areas. A consistent approach should be used to evaluate net depletions at Lee Ferry for comparison against the yield available to the Upper Basin at that point on the river. Only the depletion effects of uses on the flow at Lee Ferry should be accounted in the depletion schedules that are compared a state's apportionment of the yield available at Lee Ferry.

7. To the extent that historic salvage was not accounted in quantifying the natural flows at Lee Ferry, the annual natural flows are overestimated because at-site depletions that were added to the gaged flows were not reduced for salvage. To that extent only, the average annual salvage occurring historically during the critical water supply period should not be allowed in the depletion schedules. Historic salvage that was accounted and additional salvage resulting from increased depletions occurring after the critical period should be accounted in the depletion schedules.





John

10-26-55

In the Arroyo del Valle decree accounting, Reclamation estimates both unmeasured tributary inflows from Hoover Dam to the Mexican boundary and unmeasured return flows, and unmeasured return flow from Southern Nevada USB.

This process in the decree accounting might be useful to mention to Reclamation if they are not inclined to estimate salvage by use in the Upper Basin.

I don't have an annual report of the decree accounting, but as I recall Nevada is credited with a considerable amount of unmeasured return, and thereby can divert that amount.

Phil

Also, USBR computes channel losses for decree actg. in UB despite difficulties in estimating losses.



**PRELIMINARY DETERMINATIONS OF UPPER BASIN YIELD**

The following Upper Basin yield estimates are based on the Bureau of Reclamation's annual water budget spreadsheet, 1906-2000 period Colorado River at Lee Ferry natural flows, and Lake Powell storage reduced for sedimentation through 2060:


| <u>Storage assumptions</u>  | <u>Yield (maf)</u> | <u>Shortages</u> |                     |
|---|--------------------|------------------|---------------------|
|   |                    | <u>Year</u>      | <u>Amount (maf)</u> |
| CRSP active storage plus 4% bank storage                                | 5.9                | none             |                     |
|   | 6.0                | 1964             | 0.7                 |
|   |                    | 1977             | 2.0                 |
|   | 6.1                | 1963             | 0.3                 |
|   |                    | 1964             | 3.1                 |
| 1968  |                    | 0.2              |                     |
| 1977  |                    | 3.1              |                     |
| CRSP live storage except Navajo active storage,<br>plus 4% bank storage | 6.0                | none             |                     |
|   | 6.1                | 1964             | 0.3                 |
|   |                    | 1977             | 2.6                 |
|   | 6.2                | 1964             | 3.2                 |
|   |                    | 1967             | 0.1                 |
|   |                    | 1968             | 0.3                 |
|   |                    | 1977             | 3.6                 |

The Bureau of Reclamation may use the annual water budget spreadsheet analyses, with the resulting sensitivities of yield and shortages to different storage scenarios, to confirm the conclusion of the 1988 Hydrologic Determination that the yield to the Upper Basin is at least 6.0 maf. Based on the annual spreadsheet analyses, Reclamation also could perform more detailed monthly modeling of the Upper Colorado River Basin under 2060 storage conditions to refine the results. Alternatively, Reclamation could update the 1988 Hydrologic Determination using a multi-trace risk assessment over time through 2060, though doing so probably would not materially affect the conclusion of the water supply analysis.



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**Whipple, John J., OSE**

**From:** Don Ostler [DOSTLER@uc.usbr.gov] **Sent:** Tue 8/16/2005 5:06 PM  
**To:** ekuhn@crwcd.org; Lopez, Estevan, OSE; Whipple, John J., OSE; jshiel@seo.wyo.gov; hal.simpson@state.co.us; Randy.Seaholm@state.co.us; Brown, Jayne R., OSE; jerryolds@utah.gov; robertking@utah.gov  
**Cc:**  
**Subject:** Engineering Committee Meeting 8/23/05 McCarin Airport 1:00pm  
**Attachments:**  hydrodeter.issueslist.081005.doc(50KB)

Hello all:

The engineering committee will meet in Las Vegas immediately following the initial AOP consultation meeting on 8/23/05 in the same room (mezanine room). John Whipple has put together an outline of issues that we might consider in discussing the hydrologic determination. The following is a proposed agenda:

**AGENDA:**

1. Continue discussion of the hydrologic determination (see the attachment provided by John Whipple)
2. Discuss plans for updating our Upper Basin depletion schedules
3. Discuss any carry over items regarding coordinated reservoir operations models
4. Curtailment procedures ( I don't expect we will actually get to this, but I would like to keep it on the windshield)

I have not had a chance to talk with our chairman John Shields about agenda details as yet. So I would appreciate John S's comments as well as any sugestions from any of you about the agenda..Also, Dave Trueman has not been invited, as my early discussions with a few of you indicated this might not be appropriate...If you want him there we will need to act soon.

Thanks  
Don Ostler

OSE-0068



**August 10, 2005, Confidential Draft for Upper Colorado River Commission**  
**Engineering Advisory Committee Deliberations – Not for Distribution**

**ISSUES TO CONSIDER IN MAKING A HYDROLOGIC DETERMINATION  
THAT SUFFICIENT WATER IS REASONABLY LIKELY TO BE AVAILABLE  
FROM NAVAJO RESERVOIR AND WITHIN NEW MEXICO'S UPPER BASIN  
APPORTIONMENT TO SERVICE A CONTRACT WITH THE NAVAJO  
NATION FOR WATER FOR THE NAVAJO-GALLUP PROJECT**

**DETERMINATION OF UPPER BASIN YIELD AT LEE FERRY**

1. Natural flow at Lee Ferry, 1906-2000
  - To compute natural flows, were gaged flows adjusted for irrigation depletions computed using the original or modified Blaney-Criddle method, or some combination (supply and demand must be compared on the basis of the same methodology, particularly for the critical period)?
  - Should flows be adjusted for changes in channel loss conditions over time to reflect current or future conditions?
  
2. Reservoir storage capacity
  - Use Powell or all CRSP storage capacity? Include non-CRSP storage?
  - Use live or active storage capacity (i.e., protect minimum power pools)? Is capacity at Navajo Reservoir below the NIIP intake and riprap protection available?
  - Use capacities adjusted for future sedimentation (at Powell or all reservoirs)? Use 2060 or other future sediment condition to evaluate Navajo-Gallup Project contract?
  - Bank storage factor for Powell and other reservoirs? Is bank storage within error of surface capacities?
  
3. Releases to Lee Ferry
  - 8.25 MAF/yr minimum objective release from the LROC or some other constant or variable amount consistent with articles III(c), III(d) and III(e) of the Colorado River Compact (i.e., require basin-wide accounting and annual determinations of amounts and locations of surplus and deficiency)?
  - Include graduated reductions in releases to Lee Ferry as a function of low storage levels (to avoid an anticipated call against Upper Basin uses if storage is exhausted)?

#### 4. Reservoir Evaporation

- Use net or gross evaporation losses from storage (i.e., net after salvage of losses within reservoir area under pre-reservoir conditions)? Treat evaporation from Powell different than for other reservoirs?
- Include reservoir evaporation as part of the Upper Basin demand, or separate evaporation from the Upper Basin demand and use variable evaporation volume as a function of storage and/or annual evaporation rates?

#### 5. Upper Basin demand

- Firm yield vs. yield with imposed shortages to Upper Basin demand? What constitutes tolerable imposed shortages (i.e., number of years of imposed shortage and magnitudes of shortage, average annual shortages)?
- Include physical water supply shortages to Upper Basin demand (are data available to determine physical water supply shortages to the Upper Basin demand as a function of natural flow at Lee Ferry)?
- Does demand represent water rights or water use? If water use, also include increased demand during wet years (opposite of reducing demand for physical shortages in dry years)?
- Include graduated imposed shortage criteria to the Upper Basin demand as a function of low storage levels (to avoid an anticipated call against Upper Basin uses if storage is exhausted)?

### NEW MEXICO DEPLETION SCHEDULE

#### 1. Consumptive uses

- Use 2060 or other date for projecting water uses to evaluate Navajo-Gallup Project contract?
- Use water rights or anticipated future water uses pursuant to water rights (i.e., anticipate portions of rights not used, on average, in future due to fallowing, physical water supply shortages, forfeiture in adjudication or other factors)? Consider average uses for 95 years of hydrology versus average uses in critical dry periods (physical water supply shortages factored in already)?
- Achieve consistency between all Upper Division States in the methodologies used to determine depletions in the Upper Basin depletions schedules?
- Include salvage by use to reflect depletion at Lee Ferry, as opposed to at-site use (salvage would only be considered since the beginning or end of



the critical period because historic salvage is already imbedded within the computed natural flows at Lee Ferry – use in addition to historic use will still salvage water)?

- Exclude non-tributary ground water uses?
- Include only impacts on San Juan River flows of ground water pumping uses (i.e., delayed impacts over time versus at-site depletions)?
- Include only impacts on San Juan River flows of ephemeral tributary uses (i.e., impacts less than at-site depletions due to salvage on tributaries)?

