

**INDIAN FIRING STUDY COMMISSION  
INTERIM REPORT**

**DRAFT 10-06-05**

**Background**

On December 10, 2004 President Bush signed legislation approving the Arizona Water Settlement Act (Settlement Act) P.L. 108-451, creating greater certainty for water users in Arizona and settling longtime claims to water by the Gila River Indian Community (Community). A key provision within the Settlement Act is the provision for implementing State legislation creating a Firming program for the Community and future Indian water rights settlements. The provision reflects the result of lengthy negotiations between the Arizona Department of Water Resources and the Department of the Interior. The provision authorizes the Secretary of the Interior and the State of Arizona to develop a firming program to ensure that 60,648 acre feet of non-Indian Agricultural priority water made available for re-allocation to Indian tribes shall, for a 100 year period, be delivered during water shortages in the same manner as water with an M&I priority is delivered during water shortages. Because the non-Indian agricultural priority water has the lowest priority on the CAP system, in times of shortage this supply would be reduced or eliminated before M&I and Indian supplies are impacted. Therefore, in the case of reallocating non-Indian agricultural priority water to the Tribes, the parties to the Settlement agreed to increase the reliability (firm) of this block of water in times of shortage on the Colorado River. The importance of this provision is underscored by the clause in the Settlement Act that State legislation be enacted as part of the enforceability conditions to the Settlement.

The Settlements Act further identifies specific firming responsibilities for the Secretary and the State of Arizona. Of the 60,648 acre feet, the Secretary has responsibility for 28,200 acre-feet, as required by the Southern Arizona Water Rights Settlement Act, and the State agreed to firm 15,000 acre-feet toward the Gila River Indian Community (GRIC) settlement. Responsibility for the remaining 17,447 acre-feet, which is to be dedicated for future Indian settlements, was divided equally (8,724 acre-feet each) between the Secretary and the State. Therefore, the State's total responsibility under this program is 23,724 acre-feet.

In the spring of 2005 the Arizona Legislature created the Indian Firming Study Commission to develop the Firming Program for Arizona (Appendix I HB 2728, Section 12) to:

- Review the modeling assumptions that were developed by the Arizona Department of Water Resources to estimate the volume of water needed to meet the firming obligation;
- Assist in the development of options for meeting the firming obligations;
- Identify cost components for each of the firming options;
- Identify funding sources appropriate to finance the options; and
- Identify the necessary changes to statute to meet the obligations.

### **Membership**

In April of 2005, the Director of the Arizona Department of Water Resources appointed the following members to the Study Commission:

Herb Guenther	Arizona Department of Water Resources - Chair
Bill Richardson	Phelps Dodge Corporation
Dennis Rule	Tucson Water
Dave Roberts	Salt River Project
Tom Buschatzke	City of Phoenix
Cecil Antone	Gila River Indian Community
Supervisor David Snider	Pinal County Board of Supervisors
Bill Perry	Central Arizona Project Board of Directors
Larry Dozier	Central Arizona Project
Chuck Cahoy	Arizona a Water Banking Authority
Tim Henley	Arizona Water Banking Authority
Mike Leonard	Roosevelt Water Conservation District
Grant Ward	Maricopa-Stanfield Irrigation & Drainage Dist
Selso Villegas	Tohono O'odham Nation
Senator Jake Flake	Senate (ex officio/non-voting)
Representative Jim Weiers	House of Representatives (ex officio/non-voting)

### **Meetings/Progress to Date**

The Indian Firming Study Commission has held four public meetings at the Arizona Department of Water Resources. Staff has also met with the United States Bureau of Reclamation to review the State's role in assisting the U.S. in meeting its firming obligation as required in the Settlement, the Gila River Indian Community to discuss firming options on tribal lands and possible water supply options available from the Community. Additionally, staff has met with the San Carlos Apache Tribe to discuss possible water supply options available from the Tribe, as well as with water providers in the Phoenix area to discuss recovery and transmission options.

The first public meeting held on May 10, 2005 focused on providing an overview of modeling studies to identify potential shortages to the CAP supply and the estimated firming volume needed to meet the State's firming obligation

(Appendix II). Additionally, staff provided an overview of the water supplies potentially available to meet the obligation (Appendix III) as well as an overview of the Arizona Water Banking Authority's municipal and industrial (M&I) firming program, which is the basis for identifying the firming obligation to the Tribes (Appendix IV). Staff also reviewed the Workplan for the Study Commission, included in Appendix V.

At the second public meeting, held on June 14, 2005, staff provided the estimated total supply of water necessary to meet the firming obligation. The estimated volume is 548,770 acre-feet over the 100-year period. A range of firming volume was also presented, between 400,000 acre-feet and 600,000 acre-feet based on various assumptions for how much water is cut from the Central Arizona Project entitlement, 300,000 acre-feet, 500,000 acre-feet, or 800,000 acre-feet. The range is also based on an assumption of normal mainstream demand or a limited mainstream demand of 1.25 million acre-feet (Appendix VI).

The meeting also focused on identifying possible solution elements for meeting the firming obligation. The Study Commission was asked to identify options, or combination of options, that could be utilized to actually make water available to the Community in times of shortage, based on the estimated volume of water needed for firming. The following issues were identified for consideration in developing the possible solution elements:

- The capability of delivering water to the Community whether it is stored and recovered, or directly delivered for use or storage by the Commission.
- In times of shortage well capacity may be limited for recovery due to the need for increased groundwater pumping.
- Competition for excess supplies will increase over the next ten, twenty, fifty, and even one hundred years. Competition for storage capacity could also increase in the early years.
- How can the firming program be implemented while ensuring that the goals of the Active Management Areas are being met?

The Study Commission was asked to develop specific ideas to put on the table for further review. Staff provided the following general options to begin discussions:

1. Direct or Indirect banking, either inside of outside of the Gila River Indian Community lands
2. Extinguishment of existing long-term storage credits
3. Post-shortage replenishment
4. Groundwater transfers
5. Demand management strategies (e.g., land fallowing in times of shortage)
6. Payment of damages in lieu of delivery

Based on the discussion at this meeting, the Study Commission asked staff to take options 1, 2, 4, and 5, identified above, and further identify cost components, supply availability, legal feasibility, hydrologic feasibility, storage/recovery locations, partnerships, the availability of existing infrastructure and possible funding sources.

The third public meeting held August 16, 2005, focused on three options for meeting the firming obligation (Appendix VII). Staff provided an overview of the three options and identified the issues related to utilizing the options.

- 1) Traditional Arizona Water Banking Authority approach
- 2) Water Banking on Gila River Indian Community and possibly other Indian reservations
- 3) Leases or other monetary payment approaches
- 4) Dry year fallowing bank and/or groundwater importation

The Study Commission was asked which options should be investigated further? Which options should be eliminated from consideration? Should a single recommendation be made or should the recommendation be that the AWBA Board be given discretion to pick and choose from a menu of options in its Plan of Operation? The Study Commission was also asked for comments (Appendix VIII) and staff was asked to continue evaluating all four options based on the comments and provide more information at the next meeting.

The fourth public meeting, held October 11, 2005 focused on staff's recommendations for moving forward with the options and financing of the Firming obligation. Staff recommended that the Commission in developing its final recommendation, consider allowing the Arizona Water Banking Authority specific discretion in developing the firming obligation to use a combination of the recommendations presented to the Commission at its last meeting. (WILL BE UPDATED AFTER THE MEETING ON THE 11<sup>TH</sup>).

### **Next Steps**

To date, staff is continuing to review the options identified at the last public meeting. Staff will continue to refine the options including identifying specific partners for recovery and transmission of water to the Tribes in times of shortage. The Commission will be making recommendations for a preferred approach and staff will draft the Final Report and necessary legislation to be submitted to the Legislature in January 2006.

**APPENDIX I**  
**HOUSE BILL 2728**

Sec. 12. Arizona water firming program study commission

A. The Arizona water firming program study commission is established. The purpose of the commission is to:

1. Study the options for a water firming program that would satisfy the requirements of section 105(b)(2) of the Arizona water settlements act (P.L. 108-451).
2. Identify appropriate mechanisms for the firming of water under the water firming program, including storage and recovery with specification of authorized entities to recover the water and determination of the financial structure for the recovery, as well as forbearance, and other alternative mechanisms.
3. Study the existing powers and duties of the Arizona water banking authority and the general statutory authorities necessary to implement the firming program and to make recommendations regarding appropriate statutory and regulatory provisions that are necessary to fully implement the water firming program.