## 2. Irrigation depletions

- Use original or modified Blaney-Criddle method for non-NIIP crop use?
- How determine incidental depletions?
- What approach to use for NIIP depletions (i.e., approach to account for streamflow depletions caused by deep percolation to ground water storage until project in equilibrium, then original or modified Blaney-Criddle method)? This is more a future accounting issue for administration of NIIP uses, as opposed to a depletions issue.
- Adjust depletions for shortages in water supply, and how determine shortages?

## 3. Other compact accounting issues

- Does the Colorado River Compact article III(a) apportionment to the Upper Basin relate to at-site consumptive uses on tributaries as opposed to uses measured at Lee Ferry? Is article III(a) distinct from, and trumped by, articles III(c) and III(d), which relate to water deliveries at a specific point on the river and therefore require measurement of depletions at the delivery point? Should a restriction be considered on Navajo ground water at-site uses to reflect article III(a)?
- How much of the Navajo Reservoir evaporation is chargeable to Colorado and Arizona (some reservoir water would be used in Arizona under the Navajo-Gallup Project, some reservoir water is currently used in Colorado and some water is regulated by the reservoir to allow uses in Colorado to move forward by exchange in compliance with the ESA)?

## 4. Future use reduction issues

- Will the hydrologic determination rely on New Mexico reducing future uses either by retirement of water rights or conditioning NIIP uses?
- Will Reclamation, pursuant to its Indian trust responsibilities, forfeit water rights acquired in connection with construction of Navajo Reservoir?

## PHYSICAL AVAILABILITY OF WATER FOR NAVAJO-GALLUP PROJECT

### 1. San Juan Basin modeling

- Should baseline depletions in the modeling for ESA compliance be consistent with those in the New Mexico depletions schedule (baseline depletions exceed New Mexico anticipated depletions by about 37,000 AF/yr)? Is there a valid rationale for using different depletions (such as use of other states' unused apportionments)?
- Should physical water supply shortages to Navajo Reservoir contractors be based on current flow recommendations (the flow recommendations are not inviolate, are subject to change, and are only not met by modeling more depletions in New Mexico than are in the depletions schedule)?

### 2. Shortages to Navajo uses under the project

- How should years and amounts of shortage to the Navajo Nation's uses under the project be determined (when do compact calls against Upper Basin uses occur and do Navajo uses under the project constitute present perfected rights, are flow recommendations assumed inviolate, how is section 11 of Public Law 87-483 implemented, are NIIP uses curtailed to make water available to Navajo uses under the Navajo-Gallup Project when necessary, etc.)
- If the Navajo Nation is willing to guarantee to FWS that it will forgo some amount of depletion on NIIP as necessary to allow its uses under the Navajo-Gallup Project to move forward without impairing flow recommendations, would the Nation similarly agree to condition use of the full NIIP right on not causing New Mexico to exceed its Upper Basin apportionment (leaving some issues to be resolved later that could increase the apportionment pending further evaluation)?



**POSSIBLE HYDROLOGIC DETERMINATION ISSUES**

**DETERMINATION OF UPPER BASIN YIELD AT LEE FERRY**

1. CR Natural Flow

- a. Lee Ferry – USBR, 1906-2000 – adjust for changes in channel loss conditions over time vs. current or future conditions? *How were gaged flows adjusted for irrigation depletions (OCC, MBC, mix over time)?*
- b. Lower Basin tributary inflow – historic inflows ungaged - natural inflows averaged for runoff less tributary losses (prior to uses)? Basin-wide accounting? *- consistency w/ net flow & LRO?*

- c. Deficiency - no deficiency if annual total > 17.7 MAF, 100% deficiency if annual total < 16.0 MAF; other deficiency definition consistent with CR compact articles III(c) and III(e)? *(Trib. supply avg. 1.5 MAF?)*

2. CRSP Storage Capacity *d. III(c) interp. - del. 1/2 def. above III(d) available in some years to meet delivery, perhaps not all scheduled in those years*

- a. Live Capacity vs. Active Capacity (Powell adjusted for sedimentation 1986-2060): *(follows?)*

| Reservoir     | Live                 | Active               |
|---------------|----------------------|----------------------|
| Lake Powell   | 24,322,000 AF        | 20,309,919 AF        |
| Flaming Gorge | 3,749,000 AF         | 3,515,700 AF         |
| Blue Mesa     | 829,500 AF           | 748,500 AF           |
| Morrow Point  | 117,025 AF           | 42,120 AF            |
| Crystal       | 17,536 AF            | 13,000 AF            |
| Navajo        | 1,696,000 AF         | 1,036,100 AF         |
| Total         | 30,731,061 AF        | 25,665,339 AF        |
|               | <i>28,030,061 AF</i> | <i>23,892,023 AF</i> |

*use all res. storage regulation in UB = ~35 MAF?*

Protect minimum power pool at Powell and other reservoirs? – article IV of CR compact, power revenues fund project operations and environmental compliance programs (assume remain in place?)

Protect inactive pool at Navajo? – reservoir yield contracted for use, inactive pool below NIIP intake and riprap protection on upstream dam face.

*bank storage factor - 0.08 in Lake Powell, 0.033 in Flaming Gorge (1988 HD) or 0.04 all CRSP reservoirs (CRSS)*

- b. Navajo Reservoir – storage subject to call (none, all storage, storage increase in previous 9 years)?

c. *2060 condition for marketing for 50 yrs. vs. perpetual contracts?*

3. Lee Ferry Release – 8.25 vs. function of annual deficiency? Other quantity consistent with CR compact articles III(c) and III(d) (ie, 8.0 recognizing deficiency in two-thirds of years)?

4.  
5.A.

*Variable evap. volume w/ storage - @ Powell = gross ev. less evap. & losses w/o Res. → net ev. after salvage in ret. area*

- a. Firm Yield annually vs. greater yield with shortages? *@ others = no salvage*

- b. Annual yield a function of water supply to reflect physical shortages on tributaries in drought years for direct-flow uses (ie, 6.0 if CR Natural Flow > 13.0 MAF or 2/3 of years, 5.9 if < 13.0 or 1/3 of years)?
- c. Annual shortages vs. shortages when run out of storage? Graduated shortages taken when Powell or CRSP combined storage at increasingly low levels vs. only when storage exhausted?  
*(w/ firm yield then the actual use)*
- d. Tolerable shortages – number of years and amounts or percents of shortages; average annual shortages?

*low req. storage  
of criteria?  
to implement short.  
utilization of  
UB all?*

**NEW MEXICO DEPLETION SCHEDULE**

- 1. Salvage by use – nontributary groundwater, ephemeral tributary uses hydrologically removed from San Juan River mainstem, salvaged channel losses above Lee Ferry? *(AZ Gila R. argument from AZ v. CA)*  
*To extent water salvaged by historic uses, already included in CR natural flow @ yield at Lee Ferry.*
- 2. Evaporation chargeable to Colorado for increment caused by operating reservoir for ESA compliance to offset depletions for uses in Colorado?
- 3. Water rights vs. water uses – irrigation use projections (OBC vs. MBC methods), irrigated land, fallowing?  
*NIP depletions (gr mounding, who/how determine)?*
- 4. Average uses in 10-year dry period vs. for 70 years of hydrology?  
*1965 CF Study used in dry. sched's.*
- 5. Future use reductions
  - a. San Juan River Adjudication – forfeiture and abandonment of water rights (significant forfeiture of water rights agreed to by Farmington)  
*1800 AF dep.*
  - b. Avoid Jicarilla settlement provision – required acquisition and retirement of private rights to match depletion schedule with New Mexico share under 1988 Hydrologic Determination (11,000 AF dep, ~5000 Acres)

*- in 1948 EAC reports & compact negotiations - in I-0 method of Art. VI of UCRBC*

*6. Colo. Compact III(a) limit-inc, gov't use limit?*

**PHYSICAL AVAILABILITY OF WATER FOR NAVAJO-GALLUP PROJECT**

- 1. San Juan River Basin hydrology modeling – USBR, 1929-2000
  - a. No shortages under NM depletions schedule with current flow recommendations - NM depletion schedule vs. USBR/BIA baseline depletions conservative for ESA Section 7 consultations  
*(609 TAF)*
  - b. Number of years and amounts of shortage to NGP with baseline depletions? - flow recommendations not inviolate or sacrosanct (ie, cooperative San Juan River administration agreements for 2003-2005)

*D = 24 TAF for NIP  
+ 7 TAF for HB  
+ 30 TAF for NGP  
- 13 TAF for NM-NGP in  
none for NM total  
net - 37 TAF  
(can't use -13 for non-NM  
may if use MBC)*

*7%  
10,630  
160 AC*

*c. Unfavorable determination with baseline depletions? Inconsistent!  
(640 AF v. 610 AF dep's.)*

*↑  
guarantee of NIP reduction  
vs. guarantee flow recs  
w/ NIP reductions*

2. Water rights - number of years and amounts of shortage to NGP with tolerable Upper Basin shortages - present perfected rights under article VIII (Indian reserved rights), quantity available to Indians shared with other NM users under subordinated priority?