B. The commission consists of members who are appointed by the director of the department of water resources and who represent at least the following entities:

1. Municipal and industrial priority central Arizona project water users.
2. Agricultural improvement districts established pursuant to title 48, chapter 17, Arizona Revised Statutes.
3. Non-Indian agricultural priority central Arizona project water users.
4. The Gila River Indian community.
5. The Tohono O'odham nation.
6. A multi-county water conservation district established under title 48, chapter 22, Arizona Revised Statutes.
7. The Arizona water banking authority established under title 45, chapter 14, Arizona Revised Statutes.
8. Hardrock mining industries.

C. The director of the department of water resources shall serve as chairperson of the commission. All members appointed by the director shall be knowledgeable in water resource management in this state. The president of the senate and the speaker of the House of Representatives, or their designees, shall serve as nonvoting ex officio members of the commission.

D. The department of water resources shall provide staff support for the commission.

E. The commission shall submit to the legislature an interim report of its activities on or before November 1, 2005 and shall report its final findings and recommendations to the legislature on or before January 6, 2006. The commission

shall provide copies of each report to the secretary of state and the director of the Arizona state library, archives and public records.

Sec. 13. Delayed repeal

Section 12 of this act, establishing the Arizona water firming program study commission, is repealed on June 1, 2006.

Sec. 14. State and tribal cooperation for acquisition of certain land

A. This state recognizes the interest of the Gila River Indian community to acquire and to place into trust status a parcel of land located within the exterior boundaries of the community's reservation. This state, through any of its authorized agencies, in cooperation with the community and on application of the community shall take actions in accordance with Arizona law for the acquisition of the property designated as section 36, township 4 south, range 4 east, Gila and Salt river base and meridian, to include the maximum right, title and interest in that property, including mineral rights as permitted by Arizona law.

B. For purposes of a finding by the secretary of interior or for any other legal requirement, the state and the community agree that this section combined with the enactment of the firming program authorized by this act fully satisfies section 207(c)(1)(E) of the Arizona water settlements act (P.L. 108-451).

Sec. 15. Conditional enactment; written notice

A. Sections 45-611, 45-2423, 45-2425 and 45-2457, Arizona Revised Statutes, as amended by this act, sections 45-2602 and 45-2604, Arizona Revised Statutes, as added by this act, title 45, chapter 15, articles 2, 3 and 6, Arizona Revised Statutes, as added by this act, and title 45, chapter 16, Arizona Revised Statutes, as added by this act, are effective only if on or before December 31, 2010 the United States secretary of interior publishes in the federal register the statements of findings described in sections 207(c)(1) and 302(c) of the Arizona water settlements act (P.L. 108-451).

B. The director of the department of water resources shall promptly provide written notice to the executive director of the Arizona legislative council of the date of publication of the findings or if the condition prescribed in subsection A of this section is not met. The date of publication is the effective date of the conditional enactment.

Sec. 16. Conditional delayed repeal; conditional enactment

A. Title 45, chapter 15, Arizona Revised Statutes, as added by this act, and section 11 of this act, relating to the establishment of the water firming program for Arizona Indian tribes, are repealed if the condition prescribed in section 15 of this act is not met.

B. Section 45-841.01, Arizona Revised Statutes, as amended by section 3 of this act, is effective only if the condition prescribed in section 15 of this act is not met.

**APPENDIX II**  
**COLORADO RIVER MODELING ASSUMPTIONS AND SCENARIOS**  
*From ADWR Colorado River Management*

**ASSUMPTIONS THAT IMPACT DEGREE OF PROJECTED SHORTAGE**

1. Upper Basin Development: This includes both the amount of upper basin depletion and the rate at which the upper basin use increases over time. ADWR studies evaluated a moderate rate of use of 4.8 million acre-feet (used by the AWBA Study Commission for determining M&I Firming requirements) and a high rate of use of 5.2 million acre-feet (used by ADWR's Colorado River Management office for non-AWBA projections). The studies also evaluated a higher rate of use utilized by the Bureau of Reclamation of 5.4 million acre-feet.
2. Colorado River Surplus Strategy: The surplus strategy can be designed to meet different objectives. Surplus can be declared to avoid spills or can be declared to use water stored in Lake Mead to meet excess demands. More conservative strategies minimize the risk of shortage while more liberal strategies increase the risk of shortage. ADWR studies utilize two approaches. The conservative approach assumes a strategy of spill avoidance based upon a presumed inflow from the upper basin of approximately 17million acre-feet (70<sup>th</sup> percentile level of historic runoff), referred to as "70R". A more liberal assumption is based on the Interim Surplus Guidelines (ISG), which allows for a surplus to be declared to use water stored in Lake Mead to allow California to gradually reduce their use to 4.4 million acre-feet by the year 2016.
3. Colorado River Shortage Strategy: Lake Mead can be operated to reduce the probability of lowering the reservoir below some predetermined level called the protection level. The protection level can determine the frequency and amount of Arizona shortages. The standard probability of protection is to protect a lake elevation at a probability of 80%. In other words, if Lake Mead is at the probability protection elevation, there is an 80% chance, based upon all stochastic hydrologic series that the lake level will not drop below the protection level or there is a 20% chance of the elevation dropping below the protection level. For purposes of this evaluation, ADWR studies assume Arizona's users will be reduced from 2.8 to 2.3million acre-feet when the probability protection elevation is reached that will protect Lake Mead elevations to 1000 feet (more liberal - less shortage) which is the elevation of the new Southern Nevada Water Authorities intake, 1050 feet (moderate) which is the elevation of the current intake for the Southern Nevada Water Authority, and 1083 feet (more conservative - more shortage) which is the minimum power elevation.
4. Operation of the Yuma Desalting Plant

Title I of the Colorado River Basin Salinity Control Act (P.L. 93-320, 43 U.S.C. § 1571, June 24, 1974) authorized construction of the Yuma Desalting Plant (YDP) near Yuma, Arizona, to meet the salinity control provisions of Minute No. 242 and to recover saline agricultural drainage water from the Wellton-Mohawk Division of the Gila Project for delivery to Mexico. The Act also authorized construction of a Bypass Drain to transport untreated saline agricultural drainage water and the more saline wastewater (i.e., the reject stream) from the desalting process to the Cienega de Santa Clara in Mexico (Cienega) near the Gulf of California.

Because the Colorado River has had many years of surplus flow available, the YDP operated for only a few months in 1992. With the exception of 1992 the U.S. salinity control obligations to Mexico have been met through the bypass of about 108,000 acre-feet per year<sup>1</sup> of saline agricultural drainage water to the Cienega, without charge against the United States Treaty delivery obligation to Mexico and through selective pumping of the remaining Yuma Area agricultural drainage. Because the drainage water in the bypass drain is not desalted and returned to the river, this method of operation results in the release from Lake Mead of comparable quantities of water, which otherwise would not be needed if the bypassed water was delivered to Mexico as a part of the U.S. Treaty delivery obligation. If this release from Lake Mead continues indefinitely, the declining storage in Colorado River Basin reservoirs could cause additional and/or larger water supply shortages in the future to Colorado River water users in the United States.

For purposes of this analysis, ADWR studied two approaches – first, beginning operation of the YDP in 2004 (reduce the likelihood of shortages occurring earlier) and secondly, delay operation of the YDP until 2030 (increase the likelihood of shortages occurring earlier).

#### **OTHER MODEL ASSUMPTIONS**

1. Hydrology: The model uses an historic hydrology (Usually 1906 through 2002). The start year for hydrology can be modified to for any year in this period to reflect current or expected conditions.
  2. Lower Basin State's Water Demand Schedules: Based on projected demands for each of the Lower Basin State's
  3. Mexican Surplus: If Surplus is declared an additional 200,000 acre-feet is provided to Mexico. If Flood Control Releases are made any excess is delivered to Mexico.
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4. Shortage Sharing between Arizona P4 contractors: CAP will share shortage with the approximately 164,000 acre-feet of diversion contracts along the Colorado River. ADWR studies assume that the consumptive use volume of the River contracts would share shortage with CAP on a proportional basis.
5. Shortage Sharing between CAP M&I and Indian Priority water users: ADWR studies assumed that shortage will be shared as proposed in the compromise agreement between the State and US in the GRIC Settlement.