3. Flow recommendations for San Juan River endangered fish

a. Revisions to flow recommendations (SJRIP adaptive management), flow maintenance continues?

b. Depletion guarantee for NGP BA needed? – flow recommendations not inviolate, no agreement for accounting uses, baseline depletions not binding on others, article IX of UCRB compact

4. *Implementation of PL 87-483, Section 11 – procedures?*



SAN JUAN BASIN TOTAL IRRIGATION DEPLETIONS

| YEAR | 1936 Acres |      | 1938 Crop Mix                |                              | 1938 Acres |      | 2003 Crop Mix                |                              | Baseline/Settlement Acres 1966 Crop Mix |       | Baseline/Settlement Acres 2003 Crop Mix |       |
|------|------------|------|------------------------------|------------------------------|------------|------|------------------------------|------------------------------|---|-------|---|-------|
|      | OBC        | MBC  | OBC<br>w/alfalfa<br>function | MBC<br>w/alfalfa<br>function | OBC        | MBC  | OBC<br>w/alfalfa<br>function | MBC<br>w/alfalfa<br>function | OBC                                     | MBC   | OBC                                     | MBC   |
| 1929 | 3665       | 4453 | 3689                         | 4454                         | 4381       | 5294 | 4386                         | 5295                         | 7435                                    | 8837  | 7742                                    | 9499  |
| 1930 | 4363       | 4868 | 4369                         | 4869                         | 5219       | 5753 | 5244                         | 5755                         | 8673                                    | 9487  | 9091                                    | 10208 |
| 1931 | 4104       | 4876 | 4102                         | 4873                         | 4860       | 5721 | 4862                         | 5722                         | 8243                                    | 9548  | 8645                                    | 10270 |
| 1932 | 3919       | 4678 | 3921                         | 4676                         | 4732       | 5593 | 4736                         | 5594                         | 7923                                    | 9228  | 8305                                    | 9802  |
| 1933 | 4272       | 4867 | 4256                         | 4875                         | 5074       | 5883 | 5079                         | 5884                         | 8753                                    | 9899  | 9146                                    | 10429 |
| 1934 | 4180       | 4978 | 4196                         | 4979                         | 5052       | 5926 | 5054                         | 5934                         | 8513                                    | 10094 | 8940                                    | 10738 |
| 1935 | 3932       | 4549 | 3948                         | 4549                         | 4783       | 5370 | 4783                         | 5378                         | 8231                                    | 9248  | 8628                                    | 9919  |
| 1936 | 4282       | 5043 | 4299                         | 5049                         | 5136       | 5997 | 5139                         | 5998                         | 8749                                    | 9924  | 9183                                    | 10643 |
| 1937 | 4200       | 4943 | 4236                         | 4943                         | 5088       | 5858 | 5090                         | 5858                         | 8634                                    | 9885  | 9054                                    | 10703 |
| 1938 | 4293       | 4702 | 4216                         | 4709                         | 5067       | 5615 | 5066                         | 5621                         | 8544                                    | 9409  | 9062                                    | 10122 |
| 1939 | 4257       | 4923 | 4263                         | 4930                         | 5147       | 5783 | 5167                         | 5746                         | 8548                                    | 10230 | 9015                                    | 10192 |
| 1940 | 3193       | 3889 | 3190                         | 3890                         | 3715       | 4412 | 3716                         | 4415                         | 6504                                    | 7628  | 6790                                    | 8164  |
| 1941 | 4648       | 5240 | 4644                         | 5245                         | 5541       | 6157 | 5541                         | 6157                         | 9088                                    | 10804 | 9531                                    | 10841 |
| 1942 | 4536       | 5205 | 4533                         | 5211                         | 5380       | 5751 | 5382                         | 5759                         | 9142                                    | 9691  | 9547                                    | 10375 |
| 1943 | 4519       | 4947 | 4536                         | 4943                         | 5270       | 5919 | 5279                         | 5919                         | 8931                                    | 10118 | 9362                                    | 10724 |
| 1944 | 4547       | 5229 | 4564                         | 5244                         | 5450       | 6063 | 5452                         | 6063                         | 9063                                    | 10108 | 9525                                    | 10804 |
| 1945 | 4316       | 4738 | 4317                         | 4742                         | 4818       | 5381 | 4820                         | 5381                         | 8195                                    | 9041  | 8603                                    | 9709  |
| 1946 | 4272       | 4625 | 4275                         | 4624                         | 5152       | 5532 | 5152                         | 5532                         | 8506                                    | 9259  | 8967                                    | 9830  |
| 1947 | 4063       | 4617 | 4079                         | 4619                         | 5380       | 5884 | 5381                         | 5884                         | 8683                                    | 9086  | 9158                                    | 9830  |
| 1948 | 4276       | 4625 | 4275                         | 4624                         | 5193       | 5432 | 5197                         | 5439                         | 10097                                   | 10807 | 10691                                   | 11624 |
| 1949 | 4761       | 5356 | 4762                         | 5357                         | 5631       | 6250 | 5631                         | 6251                         | 9423                                    | 10429 | 9878                                    | 11487 |
| 1950 | 4768       | 5484 | 4766                         | 5485                         | 5731       | 6381 | 5736                         | 6382                         | 9614                                    | 10523 | 10052                                   | 11194 |
| 1951 | 4883       | 5451 | 4883                         | 5452                         | 5762       | 6329 | 5763                         | 6337                         | 9592                                    | 10436 | 10173                                   | 11344 |
| 1952 | 4820       | 5561 | 4828                         | 5520                         | 5783       | 6461 | 5762                         | 6468                         | 9620                                    | 10643 | 10123                                   | 11383 |
| 1953 | 4893       | 5242 | 4891                         | 5243                         | 5569       | 6145 | 5568                         | 6145                         | 9360                                    | 10155 | 9782                                    | 10875 |
| 1954 | 5217       | 5804 | 5226                         | 5809                         | 6283       | 6811 | 6283                         | 6811                         | 10336                                   | 11294 | 10927                                   | 12072 |
| 1955 | 3947       | 4384 | 3956                         | 4389                         | 4743       | 5030 | 4742                         | 5036                         | 8058                                    | 8486  | 8453                                    | 9104  |
| 1956 | 4920       | 5512 | 4926                         | 5504                         | 5873       | 6354 | 5874                         | 6355                         | 9307                                    | 10586 | 10510                                   | 11430 |
| 1957 | 4820       | 5398 | 4820                         | 5394                         | 5420       | 6226 | 5429                         | 6226                         | 10152                                   | 11436 | 9793                                    | 11352 |
| 1958 | 5050       | 5657 | 5058                         | 5652                         | 6104       | 6876 | 6106                         | 6880                         | 9357                                    | 10362 | 10767                                   | 12349 |
| 1959 | 4614       | 5217 | 4614                         | 5213                         | 5506       | 6153 | 5507                         | 6156                         | 8574                                    | 9363  | 9866                                    | 11109 |
| 1960 | 5027       | 5579 | 5025                         | 5584                         | 5958       | 6470 | 5959                         | 6477                         | 10073                                   | 10993 | 10638                                   | 11702 |
| 1961 | 5130       | 5791 | 5130                         | 5795                         | 6242       | 6792 | 6250                         | 6791                         | 10308                                   | 11209 | 10953                                   | 12107 |
| 1962 | 4843       | 5305 | 4843                         | 5301                         | 5802       | 6167 | 5809                         | 6164                         | 9751                                    | 10293 | 10299                                   | 11064 |
| 1963 | 3884       | 4383 | 3890                         | 4385                         | 4673       | 5182 | 4679                         | 5185                         | 7919                                    | 8756  | 8403                                    | 9479  |
| 1964 | 5235       | 5853 | 5236                         | 5853                         | 6349       | 6885 | 6356                         | 6887                         | 10592                                   | 11404 | 11174                                   | 12206 |
| 1965 | 4627       | 5061 | 4623                         | 5063                         | 5683       | 6063 | 5686                         | 6065                         | 9403                                    | 10024 | 9901                                    | 10776 |
| 1966 | 4416       | 4902 | 4413                         | 4903                         | 5259       | 5818 | 5259                         | 5815                         | 8749                                    | 9497  | 9269                                    | 10203 |
| 1967 | 4319       | 4915 | 4322                         | 4915                         | 5349       | 5840 | 5351                         | 5842                         | 8654                                    | 9356  | 9025                                    | 10167 |
| 1968 | 4147       | 4840 | 4143                         | 4842                         | 4973       | 5729 | 4975                         | 5723                         | 8162                                    | 9270  | 8558                                    | 9833  |
| 1969 | 4745       | 5283 | 4745                         | 5284                         | 5676       | 6170 | 5679                         | 6170                         | 9442                                    | 10202 | 9927                                    | 10956 |
| 1970 | 4020       | 4608 | 4020                         | 4610                         | 4915       | 5456 | 4915                         | 5457                         | 8125                                    | 8942  | 8549                                    | 9597  |
| 1971 | 4676       | 5274 | 4680                         | 5275                         | 5455       | 6145 | 5458                         | 6143                         | 9170                                    | 10202 | 9654                                    | 10923 |
| 1972 | 4073       | 4576 | 4075                         | 4576                         | 4876       | 5448 | 4876                         | 5448                         | 7906                                    | 8619  | 8303                                    | 9290  |
| 1973 | 4267       | 4932 | 4271                         | 4933                         | 5451       | 5849 | 5451                         | 5849                         | 8567                                    | 9519  | 9018                                    | 10215 |
| 1974 | 4486       | 5062 | 4486                         | 5062                         | 5457       | 6063 | 5457                         | 6063                         | 9203                                    | 10046 | 9755                                    | 10872 |
| 1975 | 4528       | 4980 | 4528                         | 4980                         | 5268       | 5810 | 5268                         | 5810                         | 8905                                    | 9728  | 9293                                    | 10482 |
| 1976 | 4752       | 5143 | 4751                         | 5143                         | 5649       | 6021 | 5649                         | 6021                         | 9254                                    | 9836  | 9728                                    | 10564 |
| 1977 | 4561       | 5202 | 4561                         | 5202                         | 5378       | 6091 | 5379                         | 6091                         | 8593                                    | 9713  | 8964                                    | 10407 |



|           |       |       |       |       |       |       |       |       |        |        |        |        |
|-----------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
| 1981      | 47157 | 54136 | 47161 | 54136 | 57240 | 63039 | 57243 | 63039 | 94616  | 104180 | 100360 | 112156 |
| 1982      | 43713 | 48975 | 44761 | 48975 | 52489 | 57341 | 53877 | 57843 | 86939  | 94363  | 90823  | 100824 |
| 1983      | 42562 | 49151 | 44297 | 49153 | 50436 | 57290 | 52763 | 57292 | 85654  | 95540  | 89882  | 102799 |
| 1984      | 45579 | 51260 | 46578 | 51366 | 53285 | 58993 | 54519 | 59096 | 91652  | 99839  | 96008  | 106871 |
| 1985      | 43946 | 52102 | 47144 | 52482 | 51291 | 59921 | 55707 | 60451 | 86067  | 99176  | 90387  | 106315 |
| 1986      | 35080 | 42159 | 38520 | 43040 | 42346 | 49933 | 47049 | 51077 | 71585  | 83303  | 75252  | 89820  |
| 1987      | 42583 | 50896 | 48636 | 51754 | 55456 | 59959 | 59423 | 61134 | 87218  | 97025  | 92477  | 104604 |
| 1988      | 47551 | 56530 | 49701 | 56531 | 58102 | 67505 | 60974 | 67506 | 87040  | 101014 | 92866  | 109657 |
| 1989      | 43764 | 51161 | 46639 | 51358 | 53197 | 60103 | 57108 | 60904 | 94768  | 109980 | 101186 | 118863 |
| 1990      | 48796 | 52239 | 51358 | 53364 | 58924 | 61314 | 62833 | 62833 | 88734  | 99719  | 94086  | 107365 |
| 1991      | 45943 | 49994 | 50318 | 53039 | 56232 | 59009 | 62282 | 63151 | 97807  | 102426 | 103657 | 110493 |
| 1992      | 46881 | 50575 | 49697 | 52041 | 56399 | 59214 | 60415 | 61179 | 90088  | 94959  | 95590  | 102343 |
| 1993      | 50797 | 57980 | 52297 | 58008 | 60761 | 66934 | 62833 | 66972 | 92366  | 98573  | 98209  | 106179 |
| 1994      | 46981 | 50923 | 51515 | 53724 | 56582 | 59548 | 62805 | 63309 | 100339 | 111799 | 105862 | 120030 |
| 1995      | 49739 | 57241 | 53045 | 57706 | 59013 | 66598 | 63481 | 67186 | 95100  | 100757 | 99353  | 107403 |
| 1996      | 40087 | 45191 | 43689 | 47024 | 48620 | 52886 | 53563 | 55330 | 89193  | 111431 | 103108 | 119432 |
| 1997      | 37352 | 43446 | 43745 | 47418 | 53737 | 59546 | 62894 | 64822 | 83923  | 90864  | 87798  | 97105  |
| 1998      | 52883 | 61190 | 55215 | 61257 | 48791 | 52715 | 55415 | 58003 | 92118  | 101556 | 96438  | 108771 |
| 2000      | 51208 | 57169 | 53928 | 57570 | 62914 | 70781 | 66049 | 70873 | 81041  | 90435  | 85819  | 97511  |
| 2001      | 50414 | 59723 | 54328 | 60216 | 62633 | 67516 | 66356 | 68065 | 104157 | 117069 | 109964 | 125734 |
| 2002      | 51174 | 56105 | 51250 | 56116 | 59244 | 68172 | 64592 | 68827 | 102522 | 111990 | 108528 | 120544 |
| 2003      |       |       |       |       | 61571 | 67710 | 61676 | 67728 | 97583  | 112111 | 102459 | 118702 |
| Averages: |       |       |       |       |       |       |       |       | 102310 | 113073 | 108213 | 121603 |
| 1929-2003 | 44971 | 51132 | 45844 | 51435 | 53903 | 59917 | 55091 | 60323 | 90116  | 99688  | 94873  | 107054 |
| 1929-1981 | 44612 | 50694 | 44623 | 50698 | 53409 | 59443 | 53422 | 59449 | 89451  | 98877  | 94104  | 106153 |
| 1982-2003 | 45837 | 52188 | 48784 | 53209 | 55095 | 61061 | 59110 | 62428 | 91718  | 101641 | 96727  | 109226 |
| Acres:    | 26066 | 26066 | 26066 | 26066 | 26066 | 26066 | 26066 | 26066 | 45565  | 45565  | 45565  | 45565  |
| CIR:      |       |       |       |       |       |       |       |       |        |        |        |        |
| 1929-2003 | 1.73  | 1.96  | 1.76  | 1.97  | 2.07  | 2.30  | 2.11  | 2.31  | 1.98   | 2.19   | 2.08   | 2.35   |
| 1929-1981 | 1.71  | 1.94  | 1.71  | 1.94  | 2.05  | 2.28  | 2.05  | 2.28  | 1.96   | 2.17   | 2.07   | 2.33   |
| 1982-2003 | 1.76  | 2.00  | 1.87  | 2.04  | 2.11  | 2.34  | 2.27  | 2.40  | 2.01   | 2.23   | 2.12   | 2.40   |

↑ (A) ↑ (B) ← differences caused by change in distribution of acres between irrigated areas →

- 1/ Non-Indian, excludes Chaco drainage & Hammond Project.
- 2/ Baseline excludes extra Jacuilla historic use rights, includes full Hammond Project; Settlement includes dryback & Fruitland project full acres; Chaco drainage excluded.
- 3/ Alpha yield function applied beginning 1982 w/ reported variable yields.

Bloomfield: 1.84  
Shiprock: —  
2.25 2.17 2.05 2.17  
2.10 2.34 2.07 2.34  
2.25 2.50  
2.10 2.45



CHANGES TO THE DEPLETION SCHEDULE SINCE DECEMBER 2003  
AND  
COMPARISON OF DEPLETIONS FROM THE  
SAN JUAN RIVER STREAM SYSTEM IN NEW MEXICO BETWEEN THE  
INTERSTATE STREAM COMMISSION'S DEPLETION SCHEDULE AND THE  
BUREAU OF RECLAMATION'S BASELINE DEPLETIONS USED IN THE DRAFT  
ENVIRONMENTAL IMPACT STATEMENT ON NAVAJO DAM OPERATIONS

This appendix describes the changes made to the Interstate Stream Commission's draft schedules of anticipated depletions from the Upper Colorado River Basin in New Mexico prepared in connection with the proposed San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement, and compares the depletions in the Interstate Stream Commission's depletion schedule with the Bureau of Reclamation's baseline depletions for the San Juan River Basin in New Mexico used for federal water project planning and environmental compliance activities under the Endangered Species Act and the National Environmental Policy Act. The table attached to this appendix is a tabulation for comparison purposes of both the State of New Mexico's anticipated average annual depletions under 2060 conditions and Reclamation's environmental baseline depletions used in its San Juan River Basin hydrology model for evaluating the Preferred Alternative in the September 2002 Draft Environmental Impact Statement for Navajo Dam Operations.