## **MODELING SCENARIOS**

Taken from the *Arizona Water Banking Authority Indian Firming Technical Committee - Staff Recommendations for Estimated Firming Volume, October 30, 2003*

In order to estimate the volume needed to meet the firming obligations under the Arizona Water Settlement Act, ADWR staff began by analyzing approximately 200 combinations of the CRSSez model variables identified in Table 1. Table 2 describes a few of the combinations used to estimate the water available for delivery to Arizona for the next 100 years. The input variables chosen represented a wide range of possible operational conditions – from the most conservative to the most optimistic – including input parameters that form a reasonable basis for further analysis and decision-making. All of the analyses used January 1, 2003 reservoir levels at Lake Mead and Lake Powell and assumed full utilization by Mexico of its entitlement under the Mexican Water Treaty (1.5 MAF during normal and shortage years and 1.7 MAF during surplus years). The model results using these parameters were then input into the shortage calculation spreadsheet, that assumed a constant normal year annual demand for CAP water of 1.49 million acre-feet for the projection period (2003 to 2103).

**Table 1. CRSSez Model Input Variables and Descriptions**

<b>Input Variable</b>	<b>Description of Input Variable</b>
Hydrology	The model uses a period of historic hydrology that can be selected by the user. The available hydrologic data is 1906-2002. The start year can be any year in this period and any portion(s) of the historic hydrology can be utilized.
Lower Basin Demand Projections	This is a demand schedule developed in 1997 by the ADWR and CAP. ADWR and CAP are currently working on updating the projected consumptive uses for on-river uses and for CAP users. Current runs project full utilization of allocation by the Lower Basin states.
Upper Basin Demand Schedules	This is the total quantity of demand for the Upper Basin starting at the current demand and building up to a specified demand level. Current demand in the Upper Basin is approximately 4.1 MAF. Build-out demands in the Upper Basin have been estimated using current demand, limited Upper Basin build-out at 4.8MAF, and a maximum build-out demand of 5.4 MAF.
Reservoir Elevations	Reservoir elevations are input for the 5 Upper Basin reservoirs and Lakes Mead and Powell. The user can select any reservoir elevation desired as a starting point for projecting, however, current reservoir elevations are typically utilized.
Surplus strategy	The surplus strategy utilized is one that will avoid spills in the system. Due to the Interim Surplus Guidelines (ISG) there are now two options. In both, Lake Mead elevations are used to determine if a spill could occur in that year. If so, a surplus year is declared and extra water can be made available to the Lower Basin States.
Mexico Delivery	Deliveries to Mexico can be set at any level. Most model runs done to date have set Mexican deliveries to 1.5 million acre feet pursuant to the Treaty. Additional water can be identified as delivered to Mexico in times of surplus or flood control releases but is limited to 200 KAF.

<b>Input Variable</b>	<b>Description of Input Variable</b>
Operation of the Yuma Desalination Plant ("Yuma Desalter")	This variable is essentially an "on" or "off" selection. The variable can be turned on at any point within the span of the model run, i.e. begin operation of Yuma Desalter in 2009.
Lake Mead Shortage Protection Elevation	The strategy involves selecting a specific Lake Mead elevation and then protecting against dropping below that elevation. The probability of achieving that protection is also user selected. Values used for this analysis include 915 feet; 1,000 feet; 1,050 feet; and 1,083 feet. Elevation 1,000 and 1,050 feet are the lake elevation of the Southern Nevada Water system intakes. The probability of achieving this protection is then expressed in percentage of occurrence.
Arizona Shortage Delivery	This variable is set based on the total amount of water that will be available to all Arizona Colorado River water users when a shortage declaration is made on the Colorado system. Two values have been modeled for this purpose: 1) delivery of 2.3 MAF to Arizona users during shortages (i.e., 500KAF shortage), and 2) delivery of 2.0 MAF to Arizona users during shortages (i.e., 800KAF shortage). It should be noted that there is not currently an established minimum or maximum volume that may be used by the Bureau in these events and the values that have been used are simply planning numbers.
Lake Mead Minimum Elevation	This variable is an elevation; any value could be input. Two are commonly used in current analyses, (1) 1,000 feet, which is the minimum elevation from which Southern Nevada can withdraw water, and (2) 915 feet, which is the minimum elevation for releases through the dam.
CAP Shortage Sharing Method	On-River users would share shortage at an equal percentage with CAP. The shortage sharing method described in the Gila River Indian Community Water Rights Settlement Agreement between CAP Indian and M&I uses has been used for these purposes.

**Table 2. Indian Firming Scenarios**

<b>Scenario</b>	<b>Surplus Strategy</b>	<b>Shortage Strategy</b>	<b>Min. Lake Mead Elev.</b>	<b>Upper Basin Demand</b>	<b>YDP Operation</b>	<b>Shortage to CAP</b>	<b>Est. Firming Req.</b>	<b>Est. Storage Req.**</b>
1 "USBR EIS Scenario"	ISG	Protect to Elevation 1083'	1000'	5.4MAF	Begin Operation in 2030	500KAF	103KAF	108KAF
2	70R	Protect to Elevation 1083'	1000'	4.8MAF	Begin Operation in 2009	500KAF	617KAF	648KAF
3	70R	Protect to Elevation 1050'	915'	4.8MAF	No Operation	500KAF	563KAF	591KAF
4	70R	Protect to Elevation 1083'	1000'	4.8MAF	Begin Operation in 2009	800KAF	380KAF	399KAF
5A "Planned Operating Scenario"	70R	Protect to Elevation 1050'	915'	4.8MAF	Begin Operation in 2009	500KAF	538KAF	565KAF
5B "Planned Operating Scenario"	ISG	Protect to Elevation 1050'	915'	4.8MAF	Begin Operation in 2009	500KAF	550KAF	578KAF
6	70R	Protect to Elevation 1050'	1000'	4.8MAF	Begin Operation in 2009	500KAF	483KAF	507KAF
7	70R	Protect to Elevation 1050'	915'	4.8MAF	Begin Operation in 2009	800KAF	302KAF	317KAF
8	70R	Protect to Elevation 1050'	915'	4.4MAF	Begin Operation in 2009	500KAF	271KAF	285KAF
9 "Baseline Condition"	70R	Protect to Elevation 1050'	915'	4.1MAF	Begin Operation in 2009	500KAF	16KAF	17KAF

\*\* Includes a 5% cut-to-the-aquifer

### Basis for Proposed Volume

Scenario 5B (ISG-80P1050-915-UBLIM-YDP2009-500kafSHORTAGE) was identified by staff as the scenario that has the most reasonable assumptions for estimating the firming volume. This section describes each parameter and the basis for staff's recommendation.

### Surplus Strategy

Surplus strategies can be designed to meet many different objectives, including flood control, spill avoidance, and to use stored water to meet excess demands. ADWR uses the system spill avoidance strategy whereby Lake Mead elevations are used to determine if a spill could occur in any year. If so, a surplus year is declared and extra water can be made available to the Lower Basin States. A "70R" surplus strategy was adopted by the Arizona Water Banking Authority Study Commission for planning purposes and is used in this analysis beginning in 2017. Under a 70R strategy, if there is not sufficient space to store the 70<sup>th</sup> percentile runoff (about 17.3 MAF) at the beginning of the year, then a surplus is declared. In the years prior to 2017, the surplus strategy is based on the Interim Surplus Guidelines adopted in 2000. The Interim Surplus Guidelines were created by the Basin States to assist California agencies in incrementally reducing consumptive use to 4.4 million acre-feet during an interim period commencing on January 1, 2002 and ending on December 31, 2016. The Interim Surplus Guidelines use modified Lake Mead elevations to determine if a surplus could be declared in any year and allow the reservoir to be drawn down more than under the 70R strategy.

### Shortage Strategy

The shortage strategy involves selecting a specific Lake Mead elevation and then operating the system to protect against dropping below that elevation. The Lake Mead shortage trigger elevation is used to determine whether a shortage should be declared in a given year. If the elevation of Lake Mead is greater than the trigger, then no shortage is declared. If the elevation of Lake Mead is less than the trigger, a shortage is declared. The following Lake Mead shortage elevations were analyzed for this exercise: 915 feet; 1,000 feet; 1,050 feet and 1,083 feet. Elevation 1,000 and 1,050 feet are the lake elevation of the Southern Nevada Water system intakes. Staff believes that it is important operationally to protect the intakes of the Southern Nevada Water Authority; elevations 1,000 and 1,050 were identified as the appropriate assumptions for this variable. Further analysis showed no significant difference in the results of using either of these assumptions and thus staff recommends using the upper elevation of 1,050 feet.

Another assumption within this variable is the probability of achieving the specified protection elevation. This variable is also user specified. A percentage probability can be assigned to the probability of the lake staying above the shortage trigger elevation. The probability of achieving this protection is expressed in percentage of occurrence (i.e., 80% of the time, Lake Mead can be operated to protect the lake level at or above the specified elevation). Staff reviewed the elevation shortage protection probabilities of 50 percent and 80 percent and found that although using a 50 percent elevation shortage protection probability resulted in slightly more water being available to CAP, it was not significant enough to warrant a deviation from the AWBA Study Commission

recommendation of 80 percent. Thus staff recommends using 80 percent, which is consistent with the recommendations of the AWBA Study Commission.

#### Minimum Lake Mead Elevations

This variable projects the minimum elevation to which Lake Mead can be drawn down to. The deeper the minimum elevation impacts the amount of reduction that would be required of Arizona Priority 4 users and Southern Nevada users. Maintaining a higher elevation during a shortage declaration would increase the amount of shortage to be borne by these users; therefore staff is recommending a minimum Lake Mead elevation of 915 feet.

#### Upper Basin Demands

The values analyzed for this variable revealed the largest impact to the availability of water supplies to CAP. Staff analyzed Upper Basin Demands at the following levels: current demand of 4.1 MAF; limited demands of 4.8 MAF; and full build out demands of 5.4 MAF. Full build out in the Upper Basin is the amount of water that could be consumptively used if currently legislated, but unfunded projects are built including development of oil shale reserves. Limited Upper Basin Demands are based on utilizing current projects to their full capacity, resulting in a demand of 4.6 MAF. However, in the analyses conducted by the AWBA Study Commission, allowances for additional development (200 KAF) was included on top of what was anticipated (4.6 MAF) for a total demand of 4.8 MAF. Staff recommends using the limited Upper Basin demand consistent with the AWBA Study Commission recommendations because the demands are based on actual projects in place as well as allowing for limited development.

#### Operation of the Yuma Desalinization Plant

Pursuant to the Mexican Treaty, the United States is required to ensure delivery of 1.5 MAF per year in normal and shortage years to Mexico. Historically agricultural return flows made up a significant portion of this delivery, which has resulted in the quality of the water to be undesirable to the users in Mexico due to high salinity. In response to this issue, the United States and Mexico entered into Minute 242, which requires the U.S. to deliver water that meets the same quality standards as water entering Imperial Dam. To meet this requirement the U.S. explored several options for improving the quality of water delivered to Mexico and settled on the bypassing of the Wellton-Mohawk agricultural returns and the construction and operation of the Yuma Desalinization Plant to replace the bypassed water. The plant was completed in 1992 and was expected to develop purified water to be blended with water from the Wellton-Mohawk District in Arizona and then delivered to Mexico. The plant was operated for eight months and then put into standby status in 1993 due to the high inflow resulting from precipitation. Since 1993, water has been by-passed from the Wellton-Mohawk Irrigation District to the Cienega de Santa Clara that has been over and above Mexico's entitlement. The model assumes approximately 120,000 acre-feet of by-pass water per year resulting in a drawdown of Lake Mead because of the inability to blend water from Wellton-Mohawk to meet the entitlement. Staff analyzed re-initiating operation of the Yuma Desalter in 2009, consistent with recent US Bureau of Reclamation (USBR) statements; delaying operation of the Desalter to 2030; and not operating the Desalter. As expected, delaying or not operating the Desalter resulted in slightly higher shortages. Staff recommends

using the assumption that the Desalter will begin operation in 2009, consistent with USBR public statements that actions will be taken to run the Desalter or offset the bypass.

#### Shortage to CAP

In a year in which the Secretary declares a shortage on the Colorado River, Arizona Priority 4 users and Southern Nevada will have their deliveries reduced to a predetermined shortage delivery amount. The analysis performed by staff focused on two possible levels of cutback to Arizona Priority 4 users (500KAF or 800KAF) in the event that a shortage is declared. The scenario in which Arizona took a deeper cut to its allocation (800 KAF) (Scenario 7 - 70R-80P1050-915-UBLIM-YDP2009-800kafSHORTAGE) revealed that the average probability of shortage decreased slightly, however, the cumulative volume of shortage was greater than occurred with 500 KAF. For instance, using the current M&I banking obligations as a benchmark (which assumed a 500 KAF shortage to Arizona), cutting Arizona's deliveries by 800 KAF resulted in an additional 3 MAF acre-foot shortage over the 100-year period to M&I water users. Thus as 800 KAF shortage makes M&I supplies less firm and reduces the volume of water that would need to be firmed on behalf of the Tribes, due to the shortage sharing criteria in the Gila River Indian Community Water Settlement Agreement. Although this reduces the potential cost to the State for developing the firming volume other factors need to be considered. The increased shortage volume due to the greater shortage to Arizona would result in an additional firming requirement by the AWBA for M&I subcontractors. It would also require the development of additional groundwater supplies in shortage years (in addition to the recovery of the firming water), resulting in the need for additional well capacity and potentially increasing the cost to develop supplies in shortage years. For these reasons, the 800KAF shortage assumption is not recommended as a planning assumption.

## APPENDIX III WATER SUPPLY STUDY

### **Indian Firming Technical Committee Water Resources Analysis November 17, 2003**

Thus far the Technical Committee has reviewed studies prepared by ADWR that estimate the probability and magnitude of shortages to CAP water under a wide range of variable assumptions. Based on these studies, the staff recommended a target range of water volumes that would be needed to “firm” against water shortages that are the State’s responsibility under the provisions of the Arizona Water Settlements Act. The Technical Committee also reviewed the potential needs for replenishment water required by the Gila River Indian Community (GRIC) settlement associated with withdrawals of groundwater in identified zones along the south boundary of the GRIC reservation. In light of these findings, one of the next steps is to identify mechanisms and water supplies that can be used to satisfy those obligations. The obligations can be viewed as distinct and may vary with regard to timing, location, volumes of water, and funding mechanisms.

### **Objectives**

The objectives of this phase of the study are to identify and study opportunities to obtain water resources to meet the following requirements:

- Water supplies to meet 100 year firming obligations for:
  - 15,000 af of NIA priority water for the benefit of GRIC.
  - 8,724 af of NIA priority water for other Indian settlements.

In order to meet these requirements there can be a variety of either full or partial solutions. For example, it may be feasible to use two or three different water supplies to obtain long-term storage credits. Expanding further on the idea of developing a menu of options, it may be that the State would want to partially meet the obligation through storage and recovery options and partially through use of alternative supplies, such as groundwater rights. The ability to have several options available in a flexible manner may lower costs. In addition, there may be opportunities to enter into partnerships with other parties to have multi-objective projects.

### **Central Arizona Project Water**

There are several categories of CAP water that may be used to meet firming and Southside objectives. CAP water is likely to be found to be a highly feasible alternative since it is currently the AWBA’s primary water source and there is excellent infrastructure available for water delivery directly to many Indian Reservations and to recharge facilities.

- Excess Water – Excess water is CAP water that may be available on a year-to-year basis that is not delivered pursuant to a long-term contract or subcontract. Generally, this supply is thought of as a transitional supply that will be available only until long-term subcontracts and Indian contracts are fully utilized. The

Arizona Water Bank was created as an institution that would be able to utilize excess water and, to date; it has exclusively stored water from this source.

- Water Bank pool – CAWCD has adopted policies on how it will market excess water among competing uses. Agriculture will be entitled to a first priority pool, but that pool will be capped in volume and will reduce over time. It is anticipated that an additional pool will be created for water banking purposes, but the size of this pool has not been determined. Studies performed by ADWR and CAWCD indicate that excess water will be available to some degree until about the year 2030.
- Periodic surplus supplies – Even after long term contractors are fully utilizing their CAP supplies, there will be opportunities for excess water supplies to be marketed. Since CAP is entitled to utilize any of Arizona’s lower basin entitlement that is not consumed by other contractors, it will be able to divert surplus water that may periodically be available from the Colorado River. While the probability of surplus will decrease over time, ADWR water supply studies show that there will be periods of high runoff that will enable surplus declarations. The “sponge” provision of the CAP contract also creates the opportunity to sell excess water in any year when consumptive uses by non-CAP Colorado River water users falls below 1,310,000 acre feet.
- NIA subcontract – Under the terms of the Arizona Water Settlements Agreement, after completion of relinquishments of NIA subcontracts by agricultural districts, there will be two pools of NIA priority water available for future allocation. While one pool will be held by the Secretary of the Interior and is reserved for use in Indian water rights settlements, the other will be held in trust by ADWR for future allocation for non-Indian purposes. The State, acting through the AWBA, either by itself or in partnership with others, could seek an allocation of a portion of this non-Indian supply. Since the NIA water subcontract will be shorted at the same time Indian firming water is needed, this supply cannot be used directly as a substitute supply. It could, however, be used as a source of water for earning long-term storage credits and as a source to meet both the initial Southside Bank and later replenishment obligations.
- Indian lease – Several Indian settlement agreements have created opportunities for Indian Tribes and Communities to lease a portion of their CAP supplies. In order to satisfy assured water supply requirements, lessees have sought leases that will last for at least 100 years and are for high priority water allocations. The State, acting through the AWBA could by itself, or in partnership, attempt to negotiate a lease. As mentioned above, for the purposes of meeting the firming and Southside obligations, it is not necessary to lease highest priority water and it may not even be necessary to have a long-term 100 year lease. Another option would be to enter into a lease for the same NIA priority water that is in need of firming. For example, the State by itself or in partnership with another party could lease the 15,000 af of NIA priority water from GRIC but pay for the lease as if it were leasing M&I priority water. Then, in times of shortage, the shortage would simply be borne by the State and no firming or substitute supply would be required. An alternative would be to lease the water from GRIC but allow a

call back option by the Indian Community in years when the supply is not shorted.