Depletion Schedule

The Upper Colorado River Commission from time to time has approved for planning purposes schedules of anticipated depletions in the Upper Basin for each of the States of the Upper Division. Thomas Turney, past State Engineer, via letter dated February 19, 2002, transmitted to the Bureau of Reclamation a revised schedule of anticipated depletions for New Mexico that indicates that sufficient water is reasonably likely to be available under the apportionments made by the Upper Colorado River Basin Compact for the Navajo Nation's uses in New Mexico under the Navajo-Gallup Water Supply Project. The Interstate Stream Commission staff has prepared an updated schedule of anticipated Upper Basin depletions in New Mexico that incorporates minor adjustments to reflect the proposed San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement (see Memorandum from John Whipple to Philip Mutz on Revised Upper Colorado River Basin Depletion Schedule for New Mexico, dated December 10, 2004). The updated depletion schedule includes the full amount of depletion planned for the Navajo-Gallup Water Supply Project and 2,000 acre-feet of potential depletions for other reserved municipal and industrial rights proposed for the Navajo Nation in the Settlement Agreement.

The December 10, 2004, Revised Draft depletion schedule also incorporates the following adjustments to reflect responses to public comments on the proposed Settlement Agreement, information recently made available, and changes in the draft Settlement Agreement made after December 5, 2003:

1. The Fruitland-Cambridge Irrigation Project depletion in 2060 was reduced by 300 acre-feet per year to fully reflect 5 percent fallowing of the water right acreage proposed by the Settlement Agreement.
2. The municipal and domestic depletions in 1990 were increased by 800 acre-feet per year to reflect Office of the State Engineer depletion estimates for 1990. Both the irrigation depletions and the municipal and domestic depletions for 2060 were kept the same as those for 1990 because it was not necessary for purposes of the depletion schedule to speculate as to the rate of conversion over time of irrigation rights and associated depletions, including under the City of Farmington's "trust" rights, to municipal uses. The total depletion amount for the San Juan River Basin in New Mexico is the same regardless of transfers of irrigation rights to municipal uses.
3. The scattered rural domestic depletions in 1990 were decreased by 400 acre-feet per year to reflect Office of the State Engineer depletion estimates for 1990. The net change in combined municipal and domestic depletions was an increase of 400 acre-feet per year and to some extent reflects current servicing of once-rural areas with municipal water supplies.
4. The depletion associated with the completion of the Navajo Indian Irrigation Project was increased by 2,500 acre-feet per year to reflect an increase in the proposed depletion right for the Project from 267,000 acre-feet per year to 270,000 acre-feet per year. The 1999 Biological Assessment for the Project includes a long-term average depletion of 270,000 acre-feet per year. The assumption that 5 percent of the Project acreage, on average, would be fallow in any year was not changed.
5. The Fruitland/Hogback rehabilitation depletion in 2060 was increased by 200 acre-feet per year to reflect 5 percent fallowing of the Hogback-Cudei Irrigation Project water right acreage proposed by the Settlement Agreement. The net change in combined Fruitland and Hogback project depletions after rehabilitation was a decrease of 100 acre-feet per year.
6. The Navajo Nation exportation to outside the San Juan River Basin under the Navajo-Gallup Water Supply Project in 2060 was increased to include 1,200 acre-feet per year of export to the Rio Grande Basin that had erroneously been omitted from the December 5, 2003, draft depletion schedule.
7. A depletion of 300 acre-feet per year was added to the depletion schedule to reflect existing diversions by the Navajo Nation for reclamation of mineral processing sites near Shiprock.
8. Navajo Reservoir evaporation was increased by 1,200 acre-feet per year to 27,700 acre-feet per year based on the September 2004 Biological Assessment for the

Navajo-Gallup Water Supply Project that factors in both the Project demand and operation of Navajo Dam in accordance with the Preferred Alternative described in the September 2002 Draft Environmental Impact Statement on Navajo Dam Operations. The average annual reservoir evaporation may be further refined when the period of record for the hydrologic modeling is extended to include 1994-2004, and also if the flow recommendations for endangered fish habitat in the San Juan River are modified.

9. The depletion by the San Juan-Chama Project was decreased by 2,300 acre-feet per year to 105,200 acre-feet per year based on the average annual diversion by the Project with the period of hydrologic record extended to include 1994-2000. The Bureau of Reclamation recently extended the period of record through 2000 in an updated version of the San Juan River Basin hydrology model that is anticipated to be available for use in 2005. The long-term average annual depletion by the Project would be reduced further by about another 2,100 acre-feet per year to 103,100 acre-feet per year if the period of record is extended to include 2001-2004 due to the extremely poor water supply available at the points of diversion in 2002 and below average water supply availability in 2003 and 2004; however, more favorable hydrologic conditions in the future could result in a subsequent increase in the long-term average depletion for the Project.

#### Baseline Depletions

The Bureau of Reclamation has developed a hydrologic model of the San Juan River Basin for use in environmental compliance activities associated with the planning and operation of federal water development projects, including Navajo Dam and Reservoir and the Navajo-Gallup Water Supply Project. The modeling forms the basis for Reclamation to consult with the US Fish and Wildlife Service under Section 7 of the Endangered Species Act regarding the potential for a proposed federal action to affect San Juan River populations of Colorado pikeminnow and razorback sucker or their critical habitat. The hydrology model used by Reclamation has been used to complete Section 7 consultation under the Act for the Navajo Indian Irrigation Project, the Animas-La Plata Project and other projects in the San Juan River Basin.

Section 7 consultations are between the federal action agency and the Fish and Wildlife Service. The Service as part of a Section 7 consultation also may consult with Indian tribes in recognition of the Secretary of the Interior's trust responsibilities to the tribes, and the federal action agency may consult with a project sponsor. Neither the Service nor Reclamation is required to consult with the States as part of the Section 7 consultation process. Although Reclamation now receives input on aspects of the hydrology model from the Hydrology Committee of the San Juan River Basin Recovery Implementation Program in which New Mexico participates, the federal action agencies do not consult with the Hydrology Committee regarding depletion amounts being consulted on for proposed federal projects.

The State of New Mexico for several years has raised concerns regarding the hydrology model used for evaluating flow recommendations to provide for endangered fish habitat in the San Juan River and evaluating impacts of federal water development and water management activities in the San Juan River Basin on the flow recommendations. Included in the concerns raised by New Mexico are the depletion amounts that comprise the environmental baseline. The Bureau of Reclamation includes in the baseline depletions the depletion amounts that the Fish and Wildlife Service has accepted in previously completed Section 7 consultations. Because of New Mexico's concerns, the Coordination Committee of the Recovery Implementation Program adopted the following disclaimer relating to the model used by Reclamation (see the San Juan River Basin Recovery Implementation Program Recommendation for Hydrology Committee, Final Document dated June 20, 2001, fourth page):

"While every effort will be made to incorporate the best data and modeling available into the San Juan Basin Model, use of the hydrologic model in the work of this Committee and this Implementation Program does not necessarily constitute agreement or approval by individual program participants with the Model data, methodologies or assumptions. The model data, methodologies and assumptions do not under any circumstances constitute evidence of actual water use, water rights or water availability under compact apportionments and should not be construed as binding on any party. Furthermore, use of the model, model data, methodologies and assumptions does not change the responsibilities of the respective states to maintain records of water rights and water use. Official records of water rights and water use are maintained by the State agencies statutorily charged with that responsibility."

In response to the model disclaimer adopted by the Coordination Committee of the Recovery Implementation Program, and in response to the State of New Mexico's repeated statements of concerns regarding inconsistencies in depletion calculations and other issues relating to the baseline depletions, Reclamation included explanatory disclaimers to these effects in the September 2002 Draft Environmental Impact Statement on Navajo Dam Operations (Volume II, Appendix C, Hydrologic Modeling Analysis, Table 1, footnotes 1-3). The following is a list of substantive issues regarding the baseline depletions for the Preferred Alternative in the Draft Environmental Impact Statement (the baseline depletions in the table attached to this appendix are from Volume II, Appendix C, Table 1, second column under the heading 250/5000 Alternative):

1. The Navajo Indian Irrigation Project (NIIP) baseline depletion used in the San Juan River Basin hydrology model totals 280,600 acre-feet per year, and includes depletions of San Juan River flows caused by buildup of groundwater storage underneath Project lands. This amount of depletion was derived by consultants to the Bureau of Indian Affairs and used in its Section 7 consultation with the Fish and Wildlife Service on completion of the NIIP. The Draft Environmental Impact Statement (EIS) at Volume II, Appendix C, Table 1, footnote 4, provides an explanation that once buildup of the groundwater storage underneath Project lands occurs and equilibrium conditions are established for return flows to the river, the

average annual NIIP depletion would be 270,000 acre-feet per year. The June 1999 Navajo Indian Irrigation Project Biological Assessment prepared for the Bureau of Indian Affairs at page 40, Figure 9, suggests that equilibrium conditions would be nearly reached by about 2060. Nevertheless, the Draft EIS includes in the baseline a Project depletion of 280,600 acre-feet per year in consideration of the completed Section 7 consultation on the NIIP. The environmental baseline as per Fish and Wildlife Service regulations includes the past and present impacts of all federal, state and private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal Section 7 consultation, and the impact of state or private actions contemporaneous with the consultation process.