### **Non-CAP Colorado River water**

- Contract transfer or lease – While there currently is no active water rights market for Colorado River water, it is possible that such a market could develop in the future. On two occasions, in the context of obtaining water for Indian water rights settlements, water was transferred from Yuma area irrigation districts to CAP service area Tribes. It is also well known that owners of land in the Cibola Irrigation District are interested in marketing some or all of their Colorado River contract rights. In order to be useful for firming NIA priority water shortages, the contract rights must either be of higher priority than CAP water or the water supplies obtained must be used to obtain underground storage credits.
- Dry year options – Since firming water is only needed in shortage years, it may be unnecessary to purchase or lease permanent water rights. If arrangements could be made to fallow irrigated land only during drought years, agricultural use could continue in most years. To some extent, a dry year options program can be viewed as a temporary transfer of priority where the senior right holder agrees to accept a lower priority in exchange for compensation.

### **Other surface water**

Opportunities to develop additional surface water supplies within Arizona are very limited. Except for periodic flood events, most of the state's watersheds are fully appropriated. However, in limited circumstances, flood flows may be a water supply that can be used in conjunction with recharge facilities.

- Salt/Verde floodwater – During the 1970's and 1980's there were frequent occurrences when runoff from the Salt and Verde River watersheds exceeded the SRP storage capacity causing water to be released to the Salt River bed. Since that time, Roosevelt Dam storage has been increased, but the Verde River still has limited reservoir storage capacity. In previous spill events, SRP provided "spill" water to agricultural lands. However, with the rapid urbanization of SRP and RWCD lands, agricultural lands may no longer be available to utilize these spill water supplies. If recharge sites are strategically located, it may be possible for some of the spill water to be stored underground.
- Little Colorado River floodwater – There are no large reservoirs on the Little Colorado River. Periodically, flood flows have been significant in this watershed, but the opportunities to make use of those supplies are limited due to high sediment loads and lack of storage facilities. Opportunities to utilize Little Colorado River water would probably be practical only if a portion of the State's firming obligation is dedicated to a Navajo or Hopi water rights settlement.

### **Effluent**

Treated municipal effluent is a highly reliable water supply that can be obtained by contract with a water treating entity. Furthermore, as municipal water demands increase, more treated effluent will become available in the future. The ability to directly deliver effluent in times of CAP shortage will need to be determined on a case by case

basis. However, even if the effluent cannot be mixed with other water supplies, it may be a very good water supply for underground storage.

- Excess effluent not under contract or pledged for Assured Water Supply - Much of the municipal effluent in the Phoenix AMA is being put to use for power plants, golf course and turf irrigation, agricultural irrigation, and for other service area requirements. In the Tucson AMA much of the effluent supply is directly used or stored underground for long-term storage credits. However, as population expands, there may be situations where the supply of effluent exceeds local demands. If these supplies are purchased in conjunction with an underground storage and recovery plan, they may be a useful opportunity to meet the Indian firming obligation.
- Mesa/Chandler effluent committed to GRIC exchange - Under the terms of the GRIC settlement Mesa and Chandler will exchange A+ effluent for GRIC Indian priority CAP water. In years of CAP shortage, the CAP water may be reduced to some extent. In that case, the Cities effluent portion of the exchange may also be reduced proportionally. If the exchange follows this scenario, then there may be a limited amount of excess effluent owned by the Cities that could be purchased by the State to meet the firming obligation to GRIC. This water would not need to be recharged since it could be delivered directly to GRIC.

## **Groundwater**

Groundwater is a plentiful and reliable water supply, but it is subject to extensive regulation by state law. Groundwater has the advantage that it is already stored underground and so it does not need to be banked. Also, most groundwater is of adequate quality and can be mixed with other supplies in existing canals and aqueducts.

- Grandfathered Rights - Grandfathered rights are the most commonly used rights to withdraw groundwater in AMAs. Of the three kinds of Grandfathered rights, Irrigation GFRs would likely be the least useful since they are limited to irrigation use and are appurtenant to the land. Type I and Type 2 non-irrigation GFRs may be more useful. For example, a Type 1 or Type 2 right could be purchased or leased and pumped into the CAP aqueduct or other delivery canals during shortage periods. Non-irrigation GFRs could also be used as a source for the Southside Bank.
- Poor quality water - There are numerous occurrences of poor quality groundwater where remedial action is needed. If the State were to participate in funding the clean up of some of this water, it may be able to use that supply either directly or by exchange to meet firming or Southside replenishment requirements.
- Water logged area groundwater - In the Buckeye area in the Phoenix AMA there is an excess amount of groundwater that has historically had to be pumped for drainage purposes. This source of supply can be accessed by permit rather than requiring a Grandfathered right. If this water were treated to improve its quality, it may be useable as a supply for direct delivery to GRIC or for exchange to other water users.
- Groundwater imported from outside of AMAs or from off-reservation sources - The groundwater transportation statutes allow, subject to limitations, importation of groundwater from the Harquahala INA and from the Butler

Valley Basin. If appropriate infrastructure is constructed, water could be pumped into the CAP aqueduct to supplement supplies during times of shortage. Depending on which Indian reservations are the recipients of the 8,724 af of NIA water in the future, off-reservation groundwater may have potential as a source for firming in areas not served directly by the CAP.

- Yuma Mesa groundwater mound – The Yuma Mesa groundwater mound is legally groundwater rather than Colorado River water. However, it is made available for transfer by using this source to meet the needs of Colorado River contractors. State law has been modified to allow the issuance of permits that will allow a party to pay for drainage pumping and receive the benefits of the captured water via exchange mechanisms.

### **Existing Long Term Storage Credits**

Under current law, long-term storage credits are marketable commodities. Currently, the AWBA and CAWCD hold the majority of these credits. The AWBA credits are committed to statutory purposes and while they can be “loaned”, they must be paid back. The CAWCD credits are an asset of the District and there is no indication at the present time that these credits are available for sale. However, since the Indian firming requirement covers a 100 year period, the possibility exists that CAWCD may be willing to dispose of some or all of their credits in the future, especially if the AWBA is successful in providing sufficient M&I firming for subcontractors. It is also possible that in the future some other entity, such as a city or wastewater treatment plant owner or a private business like the Vidler Water Company, may accumulate long-term storage credits from excess effluent or other supplies that they may want to use as a marketable asset.

### **Conserved water**

Both within Arizona and in neighboring states, there are numerous examples of one party paying for water conservation efforts of another party and then benefiting from the conserved water. During the course of the negotiations of the GRIC settlement, RWCD developed a water conservation proposal whereby they would use canal extensions and regulating reservoirs to reduce lost and unaccounted for water. The conserved water would have been made available for firming the State’s GRIC obligation. This project or others like it could be investigated further. Quite often the water conservation projects have been the result of canal lining cooperative efforts. Within the Central Arizona Project service area there are very few opportunities to participate in a lining project, since most canals and aqueducts are already lined. The exception is the San Carlos Project canal systems, which are mostly unlined, but would be improved as a result of the settlement agreements. The lining of the SCIDD system may present an opportunity for cost sharing with the State if some of the conserved water could be used for the Southside bank or for Indian firming.