Under the proposed San Juan River Basin in New Mexico Navajo Nation Water Rights Settlement Agreement, the Navajo Nation would have a right to deplete up to 270,000 acre-feet per year on the NIIP, including any and all depletions of San Juan River flows caused by buildup of groundwater storage underneath Project lands. Consequently, the Navajo Nation would have to schedule bringing lands into irrigation so as not to exceed a total depletion of 270,000 acre-feet per year. Use of full water right or project amounts in the environmental baseline for specific projects or uses that have completed Section 7 consultation, or consulting with the Service on the use of full water right or project amounts for specific projects, is conservative for evaluating potential impacts of proposed federal water development or water management activities on endangered species or their critical habitat. It is overly conservative, however, for evaluating anticipated future uses in consideration of actual farm management and water use practices. The depletion schedule assumes that 5 percent of the NIIP acreage, on average, would be fallow in any year, which is a reasonable assumption for planning purposes consistent with past fallowing and conservation acreage practices within already completed areas of the Project. New Mexico would not be able to fully utilize its Upper Colorado River Basin Compact apportionment if it based its irrigation depletions on the full amounts of water rights and did not consider actual acreage irrigated and fallow acreage in its water development and use planning.

2. The NIIP baseline depletion of 280,600 acre-feet per year in the Draft EIS includes a "transfer" of 16,400 acre-feet per year of depletions from the environmental baseline depletions for the Hogback and Fruitland irrigation projects that were used by the Bureau of Reclamation and the Fish and Wildlife Service in the Section 7 consultation for the Animas-La Plata Project in 1991 (see the 1991 Biological Opinion for the Animas-La Plata Project). The 1991 Biological Opinion used depletion amounts of 30,700 acre-feet per year for the Hogback Irrigation Project, 7,000 acre-feet per year for the Fruitland Irrigation Project, and 10,000 acre-feet per year for the Hogback Extension. However, Philip Mutz, Upper Colorado River Commissioner for New Mexico, via memoranda dated January 21, 1993, and February 11, 1993, on the subject of

Section 7 consultation for Blocks 7 and 8 of the NIIP reviewed the 1991 Biological Opinion data and found that the 10,000 acre-feet per year depletion amount for the Hogback Extension was already included within the 30,700 acre-feet per year depletion amount for the Hogback Irrigation Project. The memoranda also found that the total depletion for the Hogback and Fruitland irrigation projects, including the Hogback Extension, would amount to about 37,000 to 37,200 acre-feet per year at most.

The "transfer" of 16,400 acre-feet per year of baseline depletions from the Hogback and Fruitland projects to the NIIP occurred as part of the Section 7 consultation process on the NIIP and is not a water rights transfer. Pursuant to the Biological Opinion on the NIIP, the Navajo Nation simply agreed to not deplete more than 20,900 acre-feet per year on the Hogback, Fruitland and Cudei projects so as to offset the depletion impacts on endangered fish habitat in the San Juan River that otherwise might result from completion of the NIIP. The "transfer" constitutes an agreement between the Navajo Nation and the Fish and Wildlife Service for such period of time until the Navajo Nation consults with the Service on the biological impacts of increasing the depletions on the Hogback-Cudei and Fruitland-Cambridge irrigation projects above 20,900 acre-feet per year in the aggregate. The baseline depletions used in the Draft EIS on Navajo Dam Operations and in the hydrologic modeling therefore did not include any depletion amount for Fruitland and Hogback projects rehabilitation. Under the proposed Settlement Agreement, the depletion rights for the Fruitland-Cambridge and Hogback-Cudei irrigation projects would amount to 29,250 acre-feet per year in the aggregate (see Appendix 1 to the proposed Settlement Agreement, subparagraphs 3(e) and 3(f)). The depletion schedule assumes that 5 percent of the Fruitland and Hogback project acreage, on average, would be fallow in any year.

3. The non-Navajo irrigation baseline depletions used in the Draft EIS and in the hydrologic modeling total 81,510 acre-feet per year. The Bureau of Reclamation in computing the non-Navajo irrigation baseline depletions used the SCS modified Blaney-Criddle methodology, which depending on the crop patterns tends to yield annual crop consumptive use estimates that are greater than annual crop consumptive use estimates obtained using the original Blaney-Criddle methodology. The use of monthly crop coefficients in the modified Blaney-Criddle method allows Reclamation to obtain monthly distributions of crop consumptive use for modeling purposes, as compared to the use of seasonal crop coefficients in the original Blaney-Criddle method. However, empirical crop coefficients for the original Blaney-Criddle method were calibrated in New Mexico to irrigation practices existing in New Mexico, including in the San Juan River Basin; whereas, empirical crop coefficients for the modified Blaney-Criddle method were not calibrated to New Mexico conditions. The State of New Mexico believes that annual irrigation consumptive uses in the Colorado River Basin in New Mexico must be computed using the original Blaney-Criddle methodology for this and other reasons, and the irrigation depletions included in the Interstate

*Also consistent with the original Blaney-Criddle method - State of New Mexico  
Approved by the UCRRC in 1965  
Schubert  
Drel  
Consistent with the original Blaney-Criddle method - State of New Mexico  
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Stream Commission's depletion schedule are based on the original Blaney-Criddle method.

Representatives of the Bureau of Reclamation and the Bureau of Indian Affairs who are performing the modeling work on and with the San Juan River Basin hydrology model committed to use in the third generation of the hydrology model the original Blaney-Criddle methodology to compute irrigation depletions in New Mexico for all irrigation uses other than the NIIP (see the March 26, 2002, Meeting Summary of the San Juan River Basin Recovery Implementation Program Hydrology Committee, page 2, second paragraph). The development of the third generation of the San Juan River Basin hydrology model is expected to be completed in 2005, and the Hydrology Committee of the Recovery Implementation Program at its September 15, 2004, meeting requested the modelers for the Bureau of Reclamation to incorporate the original Blaney-Criddle method into the third generation model as previously committed. Dave King of Reclamation via email dated September 22, 2004, referred to the Hydrology Committee direction on this matter and confirmed Reclamation's plan to incorporate use of the original Blaney-Criddle method in the hydrology model. Nevertheless, the hydrologic modeling analysis in the Draft EIS on Navajo Dam Operations relied on the use of the second generation hydrology model for the San Juan River Basin, which does not incorporate the original Blaney-Criddle method.

4. The La Plata River drainage irrigation baseline depletion in the Draft EIS and used in the hydrologic modeling of 9,740 acre-feet per year does not take into account the chronic water shortages that plague the La Plata River irrigators every summer and fall. The La Plata River drainage faces south, and the snowmelt runoff season on the La Plata River consequently is of short duration. An overall shortage of 30-60 percent for irrigation uses in the drainage over the course of an irrigation season is common. Shortages must be accounted for irrigation uses from the La Plata River, and the depletion schedule accounts for the shortages.
5. Pursuant to request of the Coordination Committee of the San Juan River Basin Recovery Implementation Program, the Fish and Wildlife Service issued two biological opinions to permit expedited Endangered Species Act consultations on minor depletions in the Basin. Minor depletions are those less than about 100 acre-feet per year whose impacts on endangered fish habitat cannot be measured individually but may be significant collectively. For this reason, two minor depletion allowances totaling 4,500 acre-feet per year in the aggregate have been incorporated into the baseline depletions for purposes of evaluating endangered fish flow recommendations and impacts of water development on the flow recommendations. Minor depletions that are included within the minor depletions allowances are those for which Section 7 consultations have been completed.

The Draft EIS on Navajo Dam Operations and the hydrology model assume that the full amount of minor depletions occurs within the State of New Mexico

because the depletions that make up the minor depletions account are not fully specified as of yet and may change over time, and because placement of the impact of the minor depletions within or near the reach of critical habitat is conservative for the purpose of evaluating impacts to populations of endangered fish species in the San Juan River. The fact of the matter, however, is that only 136 acre-feet of depletion currently included in the minor depletions allowances is associated with uses in New Mexico that are not already included also in the other specified depletions in New Mexico, and these uses are made pursuant to short-term water supply contracts (see John Whipple's November 19, 2004, letter to Pat Page). The other New Mexico depletions in the minor depletions allowances are continuations of pre-1991 uses that were already included in the environmental baseline of the 1991 Biological Opinion for the Animas-La Plata Project or are included also in the current Navajo-Gallup Water Supply Project consultation, and thus double-count uses in New Mexico that are included in other specified depletion amounts. The remainder of the minor depletions that have been included within the minor depletions allowances to date occurs almost exclusively within the State of Colorado. In accordance with the Upper Colorado River Basin Compact, the consumptive use of water is charged against the Compact apportionment of the state in which the use is made.