## APPENDIX IV AWBA M&I FIRING PROGRAM

### **AWBA Determination of the CAP M&I Firing Need - AWBA 2002**

#### **Background Information**

The AWBA Study Commission (Commission) was the first entity tasked with making recommendations regarding the potential for shortages to Arizona's Colorado River supply and how many credits would be needed to firm the M&I supply. To achieve this objective, the Commission identified two areas that needed to be addressed. The first involved developing assumptions to be used in determining the frequency and quantity of water supply shortages on the Colorado River system. The second was a determination of how much water would need to be stored to protect against projected shortages. This analysis would be based upon the agreed upon assumptions and a computer model developed by the Bureau of Reclamation for Colorado River modeling purposes. The Commission's 1998 final report (1998 Report) listed the assumptions that were deemed appropriate for use in the model. Based on the assumptions and protecting for an annual CAP M&I demand of 676,000 acre feet, the model output showed that approximately 3.029 million acre feet of credits would be needed to firm CAP M&I supplies through 2100. The term firming is intended to be synonymous with providing CAP M&I protection from shortages.

In 1999, the AWBA re-addressed the firming issue in relation to recovery planning. The model was run using the 1998 Report assumptions plus the then-current Indian shortage sharing strategy and reservoir levels, 1906-1998 hydrology and annual CAP M&I demand of 648,000 acre feet. This run estimated that 2.584 million acre feet would be needed to firm CAP M&I supplies through 2100. It should be noted that this 2.5 million acre feet number was calculated from model run output and is based on the assumption that the AWBA would firm only 20% of the M&I demand. This specific percentage was selected based on the Arizona Administrative Code Rules pertaining to Assured Water Supply (AWS) and consistency with management goals. Specifically, R12-15-705 (T)(1) mandates that the Director shall take into consideration, when making a determination regarding an entity's groundwater use being consistent with achievement of the management goal, whether groundwater was withdrawn and used because the available surface water was less than or equal to that source's drought volume. Rule R12-15-701 (22) defines drought volume as 80% of the surface water volume. Therefore, it was decided at that time that the AWBA would only need to firm 20% of the CAP M&I demand because once surface water volumes fall below that level, M&I subcontracting entities can pump groundwater without penalizing their AWS designations.

In 2000, staff was asked to re-visit the firming issue, this time to examine the potential for Arizona to undertake interstate water banking. At that time, one of the underlying assumptions of previous model runs was in question. Specifically, the Basin States were in the process of moving toward the Interim Surplus Guidelines and the actual surplus strategy that would be used was unknown. Additionally, in this run, a different M&I protection level was used and the then-current reservoir levels were used. This run estimated an average of 4.524 million acre feet of credits needed to firm CAP M&I

supplies through 2100. It is not known with certainty if this number was modified to account for firming only 20% of the CAP M&I demand.

Nonetheless, it is obvious that the firming number is a dynamic target that can vary greatly depending on the information utilized in the model. Although the 1998 Report provided guidance regarding the *assumptions* to be used in the model, it did not address differences that would occur due to variability in model inputs such as reservoir levels, the period of historical hydrology used, projected CAP M&I demand levels and shortage sharing strategies with the Indian tribes. These input values change on an annual basis and can dramatically influence the magnitude of the firming number. For example, model runs completed today with current reservoir levels would show a higher probability of earlier and more frequent shortages and the firming number would increase. This is due to the reservoirs being very low, i.e. Lake Powell is currently only 46% of capacity and Lake Mead is 59% of capacity. Conversely, if the next 10 years are relatively wet years, models run in 2014 could show a decrease in the number of firming credits needed.

The 1998 Report did not provide guidance regarding whether the firming number should be fixed at a specific period in time or should be updated periodically. It also did not specifically recognize the current guiding principle of firming to 20% of the CAP M&I demand.

### **Recent Discussion Regarding Identification of the Firming Number**

In December of 2002, a run of the CRSSez Model was completed based on the parameters detailed in the attached resolution with the exception being the operational strategy for the Colorado River. In this model, the Interim Surplus Guidelines were utilized through 2016 then the 70R operational strategy was utilized through 2100.

The output of the model run is presented in columns 2 and 3 of the attached table. Columns 4 and 5 were calculated from that information as follows.

1. The CAP M&I demand being utilized is 621,000 acre-feet from 2000-2043 and 649,000 from 2044-2100. If you calculate 20% of those volumes, the shortage in any given year between 2000-2043 would be 124.2 kaf/year and between 2044-2100 would be 129.8 kaf/year. If the full amount was firming for every year that there is any possibility of shortage (i.e. probability greater than zero), you would need to store 12.7 million-acre feet. However, in many years, the likelihood of shortage is fairly low based on probabilities. The overall average probability of shortage throughout the 100 year period is only 21%. So, early on in this process, the decision was made to store based on probability. It is unknown precisely when, but it was recognized that firming the full shortage amount for every year that there is **any** possibility of shortage would result in over-storage of water. In short, it would be the best insurance policy against shortage, but it would also be the most expensive.

2. Column 2 lists the probability of a shortage in any given year based on traces of the model. For example, in 2016, 1 trace out of 100 showed a shortage, yielding a 1% chance of shortage. Column 4 was calculated by multiplying the probability in column 2 by either 124.2 (years 2001-2043) or 129.8 (years 2044-2100). For example:

in	2016	1% X 124.2 = 1.24 kaf
	2025	15% X 124.2 = 18.63 kaf

3. Therefore, column 4 illustrates how many acre feet of credits would need to be developed to firm 20% of the CAP M&I demand based on the statistical probability of the occurrence of a shortage in that year.
4. Column 5 was calculated by taking the lesser of either column 3 or column 4. In essence, this lets the firming number be driven by level of demand versus straight 20% driven. For example, in the early years (pre-2037) when M&I demand is lower, the actual average annual shortage is all that will need to be firming. In the latter years, firming to 20% will be the limit.
5. The sum of column 5 is 2.659 million-acre feet. That is the total number of credits need to firm 20% of M&I supplies (or demand in the early years) based on the probability of a shortage. The number was rounded to 2.7 million-acre feet for the draft resolution.

## APPENDIX V WORKPLAN

### Indian Firming Study Commission Work Plan DRAFT 04-19-04

**GOAL:** Develop recommendations for meeting the State's Firming Requirements included in the Gila River Indian Community Settlement, including firming 15,000 acre-feet of Non-Indian Agricultural priority water to Municipal & Industrial Priority for the Gila River Indian Community and firming 8,724 acre-feet of Non-Indian Agricultural priority water to Municipal & Industrial Priority for future Indian Water Rights Settlements. Concurrent with this process, the Study Commission will review the US obligations and the ability of the State to "assist" the US in meeting their obligations under the Settlement.

1. **Define Problem - QUANTIFY RISK OF SHORTAGE ON COLORADO RIVER**
  - a. Identify the volume of water projected to be needed to offset projected shortages to NIA water for the next 100 years
    - i. Review previous model runs and identify necessary updates to selected scenarios
    - ii. Re-run model and develop recommendations for volume of water to be firming
2. **List Solution Elements**
  - a. Define alternative methods for firming water including:
    - i. Infrastructure utilization
    - ii. Water Supply
    - iii. Partnerships
  - b. Narrow down elements that are worth pursuing for expanded evaluation
3. **Evaluate Solution Elements**
  - a. Provide additional information on each solution element including:
    - i. Cost/Funding Source
    - ii. Identification of Supply Requirement to Meet Obligation
    - iii. Water Supply Availability
    - iv. Hydrologic Feasibility
    - v. Legal Feasibility
    - vi. Partnerships
  - b. Revise Evaluation based on Study Commission input
4. **Ranking/Prioritization of Solution Elements**
  - a. Identify ranking criteria with Study Commission
  - b. Rank Solution elements and present to Study Commission
5. **Develop Interim Report - deadline November 1, 2005**

- a. Study Commission participants
  - b. Meeting discussions overview
  - c. Overview of Solution Elements
  - d. Results of Ranking
6. **Develop Recommendations**
- a. Discussion of Ranking and Prioritization
  - b. Develop final recommendation
7. **Develop Final Report** - deadline January 6, 2006

**APPENDIX VI**

**MODELING SCENARIOS AND ESTIMATED FIRING VOLUMES (REVISED)  
INDIAN FIRING STUDY COMMISSION  
(Acre-Feet - Values rounded to the nearest 10s)**

<b>Upper Colorado River Basin Buildup Assumption</b>	<b>2003 Mainstem Use Projection Assumption</b>	<b>300,000 AF Shortage</b>	<b>500,000 AF Shortage</b>	<b>800,000 AF Shortage</b>
<b>4.6 Million Acre-Feet</b>	<b>Normal</b>	<b>448,640</b>	<b>447,490</b>	<b>383,330</b>
	<b>Limited to 1.25 Million Acre-Feet</b>	<b>296,610</b>	<b>366,450</b>	<b>298,710</b>
<b>4.8 Million Acre-Feet AWBA Option</b>	<b>Normal</b>	<b>646,850</b>	<b>548,770</b>	<b>420,500</b>
	<b>Limited to 1.25 Million Acre-Feet</b>	<b>474,100</b>	<b>493,200</b>	<b>357,230</b>
<b>4.8 Million Acre-Feet</b>	<b>Normal</b>	<b>657,060</b>	<b>569,880</b>	<b>435,860</b>
	<b>Limited to 1.25 Million Acre-Feet</b>	<b>482,050</b>	<b>510,920</b>	<b>373,300</b>
<b>5.0 Million Acre-Feet</b>	<b>Normal</b>	<b>845,570</b>	<b>805,470</b>	<b>555,390</b>
	<b>Limited to 1.25 Million Acre-Feet</b>	<b>656,940</b>	<b>798,380</b>	<b>529,280</b>

## APPENDIX VII SOLUTION ELEMENTS

1. Traditional AWBA approach.
2. Water Banking on GRIC and possibly other Indian reservations.
3. Leases or other monetary payment approaches.
4. Dry year following bank and/or groundwater importation.