6. The baseline depletion for the San Juan-Chama Project in the Draft EIS and the San Juan River Basin hydrology model is 107,500 acre-feet per year based on the hydrologic record through 1993. The Bureau of Reclamation staff working on the upgrade of the hydrology model recently estimated that the long-term average annual depletion by the San Juan-Chama Project is 105,200 acre-feet per year based on adding more recent hydrology for the period 1994-2000 to the hydrologic record.
7. The Draft EIS and the hydrology model do not include in the baseline any potential depletions for the Navajo-Gallup Water Supply Project or other Navajo Nation municipal and domestic uses. <sup>except for 450 acre-feet for NM food processing purposes at a proposed fence factory plant this would be supplied with water under the NW rights for the NGWS.</sup> The environmental baseline does not include potential federal water development projects for which Section 7 consultation has not been completed. The Bureau of Reclamation in September 2004 requested the Fish and Wildlife Service to begin formal Section 7 consultation on the Navajo-Gallup Water Supply Project.
8. The Draft EIS, Volume I, at table III-3 reports that the environmental baseline of depletions considered in Endangered Species Act Section 7 consultations includes existing Navajo Nation uses in the amount of 1,400 acre-feet of depletion for the Shiprock helium plant and 1,200 acre-feet of depletion under two licenses originally acquired by Kerr-McGee for uranium ore processing purposes. The US Department of the Interior under State Engineer File No. 2472 appropriated about 1,448 acre-feet per year with a 1944 priority for use at the Navajo Helium Plant at Shiprock, and uses at the helium plant peaked during World War II. The plant has been dismantled. Kerr-McGee Oil Industries under State Engineer File No. 2807 appropriated 500 acre-feet per year with a 1954 priority and under State

Engineer File No. 2875 appropriated 700 acre-feet per year with a 1957 priority for use in uranium ore processing near Shiprock. Changes of ownership for the licenses originally issued to Kerr-McGee were filed in the name of the Navajo Nation in 1976. The Kerr-McGee operations reportedly were ongoing until the mid 1980s, and small amounts of diversion from alluvial wells in the San Juan River floodplain are now used for site reclamation purposes. The Office of the State Engineer has no records of water use under the three licenses.

However, note 1 to table III-3 also states that the depletions in the table are not the same as the baseline depletions derived for the Draft EIS. It is not clear how the uses under New Mexico State Engineer File Nos. 2472, 2807 and 2875 were considered in the environmental baseline, but the baseline depletions used in the San Juan River Basin hydrology model and the modeling of the Draft EIS do not include any depletions under File Nos. 2472, 2807 or 2875. The licenses pursuant to File Nos. 2472, 2807 and 2875 would be cancelled under the proposed Settlement Agreement.

#### Compact Apportionment

The Upper Colorado River Basin Compact apportions to the Upper Basin States the yield available to them under the apportionment of water to the Upper Basin by Article III of the Colorado River Compact. The Upper Colorado River Commission does not object for planning purposes to the Bureau of Reclamation's Hydrologic Determination approved in 1989 by the Secretary of the Interior that the yield available to the Upper Basin States is at least 6.0 million acre-feet annually as measured at Lee Ferry. However, the Upper Colorado River Commission does not agree with the assumption used in the Hydrologic Determination that the deficiency in deliveries of water to Mexico would require a release from Lake Powell of one-half of the total Mexican Treaty obligation. Assuming less or no deficiency, the yield available to the Upper Basin States would exceed 6.0 million acre-feet annually. The amount of deficiency has not been determined.

Based on the conservatively low estimate of yield available to the Upper Basin States of at least 6.0 million acre-feet annually, the State of New Mexico's Upper Colorado River Basin Compact Article III(a) apportionment is at least 669,375 acre-feet of consumptive use annually. After accounting for New Mexico's share of Colorado River Storage Project evaporation losses pursuant to Article V of the Upper Colorado River Basin Compact, which share is estimated at about 58,000 acre-feet per year, the amount of apportionment remaining for consumptive uses from the Upper Colorado River Basin to be made within New Mexico is at least about 611,400 acre-feet per year. The schedule of anticipated depletions prepared by the Interstate Stream Commission staff also is conservative in that it includes depletions at the sites of use in New Mexico and does not account for: (a) the water available at sites of use in New Mexico for water salvaged from river losses on the San Juan and Colorado rivers above Lee Ferry that would have occurred without the use in New Mexico; or (b) any reduction in the amounts of depletions for those uses from ephemeral tributaries or ground water that do not fully

impact the flow of the San Juan River. Previous studies prepared for the Upper Colorado River Commission have indicated that salvage by use averages about 4 percent of the at-site depletions by projects in the Upper Basin, and the Bureau of Reclamation in developing long-range operating criteria for the Colorado River also considered salvage by use in the Upper Basin averaging about 4 percent of at-site depletions. Neither the Hydrologic Determination approved by the Secretary nor the Upper Colorado River Commission has yet applied salvage by use. Adjustments for salvage by use and partial flow impacts must be made to account depletions against the apportionment of water made at Lee Ferry.

The schedule of anticipated depletions uses several conservative assumptions because the deficiency in the Mexican Water Treaty deliveries has not been determined and because the Upper Colorado River Commission has yet to make specific findings regarding methodologies to compute irrigation depletions, river flow impacts or salvage by use. Another conservative assumption is that no rights adjudicated by the Echo Ditch Decree would be lost due to forfeiture or abandonment for non-use since 1948, though some rights undoubtedly will be found forfeited or abandoned in the San Juan River Adjudication. For example, the following information from surveys of cropland acreage irrigated in New Mexico from the Animas River, excluding acreage under the Farmers Mutual Ditch, indicate that the acreage irrigated in the Animas River valley has declined since 1965:

| <u>Year</u> | <u>Total Acres</u> | <u>Acres Irrigated</u> | <u>Fallow Acres</u> | <u>Source</u>                 |
|-------------|--------------------|------------------------|---------------------|-------------------------------|
| 1965        | 16,400             | 15,600                 | 800                 | SCS - Comprehensive Framework |
| 1994        | 7,290              | 6,000                  | 1,290               | ISC - field survey            |
| 2000        | 6,620              | 4,980                  | 1,640               | ISC - field survey            |
| 2003        | 6,200              | 5,610                  | 590                 | ISC - field survey            |

The Interstate Stream Commission field surveys of agricultural cropland in 1994, 2000 and 2003 did not include residential yard and garden acreages within city limits or subdivisions that are irrigated from ditches rather than municipal or domestic water supply systems. The State Engineer Hydrographic Survey currently being prepared for the San Juan River Adjudication, not the Interstate Stream Commission's cropland field surveys, will form the basis for water rights determinations in the Adjudication. Nevertheless, the field survey data is indicative of the subdivision and development of cropland for other land uses that has occurred since the early 1960s. The depletion schedule does not speculate on the ultimate disposition of water rights for irrigated croplands that no longer receive irrigation water due to development, that is, whether such rights are abandoned or transferred to different ownership and purpose. The Adjudication will determine the amounts of irrigation water rights owned by the cities or San Juan County and either transferred or reserved for municipal and domestic water uses.

The baseline depletions and the San Juan River Basin hydrology model do not consider compact apportionments of consumptive use to each Upper Basin state or water rights administration in New Mexico. The hydrologic modeling only evaluates whether the

flow recommendations for endangered fish habitat in the San Juan River can be met if certain depletions are placed on the river system and if Navajo Reservoir is operated in a certain manner. Using the baseline depletions provided in the Draft EIS on Navajo Dam Operations for this purpose is conservative towards evaluating potential impacts on endangered fish habitat of proposed water development projects and proposed reservoir management, but does not necessarily reflect actual or anticipated uses of water or actual administration of water rights or compact apportionments.