### Traditional AWBA Approach

- The AWBA would add Indian firming to their water banking responsibilities. Storage would occur through permitted off-reservation facilities.
- Water credits would be transferred to CAWCD for recovery in times of shortage.
- CAWCD would recover water through its recovery plan and deliver water to GRIC and other tribes either directly or by exchange.
- GRIC and other tribes would order CAP water and would pay as if there were no shortage.

### Traditional AWBA Approach - ISSUES

- AWBA will need to purchase and store an additional ±548,770 af (plus losses and cut to the aquifer) of excess CAP supply.
- Would need to establish a priority vs. existing M&I firming and Interstate banking obligations.
- May cause a timing impact on CAGR and other secondary users of excess water.
- Will probably require extending AWBA funding period beyond 2016

### Traditional AWBA Approach - ESTIMATED COST (at today's cost)

- At current rates water purchase and storage averages for direct underground storage (based on GRUSP) =  $\$88.60/\text{af} * 548,770 \text{ af} * 1.1$  (10% losses and aquifer cut) = **\$53,480,000**
- At current rates water purchase and storage averages for GSF storage =  $\$42.00/\text{af} * 548,770 \text{ af} * 1.1$  = **\$25,350,000**
- At current rates assuming 50% USF / 50%GSF = **\$39,420,000**
- Recovery costs are unknown, but need to assume amortization of CAP owned wells, possible leases of non-CAP wells, pumping energy, conveyance or wheeling to Indian delivery points.
- If recovery cost is less than or equal to the CAP delivery charges paid by Indian water users, there should not be an incremental additional cost to the State for recovery. If recovery cost is greater than delivery charge, there could be an additional State cost.

### Traditional AWBA Approach - EVALUATION

- Advantages
  - Similar to current firming approach. Would expand need for recovery, but would still use same techniques. Few statutory amendments would be needed.

- Transparent to tribes.
- If there are few shortages, the State maintains a valuable asset that can be used for other purposes.
- Some of storage and recovery cost is offset by payment for CAP water by tribes.
- Disadvantages
  - High upfront expense to purchase and store excess CAP water.
  - Funding would be required for several years.
  - Over time, there will be less excess water supply available
  - Could add complexity to recovery plan – especially if much of the 8,724 acre-feet would need to be delivered by exchange.

**Water Banking on GRIC and possibly other Indian reservations.**

- Two potential approaches
  - Traditional permits for storage and recovery as overseen by ADWR
  - Non-traditional storage and recovery contracts between AWBA, CAP, and GRIC or other tribe
- Water would be delivered on a schedule for either:
  - Direct recharge at underground storage facilities
  - Direct delivery to GRIC/ Tribes for on-reservation use. An account similar to a GSF credit account would be established. Cost sharing for storage would depend on negotiated agreements.
  - If 548,770 af is estimated volume for shortage scenario:
    - GRIC 15,000 = 346,971 af
    - Other Settlements 8,724 = 201,799 af

**Water Banking on GRIC and possibly other Indian reservations - ISSUES**

- Payment issues
  - Under more traditional approach credits would be owned by AWBA and CAP would pay for on-reservation recovery, but Tribes would have to pay for CAP delivery in times of shortage.
  - Under non-traditional approach, credits would not be earned, but a *firming account* would be credited with deposits and debited in times of shortage. GRIC/ Tribes would pump groundwater in lieu of ordering CAP water. They would pay for recovery, but would not make CAP payments for “firmed” water. They could also choose not to pump and absorb the shortage.
- Water supply availability (excess CAP water) would be the same as under the AWBA traditional alternative.
- Advanced delivery to GRIC will be subject to excessive losses until main inter-connect delivery point is lined. Options exist for delivery through RWCD canal, SRP canal, or MSIDD canal, but will probably require payment of capacity and use fee.
- There are currently no USF facilities on GRIC reservation, so unless one is constructed, only direct delivery for current uses would be viable.
- This plan could work well for the GRIC 15,000 af component, but could be more difficult for 8,724 af component. However, if GRIC would allow advanced

delivery of all 548,770 af, then they could provide firming for other tribes by forbearing a portion of their CAP Indian priority supply in times of shortage. They could then either receive groundwater pumped as credits or pumped as groundwater. The GRIC water budget accounting method will need to be amended so GRIC is not penalized for not taking CAP water that was available.

#### Water Banking on GRIC and possibly other Indian reservations - ESTIMATED COST (at today's cost)

- GRIC has indicated that the advanced water delivered to the reservation at no cost. This is because they would not necessarily be offsetting existing groundwater withdrawals, so there may not be an offsetting savings in pumping cost. At current rates this would be equal to \$70/af.
- Delivery to the reservation past the CAP turnout would be subject to losses and delivery charges. These charges are unknown at the present time, but a reasonable assumption may be about \$10/af.
- Total storage cost = 548,770 af \* 1.05 (5% loss factor) \* \$80 = **\$46,100,000**.
- Recovery would need to take place from on-reservation wells. Additional well capacity will be needed, but it is unknown if GRIC will have excess well capacity once their irrigation project is completed.
- Under the more traditional approach, CAP would need to lease on-reservation wells and pay for recovery. However, they would receive payment for CAP delivery charges to offset cost.
- Under the non-traditional approach, GRIC would bear all costs of infrastructure and pumping, but would not pay CAP charges.

#### Water Banking on GRIC and possibly other Indian reservations - EVALUATION

- Advantages
  - Advanced banking agreement could establish a maximum firming exposure limit (at least for GRIC).
  - On reservation storage and recovery not in competition for capacity with other AWBA missions.
  - GRIC would benefit from assistance in obtaining and using CAP water while canal project is being built.
  - Creates opportunities for partnerships between State and tribes.
- Disadvantages
  - Early delivery water is committed to Indian tribes, even if there are few shortages. No USF sites currently available.
  - High upfront expense to purchase and store excess CAP water.
  - Non-traditional storage and recovery would require authorizing legislation.
  - Requires contracts which must honor tribal sovereignty (compact?)
  - Firming for GRIC easier to accomplish than firming for other 8,724 af.

#### State Lease of Indian CAP Water

- State would partner with CAGR to lease 15,000 af of NIA priority water from GRIC at M&I priority price for a 100 year period. The leased water would bear

the shortage burden. When water is available, CAGRDR would use it for replenishment. State share of lease would cover the burden of the shortages.

- To provide a shortage supply for the remaining 8,724 af, the State and CAGRDR could lease additional NIA priority water from Tribes for 100 year period as new settlements are negotiated.
- If NIA priority leases are unavailable, the State and CAGRDR could seek leases of Indian priority water from Tribes whose settlements allow leasing, such as Ft. McDowell, San Carlos Apache, or Tohono O'odham.

#### State Lease of Indian CAP Water - ESTIMATED COST

- Lease payments are made up-front or over time plus interest. Current rate is about \$2200 per acre-foot of contract right.
- Lease cost = \$2200 \* 23,724 af = \$52,190,000
- If lease cost is shared proportionally:
  - CAGRDR ≈ 70% = **\$36,530,000**
  - State ≈ 30% = **\$15,660,000**
  - CAWCD would receive water delivery payments from CAGRDR when water is available, but would not receive payments from State in shortage years.

#### State Lease of Indian CAP Water - EVALUATION

- Advantages
  - Doesn't require use of excess water, which makes it available for other purposes. Doesn't require storage and recovery resources.
  - Allows economic cost sharing arrangement with CAGRDR. Both partners will benefit.
  - State exposure is limited if there are only limited shortages.
  - Potential low cost for State contribution.
- Disadvantages
  - Tribes lose the benefit of the water resource for 100 years (although they receive payment).
  - Would require large upfront payments by State and CAGRDR. State funding may need to be financed which will increase cost due to interest charges.
  - Settlement agreements may have limitations on leases.
  - State legislation may be needed, depending on which State agency is authorized to enter into lease contract.

#### Dry Year Fallowing Bank and/or Groundwater Importation

- State would arrange for alternative supplies that could be delivered through the CAP only in times of shortage.
- Dry year options could be taken with high priority Colorado River irrigation districts or Ak Chin to intentionally reduce consumptive use in years when there is a firming obligation.

- As an alternative or in conjunction with the fallowing bank, groundwater could be imported from the Butler Valley Basin under contract with the State Land Department.

#### Dry Year Fallowing Bank and/or Groundwater Importation - ESTIMATED COST

- State would need to plan to obtain 548,770 acre-feet plus approximately 5% for distribution losses.
- Cost for land fallowing options are subject to negotiation with willing sellers. Based on Palo Verde IDD programs in California, cost could be between \$153-\$203/af.  $548,770 * 1.05 * \$153$  (\$203) = **\$88,160,000** (~~\$116,970,000~~).
- Cost for Butler Valley groundwater would include SLD payments, wells and pipeline infrastructure, and pumping costs.

#### Dry Year Fallowing Bank and/or Groundwater Importation - EVALUATION

- Advantages
  - High priority supplies and groundwater are secure sources.
  - State exposure is limited if there are few shortages.
  - Expenses can be deferred until shortages are more imminent.
  - State payments to SLD would benefit Land Trust.
- Disadvantages
  - Land fallowing is controversial and could affect area of origin.
  - Cost is very uncertain until negotiated. Potentially very expensive.
  - Hard to justify fallowing land on River so water can be used for irrigation on reservation.
  - Groundwater development will require infrastructure development.
  - Would need extensive legal/institutional arrangements including authorizing

**APPENDIX VIII  
STUDY COMMISSION COMMENTS**

**Received from Salt River Project**

Sandy,

As we briefly discussed, here are a few items that we believe the Indian Firming Study Commission should consider in its deliberations in recommending how the state might best meet its obligation in firming agricultural priority CAP water as set forth in section 105 (b)(2) of the Arizona Water Settlements Act.

1. At present there are about 400,000 acre-feet of recharge credits stored in the Phoenix and Pinal AMAs by the Arizona Water Banking Authority with funds generated from withdrawal fees from the pumping of groundwater in these two AMAs. Under current law these recharge credits may be used for a few specific purposes, one of which is for facilitating the settlement of Indian water rights claims. Since the Arizona Legislature has already indicated that recharge credits earned with funds generated from withdrawal fees may be used to facilitate the settlement of Indian water rights claims, it seems to us that a portion of the 400,000 acre-feet of credits stored in both the Phoenix and Pinal AMAs should be used to help the state in meeting its firming obligation under the Arizona Water Settlements Act.

2. A few years ago when the state's financial situation was rather bleak, the Arizona Legislature took approximately \$9,000,000 from the Arizona Water Banking Fund to use for non-water banking purposes. The \$9,000,000 was generated from withdrawal fees paid by water users in the Phoenix AMA. As noted above, under current law, these monies may be used to facilitate the settlement of Indian water rights claims. Given the expected cost to the state in developing recharge credits for use in meeting the state's firming obligations under the Arizona Water Settlements Act, and the fact that the state's financial situation is much better, it seems appropriate that the Firming Commission might want to recommend that the state restore the \$9,000,000 to the Water Banking fund and that some or all of these funds be used to help the state meet its firming obligations.

3. We believe there is a lot of merit with the approach in which the state partners with a third party that has or could lease Indian priority CAP water to facilitate meeting the firming obligation. Along with the CAGR, we believe there may be other entities interested in partnering with the state under a lease approach. Additionally, another option for encouraging a third party to join with the state might be an additional allocation of allowable groundwater pumping. For example, instead of giving the third party a price break on the lease rate (to account for giving up the supply in shortage years), the state, through the Water Banking Authority, could provide the third party with recharge credits and allow the third party to recover 110% of the amount of credits provided by the Water Banking Authority.

We believe the state would benefit from this approach because it would avoid the cost of recovering the recharge credits to facilitate the firming requirement. Additionally, we believe a third party would benefit from this approach because 1) it would be able to use the full amount of the leased CAP water for assured water supply purposes (the leased CAP water is being backed up with recharge credits provided by the Water Banking Authority) and 2) it would receive an additional modest amount of allowable groundwater that could be used for assured water supply purposes.

4. Lastly, we have reviewed the proposal prepared by RWCD. Unfortunately, because there are no financial terms associated with the proposal, we do not know how it compares to the concepts that have previously been presented to the Commission. Accordingly, we believe the Department should request RWCD to supplement its proposal with a summary of its overall costs so that the Commission can better assess it in comparison to the other concepts.

Call or write if you have any questions.....thanks

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**Received from Roosevelt Water Conservation District**

RWCD can assist in fulfilling State and federal firming obligations to GRIC and other Indian tribes, as follows:

For GRIC 15,000 acre-feet obligation:

- RWCD can pre-deliver 347,000 acre-feet of CAP water to GRIC at the northern boundary of the Reservation through the existing RWCD CAP interconnect and main canal.
- Pre-deliveries can be made over a ten to twenty year period, as needed by AWBA and/or CAWCD, scheduled annually in September, beginning in the year prior to the first pre-delivery of CAP water to GRIC.
- There would be no CAP interconnection fee.
- Wheeling charge: \$12 per acre-foot delivered at the northern boundary of the Reservation; the wheeling charge would be adjusted for inflation annually during the pre-delivery period.
- Losses: Assumed to be 5% in first year of delivery but would be measured in the main canal throughout the year to determine actual loss as of the end of the first year. Actual loss determined for the end of first year would be used during second year and recalculated at year-end. The same recalculation procedure would be used each year during the pre-delivery period so as to charge no more than actual losses in the main canal. (RWCD believes current actual losses in the main canal, as apposed to losses in the entire RWCD system, are approximately 5% per year.)
- RWCD would contract with AWBA and/or CAWCD to pre-deliver the firming water to GRIC.
- AWBA and/or CAWCD would be responsible for reimbursing RWCD's reasonable costs, if any, of implementing the recovery arrangements (e.g., regulatory costs, ect.)
- Wheeling charges would be estimated annually for the ensuing year and then paid monthly throughout the year, with reconciliation at year end.

For State 8,724 acre-feet firming obligation:

- RWCD will lease 7 of its production wells that deliver water into the RWCD main canal to CAWCD/AWBA or some other state-authorized entity to be used to recover firming credits made available by AWBA or CAWCD. RWCD would operate the wells as CAWCD/AWBA's agent. Six wells would be sufficient to deliver 8,724 acre-feet per year of firming water to GRIC; the seventh well would be used for stand-by purposes. RWCD has a total of 58 wells, which can be pumped into the RWCD main canal; so more wells can be added if it is thought necessary.
- Lease period: 100 years
- Losses: Calculated in same manner as for pre-delivered CAP water, described above.
- Charges: For a lease charge to CAWCD (or other authorized entity), RWCD would charge the following annually:
  - All direct costs of maintaining the leased wells, plus an administrative overhead charge equal to a reasonable percentage of the direct costs of maintaining the leased wells. Direct costs would include all costs of whatever nature that RWCD incurs with respect to the leased well (e.g., monthly maintenance; period replacement of casing; periodic

replacement of pumps, etc.). All costs would be documented and verified annually.

- Actual power costs for recovering AWBA/CAWCD credits and delivering them into the RWCD main canal. All power costs would be documented and verified annually.
  - AWBA and/or CAWCD would be responsible for reimbursing RWCD's reasonable costs, if any, of implementing the recovery arrangements (e.g., regulatory costs, etc.)
  - Lease costs would be estimated annually for the ensuing year and then paid monthly throughout the year, with reconciliation at year-end.
- AWBA or CAWCD would provide whatever credits are necessary to cause 8,724 acre-feet or water per year to be available for delivery to the GRIC Reservation during times of shortage.

For Federal 8,724 acre-feet firming obligation:

- Same terms as for State 8,724 acre-feet firming obligation as stated above, but involving more wells.
- RWCD would prefer to contract with AWBA or CAWCD to provide this service should the State be willing to help the United States meet its firming commitments.