Anticipated Depletions and Baseline Depletions for the San Juan River Basin in New Mexico  
(Depletions in 1,000 acre-feet per year)

| Depletion category                                     | Anticipated Annual Depletion for 2060 from Depletion Schedule | Baseline Depletion from Draft EIS on Navajo Dam Operations | Notes  |
|--|---|--|--|
| Navajo lands irrigation depletions:                    |   |  |  |
| Navajo Indian Irrigation Project                       | 256.5   | 280.6  | Anticipated depletion assumes 270.0 right, full completion of project, and 5% fallow acreage.  |
| Hogback-Cuddeh Irrigation Project (includes Cuddeh)    | 20.2  | 13.0   | Anticipated depletion assumes 21.3 right, full rehabilitation of project, and 5% fallow acreage.   |
| Fruitland-Cambridge Irrigation Project                 | 7.8   | 7.9  | Anticipated depletion assumes 8.0 right, full rehabilitation of project, and 5% fallow acreage.  |
| Chaco River drainage                                   | 3.1   | 2.8  | Irrigation uses in Chaco River drainage not explicitly modeled in San Juan Basin hydrology model.  |
| Crystal-Whiskey Creek area                             | 0.3   | 0.5  | Irrigation uses in Crystal area not explicitly modeled in San Juan Basin hydrology model.  |
| Subtotal   | 287.7   | 304.8  |  |
| Non-Navajo lands irrigation depletions:                |   |  |  |
| Above Navajo Dam (including private and Jicarilla)     | 1.7   | 2.9  | Anticipated depletions based on original B-C method. Baseline based on modified B-C method. Baseline includes 2.2 for Jicarilla irrigation, but 1.7 is decreed Jicarilla irrigation right.   |
| Animas River drainage                                  | 31.7  | 36.7   |  |
| La Plata River drainage                                | 5.1   | 9.7  | Anticipated depletion accounts typical water supply shortages on La Plata River.   |
| Upper San Juan River area (excluding Hammond)          | 8.2   | 9.1  |  |
| Hammond Project area                                   | 9.2   | 10.3   |  |
| Farmers Mutual Ditch (including Westwater area)        | 8.8   | 9.6  |  |
| Jewett Valley Ditch                                    | 2.8   | 3.1  |  |
| Chaco River drainage                                   | 0.7   | 0.0  | Irrigation uses in Chaco River drainage not explicitly modeled in San Juan Basin hydrology model.  |
| Subtotal   | 68.2  | 81.4   | Baseline total without rounding is 81.5.   |
| Total irrigation depletions in Basin                   | 355.9   | 386.2  | Baseline total without rounding is 386.4.  |
| Non-irrigation depletions:                             |   |  |  |
| Navajo Reservoir evaporation                           | 27.7  | 27.4   | Baseline assumes Preferred Alternative In Draft EIS on Navajo Dam Operations without NGWSP.  |
| BHP-Billiton   | 39.0  | 39.0   |  |
| PNM - Navajo Reservoir water supply contract           | 16.2  | 16.2   | Supplied under subcontract with Jicarilla Apache Nation beginning 2006.  |
| Industrial diversions near Bloomfield                  | 2.6   | 2.5  | Anticipated depletion includes 0.1 for Williams Gas contract.  |
| Municipal & Industrial uses (excluding ALP, NGWSP)     | 9.7   | 8.5  | Does not account transfers from irrigation to municipal uses after 1965.   |
| Animas-La Plata Project                                | 13.6  | 13.6   | Includes NM share of Ridges Basin Reservoir evaporation.   |
| Navajo-Gallup Water Supply Project                     | 29.5  | 0.0  | NGWSP uses in New Mexico: 20.8 for Navajo uses, plus 8.7 supplied through Jicarilla contract.  |
| Scattered domestic uses (including Jicarilla, Navajo)  | 3.8   | 1.4  | Anticipated depletion includes 2.0 of potential Navajo municipal and industrial uses per settlement.   |
| Scattered stock pond evap. and livestock uses          | 4.3   | 2.2  | Baseline assumes the impact on San Juan River flow is 50% of 4.3 total pond evap. and stock use.   |
| Fish & wildlife (includes small reservoir evaporation) | 1.2   | 1.4  | Baseline includes 0.2 at Jackson Refuge, which is included in anticipated La Plata irrig. depletion.   |
| Industrial diversions near Shiprock                    | 0.3   | 0.0  |  |
| Unspecified minor depletions                           | 0.0   | 4.5  | Anticipated depletions in NM included in specified uses. San Juan model includes 4.5 allowance for minor depletions in CO and NM, but only 0.1 short-term use in NM chargeable to allowance. |
| Total non-irrigation depletions in Basin               | 147.9   | 116.7  | <i>Also, 0.1 for Navajo food processing included in NGWSP uses in anticipated depletions</i>   |
| San Juan-Chama Project                                 | 105.2   | 107.5  | Anticipated depletion updated for extension of hydrologic record to include 1994-2000.   |
| Total New Mexico depletions                            | 609.0   | 610.4  | Baseline total without rounding is 610.6.  |

Note: The baseline in the September 2004 Biological Assessment for the Navajo-Gallup Water Supply Project includes also 6,570 acre-feet for the Jicarilla Apache Nation's Navajo River Water Supply Project pursuant to the Biological Opinion previously completed on the latter project. However, the Jicarilla depletions associated with the latter project and some of the other Jicarilla depletions above Navajo Dam would be "transferred" to uses under the Navajo-Gallup Project, including Jicarilla uses and a lease to supply the City of Gallup. The Biological Assessment for the Navajo-Gallup Project includes about 29,500 acre-feet of depletion for the Project in New Mexico in addition to the baseline depletions shown above.



## NOTES

The following is a digest of discussions held during the meeting of the Task Force on Operating Criteria for the Colorado River on August 7, 1969, in Salt Lake City, Utah. Recipients of these notes are requested to edit the material and submit comments on the accuracy of reporting. Enclosed is an attendance list of the August 7 meeting.

Mr. Riter explained that the objective of the August 7 meeting was to obtain the views of the States on the operating criteria. Special emphasis was placed on the desirability of input from all interested parties.

### Item 1. List of Representatives from States in the Task Force

Mr. Riter read the following list of State representatives and asked for a verification of those appointed:

|                                    |                    |
|------------------------------------|--------------------|
| Arizona                            | Wesley E. Steiner  |
| California                         | Myron B. Holburt   |
| Colorado                           | Felix L. Sparks    |
| Nevada                             | Thomas R. Rice     |
| New Mexico                         | S. E. Reynolds     |
| Utah                               | Daniel F. Lawrence |
| Wyoming                            | Floyd A. Bishop    |
| Upper Colorado<br>River Commission | Ival V. Goslin     |

*Riter  
Crawhall  
8/11/69*

The appointment of those listed was verified. It was agreed that any future correspondence with the States would be with the listed representatives and that such representatives would inform all concerned interests within their respective States.

### Item 2. Lake Powell Bank Storage

Mr. Holburt and others requested a justification for using a future incremental bank storage charge of 10 percent of surface storage at Lake Powell. This 10 percent figure was not in agreement with those presented before Congress in 1965 by the Bureau of Reclamation. Also bank storage calculated periodically since the commencement of storage represents values much higher than the presented 10 percent figure.



Mr. Crandall presented the latest Bureau study of estimated bank storage at Lake Powell. The reservoir area is underlain by the impervious Chinle shale formation. Therefore, water enters into bank storage only in the more porous overlying Navajo and other formations. A natural ground-water gradient to the riverbed of 0.0125 has been verified by measurements of observation wells drilled into the Navajo formation. A number of cross sections have been taken of the reservoir to determine the area above the natural ground-water line capable of receiving bank storage. From the data gathered, it is estimated that when Lake Powell is filled bank storage will equal 6.0 million acre-feet. This study will be published as a technical paper in the near future. Mr. Holburt requested to withhold comments until the paper had been reviewed.

Mr. Riter explained the use of the 10 percent of surface storage used for an estimate of bank storage. Storage in Lake Powell when filled to 3700 feet will be approximately 15 million acre-feet above the present level. The present exposure of the reservoir formations to bank storage is at elevation 3580 feet with an estimated 4.5 million acre-feet in bank storage. Therefore, the estimated future bank storage of 1.5 million acre-feet (6.0 million acre-feet total - 4.5 million acre-feet present) is about 10 percent of remaining surface storage to be filled. Mr. Holmes pointed out that the use of a percentage of surface storage gives an erroneous value because the bank storage is related to the area exposed and is better expressed as a quantitative amount. After the reservoir has once filled, it was suggested that the value for bank storage be reduced to zero for study purposes. Thus a more conservative approach would be taken in lieu of the 5 percent of surface storage change after initial filling now used in the proposed operating criteria.

### Item 3. Reservations for Flood Control Storage

In response to questions raised by Mr. Holburt regarding the table on page 20 of the July 25, 1969 statement under the heading "Bibliography of Legal Documents," Mr. Riter explained that the 1,500,000-acre-foot flood control reservation at Lake Mead was a "minimum" reservation; hence, the tabulation on page 20 represents the "maximum amount of active live conservation storage capacity." The distribution among the upper basin reservoirs and Lake Mead of the remaining 3,850,000 acre-feet of vacant flood control capacity required on January 1 each year will be determined from the operation studies. Bureau of Reclamation estimates of future sedimentation in Lake Powell and Lake Mead show the following relationships for maximum active conservation storage capacity:

| Condition                | (million acre-feet) |             |
|--------------------------|---------------------|-------------|
|                          | : Lake Powell       | : Lake Mead |
| Present capacity curve : | 25.00               | 25.88       |
| Estimated by year 2000 : | 22.69               | 24.92       |